Prepared in cooperation with the Bureau of Land Management

Groundwater and Surface-Water Resources in the Bureau of Land Management Moab Master Leasing Plan Area and Adjacent Areas, Grand and San Juan Counties, Utah, and Mesa and Montrose Counties, Colorado

Open-File Report 2014-1062

U.S. Department of the Interior
U.S. Geological Survey

Cover photo:
Large photo, looking west from Green River Overlook, Canyonlands National Park Island in the Sky District, April 2013.

Small photo, looking south from Wooden Shoe Arch Overlook, Canyonlands National Park Needles District, April 2013.

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SALLY JEWELL, Secretary

U.S. Geological Survey
Suzette M. Kimball, Acting Director

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SI to Inch/Pound

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	0.004047	square kilometer (km^2)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
acre-foot (acre-ft)	1,233	cubic meter (m^3)
	Flow rate	
gallon per minute (gal/min)	0.06309	liter per second (L/s)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
acre-foot per year (acre-ft/yr)	1,233	cubic meter per year (m^3/yr)
	Radioactivity	
picocurie per liter (pCi/L)	0.037	becquerel per liter (Bq/L)
	Transmissivity*	
foot squared per day (ft^2/d)	0.09290	meter squared per day (m^2/d)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

°F=(1.8×°C)+32

In this report, specific conductance is reported in microsiemens per centimeter (μS/cm).

*Transmissivity: The standard unit for transmissivity is cubic foot per day per square foot times foot of aquifer thickness [(ft^3/d)/ft^2]ft. In this report, the mathematically reduced form, foot squared per day (ft^2/d), is used for convenience.

Datums

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Altitude, as used in this report, refers to distance above the vertical datum.

Groundwater and Surface-Water Resources in the Bureau of Land Management Moab Master Leasing Plan Area and Adjacent Areas, Grand and San Juan Counties, Utah, and Mesa and Montrose Counties, Colorado

By Melissa D. Masbruch and Christopher L. Shope

Abstract

The Bureau of Land Management (BLM) Canyon Country District Office is preparing a leasing plan known as the Moab Master Leasing Plan (Moab MLP) for oil, gas, and potash mineral rights in an area encompassing 946,469 acres in southeastern Utah. The BLM has identified water resources as being potentially affected by oil, gas, and potash development and has requested that the U.S. Geological Survey prepare a summary of existing water-resources information for the Moab MLP area. This report includes a summary and synthesis of previous and ongoing investigations conducted in the Moab MLP and adjacent areas in Utah and Colorado from the early 1930s through the late 2000s.

Eight principal aquifers and six confining units were identified within the study area. Permeability is a function of both the primary permeability from interstitial pore connectivity and secondary permeability created by karst features or faults and fractures. Vertical hydraulic connection generally is restricted to strongly folded and fractured zones, which are concentrated along steeply dipping monoclines and in narrow regions encompassing igneous and salt intrusive masses. Several studies have identified both an upper and lower aquifer system separated by the Pennsylvanian age Paradox Member of the Hermosa Formation evaporite, which is considered a confining unit and is present throughout large parts of the study area.

Surface-water resources of the study area are dominated by the Colorado River. Several perennial and ephemeral or intermittent tributaries join the Colorado River as it flows from northeast to southwest across the study area. An annual spring snowmelt and runoff event dominates the hydrology of streams draining mountainous parts of the study area, and most perennial streams in the study area are snowmelt-dominated. A bimodal distribution is observed in hydrographs from some sites with a late-spring snowmelt-runoff peak followed by smaller peaks of shorter duration during the late summer. The large regional streams (Colorado, Green, and Dolores Rivers) integrate the regional hydrologic partitioning of a very large contributing area and, therefore, the hydrographs for these streams are much more smooth and consistent. Several streams throughout the study area are considered impaired and do not meet the standards set by the Environmental Protection Agency for specific designated-use classifications.

Limited data are available to quantitatively estimate the large-scale regional groundwater budget for the study area. Previous studies have estimated groundwater budgets for areas in and adjacent to the current study area, namely Moab-Spanish Valley and parts of the Paradox Basin. Most groundwater recharge to the study area originates as infiltration of precipitation from upland areas and is further enhanced in areas covered with sandy soils or in areas where the bedrock is highly fractured. Additional groundwater recharge occurs as seepage from streams and irrigation water, and as subsurface inflow, both vertically between aquifers and as lateral movement into the study area. Groundwater discharge occurs as seepage to streams, evapotranspiration, to springs and seeps, well withdrawals; and as subsurface outflow, both vertically between aquifers and as lateral movement out of the study area across its defined boundaries. Groundwater use in the study area was determined using data from the Utah Division of Water Rights. Most wells in the study area are categorized as having multiple uses.

Mean specific-conductance values for groundwater from wells and springs in the study area range from 101 to 220,000 microsiemens per centimeter at 25° C (µS/cm); most of the wells or springs have mean specific-conductance values of less than or equal to 1,000 µS/cm. Previously reported total dissolved-solids concentrations, specific conductances, and other groundwater-quality data for each of the principal aquifers indicate relative freshwater throughout the study area, except within the lower aquifer system and areas in contact with the Paradox Member of the Hermosa Formation evaporites.

There is limited information on the resource availability of brines and saline groundwater in the study area. Total dissolved-solids concentrations typically are high (greater than

35,000 milligrams per liter) in groundwater from, or in contact with, the Paradox Member of the Hermosa Formation. Total dissolved-solids concentrations also are high in groundwater samples collected from the lower aquifer system. Because the Paradox Member of the Hermosa Formation is considered a barrier to vertical groundwater flow, most of the brine and saline groundwater resources are restricted to the lower aquifer system.

Introduction

The Bureau of Land Management (BLM) Canyon Country District Office is preparing a leasing plan known as the Moab Master Leasing Plan (Moab MLP) for oil, gas, and potash mineral rights in an area encompassing 946,469 acres in Grand and San Juan Counties in southeastern Utah. The BLM has received recent expressions of interest to lease about 120,000 acres of BLM land for oil and gas exploration. Additionally, the BLM has received 170 potash mining permit applications covering 350,000 acres. This planning effort may lead to amendments to area resource management plans. An environmental impact statement (EIS) will be prepared to analyze development scenarios and land use plan alternatives with varying mitigation levels for mineral leasing. The BLM has identified water resources as being potentially affected by oil, gas, and potash development and has requested that the U.S. Geological Survey (USGS) prepare a summary of existing water-resources information for the Moab MLP area.

Purpose and Scope

The purpose of this report is to present a summary of the hydrogeology and existing water resources within the Moab MLP and adjacent areas. The report provides information that will assist the BLM in developing leasing configurations, addressing resource conflicts, and developing mitigation strategies for the Moab MLP area, and will serve as the basis for analysis of water-resource issues in the EIS. This report includes a summary and synthesis of previous and ongoing investigations conducted in the Moab MLP and adjacent areas from the early 1930s through the late 2000s.

The data compilation and summary are divided into several major parts including: (1) a description of the hydrogeology of the area with focus on the major aquifers, confining units, and geologic structures that may affect groundwater flow; (2) an assessment of surface-water resources including flow and general water-quality data, and a summary of streams identified as impaired with respect to water quality under the Clean Water Act; (3) an assessment of spring locations, discharge, and water-quality data; (4) an assessment of groundwater resources including potential recharge areas, water-level data, water-quality data, groundwater-use data, and summary of groundwater budget estimates for the area; and (5) an assessment of brackish groundwater as a potential water resource for use in potash development.

General Description of the Study Area

The Moab MLP area is located in southeastern Utah in the Upper Colorado River Basin (UCRB; fig. 1). The Moab MLP area surrounds two National Parks and is home to some of the most iconic natural scenery on the Colorado Plateau. About 2 million people per year visit the area to participate in a wide variety of recreational activities (Bureau of Land Management, 2012). Additionally, the area has a high potential for the development of oil, gas, and potash production, which has steadily increased in the planning area during recent years (Bureau of Land Management, 2012).

The Moab MLP area includes approximately 946,469 acres in southeastern Utah, encompassing 526,784 acres in Grand County and 419,685 acres in San Juan County (fig. 1). Nearly 783,000 acres of public lands are included within the Moab MLP area. The Moab MLP area is south of Interstate 70 and surrounds Arches National Park. The Green River and Canyonlands National Park form the western boundary of the Moab MLP area. South of the city of Moab, the planning area extends between Canyonlands National Park and U.S. Route 191, to just north of the Abajo Mountains and Monticello, Utah.

For the purposes of the hydrogeologic assessment presented in this report, the study area was extended beyond the boundaries of the Moab MLP area to the watershed boundaries that contribute water to the Moab MLP area (fig. 1). Inclusion of the surrounding watersheds in the study area provides a more complete analysis of water resources and movement of water near and through the Moab MLP area. The study area is bounded by the Book Cliffs on the north, the La Sal Mountains and Uncompahgre Plateau on the east, the Abajo Mountains on the south, and the Green River on the west. It includes all of Arches National Park and parts of Canyonlands National Park.

The study area is located entirely within the Canyonlands section of the Colorado Plateaus physiographic province (Fenneman, 1931; Fenneman and Johnson, 1946; Freethey and Cordy, 1991). The Canyonlands section encompasses the Green and Colorado Rivers and is dissected by numerous deep canyons dividing the Mesozoic aquifers into subregionally drained systems (Freethey and Cordy, 1991). The Canyonlands section is characterized by young to mature plateaus and large topographic relief. Although the 12,000-mi^2 Paradox Basin is not a definable physiographic feature, it is described as an area of the Colorado Plateaus that is underlain by a sequence of Pennsylvanian-age evaporites dominated by halite bedding (Hite and Lohman, 1973), and occurs in areas throughout the southeastern part of the study area (fig. 1).

The study area has a diverse climate because of the variation in altitude and the orographic effect of mountains on the movement of air masses and storms. Pacific air masses and storm events dominate the regional weather from October through April, and warm moisture-laden air masses from the Gulf of Mexico are frequent occurrences throughout the summer. The summer monsoonal storm events are less frequent,

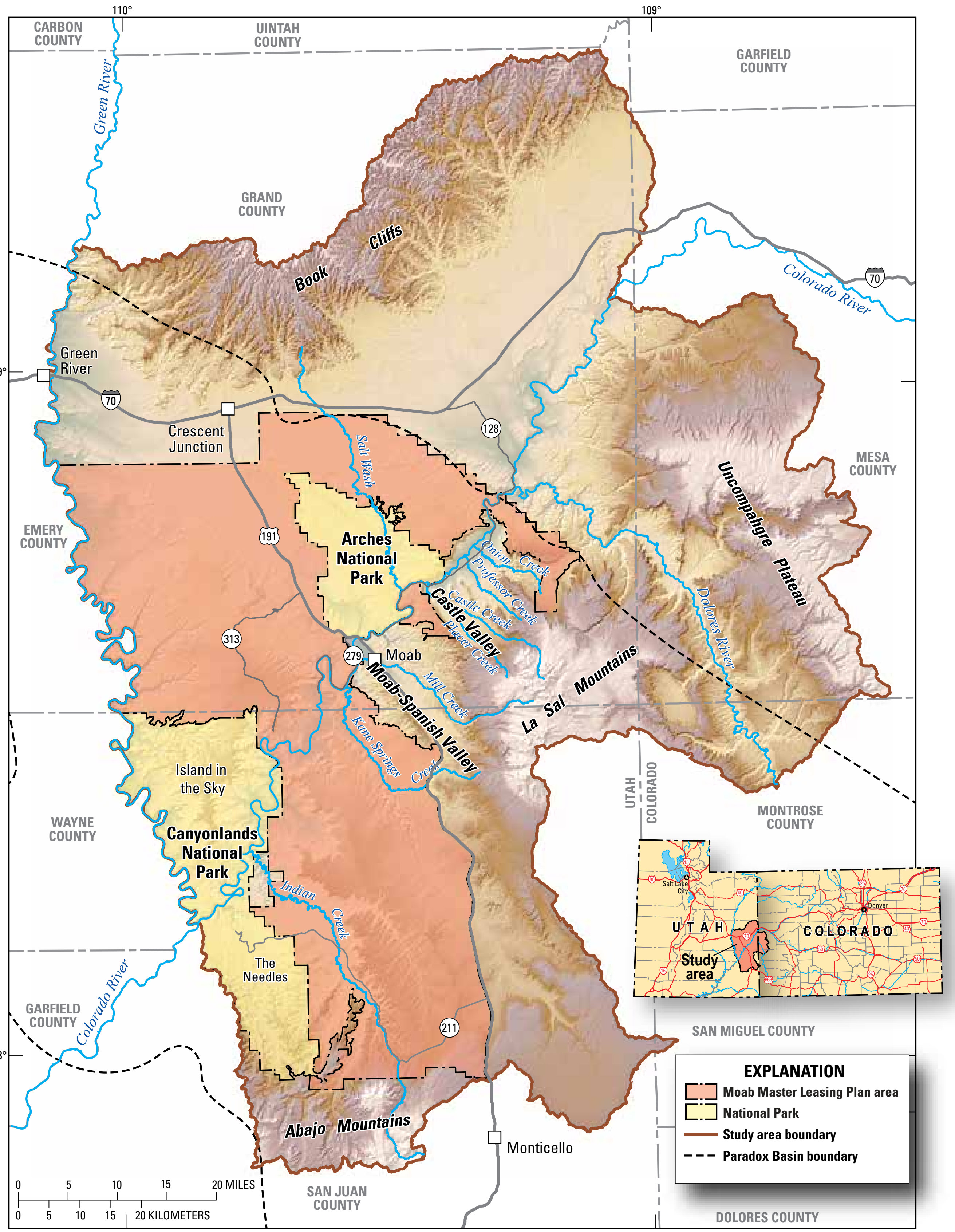

Figure 1. Location of the study area and Moab Master Leasing Plan area, Utah and Colorado.

although more intense, than the Pacific storms. Land-surface altitudes exceed 4,900 ft throughout much of the Colorado Plateaus province. Deep incised canyons, escarpments, and benches have resulted from differential erosion of variable-density stratigraphic layers and typically parallel structural features (Weir and others, 1983). Land-surface altitudes in the study area range from 3,800 ft near the Colorado and Green Rivers to 12,700 ft in the La Sal Mountains. Mean annual precipitation ranges from a minimum of about 6 in. at Green River, Utah, to about 30 in. in the La Sal Mountains (Blanchard, 1990; Steiger and Susong, 1997).

The mean annual temperature near Moab (altitude 4,000 ft) is 13.3 °C, and ranges from -7.8 °C in January to 36.8 °C in July based on 124 years of records (Western Regional Climate Center, various dates). The mean annual temperature in the La Sal Mountains at an altitude of 9,560 ft is about 4 °C (Natural Resources Conservation Service, various dates).

Evaporation constitutes the bulk of consumptive water use (Weir and others, 1983), which includes water loss through vegetative transpiration and evaporation from land, vegetation, and water surfaces. The annual potential evapotranspiration rate for the Moab-Monticello area is about 40 in., and ranges from 25 in. near the higher mountain peaks to 55 in. at lower altitudes (Weir and others, 1983). These estimates of potential water loss may constitute a much greater estimate than actual water loss because soil moisture is nearly continuously deficient in arid and semiarid environments that occur in the canyons and valleys throughout the study area (Weir and others, 1983).

Two major regional streams, the Green River and the Colorado River, originate beyond the boundaries of the study area to the north and the northeast, respectively (fig. 1). The Green River joins the Colorado River in Canyonlands National Park on the western border of the study area. There are no major perennial tributaries to the Green River in the study area. There are, however, a number of ephemeral or intermittent tributaries that are discussed further in section, "Surface-Water Resources." Several perennial and ephemeral or intermittent tributaries drain the areas of the Book Cliffs, Arches National Park, the La Sal Mountains and intervening mesas, and the Abajo Mountains entering the Colorado River upstream of its confluence with the Green River. The perennial tributaries from upstream to downstream include the Dolores River, Onion Creek, Professor Creek, Castle Creek, Salt Wash, Mill Creek, Kane Springs Creek, and Indian Creek (fig. 1).

Numerous springs and seeps occur throughout the study area; however, many of these springs have significant uncertainty associated with them in terms of location, discharge magnitude, and temporal variability. The springs are discussed further in section, "Groundwater."

Previous Investigations

A number of hydrogeologic studies have been done in the UCRB and the study area. Jobin (1962) identified and characterized the transmissive capacity of the Colorado Plateau sedimentary aquifers in a study that focused on determining ore-bearing mineral distribution, in particular uranium deposits. Freethey and Cordy (1991) described the hydrogeology of the Mesozoic aquifers in the UCRB, and concluded that the southern region of the UCRB has the largest potential for the development of groundwater resources. Although the thickness of Mesozoic rocks in the southern region of the UCRB (less than 5,000 ft) is less than thicknesses in the northern region of the UCRB (greater than 5,000 ft), 50–75 percent of this Mesozoic rock thickness in the southern UCRB is aquifer material, indicating that only 25–50 percent of less than 5,000 ft needs to be penetrated to tap the aquifers, decreasing groundwater-withdrawal costs (Freethey and Cordy, 1991). Geldon (2003) later described the hydrologic properties and groundwater-flow systems of the deeper Paleozoic aquifers in the UCRB.

More focused investigations of the hydrogeology within the Paradox Basin of southeastern Utah also include parts of the Moab MLP area. Baker (1933) described the general geology, water resources, and the potential for oil production in a number of sections of the Moab-Monticello area. One of the earliest recorded hydrologic reconnaissance studies in the Green River-Moab area was done by Thomas (1952). Hunt (1958) focused on the structural and igneous geology of the La Sal Mountains and described and characterized a number of local water resources. The Quaternary stratigraphy and the physiographic development of the La Sal Mountains were further described by Richmond (1962). Irons and others (1965) and Price and Arnow (1974) examined the geohydrology and water resources of the UCRB from Green River to Monticello, Utah. Feltis (1966) analyzed the bedrock hydrology from approximately 50 groundwater wells in the Green River-Moab area, where he described both the occurrence and quality of water in eastern Utah bedrock aquifers. Hanshaw and Hill (1969) developed a potentiometric-surface map for the Paradox Basin from regional hydrologic interpretations and water-quality analysis for five aquifers ranging from Mississippian to Permian age. Regional springs were inventoried and characterized by Mundorff (1971) and Sumsion and Bolke (1972). Thackston and others (1981) described groundwater circulation and flow patterns throughout the western Paradox Basin. Rush and others (1982) assessed the regional hydrology of the Green River-Moab area northwest of the Colorado River in the northwestern part of the Paradox Basin as a potential isolation source for high-level radioactive waste. Rush and others (1982) used existing data and a number of additional field measurements to describe hydrologic flow systems throughout the area. Weir and others (1983) examined the surface water and groundwater hydrology of the medial part of the Paradox Basin in Grand and San Juan Counties in the Moab-Monticello area, focusing on the eastern flank of the Colorado River. Although Weir and others (1983) primarily used existing data, they also incorporated supplemental measurements and reconnaissance into their findings. Eisinger and Lowe (1999) provided a summary of groundwater resources and the hydrogeology of Grand County, Utah, from previously published literature. Additionally, Eisinger and Lowe (1999) developed a number of structural-contour maps describing the depth to and thickness of aquifers and fracture orientations of bedrock discontinuities.

Several studies have examined the hydrogeologic units of localized areas—in particular, the Salt Valley Anticline northwest of the Colorado River. These studies provide the results of borehole construction, monitoring, and hydrologic interpretation in support of the goal of potentially defining a high-level nuclear waste repository. Price (1959) described the drilling and testing of a production well in Arches National Park. Hite and Lohman (1973), Gard (1976), and Hite (1977) described Salt Valley anticlinal areas. Rush and others (1980) characterized hydraulic test results in three wells within the Salt Valley Anticline of the Paradox Basin in Grand County, and generated site-specific hydrogeophysical data and interpretations for the Paradox Member of the Hermosa Formation. Wollitz and others (1982) characterized hydraulic test results in six additional wells not described by Rush and others (1980) within the Salt Valley Anticline of the Paradox Basin in Grand County.

Several other studies focused specifically on the Moab and Spanish Valleys in the medial part of the Paradox Basin, southeast of the Colorado River. Sumsion (1971) examined the geology and water resources of Moab and Spanish Valleys and surrounding areas, providing an estimate of average annual water yield, quantifying the amount of groundwater available for beneficial use, and evaluating the effect of use on groundwater storage. Eychaner (1977) developed a digital model of the same area using data from Sumsion (1971) to investigate the effects of a proposed area of artificial recharge near what is now Ken’s Lake, and increased well withdrawals for irrigation. Blanchard (1990) provided a reconnaissance of groundwater conditions in the bedrock aquifers of Grand County and parts of San Juan County, with emphasis on bedrock aquifers in the Mill Creek-Spanish Valley area. Steiger and Susong (1997) presented a map of recharge areas and groundwater-quality data for the Spanish Valley area. Kovacs (2000) developed a numerical groundwater-flow model to investigate the effects of increased well withdrawals in an unincorporated area of Moab and Spanish Valleys at the request of the Grand Water and Sewer Service Agency. Gardner (2004) investigated the hydrogeology and groundwater conditions within the Scott M. Matheson Wetlands Preserve, located between Moab and the Colorado River, using a suite of environmental tracers to characterize the valley-fill aquifer at the downgradient part of Moab Valley. Lowe and others (2007) summarized the geology, groundwater conditions, and groundwater quality in Moab and Spanish Valleys in order to determine the potential effects of projected increases in septic-tank systems on water quality in the valley-fill aquifer, including modifying the numerical groundwater-flow model developed by Kovacs (2000).

Geology

The geologic setting and history of the study area is preserved in rocks and geologic structures that span more than 1 billion years (Geldon, 2003). Rocks and sediments exposed in the study area are Paleozoic to Quaternary in age; Mesozoic-age sedimentary rocks, however, dominate the study area. Archean- and Proterozoic-age granitic and metamorphic rocks underlie the study area (Geldon, 2003).

During Cambrian through Early Mississippian time, the entire Colorado Plateau received only thin marine sediments as a result of occasional advancements of the Cordilleran seas to the west (Hanshaw and Hill, 1969) including the Leadville Limestone and equivalents, the Ouray Limestone, the Elbert Formation Limestones, and the Lynch Dolomite (Geldon, 2003). These sedimentary rocks consisting of limestone, fine-grained clastics, and interbedded evaporites have been observed (Jobin, 1962), although minimal exposures have been discussed in previous studies. Some of the sandstone layers (such as the McCracken Sandstone Member of the Elbert Formation), mixed with limestone and dolomitic layers, have been penetrated by oil wells in southeastern Utah (Wengerd, 1955). From Late Mississippian through the Pennsylvanian and into the Early Permian, the crustal stability of the region ended with the Ancestral Rockies orogeny (Hanshaw and Hill, 1969). The Ancestral Rocky Mountains formed and compressive tectonic forces caused uplifts and downwarps throughout the Colorado Plateau (Hanshaw and Hill, 1969). Adjacent to the uplift, a large north-south basin (Paradox Basin) developed throughout the Pennsylvanian and continued to subside and receive the thick evaporitic deposits of the Hermosa Formation (Hanshaw and Hill, 1969). As subsidence decreased, thick Permian shales and sandstones from the eastern uplift spread across the basin. The deposits are interfingered with sandstones derived from the west, and a few Permian limestone beds occur in the central and western part of the Paradox Basin (Hanshaw and Hill, 1969). Late Permian age units include the extensive Cutler Formation—an assemblage of red to white-bedded, interbedded mudstone, siltstone, sandstone, and conglomerates that includes the White Rim and Cedar Mesa Sandstones (Rush and others, 1982).

The Triassic Period sediments are characterized by classic red-bed deposits. Present-day salt anticlines began to develop during the Triassic (Hanshaw and Hill, 1969). The basal unit of Triassic age is the Moenkopi Formation, which is composed of shaly siltstones and sandstones that locally contain gypsum beds representative of a marginal marine environment (Eisinger and Lowe, 1999). A persistent unconformity exists, separating the Middle and Lower Triassic Moenkopi Formation from the Upper Triassic Chinle Formation (Freethey and Cordy, 1991). The Chinle Formation is a widespread, thin, poorly-sorted stratum of sandstone, siltstone, limestone, and conglomeratic sandstone representative of flood-plain and fluvial environments (Freethey and Cordy, 1991; Eisinger and Lowe, 1999).

Upper Triassic and Lower Jurassic deposits consist predominantly of eolian sandstones and fluvio-lacustrine sandstones and shale (Hanshaw and Hill, 1969) represented by the Glen Canyon Group, the San Rafael Group, the Summerville Formation, and the Morrison Formation. The basal formation of the Glen Canyon Group is the Late Triassic- or Early Jurassic-age Wingate sandstone that extends over most of the Colorado Plateau. This predominantly eolian sandstone is highly cross-bedded and relatively well sorted (Baker and others, 1936). Overlying the Wingate Sandstone within the Glen Canyon Group is the Late Triassic- to Early Jurassic-age Kayenta Formation, predominantly composed of relatively uniform grain size from lenticular channel sandstone, siltstone, and mudstone deposition (Rush and others, 1982). The uppermost member of the Glen Canyon Group is the Early Jurassic age, thick eolian Navajo Sandstone, which extends over much of southeastern Utah (Jobin, 1962).

Because of a substantial unconformity, the Middle Jurassic age San Rafael Group overlies the Navajo Sandstone. The basal Carmel Formation of the San Rafael Group consists of silty sandstones and sometimes is classified as the Dewey Bridge Member of either the Carmel Formation (Lowe and others, 2007) or the Entrada Sandstone (Rush and others, 1982; Freethey and Cordy, 1991). Overlying the Dewey Bridge Member is the orange-to-white, cross-bedded, fine-grained Slick Rock Member of the Entrada Sandstone, followed by the white, cross-bedded, fine-grained Moab Member of the Curtis Formation (Rush and others, 1982). The Summerville Formation and the Tidwell Member of the Morrison Formation consist of siltstone, interbedded sandstone, and minor chert (Lowe and others, 2007). The Late Jurassic Morrison Formation also includes the Salt Wash Member, which consists of lenticular sandstones and mudstones with thin limestone laminates (Rush and others, 1982), and the Brushy Basin Member, a variegated mudstone of bentonite origin, with siltstone, sandstone, and conglomerate (Rush and others, 1982).

The Cretaceous Period was a time of thick marine shale deposition, although non-marine sandstone is present at both the beginning and the end of the period (Hanshaw and Hill, 1969). Overlying the Morrison Formation is the Early Cretaceous Burro Canyon Formation, which consists of sandstone and conglomerate, with minor beds of mudstone (Lowe and others, 2007). The Burro Canyon Formation and the Dakota Sandstone are separated by the Upper and Lower Cretaceous Unconformity (Freethey and Cordy, 1991). The Dakota Sandstone consists of inter-bedded sandstone and conglomerate with mudstone, carbonaceous shale, coal, and claystone (Lowe and others, 2007). Overlying the Dakota Sandstone is the Mancos Shale, a fissile, marine-derived, dark-gray shale (Rush and others, 1982). The Mancos Shale is gradational with and laterally interfingers the overlying Mesaverde Group, which consists of sandstones with thin coal seams and shale (Rush and others, 1982).

Tertiary sediments in the study area are predominantly fluvial or lacustrine, depending on the geographic location; many of the Tertiary sediments, however, are absent because of erosive features (Hanshaw and Hill, 1969). Between the Cretaceous and Tertiary Periods, the Laramide orogeny caused extensive folding and faulting, creating many of the regional tectonic features (Hanshaw and Hill, 1969). As Pennsylvanian-age salt layers were buried beneath younger Mesozoic and Tertiary sedimentary deposits, the increase in overlying pressure caused plastic salt deformation and the evaporites deformed into a series of alternating northwest-trending, salt-cored anticlines and depositional synclines (Blanchard, 1990). As subsequent uplift and erosion of the Colorado Plateau continued through the Tertiary Period, this allowed surface water and groundwater to come into contact with, and dissolve, the salt layers from the core of the anticlines (Doelling and others, 2002; Gutierrez, 2004; Lowe and others, 2007). The overlying rock strata collapsed as the dissolved salt was removed by groundwater. Paradox Valley and Moab-Spanish Valley represent two of these collapsed salt anticline features. The collapse occurred along high-angle normal faults along the margins of the valley; one such example is the Moab Fault, which has a maximum offset of about 1,000 ft, and an average offset of about 650 ft (Lowe and others, 2007). During the Tertiary Period, the La Sal and Abajo Mountains also were formed as intrusive igneous rocks that were injected through and into the surrounding older deposits, causing uplift and doming of the strata along the flanks of the mountains (Sumsion, 1971; Stokes, 1986; Blanchard, 1990).

Quaternary-age deposits typically are deposited as thin layers over bedrock and along stream channels, or as thicker valley fill in the collapsed salt-anticline depressions (Sumsion, 1971; Eisinger and Lowe, 1999). The unconsolidated sediments consist of alluvial stream, alluvial fan, mass-movement (including glacial till), and eolian-sand deposits (Steiger and Susong, 1997; Lowe and others, 2007), and are discontinuous and scattered throughout the study area.

Hydrogeologic Characterization

Based on studies by Rush and others (1982), Weir and others (1983), Freethey and Cordy (1991), Geldon (2003), and Lowe and others (2007), eight principal aquifers and six confining units were identified in the study area (table 1). Generally, the aquifers can be split into four types: (1) limestone aquifers of marine origin, (2) sandstone aquifers of eolian and marine origin, (3) sandstone and conglomerate aquifers of fluvial origin, and (4) valley-fill aquifers in unconsolidated deposits. The permeability is a function of both the primary permeability from interstitial pore connectivity and secondary permeability created by karst features or faults and fractures. Vertical hydraulic connection generally is restricted to strongly folded and fractured zones, which are concentrated along steeply dipping monoclines and in narrow regions encompassing igneous and salt intrusive masses (Jobin, 1962). Several studies (Rush and others, 1982; Weir and others, 1983;

Table 1. Principal aquifers and confining units within the study area, Utah and Colorado.

[**Abbreviations:** ft, feet; ft^2/d, squared feet per day; NR, not reported; <, less than]

Aquifer system	Erathem	System or series	Hydrogeologic unit	Thickness (ft)	Reported transmissivity range (ft^2/d)
Upper aquifer system	Cenozoic		**Unconsolidated aquifers**		
		Quarternary	Unconsolidated deposits	Range unknown	197–72,750[1,2]
	Mesozoic		**Mesaverde aquifer**		
		Tertiary	Wasatch Formation	0–1,600[3]	NR
		Upper Cretaceous	Mesaverde Group	0–3,000[4]	< 50[4]
			Mancos confining unit		
		Upper Cretaceous	Mancos Shale	0–4,000[4]	NR
			Dakota aquifer		
		Upper Cretaceous	Dakota Sandstone	0–300[4]	10–150[4,5]
		Lower Cretaceous	Burro Canyon Formation		
			Brushy Basin confining unit		
		Upper Jurassic	Brushy Basin Member of the Morrison Formation	0–400[4]	NR
			Morrison aquifer		
		Upper Jurassic	Salt Wash Member of the Morrison Formation	0–400[4]	20–55[4,5]
			Tidwell-Summerville confining unit		
		Middle Jurassic	Tidwell Member of the Morrison Formation	0–400[4]	NR
		Middle Jurassic	Summerville Formation		
			Entrada aquifer		
		Middle Jurassic	Moab Member of the Curtis Formation	0–400[4]	< 50–500[4,5]
		Middle Jurassic	Slick Rock Member of the Entrada Sandstone		
			Dewey Bridge confining unit		
		Middle Jurassic	Dewey Bridge Member of the Carmel Formation/Entrada Sandstone	0–150[4]	NR
			Glen Canyon Group aquifer		
		Lower Jurassic-Upper Triassic	Navajo Sandstone	0–1,000[4]	0–6,000[1,5,6]
		Lower Jurassic-Upper Triassic	Kayenta Formation		20–55[5,6]
		Lower Jurassic-Upper Triassic	Wingate Sandstone		40–150[5,6]
			Lower Mesozoic confining unit		
		Upper Trassic	Chinle Formation	0–1,000[7]	NR
		Middle-Lower Triassic	Moenkopi Formation		
	Paleozoic		**Cutler Formation aquifer**		
		Permian	White Rim Sandstone	0–400[7]	0.01–6,000[7]
		Permian	Cedar Mesa Sandstone	0–10,000[7]	0.0005–10,000[7]
		Middle Pennsylvanian	Honaker Trail Member of the Hermosa Formation		
			Upper Paleozoic confining unit		
		Middle Pennsylvanian	Paradox Member of the Hermosa Formation	0–6,000[7]	0.001–50[7]
		Middle-Lower Pennsylvanian	Pinkerton Trail Member of the Hermosa Formation and Molas Formation	0–200[7]	
Lower aquifer system			**Lower Paleozoic aquifer system**		
		Mississippian	Leadville Limestone and equivalents, specifically the Redwall Limestone	0–1,800[7]	0.008–47,000[7]
		Devonian	Ouray Limestone		
		Devonian	Elbert Formation Limestone and McCraken Sandstone Member of the Elbert Formation		
		Cambrian	Lynch Dolomite		

[1]Sumsion, 1971. [2]Lowe and others, 2007. [3]Eisinger and Lowe, 1999. [4]Freethey and Cordy, 1991. [5]Jobin, 1962. [6]Blanchard, 1990. [7]Geldon, 2003.

Blanchard, 1990; Eisinger and Lowe, 1999) have identified both an upper and lower aquifer system separated by the Pennsylvanian age Paradox Member of the Hermosa Formation, an evaporite that is considered to be a confining unit. The principal aquifers and confining units have varied in their aggregated classification between studies and are not considered laterally or vertically homogeneous. Additionally, aquifer information throughout the study area is not equally available or explicitly characterized for all geologic units (Eisinger and Lowe, 1999).

Unconsolidated Aquifers

The unconsolidated aquifers consist of unconsolidated Quaternary-age deposits and typically are deposited as a thin layer over bedrock or as valley fill in the structural collapsed salt-anticline depressions (Sumsion, 1971; Eisinger and Lowe, 1999). The unconsolidated sediments are composed of stream, alluvial fan, mass-movement (including glacial till), and eolian-sand deposits (Steiger and Susong, 1997; Lowe and others, 2007), and are scattered throughout the study area. These unconsolidated deposits generally are composed of interbedded and lenticular deposits of sand, silt, and clay, with a wide range in physical and hydrologic characteristics (Eisinger and Lowe, 1999). Outside of the Moab-Spanish Valley and Castle Valley structural anticlines, little information on unconsolidated deposit thicknesses is available (Eisinger and Lowe, 1999). In Moab-Spanish Valley, the average saturated thickness of the unconsolidated aquifer is 70 ft, with a maximum thickness of about 300 ft (Sumsion, 1971; Lowe and others, 2007).

The valley-fill unconsolidated aquifers in Moab-Spanish and Castle Valleys are classified as low to highly transmissive (Lowe and others, 2007). Sumsion (1971) evaluated water yield and transmissivity for more than 200 wells ranging in depth from 30 to 300 ft throughout Moab-Spanish Valley. Well yields ranged from 8 to 1,000 gal/min, and transmissivities ranged from 1,600 to 13,900 ft^2/d, with an average of 6,000 ft^2/d (Sumsion, 1971). Based on the results of pumping tests in valley fill in other areas of Utah, however, Sumsion (1971) believed that a more realistic average value for the transmissivity of the unconsolidated aquifer in Moab-Spanish Valley was about 10,000 ft^2/d. Lowe and others (2007) estimated transmissivities from 32 wells, including those estimated by Sumsion (1971), to range from 197 to 72,750 ft^2/d, with an average transmissivity of 6,956 ft^2/d. Because there are no continuous layers of low-permeability materials within the valley-fill deposits, the unconsolidated aquifer in Moab-Spanish Valley is considered unconfined throughout most of the valley (Sumsion, 1971) and is likely in direct hydraulic connection with the underlying Glen Canyon Group aquifer. Transmissivities and other aquifer characteristics likely are similar in other unconsolidated aquifers throughout the area.

The primary source of recharge to the unconsolidated aquifer in Moab-Spanish Valley occurs as subsurface inflow from the Glen Canyon Group aquifer along the northeastern side of the valley from groundwater that is sourced in the La Sal Mountains (Sumsion, 1971). Lesser amounts of recharge to the unconsolidated aquifer occur as infiltration of precipitation that falls directly on the valley-fill deposits or from seepage from Ken’s Lake and Pack Creek (Sumsion, 1971; Eychaner, 1977; Steiger and Susong, 1997). For Castle Valley, most of the recharge to the unconsolidated aquifer is from seepage from Castle and Placer Creeks, which originate in the La Sal Mountains. Lesser amounts of recharge are from infiltration of precipitation that falls directly on the valley-fill deposits, as seepage of irrigation water, or as inflow from the Cutler Formation aquifer along the southwestern side of the valley (Snyder, 1996). Discharge from the unconsolidated aquifer in Moab-Spanish Valley is to springs and wells, as seepage to reaches of Mill and Pack Creeks, as evapotranspiration in the Scott M. Matheson Wetlands Preserve, and as seepage to the Colorado River (Sumsion, 1971; Blanchard, 1990). Discharge from the unconsolidated aquifer in Castle Valley occurs to wells, evapotranspiration, as seepage to lower Castle Creek, and as seepage to the Colorado River (Snyder, 1996). In both valleys, groundwater flow generally is to the northwest towards the Colorado River.

The unconsolidated aquifers are an important groundwater source for the relatively populous areas of Moab-Spanish Valley and Castle Valley within Grand County (Eisinger and Lowe, 1999). Groundwater from these deposits is used primarily for irrigation, with lesser amounts allocated to domestic water supply (Steiger and Susong, 1997).

Mesaverde Aquifer

The Mesaverde aquifer consists of units of the Upper Cretaceous Mesaverde Group and the Tertiary Wasatch Formation, which form the Book Cliffs in the northern part of the study area (Freethey and Cordy, 1991; Eisinger and Lowe, 1999). The Mesaverde Group is composed of sandstones and mudstones interbedded with shale and coal beds, and the Wasatch Formation is composed of deposits ranging from coarse conglomerate to fine sandstone with shale and mudstone (Rush and others, 1982; Eisinger and Lowe, 1999). The Mesaverde Group ranges in thickness from 0 to 3,000 ft within the study area (Freethey and Cordy, 1991). The Wasatch Formation ranges in thickness from 0 to 1,600 ft within the study area (Eisinger and Lowe, 1999). The Mesaverde aquifer crops out extensively along its southern terminus in central Grand County, Utah, between the Green and Colorado Rivers to the north of the Interstate-70 corridor (Freethey and Cordy, 1991; Hintze and others, 2000; Stoeser and others, 2005).

The Mesaverde aquifer is classified as having low permeability. Freethey and Cordy (1991) estimated transmissivities of the Mesaverde Group of less than 50 ft^2/d. Although Freethey and Cordy (1991) classify the Mesaverde Group as an aquifer, Blanchard (1990) and Eisinger and Lowe (1999) classify it as a confining unit. Transmissivities of the Wasatch

Formation in this area have not been reported; however, it generally is reported as having low permeability (Eisinger and Lowe, 1999).

Recharge to the Mesaverde aquifer is likely from the infiltration of precipitation on local outcrops. Discharge from the aquifer occurs to evapotranspiration, and to springs and seeps. Discharge from seeps and springs located north of the Book Cliffs typically ranges from less than 1 to 20 gal/min (Blanchard, 1990).

Potentiometric contours for the Mesaverde aquifer indicate groundwater flow through the aquifer within the study area generally is to the southwest from the Book Cliffs towards the Green and Colorado Rivers (Freethey and Cordy, 1991).

Mancos Confining Unit

The Mancos confining unit consists of the Upper Cretaceous Mancos Shale, a marine-derived shale, mudstone, and claystone (Freethey and Cordy, 1991). Both the lower and upper contacts of the Mancos Shale are gradational and interfingering with the Dakota aquifer below and the Mesaverde Group above (Freethey and Cordy, 1991; Lowe and others, 2007). The Mancos confining unit ranges in thickness from 0 to 4,000 ft within the study area, and thickness increases from south to north (Freethey and Cordy, 1991). The Mancos confining unit crops out extensively along its southern terminus in central Grand County, Utah, between the Green and Colorado Rivers along the Interstate-70 corridor (Freethey and Cordy, 1991; Hintze and others, 2000; Stoeser and others, 2005). The Mancos confining unit is considered to have very low permeability and is a barrier to both horizontal and vertical groundwater movement (Freethey and Cordy, 1991; Lowe and others, 2007); however, there are no reported values of transmissivity or hydraulic conductivity for the unit.

Dakota Aquifer

The Dakota aquifer consists of the Cretaceous Burro Canyon Formation overlain by the Dakota Sandstone. The Burro Canyon Formation is composed of sandstone and conglomerate, interbedded with mudstone (Lowe and others, 2007). The Dakota Sandstone is composed of sandstone and conglomerate, interbedded with mudstone, carbonaceous shale, coal, and claystone (Lowe and others, 2007). The Dakota aquifer ranges in thickness from 0 to 300 ft within the study area, and thickness generally increases from east to west and west to east towards western Grand County, Utah (Freethey and Cordy, 1991). The Dakota aquifer crops out along its southern terminus through central Grand County, Utah, and along the flanks of the La Sal and Abajo Mountains and the Uncompahgre Plateau (Freethey and Cordy, 1991; Hintze and others, 2000; Stoeser and others, 2005).

The Dakota aquifer is classified as low to moderately transmissive, except where faulted or fractured and the transmissivity is increased (Lowe and others, 2007). Jobin (1962) estimated transmissivities ranging from 55 to 150 ft^2/d, although Freethey and Cordy (1991) estimated slightly decreased transmissivities ranging from 10 to 50 ft^2/d.

Recharge to the Dakota aquifer is likely from the infiltration of precipitation on local outcrops. Discharge from the aquifer occurs to evapotranspiration, springs, and flowing wells that typically discharge at less than 1 gal/min (Blanchard, 1990). Seeps and springs along the flanks of the La Sal Mountains show large variations in discharge rates that can average as much as 18 gal/min (Weir and others, 1983). Discharge to the underlying Morrison aquifer also may occur in areas where the Brushy Basin confining unit is not present between the Dakota and Morrison aquifers.

Potentiometric contours for the Dakota aquifer indicate that groundwater flow through the aquifer within the study area generally is to the west-southwest from north-central Grand County, Utah, towards the Colorado River (Freethey and Cordy, 1991). Because the Dakota aquifer is not contiguous east of the Colorado River, groundwater-flow directions are not well defined but likely are towards localized discharge areas.

Brushy Basin Confining Unit

The Brushy Basin confining unit separates the Morison and Dakota aquifers, and consists of the Brushy Basin Member of the Morrison Formation, a variegated bentonitic mudstone, claystone, and siltstone with discontinuous lenses of conglomerate and sandstone (Freethey and Cordy, 1991; Lowe and others, 2007). The Brushy Basin confining unit ranges in thickness from 0 to 400 ft within the study area, and thickness increases from north to south and east to west (Freethey and Cordy, 1991). The Brushy Basin confining unit crops out locally along its southern terminus in central Grand County, Utah, and along the flanks of the La Sal and Abajo Mountains and the Uncompahgre Plateau (Freethey and Cordy, 1991; Hintze and others, 2000; Stoeser and others, 2005). The Brushy Basin confining unit is considered to have very low permeability, and is a barrier to groundwater movement (Lowe and others, 2007); however, there are no reported values of transmissivity or hydraulic conductivity for the unit.

Morrison Aquifer

The Upper Jurassic Morrison aquifer consists of the Salt Wash Member of the Morrison Formation. The Salt Wash Member is a well-sorted, fine- to medium-grained, fluvial cross-bedded sandstone, with occasional conglomeratic sandstone interbedded with mudstone (Sumsion, 1971; Lowe and others, 2007). The Morrison aquifer ranges in thickness from 0 to 400 ft within the study area, and thickness generally increases from northeast to southwest (Freethey and Cordy, 1991). The Morrison aquifer crops out along its southern terminus through central Grand County, Utah, and along the flanks of the La Sal and Abajo Mountains and the

Uncompahgre Plateau (Freethey and Cordy, 1991; Hintze and others, 2000; Stoeser and others, 2005).

The Morrison aquifer is classified as having a relatively low transmissivity. Jobin (1962) estimated transmissivities ranging from 20 to 55 ft^2/d, and Freethey and Cordy (1991) estimated transmissivities of less than 50 ft^2/d.

Recharge to the Morrison aquifer is likely from infiltration from precipitation that falls locally on areas where the aquifer crops out, where there is no intervening confining unit between overlying aquifers and the Morrison aquifer, or where the aquifer is mantled by unconsolidated deposits (Blanchard, 1990; Freethey and Cordy, 1991). Discharge from the aquifer occurs to evapotranspiration, and seeps, springs, and flowing wells that typically discharge at less than 1 gal/min and are slightly saline (Blanchard, 1990; Lowe and others, 2007). Additionally, the Morrison Formation contains large quantities of uranium, and the groundwater can contain high concentrations of radionuclides (Blanchard, 1990). Discharge also may occur to the underlying Entrada aquifer in areas where the Tidwell-Summerville confining unit is not present between the Morrison and Entrada aquifers.

Potentiometric contours for the Morrison aquifer indicate that groundwater flow through the aquifer within the study area generally is to the south from the Book Cliffs towards the Colorado River (Freethey and Cordy, 1991). Because the Morrison aquifer is not contiguous east of the Colorado River, groundwater-flow directions are not well defined but are likely towards localized discharge areas.

Tidwell-Summerville Confining Unit

The Tidwell-Summerville confining unit consists of the Middle Jurassic-age Summerville Formation and the Tidwell Member of the Morrison Formation (Rush and others, 1982; Lowe and others, 2007), and separates the Entrada and Morrison aquifers. The units are composed of shale and siltstone interbedded with sandstone and chert (Eisinger and Lowe, 1999; Lowe and others, 2007). The Tidwell-Summerville confining unit ranges in thickness from 0 to 400 ft within the study area and is present in two areas (1) across the northwestern part of Grand County, Utah, where thickness increases from east to west; and (2) across the eastern part of the study area, where thickness increases from west to east (Freethey and Cordy, 1991). The unit is missing through the central part of the study area near the Colorado River (Freethey and Cordy, 1991). The Tidwell-Summerville confining unit crops out locally along its southern terminus in western Grand County, Utah, and along the flanks of the La Sal and Abajo Mountains and the Uncompahgre Plateau (Freethey and Cordy, 1991; Hintze and others, 2000; Stoeser and others, 2005). The Tidwell-Summerville confining unit is considered to have very low permeability and is a barrier to vertical groundwater movement (Lowe and others, 2007); however, there are no reported values of transmissivity or hydraulic conductivity for the unit.

Entrada Aquifer

The Middle Jurassic-age Entrada aquifer, sometimes referred to as the San Rafael Group, consists of the Slick Rock Member of the Entrada Sandstone and the Moab Member of the Curtis Formation (Rush and others, 1982; Lowe and others, 2007). The Slick Rock Member of the Entrada Sandstone is a well-sorted, very fine- to medium-grained, cross-bedded sandstone of eolian or possibly shallow marine origin (Lowe and others, 2007). The Moab Member of the Curtis Formation is a well-sorted, medium- to fine-grained, cross-bedded, eolian sandstone (Lowe and others, 2007). The Entrada aquifer ranges in thickness from 0 to 400 ft within the study area, and thickness generally increases from northeast to southwest (Freethey and Cordy, 1991). The Entrada aquifer crops out along its southern terminus through central Grand County, Utah, and along the flanks of the La Sal Mountains and Uncompahgre Plateau (Freethey and Cordy, 1991; Hintze and others, 2000; Stoeser and others, 2005).

Both units of the Entrada aquifer are classified as being moderately transmissive. Jobin (1962) and Blanchard (1990) estimated transmissivities ranging from 50 to about 150 ft^2/d in the central part of the study area. Freethey and Cordy (1991) estimated transmissivities ranging from less than 50 to 500 ft^2/d for the aquifer within the study area.

Recharge to the Entrada aquifer likely is from infiltration of precipitation that falls locally on areas where the aquifer crops out, where there is no intervening confining unit between overlying aquifers and the Entrada aquifer, or where the aquifer is mantled by unconsolidated deposits (Blanchard, 1990; Freethey and Cordy, 1991). Discharge from the aquifer occurs to evapotranspiration, numerous seeps and springs, and wells. The Dewey Bridge Member of the Carmel Formation, which underlies the Entrada aquifer, commonly acts as a confining unit and, therefore, discharge from the aquifer commonly occurs as seeps and springs at the lower contact with the finer-grained Dewey Bridge Member of the Carmel Formation or at contacts between cross-bed sets where the vertical hydraulic conductivity is decreased (Blanchard, 1990). Discharge also may occur to the underlying Glen Canyon Group aquifer in areas where the Dewey Bridge Member of the Carmel Formation is not present between the Entrada aquifer and the Glen Canyon Group aquifer, such as in the eastern and southern parts of the study area (Freethey and Cordy, 1991). Blanchard (1990) inventoried several springs and seeps and one flowing well in the Entrada Aquifer; the springs and seeps yielded discharges of 0.1 to 11.1 gal/min, and discharge from the well was about 15 gal/min.

Potentiometric contours from the Entrada aquifer (Freethey and Cordy, 1991) indicate groundwater flow through the aquifer within the study area generally is to the south and southwest from the Book Cliffs towards the Colorado and Green Rivers. Because the Entrada aquifer is not contiguous east of the Colorado River, groundwater-flow directions are not well defined but are likely towards localized discharge areas.

Dewey Bridge Confining Unit

The Dewey Bridge confining unit consists of the Dewey Bridge Member of the Carmel Formation/Entrada Sandstone (Rush and others, 1982; Lowe and others, 2007), and separates the Glen Canyon Group and Entrada aquifers. The Dewey Bridge Member is composed of sandstone and siltstone with contorted bedding (Rush and others, 1982). The Dewey Bridge confining unit only occurs across the north and northwest parts of Grand County, Utah, where it ranges in thickness from 0 to 150 ft, with thickness increasing from east to west (Freethey and Cordy, 1991). The Dewey Bridge confining unit crops out locally along the Green River in northwestern Grand County, Utah (Freethey and Cordy, 1991). The Dewey Bridge confining unit is considered to have very low permeability and is a barrier to vertical groundwater movement (Blanchard, 1990; Lowe and others, 2007); however, there are no reported values of transmissivity or hydraulic conductivity for the unit.

Glen Canyon Group Aquifer

The Glen Canyon Group aquifer consists of the Lower Jurassic- to Upper Triassic-age Wingate Sandstone, Kayenta Formation, and Navajo Sandstone (Rush and others, 1982; Blanchard, 1990; Freethey and Cordy, 1991; Lowe and others, 2007). The Wingate Sandstone is a well-sorted, very fine- to medium-grained, calcareous, massively bedded, well-cemented, cross-bedded, eolian sandstone (Sumsion, 1971; Lowe and others, 2007). The Wingate Sandstone typically is observed as abrupt, high, desert-varnished cliff outcrops in the southern half of Grand County (Eisinger and Lowe, 1999). The Kayenta Formation is a very fine- to coarse-grained, locally conglomeratic, fluvial sandstone, siltstone, and shale (Sumsion, 1971; Lowe and others, 2007). The Navajo Sandstone is a well-rounded, well-sorted, fine- to medium-grained, cross-bedded eolian sandstone (Sumsion, 1971; Lowe and others, 2007). The Navajo Sandstone is weakly cemented silica or calcium carbonates and contains thin lenticular beds of sandy limestone (Sumsion, 1971). The Navajo sandstone outcrops are extensively observed throughout the study area as cliffs and domes (Sumsion, 1971). The Glen Canyon Group aquifer ranges in thickness from 0 to 1,000 ft within the study area, and thickness generally increases from south to north and east to west (Freethey and Cordy, 1991). The Glen Canyon Group aquifer crops out extensively to the north, northeast, east, and southeast of the confluence of the Green and Colorado Rivers (Freethey and Cordy, 1991; Hintze and others, 2000; Stoeser and others, 2005).

All three units in the Glen Canyon Group aquifer are classified as being moderately transmissive, which is further enhanced where fractures exist. Transmissivities of the aquifer range from less than 50 to 6,000 ft^2/d (Sumsion, 1971; Freethey and Cordy, 1991). Because the Kayenta Formation has many seams of interbedded silt and clay and large amounts of cementing material that reduce the transmissive properties of the unit, it functions as a confining unit in some areas of the Colorado Plateau (Freethey and Cordy, 1991). The lithology and fracturing of the Kayenta Formation, however, have a direct influence on the hydraulic connection between the Navajo Sandstone and the Wingate Sandstone. For example, in the Mill Creek-Spanish Valley area, the Kayenta Formation is predominantly sandstone and, therefore, provides a direct hydraulic connection between the Navajo Sandstone and Wingate Sandstone (Blanchard, 1990). Transmissivities for the Kayenta Formation and the Wingate Sandstone were estimated as 20–55 ft^2/d and 40–150 ft^2/d, respectively (Jobin, 1962; Blanchard, 1990). The Wingate Sandstone was observed to yield moderate quantities of water where it is highly fractured (Sumsion, 1971). The thick, well-sorted Navajo Sandstone is highly permeable, and the transmissivity values are among the greatest in the Colorado Plateau (Jobin, 1962). Transmissivities for the Navajo Sandstone were estimated to range from 0 ft^2/d to the east, where the Navajo pinches out, to as much as 700 ft^2/d in the thick stratum to the southwest (Jobin, 1962; Blanchard, 1990). Sumsion (1971) estimated transmissivities between 1,200 and 1,500 ft^2/d in areas where the Navajo Sandstone is relatively unfractured, and as much as 6,000 ft^2/d in areas where the Navajo Sandstone is highly fractured from wells near Moab. These transmissivities for the Navajo Sandstone are similar to more recently reported transmissivities from aquifer tests in other areas of the Navajo Sandstone (Heilweil and others, 2000).

Recharge to the Glen Canyon Group aquifer primarily occurs as infiltration from precipitation, mainly in the form of snow, in the upland areas (Blanchard, 1990; Freethey and Cordy, 1991; Steiger and Susong, 1997). Recharge to the aquifer is enhanced in areas where the formations are covered by shallow deposits of eolian sand or sandy soil, where the formations are highly fractured, or where younger sedimentary deposits, such as the Entrada Sandstone, directly overlie the Navajo Sandstone without an intervening confining unit (Blanchard, 1990; Steiger and Susong, 1997). Recharge also can occur from the infiltration of surface water where perennial streams, such as Mill Creek, traverse the Navajo Sandstone (Steiger and Susong, 1997). All three units of the aquifer are highly faulted and fractured, especially along the flanks of the La Sal and Abajo Mountains and the Uncompahgre Plateau (Blanchard, 1990; Freethey and Cordy, 1991). Discharge from the aquifer occurs to numerous seeps and springs, to streams, to evapotranspiration, to wells, as vertical flow into overlying or underlying units, and as lateral flow across the study-area boundaries. Spring discharge from the Wingate Sandstone is reported as 10 to 240 gal/min in Grand County (Blanchard, 1990). Spring discharge from the Navajo Sandstone ranges from less than 5 to more than 300 gal/min, and well yields of as much as 2,000 gal/min have been observed (Blanchard, 1990). Because the Navajo Sandstone is the most shallow and permeable unit in the Glen Canyon Group, it is the source of water for most groundwater wells drilled in southern Grand County.

Potentiometric contours for the Glen Canyon Group aquifer (Freethey and Cordy, 1991) indicate that groundwater flow through the aquifer within the study area generally is (1) towards the west from the Uncompahgre Plateau to the Dolores River; (2) towards the east, north, and west from the La Sal Mountains to the Dolores and Colorado Rivers; (3) towards the northeast and then north from the Abajo Mountains to the Colorado River; and (4) towards the southwest through the western part of Grand County, Utah, to the Green River.

Lower Mesozoic Confining Unit

The Lower Mesozoic confining unit consists of the Moenkopi Formation, a brown shale, mudstone, arkosic sandstone, and conglomerate, with local beds of gypsum (Rush and others, 1982), and the Chinle Formation, which comprises reddish siltstone, sandstone, mudstone, and conglomerates (Rush and others, 1982). The Lower Mesozoic confining unit separates the Cutler Formation and Glen Canyon Group aquifers. The Lower Mesozoic confining unit ranges in thickness from 0 to 1,000 ft in the study area, and thickness generally increases from south to north and east to west (Freethey and Cordy, 1991). The Moenkopi and Chinle Formations crop out locally along the Colorado and Green Rivers and other various washes in the study area, and more extensively in southeastern Mesa County, Colorado (Freethey and Cordy, 1991; Hintze and others, 2000; Stoeser and others, 2005). The Lower Mesozoic confining unit is considered to have very low permeability and is a barrier to groundwater movement except where jointed, faulted, or fractured (Lowe and others, 2007); however, there are no reported values of transmissivity or hydraulic conductivity for the unit.

Cutler Formation Aquifer

The Cutler Formation aquifer consists of the Honaker Trail Member of the Hermosa Formation, and the Cedar Mesa and White Rim Sandstones of the Cutler Formation. The Middle Pennsylvanian-age Honaker Trail Member of the Hermosa Formation consists of gray, cyclically alternating limestone, sandstone, and shale (Baars, 2000). The Permian-age Cutler Formation is a thick, predominantly red arkosic sandstone and conglomerate interfingered with siltstone and mudstone (Rush and others, 1982), and is sometimes classified as a confining unit (Rush and others, 1982; Blanchard, 1990). Eisinger and Lowe (1999) and Geldon (2003), however, noted that locally important sections of the formation, especially the Cedar Mesa and White Rim Sandstones are very permeable. Jobin (1962) stated that, at some locations, the aquifer is known for a high and relatively uniform permeability, most likely caused by the stability and duration of the dune-forming environment. The Honaker Trail Member of the Hermosa Formation together with the Cedar Mesa Sandstone range in thickness from 0 to 10,000 ft, with the thickest sections occurring in the center of the study area (Geldon, 2003). The White Rim Sandstone ranges in thickness from 0 to 400 ft and occurs mainly in the center of the study area (Geldon, 2003). The various units of the aquifer crop out extensively within Canyonlands National Park, especially in the Needles District and around the rim of the Island in the Sky District, and locally in other parts of the study area, such as along the lower parts of Indian Creek, to the northeast of Castle Valley, and along parts of the Dolores River in Colorado (Hintze and others, 2000; Stoeser and others, 2005).

The Cutler Formation aquifer transmits water through a variety of ways, depending on the lithology. The Cedar Mesa and White Rim Sandstones have intergranular and fracture permeability, although the Honaker Trail Member of the Hermosa Formation has little intergranular permeability and transmits water mainly through fractures and solution channels (Geldon, 2003). Transmissivities for the Honaker Trail Member of the Hermosa Formation together with the Cedar Mesa Sandstone range from 0.0005 to 10,000 ft^2/d, depending on thickness, lithology, and development of fractures and solution channels (Geldon, 2003). Transmissivities for the White Rim Sandstone range from 0.01 to 6,000 ft^2/d, depending on cementation and, to a lesser degree, on fracturing (Geldon, 2003). Transmissivities are greatest along uplifted areas where secondary openings increase and cementation decreases (Geldon, 2003).

Recharge to the Cutler Formation aquifer primarily occurs as infiltration from precipitation in the upland areas (Geldon, 2003). Recharge to the aquifer is enhanced in areas where the formations are covered by shallow deposits of eolian sand or sandy soil or where the formations are highly fractured (Geldon, 2003). Discharge from the aquifer within the study area occurs to numerous seeps and springs; to some reaches of the Dolores, Green, and Colorado Rivers; to wells; or as subsurface outflow. Discharge from outcrops of the Cedar Mesa and White Rim Sandstones are observed within Canyonlands National Park in the form of springs and seeps that generally are concentrated at the base of these units (Sumsion and Bolke, 1972; Huntoon, 1979). Discharge from these springs and seeps generally is only a few gallons per minute (Sumsion and Bolke, 1972; Huntoon, 1979; Eisinger and Lowe, 1999). Sumsion and Bolke (1972) describe three wells drilled into the White Rim Sandstone in the Island in the Sky District of Canyonlands National Park that had yields between 40 and 100 gal/min and several other wells completed in the Cedar Mesa Sandstone located within the Needles District of Canyonlands National Park. Blanchard (1990) reported that undifferentiated units of the Cutler Formation were the source of water for about 30 groundwater wells on the southwestern side of Castle Valley.

Upper Paleozoic Confining Unit

The Upper Paleozoic confining unit consists of the Molas Formation overlain by the Pinkerton Trail and Paradox Members of the Hermosa Formation (Rush and others, 1982; Weir and others, 1983; Hintze and others, 2000), and separates the Lower Paleozoic aquifer system from the Cutler Formation aquifer. The Molas Formation consists of interbedded red siltstone, sandstone, limestone, and shale (Rush and others, 1982). The Pinkerton Trail Member of the Hermosa Formation consists of interbedded limestone, dolomite, shale, and anhydrite (Rush and others, 1982). The Paradox Member of the Hermosa Formation consists mostly of bedded salts (Rush and others, 1982). The Molas Formation and the Pinkerton Trail Member of the Hermosa Formation range in thickness from 0 to 200 ft within the study area, and thickness generally increases from north to south (Geldon, 2003). The Paradox Member of the Hermosa Formation ranges in thickness from 0 to 6,000 ft in the study area, and thickness generally increases from the north, east, and west (Geldon, 2003). The Paradox Member of the Hermosa Formation crops out in isolated areas in salt valleys and along salt-dissolution deformed bedrock, such as Salt Valley and Castle Valley. These outcrops generally are classified as the Paradox Member caprock, which is the residue left after the salt is dissolved (Doelling and others, 2002). The Paradox Member of the Hermosa Formation also crops out locally along the Green and Colorado Rivers near their confluence (Baars, 2000; Hintze and others, 2000). Transmissivities of the various units range from 0.001 to 50 ft^2/d and depend primarily on the lithology and the development of fractures and solution channels (Geldon, 2003).

Lower Paleozoic Aquifer System

The Lower Paleozoic aquifer system consists of the Lynch Dolomite overlain by the Elbert Formation Limestone and McCracken Sandstone Member of the Elbert Formation, the Ouray Limestone, and the Leadville Limestone and its equivalents, specifically the Redwall Limestone (Rush and others, 1982; Weir and others, 1983). Thicknesses of the various units range from 0 to 800 ft throughout the study area, and generally increase from north to south and east to west throughout the study area (Geldon, 2003). The Lower Paleozoic aquifer system has a maximum thickness of 1,800 ft in the southernmost parts of the study area near the confluence of the Green and Colorado Rivers (Geldon, 2003). The Lower Paleozoic aquifer system does not crop out within the study area but it is laterally continuous to areas outside of the study area (Doelling and others, 2002; Doelling, 2004; Gualtieri, 2004; Witkind, 2004; Stoeser and others, 2005).

The Lower Paleozoic aquifer system transmits water mostly through secondary features such as fractures, joints, faults, and solution channels or caverns (Hood and Danielson, 1981; Geldon, 2003). Transmissivities of the various units range from 0.008 to 47,000 ft^2/d and depend primarily on the lithology and the degree of fracturing and solution channeling (Geldon, 2003). The Redwall Limestone has been reported to have some of the greatest hydraulic-conductivity values in the region (Weir and others, 1983). The Lower Paleozoic aquifer system is an important source of groundwater in some locations, particularly in San Juan County (Gloyn and others, 1995; Lowe, 1996). In most areas of Grand County, however, the top of the Lower Paleozoic aquifer system occurs at a depth between about 3,900 and 13,000 ft below land surface and, therefore, is too deep to provide an economically viable source of groundwater (Rush and others, 1982; Eisinger and Lowe, 1999).

Potentiometric contours (Rush and others, 1982; Weir and others, 1983) indicate that groundwater flow through the Lower Paleozoic aquifer system in the study area generally is towards the south and west. Because the Lower Paleozoic aquifer system does not crop out within the study area, recharge to the aquifer primarily is from precipitation on outcrops outside of the study area, which enters the study area as lateral subsurface inflow (Rush and others, 1982; Weir and others, 1983; Geldon, 2003). Regional discharge from the Lower Paleozoic aquifer system also occurs outside the study area, and has been observed as discharge to the Colorado River in Marble and Grand Canyons southwest of the Paradox Basin (Weir and others, 1983). Discharge from the Lower Paleozoic aquifer system in the study area is mainly to lateral subsurface outflow and well withdrawals. Although some water may possibly migrate upward, it is assumed that the evaporitic deposits that overlie the aquifer (Upper Paleozoic confining unit, discussed in section, “Upper Paleozoic Confining Unit”) form a relatively impermeable confining unit that prohibits upward flow (Rush and others, 1982; Weir and others, 1983).

Surface-Water Resources

Surface-water resources of the study area are dominated by the Colorado River. Numerous perennial and ephemeral or intermittent tributaries join the Colorado River as it flows from northeast to southwest across the study area, draining the surrounding upland areas of the Book Cliffs, Arches National Park, the La Sal Mountains, and the Abajo Mountains (fig. 2). The Green River is the largest perennial tributary to the Colorado River in the study area. The Green River flows south into the study area, joining the Colorado River in Canyonlands National Park.

Perennial Streams and Rivers

The sole perennial stream to the northwest of the Colorado River in the study area is Salt Wash, which drains the eastern part of Arches National Park and surrounding areas. The Dolores River enters the Colorado River immediately northeast of the Moab MLP area. Numerous perennial streams are located to the southeast of the Colorado River between the Dolores River and the confluence of the Colorado River and the Green River. Several of these streams originate on the northwestern slope of the La Sal Mountains and lowland mesas, subsequently incising through several collapsed salt anticline

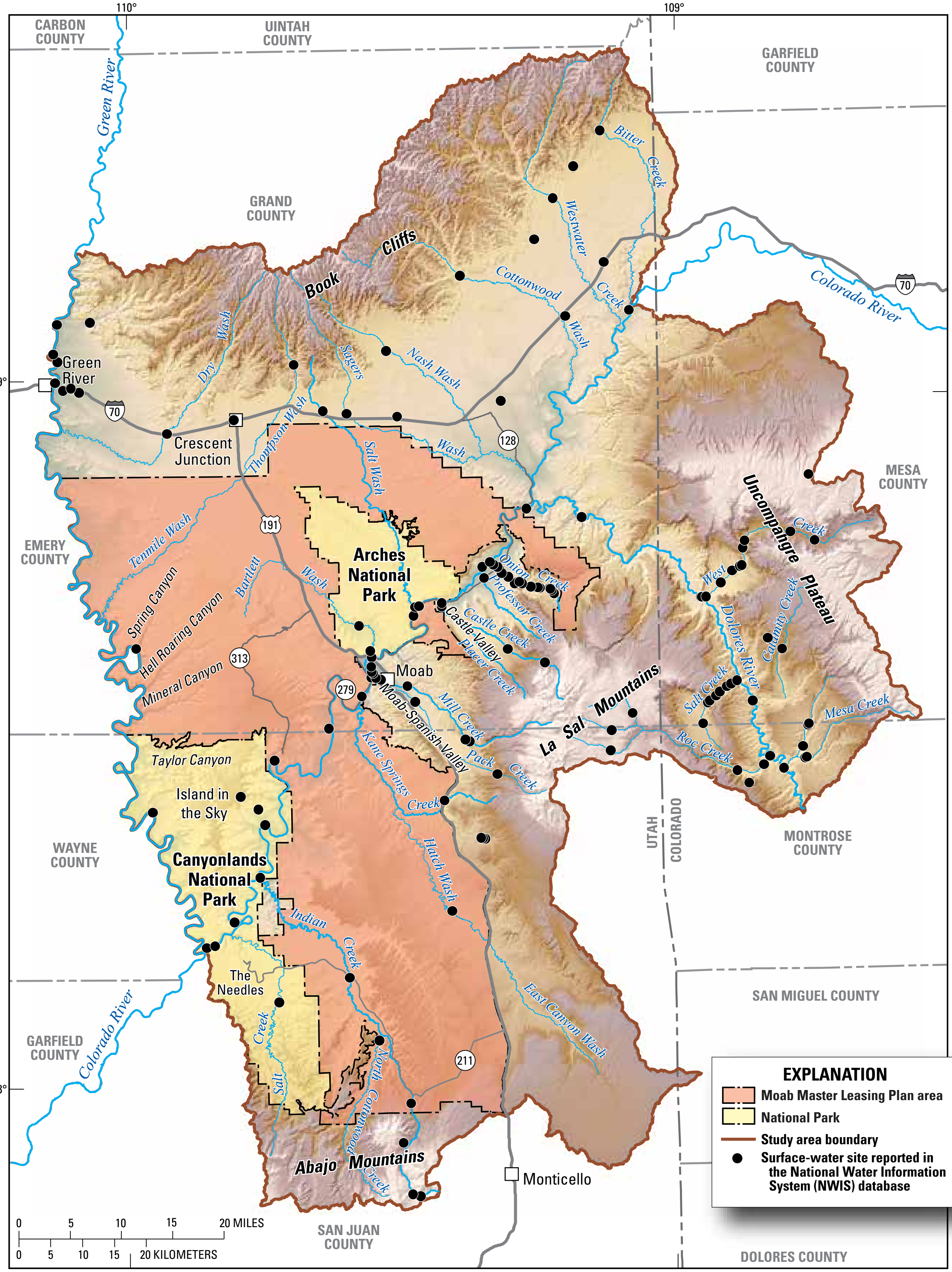

Figure 2. Location of surface-water sites within the study area reported in the National Water Information System database.

valleys in the Castle Valley area. These streams include Onion Creek, Professor Creek, and Castle Creek. Farther southeast, Pack Creek joins with its largest tributary, Mill Creek, both of which originate on the western slope of the La Sal Mountains and flow through or adjacent to Moab-Spanish Valley, ultimately reaching the Colorado River near Moab, Utah (Sumsion, 1971). It should be noted, however, that all streamflow from Pack Creek upstream of the springs near Moab City Park is diverted for irrigation purposes throughout Moab-Spanish Valley (Sumsion, 1971). Kane Springs Creek and its primary tributaries, Hatch Wash and East Canyon Wash, flow westerly and northwesterly from the southern La Sal Mountains and the mesa-dominated area between the La Sal and Abajo Mountains. Kane Springs Creek is intermittent upstream of U.S. Route 191, and perennial downstream of U.S. Route 191. Indian Creek and Salt Creek drain the northern slope of the Abajo Mountains predominantly during spring and early summer periods of increased runoff (Weir and others, 1983). The Indian Creek headwaters are largely diverted south through an aqueduct to Blanding, Utah (south of the study area), and are used predominantly for public-water supply. The remaining Indian Creek discharge is appropriated for irrigation on ranches throughout the Indian Creek drainage system (Weir and others, 1983).

Ephemeral or Intermittent Streams

To the east of the Green River, there are numerous ephemeral or intermittent tributaries including Dry Wash, Tenmile Wash, Spring Canyon, Hell Roaring Canyon, Mineral Canyon, and Taylor Canyon, which drain the area between U.S. Route 191 and the Green River. To the northwest of the Colorado River, there are numerous ephemeral or intermittent tributaries including Bitter Creek, Westwater Creek, Cottonwood Wash, and Sagers Wash, which originate in the Book Cliffs; and Salt Wash, which drains the southwestern part of Arches National Park. Many of these drainages exhibit short segments of minor perennial flow, although the remainder of streamflow displays short-term snowmelt driven and infrequent storm-runoff response.

Surface-Water Data

Surface-water discharge and water-quality data were obtained from the USGS National Water Information System (NWIS) database (available at *http://waterdata.usgs.gov/nwis*). While other unpublished surface-water data may exist from other agencies, only USGS data are discussed in the following sections.

Within the study area, there are 133 surface-water sites reported in NWIS (fig. 2; table 2). Although most of the sites are located in Utah, 36 are in western Colorado. There were 46 sites with as many as 2,697 instantaneous discharge measurements, 41 sites with between 1 and 94 peak-flow measurements, and 99 sites with as many as 2,983 water-quality records. Typically, discharge is measured when water-quality samples are collected.

Out of the 133 surface-water sites reported in NWIS, 3 are at the Moab Slough Pond, which is classified as a lake. Thirteen of the sites have only location data, with no associated discharge or water-quality data. A total of 77 surface-water sites have between 1 and 159 instantaneous discharge measurements. Ten surface-water sites have only annual peak streamflow data. The remaining 31 surface-water sites are USGS streamgage sites, which have continuous streamflow records for varying periods of time (table 3).

Daily Streamflow Statistics

Streamflow statistics often are used to assess the long-term availability of surface-water resources within a study area. There are 31 current (2013) and historical USGS streamgages (table 3) located throughout the study area that have continuous data over a period of record that can be used to develop streamflow statistics that characterize the variability in surface-water resources. The streamflow statistics include the mean daily discharge and the maximum and minimum daily discharge. These values were computed from daily discharge data collected at each site over the entire period of record for that site. Individual measurements distributed throughout the area of interest over an extended period of time provide information on the spatial variability and temporal trends of the water resources. Within the study area, however, sample locations are sparse and processes affecting streamflow, such as altitude or geology, are highly variable. Under these circumstances, it is preferable to estimate the mean daily discharge over an extended period of record bounded by the measurement uncertainty, expressed as the minimum and maximum daily discharge.

Streams in the study area are divided into six groups. The groups are (1) perennial streams with maximum daily discharges of less than 10 ft^3/s, (2) perennial streams with maximum daily discharges between 10 and 100 ft^3/s, (3) ephemeral or intermittent streams with maximum daily discharges between 10 and 100 ft^3/s, (4) perennial streams with maximum daily discharges between 100.1 and 1,000 ft^3/s, (5) ephemeral or intermittent streams with maximum daily discharges between 100.1 and 1,000 ft^3/s, and (6) perennial streams with maximum daily discharges greater than 10,000 ft^3/s. The distribution of streamgage locations for each group classification is presented in figure 3.

Most streamgages are located east of the Colorado River between the Dolores River and Mill Creek tributaries (fig. 3). Streams are classified based on the mean daily discharge measured at a streamgage as either perennial or ephemeral/intermittent. This classification, however, may vary both along the reach and throughout the year. To show the variation in daily discharge statistics over the period of record, two representative stream hydrographs for each of the six groups are provided in figure 4.

Table 2. Streamgage and surface-water sites that have more than location data reported in the National Water Information System database within the study area, Utah and Colorado.

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Discharge data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	09163530	Colorado River below Colorado-Utah state line	39.08831747	-109.1009454	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=09163530&agency_cd=USGS&
USGS	09163570	Hay Press C ab Fruita Res #3, nr Glade Park, CO.	38.8508166	-108.7828793	8,990	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09163570&agency_cd=USGS&
USGS	09163675	Cottonwood Wash at I-70, near Cisco, Utah	39.08165184	-109.2176153	NR	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09163675&agency_cd=USGS&
USGS	09179000	Roc Creek near Uranium, CO.	38.435266	-108.922883	5,200	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09179000&agency_cd=USGS&
USGS	09179200	Salt Creek near Gateway, CO	38.5330428	-108.9709404	5,220	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=09179200&agency_cd=USGS&
USGS	09179500	Dolores River at Gateway, CO.	38.6813734	-108.9803867	4,548	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09179500&agency_cd=USGS&
USGS	09180000	Dolores River near Cisco, UT	38.79720805	-109.1951142	4,165	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=09180000&agency_cd=USGS&
USGS	09180500	Colorado River near Cisco, UT	38.81054095	-109.2934493	4,090	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=09180500&agency_cd=USGS&
USGS	09180920	Onion Creek above Onion C bridge nr Moab, UT	38.69693046	-109.2551154	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=09180920&agency_cd=USGS&
USGS	09180970	Onion Creek below Onion Crk bridge nr Moab, UT	38.70637365	-109.3151161	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=09180970&agency_cd=USGS&
USGS	09181000	Onion Creek near Moab, Utah	38.724984	-109.345117	4,120	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09181000&agency_cd=USGS&
USGS	09181500	Professor Creek near Moab, UT	38.72915	-109.375672	4,070	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09181500&agency_cd=USGS&
USGS	09182000	Castle Creek above diversions, near Moab, Utah	38.5927639	-109.2656708	7,070	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09182000&agency_cd=USGS&
USGS	09182400	Castle Creek below Castle Valley near Moab, UT	38.6738712	-109.4501174	4,120	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09182400&agency_cd=USGS&
USGS	09182500	Castle Creek near Moab, Utah	38.67914895	-109.4492841	4,060	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=09182500&agency_cd=USGS&
USGS	09182880	Colorado River at highway bridge nr Moab, UT	38.6038705	-109.5778956	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=09182880&agency_cd=USGS&
USGS	09182900	Courthouse Wash at Arches hwy cross nr Moab, UT	38.648592	-109.599285	4,100	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09182900&agency_cd=USGS&
USGS	09183000	Courthouse Wash near Moab, Utah	38.61275926	-109.5798402	3,980	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09183000&agency_cd=USGS&
USGS	09183210	Colorado R above Mill Creek near Moab, Utah	38.57525984	-109.5787286	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=09183210&agency_cd=USGS&
USGS	09183500	Mill Creek at Sheley Tunnel, near Moab, UT	38.4830403	-109.4040043	5,500	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09183500&agency_cd=USGS&
USGS	09183600	Mill Creek below Sheley Tunnel, near Moab, UT	38.48571796	-109.4111044	5,341	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09183600&agency_cd=USGS&
USGS	09184000	Mill Creek near Moab, UT	38.56220477	-109.5140057	4,240	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09184000&agency_cd=USGS&

Table 2. Streamgage and surface-water sites that have more than location data reported in the National Water Information System database within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Discharge data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	09184500	Pack Creek at M4 Ranch, nr Moab, Utah	38.436097	-109.354837	6,140	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09184500&agency_cd=USGS&
USGS	09185000	Pack Creek near Moab, Utah	38.540261	-109.500672	NR	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09185000&agency_cd=USGS&
USGS	09185500	Hatch Wash near La Sal, Utah	38.24332	-109.440114	5,500	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09185500&agency_cd=USGS&
USGS	09185800	Indian Creek Tunnel near Monticello, Utah	37.8411046	-109.5054004	9,120	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09185800&agency_cd=USGS&
USGS	09186000	Indian Creek near Monticello, Utah	37.844438	-109.518734	8,700	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09186000&agency_cd=USGS&
USGS	09186500*	Indian C ab Cottonwood Creek, nr Monticello, UT	37.9722137	-109.5192888	6,290	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09186500&agency_cd=USGS&
USGS	09187000*	Cottonwood Creek near Monticello, Utah	38.062489	-109.574288	5,340	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09187000&agency_cd=USGS&
USGS	09187500*	Indian Creek abv Harts Draw, nr Monticello, UT	38.151655	-109.625675	4,920	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09187500&agency_cd=USGS&
USGS	09187550*	Indian Creek blw Bogus Pocket, nr Monticello, UT	38.1516546	-109.6256753	4,920	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=09187550&agency_cd=USGS&
USGS	09187650	Salt Cr at Canyonlands Natl Park nr Monitcello, UT	38.118071	-109.752845	5,000	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09187650&agency_cd=USGS&
USGS	09316000	Browns Wash near Green River, Utah	38.98608294	-110.1298576	4,085	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09316000&agency_cd=USGS&
USGS	09316100	FloyWash@highway bridge 6&50 near Green River,UT	38.92330555	-109.9423497	NR	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=09316100&agency_cd=USGS&
USGS	381145109525201	Colo. R. abv Green R. Confluence	38.1958611	-109.8811111	3,870	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=381145109525201&agency_cd=USGS&
USGS	381354109495201	(d-29-19)33dca Colorado R. at the loop	38.23177778	-109.8311944	3,880	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=381354109495201&agency_cd=USGS&
USGS	381741109465901	(d-29-19)12bdc Indian Creek at mouth near Moab	38.29480556	-109.7831944	3,950	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=381741109465901&agency_cd=USGS&
USGS	382042109224201	(d-28-23)22cdd Muleshoe Creek 3 upstream	38.3449722	-109.3783611	5,800	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382042109224201&agency_cd=USGS&
USGS	382046109225801	(d-28-23)22ccd Muleshoe Creek 2 at mining area	38.3460833	-109.3828611	5,720	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382046109225801&agency_cd=USGS&
USGS	382048109230801	(d-28-23)21dda Muleshoe Creek 1 downstream	38.34677778	-109.3855833	5,680	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382048109230801&agency_cd=USGS&
USGS	382208109462701	(d-28-19)13acb Colorado R. at Lathrop Canyon	38.36888889	-109.7741667	3,950	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382208109462701&agency_cd=USGS&
USGS	382319109582801	Holman Can. Pond, rm 28.1 nr Mineral Bottom	38.38859437	-109.975125	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382319109582801&agency_cd=USGS&
USGS	382328109470401	Lathrup Canyon no.4 Sog Springs nr. Moab, Utah	38.39109579	-109.7851196	4,800	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382328109470401&agency_cd=USGS&
USGS	382432109490201	Lathrup Canyon no. 1 Upper Wash, nr. Moab, Utah	38.40887305	-109.8178982	4,800	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382432109490201&agency_cd=USGS&

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Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Discharge data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	382433109485901	Lathrup Canyon no.3 mine shaft pool nr. Moab, UT	38.4091508	-109.8170648	4,800	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382433109485901&agency_cd=USGS&
USGS	382434109485801	Lathrup Canyon no.2,Mine Shaft Seep nr. Moab, UT	38.4094286	-109.816787	4,800	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382434109485801&agency_cd=USGS&
USGS	382500108540702	Yellowjacket Canyon (bl Sand Canyon)(Moqui nw qu	38.41665536	-108.9026039	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382500108540702&agency_cd=USGS&
USGS	382613108501800	Dolores R ab Mesa C nr Uravan, CO	38.4369329	-108.8389908	NR	N	Y	N	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382613108501800&agency_cd=USGS&
USGS	382632108523001	Rock Creek dup1	38.44221066	-108.8756587	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382632108523001&agency_cd=USGS&
USGS	382702108480101	South Fork Mesa Creek Red Canyon quad	38.45054389	-108.800934	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382702108480101&agency_cd=USGS&
USGS	382704108475301	South Fork Mesa Creek	38.45109944	-108.7987118	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382704108475301&agency_cd=USGS&
USGS	382714108514900	Roc C at mouth nr Uravan, CO	38.4538772	-108.8642695	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382714108514900&agency_cd=USGS&
USGS	382737109452101*	(d-27-20)18aab Colorado R. at Gooseneck	38.4602222	-109.75575	3,960	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382737109452101&agency_cd=USGS&
USGS	382800108481401	North Fork Mesa Creek (lower)	38.46665484	-108.8045454	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382800108481401&agency_cd=USGS&
USGS	382948108473701	North Fork Mesa Creek (Red Canyon)	38.4966545	-108.7942674	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382948108473701&agency_cd=USGS&
USGS	382955108473101	North Fork Mesa Creek Red Canyon quad	38.49859895	-108.7926007	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382955108473101&agency_cd=USGS&
USGS	382955108473102	N.F. Mesa Creek ab mine (Red Canyon quad)	38.49859895	-108.7926007	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382955108473102&agency_cd=USGS&
USGS	383006108585501	Salt Creek site number 1	38.5016545	-108.9826072	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383006108585501&agency_cd=USGS&
USGS	383015109392301*	(d-26-20)36aab Colorado River at JL Eddy	38.50416667	-109.6563889	3,950	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383015109392301&agency_cd=USGS&
USGS	383158108533301	Blue Creek at mouth near Gateway	38.53276504	-108.8931599	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383158108533301&agency_cd=USGS&
USGS	383203108581001	Salt Creek below Sinbad Valley near Gateway Colo	38.5341539	-108.970107	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383203108581001&agency_cd=USGS&
USGS	383226108573001	Salt Creek site number 7-	38.54054269	-108.9589956	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383226108573001&agency_cd=USGS&
USGS	383247108570401	Salt Creek site number 8	38.5463759	-108.9517732	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383247108570401&agency_cd=USGS&
USGS	383256109354801	(d-26-21)10ccc Colorado River at King's Bottom	38.5488333	-109.5966667	3,950	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383256109354801&agency_cd=USGS&
USGS	383312108561801	Salt Creek site number 10	38.5533202	-108.938995	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383312108561801&agency_cd=USGS&
USGS	383328108555201	Salt Creek site number 2	38.55776459	-108.9317726	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383328108555201&agency_cd=USGS&

Table 2. Streamgage and surface-water sites that have more than location data reported in the National Water Information System database within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Discharge data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383342108551001	Salt Creek site number 14	38.5616534	-108.9201056	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383342108551001&agency_cd=USGS&
USGS	383420109334001	Mill Creek at 500 west, Moab, UT	38.5722044	-109.561784	3,985	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383420109334001&agency_cd=USGS&
USGS	383427109341501	(d-26-21) 2bda Mill Creek nr mouth	38.5740833	-109.5708889	3,960	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383427109341501&agency_cd=USGS&
USGS	383454109343001	Moab Slough pond 1	38.58164865	-109.575673	3,860	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383454109343001&agency_cd=USGS&
USGS	383502109343901	Moab Slough pond 2	38.5838708	-109.5781731	3,860	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383502109343901&agency_cd=USGS&
USGS	383525109344101	Moab slough pond 3	38.5902596	-109.5787288	3,860	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383525109344101&agency_cd=USGS&
USGS	383619108501201	Mesa Creek at mouth near Uravan	38.6052637	-108.8373252	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383619108501201&agency_cd=USGS&
USGS	383712110000501*	Spring Canyon, rm 67.5 at Bowknot Bend of Green R.	38.6199794	-110.0020706	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383712110000501&agency_cd=USGS&
USGS	383714108514601	Roc Creek at mouth near Uravan	38.6205412	-108.8634374	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383714108514601&agency_cd=USGS&
USGS	383942109300401	(d-25-22) 5ada Colorado R. blw Salt Wash Rapids	38.66166667	-109.5011111	4,000	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383942109300401&agency_cd=USGS&
USGS	384025109295201*	(d-24-22)33bcc Salt Wash at mouth nr Moab, UT	38.67377778	-109.4978889	4,000	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384025109295201&agency_cd=USGS&
USGS	384029109292701	(d-24-22)33acc Colorado R abv Salt Wash nr Moab	38.6748611	-109.4909722	4,000	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384029109292701&agency_cd=USGS&
USGS	384050108585201	Dolores River at Gateway	38.68054009	-108.9817756	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384050108585201&agency_cd=USGS&
USGS	384051108584601	Dolores River @ Gateway	38.68081786	-108.9801089	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384051108584601&agency_cd=USGS&
USGS	384052108582101	West Creek at Dolores	38.68109564	-108.9731642	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384052108582101&agency_cd=USGS&
USGS	384124109144501	Onion Creek seep site number 1	38.68998609	-109.2465042	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384124109144501&agency_cd=USGS&
USGS	384139109150101	Onion Creek site number 3	38.69415277	-109.2509487	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384139109150101&agency_cd=USGS&
USGS	384146109151001	Onion Creek site number 5	38.69609716	-109.2534487	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384146109151001&agency_cd=USGS&
USGS	384152109161801	Onion Creek site number 8	38.69776344	-109.2723378	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384152109161801&agency_cd=USGS&
USGS	384155109163301	Onion Creek site number 10	38.69859669	-109.2765046	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384155109163301&agency_cd=USGS&
USGS	384201109171801	Onion Creek site number 12	38.7002631	-109.2890047	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384201109171801&agency_cd=USGS&
USGS	384203108564201	204 lower West Creek	38.7008175	-108.9456634	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384203108564201&agency_cd=USGS&

Table 2. Streamgage and surface-water sites that have more than location data reported in the National Water Information System database within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Discharge data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	384218109190101	Onion Creek site number 19	38.7049847	-109.3176162	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384218109190101&agency_cd=USGS&
USGS	384219109181101	Onion Creek site number 15	38.70526278	-109.3037271	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384219109181101&agency_cd=USGS&
USGS	384225109183001	Onion Creek site number 17	38.7069293	-109.309005	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384225109183001&agency_cd=USGS&
USGS	384248109222101	(d-24-23)16dad Professor Creek at hwy 128	38.71327778	-109.3724167	4,120	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384248109222101&agency_cd=USGS&
USGS	384253109194201	Onion Creek site number 22	38.71470666	-109.3290052	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384253109194201&agency_cd=USGS&
USGS	384314109202401	Onion Creek site number 24	38.7205397	-109.340672	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384314109202401&agency_cd=USGS&
USGS	384329108542201	West Creek @ Ute Creek q	38.72470598	-108.9067732	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384329108542201&agency_cd=USGS&
USGS	384341109205501	Onion Creek Seep site number 26	38.72803949	-109.3492833	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384341109205501&agency_cd=USGS&
USGS	384345109205301	Onion Creek site number 26	38.7291506	-109.3487278	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384345109205301&agency_cd=USGS&
USGS	384357109212001	Onion Creek site #28	38.73248376	-109.3562279	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384357109212001&agency_cd=USGS&
USGS	384408109214001	Onion Creek seep site number 30	38.73553918	-109.3617835	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384408109214001&agency_cd=USGS&
USGS	384458108541501	West Creek near North Fork	38.74942776	-108.9048289	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384458108541501&agency_cd=USGS&
USGS	384527108462701	West Creek below Pansy Gulch near Gateway, CO	38.75748339	-108.7748237	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384527108462701&agency_cd=USGS&
USGS	384532108540201	North Fork @ mouth s	38.7588722	-108.9012176	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384532108540201&agency_cd=USGS&
USGS	384613108490400	West C nr mouth nr Gateway, CO	38.77026115	-108.8184365	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384613108490400&agency_cd=USGS&
USGS	385948110083801	drain no.1 near Green River, UT	38.99677778	-110.1438611	NR	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385948110083801&agency_cd=USGS&
USGS	390135110082301	East-Side Canal at mouth nr Green River, UT	39.0265	-110.1397222	NR	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=390135110082301&agency_cd=USGS&
USGS	390212109323401	Nash Wash near Thompson, Utah	39.0366411	-109.5434565	5,000	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=390212109323401&agency_cd=USGS&
USGS	390214110084901	ditch no. 3 near Green River, UT	39.03719444	-110.1470278	NR	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=390214110084901&agency_cd=USGS&
USGS	390446110082401	East-Side Canal at head nr Green River, UT	39.0794722	-110.1398611	NR	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=390446110082401&agency_cd=USGS&
USGS	390828109242201	Cottonwood Wash near Cisco, Utah	39.141088	-109.4067885	5,080	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=390828109242201&agency_cd=USGS&
USGS	391455109140401	Westwater Wash near Harley Dome, Utah	39.24859	-109.235119	4,900	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=391455109140401&agency_cd=USGS&

* Denotes sites that are loacted in the Moab Master Leasing Plan area.

Table 3. Streamgages with daily discharge data from the National Water Information System database used to estimate streamflow statistics within the study area, Utah and Colorado.

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Altitude of gage, in feet	Period of record	Group classification[1]	Link to NWIS website
USGS	09163570	Hay Press c ab Fruita Res #3, nr Glade Park, CO	38.850817	-108.782879	8,990	1983-04-01 to 1988-03-31	1	http://waterdata.usgs.gov/nwis/inventory/?site_no=09163570&agency_cd=USGS&
USGS	09180920	Onion Creek above Onion C Bridge nr Moab, UT	38.69693	-109.255115	NR	1979-08-17 to 1981-10-19	1	http://waterdata.usgs.gov/nwis/inventory/?site_no=09180920&agency_cd=USGS&
USGS	09180970	Onion Creek below Onion Crk Bridge nr Moab, UT	38.706374	-109.315116	NR	1979-08-16 to 1981-10-08	2	http://waterdata.usgs.gov/nwis/inventory/?site_no=09180970&agency_cd=USGS&
USGS	09182200	Castle Creek below Castleton near Moab, UT	38.612485	-109.332338	5,600	1992-04-03 to 2001-09-30	2	http://waterdata.usgs.gov/nwis/inventory/?site_no=09182200&agency_cd=USGS&
USGS	09182400	Castle Creek below Castle Valley near Moab, UT	38.673871	-109.450117	4,120	1992-04-03 to 2012-10-14	2	http://waterdata.usgs.gov/nwis/inventory/?site_no=09182400&agency_cd=USGS&
USGS	09183600	Mill Creek below Sheley Tunnel, near Moab, UT	38.485718	-109.411104	5,341	2003-10-01 to 2012-10-30	2	http://waterdata.usgs.gov/nwis/inventory/?site_no=09183600&agency_cd=USGS&
USGS	09184500	Pack Creek at M4 Ranch, nr Moab, Utah	38.436097	-109.354837	6,140	1954-10-01 to 1959-09-30	2	http://waterdata.usgs.gov/nwis/inventory/?site_no=09184500&agency_cd=USGS&
USGS	09185000	Pack Creek near Moab, Utah	38.540261	-109.500672	NR	1954-10-01 to 1959-09-30	2	http://waterdata.usgs.gov/nwis/inventory/?site_no=09185000&agency_cd=USGS&
USGS	09182000	Castle Creek above diversions, near Moab, Utah	38.592764	-109.265671	7,070	1950-07-11 to 1975-10-07	3	http://waterdata.usgs.gov/nwis/inventory/?site_no=09182000&agency_cd=USGS&
USGS	09185800	Indian Creek Tunnel near Monticello, Utah	37.841105	-109.5054	9,120	1957-10-01 to 1980-09-30	3	http://waterdata.usgs.gov/nwis/inventory/?site_no=09185800&agency_cd=USGS&
USGS	09186000	Indian Creek near Monticello, Utah	37.844438	-109.518734	8,700	1949-10-01 to 1957-09-30	3	http://waterdata.usgs.gov/nwis/inventory/?site_no=09186000&agency_cd=USGS&
USGS	09187000	Cottonwood Creek near Monticello, Utah	38.062489	-109.574288	5,340	1949-10-01 to 1957-09-30	3	http://waterdata.usgs.gov/nwis/inventory/?site_no=09187000&agency_cd=USGS&
USGS	09316100	Floywash@highway Bridge 6&50 near Green River,UT	38.923306	-109.94235	NR	1983-04-15 to 1986-09-30	3	http://waterdata.usgs.gov/nwis/inventory/?site_no=09316100&agency_cd=USGS&
USGS	09163675	Cottonwood Wash at I-70, near Cisco, Utah	39.081652	-109.217615	NR	1983-04-13 to 1986-09-30	4	http://waterdata.usgs.gov/nwis/inventory/?site_no=09163675&agency_cd=USGS&
USGS	09179200	Salt Creek near Gateway, CO	38.533043	-108.97094	5,220	1979-09-01 to 1985-09-30	4	http://waterdata.usgs.gov/nwis/inventory/?site_no=09179200&agency_cd=USGS&
USGS	09183500	Mill Creek at Sheley Tunnel, near Moab, UT	38.48304	-109.404004	5,500	1954-10-01 to 2012-12-02	4	http://waterdata.usgs.gov/nwis/inventory/?site_no=09183500&agency_cd=USGS&
USGS	09184000	Mill Creek near Moab, UT	38.562205	-109.514006	4,240	1949-07-01 to 1993-10-25	4	http://waterdata.usgs.gov/nwis/inventory/?site_no=09184000&agency_cd=USGS&
USGS	09187550	Indian Creek blw Bogus Pocket, nr Monticello, UT	38.151655	-109.625675	4,920	1983-04-01 to 1988-03-02	4	http://waterdata.usgs.gov/nwis/inventory/?site_no=09187550&agency_cd=USGS&
USGS	09179000	Roc Creek near Uranium, CO.	38.435266	-108.922883	5,200	1944-08-01 to 1952-09-30	5	http://waterdata.usgs.gov/nwis/inventory/?site_no=09179000&agency_cd=USGS&
USGS	09181000	Onion Creek near Moab, Utah	38.724984	-109.345117	4,120	1950-06-29 to 1955-09-30	5	http://waterdata.usgs.gov/nwis/inventory/?site_no=09181000&agency_cd=USGS&
USGS	09181500	Professor Creek near Moab, UT	38.72915	-109.375672	4,070	1950-07-01 to 1953-09-30	5	http://waterdata.usgs.gov/nwis/inventory/?site_no=09181500&agency_cd=USGS&

Table 3. Streamgages with daily discharge data from the National Water Information System database used to estimate streamflow statistics within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Altitude of gage, in feet	Period of record	Group classification[1]	Link to NWIS website
USGS	09182500	Castle Creek near Moab, Utah	38.679149	-109.449284	4,060	1950-07-10 to 1958-09-30	5	http://waterdata.usgs.gov/nwis/inventory/?site_no=09182500&agency_cd=USGS&
USGS	09182900	Courthouse Wash at Arches hwy cross nr Moab, UT	38.648592	-109.599285	4,100	1958-10-01 to 1966-07-15	5	http://waterdata.usgs.gov/nwis/inventory/?site_no=09182900&agency_cd=USGS&
USGS	09183000	Courthouse Wash near Moab, Utah	38.612759	-109.57984	3,980	1949-10-01 to 1989-09-30	5	http://waterdata.usgs.gov/nwis/inventory/?site_no=09183000&agency_cd=USGS&
USGS	09185500	Hatch Wash near La Sal, Utah	38.24332	-109.440114	5,500	1950-08-01 to 1971-09-30	5	http://waterdata.usgs.gov/nwis/inventory/?site_no=09185500&agency_cd=USGS&
USGS	09186500	Indian C ab Cottonwood Creek, nr Monticello, UT	37.972214	-109.519289	6,290	1949-10-01 to 1991-10-07	5	http://waterdata.usgs.gov/nwis/inventory/?site_no=09186500&agency_cd=USGS&
USGS	09187500	Indian Creek abv Harts Draw, nr Monticello, UT	38.151655	-109.625675	4,920	1949-10-01 to 1984-01-31	5	http://waterdata.usgs.gov/nwis/inventory/?site_no=09187500&agency_cd=USGS&
USGS	09316000	Browns Wash near Green River, Utah	38.986083	-110.129858	4,085	1949-03-01 to 1968-09-30	5	http://waterdata.usgs.gov/nwis/inventory/?site_no=09316000&agency_cd=USGS&
USGS	09179500	Dolores River at Gateway, CO.	38.681373	-108.980387	4,548	1936-10-01 to 1954-09-30	6	http://waterdata.usgs.gov/nwis/inventory/?site_no=09179500&agency_cd=USGS&
USGS	09180000	Dolores River near Cisco, UT	38.797208	-109.195114	4,165	1950-12-01 to 2012-10-29	6	http://waterdata.usgs.gov/nwis/inventory/?site_no=09180000&agency_cd=USGS&
USGS	09180500	Colorado River near Cisco, UT	38.810541	-109.293449	4,090	1913-10-01 to 2012-10-18	6	http://waterdata.usgs.gov/nwis/inventory/?site_no=09180500&agency_cd=USGS&

[1]Group classification based on the following stream characteristics:

1 Low discharge perennial streams with maximum daily discharges of less than 10 cfs.

2 Moderate discharge perennial streams with maximum daily discharges between 10 and 100 cfs.

3 Moderate discharge ephemeral or intermittent streams with maximum daily discharges between 10 and 100 cfs.

4 High discharge perennial streams with maximum daily discharges between 100.1 and 1,000 cfs.

5 High discharge ephemeral or intermittent streams with maximum daily discharges between 100.1 and 1,000 cfs.

6 Very high discharge perennial streams with maximum daily discharges greater than 10,000 cfs.

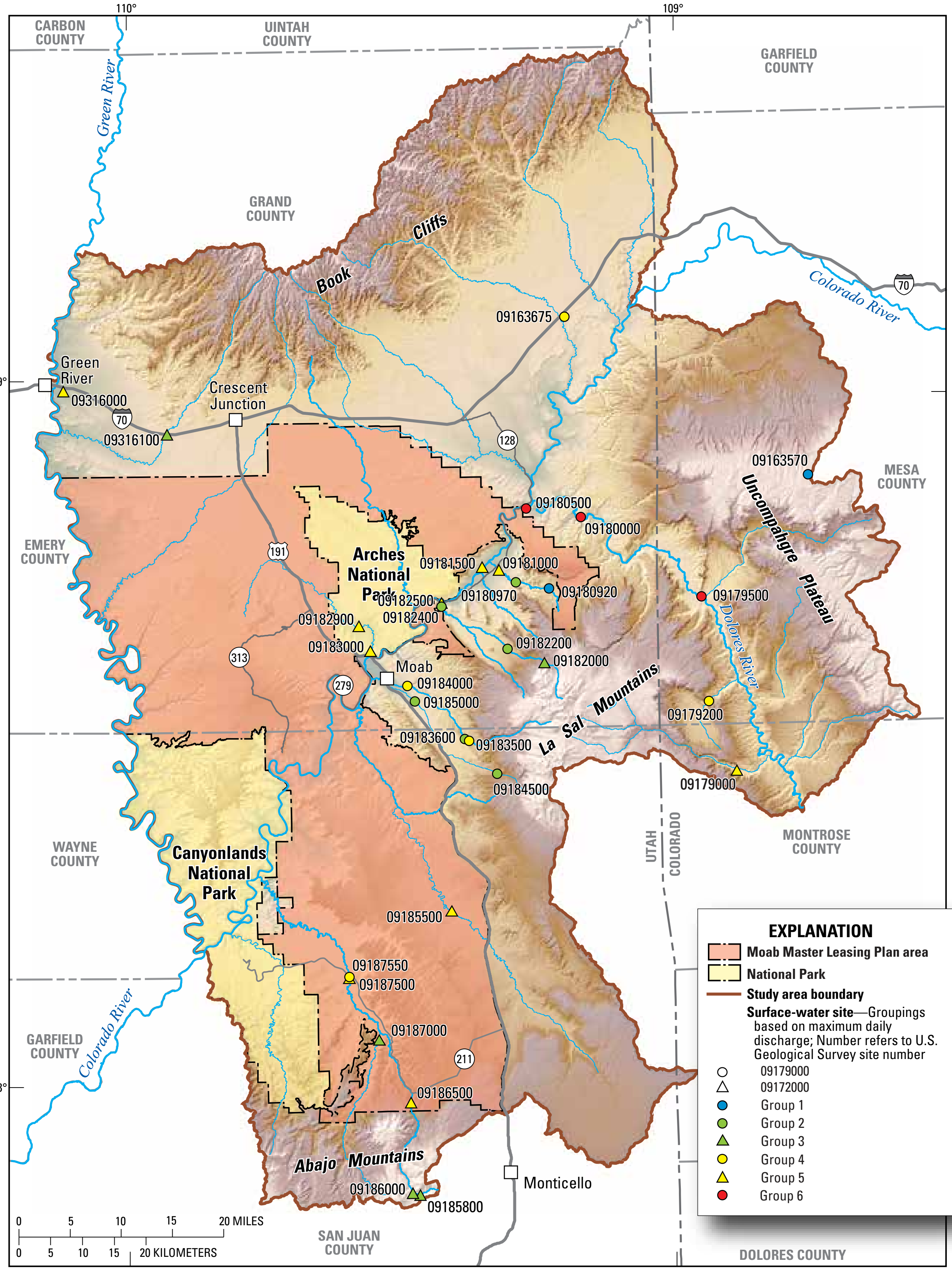

Figure 3. Location of U.S. Geological Survey streamgages used to compute daily streamflow statistics within the study area and associated group classification.

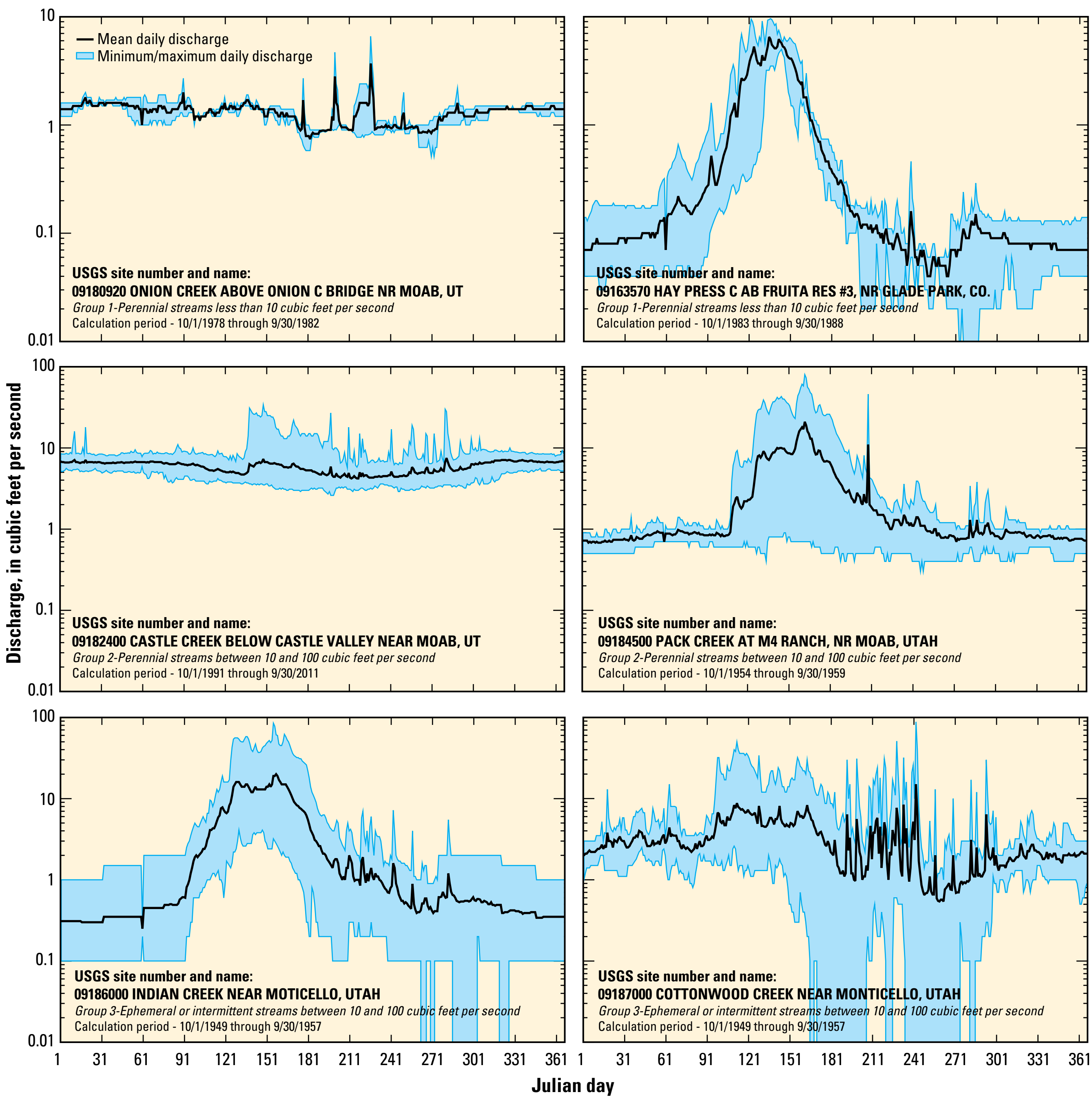

Figure 4. Hydrographs showing daily stream discharge statistics of representative streams for each of the six stream groups within the study area.

General Streamflow Classification

An annual spring snowmelt and runoff event dominates the hydrology of streams draining mountainous parts of the study area, and most of the perennial streams within the study area are considered to be snowmelt-dominated. Hydrographs for snowmelt-dominated streams such as Hay Press Creek (USGS site number 09163570) or Mill Creek at Sheley Tunnel (USGS site number 09183500) show a well-defined peak that lasts several weeks during the spring to early summer (generally, Julian days 91 through 211; fig. 4). Many of the gaged streams also are perennial for most of the period of the record, such as Castle Creek (USGS site number 09182400) or Mill Creek near Moab (USGS site number 09184000; fig. 4). If the minimum daily flow decreases to zero, however, the stream is considered ephemeral/intermittent at that location. The hydrographs for streamgage sites on Indian Creek (USGS site number 09186000) and Cottonwood Creek (USGS site number 09187000) show this ephemeral/intermittent pattern (fig. 4).

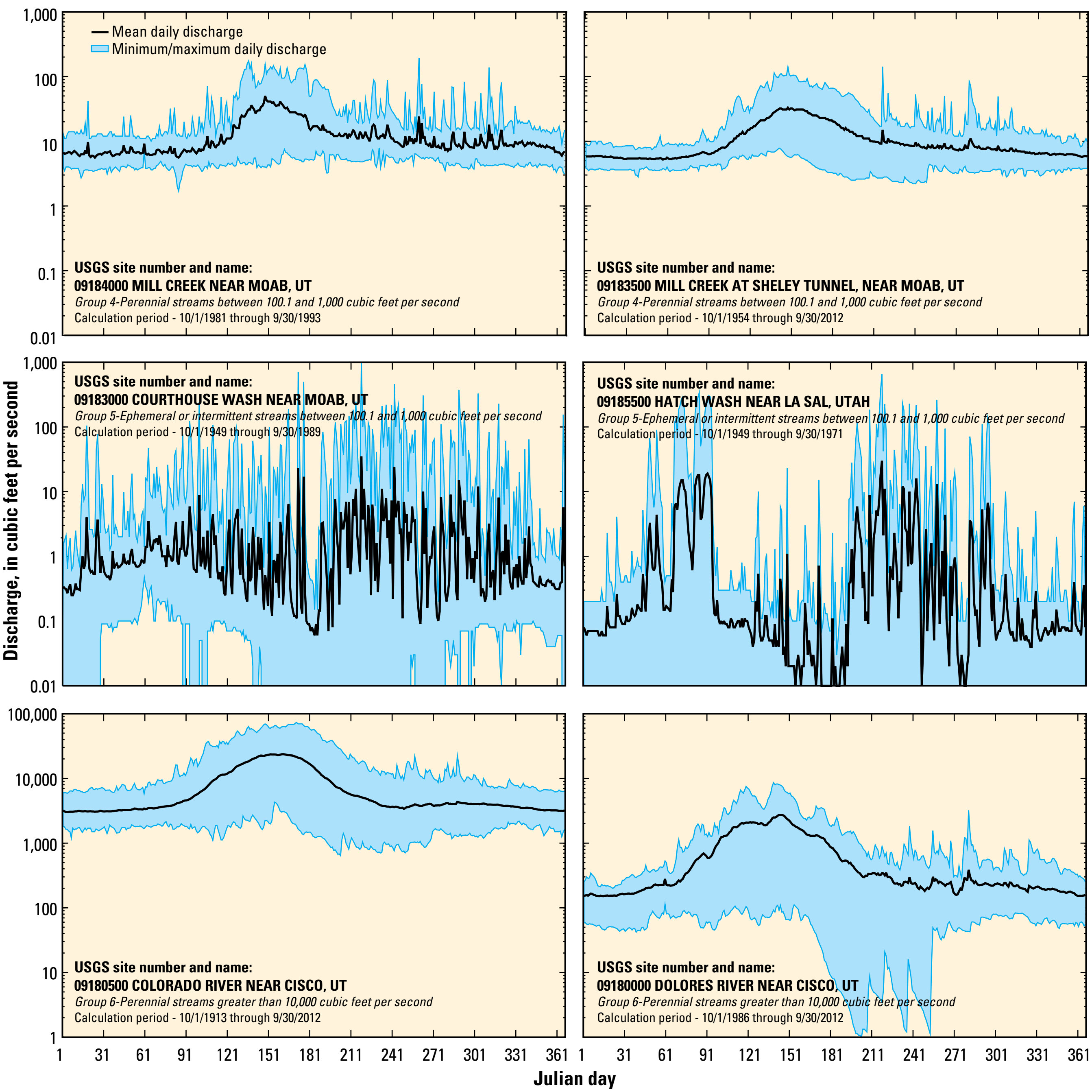

Figure 4. Hydrographs showing daily stream discharge statistics of representative streams for each of the six stream groups within the study area.—Continued

The timing of the peak snowmelt runoff at a streamgage will vary in time because of year-to-year variations in snowpack depth and air temperature, which control the rate of spring snowmelt (Clow, 2010). Higher-altitude locations generally are underlain by fractured volcanics with secondary permeability that increases subsurface infiltration and groundwater recharge, as opposed to rapid surficial runoff (Gardner and others, 2010). Examples of this behavior are Pack Creek (USGS site number 09184500) and Indian Creek (USGS site number 09186000; fig. 4).

A bimodal distribution is observed in hydrographs from some sites with a late-spring snowmelt-runoff peak followed by smaller peaks of shorter duration during the late summer, such as Cottonwood Creek (USGS site number 09187000), Courthouse Wash (USGS site number 09183000), and Hatch Wash (USGS site number 09185500; fig. 4). The rapid and intense (flashy) response to monsoonally-derived precipitation events (generally occurring on Julian days 181 through 301) is typical of watersheds where semi-impermeable slickrock sandstone is prevalent. In these areas, high rainfall intensities can lead to excess overland flow.

The very large regional streams include the Colorado River, the Green River, and the Dolores River. These rivers integrate local streamflow variations caused by local meteorological conditions, event-based variations, and complex topography of very large contributing areas. The hydrographs for these streams, therefore, are much more smooth and consistent, as indicated by the Colorado River (USGS site number 09180500) or the Dolores River (USGS site number 09180000) hydrographs (fig. 4). These hydrographs show a clear late spring snowmelt-runoff peak, and less flashy response to subsequent precipitation events than some of the smaller streams.

The mean daily discharge and the maximum and minimum daily discharge for the period of record provide information on the stream type, flow duration, and range of discharge that has been observed at the streamgage. Additional information on streamflow can be obtained by examining mean annual discharge. The mean annual discharge for each of the 31 locations with long-term statistics, arranged into the six group classifications, is shown in figure 5. In general, the larger and (or) perennial streams show less variation in mean annual discharge than the smaller and (or) ephemeral/intermittent streams.

Surface-Water Quality

Water-quality samples were collected by the USGS from the streamgages and surface-water sampling sites within the study area during a variety of previous and ongoing investigations. At 99 of the streamgages and sampling sites, stream discharge and (or) field parameters were measured, and (or) water samples were collected and analyzed for varying suites of parameters (table 2). As many as 501 individual parameters have been measured, including physical stream parameters, hydrologic conditions, water quality, and biological constituents.

Each of the streamgages and sampling sites were sampled between 1 and 2,983 times over the period of record for the site, with an average of 65 samples collected per site. A total of 6,444 water-quality samples were collected within the study area. Most samples (67 percent) were collected at the Dolores River near Cisco (USGS site number 09180000) and Colorado River near Cisco (USGS site number 09180500) streamgages.

Specific conductance provides a spatial indicator of the relative difference in total dissolved solids between locations that can be used to infer general water quality. Specific conductance is essentially a surrogate for total dissolved solids because conductance is highly dependent on the amount of dissolved solids in the water. As a general rule of thumb, specific conductance can be converted to concentrations of total dissolved solids by multiplying the conductance by 0.65 (Hem, 1985). The measured mean values of specific conductance from streamgages and surface-water sampling sites within the study area are shown in figure 6. Mean specific-conductance values were calculated as the mean of all specific-conductance measurements made at each surface-water streamgage or sampling site; the number of measurements and period of record are highly variable from site to site. Eight sites in Salt Creek, a tributary of the Dolores River, had 8 of the 10 greatest mean specific-conductance measurements, ranging from slightly greater than 12,000 µS/cm up to about 141,000 µS/cm. The other two locations with mean specific-conductance values greater than 10,000 µS/cm were Professor Creek at Highway 128, near Moab, Utah (USGS site number 384248109222101), and Lathrop Canyon No. 2 (USGS site number 382434109485801) located north of the confluence of the Green and Colorado Rivers in Canyonlands National Park. These results are consistent with previous investigations that identify the effects of regional salt anticlines on salinity loading (Weir and others, 1983).

Because the regional surface-water resources are an extremely limited and valuable resource, pollutants that cause restrictions on use can be detrimental. The Clean Water Act Amendments of 1977 (available at *http://www.epa.gov/npdes/pubs/cwatxt.txt,* accessed June 3, 2013) require states to establish and maintain water-quality standards that are designed to protect, restore, and preserve the quality of water throughout the state. When the water-quality standards are not maintained in a water body for the designated use classification, section 303(d) of the Clean Water Act requires the state to place the water body on a list of impaired waters and to prepare a plan to restore the water quality. The plan of study is based on the total maximum daily load, which establishes the maximum amount of the pollutant in a specific water body to maintain the designated beneficial use. Several streams throughout the study area are considered impaired for specific designated-use classifications (available at *http://www.epa.gov/waters/ir/index.html* accessed on November 8, 2013). Based on the reporting cycle for 2010, the EPA has reported that the Colorado River is impaired with respect to selenium. Mill Creek, Onion Creek, Pack Creek, and the Dolores River are impaired with respect to total dissolved solids. Additionally, Mill Creek, Onion Creek, and Pack Creek are impaired with respect to temperature, and the Dolores River is impaired with respect to iron. Finally, Castle Creek, Westwater Creek, and Cottonwood Wash are impaired with respect to benthic macroinvertebrates bioassessments.

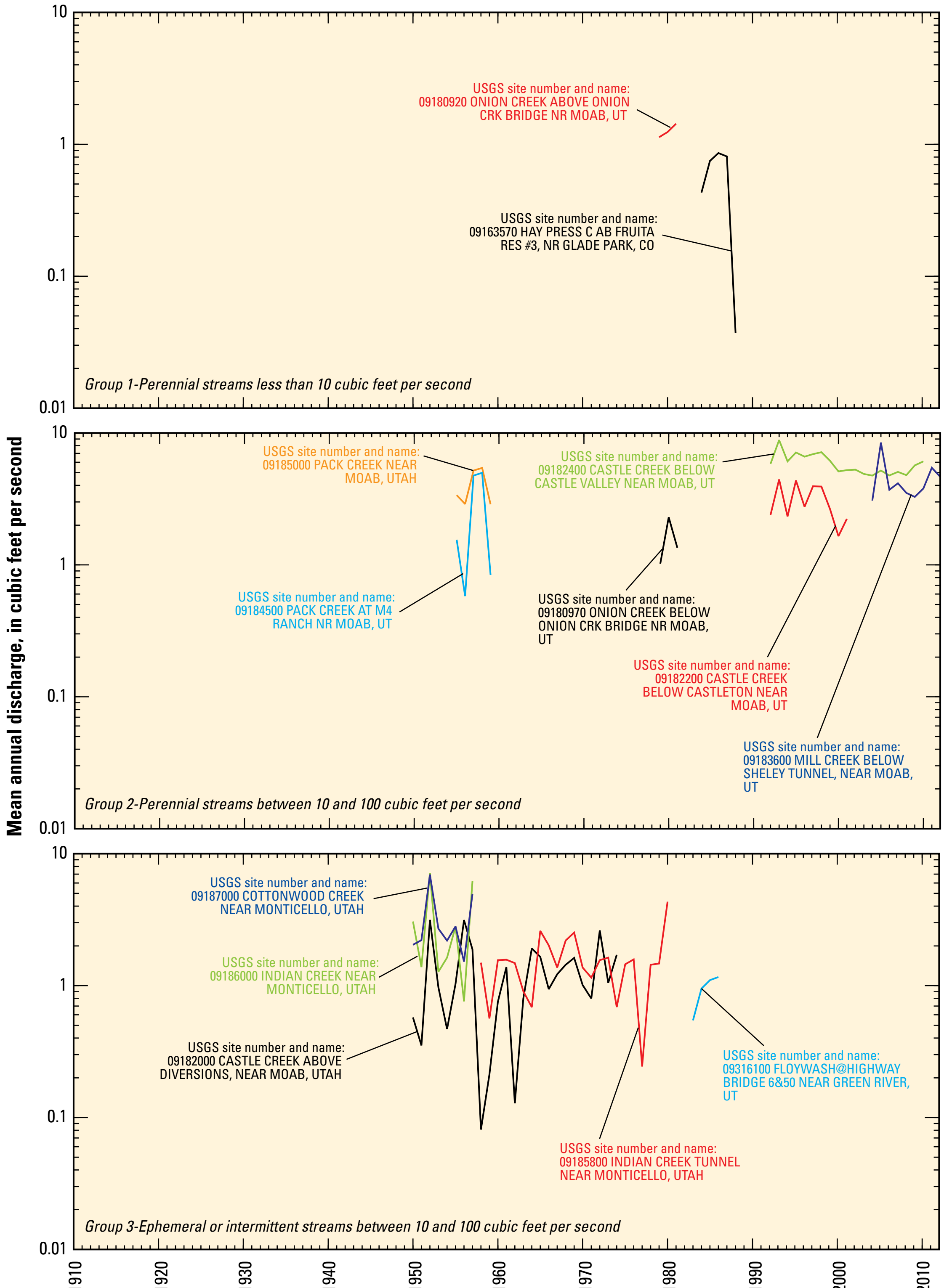

Figure 5. Hydrographs showing mean annual surface-water discharge, grouped by stream classification.

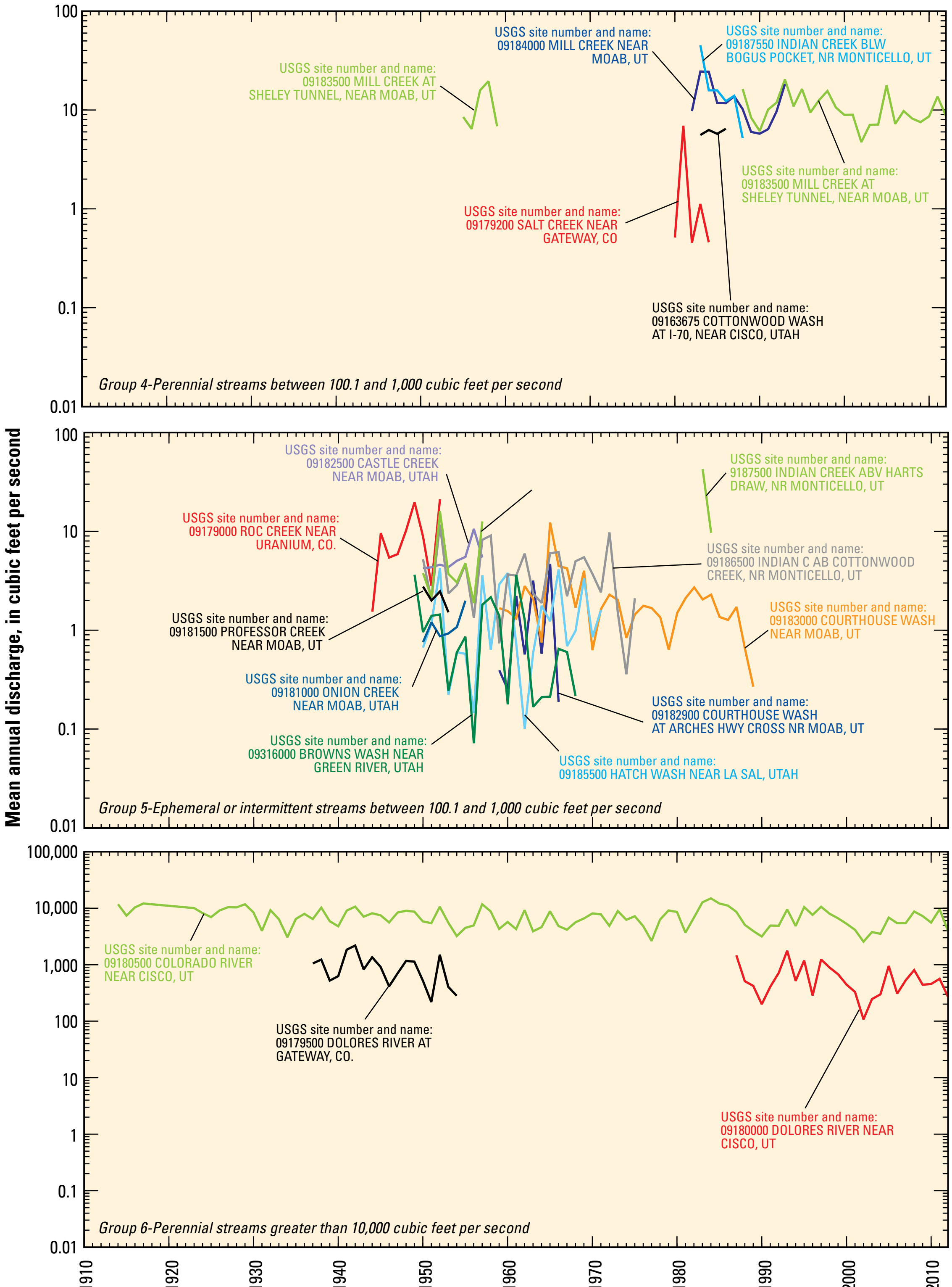

Figure 5. Hydrographs showing mean annual surface-water discharge, grouped by stream classification.—Continued

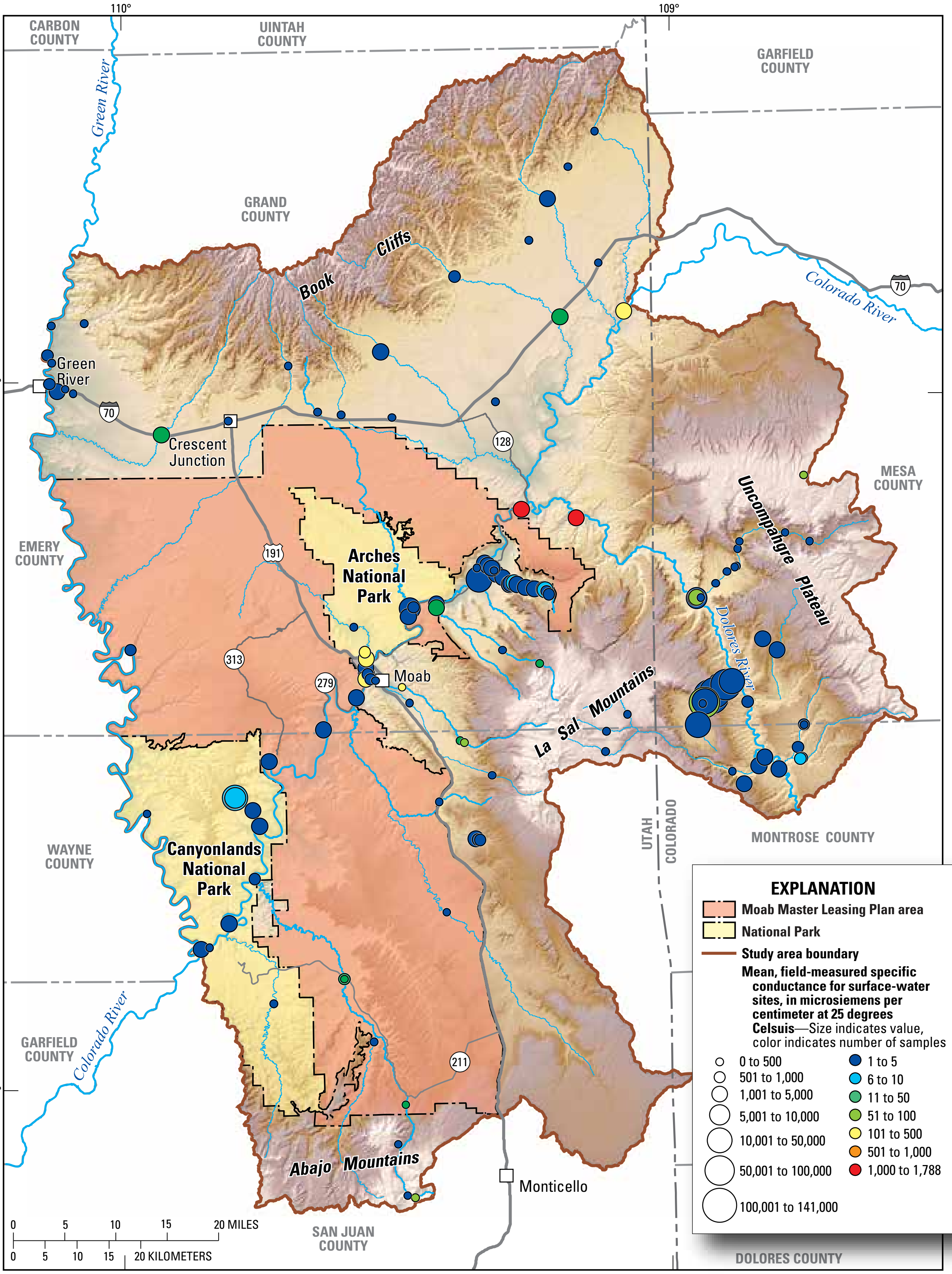

Figure 6. Mean field-measured specific conductance for surface-water sites within the study area.

Groundwater

Data for springs and wells within the study area were obtained from the USGS NWIS database (available at *http://waterdata.usgs.gov/nwis*), and include location information; discharge data for springs; water-level and total depth data for wells; and selected field parameters, major ions, and trace metals. While other unpublished groundwater data may exist from other agencies, only USGS data are discussed in the following sections. Within the study area, there are 216 springs (fig. 7) and 1,062 wells (fig. 8) reported in NWIS. Most of these reported sites, however, have no data associated with them in NWIS other than location.

Springs

Of the 216 springs reported in the NWIS database for the study area (fig. 7), 129 have no discharge or water-quality data associated with them. Of the remaining 87 springs, 64 have at least 1 discharge measurement; 65 have reported field measurements of temperature, pH, and (or) specific conductance; 65 have reported major ion concentrations; and 61 have reported concentrations of trace metals, including iron, manganese, arsenic, selenium, and (or) uranium (table 4). Links to the NWIS database are provided in table 4 for sites with discharge and (or) water-quality data. Although few of the reported springs are present within the Moab MLP area, large parts of the Moab MLP area are upgradient of springs that are important water resources, especially springs in Canyonlands and Arches National Parks. Groundwater withdrawals within the Moab MLP area, therefore, potentially could affect discharge to these downgradient springs.

The mean discharge for the 64 springs with available discharge data within the study area is shown in figure 9. Mean discharge was calculated as the mean of all discharge measurements made at each spring; the number of measurements and period of record are highly variable from spring to spring. Mean spring discharge within the study area varies widely between less than 1 and 371 gal/min. The largest reported mean spring discharges are in Moab-Spanish Valley, and on the western flank of the La Sal Mountains. Most springs within the study area have mean discharges of less than 10 gal/min.

Wells

Of the 1,062 wells reported in the NWIS database for the study area (fig. 8), 590 have no water-level or water-quality data associated with them. Of the remaining 472 wells, 417 have at least 1 water-level measurement; 115 have reported field measurements of temperature, pH, and (or) specific conductance; 109 have reported major ion concentrations; and 77 have reported concentrations of trace metals, including iron, manganese, arsenic, selenium, and (or) uranium (table 5). Links to the NWIS database are provided in table 5 for wells with water-level and (or) water-quality data. Although a number of the reported wells are located within the Moab MLP area, there are no data other than location reported in the NWIS database for most of these wells.

Water Levels

Mean water-level altitudes for 417 wells within the study area are shown in figure 10. Mean water-level altitudes were calculated as the mean of all water-level measurements made at each well; the number of measurements and period of record are highly variable from well to well. Mean water-level altitudes range from 2,500 to 8,500 ft within the study area. The water-level altitudes generally indicate a regional hydraulic gradient, or groundwater flow potential, towards the Colorado River, with local gradients showing groundwater movement towards small surface-water drainage features.

The locations of 20 wells with long-term (20 years or greater) water-level records in the study area are shown in figure 11. Hydrographs of the water levels in these wells are shown in figure 12. Wells 1, 2, 4, 5, 7, and 15 are completed in unconsolidated aquifers; wells 6, 8, and 10 are completed in the Glen Canyon Group aquifer; and aquifers of completion are unknown for wells 3, 9, 11, 12, 13, 14, 16, 17, 18, 19, and 20.

Seasonally, water levels are higher in the spring and lower in the autumn, which can be seen in hydrographs of wells that were measured more than once annually (for example, wells 7 and 9 from 1971 to 1982 on fig 12). Water levels generally declined from the late 1960s to the late 1970s (for example, wells 1, 7, and 9 on fig. 12), corresponding to a period of below-average precipitation in the area (Burden and others, 2011, fig. 40). Water levels in the 1980s show a large rise (for example, wells 1, 6, 7, 8, 9, and 17 on fig. 12), which corresponds to an increase in precipitation to near-average or above-average conditions in the mid- to late 1980s (Burden and others, 2011, fig. 40). Water levels generally rose or remained constant in the 1990s (for example, wells 1, 2, 6, 7, 8, and 9 on fig. 12), followed by a decline from the early to mid-2000s (for example, wells 6, 7, 8, 9, and 17 on fig. 12), corresponding to a slight decrease in precipitation (Burden and others, 2011, fig. 40). Since the mid-2000s, water levels have remained relatively constant (for example, wells 1, 2, 5, 7, 8, 9, and 10 on fig. 12).

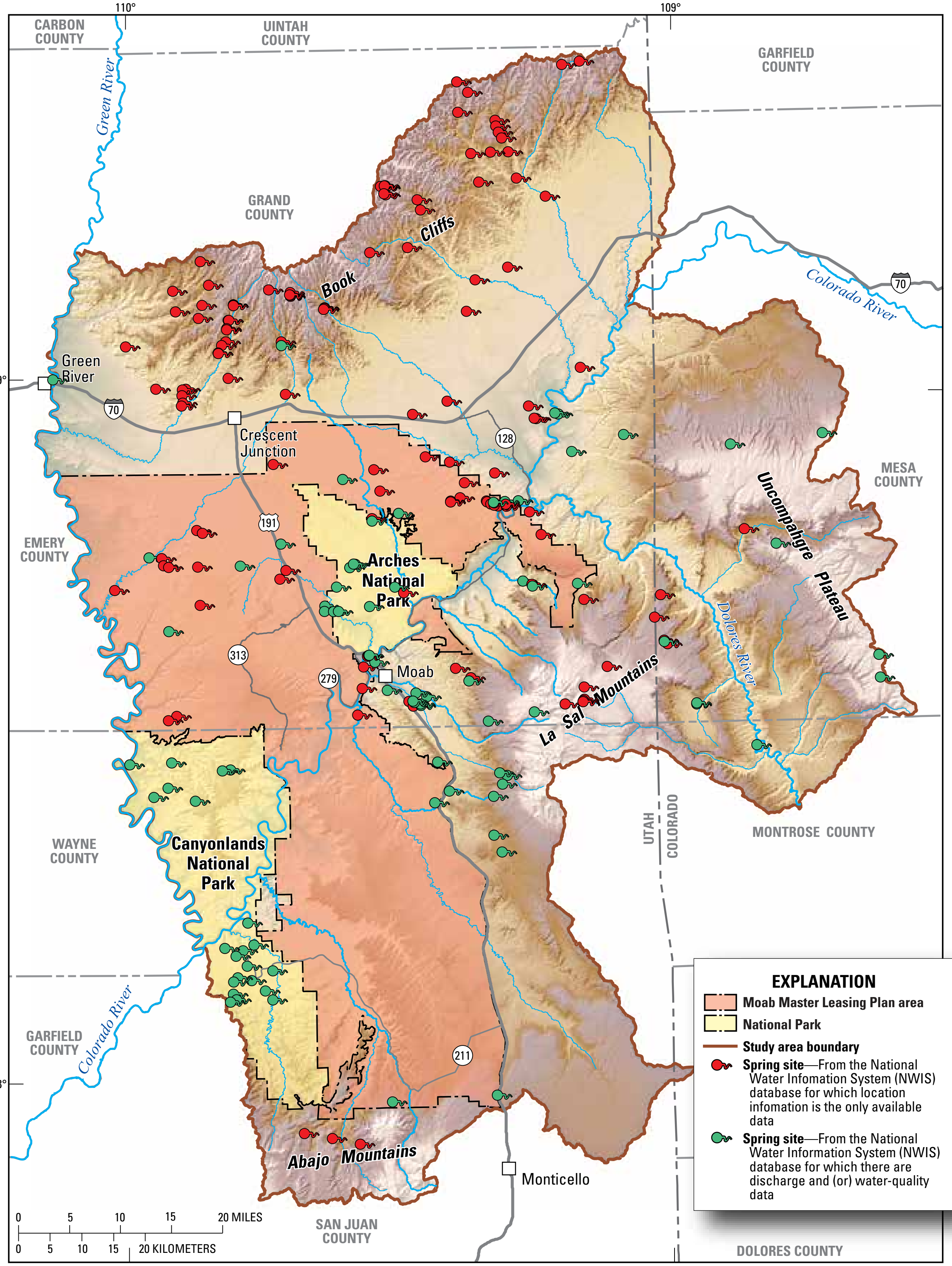

Figure 7. Location of spring sites within the study area reported in the National Water Information System database.

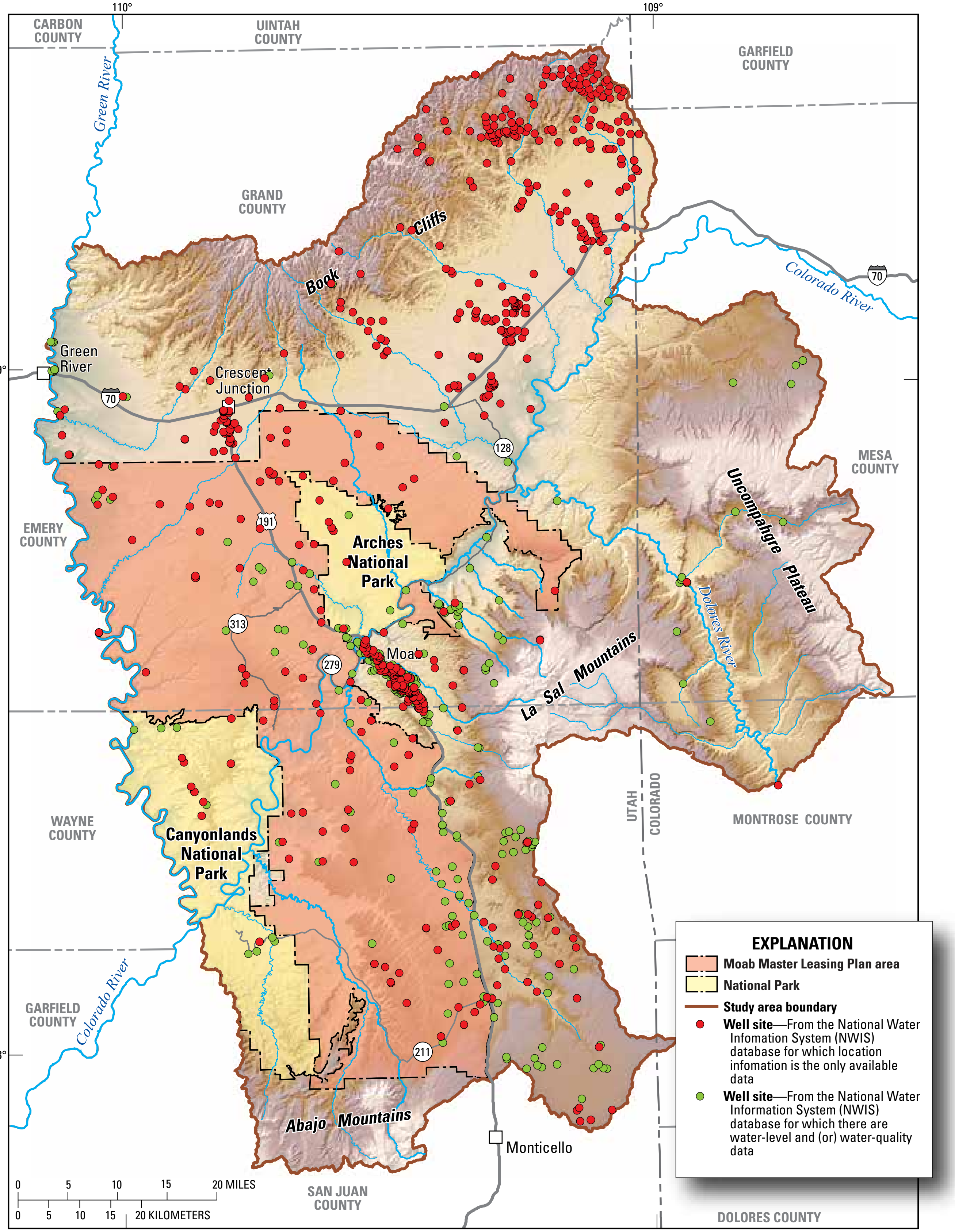

Figure 8. Location of wells within the study area reported in the National Water Information System database.

Table 4. Spring sites with discharge and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Discharge data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	375802109323001*	(D-32-22)30dba-S1	37.96721	-109.54234	7,100	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=375802109323001&agency_cd=USGS&
USGS	375831109211001	(D-32-23)24ccc-S1	37.97527	-109.35345	6,850	N	N	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=375831109211001&agency_cd=USGS&
USGS	380646109494701	(D-31-19) 4adc-S1	38.11277	-109.83040	5,400	Y	N	N	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=380646109494701&agency_cd=USGS&
USGS	380655109451501	(D-31-20) 6ada-S1	38.11527	-109.75484	5,020	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=380655109451501&agency_cd=USGS&
USGS	380658109490701	(D-31-19) 3bda-S1	38.11610	-109.81929	5,270	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380658109490701&agency_cd=USGS&
USGS	380728109492801	T(D-30-19)34cac-S1	38.12443	-109.82512	5,200	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=380728109492801&agency_cd=USGS&
USGS	380742109460201	(D-30-19)31cdd-S1	38.12832	-109.76790	5,030	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=380742109460201&agency_cd=USGS&
USGS	380830109492501	(D-30-19)27cdd-S1	38.14165	-109.82429	5,180	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=380830109492501&agency_cd=USGS&
USGS	380835109473001	(D-30-19)25cdc-S1	38.14304	-109.79235	5,060	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=380835109473001&agency_cd=USGS&
USGS	380850109485501	(D-30-19)26cbc-S1	38.14721	-109.81596	5,080	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380850109485501&agency_cd=USGS&
USGS	380924109451001	(D-30-20)20cdd-S1	38.15665	-109.75346	4,936	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380924109451001&agency_cd=USGS&
USGS	380950109475601	(D-30-19)22add-S1	38.16388	-109.79957	4,950	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=380950109475601&agency_cd=USGS&
USGS	381041109490701	(D-30-19)15adc-S1	38.17804	-109.81929	4,780	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=381041109490701&agency_cd=USGS&
USGS	381110109482101	(D-30-19)14aab-S1	38.18610	-109.80651	4,780	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=381110109482101&agency_cd=USGS&
USGS	381122109502001	(D-30-19) 9dbd-S1	38.18943	-109.83957	4,750	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381122109502001&agency_cd=USGS&
USGS	381138109471101	(D-30-19)12acb-S1	38.19388	-109.78707	4,730	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=381138109471101&agency_cd=USGS&
USGS	381331109474901	T(D-29-19)36bbc-S1	38.22526	-109.79762	4,390	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=381331109474901&agency_cd=USGS&
USGS	381914109201101	(D-28-23)36dba-S1	38.32054	-109.33706	6,300	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=381914109201101&agency_cd=USGS&
USGS	382041109210201	(D-28-23)23ddb-S1	38.34471	-109.35122	6,170	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382041109210201&agency_cd=USGS&
USGS	382330109272001*	(D-28-22) 1cab-S1	38.39165	-109.45623	5,130	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382330109272001&agency_cd=USGS&
USGS	382357109531901	(D-28-18) 1abc-S1	38.39915	-109.88929	5,920	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382357109531901&agency_cd=USGS&

Table 4. Spring sites with discharge and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Discharge data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	382400109210001	(D-28-23) 3ad -S1	38.39999	-109.35067	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382400109210001&agency_cd=USGS&
USGS	382417109574801	(D-27-18)32dcb-S1	38.40471	-109.96401	4,240	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382417109574801&agency_cd=USGS&
USGS	382430109254501	(D-27-23)31dbc-S1	38.40832	-109.42984	5,320	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382430109254501&agency_cd=USGS&
USGS	382500109200001	(D-27-24)19c -S1	38.41665	-109.33400	NR	N	N	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382500109200001&agency_cd=USGS&
USGS	382505109561801	(D-27-18)27ccb-S1	38.41804	-109.93901	4,640	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382505109561801&agency_cd=USGS&
USGS	382543109193101	(D-27-24)30bbc-S1	38.42860	-109.32595	6,700	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382543109193101&agency_cd=USGS&
USGS	382558109201901	(D-27-23)24dcc-S1	38.43276	-109.33928	6,400	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382558109201901&agency_cd=USGS&
USGS	382630109502001	(D-27-19)21bdc-S1	38.44165	-109.83957	5,680	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382630109502001&agency_cd=USGS&
USGS	382633109492801	(D-27-19)22bbc-S1	38.44248	-109.82512	5,680	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382633109492801&agency_cd=USGS&
USGS	382700109270001	(D-27-23)17a -S1	38.44998	-109.45067	NR	N	N	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382700109270001&agency_cd=USGS&
USGS	382707110002301	R(D-27-17)13dba-S1	38.45193	-110.00707	3,990	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382707110002301&agency_cd=USGS&
USGS	382713109555001	(D-27-18)15bdc-S1	38.45359	-109.93123	4,890	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382713109555001&agency_cd=USGS&
USGS	383023109212501	(D-26-23)26dcc-S1	38.50637	-109.35762	7,440	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383023109212501&agency_cd=USGS&
USGS	383107109162301	(D-26-24)28aba-S1	38.51860	-109.27373	9,370	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383107109162301&agency_cd=USGS&
USGS	383149109284601	(D-26-22)22aad-S1	38.53082	-109.47928	4,580	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383149109284601&agency_cd=USGS&
USGS	383156109284201	(D-26-22)22aaa-S1	38.53248	-109.47984	4,580	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383156109284201&agency_cd=USGS&
USGS	383203109280001	(D-26-22)14acc-S1	38.54248	-109.46845	4,660	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383203109280001&agency_cd=USGS&
USGS	383206109292401	(D-26-22)15cdc-S1	38.53498	-109.49067	4,480	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383206109292401&agency_cd=USGS&
USGS	383213109293301	(D-26-22)15cca-S1	38.53693	-109.49317	4,480	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383213109293301&agency_cd=USGS&
USGS	383254109291201	(D-26-22)15cbb-S1	38.54832	-109.48734	4,460	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383254109291201&agency_cd=USGS&
USGS	383309109322001	(D-26-22) 7cca-S1	38.55248	-109.53956	4,240	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383309109322001&agency_cd=USGS&

Table 4. Spring sites with discharge and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Discharge data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383351109232801	(D-26-23) 3ccc-S1	38.56415	-109.39178	5,600	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383351109232801&agency_cd=USGS&
USGS	383534109334001	(D-25-21)35aaa-S1	38.59276	-109.56178	4,080	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383534109334001&agency_cd=USGS&
USGS	383607109342801	(D-25-21)26bdc-S1	38.60193	-109.57512	4,040	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383607109342801&agency_cd=USGS&
USGS	383610109341601	(D-25-21)26bdd-S1	38.60276	-109.57178	4,000	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383610109341601&agency_cd=USGS&
USGS	383610109342201	(D-25-21)26bdc-S2	38.60276	-109.57345	4,040	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383610109342201&agency_cd=USGS&
USGS	383824109555801*	(D-25-18) 9ddc-S1	38.63998	-109.93346	5,040	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383824109555801&agency_cd=USGS&
USGS	383955109373001	(D-25-21) 5abb-S1	38.66526	-109.62567	4,240	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383955109373001&agency_cd=USGS&
USGS	383957109380301	(D-25-21) 5bbb-S1	38.66581	-109.63484	4,240	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383957109380301&agency_cd=USGS&
USGS	383957109390101*	(D-25-21) 6bba-S1	38.66581	-109.65095	4,320	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383957109390101&agency_cd=USGS&
USGS	384020109340601	(D-24-22) 8aba-S1	38.67220	-109.56901	4,360	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384020109340601&agency_cd=USGS&
USGS	384025109385701	(D-24-21)31dab-S1	38.67359	-109.64984	4,240	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384025109385701&agency_cd=USGS&
USGS	384155109312001	(D-24-22) 6bdc-S1	38.69859	-109.52290	4,500	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384155109312001&agency_cd=USGS&
USGS	384157109162301	(D-24-24)21ddb-S1	38.69915	-109.27373	4,960	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384157109162301&agency_cd=USGS&
USGS	384157109162302	(D-24-24)21dbb-S2	38.69915	-109.27373	5,200	N	N	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384157109162302&agency_cd=USGS&
USGS	384158109113001	(D-24-25)20cac-S1	38.69943	-109.19234	5,430	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384158109113001&agency_cd=USGS&
USGS	384203109373901	(D-24-21)20cad-S1	38.69998	-109.62818	4,640	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384203109373901&agency_cd=USGS&
USGS	384215109172201	Little Salt Spring near	38.70415	-109.29012	NR	N	N	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384215109172201&agency_cd=USGS&
USGS	384340109361301	(D-24-21)30cad-S1	38.72776	-109.60429	4,310	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384340109361301&agency_cd=USGS&
USGS	384354109480801*	(D-24-19)10dcd-S1	38.73164	-109.80290	4,720	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384354109480801&agency_cd=USGS&
USGS	384355109353501	(D-24-21)31bda-S1	38.73192	-109.59373	4,240	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384355109353501&agency_cd=USGS&
USGS	384357109354701	(D-24-21)31bba-S1	38.73248	-109.59706	4,340	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384357109354701&agency_cd=USGS&

Table 4. Spring sites with discharge and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Discharge data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	384443109580201*	(D-24-18) 7aaa-S1	38.74525	-109.96790	4,400	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384439109563901&agency_cd=USGS&
USGS	384544109434201*	(D-23-20)32dca-S1	38.76220	-109.72901	4,580	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384544109434201&agency_cd=USGS&
USGS	384736109334201	(D-23-21)23dad-S1	38.79331	-109.56234	4,520	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384736109334201&agency_cd=USGS&
USGS	384813109304701*	(D-23-22)17cab-S1	38.80359	-109.51373	4,660	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384813109304701&agency_cd=USGS&
USGS	384900109203001*	(D-23-23)11dbc-S1	38.81665	-109.34234	4,420	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384900109203001&agency_cd=USGS&
USGS	384903109191201*	(D-23-23)12dba-S1	38.81748	-109.32067	4,240	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384903109191201&agency_cd=USGS&
USGS	384908109174501	(D-23-24) 8cbb-S1	38.81887	-109.29650	4,155	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384908109174501&agency_cd=USGS&
USGS	385109109364801*	(D-22-21)32aac-S1	38.85248	-109.61401	4,700	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=385109109364801&agency_cd=USGS&
USGS	385314109114901	(D-22-25)18cdb-S1	38.88721	-109.19761	4,520	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=385314109114901&agency_cd=USGS&
USGS	385433109060701	(D-22-25)12bda-S1	38.90915	-109.10261	5,720	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=385433109060701&agency_cd=USGS&
USGS	385627109131201	(D-21-24)36bbc-S1	38.94082	-109.22067	4,200	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385627109131201&agency_cd=USGS&
USGS	385631109133301	(D-21-24)35aab-S1	38.94193	-109.22650	4,200	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=385631109133301&agency_cd=USGS&
USGS	385958110082301	(D-21-16)10dbd-S1 Seep	38.99947	-110.13972	4,060	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385958110082301&agency_cd=USGS&
USGS	390239109432201	(D-20-20)28bbb-S1	39.04414	-109.72346	5,760	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=390239109432201&agency_cd=USGS&
USGS	382756108522001	NB04901833DAC	38.46554	-108.87288	4,750	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382756108522001&agency_cd=USGS&
USGS	383131108584701	042 Sinbad Spring	38.52527	-108.98039	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383131108584701&agency_cd=USGS&
USGS	383135108584701	Salt Springs at Sinbad Valley, CO site 1a	38.52638	-108.98039	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383135108584701&agency_cd=USGS&
USGS	383135108584702	Salt Springs at Sinbad Valley, CO site 1b	38.52638	-108.98039	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383135108584702&agency_cd=USGS&
USGS	383326108384801	NB05001634BCB1	38.55721	-108.64732	9,180	N	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383326108384801&agency_cd=USGS&
USGS	383521108385301	NB05001622BBC1	38.58915	-108.64871	9,300	N	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383521108385301&agency_cd=USGS&
USGS	383655109021001	001 Willow Spring	38.61526	-109.03678	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383655109021001&agency_cd=USGS&

Table 4. Spring sites with discharge and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Discharge data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	384502108494501	SC01510218ADC1	38.75054	-108.82983	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384502108494501&agency_cd=USGS&
USGS	385334108542901	SC01310127DAD1	38.89276	-108.90872	8,630	N	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385334108542901&agency_cd=USGS&
USGS	385420108442701	SC01310224DCA1	38.90554	-108.74149	NR	N	N	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=385420108442701&agency_cd=USGS&

* Denotes sites that are loacted in the Moab Master Leasing Plan area.

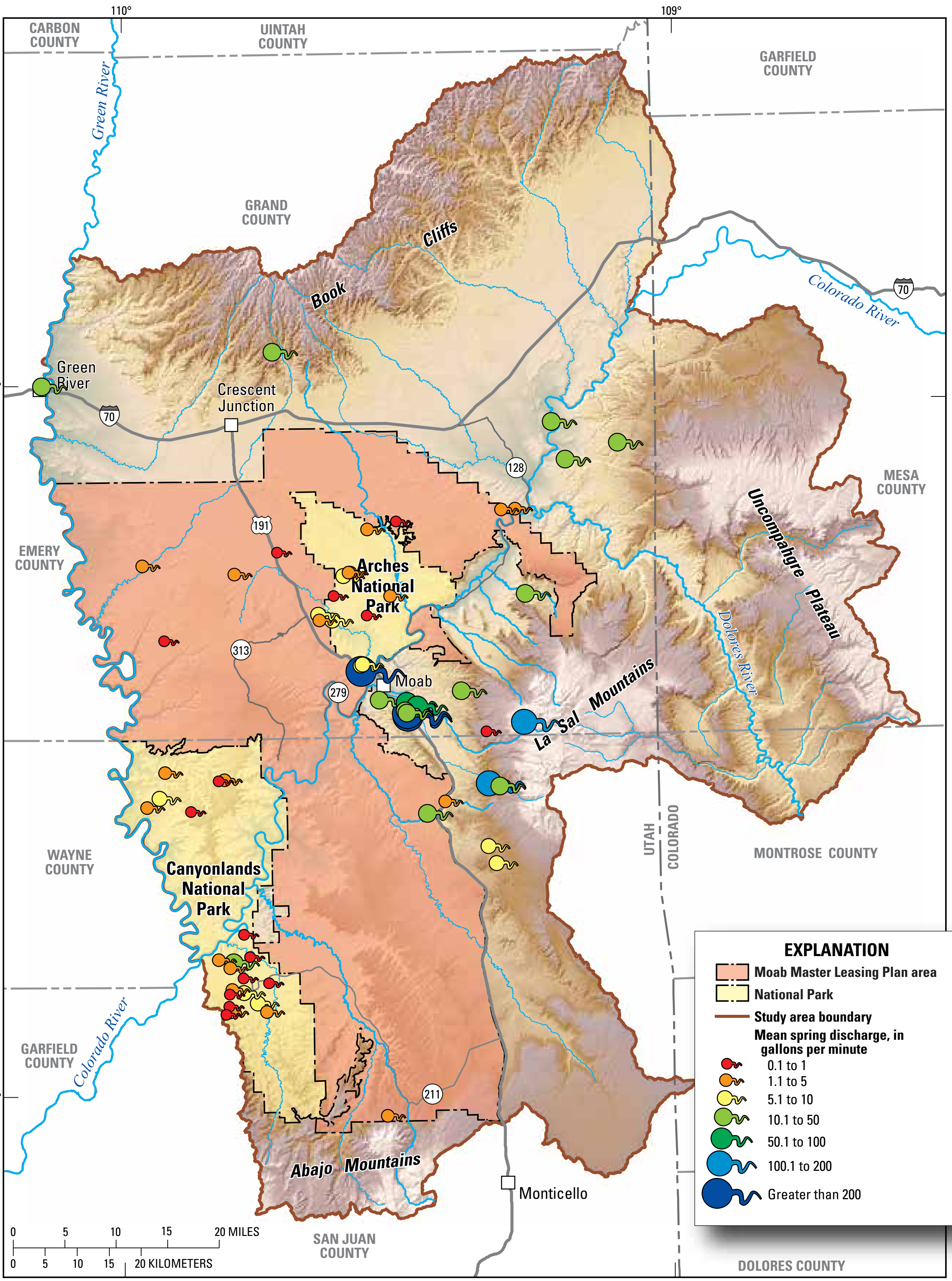

Figure 9. Mean discharge for springs reported in the National Water Information System database within the study area.

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	375642109105001	(D-32-25)33cdd- 1	37.94499306	-109.1812233	6,750	NR	147	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=375642109105001&agency_cd=USGS&
USGS	375801109080000	(D-32-25)25cbb- 1	37.96693721	-109.1339999	6,820	NR	169	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=375801109080000&agency_cd=USGS&
USGS	375804109082300	(D-32-25)26adc- 1	37.96777057	-109.140389	6,795	NR	240	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=375804109082300&agency_cd=USGS&
USGS	375804109093000	(D-32-25)27adc- 1	37.96777063	-109.1590005	6,765	NR	145	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=375804109093000&agency_cd=USGS&
USGS	375809109165500	(D-32-24)28ada- 1	37.96915961	-109.2826146	6,880	NR	150	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=375809109165500&agency_cd=USGS&
USGS	375816109151200	(D-32-24)26bad- 1	37.97110418	-109.2540026	6,860	NR	210	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=375816109151200&agency_cd=USGS&
USGS	375825109085700	(D-32-25)26bab- 1	37.97360391	-109.1498336	6,740	NR	145	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=375825109085700&agency_cd=USGS&
USGS	375827109154201	(D-32-24)26bbb- 1	37.97415965	-109.2623362	6,840	90	90	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=375827109154201&agency_cd=USGS&
USGS	375830109133200	(D-32-25)18ccc- 1	37.97499298	-109.2262241	6,815	NR	200	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=375830109133200&agency_cd=USGS&
USGS	375902109190400	(D-32-24)20bcb- 1	37.98388144	-109.3184491	7,005	NR	210	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=375902109190400&agency_cd=USGS&
USGS	375903109155801	(D-32-24)22adb- 1	37.98415949	-109.2667807	6,910	1,620	1,595	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=375903109155801&agency_cd=USGS&
USGS	375913109190700	(D-32-24)19aad- 1	37.98693695	-109.3192824	7,020	NR	210	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=375913109190700&agency_cd=USGS&
USGS	380000109150501	(D-32-24)11abc- 1	37.99999269	-109.2520579	6,720	175	175	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380000109150501&agency_cd=USGS&
USGS	380006109084101	(D-32-25)14baa- 1	38.00165937	-109.1453889	6,880	225	220	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380006109084101&agency_cd=USGS&
USGS	380034109260701*	(D-32-23) 7dbb- 1	38.00943595	-109.4359527	6,310	NR	275	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380034109260701&agency_cd=USGS&
USGS	380244109202201	(D-31-23)36dac- 1	38.0455469	-109.3401156	6,080	NR	402	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380244109202201&agency_cd=USGS&
USGS	380307109253101*	(D-31-23)32bbd- 1	38.05193515	-109.4259515	6,200	1,545	1,480	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380307109253101&agency_cd=USGS&
USGS	380356109195801	(D-31-24)30bca- 1	38.06554656	-109.3334484	6,040	NR	190	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380356109195801&agency_cd=USGS&
USGS	380402109213301*	(D-31-23)26abd- 1	38.06721303	-109.3598381	6,060	NR	220	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380402109213301&agency_cd=USGS&
USGS	380425109204201	(D-31-23)24dbc- 1	38.07360188	-109.3456709	5,980	NR	164	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380425109204201&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	380435109212901*	(D-31-23)23add- 1	38.07637952	-109.3587267	6,020	156	154	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380435109212901&agency_cd=USGS&
USGS	380445109142701	(D-31-24)24bdb- 1	38.07915796	-109.2415011	5,960	1,200	365	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380445109142701&agency_cd=USGS&
USGS	380542109252201*	(D-31-23)17bbd- 1	38.09498984	-109.4234504	6,240	NR	350	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380542109252201&agency_cd=USGS&
USGS	380552109234201*	(D-31-23) 9ddd- 1	38.09776775	-109.3956718	6,195	NR	352	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380552109234201&agency_cd=USGS&
USGS	380613109141501	(D-31-24) 7daa- 1	38.10360199	-109.2381674	5,980	1,100	220	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380613109141501&agency_cd=USGS&
USGS	380632109221301*	(D-31-23) 2ccc- 1	38.10887881	-109.3709487	6,070	NR	275	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380632109221301&agency_cd=USGS&
USGS	380649109112601	(D-31-25) 5dda- 1	38.113602	-109.1912219	6,360	NR	280	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380649109112601&agency_cd=USGS&
USGS	380730109251301*	(D-31-23) 5baa- 1	38.12498925	-109.4209497	6,210	NR	420	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380730109251301&agency_cd=USGS&
USGS	380804109190301	(D-30-24)32ccd- 1	38.13443424	-109.3181691	5,840	NR	300	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380804109190301&agency_cd=USGS&
USGS	380812109152501	(D-30-24)35bac- 1	38.13665685	-109.2576119	6,160	NR	700	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380812109152501&agency_cd=USGS&
USGS	380835109473002	(D-30-19)25cdc- 1	38.14304298	-109.7923453	5,080	NR	77	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380835109473002&agency_cd=USGS&
USGS	380850109463501	(D-30-20)30cba- 1	38.14720977	-109.777067	5,020	NR	52	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=380850109463501&agency_cd=USGS&
USGS	380857109164001	(D-30-24)27cba- 1	38.14915647	-109.2784456	5,970	NR	1,800	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380857109164001&agency_cd=USGS&
USGS	380906109194601	(D-30-24)30bda- 1	38.15165605	-109.3301135	5,830	NR	185	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380906109194601&agency_cd=USGS&
USGS	380922109334601*	(D-30-21)25aaa- 1	38.15609908	-109.563452	6,340	NR	200	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380922109334601&agency_cd=USGS&
USGS	380924109210001	(D-30-23)25bba- 1	38.1566558	-109.3506695	5,988	NR	350	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380924109210001&agency_cd=USGS&
USGS	380940109443501	(D-30-20)20dac- 1	38.16109885	-109.7437325	4,940	NR	65	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=380940109443501&agency_cd=USGS&
USGS	380946109162101	(D-30-24)22caa- 1	38.16276737	-109.2731675	5,990	NR	500	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380946109162101&agency_cd=USGS&
USGS	380951109162401	(D-30-24)22bdd- 1	38.16415623	-109.2740008	6,000	NR	500	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380951109162401&agency_cd=USGS&
USGS	380959109234201*	(D-30-23)22bcb- 1	38.1663775	-109.3956704	5,870	NR	300	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=380959109234201&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	380959109445001	(D-30-20)20aca- 1	38.16637661	-109.7478992	5,000	NR	78	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=380959109445001&agency_cd=USGS&
USGS	381034109274501*	(D-30-22)13cab- 1	38.17633333	-109.4624722	6,020	373	373	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=381034109274501&agency_cd=USGS&
USGS	381035109162901	(D-30-24)15caa- 1	38.17637822	-109.2753896	6,099	NR	8,861	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381035109162901&agency_cd=USGS&
USGS	381043109253200*	(D-30-23)17bdc- 1	38.17859924	-109.4262265	6,200	NR	375	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381043109253200&agency_cd=USGS&
USGS	381050109251301*	(D-30-23)17acb- 1	38.18054369	-109.4209485	5,900	NR	300	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381050109251301&agency_cd=USGS&
USGS	381100109152801	(D-30-24)14bad- 1	38.18332266	-109.2584446	6,732	NR	9,022	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381100109152801&agency_cd=USGS&
USGS	381100109170001	(D-30-24)16aax- 1	38.18332247	-109.2840008	6,218	NR	9,120	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381100109170001&agency_cd=USGS&
USGS	381125109140101	(D-30-24)12dab- 1	38.19026715	-109.2342774	6,320	NR	670	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381125109140101&agency_cd=USGS&
USGS	381137109245001*	(D-30-23) 8ada- 1	38.19359903	-109.4145592	5,860	NR	355	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381137109245001&agency_cd=USGS&
USGS	381140109222501	(D-30-23)10add- 1	38.19443266	-109.3742805	5,712	NR	47	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381140109222501&agency_cd=USGS&
USGS	381142109171301	(D-30-24) 9acd- 1	38.19498889	-109.2876118	6,259	NR	8,848	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381142109171301&agency_cd=USGS&
USGS	381146109173001	(D-30-24) 9bac- 1	38.19609994	-109.2923341	6,294	NR	9,533	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=381146109173001&agency_cd=USGS&
USGS	381247109230001*	(D-30-23) 3bac- 1	38.21304333	-109.3840026	5,680	NR	300	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381247109230001&agency_cd=USGS&
USGS	381256109253801*	T(D-29-23)32ccc- 1	38.21554292	-109.4278924	5,810	NR	275	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381256109253801&agency_cd=USGS&
USGS	381322109235801*	T(D-29-23)33dbb- 1	38.22276523	-109.4001138	5,670	NR	133	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381322109235801&agency_cd=USGS&
USGS	381329109240001*	T(D-29-23)33aca- 1	38.22470963	-109.4006694	5,690	NR	178	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381329109240001&agency_cd=USGS&
USGS	381430109260001*	(D-29-23)31bac- 1	38.24165345	-109.434003	5,600	NR	NR	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381430109260001&agency_cd=USGS&
USGS	381452109240801*	(D-29-23)28cbd- 1	38.2477647	-109.4028912	5,880	NR	350	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381452109240801&agency_cd=USGS&
USGS	381502109313101*	(D-29-22)30add- 1	38.25054173	-109.5259491	6,000	NR	325	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381502109313101&agency_cd=USGS&
USGS	381534109263101*	(D-29-22)24ddb- 1	38.25943089	-109.4426142	5,720	NR	425	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381534109263101&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	381600109244501*	(D-29-23)20caa- 1	38.2666533	-109.4131692	5,920	NR	425	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381600109244501&agency_cd=USGS&
USGS	381634109393401*	(D-29-21)18bdx- 1	38.27609763	-109.6601181	6,196	NR	7,256	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381634109393401&agency_cd=USGS&
USGS	381700109190801	(D-29-24)18bab- 1	38.28332068	-109.3195566	6,415	NR	126	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381700109190801&agency_cd=USGS&
USGS	381707109175501	(D-29-24)17aax- 1	38.2852653	-109.2992785	6,600	NR	2,190	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381707109175501&agency_cd=USGS&
USGS	381721109163301	(D-29-24) 9ddd- 1	38.28915437	-109.2765003	6,660	175	175	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381721109163301&agency_cd=USGS&
USGS	381735109155001	(D-29-24)10cda- 1	38.29304335	-109.2645558	6,730	585	575	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381735109155001&agency_cd=USGS&
USGS	381745109154401	(D-29-24)10acc- 1	38.29582112	-109.2628891	6,765	100	100	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381745109154401&agency_cd=USGS&
USGS	381747109155001	(D-29-24)10caa- 1	38.29637666	-109.2645558	6,750	535	535	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381747109155001&agency_cd=USGS&
USGS	381800109153001	(D-29-24)10aab- 1	38.2999878	-109.2590002	6,820	NR	186	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=381800109153001&agency_cd=USGS&
USGS	381806109185801	(D-29-24) 7aba- 1	38.3016539	-109.316779	6,570	NR	620	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381806109185801&agency_cd=USGS&
USGS	381807109161501	(D-29-24)10bba- 1	38.30193211	-109.2715005	6,770	180	180	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381807109161501&agency_cd=USGS&
USGS	381820109435501*	(D-29-20) 4cba- 1	38.30554192	-109.7326192	4,585	NR	5,076	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=381820109435501&agency_cd=USGS&
USGS	381829109173701	(D-29-24) 5daa- 1	38.30804296	-109.2942787	6,650	NR	NR	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381829109173701&agency_cd=USGS&
USGS	381830109240801*	(D-29-23) 4cba- 1	38.30831968	-109.4028916	5,920	828	828	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381830109240801&agency_cd=USGS&
USGS	381842109241001	(D-29-23) 4bca- 1	38.31165298	-109.4034472	5,940	NR	712	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381842109241001&agency_cd=USGS&
USGS	381852109184601	(D-29-24) 6aad- 1	38.31443162	-109.3134458	6,520	NR	215	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381852109184601&agency_cd=USGS&
USGS	381857109182101	(D-29-24) 5bab- 1	38.31582056	-109.3065013	6,560	215	215	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381857109182101&agency_cd=USGS&
USGS	381900109254201*	(D-28-23)31dcc- 1	38.31665268	-109.4290032	5,800	NR	280	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381900109254201&agency_cd=USGS&
USGS	381906109170401	(D-28-24)33cdc- 1	38.31832076	-109.2851121	6,780	NR	410	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381906109170401&agency_cd=USGS&
USGS	381935109254501*	(D-28-23)31acb- 1	38.3263748	-109.4298367	5,880	NR	925	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381935109254501&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	381938109254701*	(D-28-23)31abc- 1	38.32720812	-109.4303922	5,880	830	827	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=381938109254701&agency_cd=USGS&
USGS	382041109254601	(D-28-23)19dcc- 1	38.34470796	-109.4301146	5,580	NR	450	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382041109254601&agency_cd=USGS&
USGS	382055109355501*	(D-28-21)22cac- 1	38.34859636	-109.5992836	5,998	NR	8,518	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382055109355501&agency_cd=USGS&
USGS	382138109250001	(D-28-23)17cdb- 1	38.36054128	-109.4173367	5,749	NR	8,450	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382138109250001&agency_cd=USGS&
USGS	382140109515601	(D-28-19)18dca- 1	38.3610956	-109.8662333	6,264	NR	7,193	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382140109515601&agency_cd=USGS&
USGS	382230109285601*	(D-28-22)10ddb- 1	38.37498487	-109.4828932	5,211	NR	7,853	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382230109285601&agency_cd=USGS&
USGS	382321109270201	(D-28-22) 1cdb- 1	38.38915174	-109.4512262	5,120	NR	180	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382321109270201&agency_cd=USGS&
USGS	382321109373701*	(D-28-21) 5dcd- 1	38.38915142	-109.6276172	5,600	NR	NR	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382321109373701&agency_cd=USGS&
USGS	382343109265301	(D-28-22) 1caa- 1	38.39526282	-109.4487263	5,110	NR	114	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382343109265301&agency_cd=USGS&
USGS	382350109214201	(D-28-23) 2bcd- 1	38.39720823	-109.3623365	6,850	NR	10,516	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382350109214201&agency_cd=USGS&
USGS	382618109213201	(D-27-23)23caa- 1	38.43831903	-109.3595591	6,080	105	105	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382618109213201&agency_cd=USGS&
USGS	382621109214001	(D-27-23)23cab- 1	38.43915233	-109.3617814	6,040	NR	84	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382621109214001&agency_cd=USGS&
USGS	382655109310001*	(D-27-22)17ddb- 1	38.44859498	-109.5173382	5,290	NR	7,874	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382655109310001&agency_cd=USGS&
USGS	382757109235601	(D-27-23) 9cac- 1	38.46581829	-109.3995597	5,280	NR	96	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382757109235601&agency_cd=USGS&
USGS	382814108554401	NB04900931BBB	38.4705437	-108.9295496	5,892	NR	28	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382814108554401&agency_cd=USGS&
USGS	382829109550701	(D-27-18)10aaa- 1	38.47470484	-109.9192893	4,240	585	585	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382829109550701&agency_cd=USGS&
USGS	382829109565401	(D-27-18) 9bab- 1	38.47470469	-109.9490124	4,170	NR	585	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382829109565401&agency_cd=USGS&
USGS	382834109270701	(D-27-22) 1cdd- 1	38.47609529	-109.4526157	4,920	NR	310	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382834109270701&agency_cd=USGS&
USGS	382840109274300	(D-27-22) 2dbd- 1	38.47776182	-109.4626157	4,940	NR	315	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382840109274300&agency_cd=USGS&
USGS	382840109355001*	(D-27-21) 3cdc- 1	38.47776128	-109.5978945	4,300	NR	6,354	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382840109355001&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	382910109270701	(D-27-22) 1bda- 1	38.48609519	-109.4526157	4,880	NR	192	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382910109270701&agency_cd=USGS&
USGS	382918109272001	(D-27-22) 1bbd- 1	38.48831735	-109.4562269	4,840	250	250	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382918109272001&agency_cd=USGS&
USGS	382921109265801	(D-27-22) 1abb- 1	38.48915075	-109.4501157	4,860	NR	315	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382921109265801&agency_cd=USGS&
USGS	382924109273301	(D-27-22) 1bbb- 1	38.48998395	-109.459838	4,820	NR	350	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382924109273301&agency_cd=USGS&
USGS	382948109280601	(D-26-22)35dbb- 1	38.49665043	-109.4690047	4,760	186	186	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382948109280601&agency_cd=USGS&
USGS	382951109273501	(D-26-22)35daa- 3	38.49748387	-109.4603936	4,755	192	192	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382951109273501&agency_cd=USGS&
USGS	382952109252701	(D-27-23) 6dad- 1	38.49776211	-109.4248379	5,060	NR	455	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382952109252701&agency_cd=USGS&
USGS	382952109280101	(D-26-22)35bdd- 1	38.49776154	-109.4676158	4,750	140	140	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382952109280101&agency_cd=USGS&
USGS	382953109274801	(D-26-22)35acd- 1	38.49803937	-109.4640047	4,760	210	210	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382953109274801&agency_cd=USGS&
USGS	382953109274802	(D-26-22)35acd- 2	38.49803937	-109.4640047	4,760	185	185	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382953109274802&agency_cd=USGS&
USGS	382954109274201	(D-26-22)35adc- 1	38.49831716	-109.462338	4,760	173	173	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382954109274201&agency_cd=USGS&
USGS	382955109280401	(D-26-22)35bdd- 2	38.49859486	-109.4684492	4,740	NR	247	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=382955109280401&agency_cd=USGS&
USGS	382956109273401	(D-26-22)35daa- 1	38.49887274	-109.4601158	4,780	NR	170	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382956109273401&agency_cd=USGS&
USGS	382957109281501	(D-26-22)35bdd- 3	38.49915037	-109.4715048	4,740	NR	250	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=382957109281501&agency_cd=USGS&
USGS	383001109273401	(D-26-22)35ada- 1	38.50026162	-109.4601158	4,740	185	185	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383001109273401&agency_cd=USGS&
USGS	383001109281501	(D-26-22)35bdb- 1	38.50026147	-109.4715048	4,740	295	295	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383001109281501&agency_cd=USGS&
USGS	383005109280901	(D-26-22)35bda- 1	38.50137259	-109.4698381	4,720	336	336	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383005109280901&agency_cd=USGS&
USGS	383006109275201	(D-26-22)35abd- 1	38.50165043	-109.4651159	4,730	205	205	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383006109275201&agency_cd=USGS&
USGS	383006109275401	(D-26-22)35abd- 2	38.50165042	-109.4656714	4,730	182	182	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383006109275401&agency_cd=USGS&
USGS	383010109281901	(D-26-22)35bac- 1	38.50276144	-109.4717826	4,710	151	150	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383010109281901&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383014109281801	(D-26-22)35bab- 1	38.50387253	-109.4723381	4,710	288	288	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383014109281801&agency_cd=USGS&
USGS	383022109283801	(D-26-22)26ccc- 1	38.50609465	-109.4778937	4,700	120	120	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383022109283801&agency_cd=USGS&
USGS	383028109335201*	(D-26-22)26ddb- 3	38.5077609	-109.5651165	4,740	200	200	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383028109335201&agency_cd=USGS&
USGS	383030109274901	(D-26-22)26ddb- 1	38.50831704	-109.4642826	4,720	210	210	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383030109274901&agency_cd=USGS&
USGS	383031109275101	(D-26-22)26dca- 1	38.50859481	-109.4648382	4,720	190	190	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383031109275101&agency_cd=USGS&
USGS	383032109274001	(D-26-22)26dda- 1	38.50887262	-109.4617826	4,740	220	220	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383032109274001&agency_cd=USGS&
USGS	383032109274500	(D-26-22)26ddb- 2	38.5088726	-109.4631715	4,740	250	250	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383032109274500&agency_cd=USGS&
USGS	383032109274901	(D-26-22)26dbd- 1	38.50887259	-109.4642826	4,710	210	210	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383032109274901&agency_cd=USGS&
USGS	383032109283100	(D-26-22)26cbc- 1	38.50887243	-109.4759493	4,680	209	209	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383032109283100&agency_cd=USGS&
USGS	383034109280501	(D-26-22)26dbc- 1	38.50998364	-109.467616	4,700	235	235	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383034109280501&agency_cd=USGS&
USGS	383036109281001	(D-26-22)26baa- 1	38.50998361	-109.470116	4,750	180	180	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383036109281001&agency_cd=USGS&
USGS	383043109282401	(D-26-22)26cba- 1	38.51241667	-109.4739722	4,650	250	250	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383043109282401&agency_cd=USGS&
USGS	383047109275201	(D-26-22)26acd- 1	38.5130392	-109.465116	4,740	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383047109275201&agency_cd=USGS&
USGS	383049109285201	(D-26-22)27adc- 1	38.51359452	-109.4817827	4,630	132	132	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383049109285201&agency_cd=USGS&
USGS	383052109285701	(D-26-22)28adb- 1	38.51442783	-109.4831716	4,635	130	130	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383052109285701&agency_cd=USGS&
USGS	383104109284701	(D-26-22)27aad- 1	38.51776116	-109.4803939	4,605	81	80	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383104109284701&agency_cd=USGS&
USGS	383109109285501	(D-26-22)27aaa- 1	38.51915001	-109.4826161	4,610	300	300	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383109109285501&agency_cd=USGS&
USGS	383111109300901	(D-26-22)16cdb- 1	38.5197053	-109.5031718	4,450	40	40	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383111109300901&agency_cd=USGS&
USGS	383113109281201	(D-26-22)23cdd- 1	38.52081681	-109.4717828	4,680	174	174	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383113109281201&agency_cd=USGS&
USGS	383113109285301	(D-26-22)22ddc- 1	38.52026113	-109.4812272	4,590	237	237	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383113109285301&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383115109295701	(D-26-22)21ddc- 1	38.52081641	-109.4998384	4,650	200	200	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383115109295701&agency_cd=USGS&
USGS	383116109290101	(D-26-22)22dcd- 1	38.52109441	-109.4842828	4,580	70	70	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383116109290101&agency_cd=USGS&
USGS	383117109294001	(D-26-22)22ccc- 2	38.52137203	-109.4951162	4,620	200	200	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383117109294001&agency_cd=USGS&
USGS	383117109294601	(D-26-22)22ccc- 1	38.52137201	-109.4967829	4,640	220	220	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383117109294601&agency_cd=USGS&
USGS	383117109295501	(D-26-22)21ddc- 2	38.52137197	-109.4992829	4,640	300	300	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383117109295501&agency_cd=USGS&
USGS	383118109283301	(D-26-22)23ccb- 2	38.52165007	-109.476505	4,560	NR	110	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383118109283301&agency_cd=USGS&
USGS	383118109283701	(D-26-22)23ccc- 1	38.52165005	-109.4776161	4,610	104	104	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383118109283701&agency_cd=USGS&
USGS	383118109293701	(D-26-22)22bca- 1	38.52164982	-109.4942829	4,500	216	216	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383118109293701&agency_cd=USGS&
USGS	383119109290701	(D-26-22)22dcb- 1	38.52192771	-109.4859495	4,580	130	130	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383119109290701&agency_cd=USGS&
USGS	383123109295702	(D-26-22)21dda- 1	38.52303861	-109.4998385	4,600	240	240	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383123109295702&agency_cd=USGS&
USGS	383124109301601	(D-26-22)20dac- 1	38.52331636	-109.5051163	4,680	420	420	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383124109301601&agency_cd=USGS&
USGS	383124109303501	(D-26-22)20dbd- 1	38.52331635	-109.5103941	4,840	400	400	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383124109303501&agency_cd=USGS&
USGS	383125109292201	(D-26-22)22cad- 1	38.5235943	-109.4901162	4,570	69	69	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383125109292201&agency_cd=USGS&
USGS	383127109290401	(D-26-22)22dbd- 1	38.52414992	-109.4851162	4,570	126	126	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383127109290401&agency_cd=USGS&
USGS	383129109284001	(D-26-22)22dad- 1	38.52470556	-109.4784495	4,600	110	110	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383129109284001&agency_cd=USGS&
USGS	383129109293401	(D-26-22)22cbd- 1	38.52470535	-109.4934496	4,570	72	72	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383129109293401&agency_cd=USGS&
USGS	383130109293201	(D-26-22)22cbd- 2	38.52498313	-109.492894	4,555	119	119	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383130109293201&agency_cd=USGS&
USGS	383132109293301	(D-26-22)22cba- 2	38.52553868	-109.4931718	4,510	80	72	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383132109293301&agency_cd=USGS&
USGS	383132109294901	(D-26-22)21daa- 1	38.52553861	-109.4976163	4,580	57	57	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383132109294901&agency_cd=USGS&
USGS	383132109294902	(D-26-22)21daa- 3	38.52553861	-109.4976163	4,580	57	57	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383132109294902&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383133109293901	(D-26-22)22cab- 1	38.52581643	-109.4948385	4,600	125	125	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383133109293901&agency_cd=USGS&
USGS	383133109294201	(D-26-22)22cbb- 1	38.52581642	-109.4956718	4,560	87	87	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383133109294201&agency_cd=USGS&
USGS	383134109293501	(D-26-22)22cba- 1	38.52609422	-109.4937274	4,550	81	81	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383134109293501&agency_cd=USGS&
USGS	383134109295401	(D-26-22)21daa- 4	38.52609414	-109.4990052	4,560	137	137	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383134109295401&agency_cd=USGS&
USGS	383134109295701	(D-26-22)21dba- 1	38.52609413	-109.4998385	4,570	65	65	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383134109295701&agency_cd=USGS&
USGS	383134109295702	(D-26-22)21dba- 2	38.52609413	-109.4998385	4,570	75	75	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383134109295702&agency_cd=USGS&
USGS	383134109301501	(D-26-22)21cbb- 1	38.52609411	-109.5048385	4,560	280	280	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383134109301501&agency_cd=USGS&
USGS	383135109295001	(D-26-22)21daa- 2	38.52637193	-109.4978941	4,560	72	72	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383135109295001&agency_cd=USGS&
USGS	383135109302701	(D-26-22)20daa- 1	38.52637188	-109.5081719	4,600	175	175	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383135109302701&agency_cd=USGS&
USGS	383135109370101*	(D-25-23)20add- 1	38.52637161	-109.6176171	5,040	400	400	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383135109370101&agency_cd=USGS&
USGS	383136108584001	Salt Cr above unnamed spring nr Sinbad Valley, CO	38.52665406	-108.9784406	NR	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383136108584001&agency_cd=USGS&
USGS	383136109304601	(D-26-22)20acb- 1	38.52664964	-109.5134497	4,600	240	240	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383136109304601&agency_cd=USGS&
USGS	383139109303301	(D-26-22)20adc- 1	38.52748297	-109.5098386	4,600	152	150	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383139109303301&agency_cd=USGS&
USGS	383140109295401	(D-26-22)21acd- 1	38.52776079	-109.4990052	4,540	60	60	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383140109295401&agency_cd=USGS&
USGS	383141109303801	(D-26-22)20dba- 1	38.52803852	-109.5112275	4,610	190	190	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383141109303801&agency_cd=USGS&
USGS	383143109294501	(D-26-22)22bcc- 2	38.52859415	-109.4965052	4,490	75	75	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383143109294501&agency_cd=USGS&
USGS	383143109304101	(D-26-22)20acd- 3	38.52859406	-109.5120608	4,600	280	214	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383143109304101&agency_cd=USGS&
USGS	383145109295201	(D-26-22)21adb- 2	38.52914967	-109.4984496	4,510	65	65	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383145109295201&agency_cd=USGS&
USGS	383145109300101	(D-26-22)21acb- 1	38.52914964	-109.5009497	4,530	NR	65	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383145109300101&agency_cd=USGS&
USGS	383146109285401	(D-26-22)22adb- 1	38.52942768	-109.4823384	4,561	59	59	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383146109285401&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383146109301201	(D-26-22)21bbb- 3	38.52942741	-109.5040052	4,480	260	260	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383146109301201&agency_cd=USGS&
USGS	383147109301401	(D-26-22)21acb- 2	38.52970518	-109.5045608	4,540	196	196	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383147109301401&agency_cd=USGS&
USGS	383147109304201	(D-26-22)20acd- 2	38.52970516	-109.5123386	4,590	153	153	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383147109304201&agency_cd=USGS&
USGS	383148109291001	(D-26-22)22acb- 1	38.52998316	-109.4867829	4,500	70	70	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383148109291001&agency_cd=USGS&
USGS	383148109291100	(D-26-22)22acb- 2	38.52998316	-109.4870607	4,500	120	102	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383148109291100&agency_cd=USGS&
USGS	383148109295501	(D-26-22)21aca- 1	38.52998299	-109.499283	4,510	63	63	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383148109295501&agency_cd=USGS&
USGS	383148109303701	(D-26-22)20acd- 1	38.52998294	-109.5109497	4,580	NR	133	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383148109303701&agency_cd=USGS&
USGS	383149109290801	(D-26-22)22abc- 1	38.53053868	-109.4890052	4,520	80	80	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383149109290801&agency_cd=USGS&
USGS	383149109295301	(D-26-22)21adb- 1	38.53026077	-109.4987274	4,510	56	56	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383149109295301&agency_cd=USGS&
USGS	383150109295601	(D-26-22)21aca- 2	38.53053853	-109.4995608	4,500	63	63	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383150109295601&agency_cd=USGS&
USGS	383152109295801	(D-26-22)21aac- 2	38.53109407	-109.5001163	4,520	195	195	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383152109295801&agency_cd=USGS&
USGS	383153109300501	(D-26-22)21bad- 1	38.53137183	-109.5020608	4,500	62	62	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383153109300501&agency_cd=USGS&
USGS	383153109300701	(D-26-22)21abd- 2	38.53137183	-109.5026164	4,480	213	213	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383153109300701&agency_cd=USGS&
USGS	383154109302601	(D-26-22)20ada- 3	38.53164959	-109.5078942	4,540	136	136	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383154109302601&agency_cd=USGS&
USGS	383154109302801	(D-26-22)20ada- 1	38.53164959	-109.5084497	4,550	NR	113	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383154109302801&agency_cd=USGS&
USGS	383155109284801	(D-26-22)22aac- 1	38.53192768	-109.4806718	4,570	270	238	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383155109284801&agency_cd=USGS&
USGS	383155109301801	(D-26-22)21bbc- 1	38.53192737	-109.5056719	4,500	71	71	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383155109301801&agency_cd=USGS&
USGS	383156109294301	(D-26-22)22bbc- 1	38.53220523	-109.4959497	4,490	188	188	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383156109294301&agency_cd=USGS&
USGS	383157109295301	(D-26-22)21ada- 1	38.53248297	-109.4987275	4,480	180	180	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383157109295301&agency_cd=USGS&
USGS	383157109301101	(D-26-22)21bbb- 2	38.53248293	-109.5037275	4,500	225	225	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383157109301101&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383158109194301	(D-22-23)25bac- 1	38.53276319	-109.3292821	4,220	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383158109194301&agency_cd=USGS&
USGS	383158109282401	(D-26-22)23bba- 1	38.5327611	-109.4740051	4,640	450	450	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383158109282401&agency_cd=USGS&
USGS	383158109290101	(D-26-22)20aba- 2	38.53276095	-109.4842829	4,565	140	140	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383158109290101&agency_cd=USGS&
USGS	383158109300301	(D-26-22)21baa- 1	38.53276071	-109.5015053	4,480	55	55	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383158109300301&agency_cd=USGS&
USGS	383158109302901	(D-26-22)20aab- 1	38.53276069	-109.5087275	4,520	200	190	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383158109302901&agency_cd=USGS&
USGS	383159109300501	(D-26-22)21aba- 1	38.53303848	-109.5020608	4,480	136	136	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383159109300501&agency_cd=USGS&
USGS	383159109300801	(D-26-22)21bab- 1	38.53303848	-109.5028942	4,490	54	54	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383159109300801&agency_cd=USGS&
USGS	383201109295301	(D-26-22)16ddd- 3	38.53275	-109.4996389	4,480	65	65	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383201109295301&agency_cd=USGS&
USGS	383201109300301	(D-26-22)21baa- 2	38.53359403	-109.5015053	4,480	66	66	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383201109300301&agency_cd=USGS&
USGS	383202109285101	(D-26-22)22aab- 1	38.53387209	-109.4815052	4,580	106	100	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383202109285101&agency_cd=USGS&
USGS	383203109284201	(D-26-22)22daa- 1	38.5341499	-109.4790051	4,600	200	200	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383203109284201&agency_cd=USGS&
USGS	383203109285001	(D-26-22)22aab- 2	38.53414987	-109.4812274	4,580	222	222	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383203109285001&agency_cd=USGS&
USGS	383203109301501	(D-26-22)21bbb- 1	38.53414957	-109.5048386	4,470	NR	32	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383203109301501&agency_cd=USGS&
USGS	383204109294901	(D-26-22)16ddd- 1	38.5344274	-109.4976164	4,470	254	254	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383204109294901&agency_cd=USGS&
USGS	383205109291901	(D-26-22)15cdd- 1	38.5347053	-109.489283	4,560	105	105	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383205109291901&agency_cd=USGS&
USGS	383206109300901	(D-26-22)16cdc- 1	38.5349829	-109.503172	4,470	65	65	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383206109300901&agency_cd=USGS&
USGS	383206109301801	(D-26-22)16ccc- 1	38.53498289	-109.505672	4,450	NR	78	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383206109301801&agency_cd=USGS&
USGS	383206109303501	(D-26-22)20aaa- 1	38.53498288	-109.5103942	4,482	75	75	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383206109303501&agency_cd=USGS&
USGS	383209109285401	(D-26-22)15ddc- 1	38.5358165	-109.4823385	4,600	325	325	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383209109285401&agency_cd=USGS&
USGS	383209109292401	(D-26-22)15bdb- 1	38.53581638	-109.4906719	4,620	160	160	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383209109292401&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383209109300501	(D-26-22)16ccd- 1	38.53581623	-109.5020608	4,460	40	40	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383209109300501&agency_cd=USGS&
USGS	383209109300801	(D-26-22)16bdb- 1	38.53581623	-109.5028942	4,360	75	75	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383209109300801&agency_cd=USGS&
USGS	383212109301001	(D-26-22)16ccb- 2	38.53664955	-109.5034498	4,450	51	51	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383212109301001&agency_cd=USGS&
USGS	383214109295101	(D-26-22)16dca- 1	38.53720514	-109.498172	4,440	69	69	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383214109295101&agency_cd=USGS&
USGS	383215109285701	(D-26-22)15dca- 1	38.53748314	-109.4831719	4,600	185	181	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383215109285701&agency_cd=USGS&
USGS	383215109293401	(D-26-22)15cca- 1	38.53748299	-109.4934497	4,480	119	119	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383215109293401&agency_cd=USGS&
USGS	383219109283101	(D-26-22)14cdb- 1	38.53859434	-109.4759496	4,780	320	320	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383219109283101&agency_cd=USGS&
USGS	383223109284701	(D-26-22)15dab- 2	38.53998313	-109.481783	4,655	300	300	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383223109284701&agency_cd=USGS&
USGS	383223109291501	(D-26-22)15cad- 1	38.53970526	-109.4881719	4,580	108	108	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383223109291501&agency_cd=USGS&
USGS	383223109304701	(D-26-22)17dbc- 1	38.53970504	-109.5137276	4,450	153	153	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383223109304701&agency_cd=USGS&
USGS	383224109284701	(D-26-22)15daa- 2	38.53998315	-109.4803941	4,660	300	300	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383224109284701&agency_cd=USGS&
USGS	383224109290501	(D-26-22)15dab- 1	38.53998308	-109.4853941	4,680	NR	187	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383224109290501&agency_cd=USGS&
USGS	383224109291601	(D-26-22)15caa- 2	38.53998303	-109.4884497	4,580	103	103	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383224109291601&agency_cd=USGS&
USGS	383225109295401	(D-26-22)16dab- 1	38.54026065	-109.4990053	4,440	110	110	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383225109295401&agency_cd=USGS&
USGS	383226109310001	(D-26-22)17cad- 2	38.54053835	-109.5173388	4,480	100	100	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383226109310001&agency_cd=USGS&
USGS	383227109283001	(D-26-22)14cba- 1	38.54081654	-109.4756719	4,820	460	460	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383227109283001&agency_cd=USGS&
USGS	383227109291801	(D-26-22)15caa- 1	38.54081635	-109.4890053	4,560	130	115	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383227109291801&agency_cd=USGS&
USGS	383228109284101	(D-26-22)15daa- 1	38.54109427	-109.4787274	4,800	265	265	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383228109284101&agency_cd=USGS&
USGS	383228109294401	(D-26-22)15cbb- 1	38.54109402	-109.4962275	4,480	305	150	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383228109294401&agency_cd=USGS&
USGS	383230109300101	(D-26-22)16acc- 1	38.5416495	-109.5009498	4,400	75	75	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383230109300101&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383231109295001	(D-26-22)16add- 3	38.54192732	-109.4978942	4,520	120	120	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383231109295001&agency_cd=USGS&
USGS	383231109295701	(D-26-22)16acd- 1	38.54192729	-109.4998387	4,450	100	100	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383231109295701&agency_cd=USGS&
USGS	383232109294401	(D-26-22)15bcc- 1	38.54220512	-109.4962276	4,520	60	60	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383232109294401&agency_cd=USGS&
USGS	383232109294701	(D-26-22)16add- 1	38.5422051	-109.4970609	4,500	50	50	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383232109294701&agency_cd=USGS&
USGS	383232109310901	(D-26-22)17cab- 1	38.54220499	-109.5198388	4,420	170	170	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383232109310901&agency_cd=USGS&
USGS	383233109295200	(D-26-22)16add- 2	38.54248286	-109.4984498	4,460	NR	81	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383233109295200&agency_cd=USGS&
USGS	383235109290701	(D-26-22)15acc- 1	38.54303859	-109.4859497	4,600	200	200	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383235109290701&agency_cd=USGS&
USGS	383235109294101	(D-26-22)15bcc- 2	38.54303845	-109.4953942	4,520	140	140	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383235109294101&agency_cd=USGS&
USGS	383235109305001	(D-26-22)17dbb- 2	38.54303833	-109.5142832	4,422	50	50	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383235109305001&agency_cd=USGS&
USGS	383235109311401	(D-26-22)17dba- 1	38.54303831	-109.5212277	4,400	197	197	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383235109311401&agency_cd=USGS&
USGS	383237109291400	(D-26-22)15bda- 1	38.54359411	-109.4878942	4,630	140	140	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383237109291400&agency_cd=USGS&
USGS	383237109303201	(D-26-22)17adc- 1	38.54359389	-109.509561	4,380	36	36	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383237109303201&agency_cd=USGS&
USGS	383237109305601	(D-26-22)17bdd- 1	38.54359387	-109.5162277	4,390	83	83	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383237109305601&agency_cd=USGS&
USGS	383238109294901	(D-26-22)16ada- 1	38.54387174	-109.4976165	4,500	NR	26	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383238109294901&agency_cd=USGS&
USGS	383238109302501	(D-26-22)17add- 1	38.54387167	-109.5076165	4,360	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383238109302501&agency_cd=USGS&
USGS	383238109303401	(D-26-22)17adc- 2	38.54387167	-109.5101166	4,380	69	69	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383238109303401&agency_cd=USGS&
USGS	383239109303901	(D-26-22)17acd- 1	38.54414944	-109.5115055	4,380	108	108	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383239109303901&agency_cd=USGS&
USGS	383240109302401	(D-26-22)17aad- 2	38.54442722	-109.5073388	4,360	80	80	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383240109302401&agency_cd=USGS&
USGS	383241109290901	(D-26-22)15acb- 1	38.54470523	-109.4865053	4,660	270	270	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383241109290901&agency_cd=USGS&
USGS	383242109304701	(D-26-22)17acc- 1	38.54498275	-109.5137277	4,380	206	206	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383242109304701&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383244109302201	(D-26-22)17ada- 3	38.54553832	-109.5067832	4,310	42	42	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383244109302201&agency_cd=USGS&
USGS	383244109304901	(D-26-22)17acb- 1	38.5455383	-109.5142833	4,370	154	154	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383244109304901&agency_cd=USGS&
USGS	383245109302401	(D-26-22)17ada- 2	38.5458161	-109.5073388	4,310	42	42	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383245109302401&agency_cd=USGS&
USGS	383248109302801	(D-26-22)17adb- 1	38.54664942	-109.5084499	4,320	42	42	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383248109302801&agency_cd=USGS&
USGS	383249109302501	(D-26-22)17ada- 1	38.54692719	-109.5076166	4,340	201	201	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383249109302501&agency_cd=USGS&
USGS	383249109302901	(D-26-22)17aac- 4	38.54692719	-109.5087277	4,340	42	42	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383249109302901&agency_cd=USGS&
USGS	383250109302501	(D-26-22)17aad- 1	38.54720497	-109.5076166	4,340	40	40	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383250109302501&agency_cd=USGS&
USGS	383251109303001	(D-26-22)17aac- 2	38.54748274	-109.5090055	4,310	45	45	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383251109303001&agency_cd=USGS&
USGS	383252109314801	(D-26-22)18abd- 1	38.54776044	-109.5306723	4,400	280	280	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383252109314801&agency_cd=USGS&
USGS	383253109303201	(D-26-22)17aac- 1	38.54803829	-109.509561	4,420	42	42	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383253109303201&agency_cd=USGS&
USGS	383253109304701	(D-26-22)17abc- 1	38.54803827	-109.5137277	4,300	123	116	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383253109304701&agency_cd=USGS&
USGS	383253109310801	(D-26-22)17bac- 1	38.54803825	-109.5195611	4,330	220	220	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383253109310801&agency_cd=USGS&
USGS	383254109294101	(D-26-22)15bbb- 1	38.54831617	-109.4953943	4,560	400	250	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383254109294101&agency_cd=USGS&
USGS	383254109303601	(D-26-22)17aac- 3	38.54831606	-109.5106722	4,310	33	33	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383254109303601&agency_cd=USGS&
USGS	383256109304101	(D-26-22)17aba- 2	38.5488716	-109.5120611	4,300	63	58	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383256109304101&agency_cd=USGS&
USGS	383258109300001	(D-26-22) 9ddc- 1	38.54942719	-109.5006721	4,600	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383258109300001&agency_cd=USGS&
USGS	383258109303701	(D-26-22)17aba- 1	38.54942715	-109.51095	4,320	120	120	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383258109303701&agency_cd=USGS&
USGS	383258109303801	(D-26-22)17aba- 3	38.54942715	-109.5112277	4,310	100	100	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383258109303801&agency_cd=USGS&
USGS	383259109303001	(D-26-22)17aab- 1	38.54970493	-109.5090055	4,400	140	140	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383259109303001&agency_cd=USGS&
USGS	383259109304601	(D-26-22)17abb- 1	38.54970492	-109.51345	4,290	42	42	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383259109304601&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383300109302301	(D-26-22)17aaa- 2	38.54998272	-109.507061	4,460	180	180	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383300109302301&agency_cd=USGS&
USGS	383301109353001*	(D-26-21)10cdc- 1	38.55026018	-109.5923395	3,960	100	100	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383301109353001&agency_cd=USGS&
USGS	383302109310101	(D-26-22) 8cdc- 3	38.55053823	-109.5176167	4,260	42	42	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383302109310101&agency_cd=USGS&
USGS	383304109305101	(D-26-22) 8cdd- 2	38.55109379	-109.5148389	4,260	115	115	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383304109305101&agency_cd=USGS&
USGS	383305109311801	(D-26-22) 8ccd- 1	38.55137153	-109.522339	4,240	54	54	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383305109311801&agency_cd=USGS&
USGS	383305109314701	(D-26-22) 7dcd- 1	38.5513715	-109.5303946	4,275	45	45	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383305109314701&agency_cd=USGS&
USGS	383308109203801	(D-26-23)12ccb- 1	38.5522073	-109.3445601	4,460	1,100	1,100	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383308109203801&agency_cd=USGS&
USGS	383309109230601	(D-26-23)10ccb- 2	38.55248445	-109.3856714	6,880	445	445	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383309109230601&agency_cd=USGS&
USGS	383309109302601	(D-26-22) 8dda- 2	38.55248268	-109.5078944	4,440	200	188	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383309109302601&agency_cd=USGS&
USGS	383309109310201	(D-26-22) 8cdc- 1	38.55248265	-109.5178945	4,250	41	38	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383309109310201&agency_cd=USGS&
USGS	383309109313001	(D-26-22) 7dda- 1	38.55248262	-109.5256723	4,230	80	80	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383309109313001&agency_cd=USGS&
USGS	383310109305201	(D-26-22) 8dcb- 1	38.55276043	-109.5151167	4,280	105	105	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383310109305201&agency_cd=USGS&
USGS	383311109310001	(D-26-22) 8cca- 1	38.5530382	-109.5173389	4,220	33	31	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383311109310001&agency_cd=USGS&
USGS	383312109313100	(D-26-22) 7ddb- 3	38.55331593	-109.5278946	4,200	130	129	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383312109313100&agency_cd=USGS&
USGS	383312109313601	(D-26-22) 7ddb- 1	38.55331593	-109.527339	4,210	91	91	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383312109313601&agency_cd=USGS&
USGS	383313109332101	(D-26-21) 1cbb- 1	38.55359359	-109.5565059	4,020	62	62	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383313109332101&agency_cd=USGS&
USGS	383314109312200	(D-26-22) 8ccc- 1	38.5538715	-109.5234501	4,235	117	117	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383314109312200&agency_cd=USGS&
USGS	383315109312201	(D-26-22) 8cbc- 4	38.55414927	-109.5234501	4,210	34	34	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383315109312201&agency_cd=USGS&
USGS	383315109312301	(D-26-22) 8cbc- 2	38.55414927	-109.5237279	4,210	58	58	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383315109312301&agency_cd=USGS&
USGS	383315109312302	(D-26-22) 8cbc- 3	38.55414927	-109.5237279	4,210	145	101	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383315109312302&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383315109315601	(D-26-22) 7dbc- 4	38.55414923	-109.5328946	4,200	65	65	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383315109315601&agency_cd=USGS&
USGS	383315109320401	(D-26-22) 7cad- 1	38.55414923	-109.5351169	4,200	NR	31	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383315109320401&agency_cd=USGS&
USGS	383315109320801	(D-26-22) 7cac- 1	38.55414922	-109.536228	4,215	NR	42	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383315109320801&agency_cd=USGS&
USGS	383316109302101	(D-26-22) 8dda- 1	38.55442711	-109.5065055	4,460	150	150	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383316109302101&agency_cd=USGS&
USGS	383316109314001	(D-26-22) 7dbd- 2	38.55442703	-109.5284502	4,195	120	44	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383316109314001&agency_cd=USGS&
USGS	383316109314901	(D-26-22) 7dbd- 1	38.55442702	-109.5309502	4,200	45	45	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383316109314901&agency_cd=USGS&
USGS	383316109315301	(D-26-22) 7dbc- 3	38.55442701	-109.5320613	4,200	NR	57	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383316109315301&agency_cd=USGS&
USGS	383317109322801	(D-26-22) 8cbc- 1	38.55470475	-109.5417836	4,200	70	48	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383317109322801&agency_cd=USGS&
USGS	383317109330401	(D-26-21) 1dbb- 2	38.55470471	-109.5517837	4,000	28	28	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383317109330401&agency_cd=USGS&
USGS	383319109315301	(D-26-22) 7dbc- 1	38.55526033	-109.5320613	4,175	NR	50	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383319109315301&agency_cd=USGS&
USGS	383319109315801	(D-26-22) 7dbc- 2	38.55526033	-109.5334502	4,175	NR	47	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383319109315801&agency_cd=USGS&
USGS	383319109323101	(D-26-22) 7cbc- 1	38.55526029	-109.5426169	4,180	NR	70	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383319109323101&agency_cd=USGS&
USGS	383321109203901	(D-26-23)12cca- 1	38.55581838	-109.3448379	7,460	1,100	1,100	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383321109203901&agency_cd=USGS&
USGS	383322109311201	(D-26-22) 8cba- 2	38.5560937	-109.5206723	4,240	75	75	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383322109311201&agency_cd=USGS&
USGS	383323109310901	(D-26-22) 8cba- 1	38.55637148	-109.519839	4,240	50	50	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383323109310901&agency_cd=USGS&
USGS	383323109321501	(D-26-22) 7cab- 1	38.55637141	-109.5381725	4,160	NR	50	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383323109321501&agency_cd=USGS&
USGS	383325109302001	(D-26-22) 8daa- 1	38.55692708	-109.5062278	4,520	460	460	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383325109302001&agency_cd=USGS&
USGS	383326109304401	(D-26-22) 8dbb- 1	38.55720483	-109.5128945	4,520	460	460	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383326109304401&agency_cd=USGS&
USGS	383327109303101	(D-26-22) 8dac- 1	38.55770484	-109.5093389	4,528	465	460	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383327109303101&agency_cd=USGS&
USGS	383327109320801	(D-26-22) 7cab- 2	38.55748251	-109.536228	4,160	NR	47	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383327109320801&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383327109321201	(D-26-22) 7bdc- 1	38.55748251	-109.5373391	4,140	NR	47	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383327109321201&agency_cd=USGS&
USGS	383327109324201	(D-26-21)12dab- 1	38.55748247	-109.5456725	4,150	105	100	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383327109324201&agency_cd=USGS&
USGS	383329109321501	(D-26-22) 7bdc- 2	38.55803805	-109.5381725	4,125	NR	53	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383329109321501&agency_cd=USGS&
USGS	383329109322401	(D-26-22) 7bcc- 1	38.55803804	-109.5406725	4,130	NR	50	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383329109322401&agency_cd=USGS&
USGS	383337109314301	(D-26-22) 7aca- 2	38.56026028	-109.5292836	4,160	NR	222	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383337109314301&agency_cd=USGS&
USGS	383340109314301	(D-26-22) 7aca- 1	38.5610936	-109.5292836	4,160	NR	245	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383340109314301&agency_cd=USGS&
USGS	383342109201401	(D-26-23)12aba- 1	38.56165179	-109.3378934	7,690	450	450	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383342109201401&agency_cd=USGS&
USGS	383344109310001	(D-26-22) 8bad- 1	38.56220475	-109.517339	4,240	640	610	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383344109310001&agency_cd=USGS&
USGS	383344109320601	(D-26-22) 7bad- 1	38.56220467	-109.5356725	4,125	NR	80	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383344109320601&agency_cd=USGS&
USGS	383346109322201	(D-26-22) 7bbd- 1	38.5627602	-109.540117	4,110	NR	59	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383346109322201&agency_cd=USGS&
USGS	383355109321601	(D-26-22) 6ccd- 1	38.56526018	-109.5384504	4,180	100	NR	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383355109321601&agency_cd=USGS&
USGS	383357109324501	(D-26-21) 1ddc- 1	38.56581569	-109.546506	4,030	80	80	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383357109324501&agency_cd=USGS&
USGS	383357109330501	(D-26-21) 1dcc- 2	38.56581566	-109.5520616	4,045	60	60	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383357109330501&agency_cd=USGS&
USGS	383403109330301	(D-26-21) 1dbb- 3	38.57130556	-109.5518889	4,025	56	56	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383403109330301&agency_cd=USGS&
USGS	383405109324201	(D-26-21) 1ddb- 1	38.56803788	-109.5456727	4,060	30	30	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383405109324201&agency_cd=USGS&
USGS	383409109323001	(D-26-22) 6cbc- 2	38.569149	-109.5423393	4,075	NR	85	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383409109323001&agency_cd=USGS&
USGS	383410109333801	(D-26-21) 1cbc- 1	38.56942668	-109.5612284	4,035	50	50	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383410109333801&agency_cd=USGS&
USGS	383412109322901	(D-26-22) 6cbc- 1	38.56998232	-109.5420616	4,080	NR	46	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383412109322901&agency_cd=USGS&
USGS	383415109324701	(D-26-21) 1dba- 1	38.57081562	-109.5470616	3,990	40	40	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383415109324701&agency_cd=USGS&
USGS	383415109324702	(D-26-21) 1dab- 2	38.57081562	-109.5470616	3,990	42	42	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383415109324702&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383415109324703	(D-26-21) 1dab- 1	38.57081562	-109.5470616	3,990	59	59	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383415109324703&agency_cd=USGS&
USGS	383416109322801	(D-26-22) 6cbb- 1	38.57109342	-109.5417838	4,080	30	30	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383416109322801&agency_cd=USGS&
USGS	383416109323001	(D-26-22) 6cba- 1	38.57109341	-109.5423393	4,090	128	128	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383416109323001&agency_cd=USGS&
USGS	383417109325101	(D-26-21) 1dbb- 1	38.57137116	-109.5481727	4,035	37	37	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383417109325101&agency_cd=USGS&
USGS	383418109322501	(D-26-22) 6cbb- 3	38.57164897	-109.5409505	4,100	93	93	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383418109322501&agency_cd=USGS&
USGS	383419109322701	(D-26-22) 6cbb- 2	38.57192674	-109.541506	4,090	30	30	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383419109322701&agency_cd=USGS&
USGS	383419109325101	(D-26-21) 1dba- 3	38.57192671	-109.5481727	4,050	87	87	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383419109325101&agency_cd=USGS&
USGS	383420109321901	(D-26-22) 6cba- 2	38.57220453	-109.5392838	4,110	59	59	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383420109321901&agency_cd=USGS&
USGS	383423109330501	(D-26-21) 1caa- 1	38.57063889	-109.5512778	4,025	85	84	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383423109330501&agency_cd=USGS&
USGS	383427109325001	(D-26-21) 1aca- 1	38.5741489	-109.547895	4,030	NR	60	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383427109325001&agency_cd=USGS&
USGS	383427109330901	(D-26-21) 1bda- 2	38.57414888	-109.5531728	4,005	NR	60	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383427109330901&agency_cd=USGS&
USGS	383431109323701	(D-26-21) 1ada- 1	38.57526002	-109.5442839	4,070	NR	43	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383431109323701&agency_cd=USGS&
USGS	383433109331801	(D-26-21) 1bac- 1	38.57581551	-109.5556729	3,990	NR	44	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383433109331801&agency_cd=USGS&
USGS	383434109331001	(D-26-21) 1bad- 1	38.57609329	-109.5534506	3,995	NR	51	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383434109331001&agency_cd=USGS&
USGS	383435109332201	(D-26-21) 1bbd- 1	38.57637105	-109.556784	3,935	156	156	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383435109332201&agency_cd=USGS&
USGS	383436109323201	(D-26-21) 1aad- 1	38.57664889	-109.542895	4,160	115	115	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383436109323201&agency_cd=USGS&
USGS	383436109325501	(D-26-21) 1abd- 1	38.57664886	-109.5492839	4,030	NR	47	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383436109325501&agency_cd=USGS&
USGS	383436109331501	(D-26-21) 1bac- 2	38.57664883	-109.5548395	4,005	56	56	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383436109331501&agency_cd=USGS&
USGS	383439109273001	(D-26-22) 1bbb- 1	38.5774831	-109.4590055	5,160	117	117	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383439109273001&agency_cd=USGS&
USGS	383442109322601	(D-26-22) 6bbb- 1	38.57831555	-109.5412283	4,320	51	51	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383442109322601&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383444109333201	(D-26-21) 1bbb- 1	38.578871	-109.5595618	3,980	NR	48	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383444109333201&agency_cd=USGS&
USGS	383445109332101	(D-26-21) 1bab- 1	38.57914879	-109.5565062	3,990	NR	48	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383445109332101&agency_cd=USGS&
USGS	383445109333601	(D-26-21) 1bbb- 2	38.57914877	-109.5606729	3,980	NR	40	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383445109333601&agency_cd=USGS&
USGS	383446109343201	(D-25-21)35ccd- 1	38.57942646	-109.5762286	3,960	74	74	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383446109343201&agency_cd=USGS&
USGS	383448109325001	(D-26-21) 1dba- 2	38.57998215	-109.5478951	4,030	41	41	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383448109325001&agency_cd=USGS&
USGS	383449109330001	(D-25-21)36dcc- 1	38.58025991	-109.5506729	4,035	60	60	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383449109330001&agency_cd=USGS&
USGS	383452109331301	(D-25-21)36cdc- 1	38.58109322	-109.554284	3,990	89	89	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383452109331301&agency_cd=USGS&
USGS	383456109331201	(D-25-21)36cda- 1	38.58220431	-109.5540062	4,000	84	84	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383456109331201&agency_cd=USGS&
USGS	383457109335601	(D-25-21)35dca- 3	38.58248202	-109.5662286	3,920	72	72	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383457109335601&agency_cd=USGS&
USGS	383459109332701	(D-25-21)36cbd- 1	38.58303761	-109.558173	3,985	NR	85	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383459109332701&agency_cd=USGS&
USGS	383500109331101	(D-25-21)36cac- 1	38.58331541	-109.5537285	3,995	NR	90	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383500109331101&agency_cd=USGS&
USGS	383501109440501*	(D-25-20)32dbc- 1	38.5835922	-109.7353967	5,240	NR	225	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383501109440501&agency_cd=USGS&
USGS	383502109333301	(D-25-21)36cbc- 1	38.58387092	-109.5598397	4,000	65	65	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383502109333301&agency_cd=USGS&
USGS	383504109335501	(D-25-21)35dac- 1	38.58442644	-109.5659508	3,960	45	45	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383504109335501&agency_cd=USGS&
USGS	383508109400400*	(D-25-21)36cba- 1	38.58553697	-109.6684517	4,800	NR	106	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383508109400400&agency_cd=USGS&
USGS	383510109333901	(D-25-21)35daa- 1	38.58609311	-109.5615064	3,980	57	57	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383510109333901&agency_cd=USGS&
USGS	383510109335601	(D-25-21)35dab- 1	38.58611111	-109.5655556	3,980	86	86	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383510109335601&agency_cd=USGS&
USGS	383525109353801	(D-25-21)35bbd- 1	38.59025952	-109.5945622	3,965	NR	5,345	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383525109353801&agency_cd=USGS&
USGS	383532109343901	(D-25-21)35bbb- 1	38.59220403	-109.5781732	3,955	10	10	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383532109343901&agency_cd=USGS&
USGS	383536109405600*	(D-25-21)35baa- 1	38.5933145	-109.6828964	4,880	NR	141	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383536109405600&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383539109340901	(D-25-21)26dcc- 1	38.5941485	-109.5698399	3,920	55	55	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383539109340901&agency_cd=USGS&
USGS	383542109143001	(D-25-24)26ccd- 1	38.59498637	-109.2423372	8,080	35	35	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383542109143001&agency_cd=USGS&
USGS	383543109184001	(D-25-24)30cda- 1	38.59526314	-109.3117823	6,120	236	236	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383543109184001&agency_cd=USGS&
USGS	383547109345201	(D-25-22)27dda- 1	38.59637061	-109.5817844	3,950	10	10	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383547109345201&agency_cd=USGS&
USGS	383607109355201	(D-25-21)28add- 1	38.60192597	-109.5984513	3,990	67	67	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383607109355201&agency_cd=USGS&
USGS	383609109190901	(D-25-23)25adc- 1	38.60248519	-109.3198379	5,920	150	150	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383609109190901&agency_cd=USGS&
USGS	383611108591301	NB05001016ADB	38.6030415	-108.9876084	5,465	NR	17	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383611108591301&agency_cd=USGS&
USGS	383613109360801	(D-25-21)28adb- 1	38.60359258	-109.6028958	4,060	114	114	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383613109360801&agency_cd=USGS&
USGS	383651109595201	R(D-27-17)12abd- 1	38.47220446	-109.9984583	4,000	523	500	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383651109595201&agency_cd=USGS&
USGS	383652110034001	(D-25-17)20daa- 1	38.61442398	-110.0617946	4,611	7,225	185	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383652110034001&agency_cd=USGS&
USGS	383655109364001	(D-25-21)21bdc- 1	38.61525899	-109.6117849	4,080	172	172	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383655109364001&agency_cd=USGS&
USGS	383655109425501*	(D-25-20)21dbb- 1	38.61525825	-109.7159526	5,080	NR	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383655109425501&agency_cd=USGS&
USGS	383656109493301*	(D-25-19)21db	38.61553557	-109.8265104	NR	910	910	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383656109493301&agency_cd=USGS&
USGS	383658109360601	(D-25-21)28dab- 1	38.61609238	-109.6023404	4,080	130	130	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383658109360601&agency_cd=USGS&
USGS	383701109370001	(D-25-21)20add- 2	38.61692559	-109.6173406	4,120	123	123	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383701109370001&agency_cd=USGS&
USGS	383701109434301*	(D-25-21)20add- 1	38.61692479	-109.729286	4,120	117	117	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383701109434301&agency_cd=USGS&
USGS	383704109232901	(D-25-23)20adb- 1	38.61776164	-109.3920608	5,020	230	230	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383704109232901&agency_cd=USGS&
USGS	383720109294700	(D-26-22)21bba- 1	38.62220421	-109.4970618	5,300	67	67	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383720109294700&agency_cd=USGS&
USGS	383752109234001	(D-25-23)20aba- 1	38.63109482	-109.3951165	4,920	175	175	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383752109234001&agency_cd=USGS&
USGS	383815109250501	(D-25-23)18baa- 1	38.63748323	-109.4187279	4,800	166	166	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383815109250501&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	383818109233801	(D-25-23) 8dcd- 1	38.638317	-109.394561	4,750	260	260	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383818109233801&agency_cd=USGS&
USGS	383818109233802	(D-25-23) 8dcd- 2	38.638317	-109.394561	4,750	85	85	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383818109233802&agency_cd=USGS&
USGS	383826109242701	(D-25-23) 8adb- 1	38.64053895	-109.4081723	4,640	126	126	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383826109242701&agency_cd=USGS&
USGS	383827109242701	(D-25-23) 7dda- 2	38.64081673	-109.4081723	4,640	105	105	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383827109242701&agency_cd=USGS&
USGS	383827109242801	(D-25-23) 7dda- 3	38.64081672	-109.40845	4,640	217	203	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383827109242801&agency_cd=USGS&
USGS	383828109232501	(D-25-23) 8dda- 1	38.64109482	-109.3909499	4,770	156	156	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383828109232501&agency_cd=USGS&
USGS	383828109242601	(D-25-23) 7dda- 1	38.64109451	-109.4078945	4,640	102	102	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383828109242601&agency_cd=USGS&
USGS	383829109310801	(D-25-22) 7dad- 1	38.64137044	-109.5195622	4,560	139	139	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383829109310801&agency_cd=USGS&
USGS	383842109235401	(D-25-23) 8bdc- 1	38.64498353	-109.3990055	4,660	NR	NR	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383842109235401&agency_cd=USGS&
USGS	383852109232901	(D-25-23) 8adb- 2	38.64776141	-109.3920611	4,750	140	116	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383852109232901&agency_cd=USGS&
USGS	383855109253701	(D-25-22)12add- 1	38.64859409	-109.427617	4,600	233	233	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383855109253701&agency_cd=USGS&
USGS	383856109253901	(D-25-22)12aad- 1	38.64887185	-109.4281725	4,600	233	233	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=383856109253901&agency_cd=USGS&
USGS	383902109254401	(D-25-22)12aab- 1	38.65053848	-109.4295614	4,560	198	198	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383902109254401&agency_cd=USGS&
USGS	383912109190001	(D-25-23) 1ddd- 1	38.65331832	-109.3173382	5,180	100	100	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=383912109190001&agency_cd=USGS&
USGS	384014109292200*	(D-26-22)22cdc- 1	38.67053714	-109.4901178	4,595	197	197	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384014109292200&agency_cd=USGS&
USGS	384025108580001	4	38.67359578	-108.9673306	NR	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384025108580001&agency_cd=USGS&
USGS	384026108575701	NB05101922ADB	38.67387355	-108.9664972	4,595	NR	140	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384026108575701&agency_cd=USGS&
USGS	384026108584701	NB05101922BCB	38.67387355	-108.9803866	4,720	NR	100	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384026108584701&agency_cd=USGS&
USGS	384040108583501	2	38.67776237	-108.9770532	NR	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384040108583501&agency_cd=USGS&
USGS	384046109412601*	(D-24-20)34daa- 1	38.67942373	-109.6912311	4,540	315	315	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384046109412601&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	384055108583101	No information in the station header file dup 1	38.68192896	-108.975942	NR	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384055108583101&agency_cd=USGS&
USGS	384055108583201	3	38.68192896	-108.9762199	NR	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384055108583201&agency_cd=USGS&
USGS	384055109421701*	(D-24-20)23cda- 1	38.68192353	-109.7053979	4,400	NR	NR	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384055109421701&agency_cd=USGS&
USGS	384112109462201*	(D-24-19)36bba- 1	38.68664511	-109.7734546	4,880	NR	NR	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384112109462201&agency_cd=USGS&
USGS	384137109525101	(D-24-18)25dba- 1	38.6935892	-109.8815129	5,300	604	604	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384137109525101&agency_cd=USGS&
USGS	384149109400901*	(D-24-20)25bca- 1	38.69690278	-109.6692917	4,351	880	NR	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384149109400901&agency_cd=USGS&
USGS	384149109400902*	(D-24-20)25bca- 2	38.69690278	-109.6692917	4,351	880	NR	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384149109400902&agency_cd=USGS&
USGS	384205109221001	(D-24-23)22cbb- 1	38.70137256	-109.3701167	4,200	62	62	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384205109221001&agency_cd=USGS&
USGS	384211109452401*	(D-24-20)19ccd- 1	38.70303363	-109.7573433	4,880	665	665	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384211109452401&agency_cd=USGS&
USGS	384228109454401*	(D-24-20)19caa- 1	38.70775573	-109.7628991	4,680	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384228109454401&agency_cd=USGS&
USGS	384247109355501	(D-25-21)35ddc- 1	38.5794265	-109.5676174	3,920	NR	NR	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384247109355501&agency_cd=USGS&
USGS	384249109420201*	(D-24-20)22bad- 1	38.71358955	-109.7012317	4,410	NR	52	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384249109420201&agency_cd=USGS&
USGS	384251109420101*	(D-24-20)22bac- 2	38.7141451	-109.7009539	4,410	70	70	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384251109420101&agency_cd=USGS&
USGS	384441109491401*	(D-24-19) 9aba- 1	38.74469922	-109.8212344	4,800	285	285	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384441109491401&agency_cd=USGS&
USGS	384447109201701	(D-24-23) 2acd- 1	38.74637294	-109.3387277	4,160	137	137	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384447109201701&agency_cd=USGS&
USGS	384531108470501	SC01510301ACC	38.75859449	-108.7853797	6,230	NR	47	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384531108470501&agency_cd=USGS&
USGS	384632108522501	5	38.77553894	-108.874272	NR	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384632108522501&agency_cd=USGS&
USGS	384654109353601	(D-23-21)27bcd- 1	38.78164515	-109.5940091	5,200	900	900	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384654109353601&agency_cd=USGS&
USGS	384750109122701	(D-23-24)13aab- 1	38.79738889	-109.2061667	4,195	402	402	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=384750109122701&agency_cd=USGS&
USGS	384832110021701*	(D-23-17)15cba- 1	38.80886421	-110.0387405	4,280	9,523	2,896	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384832110021701&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	384832110035801*	(D-23-17)17dbc- 1	38.80886427	-110.0667971	4,280	8,764	8,748	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384832110035801&agency_cd=USGS&
USGS	384855110034101*	(D-23-17)17ada- 1	38.81525301	-110.0620748	4,340	8,876	8,811	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=384855110034101&agency_cd=USGS&
USGS	385033109440101*	(D-23-20) 5bcb- 1	38.84247443	-109.7342892	4,464	529	491	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385033109440101&agency_cd=USGS&
USGS	385034109435901*	(D-23-20) 5bca- 1	38.84275221	-109.7337337	4,464	420	420	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385034109435901&agency_cd=USGS&
USGS	385035109441401*	(D-23-20) 5bbb- 2	38.8430299	-109.7379004	4,469	450	448	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385035109441401&agency_cd=USGS&
USGS	385036109441501*	(D-23-20) 5bbb- 1	38.84330767	-109.7381782	4,469	573	524	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385036109441501&agency_cd=USGS&
USGS	385037109440901*	(D-23-20) 5bbc- 1	38.84358547	-109.7365115	4,466	527	486	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385037109440901&agency_cd=USGS&
USGS	385038109440601*	(D-23-20) 5bbc- 2	38.84386325	-109.7356782	4,466	438	436	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385038109440601&agency_cd=USGS&
USGS	385120109174401	(D-22-24)29cbc- 1	38.85554114	-109.2962271	4,150	160	160	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385120109174401&agency_cd=USGS&
USGS	385123110020101	(D-22-17)34bda- 1	38.85636307	-110.0342963	4,320	10,293	2,896	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385123110020101&agency_cd=USGS&
USGS	385153109232701	(D-22-23)29ada- 1	38.86470461	-109.3915068	4,380	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=385153109232701&agency_cd=USGS&
USGS	385230110064401	(D-22-16)25bbc- 1	38.87497407	-110.1129109	4,120	9,508	2,896	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385230110064401&agency_cd=USGS&
USGS	385554110074701	(D-22-16) 2bbd- 1	38.93163963	-110.1304124	4,067	5,896	2,896	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385554110074701&agency_cd=USGS&
USGS	385616109244701	(D-21-23)31acc- 1	38.93775892	-109.41373	4,445	NR	NR	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385616109244701&agency_cd=USGS&
USGS	385619110080601	(D-21-16)34dda- 1	38.93858397	-110.1356905	4,056	2,627	905	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385619110080601&agency_cd=USGS&
USGS	385732110002201	(D-21-17)26adc- 1	38.95886044	-110.0067958	4,470	11,895	905	N	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385732110002201&agency_cd=USGS&
USGS	385736108454901	046 KROFT	38.95998298	-108.7642671	NR	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=385736108454901&agency_cd=USGS&
USGS	385751108522001	Potholes rec site	38.9641505	-108.8728822	NR	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=385751108522001&agency_cd=USGS&
USGS	385913108451501	047 HUDSON	38.98692729	-108.7548222	NR	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=385913108451501&agency_cd=USGS&
USGS	385913109441801	(D-21-20)17bcc- 1	38.98691446	-109.7390132	5,200	2,896	2,896	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385913109441801&agency_cd=USGS&

Table 5. Well sites with water-level and (or) water-quality data as reported in the National Water Information System database, within the study area, Utah and Colorado.—Continued

[Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83). Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Abbreviations: Y, yes; N, no; Sp. C., specific conductance; NWIS, National Water Information System; USGS, U.S. Geological Survey; NR, not reported]

Source agency	Site number	Station Name	Latitude, in decimal degrees	Longitude, in decimal degrees	Land surface altitude, in feet	Hole depth, in feet below land surface	Well depth, in feet below land surface	Water-level data? (Y/N)	Field parameters (temperature, pH, Sp. C.)? (Y/N)	Major ions? (Y/N)	Trace metals? (Y/N)	Link to NWIS website
USGS	385939108442601	045 FULLER	38.9941494	-108.7412106	NR	NR	NR	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=385939108442601&agency_cd=USGS&
USGS	385947110083301	(D-21-16)10dcb- 1 Wel	38.99644444	-110.1425833	4,060	NR	NR	Y	Y	Y	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385947110083301&agency_cd=USGS&
USGS	385948110083601	(D-21-16)10cda- 1 Wel	38.99661111	-110.1431944	4,060	NR	12	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385948110083601&agency_cd=USGS&
USGS	385952110084401	(D-21-16)10cdb- 1 Wel	38.99763889	-110.1456389	4,060	8	8	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=385952110084401&agency_cd=USGS&
USGS	385958110082401	(D-21-16)10dbd- 1 Wel	38.99952778	-110.1399167	4,060	NR	10	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385958110082401&agency_cd=USGS&
USGS	385958110082601	(D-21-16)10dbd- 2 Wel	38.99947222	-110.1404167	4,060	NR	12	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=385958110082601&agency_cd=USGS&
USGS	390035109204701	(D-21-23) 2bcd- 1	39.00970587	-109.347062	4,542	NR	NR	Y	N	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=390035109204701&agency_cd=USGS&
USGS	390222110083101	(D-20-16)32adc- 1 Wel	39.03958333	-110.1418611	4,060	11	11	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=390222110083101&agency_cd=USGS&
USGS	390222110084101	(D-20-16)32acd- 1 Wel	39.03955556	-110.1447222	4,060	9	9	Y	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=390222110084101&agency_cd=USGS&
USGS	390224110084801	(D-20-16)32acc- 1 Wel	39.03986111	-110.1466667	4,060	13	13	Y	Y	N	N	http://waterdata.usgs.gov/nwis/inventory/?site_no=390224110084801&agency_cd=USGS&
USGS	390513109060601	(D-20-25)12bab- 1	39.08688889	-109.1018333	4,310	325	325	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=390513109060601&agency_cd=USGS&
USGS	390710109370301	(D-19-21)29dbc- 1	39.11941518	-109.6181823	6,420	NR	4,760	N	Y	Y	Y	http://waterdata.usgs.gov/nwis/inventory/?site_no=390710109370301&agency_cd=USGS&

* Denotes sites that are loacted in the Moab Master Leasing Plan area.

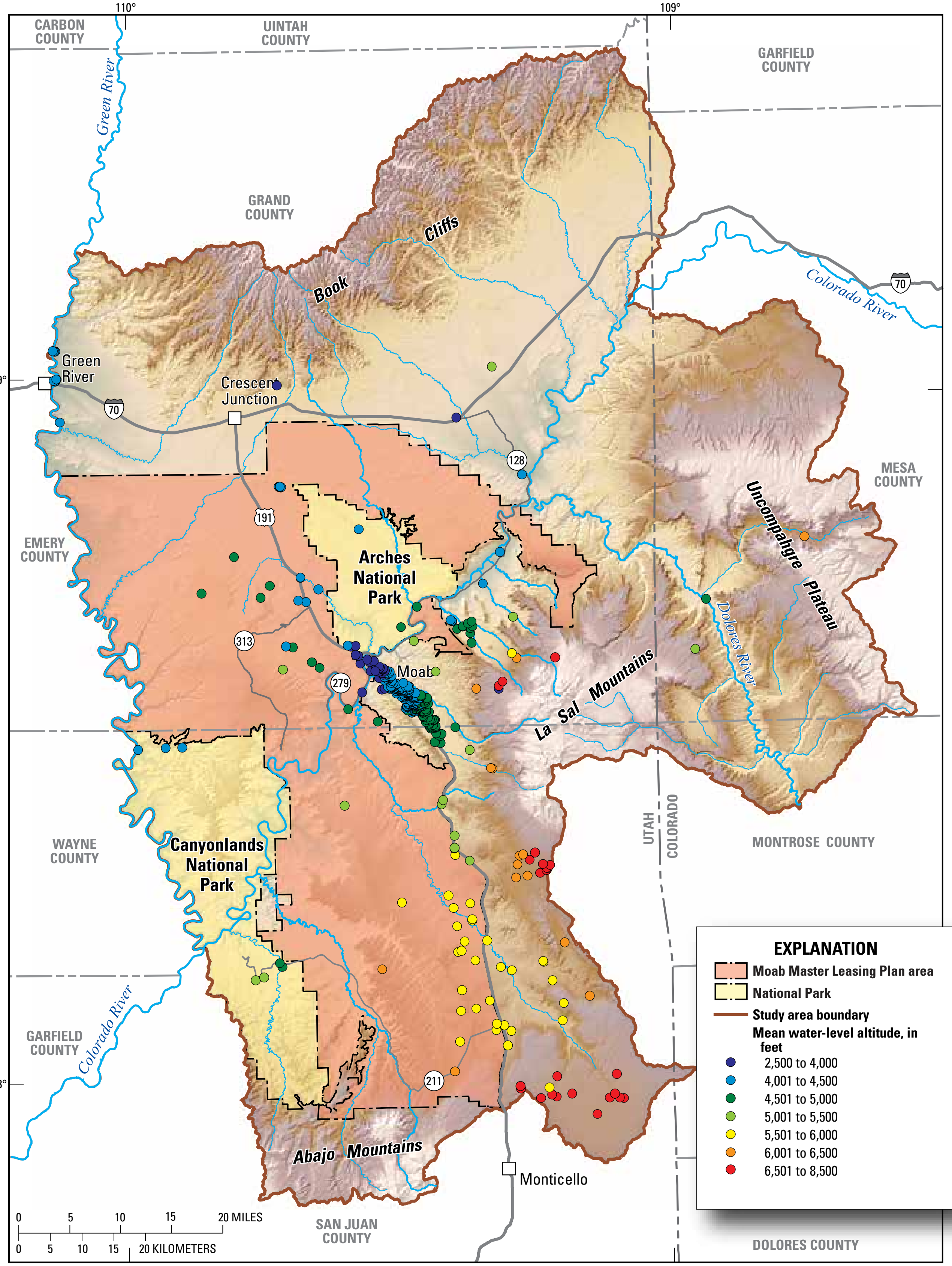

Figure 10. Mean water-level altitude for wells reported in the National Water Information System database within the study area.

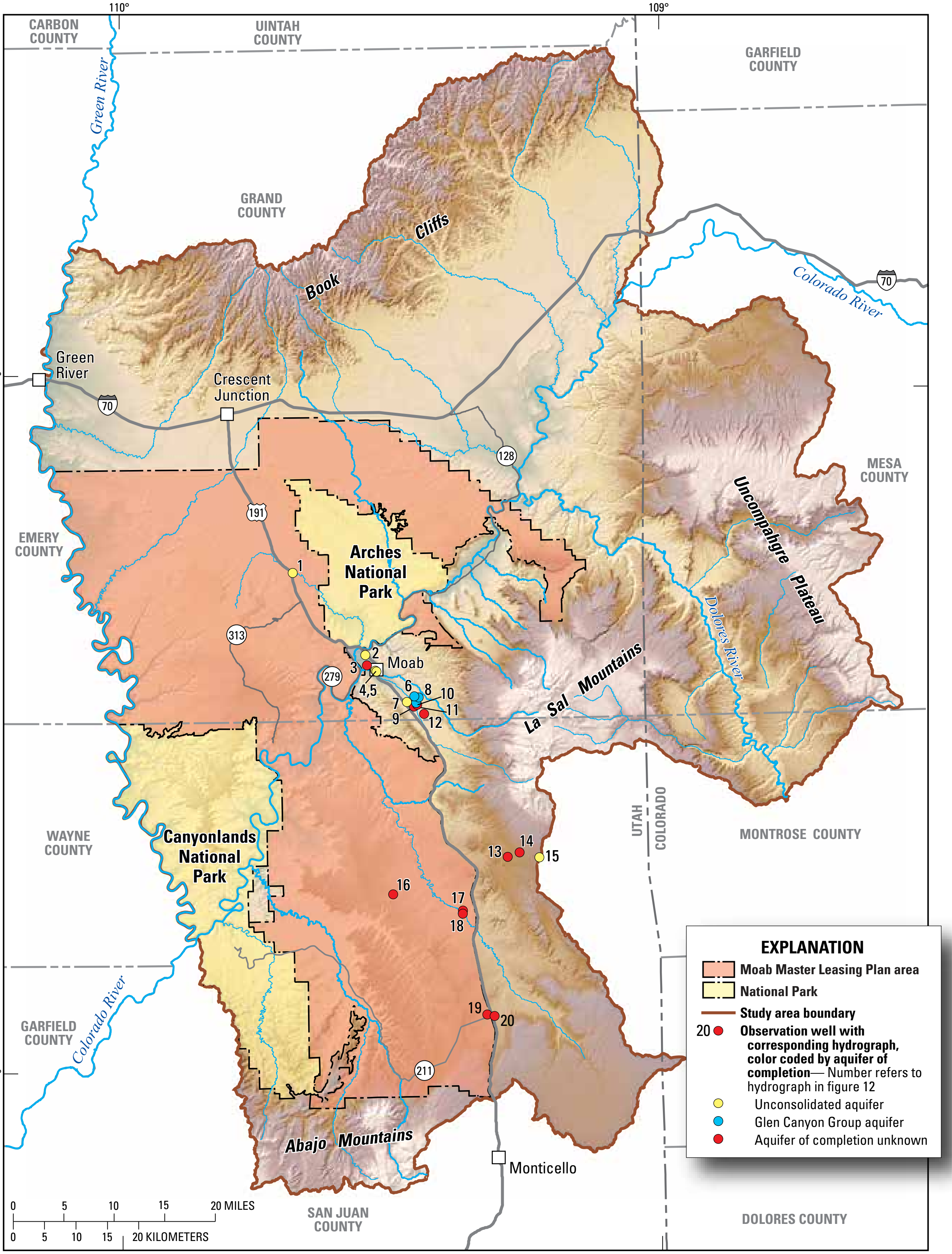

Figure 11. Location of wells within the study area that have long-term water-level records reported in the National Water Information System database. Corresponding hydrographs are shown in figure 12.

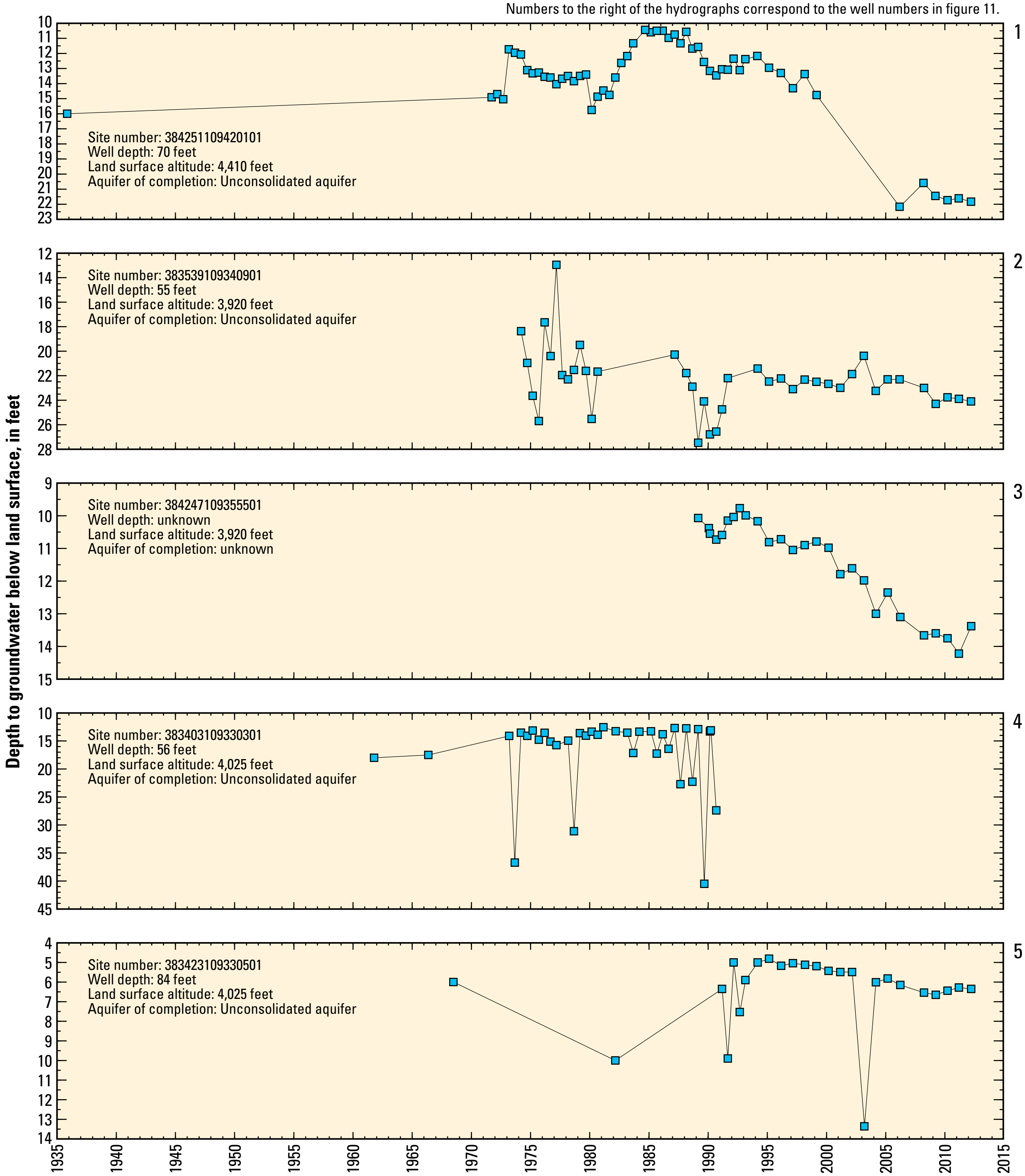

Figure 12. Hydrographs of wells with long-term water-level records within the study area.

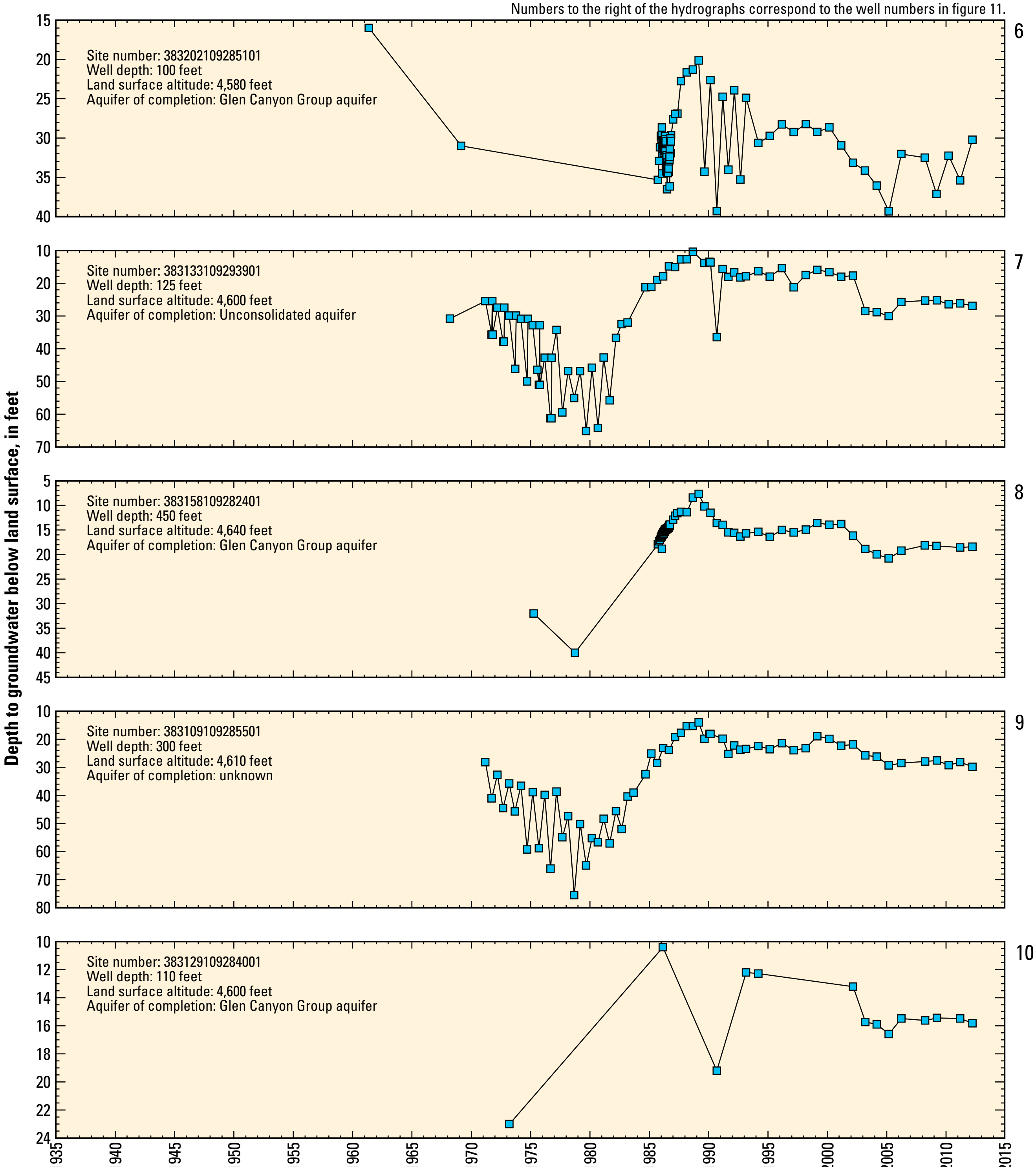

Figure 12. Hydrographs of wells with long-term water-level records within the study area.—Continued

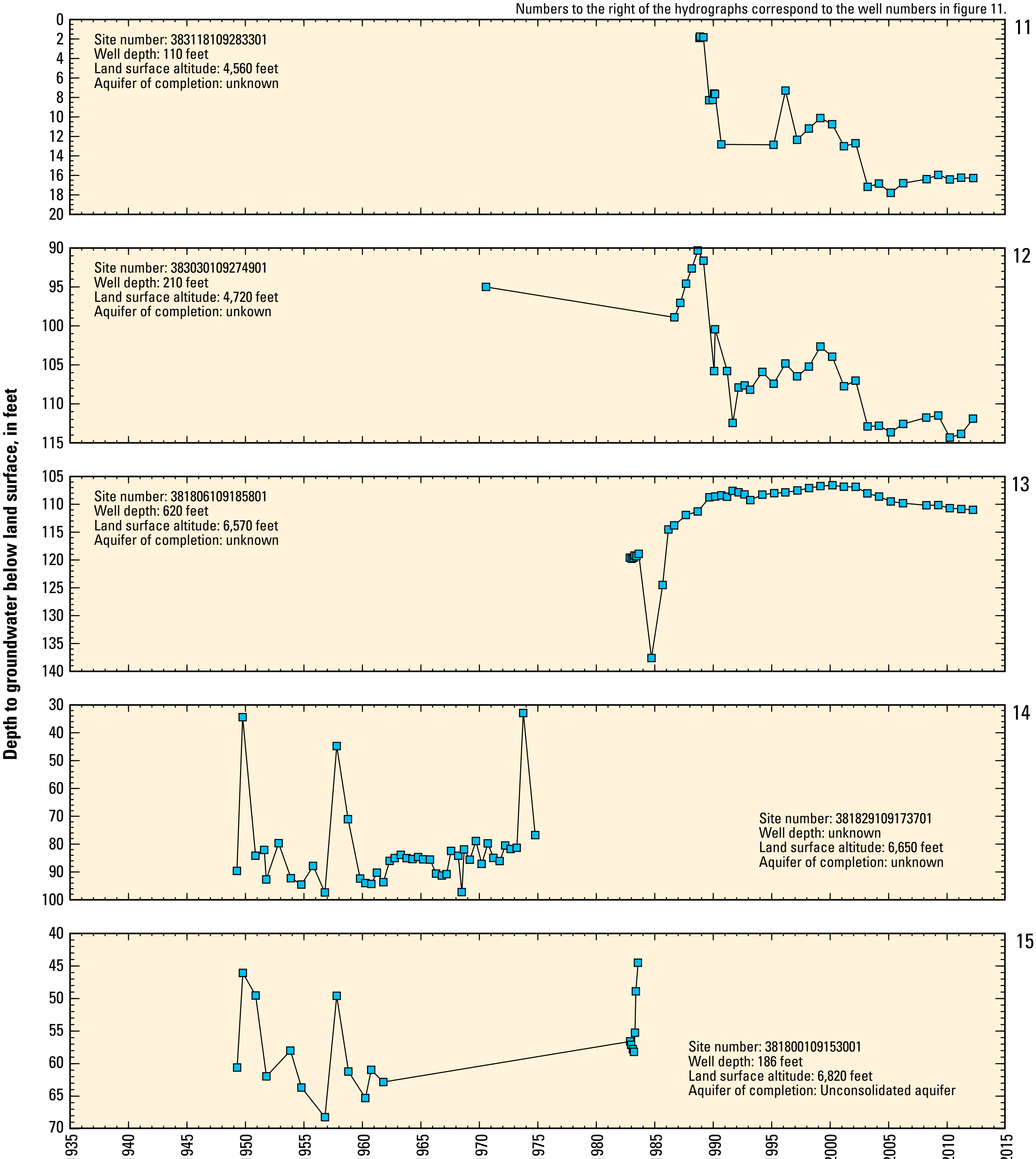

Figure 12. Hydrographs of wells with long-term water-level records within the study area.—Continued

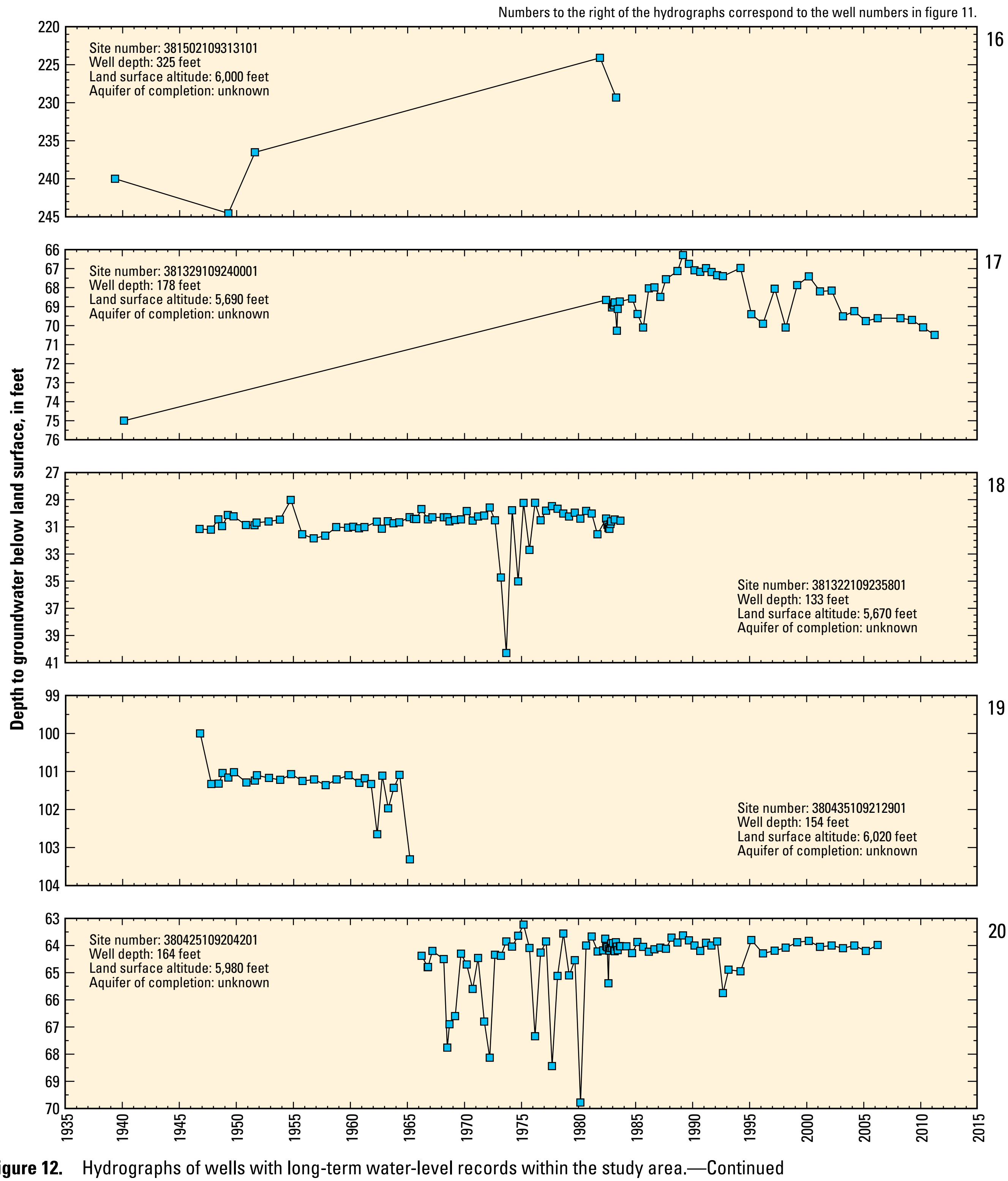

Figure 12. Hydrographs of wells with long-term water-level records within the study area.—Continued

Potential Recharge Areas

Potential recharge areas are determined based on climate, geology, topography, and hydrology. The quantity of recharge depends on several factors, including the amount and timing of precipitation, hydrologic properties of soils and unconsolidated deposits, and surface exposures and fracturing of consolidated rocks. Precipitation is the dominant source of recharge to aquifers within the study area. Recharge to consolidated-rock aquifers occurs during prolonged wet surface conditions and, therefore, winter precipitation generally determines the amount of water that will recharge these aquifers (Hood and Patterson, 1984; Freethey and Cordy, 1991; Steiger and Susong, 1997). Winter precipitation within the study area generally is in the form of snow, which melts slowly, extending the period of runoff and increasing infiltration (Danielson and Hood, 1984; Steiger and Susong, 1997). Danielson and Hood (1984) showed that areas with more than 8 in. of winter (October to April) precipitation likely contribute recharge to aquifers. Hydrologic properties of soils and unconsolidated deposits control how rapidly water infiltrates the surface and recharges underlying aquifers. Generally, sandy soils, which are common throughout the study area, facilitate faster infiltration rates than clay-rich soils. Areas covered with sandy soils enhance recharge by providing storage where precipitation can quickly infiltrate into underlying aquifers instead of running off into stream channels (Steiger and Susong, 1997). Fractured areas also enhance recharge as the near-surface fractures provide pathways for water to rapidly infiltrate and recharge the aquifer.

Datasets of precipitation and soil characteristics were used to determine potential recharge areas within the study area. Average annual winter precipitation was calculated using the 30-year (1971–2000) average monthly precipitation 800-m grids from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) climate mapping system (Daly and others, 1994). Soil characteristics were identified using the 1:250,000-scale State Soil Geographic (STATSGO) database (Schwarz and Alexander, 1995).

The hydrologic soil characteristics as defined in the STATSGO database (Schwarz and Alexander, 1995) and areas where mean annual winter precipitation is greater than 8 in. are shown in figure 13. The descriptions for the four hydrologic soil-characteristic codes from the STATSGO database are as follows (Schwarz and Alexander, 1995):

1. High infiltration rates, deep soils, well-drained to excessively-drained sands and gravels.

2. Moderate infiltration rates, deep to moderately deep, moderately well- and well-drained soils with moderately coarse textures.

3. Slow infiltration rates, soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

4. Very slow infiltration rates, soils are clayey, have a high water table, or are shallow to an impervious layer (includes some areas denoted as pits, rock outcrops, terrace escarpments, and urban lands that were not previously assigned a hydrologic characteristics code in the original state databases).

Recharge is enhanced in areas where winter precipitation is greater than 8 in., including the upland areas of the Abajo and La Sal Mountains, the Uncompahgre Plateau, and the Book Cliffs (fig. 13). Recharge also is likely to be enhanced in areas where the soil-characteristic code is 1 or 2, which denotes high–to-moderate infiltration rates through the soil. These areas are mainly in the valleys that are covered with unconsolidated deposits (for example, Moab-Spanish and Castle Valleys), in areas along some of the larger streams (for example, Indian Creek and the Colorado River), and in many of the upland areas, such as the Abajo and La Sal Mountains. Although many of the sandstone outcrops within the study area are classified with a low soil-characteristic code of 4, recharge to these units locally will be enhanced in areas where the outcrops are highly fractured.

Groundwater Budget

Limited data are available to quantitatively estimate the large-scale regional groundwater budget for the study area. Some previous studies, however, have estimated groundwater budgets for areas within and adjacent to the current study area, namely Moab-Spanish Valley and parts of the Paradox Basin (fig. 14). Various components of the groundwater budget for Moab-Spanish Valley have been estimated in several previous studies (Sumsion, 1971; Eychaner, 1977; Kovacs, 2000; Gardner, 2004; Lowe and others, 2007). Rush and others (1982) provide an estimated groundwater budget for the upper aquifer system (aquifers above the Upper Paleozoic Confining Unit) for the Green River-Moab area of the Paradox Basin. Likewise, Weir and others (1983) provide an estimated groundwater budget for the upper aquifer system for the Moab-Monticello area of the Paradox Basin. These two studies cover a large part of the current study area, however, they extend only as far east as the crest of the La Sal Mountains, and include areas to the west of the Green River that are outside the current study area. Estimates of groundwater-budget components for Moab-Spanish Valley and parts of the Paradox Basin are summarized in table 6.

Recharge

Most groundwater recharge to the study area originates as infiltration of precipitation from upland areas where precipitation quantities are the greatest (Rush and others, 1982; Weir and others, 1983; Blanchard, 1990; Freethey and Cordy, 1991; Steiger and Susong, 1997; Eisinger and Lowe, 1999). Additional groundwater recharge occurs as seepage from streams and irrigation water (Sumsion, 1971; Weir and others, 1983;

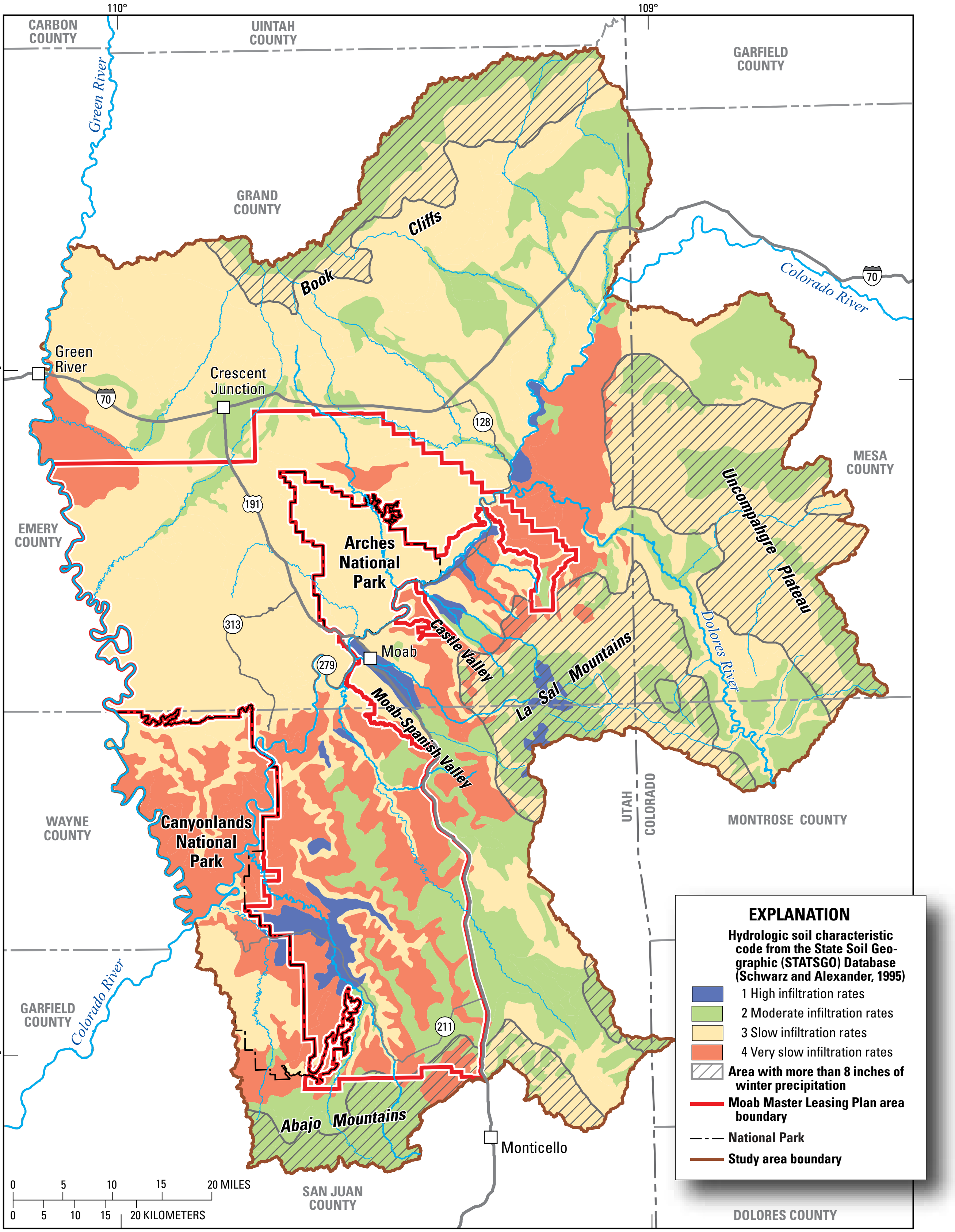

Figure 13. Distribution of hydrologic soil characteristics and areas with more than 8 inches of winter precipitation within the study area.

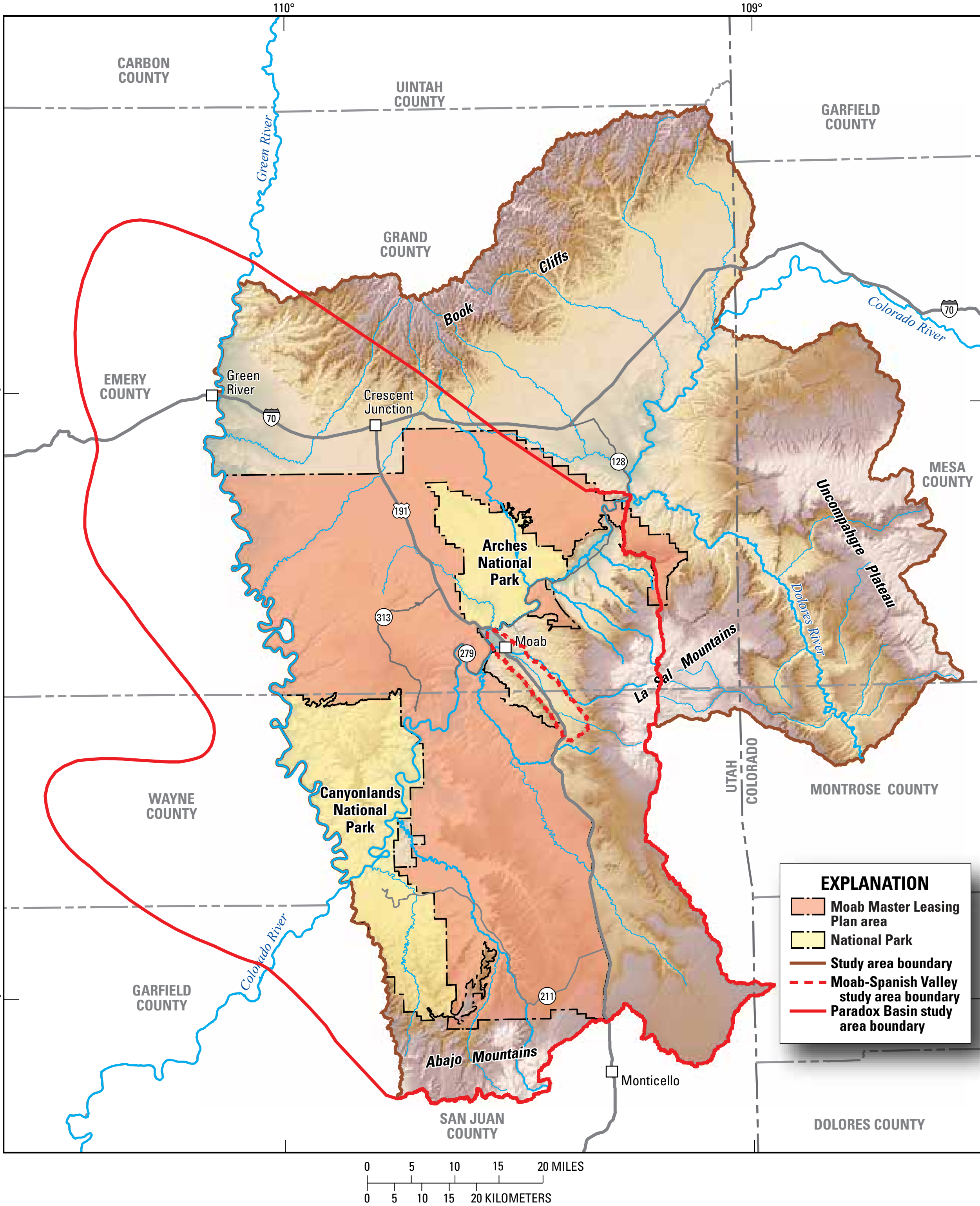

Figure 14. Locations of previous groundwater studies with estimated groundwater-budget components.

Table 6. Summary of previously reported estimates of groundwater-budget components for Moab-Spanish Valley and parts of the Paradox Basin.

[All values reported in acre-feet per year, rounded to two significant digits]

Moab-Spanish Valley

	Publication or source of data					
	Sumsion (1971)	Eychaner (1977)[1]	Kovacs (2000)[2]	Gardner (2004)[3]	Lowe and others (2007)[1]	Total
Recharge						
Precipitation						
Inflow (from infiltration of precipitation over La Sal Mountains and adjacent upland areas)	14,000	13,000	13,000	—	13,000	13,000 to 14,000
Infiltration of direct precipitation over valley	—	560	730	—	730	560 to 730
Seepage from Ken's Lake	—	—	3,300	—	3,200	3,200 to 3,300
Infiltration of water from Pack Creek	—	330	—	—	—	330
Total recharge	**14,000**	**14,000**	**17,000**	—	**17,000**	**14,000 to 17,000**
Discharge						
Seepage to streams (Mill and Pack Creeks)	—	1,300	1,200	—	1,100	1,100 to 1,300
Evapotranspiration (Scott M. Matheson Wetlands Preserve)	3,000	2,200	—	2,500 to 3,700	—	2,200 to 3,700
Withdrawals from wells/springs (net)	3,300	2,000	6,400	—	6,400	2,000 to 6,400[4]
Seepage to Colorado River	8,000	8,300	9,500[5]	110 to 1,500	9,200[5]	110 to 9,500
Total discharge	**14,000**	**14,000**	**17,000**	—	**17,000**	**14,000 to 17,000**

Paradox Basin

	Publication or source of data		
	Rush and others (1982) Green River-Moab Area	Weir and others (1983) Moab-Monticello Area	Total
Recharge			
Infiltration of precipitation and runoff	16,000	120,000	140,000
Infiltration of regional streamflow (Green and Colorado Rivers)	0	0	0
Subsurface inflow	unknown	unknown	unknown
Total recharge	**110,000[6]**	**120,000**	**230,000**
Discharge			
Evapotranspiration	24,000	32,000	56,000
Springflow	410	4,100	4,500
Seepage to regional streams (Green and Colorado Rivers)	81,000	200,000	280,000
Withdrawals from wells	minor	4,900	4,900
Subsurface outflow	very small	probably small	small
Total discharge	**110,000**	**240,000**	**350,000**

[1]Estimates are from numerical model results.

[2]As reported in Lowe and others (2007), p. 28 and Table 5.

[3]Estimates for Scott M. Matheson Wetlands Preserve only.

[4]Difference due to increased well withdrawals in the late 1990s (Loughlin Water Associates, LLC, 2010).

[5]Estimate may include evapotranspiration from Scott M. Matheson Wetlands Preserve, but unclear in the reports.

[6]In report, total recharge was assumed to equal total discharge.

Freethey and Cordy, 1991; Steiger and Susong, 1997; Eisinger and Lowe, 1999) and as subsurface inflow, both between aquifers (Sumsion, 1971; Eisinger and Lowe, 1999) and as lateral movement into the study area across its defined boundaries (Rush and others, 1982; Weir and others, 1983; Freethey and Cordy, 1991). Previous estimates of total groundwater recharge to Moab-Spanish Valley range from 14,000 to 17,000 acre-ft/yr (Sumsion, 1971; Eychaner, 1977; Downs and Kovacs, 2000; Lowe and others, 2007; table 6). Previous estimates of total groundwater recharge to the upper aquifer system of the Paradox Basin are about 230,000 acre-ft/yr (Rush and others, 1982; Weir and others, 1983; table 6).

Direct Infiltration of Precipitation

The La Sal and Abajo Mountains and adjacent upland areas are a dominant source of recharge to the primary consolidated-rock aquifers of the upper groundwater system because the talus covered, fractured, and upturned high mountain slopes readily absorb snowmelt and precipitation (Weir and others, 1983; Blanchard, 1990). The Book Cliffs and areas to the north of the study area also receive a substantial amount of precipitation (about 15.7–27.6 in/yr) and provide a considerable source of groundwater recharge to the northern parts of the study area (Rush and others, 1982). Likewise, the Uncompahgre Plateau receives a substantial amount of precipitation (more than 8 in/yr of winter precipitation), and provides a source of groundwater recharge to the eastern part of the study area (Freethey and Cordy, 1991). Recharge from direct infiltration of precipitation to the consolidated-rock aquifers is enhanced where the rocks are (1) highly fractured, such as occurs along the flanks of the Abajo and La Sal Mountains, or along the margins of the collapsed salt anticlines, such as Moab-Spanish Valley and Castle Valley (Steiger and Susong, 1997; Lowe and others, 2007); or (2) where the rock is covered by shallow deposits of sandy soil that provide storage where precipitation can quickly infiltrate and then move into the underlying rock rather than run off into stream channels (Blanchard, 1990; Freethey and Cordy, 1991; Steiger and Susong, 1997). Direct infiltration of precipitation also accounts for a small part of recharge to the unconsolidated (valley-fill) aquifers (Eychaner, 1977; Steiger and Susong, 1997; Lowe and others, 2007).

Seepage From Streams and Irrigation Water

Recharge to the consolidated-rock aquifers of the upper groundwater system also occurs along stream channels where deep infiltration is most likely (Blanchard, 1990; Weir and others, 1983; Freethey and Cordy, 1991; Steiger and Susong, 1997; Eisinger and Lowe, 1999). Seepage from streams and stream-derived irrigation water also is an important source of recharge to the unconsolidated aquifers in Moab-Spanish and Castle Valleys (Sumsion, 1971; Steiger and Susong, 1997; Eisinger and Lowe, 1999). In Moab-Spanish Valley, groundwater recharge occurs to the unconsolidated aquifers from the infiltration of water diverted from Pack Creek used as irrigation (Sumsion, 1971; Eychaner, 1977), and as seepage of water from Ken's Lake (Kovacs, 2000; Lowe and others, 2007), which is sourced from a diversion of Mill Creek. The primary source of recharge to the unconsolidated aquifer of Castle Valley is from stream seepage and infiltration of Castle and Placer Creeks (Eisinger and Lowe, 1999).

Subsurface Inflow

Subsurface inflow of groundwater across the study-area boundary is the primary source of groundwater recharge to the Lower Paleozoic aquifer system (Rush and others, 1982; Weir and others, 1983; Freethey and Cordy, 1991). Recharge to the aquifer is from precipitation on outcrops outside of the study area (Rush and others, 1982; Weir and others, 1983). The low-permeability evaporite deposits of the Paradox Member of the Hermosa Formation (Upper Paleozoic confining unit) likely limit or prevent vertical flow and, therefore, recharge from the upper aquifer system to the Lower Paleozoic aquifer system. Recharge from subsurface inflow of groundwater across the study-area boundary is likely very minor for the upper aquifer system within the study area (Rush and others, 1982; Weir and others, 1983).

Recharge from the subsurface inflow of groundwater between aquifers accounts for most of the groundwater recharge to Moab-Spanish Valley. Previous studies in Moab-Spanish Valley estimated that recharge to the unconsolidated aquifer is predominantly from subsurface inflow of groundwater from the the Glen Canyon Group aquifer along the northeast side of the valley. Sumsion (1971) assumed that groundwater recharge to the valley through the Glen Canyon Group aquifer equaled the sum of discharge to the Colorado River, evapotranspiration within the Scott M. Matheson Wetlands Preserve, discharge to springs, and well withdrawals. Recharge estimates from subsequent studies by Eychaner (1977), Kovacs (2000), and Lowe and others (2007) were based on Sumsion's estimates. Gardner (2004) concluded that Sumsion (1971) may have significantly overestimated discharge to the Colorado River and, consequently, recharge from subsurface inflow to Moab-Spanish Valley. Smaller quantities of groundwater recharge to the unconsolidated aquifer in Spanish Valley also occur as subsurface inflow from adjacent, fractured consolidated-rock aquifers, specifically from the Cutler Formation aquifer along the southwest side of the valley (Snyder, 1996; Eisinger and Lowe, 1999). Recharge from groundwater inflow between aquifers also can occur between the consolidated-rock aquifers of the upper aquifer system, where intervening confining units are missing, and vertical groundwater gradients are present (Rush and others, 1982; Weir and others, 1983; Blanchard, 1990; Freethey and Cordy, 1991).

Discharge

Groundwater discharge occurs as seepage to streams (including the Colorado and Green Rivers), evapotranspiration, to springs and seeps, well withdrawals (Sumsion, 1971; Blanchard, 1990; Rush and others, 1982; Weir and others, 1983; Freethey and Cordy, 1991); and as subsurface outflow, both between aquifers (Sumsion, 1971; Eisinger and Lowe, 1999) and as lateral movement into the study area across its defined boundaries (Rush and others, 1982; Weir and others, 1983; Freethey and Cordy, 1991). Previous estimates of total groundwater discharge from Moab-Spanish Valley range from 14,000 to 17,000 acre-ft/yr (Sumsion, 1971; Eychaner, 1977; Kovacs, 2000; Lowe and others, 2007; table 6). Previous estimates of total groundwater discharge from the upper aquifer system of the Paradox Basin are about 350,000 acre-ft/yr (Rush and others, 1982; Weir and others, 1983; table 6).

Seepage to Streams

The Green and Colorado Rivers are the terminal groundwater-discharge locations for water within the study area, and discharge to these rivers represents the largest component of groundwater discharge (table 6). Rush and others (1982) estimated groundwater discharge to the Green River between Green River, Utah, and the confluence with the Colorado River of approximately 823 acre-ft/yr per mile of underlying aquifer, and groundwater discharge to the Colorado River between Cisco, Utah, and the confluence with the Green River of approximately 3,705 acre-ft/yr per mile of underlying aquifer. The length of underlying aquifer in this study was calculated as the straight-line distance of a river segment (Rush and others, 1982, table 1). Based on these rates, Rush and others (1982) and Weir and others (1983) estimated groundwater discharge to the Green and Colorado Rivers of about 280,000 acre-ft/yr; these estimates, however, include discharge from aquifers on the northwest side of the Green River, which is outside the current study area, and excludes discharge to the Colorado River upstream of the Dolores River (fig. 14).

Groundwater discharge directly to the Green and Colorado Rivers for the study area can be estimated by multiplying the aquifer distance (length of underlying aquifer) by the rates calculated in Rush and others (1982). Using the assumption that the approximate aquifer distance that each river crosses is the straight-line distance for a particular river segment (Rush and others, 1982, table 9), the aquifer distances that the Green and the Colorado Rivers cross within the study area are approximately 69 and 75 mi, respectively. Assuming that discharge on either side of the Green River is approximately equal (Rush and others, 1982), such that the discharge rate to the Green River is approximately 411.5 acre-ft/yr per mile (823 acre-ft/yr per mile divided by 2), groundwater discharge to the Green River is about 28,000 acre-ft/yr. Groundwater discharge to the Colorado River is about 280,000 acre-ft/yr.

There are only a few previously reported estimates of groundwater discharge for the other streams within the study area. Previously reported groundwater discharge estimates to Mill and Pack Creeks in Moab-Spanish Valley range from 1,100 to 1,300 acre-ft/yr (Eychaner, 1977; Kovacs, 2000; Lowe and others, 2007). These estimates, however, are from numerical modeling results where the streams were simulated as drains. There is increased uncertainty in these estimates, therefore, because of uncertainty in the streambed conductances and geometries used in these models. Blanchard (1990) looked at the gains and losses of stream flow along the entire reaches of Mill Creek and North Fork of Mill Creek during October 1985 to determine areas and approximate quantities of groundwater recharge and discharge along the streams. Blanchard (1990) estimated that about 2,050–3,800 acre-ft/yr of groundwater discharge to the two streams. A long period of relatively wet climatic conditions began in 1980 preceding the investigation (Burden and others, 2011) and, therefore, the estimates may exceed the long-term average. Warner and others (1985) measured baseflow in the Dolores River and its tributaries in January 1978. The baseflow was assumed to be entirely derived from groundwater discharge to the river, and measurements by Warner and others (1985) indicated that about 16,000 acre-ft/yr of groundwater discharged to the Dolores River and its tributaries that are located within the current study area. A long period of below-average precipitation preceded the study (Burden and others, 2011) and, therefore, the estimates may be much lower than the long-term average.

Evapotranspiration

Groundwater discharge to evapotranspiration by deep-rooted phreatophytes can be substantial in areas adjacent to perennial streams and rivers. Typical regional phreatophytes located adjacent to the streams and rivers in the riparian areas are saltcedar, cottonwood, willow, and saltgrass (Rush and others, 1982; Weir and others, 1983; Eisinger and Lowe, 1999). In locations with deeper water tables (as deep as 50 ft), saltbrush, greasewood, and rabbitbrush dominate (Rush and others, 1982; Weir and others, 1983; Eisinger and Lowe, 1999). Rush and others (1982) and Weir and others (1983) estimated that 38 mi^2 of the Paradox Basin were covered by phreatophytes, and nearly 15 of the 38 mi^2 were located in river floodplains. The average groundwater discharge from the phreatophytes was estimated at 56,000 acre-ft/yr (Rush and others, 1982; Weir and others, 1983). Estimates of groundwater discharge by evapotranspiration in the Scott M. Matheson Wetlands Preserve of Moab-Spanish Valley range from 2,200 to 3,700 acre-ft/yr (Sumsion, 1971; Eychaner, 1977; Gardner, 2004). Evaporation of shallow soil moisture also contributes to groundwater discharge.

Springs and Seeps

Numerous springs and seeps are present within the study area; however, previous studies have measured discharge at only a few of these sites. Discharge from 36 springs in the Spanish Valley area between July 1967 and August 1986 were measured or estimated by Sumsion (1971) and (or) Blanchard (1990). These discharge measurements and estimates ranged from 30 to 200 gal/min (48 to 323 acre-ft/yr) for springs in the unconsolidated aquifer; 200 gal/min (323 acre-ft/yr) for a spring in the Burro Canyon Formation of the Dakota aquifer; 0.25 gal/min (0.4 acre-ft/yr) for springs in the Salt Wash Member of the Morrison Formation of the Morrison aquifer; 0.5 to 11 gal/min (0.8 to 18 acre-ft/yr) for springs in the Entrada Sandstone of the Entrada aquifer; 0.3 to 390 gal/min (0.5 to 630 acre-ft/yr) for springs in the Navajo Sandstone, the Wingate Sandstone, and the Glen Canyon Group; 20 to 43.5 gal/min (32 to 70 acre-ft/yr) for springs in undifferentiated Mesozoic rocks; and 2 gal/min (3 acre-ft/yr) for a spring in the Paradox Member of the Hermosa Formation. Eisinger and Lowe (1999) report that more than 200 perennial springs are present throughout the La Sal Mountains and are predominantly at altitudes greater than 7,500 ft. Rush and others (1982) and Weir and others (1983) report that there are at least 200 springs within the Paradox Basin study area, and discharge from the upper groundwater system to these springs is about 4,500 acre-ft/yr (table 6). As discussed in the section, “Springs”, mean spring-discharge measurements for 64 springs reported in the NWIS database varies widely from less than 1 to 371 gal/min (less than 1.6 to 599 acre-ft/yr; fig. 9). The largest reported mean spring discharges from NWIS are in Moab-Spanish Valley, and on the western flank of the La Sal Mountains. Most springs within the study area have mean discharges of less than 10 gal/min (less than 16 acre-ft/yr).

Well Withdrawals and Groundwater Use

There is little data on the quantity of groundwater withdrawn from wells within the study area. The combined groundwater discharge to springs and well withdrawals in Moab-Spanish Valley is estimated to range from 2,000 to 3,300 acre-ft/yr (Sumsion, 1971; Eychaner, 1977) for periods in the late 1960s and mid-1970s, and 6,400 acre-ft/yr (Kovacs, 2000; Lowe and others, 2007) for the period after the late 1990s. These estimates are net estimates, where 50 percent of the well withdrawals for irrigation are assumed to return to the groundwater system (Sumsion, 1971); therefore, only one-half of the estimated well withdrawals for irrigation are reported. Rush and others (1982) and Weir and others (1983) estimated groundwater discharge to well withdrawals of about 4,900 acre-ft/yr for the Paradox Basin.

Well withdrawals throughout the study area have likely increased in recent years; however, no current well-withdrawal inventories are present within the study area, and the number of wells and withdrawal information are limited. The Utah Division of Water Rights (UT-DWR) Web site provides geographic information system datasets (dataset WRPOD downloaded from *http://www.waterrights.utah.gov/gisinfo/wrcover.asp*, accessed May 9, 2013) that can be queried to determine the number of water rights for wells (underground points of diversion) that have been “approved” or “perfected”. The total number of wells that fit these criteria in the study area is 4,960 (fig. 15). Most of each of these wells are categorized as having multiple uses. Of the total number of wells, 4,298 are categorized as being used for domestic supply, stock watering, and irrigation; 67 are categorized as being used for municipal supplies; 19 are categorized as being used for mining; 280 are categorized as having a use of “other”; and 578 have no data regarding use.

Public water supplier data from the UT-DWR Web site (*http://www.waterrights.utah.gov/cgi-bin/wuseview.exe*, accessed May 22, 2013) report 2012 water-use estimates for the primary municipalities of Moab-Spanish Valley, Castle Valley, and Monticello. UT-DWR reports water use of 1,767 acre-ft from springs and 899 acre-ft from wells for Moab City Water, and 1,677 acre-ft from wells for the Grand County Conservancy District (primary public water suppliers for Moab-Spanish Valley); 716 acre-ft from wells for the Town of Castle Valley; and 554 acre-ft from springs and 29.5 acre-ft from wells for the Monticello Municipal Water System. Other UT-DWR 2012 public supply and water-use data within the study area is available for Arches National Park, which used 9 acre-ft from wells; Archview Campground, which used 6 acre-ft from wells; and Wilson Arch Water and Sewer Special Services District, which used 12 acre-ft from wells.

Subsurface Outflow

Subsurface outflow of groundwater across the study area boundary is the primary groundwater discharge from the Lower Paleozoic aquifer system (Rush and others, 1982; Weir and others, 1983; Freethey and Cordy, 1991). Discharge from the aquifer system primarily is to the Colorado River outside the study area (Rush and others, 1982). The evaporite deposits of the Paradox Member of the Hermosa Formation likely prevent vertical flow and, therefore, discharge to the upper aquifer system. Discharge as subsurface outflow of groundwater across the study area boundary likely is very minor for the upper aquifer system within the study area (Rush and others, 1982; Weir and others, 1983). Limited data throughout the study area increase the difficulty in estimating subsurface flow to adjacent regions.

Discharge as groundwater outflow between aquifers can occur between the consolidated-rock aquifers of the upper aquifer system, where intervening confining units are absent and vertical groundwater gradients are present (Rush and others, 1982; Weir and others, 1983; Blanchard, 1990; Freethey and Cordy, 1991).

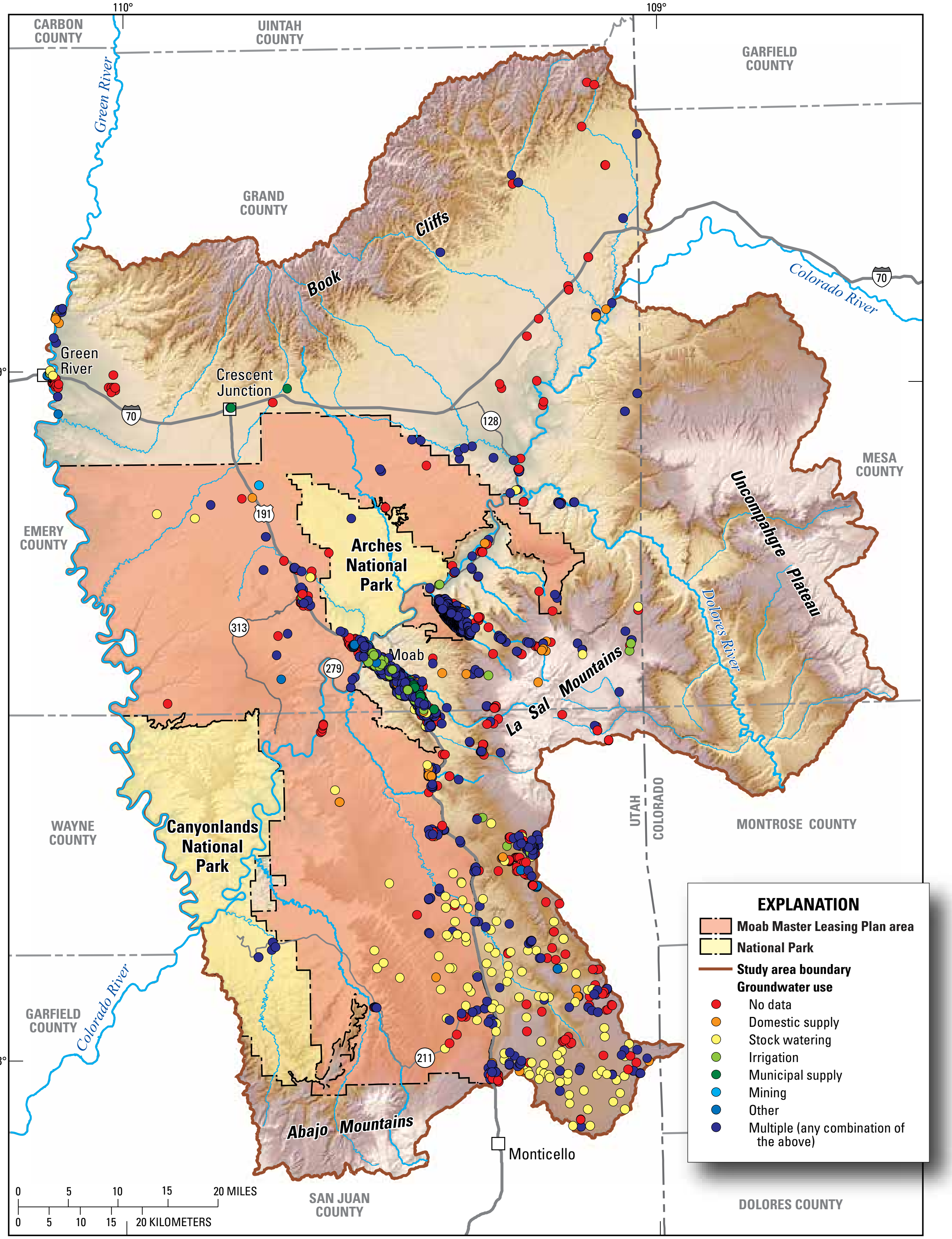

Figure 15. Use of groundwater from well withdrawals throughout the study area as reported by the Utah Division of Water Rights.

Groundwater Quality

Although groundwater recharge typically is freshwater, total dissolved-solids concentrations increase along groundwater flowpaths with depth and (or) distance from the recharge area and can be used to evaluate water quality (Weir and others, 1983; Eisinger and Lowe, 1999). The quantity and solubility of the consolidated-rock and alluvial aquifer material has a direct influence on the dissolved-solids concentration (Rush and others, 1982). According to the Utah Department of Environmental Quality (UT DEQ; *http://www.waterquality.utah.gov/GroundWater/gwclasses.htm*, accessed January 15, 2013), groundwater quality is classified according to the total dissolved-solids concentration as pristine groundwater (Class IA, less than 500 mg/L), drinking-water quality groundwater (Class II, 500 to 3,000 mg/L), limited-use groundwater (Class III, 3,000 to 10,000 mg/L), and saline groundwater (Class IV, greater than 10,000 mg/L). Class IA and Class II groundwater is considered suitable for drinking water provided that individual "contaminant" or constituent concentrations do not exceed state and federal groundwater-quality and health standards. Class III groundwater typically is considered suitable for agricultural and industrial purposes, although Class IV may be used in evaporative processes to mine dissolved materials. UT DEQ groundwater quality standards for individual constituents are available on their Web site (*http://www.waterquality.utah.gov/GroundWater/gwstandards.htm*).

Specific conductance also can be used to evaluate water quality, and essentially is a surrogate for total dissolved solids because specific conductance is dependent on the amount of dissolved solids in the water. As a general rule of thumb, specific conductance can be converted to total dissolved solids concentrations by multiplying the specific conductance by 0.65 (Hem, 1985). Groundwater with specific-conductance values of less than about 4,500 µS/cm, therefore, would be classified as Class IA or Class II water and suitable as drinking water. The mean specific conductance for groundwater from wells and springs within the study area as reported in NWIS is shown in figure 16. Mean specific conductance for each site was calculated as the mean of all specific-conductance measurements made at the site; the number of measurements and period of record are highly variable from site to site. Mean specific conductance ranges from 101 to 220,000 µS/cm, with most of the sites having a mean specific conductance of less than or equal to 1,000 µS/cm. The greatest specific-conductance values are found in wells with depths below land surface between 905 and 8,811 ft near Green River, Utah. These wells likely are penetrating the Paradox Member of the Hermosa Formation evaporites, or the Lower Paleozoic aquifer system, both of which have groundwater with high concentrations of total dissolved solids (Feltis, 1966; Hanshaw and Hill, 1969).

Lower Paleozoic Aquifer System

The limited groundwater-quality data available for the Lower Paleozoic aquifer system are associated with oil and gas exploration wells completed in geologic units classified simply as Mississippian-age or Pennsylvanian-age formations (Feltis, 1966; Hanshaw and Hill, 1969). The total dissolved-solids concentrations observed in 86 of the groundwater-quality samples collected from the Mississippian-age limestones and dolomites in Grand County range from 7,172 to 379,469 mg/L (Feltis, 1966; Hanshaw and Hill, 1969; Gwynn, 1995; Eisinger and Lowe, 1999). The Leadville Limestone and associated geological equivalents typically contain sodium-chloride groundwater with secondary sulfate and potassium (Weir and others, 1983; Gwynn, 1995). Hanshaw and Hill (1969) describe most groundwater samples from strata older than Permian as brines (more than 35,000 mg/L total dissolved solids) of sodium-chloride with large amounts of calcium-sulfate or calcium-chloride type water. Groundwater from, or in contact with, the Paradox Member of the Hermosa Formation typically has high concentrations of total dissolved solids because of the presence of thick evaporite sequences (Hanshaw and Hill, 1969). Hanshaw and Hill (1969) analyzed two chemically different regions east and west of a line that coincides with the Green River to its confluence with the Colorado River and continues southward along the east side of the Monument Uplift. Groundwater samples from west of the line had total dissolved-solids concentrations of less than 35,000 mg/L, and samples from east of the line had total dissolved-solids concentrations of greater than 35,000 mg/L, and typically more than 100,000 mg/L (Hanshaw and Hill, 1969); this is likely because the evaporite facies of the Pennsylvanian age typically are limited to the area east of the line (Geldon, 2003).

Cutler Formation Aquifer

Total dissolved-solids concentrations in groundwater-quality samples collected from the White Rim and Cedar Mesa Sandstones in Canyonlands National Park varied by an order of magnitude between springs and wells (Huntoon, 1977, 1979). Huntoon (1977, 1979) observed that four springs had total dissolved-solids concentrations ranging from 270 to 814 mg/L; four wells, however, had total dissolved-solids concentrations ranging from 1,720 to 2,730 mg/L. The difference in total dissolved-solids concentrations may be attributed to major ion concentrations in each of the samples. The spring samples were calcium-magnesium-bicarbonate and calcium-magnesium-sodium-bicarbonate type waters, although the groundwater types from the wells varied (Huntoon, 1977).

Groundwater quality of the undifferentiated Cutler Formation was reported on by Rush and others (1982), Weir and others (1983), and Blanchard (1990). Total dissolved-solids concentrations ranged from 237 to 6,010 mg/L. Blanchard (1990) also found concentrations of selenium in two wells near Castle Valley that were greater than the 50 µg/L health standard. The Cutler Formation typically contains calcium-magnesium-sulfate or calcium-magnesium-sodium-sulfate type groundwater (Blanchard, 1990).

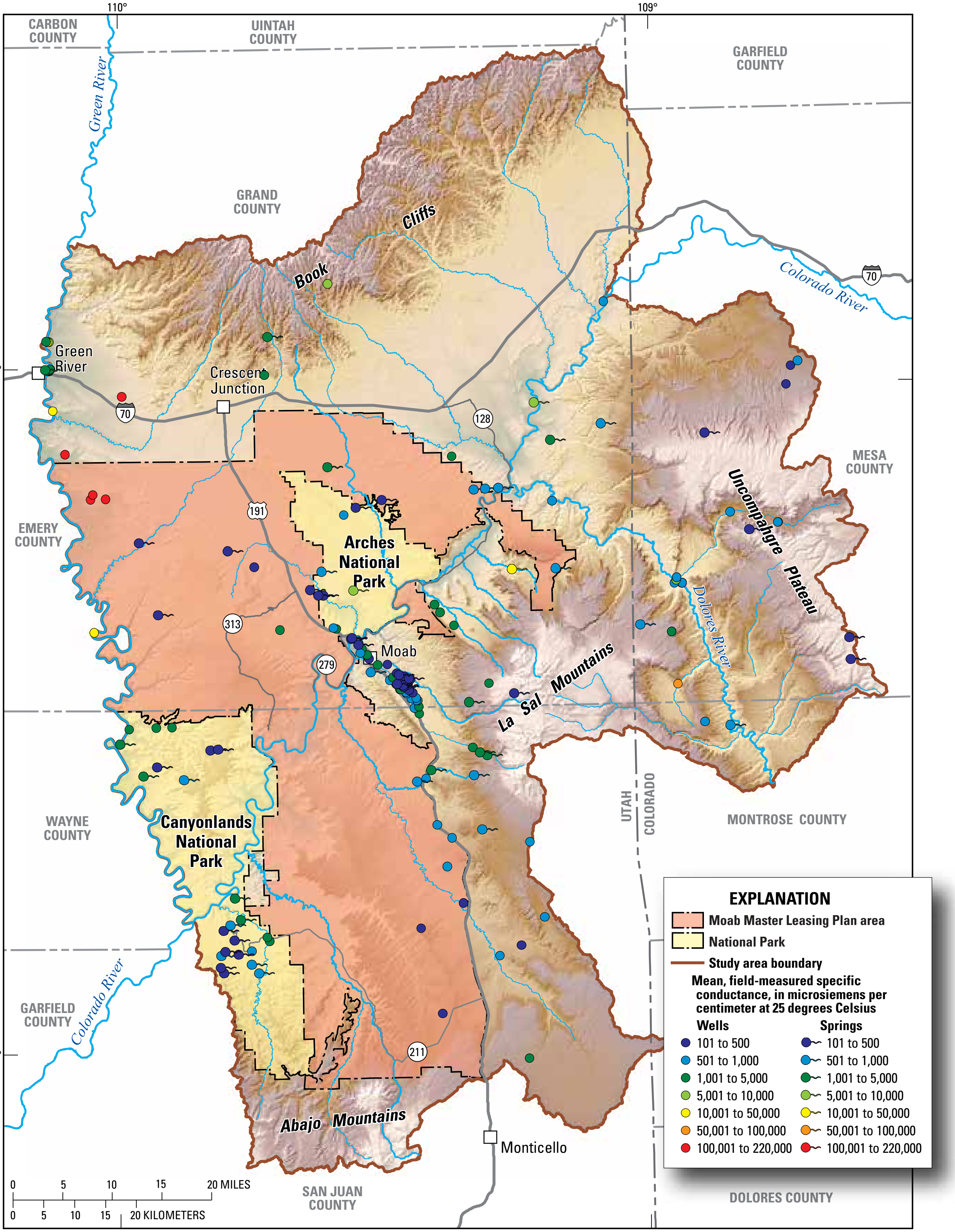

Figure 16. Mean field-measured specific conductance of groundwater from springs and wells within the study area.

Glen Canyon Group Aquifer

Total dissolved-solids concentrations for groundwater samples collected from wells completed in the Wingate Sandstone ranged from 161 to 717 mg/L (Sumsion, 1971; Rush and others, 1982; Weir and others, 1983; Blanchard, 1990). The Wingate Sandstone typically has calcium-magnesium-bicarbonate or magnesium-sodium-calcium-bicarbonate type groundwater (Blanchard, 1990). Blanchard (1990) also reported that in one location, the median total dissolved-solids concentration (from four samples) was about 45,000 mg/L, and the type of water in this location was sodium-chloride, atypical of most waters found within the upper aquifer system. It was suspected that these high concentrations were from the upward movement of brines from the Paradox Member of the Hermosa Formation at this location (Blanchard, 1990).

The Navajo Sandstone typically produces groundwater with lower total dissolved-solids concentrations because of a combination of low-solubility mineral content and direct infiltration of precipitation into extensive formation outcrops (Rush and others, 1982; Eisinger and Lowe, 1999). Total dissolved-solids concentrations reported from springs and wells in the Navajo Sandstone range from 102 to 827 mg/L (Sumsion, 1971; Rush and others, 1982; Weir and others, 1983; Blanchard, 1990; Steiger and Susong, 1997). The Navajo Sandstone typically has calcium-bicarbonate or calcium-magnesium-bicarbonate type groundwater, but also can contain calcium-sodium-magnesium-bicarbonate, magnesium-sodium-bicarbonate-sulfate, and magnesium-sodium-bicarbonate-chloride-sulfate type groundwater (Blanchard, 1990; Eisinger and Lowe, 1999).

Entrada Aquifer

Relatively shallow groundwater samples collected from the Entrada aquifer have total dissolved-solids concentrations ranging from 119 to 417 mg/L (Rush and others, 1982; Weir and others, 1983; Blanchard, 1990). Within the southern part of Grand County, the Entrada aquifer typically contains calcium-carbonate, calcium-bicarbonate, calcium-magnesium-bicarbonate, or calcium-magnesium-bicarbonate-sulfate type water (Blanchard, 1990). Three deep oil wells and one groundwater well, located in the central and northeastern parts of Grand County where the Entrada Sandstone is 900 to 5,300 ft below land surface, were reported to have total dissolved-solids concentrations between 9,470 and 86,600 mg/L (Feltis, 1966). The groundwater was sodium-chloride type at these locations (Blanchard, 1990). These samples are likely indicative of long groundwater flowpaths, as salinity typically increases with vertical depth and lateral distance from the recharge areas (Blanchard, 1990).

Morrison Aquifer

Groundwater samples collected from the undifferentiated Morrison Formation had total dissolved-solids concentrations ranging from 517 to 25,700 mg/L, and the groundwater type typically was calcium-magnesium-sodium-sulfate-bicarbonate or sodium-chloride (Feltis, 1966; Rush and others, 1982; Blanchard, 1990). Groundwater within the Brushy Basin Member of the Morrison Formation (Brushy Basin confining unit) typically has high radionuclide activity (beta, alpha, and uranium activities) because of large quantities of uranium within the formation (Blanchard, 1990).

Dakota Aquifer

Groundwater samples collected from wells completed in the Dakota aquifer had total dissolved-solids concentrations ranging from 98 to 1,800 mg/L (Sumsion, 1971; Weir and others, 1983; Blanchard, 1990). Groundwater in the Dakota aquifer typically is calcium-bicarbonate type water (Weir and others, 1983).

Mesaverde Aquifer

Total dissolved-solids concentrations ranging from 500 to 800 mg/L have been reported for groundwater from the Mesaverde aquifer (Feltis, 1966; Conroy and Fields, 1977; Blanchard, 1990; Gwynn, 1995; Eisinger and Lowe, 1999). Groundwater in the Mesaverde aquifer typically is calcium-magnesium-bicarbonate type water, although some samples can be of mixed water type (Blanchard, 1990; Eisinger and Lowe, 1999).

Unconsolidated Aquifers

In general, limited groundwater-quality data are available for the unconsolidated aquifers; however, a number of previous investigations have evaluated groundwater quality of the unconsolidated aquifers in Moab-Spanish Valley and Castle Valley. Total dissolved-solids concentrations in samples collected from the unconsolidated aquifer in Moab-Spanish Valley ranged from 167 to 1,820 mg/L (Sumsion, 1971; Steiger and Susong, 1997). Sumsion (1971) surmised that groundwater from the fractured Glen Canyon Group aquifer mixes with groundwater from the unconsolidated aquifer, which decreases the total dissolved-solids concentrations. Nitrate concentrations in the Moab-Spanish Valley unconsolidated aquifer were as high as 26 mg/L as nitrate, and four out of nine samples exceeded the groundwater-quality standard of 10 mg/L as nitrate (Sumsion, 1971; UT DEQ Web site, available at *http://www.waterquality.utah.gov/GroundWater/gwstandards.htm*). Steiger and Susong (1997), found groundwater nitrate plus nitrite concentrations ranging from 0.04 to 5.87 mg/L. Steiger and Susong (1997) suggested that areas with nitrate plus nitrite concentrations of more than 3 mg/L in the central part of Moab-Spanish Valley resulted from anthropogenic activities. Groundwater in the Moab-Spanish Valley unconsolidated aquifer typically is bicarbonate or calcium-sulfate-bicarbonate type water (Steiger and Susong, 1997).

There are no total dissolved-solids concentrations reported for Castle Valley, but specific-conductance values from eight groundwater wells ranged from 357 to 1,960 µS/cm (Ford and Grandy, Utah Geological Survey, written commun., 1995). Weir and others (1983) observed a down-valley and downgradient increase in specific conductance in the unconsolidated aquifer of Castle Valley. The increase in specific conductance through the valley may be a result of the influence of recharge from the Cutler Formation and Paradox Member of the Hermosa Formation, which are both known to contain groundwater with high concentrations of total dissolved solids, or from downgradient movement of the water (Snyder, 1996; Eisinger and Lowe, 1999).

Brines and Saline Groundwater

Information is limited on the availability of brines and saline groundwater within the study area. As discussed in section, “Groundwater Quality”, groundwater from, or in contact with, the Paradox Member of the Hermosa Formation typically shows high total dissolved-solids concentrations of greater than 35,000 mg/L, and typically more than 100,000 mg/L (Hanshaw and Hill, 1969). Total dissolved-solids concentrations observed in groundwater samples collected from wells completed in Mississippian-age limestones and dolomites in Grand County range from 7,172 to 379,469 mg/L (Feltis, 1966; Hanshaw and Hill, 1969; Gwynn, 1995; Eisinger and Lowe, 1999). The Leadville Limestone and associated equivalents typically contain sodium-chloride water with subordinate sulfate and potassium (Weir and others, 1983; Gwynn, 1995). Hanshaw and Hill (1969) describe most water samples from strata below the Permian as brines of sodium-chloride with large amounts of calcium-sulfate or calcium-chloride type water. Because the Paradox Member of the Hermosa Formation is considered a barrier to vertical groundwater flow, it appears, therefore, that most of the brine and saline groundwater resources are restricted to the Lower Paleozoic aquifer system and Upper Paleozoic confining unit (table 1), or in areas that are in contact with the Paradox Member of the Hermosa Formation. There are no previous studies, however, that quantify the amount of groundwater in, or the storage capacity of, the Lower Paleozoic aquifer system.

Future Work

To better understand and quantify surface-water and groundwater resources within the Moab MLP and the greater study area, several lines of future work need attention. First, a comprehensive, up-to-date groundwater budget for the study area needs to be investigated. This includes a robust assessment of groundwater discharge locations and groundwater recharge locations. Specifically, an inventory of spring and well locations and discharge and withdrawal data would be beneficial, as many of the sites in the NWIS database do not have more than location data associated with them and there may be newer wells that may not be in the database. Additionally, a more rigorous calculation of recharge to both the upper and lower groundwater systems is warranted.

Second, a more complete evaluation of surface-water resources is needed. This assessment should include more information or studies to examine long-term trends to surface-water resources distributed throughout the study area. A better understanding is needed of streamflow variability within each reach of an individual stream (ephemeral compared to perennial reaches) and how streamflow varies over time from the seasonal to the annual scale. Periodic and regular site visits should be completed to accurately assess, identify, quantify, and validate the surface-water resources.

Finally, incorporation of this information in numerical groundwater and (or) surface-water models would enhance greatly the quantification of the potential effects that future surface-water and groundwater use would have on water resources within the study area. Surface-water and groundwater resources are intimately linked and the benefit of a numerical model is that stresses implemented on one resource can be simulated at spatial and temporal scales that are difficult to determine with observed data only. Additionally, the predictive utility of a calibrated and validated numerical model would allow water managers to test scenarios prior to implementation and to avoid unwarranted repercussions.

Summary

The Bureau of Land Management (BLM) Canyon Country District Office is preparing a leasing plan known as the Moab Master Leasing Plan (Moab MLP) for oil, gas, and potash mineral rights in an area encompassing 946,469 acres in Grand and San Juan Counties in southeastern Utah. The BLM has identified water resources as being potentially affected by oil, gas, and potash development and has requested that the U.S. Geological Survey (USGS) prepare a summary of existing water-resources information for the Moab MLP area. This report provides information that will assist the BLM in developing leasing configurations, addressing resource conflicts, and developing mitigation strategies for the Moab MLP area, and will serve as the basis for analysis of water-resource issues in a future environmental impact statement to be prepared by the BLM. This report includes a summary and synthesis of previous and ongoing investigations conducted in the Moab MLP and adjacent areas in Utah and Colorado from the early 1930s through the late 2000s.

Eight principal aquifers and six confining units were identified in the study area. Generally, the aquifers can be split into four types: (1) limestone aquifers of marine origin, (2) sandstone aquifers of eolian and marine origin, (3) sandstone and conglomerate aquifers of fluvial origin, and (4) valley-fill aquifers in unconsolidated deposits. The permeability is a function of both the primary permeability from interstitial pore connectivity and secondary permeability created by karst features or faults and fractures. Vertical hydraulic connection generally is restricted to strongly folded and fractured zones, which are concentrated along steeply dipping monoclines and in narrow regions encompassing igneous and salt intrusive masses. Several studies have identified both an upper and lower aquifer system separated by the Pennsylvanian-age Paradox Member of the Hermosa Formation, an evaporite that is considered to be a confining unit. The principal aquifers and confining units vary in their aggregated classification between studies and are not considered laterally or vertically homogenous. Additionally, aquifer information throughout the study area is not equally available or explicitly characterized for all geologic units.

Surface-water resources of the study area are dominated by the Colorado River. Numerous perennial and ephemeral or intermittent tributaries join the Colorado River as it flows from northeast to southwest across the study area, draining the surrounding upland areas of the Book Cliffs, Arches National Park, the La Sal Mountains, and the Abajo Mountains. The Green River is the largest perennial tributary to the Colorado River in the study area. The Green River flows south into the study area, joining the Colorado River in Canyonlands National Park.

An annual spring snowmelt and runoff event dominates the hydrology of streams draining mountainous parts of the study area, and most of the perennial streams within the study area are considered to be snowmelt-dominated. The timing of the peak snowmelt runoff at a streamgage will vary in time because of year-to-year variations in snowpack depth and air temperature. Higher-altitude locations generally are underlain by fractured volcanics with secondary permeability that increases subsurface infiltration and groundwater recharge, as opposed to rapid surficial runoff. A bimodal distribution is observed in hydrographs from some sites with a late-spring snowmelt-runoff peak followed by smaller peaks of shorter duration during the late summer. The rapid and intense (flashy) response to monsoonally-derived precipitation events is typical of watersheds where semi-impermeable slickrock sandstone is prevalent. The large regional streams (the Colorado River, the Green River, and the Dolores River) integrate the hydrologic partitioning of a very large contributing area and, therefore, the hydrographs for these streams are much more smooth and consistent.

Eight sites in Salt Creek had some of the greatest mean specific-conductance measurements, ranging from slightly greater than 12,000 μS/cm to as much as about 141,000 μS/cm. Two other sampling locations with mean specific-conductance values greater than 10,000 μS/cm were in Professor Creek and Lathrop Canyon. Several streams throughout the study area are considered impaired by the EPA for specific designated-use classifications. Based on the reporting cycle for 2010, the EPA has reported that the Colorado River is impaired with respect to selenium. Mill Creek, Onion Creek, Pack Creek, and the Dolores River are impaired with respect to total dissolved solids. Additionally, Mill Creek, Onion Creek, and Pack Creek are impaired with respect to temperature, and the Dolores River is impaired with respect to iron. Finally, Castle Creek, Westwater Creek, and Cottonwood Wash are impaired with respect to benthic macroinvertebrates bioassessments.

Mean discharge for 64 springs varies widely, between less than 1 and 371 gal/min. The largest reported mean spring discharges are in Moab-Spanish Valley, and on the western flank of the La Sal Mountains. Most springs within the study area have mean discharges of less than 10 gal/min. Mean water-level altitudes from 417 wells range from 2,500 to 8,500 ft within the study area. The water-level altitudes generally indicate a regional hydraulic gradient, or groundwater flow potential, towards the Colorado River, with local gradients showing groundwater movement towards smaller surface-water drainage features.

Limited data are available to quantitatively estimate the large-scale regional groundwater budget for the study area. Some previous studies, however, have estimated groundwater budgets for areas within and adjacent to the current study area, namely Moab-Spanish Valley and parts of the Paradox Basin. Most groundwater recharge to the study area originates as infiltration of precipitation from upland areas where precipitation quantities are the greatest. Recharge from precipitation is further enhanced in areas covered with sandy soils or in areas where the bedrock is highly fractured. Additional groundwater recharge occurs as seepage from streams and irrigation water, and as subsurface inflow, both vertically between aquifers and as lateral movement into the study area across its defined boundaries. Previous estimates of total groundwater recharge to Moab-Spanish Valley range from 14,000 to 17,000 acre-ft/yr, and to the upper aquifer system of the Paradox Basin are about 230,000 acre-ft/yr. Groundwater discharge occurs as seepage to streams, evapotranspiration, to springs and seeps, well withdrawals, and as subsurface outflow, both vertically between aquifers and as lateral movement out of the study area across its defined boundaries. Previous estimates of total groundwater discharge from Moab-Spanish Valley range from 14,000 to 17,000 acre-ft/yr, and from the upper aquifer system of the Paradox Basin are about 350,000 acre-ft/yr. Groundwater use within the study area was determined using data from the Utah Division of Water Rights. Most wells within the study area are categorized as having multiple uses. Of the total number of wells (4,960), 4,298 are categorized as being used for domestic supply, stock watering, and irrigation; 67 are categorized as being used for municipal supplies; 19 are categorized as being used for mining; 280 are categorized as having a use of “other”; and 578 have no data regarding use.

Mean specific-conductance values for groundwater from wells and springs within the study area range from 101 to 220,000 μS/cm, with the most of the sites having a mean specific conductance of less than or equal to 1,000 μS/cm. The greatest specific-conductance values are found in wells with depths below land surface between 905 and 8,811 ft near Green River, Utah. These wells likely are penetrating the Paradox Member of the Hermosa Formation evaporites, or the Lower Paleozoic aquifer system, both of which have groundwater with high concentrations of total dissolved solids. Previously reported total dissolved-solids concentrations, specific conductances, and other groundwater-quality data for each of the principal aquifers also are summarized and indicate relatively fresh water throughout the study area, except within the Lower Paleozoic aquifer system and areas in contact with the Paradox Member of the Hermosa Formation evaporites.

Information is limited on the availability of brines and saline groundwater within the study area. Groundwater from, or in contact with, the Paradox Member of the Hermosa Formation typically shows high concentrations of total dissolved solids (greater than 35,000 mg/L). Concentrations of total dissolved solids in groundwater samples collected from the Lower Paleozoic aquifer system are high, and typically contain sodium-chloride water with subordinate sulfate and potassium, or brines of sodium-chloride with large amounts of calcium-sulfate or calcium-chloride type water. Because the Paradox Member of the Hermosa Formation is considered a barrier to vertical groundwater flow, it appears, therefore, that most of the brine and saline groundwater resources are restricted to the Lower Paleozoic aquifer system and Upper Paleozoic confining unit. There are no previous studies, however, that quantify the amount of groundwater in, or the storage capacity of, the Lower Paleozoic aquifer system.

To better understand and quantify surface-water and groundwater resources within the Moab MLP and the greater study area, several lines of future work need attention. First, a comprehensive, up-to-date groundwater budget for the study area needs to be investigated. Second, a more complete evaluation of surface-water resources is needed, including examination of long-term trends to surface-water resources distributed throughout the study area. Finally, incorporation of this information in numerical groundwater and (or) surface-water models would enhance greatly the quantification of the potential effects that future surface-water and groundwater use would have on water resources within the study area.

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