Volume 3

Physical Settings of Selected Springs in Clark, Lincoln, and White Pine Counties Groundwater Development Project

January 2008

PREFACE

This report was prepared by the Southern Nevada Water Authority. The U.S. Geological Survey served as technical advisor to the Bureau of Land Management in the review of this report.

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ACRONYMS

BLM	U.S. Bureau of Land Management
DRI	Desert Research Institute
GPS	Global Positioning System
HA	hydrographic area
MAT	mean annual air temperature
MVWD	Moapa Valley Water District
NDOW	Nevada Division of Wildlife
NDWR	Nevada Division of Water Resources
SNWA	Southern Nevada Water Authority
SR	State Route
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
WY	water year

ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
af	acre-foot
afy	acre-feet per year
amsl	above mean sea level
cfs	cubic feet per second
ft	foot
gpm	gallons per minute
in.	inch
m	meter
Ma	million years
mi	mile
mm	millimeter
pmc	percent modern carbon

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1.0 INTRODUCTION

This report describes the springs in an area of east-central and southeastern Nevada and adjacent western Utah. The report includes a description of the springs' general setting, geologic setting, discharge, and diversions and water use.

1.1 Project Background

The Clark, Lincoln and White Pine Counties Groundwater Development Project (hereafter referred to as the Project) proposes to develop unused groundwater resources within selected basins of eastern Nevada where Southern Nevada Water Authority (SNWA) holds groundwater rights and applications. These basins include Coyote Spring, Delamar, Dry Lake, Cave, Spring, and Snake valleys (hereafter referred to as the Project Basins) and are depicted in Figure 1-1.

In 2004, SNWA applied to the Bureau of Land Management (BLM) for issuance of rights of way to construct Project facilities, most of which will be located on public lands administered by the BLM. These facilities include groundwater production wells, water conveyance facilities, water storage and regulating reservoirs, and power facilities. BLM issuance of these rights of way to construct, maintain, and operate these facilities requires a federal action for which the National Environmental Policy Act and Endangered Species Act must be considered. BLM has determined that preparation of an Environmental Impact Statement is required to assess the potential environmental effects that may result from permitting the rights of way, including the potential indirect effects of the proposed groundwater development. This report was prepared in support of that assessment.

1.2 Regional Groundwater Flow Systems

A set of hydraulically connected valleys forms a flow system. A single valley that is not hydraulically connected to another valley can form its own flow system. Several flow systems, as defined by Harrill et al. (1988) and Nichols (2000), occur within the study area and vicinity. The primary flow systems of interest to this project are: the White River, Goshute Valley, Great Salt Lake Desert, and Meadow Valley Wash Flow systems. The regional groundwater flow system prevailing within the study area and vicinity is composed of multiple hydrographic basins, also called valleys. In many of the northern valleys, evapotranspiration is the principal source of groundwater discharge. However, the valleys that are in the central-southern part of the system, have a significant amount of groundwater discharge as subsurface outflow through the carbonate aquifer. Although numerous structural features (Dettinger et al., 1995; SNWA, 2003) compartmentalize different parts of the carbonate aquifer system, the hydraulic connectivity of the valleys is believed to be expansive.

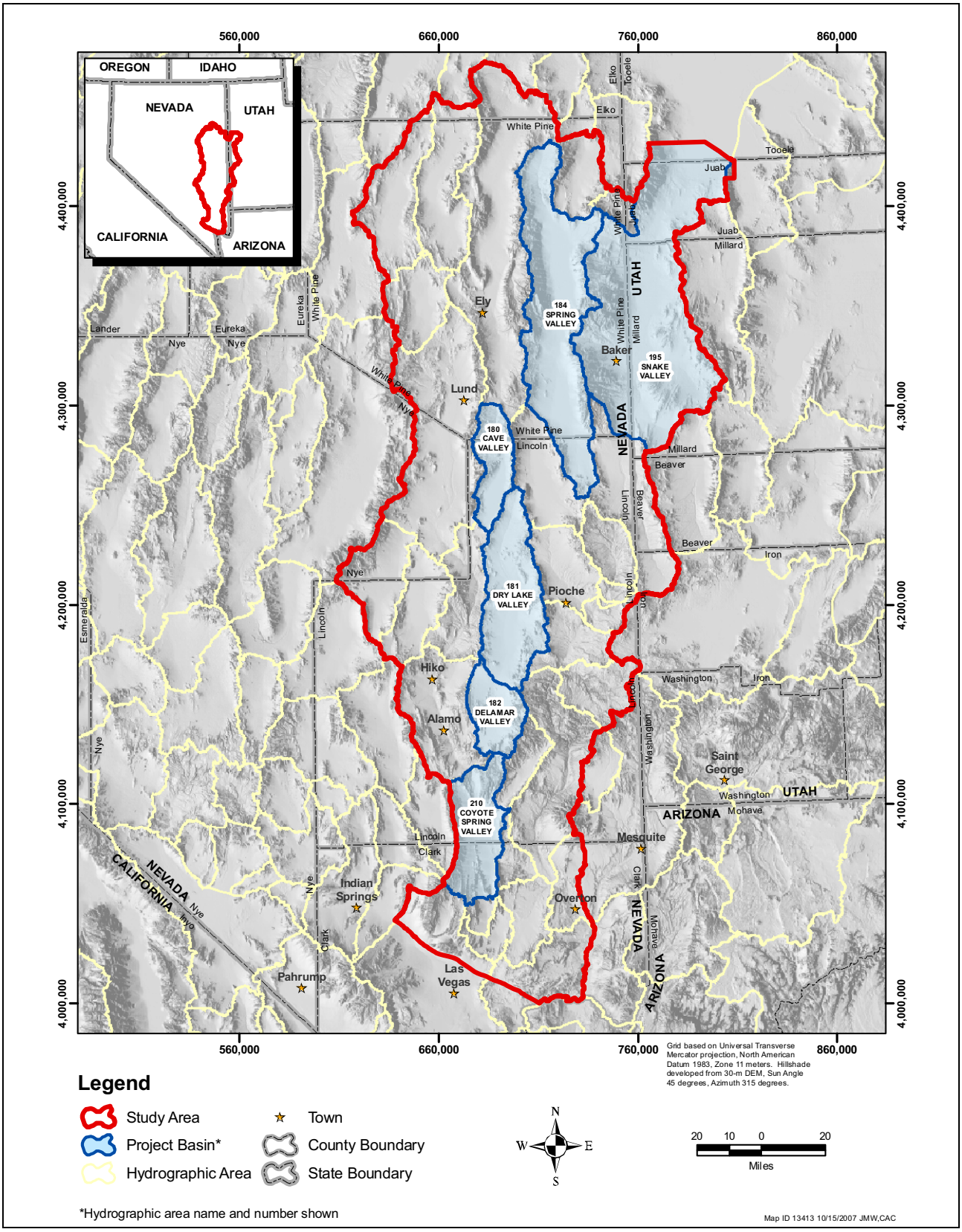

Figure 1-1
Location of Project Basins

1.3 Purpose and Scope

The purpose of this report is to provide data and documentation of the baseline hydrologic conditions of springs that were compiled during inventories conducted in the area surrounding the project basins. Springs located within 13 basins were inventoried. The scope of work consisted of compiling background data and information on each spring and determining the current physical characteristics of the springs. The scope included compilation of historical data, photographic documentation, conducting miscellaneous discharge measurements, acquiring historical and current diversion data, documenting anthropogenic influences, and detailed geologic mapping of selected springs.

1.4 Document Organization

This document consists of five sections and five appendices, as follows:

- Section 1.0 provides a description of the project background, description of regional flow systems, the purpose and scope of this report, and an overview of the structure of this report.
- Section 2.0 documents the methods and procedures used to collect the data for this report.
- Section 3.0 documents the current physical characteristics of the springs.
- Section 4.0 provides a summary of the findings of this report.
- Section 5.0 provides a list of references cited in this report.
- Appendix A tabulates the location, elevation, geologic setting, and the magnitude of discharge of the springs described in this report.
- Appendix B tabulates the discharge measurements of the springs described in this report.
- Appendix C shows examples of the site inventory form and the Discharge Measurement forms.
- Appendix D is a copy of the U.S. Forest Service Springs Survey Report with attached database.
- Appendix E tabulates additional spring locations that were not physically visited by SNWA. These locations were found in data sets maintained by the U.S. Geological Survey (USGS), Desert Research Institute (DRI) or found on 1/24,000 topographic maps.

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2.0 METHODS AND PROCEDURES

2.1 Data Collection

Data in this report came from published reports, published and preliminary data from USGS, and from field investigations conducted by SNWA during the summer and fall of 2004 and 2005.

Investigations conducted by SNWA of the springs included compilation of existing information and data from available data sources, including published and unpublished reports and databases, photographic documentation, discharge measurements, water-chemistry sampling, a written description of the physical setting of the spring, and in some cases detailed geologic mapping at the spring site.

Data collection procedures were established to ensure consistent and accurate compilation and collection of data during the spring inventory. Key points of the data collection program are as follows:

- Photographic documentation
- Discharge measurement
- Water-chemistry sampling
- Written description of each spring
- Detailed geologic mapping for a subset of the springs.

2.1.1 Selection of Springs

The selection of springs was made through a collaborative effort by a team of professional hydrologists and geologists who have numerous years of experience in the project area. A list of criteria were developed by the team and are given below:

- Aerial distribution
- Discharge
- Lithologic setting

Springs were chosen to represent each hydrographic basin as possible in both aerial extent and elevation. This was difficult to achieve because spring locations are generally not equally spaced in each valley. Springs of different magnitudes of discharge were considered for inclusion in the data set. The lithologic setting was also considered. Springs in alluvial materials, and different types of consolidated rocks were observed.

Locations of springs that were not visited but are in each of the valleys are listed in Appendix E.

2.1.2 Photographic Documentation

Photographs at spring sites include pictures of the spring pool, orifice, surrounding vegetation, diversion facilities including any impoundments, head gates, flumes, weirs, and irrigation canals. Once all photographs were reviewed, they were archived in the SNWA photo repository.

2.1.3 Discharge Measurements

Discharge measurements were performed at each spring when conditions allowed. For example, if the spring was inaccessible or other conditions existed that prevented a physical measurement from being made, the discharge was estimated. Measurements were made upstream of any diversions when possible. If this was not possible, the diversions were accounted for by either measurement or estimate of their respective discharges and summed together with the discharge measurement of the undiverted flow. A detailed description of where and how the discharge was measured is recorded in field notes, which accompanied the discharge measurement form documenting the measurement.

Discharge measurements were made and computed using the standard methods outlined in Rantz et al. (1982a and b) and Malone (1931).

The discharge measurements were recorded using USGS *Standard Discharge Measurement Notes,* form number 9-275. All discharge measurements were recorded on these forms, regardless of the method used to measure the discharge from the spring. An example of these forms can be found in Appendix C.

2.1.4 Field Notes

Summary information and data related to the spring and the surrounding area were recorded on the SNWA Site Inventory Sheet, an example of this form can be found in Appendix C. In addition, a written description describing the physical setting and hydrologic observations was completed for each spring visited. The description included the size and shape of the spring pool(s), the geometry of the discharge channel, and bathymetry of the spring pool. The bed and bank material of the stream channel was described using a modified version of the Wentworth Scale (Buffington and Montgomery, 1999). Table 2-1 describes the grain size division and names. Discharge measurement points were described, and a thorough description of all diversion facilities including any impoundments, diversions, and measuring devices was logged in the field notes. When describing the measurement and diversion devices, the general state of repair and dimensions of each were noted. The general location of the spring was observed, and a road log was also recorded.

Locations of all diversions, measurement devices, spring orifices, and wells were collected using the Global Positioning System (GPS).

2.1.5 Geology

A generalized geologic description was produced for each spring. This description included any obvious geomorphic features and the geologic unit from which the spring emanates. Detailed

Table 2-1
Bed Material Grain Size Division

Aggregate Name	Aggregate Detail	Size Range (mm)	Size Range (approximate in.)
Boulder	Coarse	>1,024	>40
	Medium	512 to 1,024	20 to 40
	Fine	256 to 512	10 to 20
Cobble	Coarse	128 to 256	5 to 10
	Fine	64 to 128	2.5 to 5
Gravel	Coarse	16 to 64	0.63 to 2.5
	Medium	8 to 16	0.32 to 0.63
	Fine	2 to 8	0.08 to 0.32
Sand	Coarse	0.5 to 2	0.02 to 0.08
	Fine	0.125 to 0.5	--
Fine Material (silts/clays)	--	< 0.125	--

Source: Modified from Buffington and Montgomery, 1999

geologic mapping was conducted at selected springs, and a summary description of the geologic setting, including geologic features likely influencing local groundwater flow, was prepared. A geologic map and generalized geologic cross section were constructed for each spring location where detailed mapping was conducted. A detailed description of geologic units is available in Volume 1.

2.2 Classification of Springs

Springs have been classified in many different ways, including discharge, temperature, and the geologic unit from which discharge occurs. In this report they are classified by discharge rates, as proposed by Oscar Meinzer in 1923 (Meinzer, 1942), and by temperature.

2.2.1 Discharge

Table 2-2 is taken after the system proposed by Oscar Meinzer in 1923 and is used in this report.

2.2.2 Temperature

Defining what constitutes a "thermal spring" versus warm and cold springs is arbitrary at best. It is a general practice to use the mean annual air temperature (MAT) at the location of the spring as a baseline from which to compare the temperature of spring discharge. If the temperature of the spring discharge is warmer than the MAT, a spring is said to be a warm spring. If it is cooler than the MAT, a spring is considered a cold spring. A more accurate temperature classification depends on several variables, including the initial temperature of the recharge water, heating or cooling during near surface movement, heating while moving to greater depths, cooling while returning to shallower depths, and the cooling or heating while mixing with other groundwater (Garside and Schilling, 1979).

Table 2-2
Classification of Spring Size Based on Volume of Discharge

Order of Magnitude	Discharge	
	cfs	gpm
First	>100	> 44,883
Second	10 to 100	4,448 to 44,883
Third	1 to 10	449 to 4,488
Fourth	0.223 to 1	100 to 449
Fifth	0.022 to 0.223	10 to 100
Sixth	0.002 to 0.022	1 to 10
Seventh	0.0003 to 0.002	0.125 to 1
Eighth	< 0.0003	<0.125

After Meinzer, 1942

Table 2-3 lists the temperature classifications used in this report and their stereotypical occurrences.

Table 2-3
Classification of Springs Based on Physical Temperature

Description	Temperature (°C)	Stereotypical Occurrences
Hot	>32.2	Thermal springs associated with deep circulation
Warm	21.1 to 32.2	Springs in the central part of valleys
Cold	<21.1	Springs near recharge areas in mountain blocks

2.3 Location Description

2.3.1 Geographical Coordinates

All coordinates of springs given in this report are reported in Universal Transverse Mercator (UTM) Zone 11 using the North American Datum of 1983. All coordinates were determined using GPS.

2.3.2 Altitude

Altitudes were compiled from published topographic maps, published reports, or were determined using GPS equipment. All alti tudes are reported in feet above mean sea level using the North American Vertical Datum of 1988.

2.3.3 Local Number

Local numbers are used to describe the spring's location using Township, Range, Section, and subdivisions of a section. This report addresses spring locations in Nevada and Utah. An explanation of both methods follows.

Nevada Local Number

Example: 209 N05 E64 26AACC

The first part of the Nevada Local Number is based on hydrographic area (HA) number as defined by Rush (1968). This is followed by the Township, Range, and Section numbers followed by a sequence of up to four letters, each being A, B, C, or D. In Nevada all references of Township and Range are related to the Mount Diablo Base Line and Meridian. Townships are described as either north or south of the Mount Diablo Base Line, and Ranges are described as east or west of the Mount Diablo Meridian. (Every Range in Nevada is east of the Mount Diablo Meridian). The section number is next and may be subdivided into quadrants labeled A, B, C, or D, in a counterclockwise direction starting with the northeast corner. When additional subdivisions are necessary, the divisions (A, B, C, or D) may be repeated up to three more times (Stockton et al., 2003).

Utah Local Number

Example: (C-28-10)29ADD

The first part of the Utah Local Number is based on the four quadrants that Utah is divided into by the intersection of the Salt Lake Base Line and the Salt Lake Meridian. These are labeled by capital letters A to D, in a counterclockwise direction starting in the northeast corner of the state. This is followed by the Township, Range, and Section numbers, followed by a sequence of up to four letters. The section number is next and may be subdivided into quadrants labeled A, B, C, or D in a counterclockwise direction, starting with the northeast corner. When additional subdivisions are necessary, the divisions (A, B, C, or D) may be repeated up to three more times (Tibbetts et al., 2003).

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3.0 PHYSICAL DESCRIPTION OF SPRINGS

This section describes the springs inventoried as part of this study in 13 hydrographic areas. The general setting, geologic setting, discharge, and diversions and water use are described for many of the springs in this report.

3.1 Steptoe Valley (HA 179)

Steptoe Valley is located in the northern part of the study area and comprises the southern portion of the Goshute Valley Flow System. The valley is approximately 95 mi long and averages 9 mi in width. The valley is bounded by the Schell Creek Range to the east and the Egan Range to the west. U.S. Highway 93 runs north from Ely, Nevada, almost the entire length of the valley until it exits at the northern portion of the valley.

This study inventoried 6 springs in Steptoe Valley. Figure 3-1 shows the springs' locations and their magnitudes of flow and temperature. Two of the springs are discussed in detail in the following section.

3.1.1 Cherry Creek Hot Springs

General Setting

Cherry Creek Hot Springs, also known as John Salvi Hot Springs, are located approximately 1.25 mi southwest of Cherry Creek, Nevada, at the base of Cocomongo Mountain along the eastern slope of the Egan and Cherry Creek ranges. This group of three small springs is located on the John Salvi Ranch. The ruins of a small bathhouse can be seen near the southern two springs (Figure 3-2).

Geologic Setting

Cherry Creek Hot Springs discharge from Quaternary alluvium near the base of a small Tertiary intrusive outcrop. The outcrop consists of a biotite-quartz monzonite dated at approximately 40.3 Ma (Hose et al., 1976). The high temperature of the spring water (47.8°C to 57.2°C) may either be the result of the deep circulation of groundwater along structures associated with the intrusive rocks or with a higher than average geothermal gradient associated with the intrusive body.

The two northernmost springs form small mounds approximately 2 to 3 ft high covering an area of about 100 ft^2, each. The southernmost spring appears to a form small pool and does not appear to have formed any mounds.

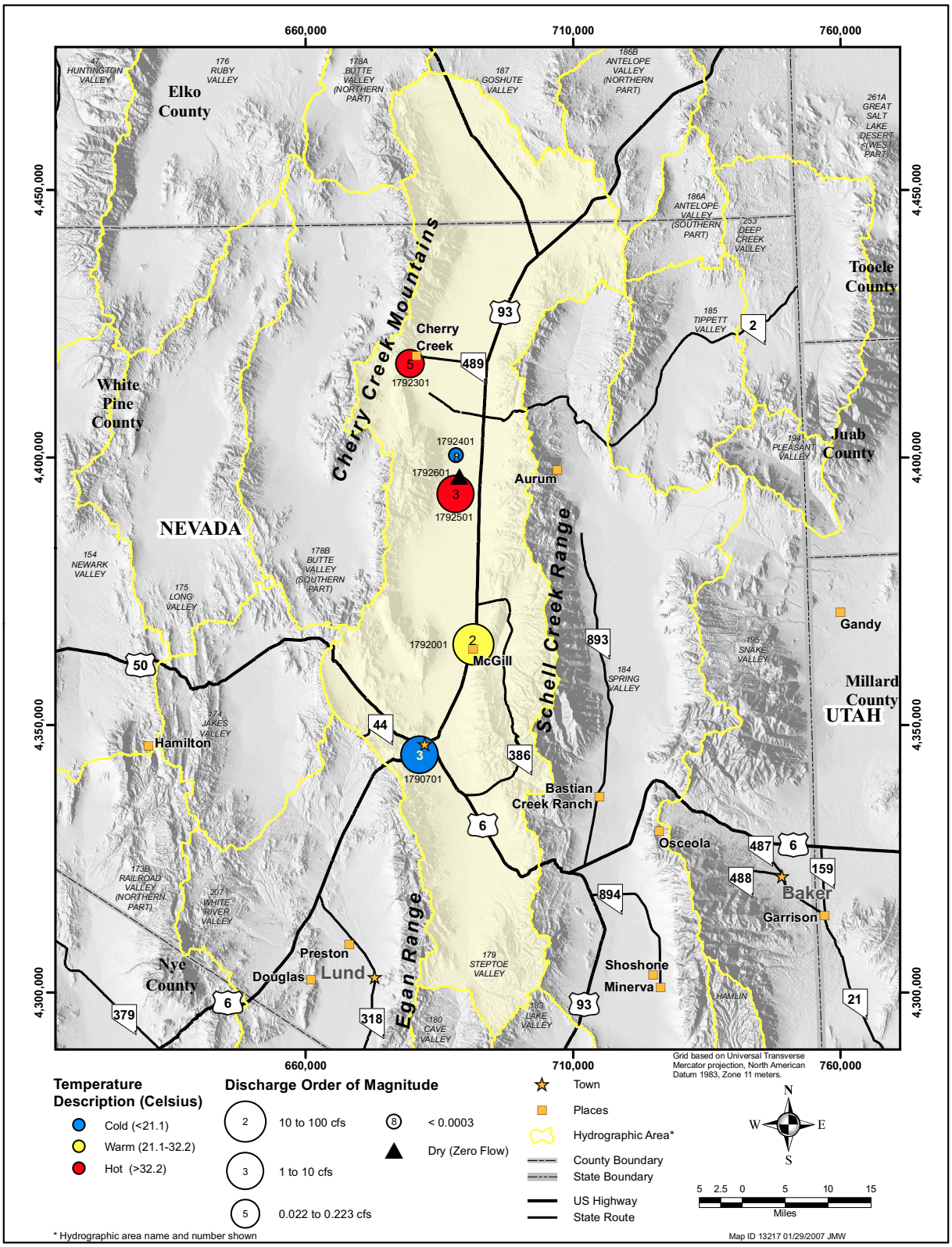


Figure 3-1
Map Showing the Location, Magnitude of Discharge, and Temperature of Selected Springs in Steptoe Valley, Nevada

Figure 3-2
Ruins of the Cherry Creek Hot Springs Bath House

Discharge

Discharge in July 2004 was estimated at 0.10 cfs (approximately 45 gpm). As a comparison, the combined flow during 1917 (Clark and Riddell, 1920) of the three springs was measured at 0.08 cfs (approximately 36 gpm), and water temperatures at the three springs, from north to south, were 47.8°C, 51.1°C, and 57.2°C.

Diversions and Water Use

Water use at the springs has changed over time. In the early part of the 20th century, the springs were used for bathing and irrigation (Clark and Riddell, 1920). Currently these three springs discharge eastward and fill a small reservoir on the ranch (Figures 3-3 and 3-4).

3.1.2 Monte Neva Hot Springs

General Setting

Monte Neva Hot Springs are located on the west side of Steptoe Valley on the east flank of the Egan Range, 11 mi north of McGill, Nevada, and 4 mi west of U.S. Highway 93 as shown on Figure 3-1. Figure 3-5 is looking east at Monte Neva Hot Springs.

Figure 3-3
Looking North (top) and West (bottom) at the Two Larger Orifices of Cherry Creek Hot Springs

Figure 3-4
Looking Northeast at Cherry Creek Hot Springs Reservoir

Figure 3-5
Looking Eastward toward Monte Neva Hot Springs Site

Geologic Setting

Monte Neva Hot Springs are located on easterly dipping alluvial fans. Isolated outcrops of Devonian Guilmette Formation (Hose et al., 1976) are approximately 1 mi east of the springs' location. One and a half miles to the northwest of the springs, the Mississippian Chainman Shale, Devonian Sevy Formation, and the Devonian Guilmette Formation are exposed and truncated by a large range-front fault along the eastern flank of the Egan Range. Altogether, six separate and distinct north-trending basin-range faults were mapped. Monte Neva Hot Springs are located on the easternmost of these faults (Figure 3-6). Several thousand feet of displacement occur along these faults. Historically, the range-front fault west of the springs was active, evidenced by the large amount of tufa/travertine deposits along the trace of this fault. No other mounds or orifices were found in this area.

Monte Neva Hot Springs form a large mound approximately 15 ft high and cover an area of more than 10 acres. The core of the spring mound is formed by sinter, with the balance of the material appearing to be windblown, fine-grained sediments held in place by vegetation and light to moderate carbonate cementation. The extent of the spring mound can be observed in the field where the light grass ends and the sagebrush begins abruptly (Figure 3-7).

Discharge

The springs currently discharge from one orifice, but evidence from the spring mound suggests that the orifice migrated over time (Figure 3-8). The discharge channel is artificial in nature and receives regular maintenance to keep it free of the mineral deposits. The stream varies between 2 to 3 ft wide and 0.5 to 1 ft deep. The flow in the channel is controlled by the steep banks lined with travertine (Figure 3-7).

The discharge and temperature measured in 1917 were 1.39 cfs (approximately 624 gpm) and 79°C, respectively (Clark and Riddell, 1920). In 2004, the discharge was estimated at 1.5 cfs (approximately 673 gpm) and the temperature was 76°C, measured 25 ft below the orifice. At the orifice, the water appears boiling, but this is believed to be the degassing of the water (Figure 3-9). There are no discharge-measuring devices installed at Monte Neva Hot Springs.

Diversions and Water Use

Documented spring diversion began in early 1917. However, the spring may have been diverted as early as 1907 when John Melvin started a ranch and platted a town site at the spring (Clark and Riddell, 1920).

Diversions at Monte Neva Hot Springs consist of a trench excavated into the west side of the spring (approximately 10 ft deep and 5 ft wide) and two aqueducts. The trench excavated into the side of the spring mound was completed before 1917 (Clark and Riddell, 1920). The first aqueduct, no longer in use, drained in a northwesterly direction. The currently used aqueduct drains directly west from the spring mound, continues north, and discharges into the first of three ponds. The aqueduct has been modified from its original route that supplied water to the swimming pool and bathhouse. The aqueduct is approximately 800 ft long. The color of the aqueduct's bed transitions from a dark red/brown near the orifice to white and then to orange. This color difference may be explained by

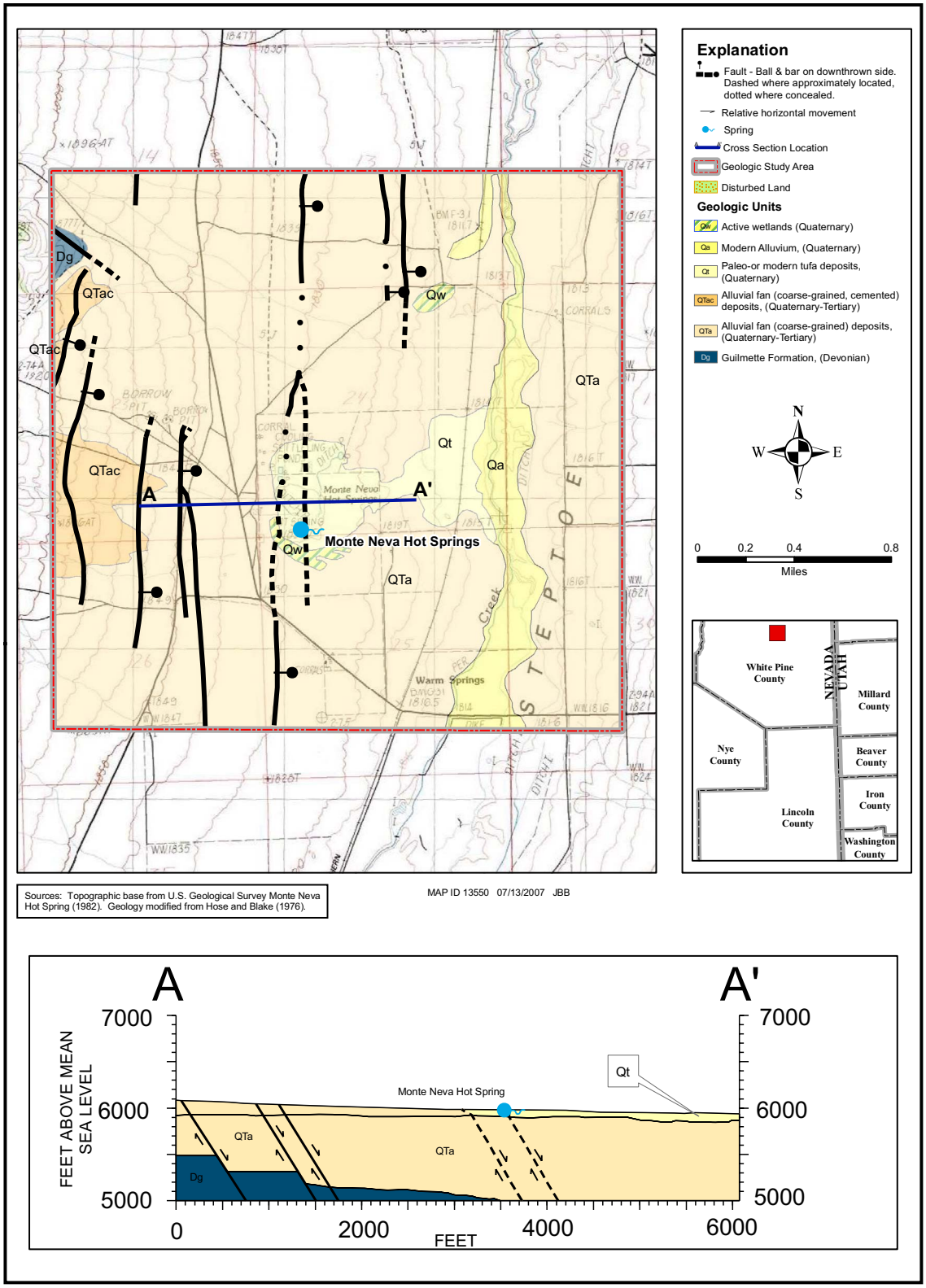


Figure 3-6
Geologic Map and Cross Section of Monte Neva Hot Springs, White Pine County, Nevada

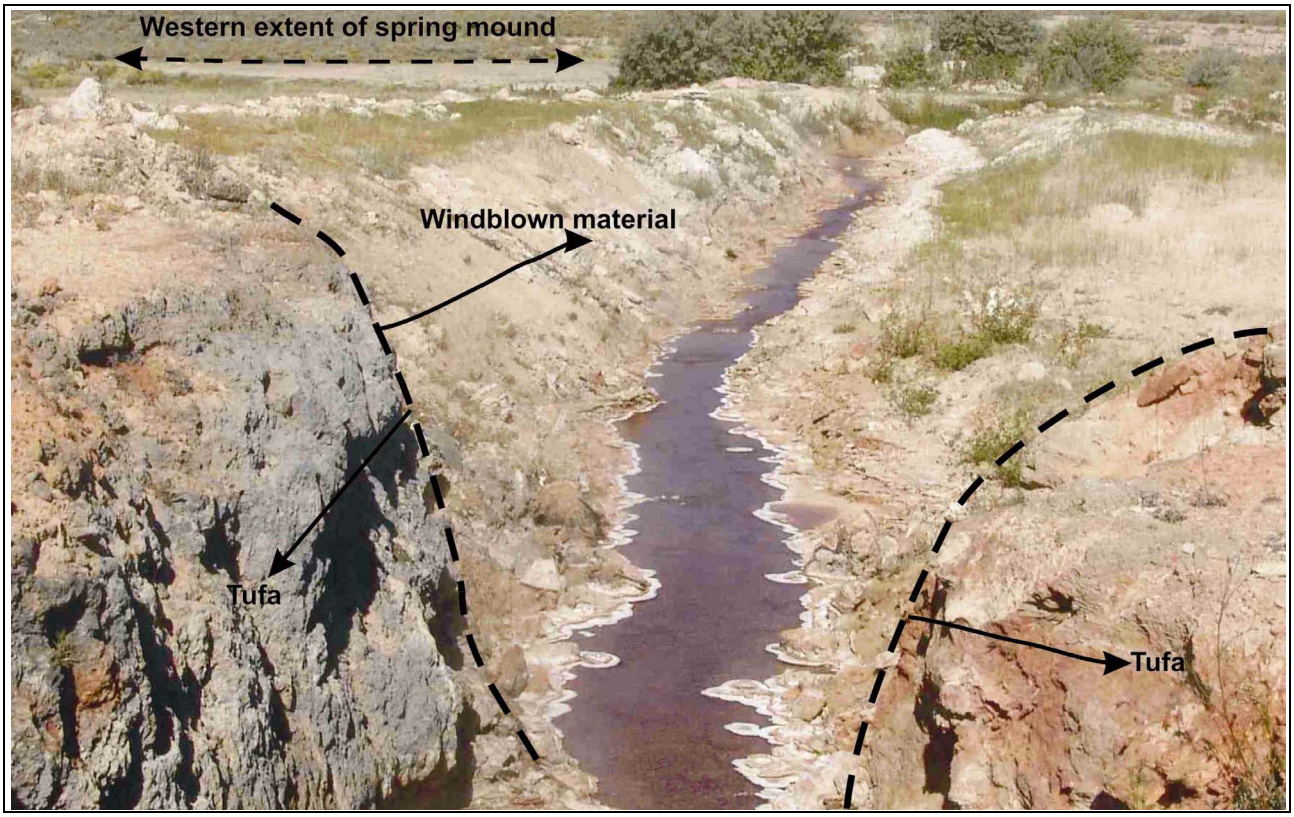


Figure 3-7
Internal Lithology of Monte Neva Hot Springs, View Looking Downstream from Orifice

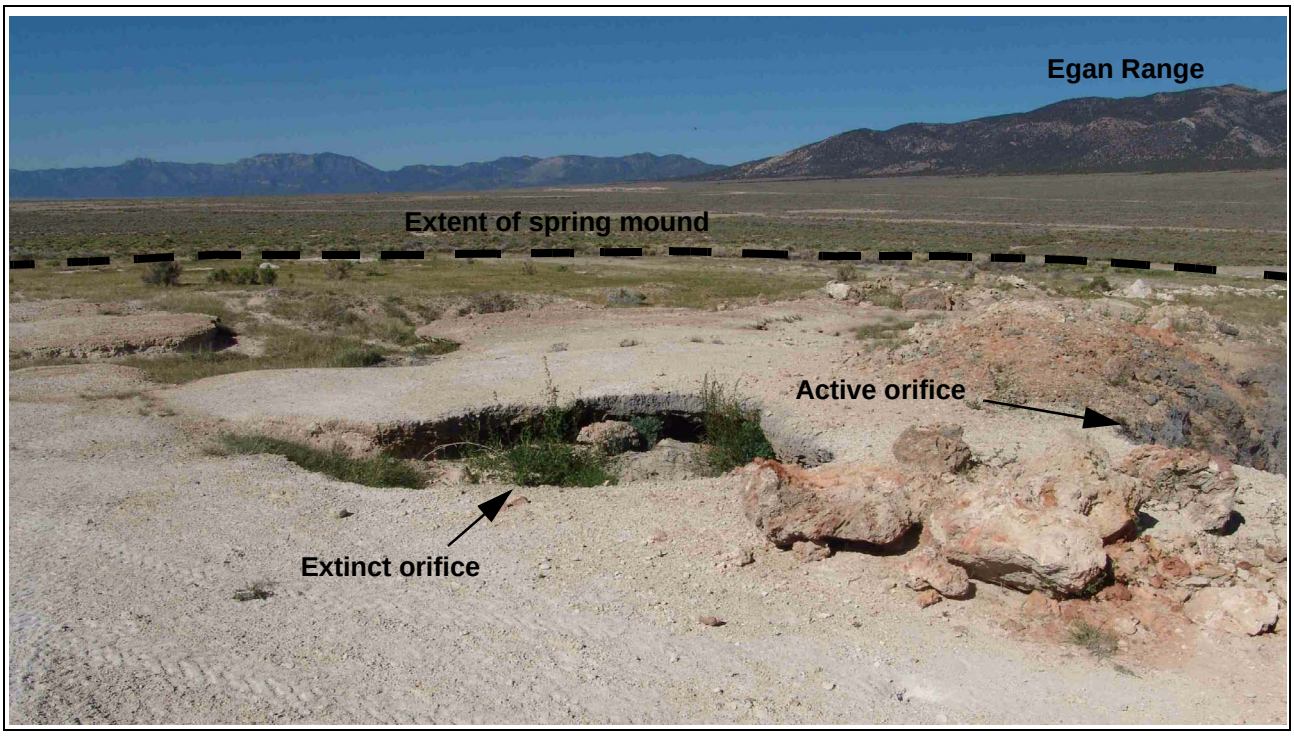


Figure 3-8
View Looking Southwest from the Top of Monte Neva Hot Springs Site

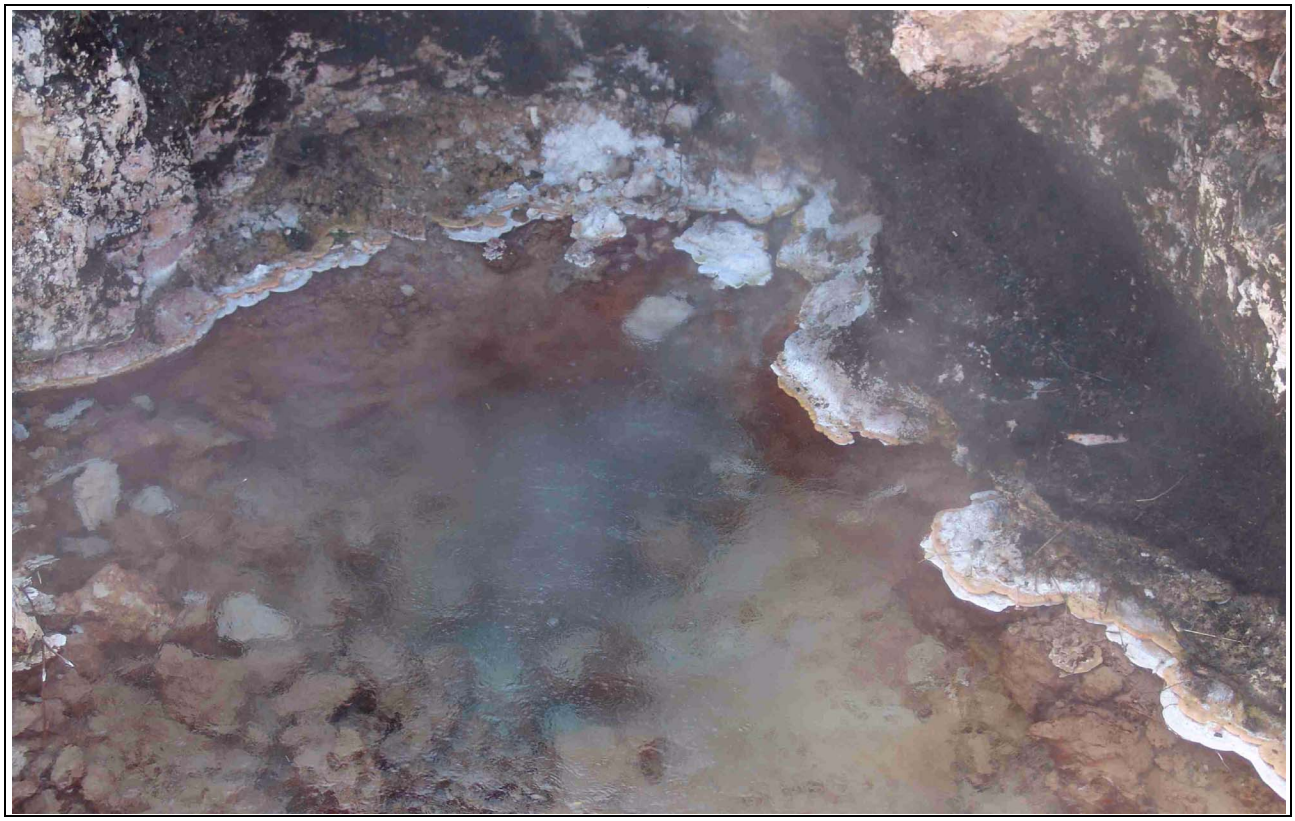


Figure 3-9
"Boiling" Water in the Orifice of Monte Neva Hot Springs

mineral deposition, bacteria colonies, algal communities, or a combination of the three (Figure 3-10). The different reaches are briefly described in Table 3-1.

From 1907 until the early 1920s, the water was used for irrigation and domestic purposes. In the 1920s a resort was built on the property, and the spring water was used for recreational and agricultural purposes. By the 1930s the resort was gone. Currently, the water is used for irrigation and livestock watering (Shaputis, 2005).

3.2 Spring Valley (HA 184)

Spring Valley comprises the southwestern portion of the Great Salt Lake Desert Flow System. The valley is approximately 120 mi long and averages 16 mi wide. Spring Valley is bounded by the Schell Creek Range to the west, the Antelope Range to the north, the Snake Range and the Limestone Hills to the east, the Wilson Creek Range to the south, and the Fortification Range to the southwest. Most of Spring Valley is in White Pine County except for the very southern portion located in Lincoln County. U.S. 50 Highway bisects the valley and U.S. Highway 93 runs along the valley's western flank.

This study inventoried 23 springs in Spring Valley and 8 are described in this section. Figure 3-11 depicts the springs' locations and their magnitudes of flow and temperature.

(From top left in a clockwise direction) Reach 1: 50 ft below the orifice, Reach 3: a weed that has been replaced by mineral deposits, Reach 4: Transition Zone, and Reach 5.

Figure 3-10
Selected Reaches in Monte Neva Hot Springs Aqueduct

Table 3-1
Description of the Reaches of Monte Neva Hot Springs

Reach Number	Color of Reach	Reach Length (ft)
1	Red/Brown	160
2	Transition Zone 1	35
3	White	140
4	Transition Zone 2	30
5	Orange	450

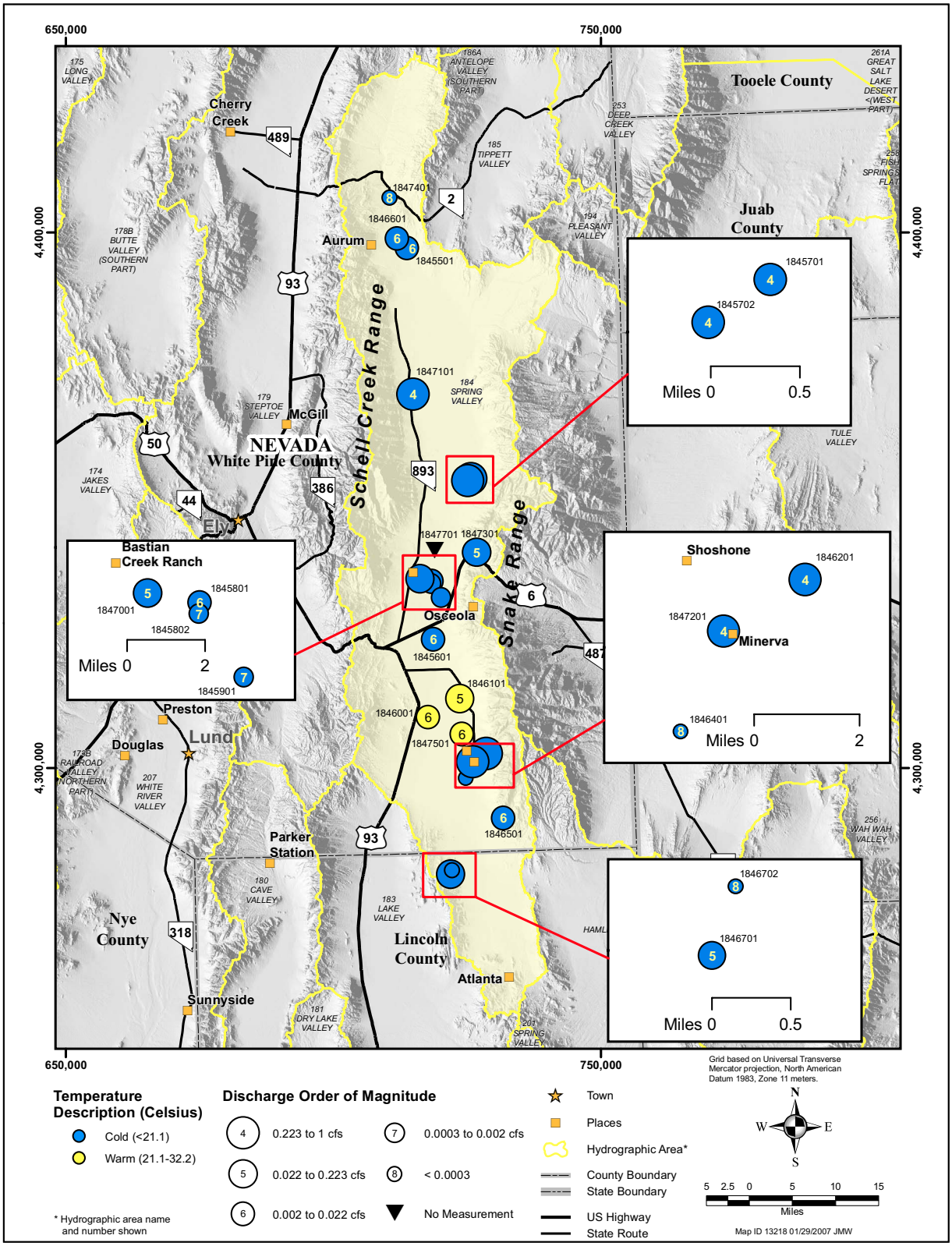


Figure 3-11
Map Showing the Location, Magnitude of Discharge, and Temperature of Selected Springs in Spring Valley, Nevada

3.2.1 Willow Spring

General Setting

Willow Spring is located in northern Spring Valley, approximately 5 mi east of Aurum, Nevada. The spring is small and has two distinct orifices that discharge to the south and join to form a single channel. From this channel, a small man-made impoundment catches the water to form a small pond. High-water marks indicate the pond could be as deep as 3 ft, when water is available. The spring area is approximately 100 ft wide and 125 ft long. This area is covered with a Bermuda-like grass, Rabbit Brush and is surrounded by sagebrush. A similar spring is located approximately 1 mi to the southwest. The water use appears to be for livestock and wildlife (Figure 3-12).

Parshall flume is in the center of the photograph.

Figure 3-12
Looking North toward the Orifice of Willow Spring

Geologic Setting

The spring discharges from Quaternary alluvium, primarily composed of fine sands and silts. Willow Spring is one of several springs that surface along a northeast trending lineation, suggesting the presence of a concealed fault.

Discharge

Discharge was measured using a 3-in. modified Parshall flume. The flume was placed 5 ft below the confluence of the two channels discharging spring flow from two orifices which are located approximately 75 ft above the measurement section. The discharge on October 9, 2007, was 0.009 cfs (approximately 4.0 gpm) and the temperature was 22.9°C. The flow was steady, and the measurement was rated excellent (Figure 3-13).

Figure 3-13
Three-Inch Modified Parshall Flume, 75 ft Downstream of the Willow Springs Orifice

Diversions and Water Use

The discharge of the spring is collected in a small reservoir 100 ft downstream of the measurement site. The reservoir is approximately 25 to 30 ft in diameter. The water use appears to be for livestock and wildlife (Figure 3-14).

3.2.2 North and South Millick Springs

General Setting

North and South Millick springs are approximately 3.5 mi southeast of the center of Yelland Dry Lake and approximately 6 mi east of the West Spring Valley Highway (SR 893). They are in north-central Spring Valley on the west flank of the Snake Range, about 6 mi north of U.S. Highway 50. South Millick Spring is approximately 0.5 mi to the southwest of North Millick Spring.

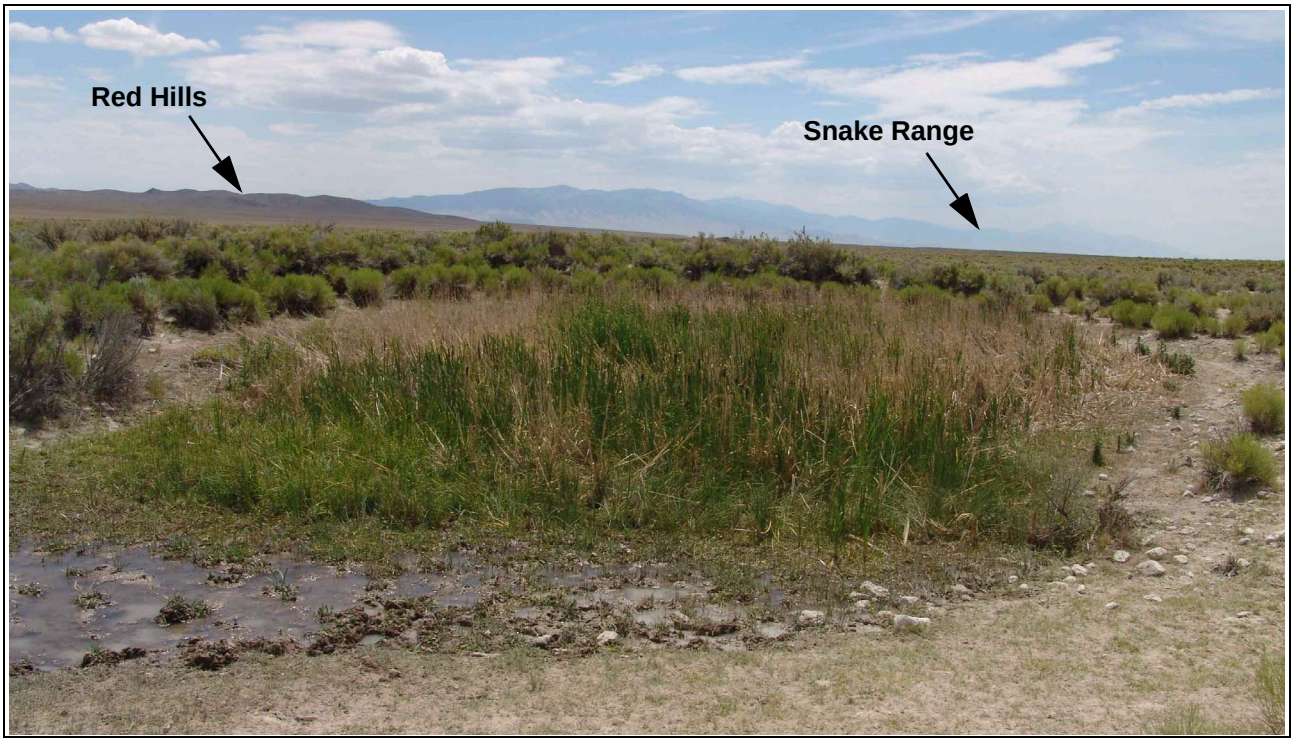


Figure 3-14
View Looking Southeast toward Willow Springs Reservoir

Several small orifices contribute flow to form large spring pools at each spring. Both springs flow westward towards the center of the valley. The spring pools are incised nearly 10 ft below the surrounding land surface, and their downstream channels are incised 4 to 5 ft below land surface (Figures 3-15 and 3-16).

Geologic Setting

Both North and South Millick springs are located on a northeast/southwest-trending normal fault that appears to straighten to the north past North Millick Spring. Both springs are located in alluvium separated by a high terrace. The most notable features in the area are the Pleistocene gravel bars, consisting of lenticular and subrounded pebbles, subparallel to the fault described previously. A barrow pit is located just south of which Millick Spring along one of the beach strands (Figure 3-17).

Discharge

The discharge of South Millick Spring was measured on October 8, 2007, at 1.25 cfs (approximately 561 gpm) using a pygmy current meter. A fair rating was assigned to the measurement, based on moderate aquatic plant growth in the channel and nonlaminar flow (Figure 3-18). The measurement cross section was a silt-lined channel with a low gravel percentage. Water-chemistry samples were collected at each spring and are listed in Appendix C.

The discharge of North Millick Spring was measured on October 8, 2007, at 0.647 cfs (approximately 290 gpm) using a pygmy current meter. A good rating was assigned to the measurement, based on

Figure 3-15
View Looking Northwest toward the North Millick Spring Orifice Pool

The Snake Range is in the background.

Figure 3-16
View Looking East toward the South Millick Orifice Pool

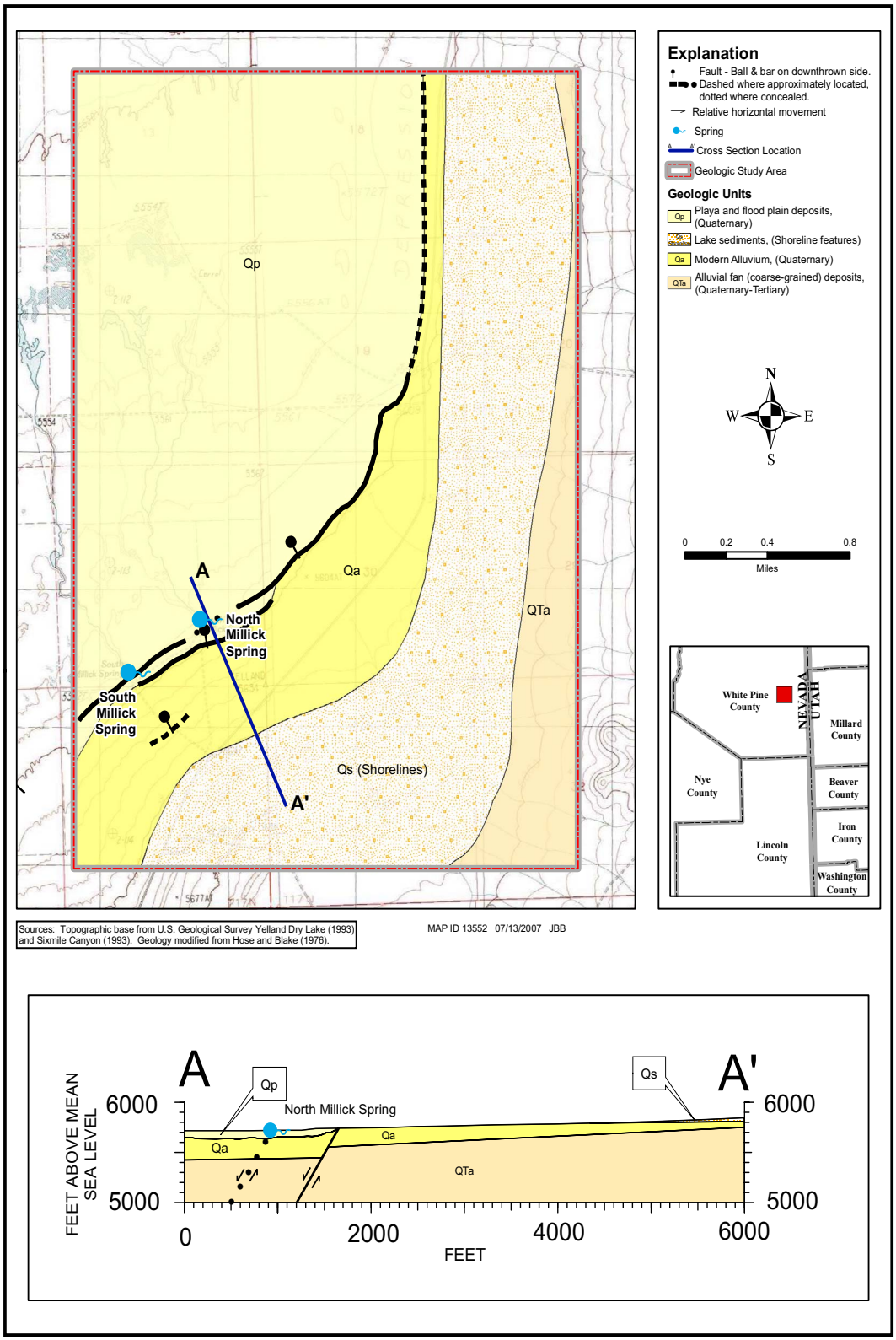
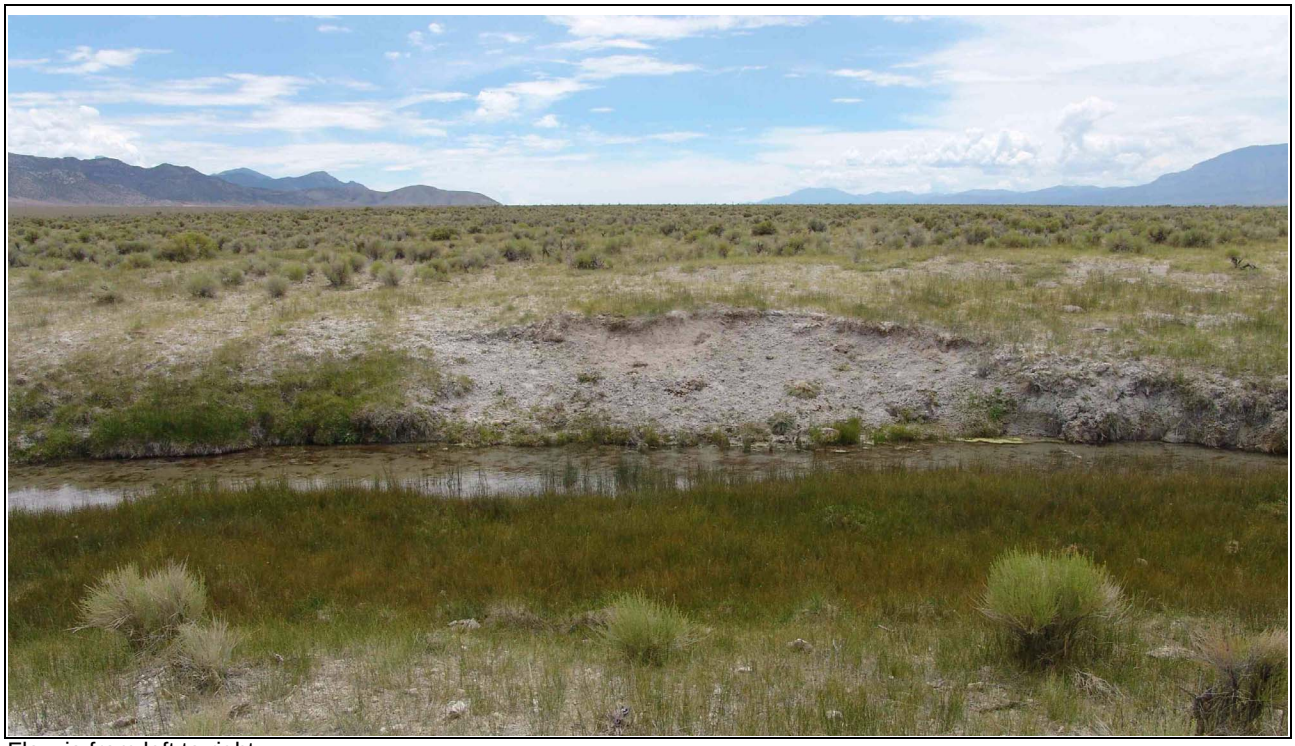


Figure 3-17
Geologic Map and Cross Section of North and South Millick Springs, White Pine County, Nevada



Flow is from left to right.

Figure 3-18
View Looking South at South Millick Spring Discharge Measurement Section

low aquatic plant growth in the immediate channel and smooth steady flow. The temperature of the water was 14.3°C. The measurement cross section was an incised channel with grass and sagebrush-lined banks (Figure 3-19). The left bank is nearly vertical and the right bank has a gentle slope.

Diversions and Water Use

Water from North and South Millick springs is used to water livestock by George Eldridge and Son, Inc. (Eldridge, 2004).

3.2.3 Layton Spring

General Setting

Layton Spring is located approximately 2.5 mi north of U.S. Highway 50 along the eastern flank of Spring Valley. The area is surrounded by sagebrush, and some shrubs are over 5 ft tall (Figure 3-20).

Geologic Setting

Layton Spring discharges from the base of a small scarp, in the alluvial deposits, approximately 6 to 8 ft high.

Orifice is approximately 300 to 400 yards to the east.

Figure 3-19
Looking West at the North Millick Spring Discharge Measurement Section

The Snake Range is in the background.

Figure 3-20
Layton Spring Discharge Pipe and Watering Trough, at the Base of a Small Scarp

Discharge

SNWA measured a maximum discharge of 0.002 cfs (1 gpm) measured on March 26, 2007. The spring has been observed dry during several years.

Diversions and Water Use

When flowing, the spring discharges from a 2-in. diameter pipe into a watering trough, then overflows into a shallow reservoir.

3.2.4 South Bastian Spring

South Bastian Spring is located approximately 2.8 mi southeast of Bastian Creek Ranch, and approximately 2.3 mi northwest of Layton Spring. The spring discharges along the western edge of an extensive marshy area with large cedar trees (*Juniperus scopulorum)* (Figure 3-21). Two other springs with similar conditions and diversion structures were observed located in the area.

Orifice is in the center of the photograph.

Figure 3-21
View Looking Northeast at South Bastian Spring Discharge Area

Geologic Setting

South Bastian Spring and the other nearby springs discharge several hundred yards to the east of a small terrace (scarp?) in the Quaternary alluvium.

Discharge

Discharge at South Bastian Spring is variable. The minimum discharge measured was 0.001 cfs (0.45 gpm) in August 2006, and the maximum discharge of 0.011cfs (4.76 gpm) was measured August 2005. The volume of the discharge was measured from the outfall of a 2-in. pipe protruding from a 20-in. pipe. The flow was clear and the temperature varies between 12.0 to 12.9°C (Figure 3-22).

Figure 3-22
South Bastian Spring Area, Showing Grasses, Cedar Trees, and Discharge Pipe

Diversions and Water Use

Water is diverted at the source of the spring. The spring flow is captured by a 20- in. diameter galvanized casing that routes the flow to a 2-in. pipe that discharges to a water trough. The trough then overflows onto the ground where it forms a marshy area approximately 25 ft in diameter. The water is used by livestock and wildlife. Two other springs in the vicinity had a similar completion (Figure 3-23).

3.2.5 North Spring

General Setting

North Spring is located 10 mi north of Lake Valley Summit and 2 mi east of U.S. Highway 93. (Figure 3-24). Water-chemistry samples were collected from the spring, and these results are listed in Appendix C.

Figure 3-23
South Bastian Spring Diversion Appliances

Figure 3-24
View Looking East from North Spring toward the Snake Range

Geologic Setting

North Spring discharges along a north-south-trending fault and is flanked on the east and west by additional north-south-trending faults (Figure 3-25). There is another small spring approximately 900 to 1,200 ft north of North Spring that appears to discharge from the same fault.

Discharge

Discharge was estimated to be 0.022 cfs (10 gpm) during the June 22, 2004, field visit. No other discharge measurements have because the conditions are not conducive to making a discharge measurement. The spring discharges to the east, and the flow travels only 150 yards before it is lost to infiltration and evapotranspiration. The spring pool appears to have been excavated. There was no distinct orifice that could be observed.

Diversions and Water Use

The water is used for livestock watering and supports a small grassy area downstream of the spring.

3.2.6 The Cedars

General Setting

The Cedars are two wells located approximately 8 mi. north of Minerva, Nevada, and 17 mi south of the Osceola, Nevada, turnoff from U.S. Highway 50. The area is at the toe of an alluvial fan originating on the Snake Range's western flank. The Cedars have multiple wells flowing under artesian pressure (Figure 3-26). Cedar #1 is a 2-in. diameter well with a 1-in. diameter discharge pipe. Cedar #2 is a 4-in. diameter well with a 2-in. diameter discharge pipe (Figure 3-27).

Geologic Setting

The wells at The Cedars are drilled near the toe of an alluvial slope consisting mainly of carbonate clasts.

Discharge

Discharge volume for both wells was measured on July 28, 2004. Cedar #1 was discharging 0.018 cfs (approximately 8 gpm), and Cedar #2 was discharging 0.074 cfs (approximately 33 gpm). The discharge measurements are rated as good and fair, respectively. The flow of Cedar #2 is estimated at least twice what was measured because of the piping arrangement at the wellhead (described below). that half of the discharge is that half is diverted to Shoshone Pond, which serves as a refugia for Pahrump poolfish (*Empetrichthys latos*) and relict dace (*Relictus solitarius*). Total discharge from the two wells is estimated at 0.166 cfs (0.018 cfs + (0.074 cfs × 2)).

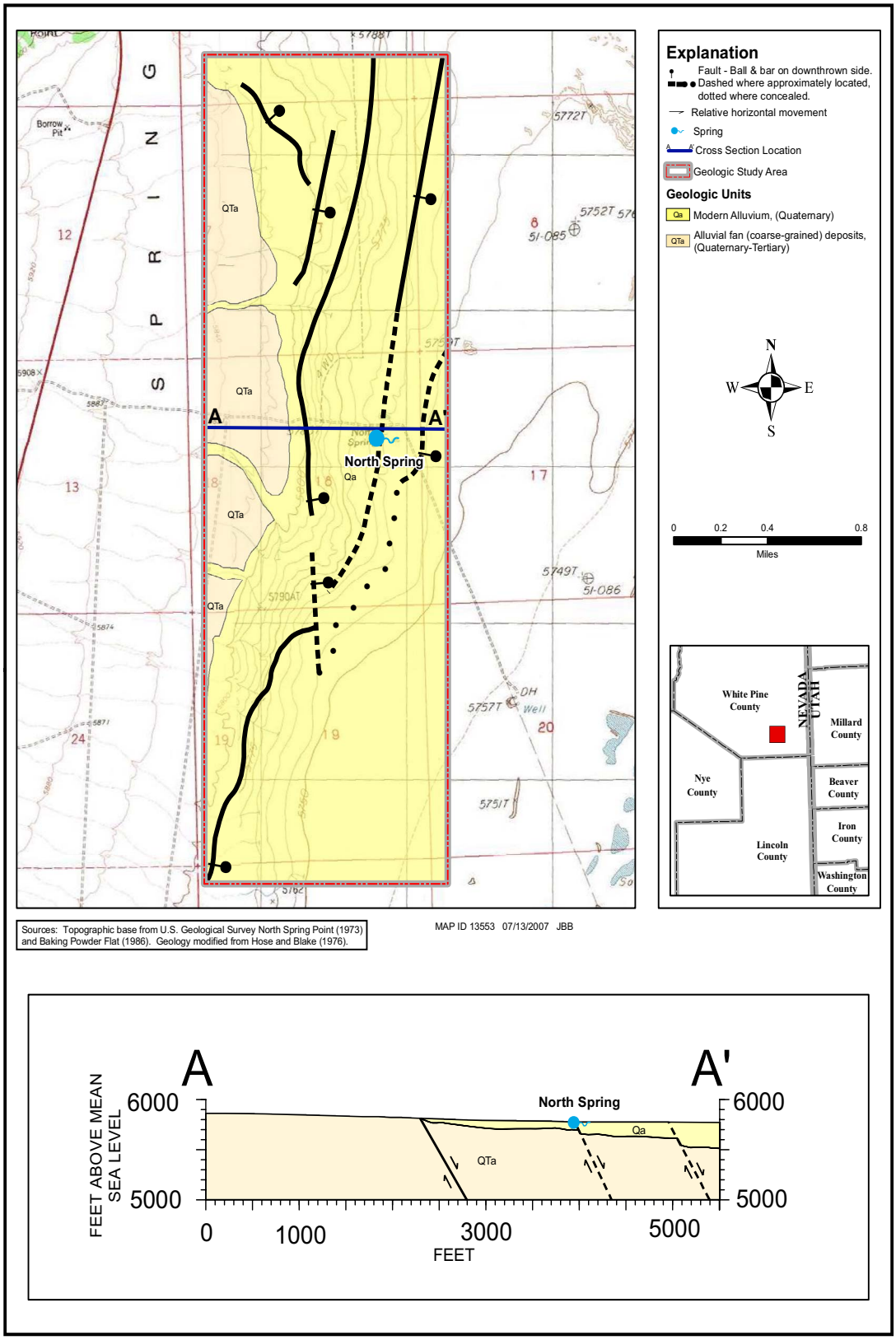


Figure 3-25
Geologic Map and Cross Section of North Spring, White Pine County, Nevada

Figure 3-26
View Looking Southwest from The Cedars #1 toward Mt. Grafton

Diversions and Water Use

Historically, water has been diverted from Cedar #1; however, water is currently diverted from Cedar #2. The water from Cedar #2 is diverted by 2-in. diameter pipe from the 4-in. diameter casing. A "T" fitting in the discharge line splits the 2-in. diameter pipe, routing flow to either Shoshone Pond or the ground surface that forms a small creek supporting a large meadow for cattle. Water routed to Shoshone Pond keeps the pond full and overflows into the meadow.

3.2.7 Swallow Springs

General Setting

Swallow Springs are located in a grove of large cottonwood trees, 1.5 mi north of Shoshone, Nevada, and east of SR 894 1.5 mi. (Figure 3-28). The springs are located approximately a quarter mile from the head of the Swallow Canyon alluvial fan on the Snake Range's western flank. The spring orifices (referred to as the northern and southern) discharge into separate channels, which join to form a single channel. At one time, the southern orifice was diverted towards Minerva, Nevada, while the northern orifice flows into an aqueduct and is delivered to Shoshone, Nevada.

Figure 3-27
(Top) The Cedars #1 is a One-Inch Well, (Bottom) The Cedars #2 is a Four-Inch Well

Figure 3-28
Grove of Cottonwood Trees at Swallow Springs

Geologic Setting

Swallow Springs is located in the middle of a large alluvial fan approximately a quarter mile from an outcrop of middle Cambrian limestone (Hose et al., 1976).

Discharge

Discharge was measured downstream of the north and the south orifices during a field investigation on November 29, 2007. Discharges of 0.664 cfs (298 gpm) in the southern channel, and 0.087 cfs (39 gpm) below the northern orifice were measured. The combined discharge of these orifices was 0.751 cfs (approximately 337 gpm). The measurements were made using a 3-in. modified Parshall flume in the northern channel and a pygmy meter in the southern channel (Figure 3-29). Both flows were clear and steady. The northern channel is incised nearly 2 ft in places.

Diversions and Water Use

Swallow Springs were likely diverted sometime before 1920, based on the observation that parts of the aqueduct for the southern channel are constructed from redwood pipe (Figure 3-30). Redwood pipe was typically not available after 1920 (Seymour, 2004). The intake of the southern channel diversion was located approximately 15 ft below the spring orifice. It appears the aqueduct fell into disrepair, and the southern channel was then diverted by a small dam with a head gate routing water to the natural channel then to a channel that sent the water towards Minerva, Nevada. Currently, the head gate for the diversion is submerged, and the flows traverse through a portion of the diversion channel and into the natural channel through a breach in the ditch (Figure 3-31).

Figure 3-29
Discharge Measurement of Swallow Spring, North Channel, Using a Modified Parshall Flume

Figure 3-30
Gate Valve and an Exposed Section of Redwood Pipe along Southern Channel Diversion of Swallow Springs

Figure 3-31
Submerged Head Gate, Formerly Used to Transfer Swallow Springs Water to Either Shoshone, Nevada to the North or Minerva, Nevada, to the South

The northern channel flows freely into the natural channel where there is an 8 × 8 ft concrete building. From this point on, the spring a ppears to have been diverted into an aqueduct towards Shoshone, Nevada. Currently, the discharge continues in the natural channel toward Shoshone, Nevada.

3.2.8 Blind Spring

General Setting

Blind Spring is loca ted in southern Spring Valley approximately 7 mi east of U.S. Highway 93 and 2 mi southwest of Minerva, Nevada.

Blind Spring is an oblong pool approximately 75 × 50 ft, roughly centered in an area of grasses and greasewood that e ncompass an area of about 7,500 ft^2 (Figure 3-32). T he pool has he avy aquatic plant growth, and the water appears to be stagnant. Blind Spring has a raised rim surrounding it, and the pool's water elevation is about 4 ft below land surface. It a ppears that the raised r im is anthropogenic in origin and not a natural feature.

Geologic Setting

Blind Spring appears to be a water-table spring, as the pool r epresents the potentiometric surface of the aquifer. Approximately 0.75 to 1.0 mi to the southwest are sand dunes 8 to 10 ft high and

Large number of greasewood surrounding the spring area.

Figure 3-32
View Looking Northeast from Blind Spring

containing pieces of tufa with a fine sandy texture, suggesting that this was a paleo-discharge area as well.

Discharge

Blind Spring discharges directly into a stagnant pool. No discharge measurements were made.

Diversions and Water Use

Water from Blind Spring is used for wildlife and livestock.

3.3 Snake Valley (HA 195)

Snake Valley comprises the central portion of the Great Salt Lake Desert Flow System. The valley is approximately 95 mi long and 40 mi wide near Garrison, Utah. Snake Valley is bounded by the Snake Range to the west, the Confusion Range, Conger Range, and Burbank Hills to the east, and a low-alluvial divide to the south. To the north, Snake Valley opens to the Great Salt Lake Desert. U.S. Highway 50 traverses the southern one-third of the valley and runs east-west through the Snake Range, then exits the valley in the east. This study inventoried 17 springs in Snake Valley. Figure 3-33 provides the locations of these springs and their magnitudes of flow and temperature. A description of three of these springs is given in the following sections. The Wilson Hot Springs Group and Cold Springs Group are discussed in the Fish Springs Flat Section.

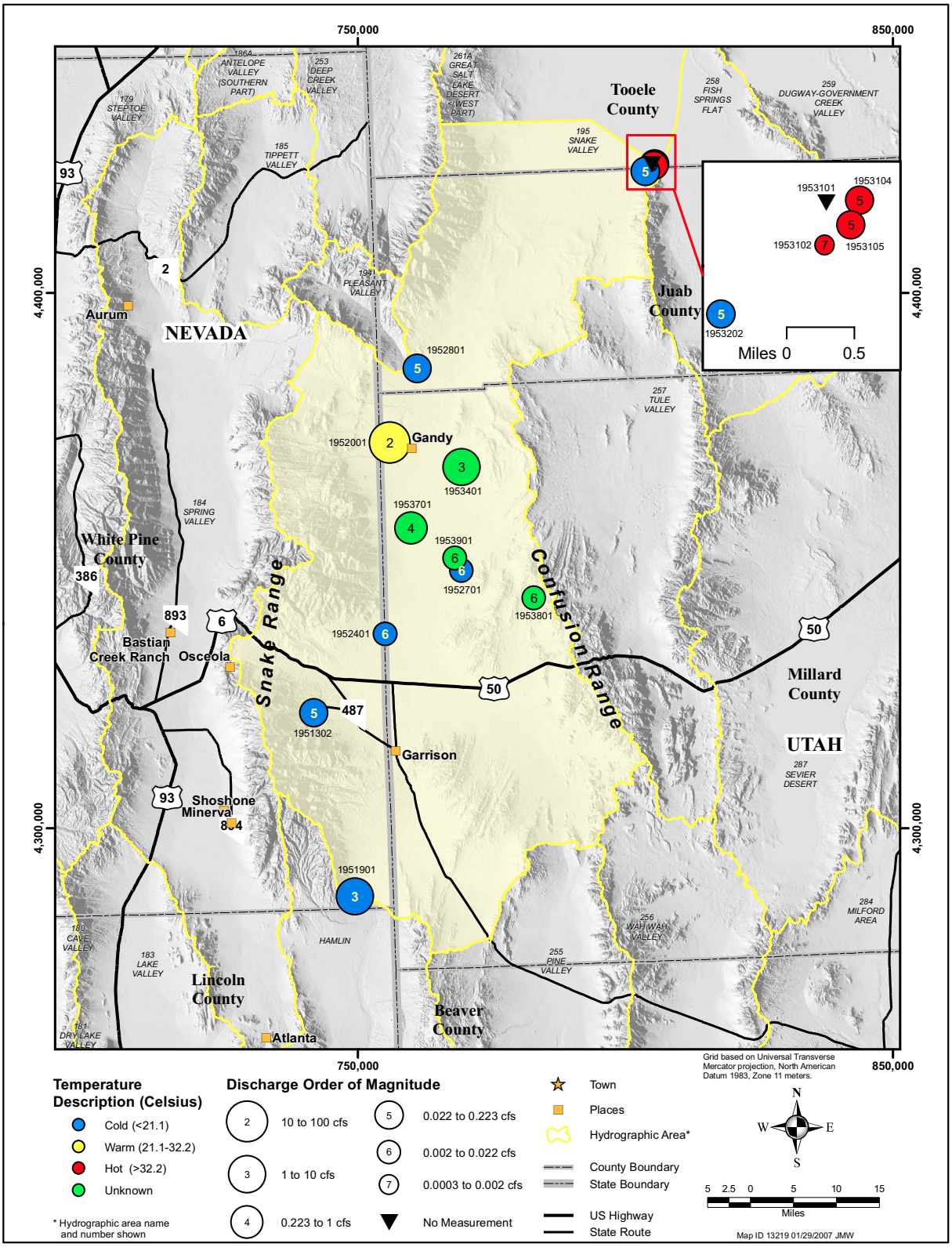
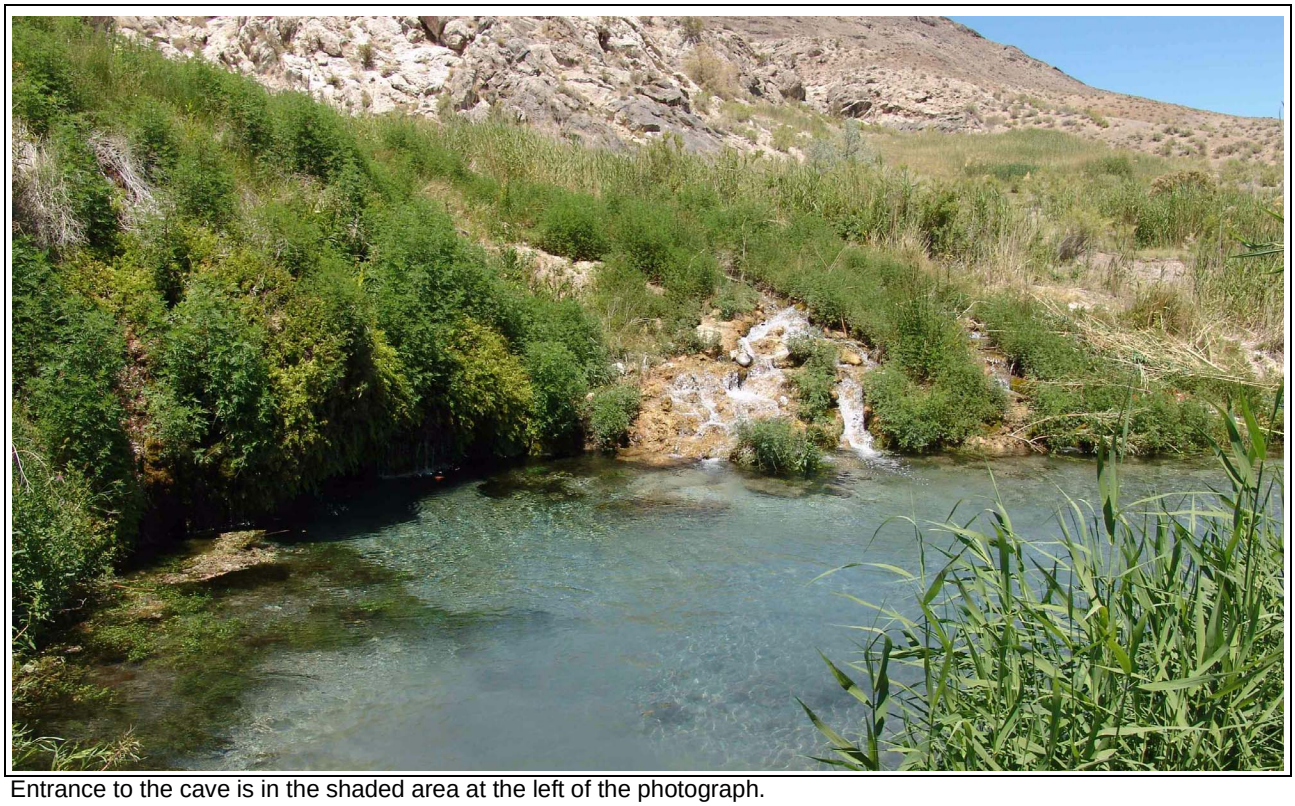


Figure 3-33
Map Showing the Location, Magnitude of Discharge, and Temperature of Selected Springs in Snake Valley, Nevada and Utah

3.3.1 Warm Springs

General Setting

Warm Springs is approximately 0.5 mi east of the Nevada state line and 3 mi west of Gandy, Utah. U.S. Highway 50 is approximately 35 mi south of the spring. A large ranch is 0.5 mi to the east of the spring. This spring discharges from a multiple-orifice system emanating from Paleozoic carbonate rocks and flows in an easterly direction toward Gandy, Utah. The spring area is a popular recreation area with local residents. Swimmers are able to swim approximately 30 ft upstream to the main orifice in a solution cavern. The cavern is approximately 7 ft high and 10 ft in diameter (Figures 3-34 and 3-35).



Entrance to the cave is in the shaded area at the left of the photograph.

Figure 3-34
Confluence of the Three Main Orifices of Warm Springs

Geologic Setting

There are several orifices in the spring complex. The largest is at the northeast reach of the stream channel where a large pool has formed. To the southwest of the main orifice, two and possibly three other source areas were noticed along the trace of a northeast-southwest-trending normal fault. These sources appear to coincide with fault and fracture zones perpendicular to the northeast-southwest-trending fault (Figure 3-36).

(Top) Looking downstream from inside the cave
(Bottom) Facing upstream into the cave

Figure 3-35
Cave at Warm Springs

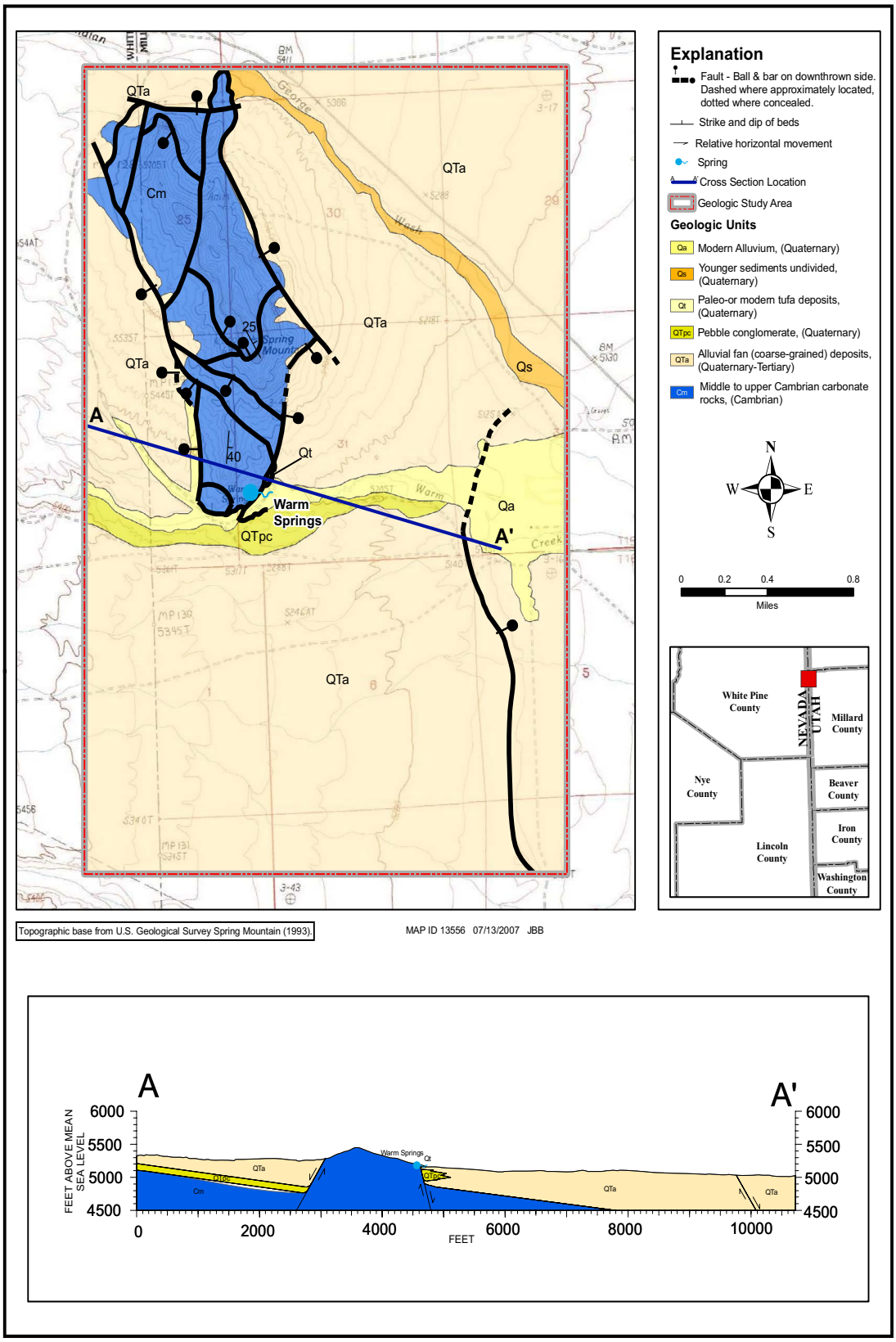


Figure 3-36
Geologic Map and Cross Section of Warm Springs, Millard County, Utah

At the intersection of these faults, thick (greater than 6.5 ft) tufa deposits were formed and are forming, similar to the main spring to the northeast. Bedrock in the area is highly complex. Hintze and Davis (2002) mapped these rocks as part of the Cambrian sequence, i.e., limestone and dolomite of the Orr Formation (middle Cambrian) (Figure 3-37). The ridge to the north of the spring is the Notch Creek Formation of upper Cambrian and consists of dolomite and limestone (Hintze and Davis, 2002).

Spring Mountain is in the background.

Figure 3-37
Source Rock at Warm Springs

There are numerous faults in the area. The northeast-southwest-trending fault more than likely controls the Warm Springs complex. Two large displacement faults north of the springs form the horst (ridge). This ridge is truncated to the south by two northeast-southwest-trending faults (these faults control the discharge at the springs). A very young Quaternary fault with several feet of displacement is exposed in the alluvium east of the site and the ranch.

Discharge

The discharge on November 3, 1964, was reported to be 8.0 cfs (Hood and Rush, 1965). The discharge was measured on June 22, 2004, at 8.42 cfs (3,780 gpm) while wading using a standard Price AA current meter. The water temperature was 27°C at the time of the measurement. The measurement was taken after extensive work was done to clear the brush along the right bank to make a measurement section. While collecting measurements, care was taken to make sure the swimmers dam was kept clear of debris so as not to affect the quality of the discharge measurement.

The channel is incised approximately 5 ft. and the bed material of the square-bottomed channel is mostly coarse sand, gravel, and limestone cobbles. Both channel banks are steep and lined with dense brush. The main discharge comes from a large orifice approximately 25 ft upstream of the measurement cross section (Figure 3-38).

Figure 3-38
Discharge Measurement Section on Warm Springs Creek, below the Orifice

Additional data were collected downstream of the main orifice. Approximately 0.5 mi downstream, the discharge was measured at the approach to a concrete diversion. During the October 30, 2004 measurement the discharge was recorded as 15.0 cfs (6,730 gpm), and the measurement was rated fair (Squires, 2004).

On August 4, 2005, discharge measurements were made 75 ft below the orifice and at the diversion structure. A discharge of 15.5 cfs (6,960 gpm) was measured below the orifice, and 17.8 cfs (7,990 gpm) was measured at the diversion. Both measurements were made using a Price AA meter and were rated fair. After the October 2004 and August 2005 measurements were made, it was apparent that the November 1964 and the June 2004 measurements missed significant incoming flow to the creek.

During September 2005, the USGS Utah District installed a gaging station (10172860) on Warm Springs Creek at the diversion structure. During the 2006 water year, the mean daily average was 16.8 cfs (7,540 gpm) or approximately 12,160 afy. The minimum daily flow was 14 cfs (6,284 gpm) and the maximum daily flow was 19 cfs (8,528 gpm) (USGS, 2006b).

Diversions and Water Use

Diversions are all approximately 0.5 mi downstream of the orifice. Here the flow is diverted to the south and the east towards Gandy, Utah, to support agriculture on the valley floor. The water enters the diversion structure through a 4-ft flume, then it is split into two streams. The east stream enters into a drop pipe, the west stream is split again, and both of these streams enter into drop pipes (Figures 3-39 and 3-40).

Figure 3-39
Warm Springs Creek Passing through Flume and Entering the Splitter Box

3.3.2 Caine Spring

General Setting

Caine Spring is located approximately 10 mi north of Baker, Nevada, and 24 mi south of Gandy, Utah, along Millard County Route 159 (Gandy Road). The spring emanates from two small seeps. One seep has been improved with a flowing 3-in. diameter well. The main spring (3-in. diameter well) is near a large Russian olive tree and flows northward into a small reservoir (Figure 3-41).

Geologic Setting

The spring discharges from alluvial deposits at the base of a scarp 2 to 3 ft in height. Two additional unnamed springs discharge along this same structure that strikes approximately north 20 degrees east.

Figure 3-40
Second Splitter Box on Warm Springs Creek

Figure 3-41
Caine Spring Discharge Area, Snake Valley, Utah

Discharge

Discharge from Caine Spring was difficult to estimate because of the poor condition of the 3-in.-diameter well and the heavy vegetation surrounding it (Figure 3-42). Discharge was estimated at 0.011 cfs (5 gpm); however, this value is considered poor because of adverse measurement conditions.

Figure 3-42
Discharge Pipe at Caine Spring

Diversions and Water Use

The entire discharge of Caine Spring is collected in a small reservoir, and the water is used for livestock and wildlife.

3.3.3 Big Springs

General Setting

Big Springs is located approximately 19 mi southwest of Garrison, Utah, and approximately 19 mi northeast of Atlanta, Nevada, at the southeast terminus of the Snake Range. The water supplies irrigation needs at the Big Springs Ranch, and the remainder flows northeast into Big Springs Creek, which becomes Lake Creek east of the Utah-Nevada border, and finally into Pruess Lake 3 mi southeast of Garrison, Utah (Figure 3-43). Big Springs begins as a few seeps then rapidly increases in discharge within 25 ft. The left bank of the creek is heavily overgrown with Willow and other woody plants, and the right bank is a steep slope that is covered in light grass.

A large pool is formed by a diversion structure consisting of two Cippoletti weirs with crest lengths of 15 and 4 ft.

Figure 3-43
Big Springs at Big Springs Ranch, Snake Valley, White Pine County, Nevada

Geologic Setting

Big Springs is the largest spring in a complex of springs emanating from the alluvium in the central to lower part of Snake Valley. Big Springs is located on a prominent Quaternary fault escarpment with several meters of displacement and a north-northeast strike. Local field mapping suggests that both Big Springs and an unnamed spring complex, located approximately 1.5 mi northeast, are on the same large fault. A northernmost spring complex, also unnamed, is about 2.5 mi northeast of Big Springs and is located on a normal fault that is subparallel to the main fault. This fault separates from the main fault just north of Big Springs. Both of these faults appear to be subparallel to a range-bounding fault that has minimal expression and appears to be oriented nearly north to south. South of Big Springs the main fault bends and becomes north-northwest and is less distinct about a mile south of Big Springs (Figure 3-44).

North Little Springs and South Little Springs are minor spring complexes approximately 1 to 2 mi southeast of Big Springs (Figure 3-44). Each of these complexes is located on separate but subparallel north-northeast to northeast striking faults. North-northeast faults, most commonly oriented approximately 20 degrees east, appear to be very common throughout this part of Snake Valley and control the locations of washes, terminations of alluvial fans, and bedrock outcrops. In general, most of the structures appear to be down to the west. However, the faults at and near Big Springs are down to the east, due to the proximity of a large range-bounding fault on the east side of the Snake Range.

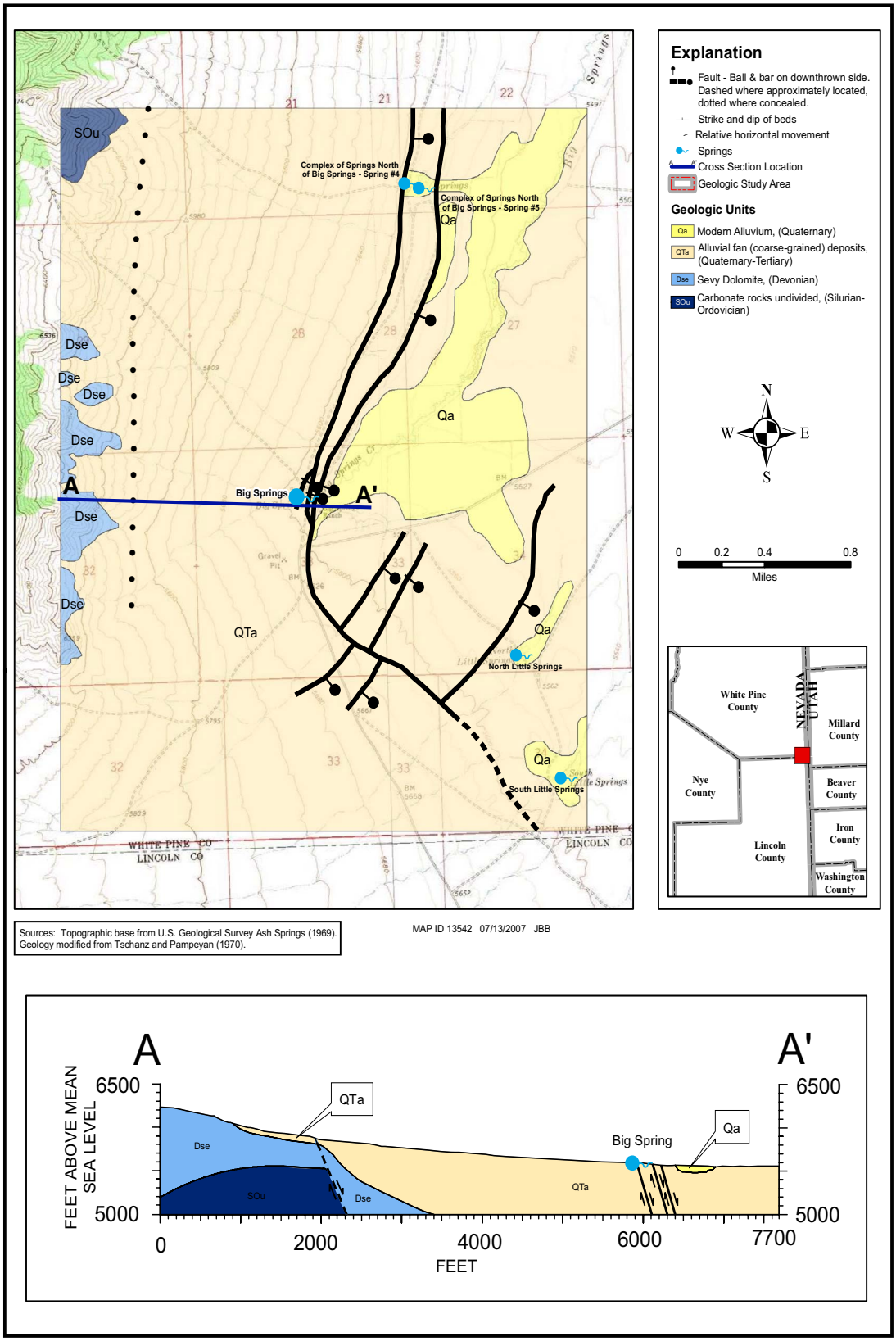


Figure 3-44
Geologic Map and Cross Section of Big Springs, White Pine County, Nevada

Discharge

The discharge of Big Springs is measured below each of the two Cippoletti weirs diverting its flow. This report considers this combined amount as "Big Springs" total flow. It is necessary to define this as the measurement point for this spring because the Big Spring Creek gains significantly in discharge below this point. In 1908, Meinzer (1911) reported that several additional springs below Big Spring contribute to the 18 cfs (8,080 gpm) discharge of Lake Creek. In 1964, Hood and Rush (1965) estimated the discharge to be 8 cfs (3,590 gpm) near the orifice of Big Springs. Walker (1972) clarified the large discrepancy in discharge values by taking measurements below the diversion structure and in three irrigation ditches. On November 18, 1972, Walker measured the discharge below the Cippoletti weirs as 8.92 cfs (4,000 gpm). He then measured the total flow downstream in the diversion ditches at 19.1 cfs (8,570 gpm), demonstrating a 10.18 cfs (4,570 gpm) gain below the diversion structure. Walker installed graphic recorders on the three diversion ditches and obtained daily discharges between 15 and 19 cfs (6,730 gpm and 8,530 gpm) from June through November, 1972. Squires (2004) measured 10.4 cfs (4,670 gpm) in November 2004, below the weirs. In early 2005, USGS in cooperation with SNWA and the Nevada Division of Water Resources (NDWR) installed a gaging station at Big Springs. The gaging station data is published under two separate gaging station numbers. 10243224 is Big Springs Creek South Channel near Baker, NV (Big Springs South) and 102432241 is Big Springs Creek North Channel near Baker, NV (Big Springs North). The 2006 mean annual discharge at Big Springs South is 6.27 cfs or 2,290 afy. The minimum and maximum daily discharges are 5.3 cfs (2,648 gpm) and 7.9 cfs (3,546 gpm) respectively. In 2006 Big Springs North had minimum and maximum discharges of 2.8 cfs (1,257 gpm) and 5.6 cfs (2,513 gpm) respectively.

Diversions and Water Use

There are numerous diversions at Big Springs. There are several portable pumps installed to divert water. In addition, there is a splitter box consisting of two Cippoletti weirs. The first weir has a crest length of 15 ft and diverts approximately 40 percent of the discharge in a northerly direction. The second weir has a crest length of 4 ft and diverts approximately 60 percent of the discharge in an easterly direction. Both weirs were clear of debris and unobstructed. The water from this spring is used for agricultural purposes; unused water flows northeasterly emptying into Pruess Lake.

3.4 White River Valley (HA 207)

White River Valley comprises most of the northern third of the White River Flow System and is the largest valley in the flow system. The valley is approximately 80 mi long and approximately 22 mi wide at Lund, Nevada. White River Valley is bounded by the White Pine Range in the northwest, the Horse and Grant Ranges to the west and the Egan Range to the east, and a low alluvial divide separates the valley from Garden and Coal valleys. The surface water drainage of White River Valley is contiguous with Pahroc Valley to the southeast. SR 318 travels north-south along the eastern side of the valley and intersects U.S. Highway 6 north of Lund, Nevada. As part of this study, 18 springs were inventoried in White River Valley and 11 are described in detail in the following sections. Figure 3-45 provides the locations of these springs and their magnitudes of flow and temperature. A description of each of these springs is listed in the following sections of this report.

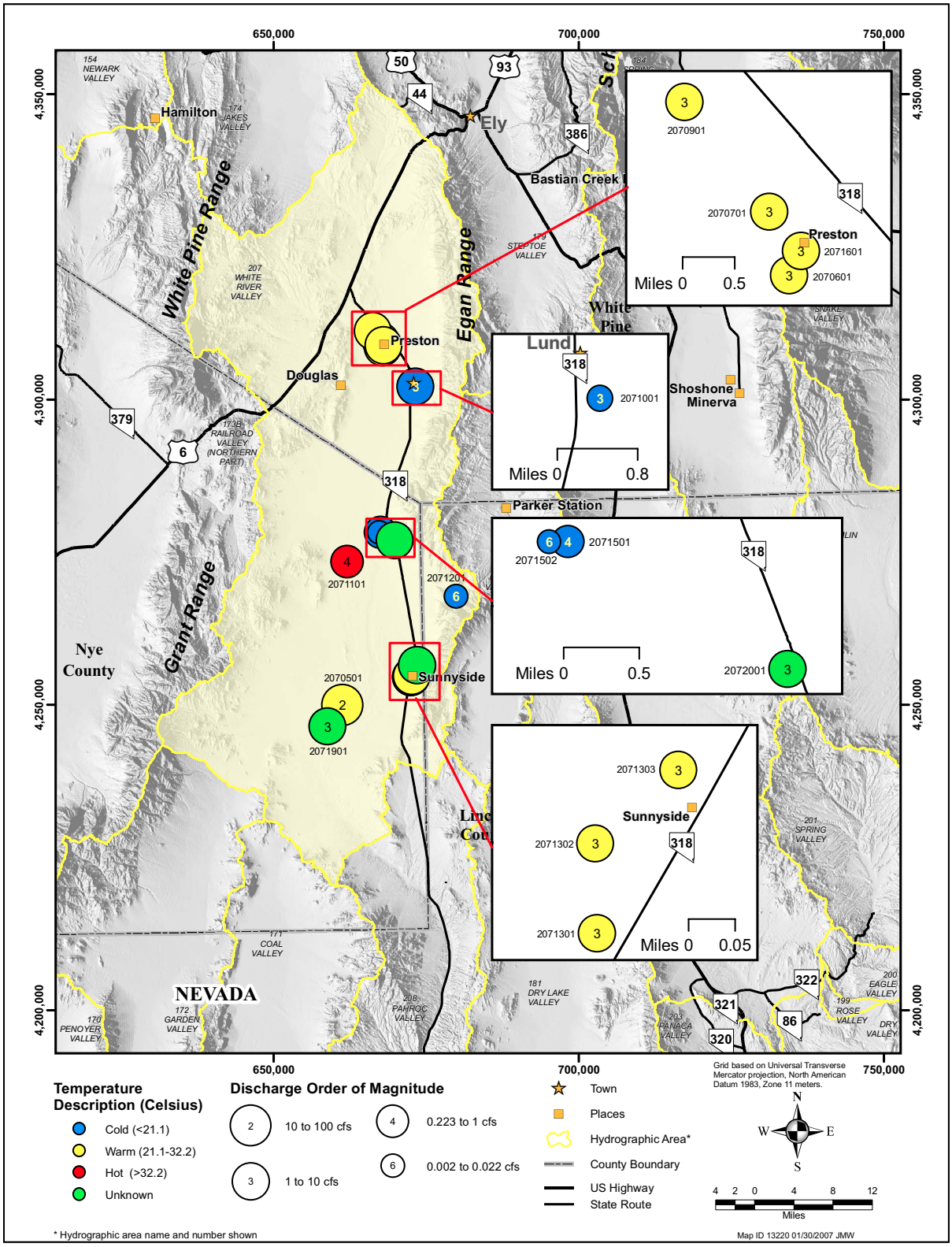


Figure 3-45
Map Showing the Location, Magnitude of Discharge, and Temperature of Selected Springs in White River Valley, Nevada

3.4.1 Williams Hot Spring

General Setting

Williams Hot Spring is located 4.5 mi northeast of U.S. Highway 6 and approximately 12 mi northwest of Preston, Nevada. The spring is on private property and appears to have three separate orifices (Figure 3-46). The spring is labeled on USGS 1:100,000 topographic map as "Warm Spring." It is published in Garside and Schilling (1979) as Williams Hot Springs; Maxey and Eakin (1949) refer to it as Williams Hot Spring.

Spring orifice is in the concrete box in the foreground.

Figure 3-46
4-H Camp at Williams Hot Spring

Geologic Setting

Williams Hot Spring discharges from near the center of a Tertiary caldera on the western flank of the White Pine Range. The spring discharges from a small hill of younger Tertiary sediments (Hose et al., 1976).

Discharge

Garside and Schilling (1979) reported the discharge of the spring to be 0.111 (50 gpm) to 0.412 cfs (185 gpm) at temperatures ranging from 51.1°C to 53.3°C. A volumetric discharge measurement of

0.067 cfs (30 gpm) was made during the July 26, 2006 field visit, at an overflow pipe to the reservoir downstream of the spring.

Diversions and Water Use

The three orifices have been improved with concrete boxes. It appe ars that they dischar ge into a small creek that is colored white and orange with either mineral deposits or thermal bacteria. The creek then empties into a small reservoir used recreationally by the 4-H Camp. The water then flows into a narrow, well-incised ditch and is eventually used for agricultural purposes.

3.4.2 Douglas Spring

General Setting

Douglas Spring is located in a small alluvial valley approximately 6 mi southwest of Preston, Nevada, at the site of Douglas, Nevada (Figure 3-47). The spring is unnamed on USGS topographic maps but is referred to as "Douglas Spring" by the local population.

Douglas Creek is shown in the lower right of the photograph.

Figure 3-47
Douglas Spring Discharge Area

Geologic Setting

Douglas Spring surfaces along a small fa ult scarp near Douglas, Nevada. The spr ing is located in Tertiary volcanic rocks. Approximately 1 mi to the east, the volcanic rocks are in contact with the

Devonian Guilmette Formation. Beyond this point, the creek, formed by Douglas Spring, infiltrates into the stream bed.

Discharge

Using a 3-in. modified Parshall flume on July 26, 2005, the discharge was measured at 0.271 cfs (120 gpm) and the temperature was 18.1°C. The flow was steady, clear, and even. The banks of the channel were steep and lined with grass and aquatic plants (Figure 3-48).

Figure 3-48
Three-Inch Modified Parshall Flume Installed 75 ft Downstream of Douglas Spring Orifice

Diversions and Water Use

Water appears to have once been diverted into a small reservoir from the channel approximately 50 ft below the orifice. Evidence of pipes possibly used to transfer water were found in the area. It is assumed that the water was used for livestock and possibly a minor amount of agriculture. However, the diversion works are currently in disrepair, and the water is possibly used for livestock and wildlife.

3.4.3 Preston Big Spring

General Setting

Preston Big Spring is a large spring located approximately 1 mi northwest of Preston, Nevada, west of SR 318 (Figure 3-49). The spring orifice is located in an incised area approximately 15 ft below the land surface in the alluvial deposits on the valley floor. The orifice area and channel are overgrown

Figure 3-49
USGS Gaging Station No. 09415510-Preston Big Spring near Preston, Nevada

with aquatic plants and a healthy grove of wild roses, and a large Russian olive tree. The orifice banks consist of fine-grained material with little to no cementation. This area is heavily overgrown and cannot be clearly observed. There does not appear to have been any anthropogenic disturbances to the orifice area. The channel near the gaging station is incised 3 ft below land surface.

Geologic Setting

Preston Big Spring is located in highly dissected alluvial terraces. Numerous faults cut these alluvial fan sequences, suggesting recent uplift. The faults at Preston Big Spring strike to the northwest; this differs from the faults in the more southerly Mormon Spring area, which strike to the northeast. This difference suggests that between the two springs a major east-west structure has changed the alignment in the White River Valley from a prominent north-northeast pattern in the central and southern parts of the valley to a northwest trend in the north (Figure 3-50).

Discharge

USGS maintains and operates a gaging station approximately 1,200 ft downstream of the orifice and 10 ft upstream of the diversion splitter box. The data are reported as USGS Gaging Station No. 09415510-Preston Big Spring near Preston, Nevada. Average daily discharge records have been computed by USGS from December, 1982 to September, 1985 and from March, 2000 to the present. The gaging station was located at the diversion structure until December 1982 when it was moved

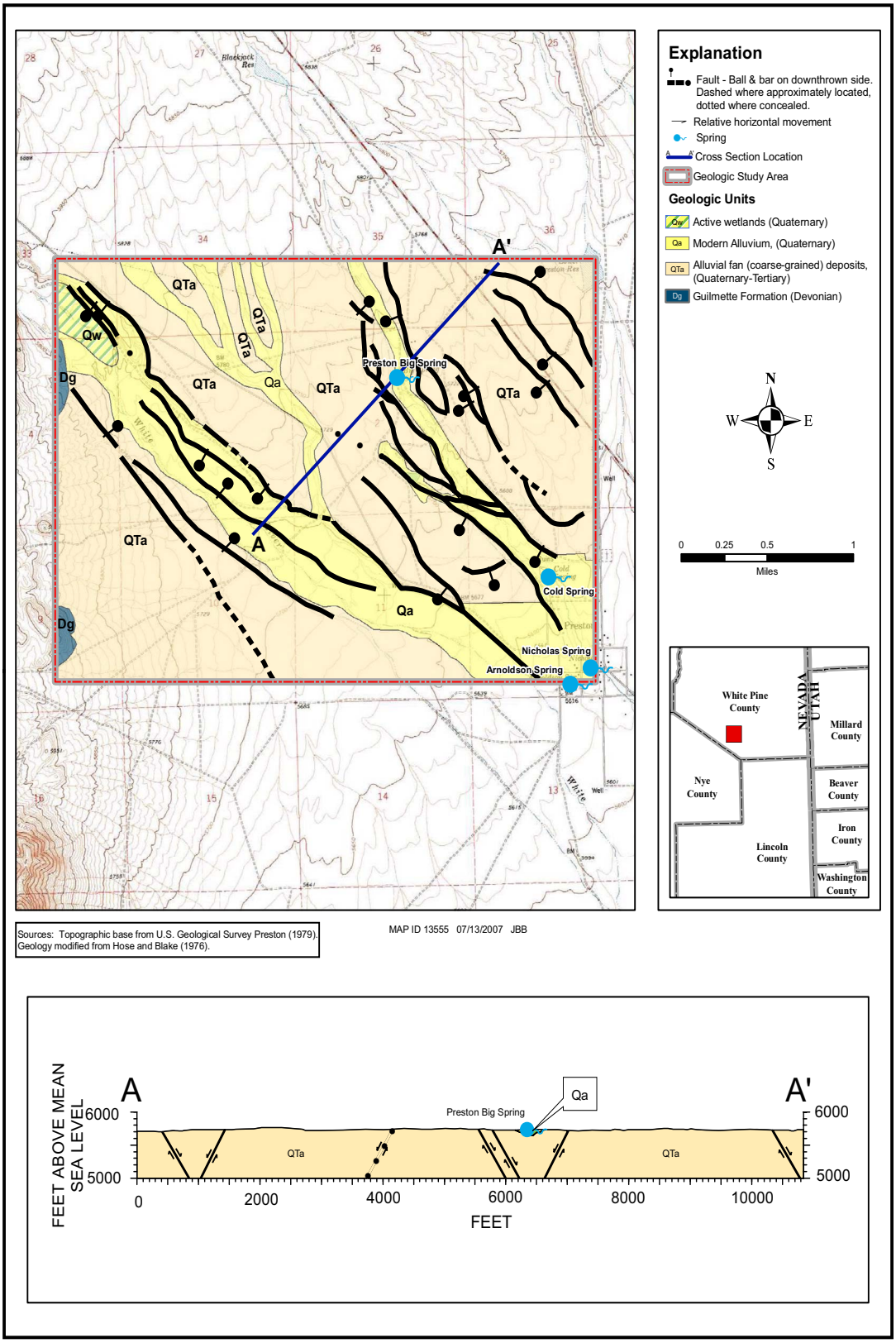


Figure 3-50
Geologic Map and Cross Section of Preston Big Spring, White Pine County, Nevada

upstream 0.2 miles. When the gaging station was reactivated in March of 2000 the station was again installed on the irrigation diversion structure. On July 29, 2005 the gage was moved again upstream 0.2 miles to eliminate the backwater problem caused by the debris catching on the structure. The average annual discharge is 7.86 cfs (3,528 gpm) and the minimum and maximum average annual discharges are 7.24 cfs (3,250 gpm) in 1984 and 9.38 cfs (4,210 gpm) in 2006. Average annual discharge for water years (WY) 1983 to 2006 is 5,700 afy (USGS, 2006). Discharge measurements are available in Appendix B. Discharge records for this spring are regularly affected by heavy aquatic plant growth. Both USGS and Preston Irrigation Company frequently remove the debris that accumulates on the structure (Figure 3-51).

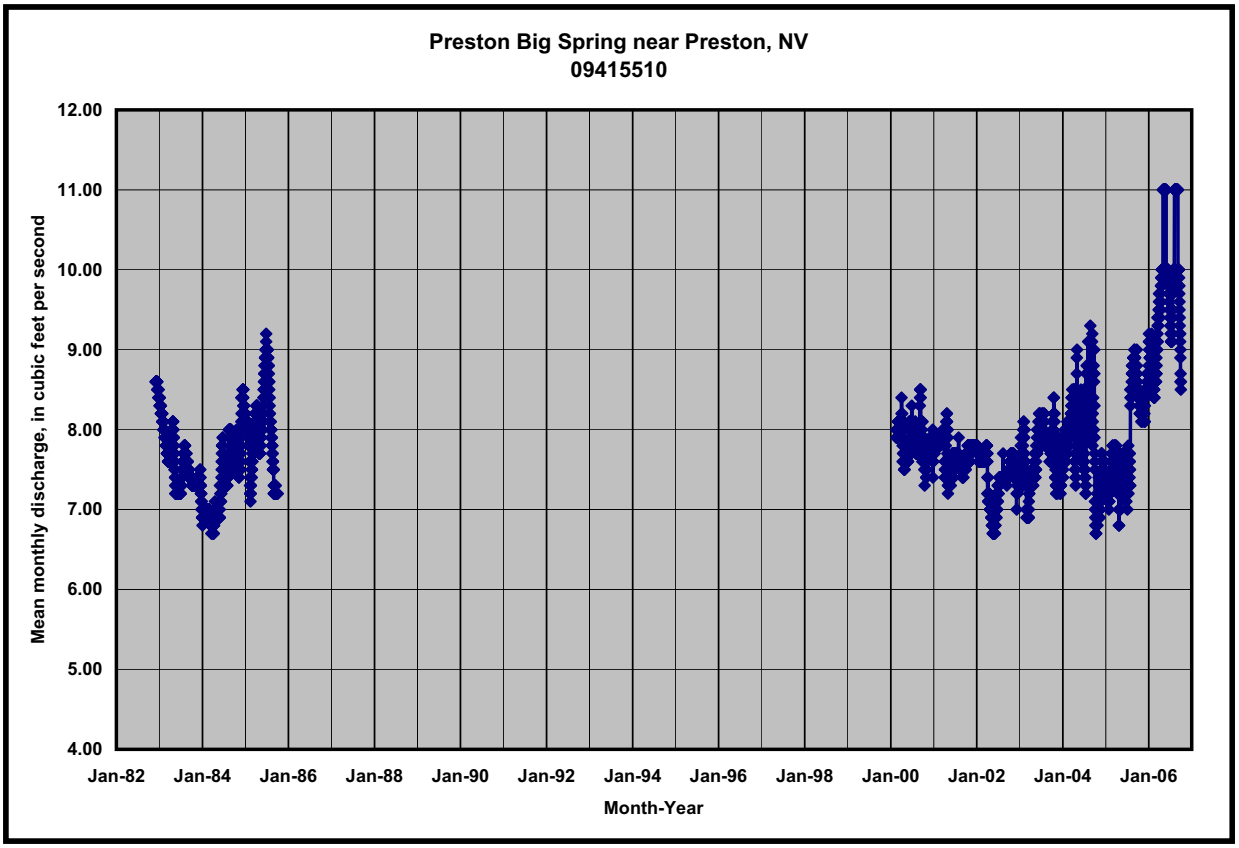
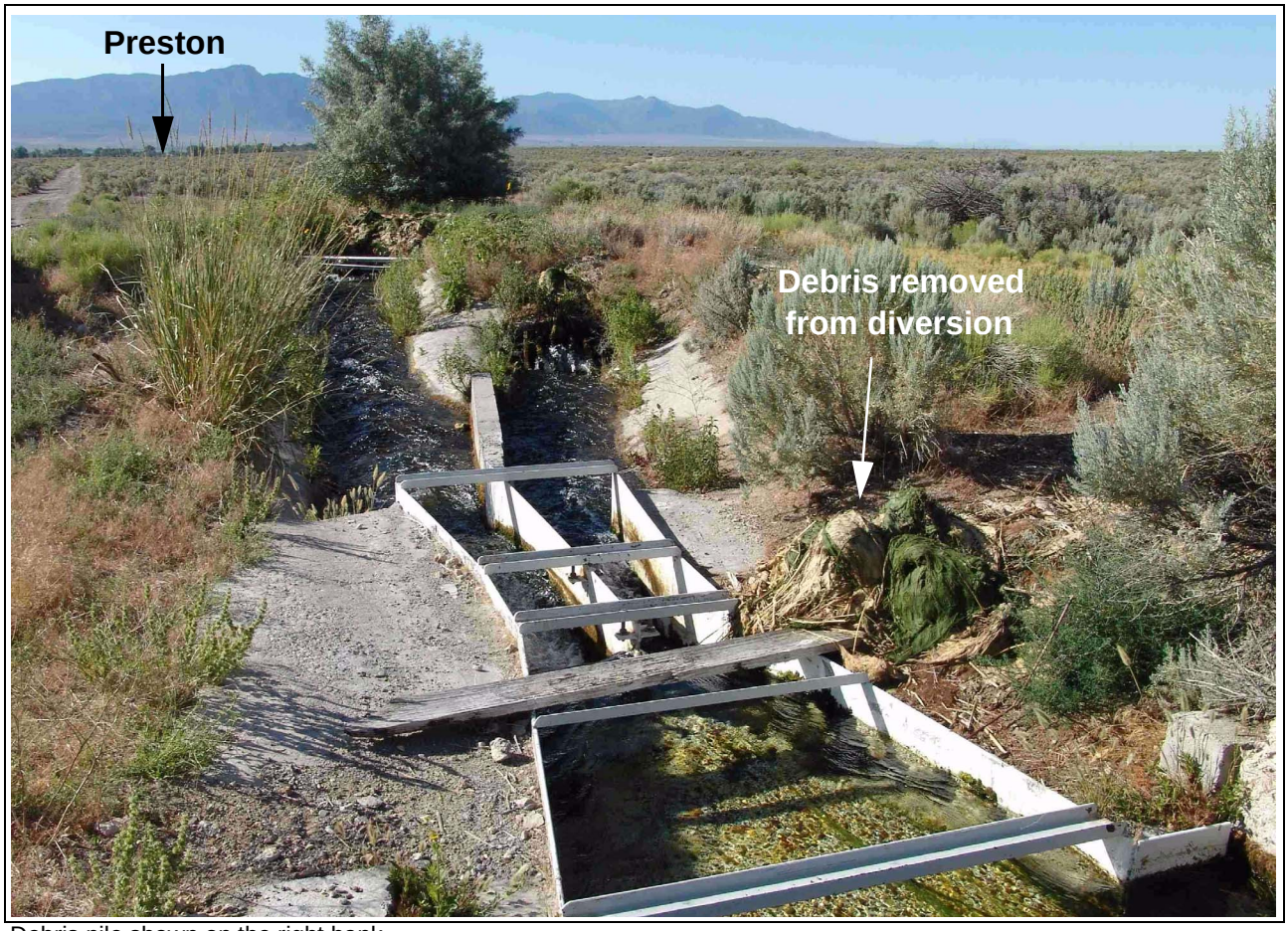


Figure 3-51
Hydrograph of Mean Monthly Discharge at Preston Big Spring, near Preston, Nevada

Diversions and Water Use

Approximately 1,200 ft downstream from the orifice, the entire flow passes through a large flume and is then split into two channels. These channels are then piped to various agricultural users near Preston, Nevada. When the flow of the main diversion becomes restricted and the water backs up, a culvert on the right bank 5 to 10 ft above the gage, diverts water into an overflow ditch (Figure 3-52).

Water from Preston Big Spring was used for agriculture before 1890 at the Maddox Ranch, which later became Preston, Nevada (Shaputis, 2005). Preston, Nevada was formally founded in 1898, and



Debris pile shown on the right bank.

Figure 3-52
Looking Downstream at the Preston Big Spring Diversion Structure

it can be assumed that water resource development was an early priority for settlers. In 1911, the Preston Irrigation Company was formed and reportedly irrigated 400 acres of land. The principal crops were alfalfa, grains, and potatoes (Malone, 1931). By 1938, the irrigated acreage was 1,100 acres, with the water sources originating from Preston Big Spring and Arnoldson Spring (Smith, 1938). In 1958, irrigated land totaled 900 acres, and the principal crops were alfalfa and small grains (Muth, 1958).

3.4.4 Preston Springs Group

The Preston Springs Group consists of three different springs: Arnoldson, Nicholas, and Cold springs.

General Setting

For the purpose of this report, Arnoldson, Nicholas, and Cold springs are considered a spring group. These three springs are located on private land in Preston, Nevada. The temperatures of these three springs are similar, ranging from 21°C to 22°C (Garside and Schilling, 1979). All of the springs

discharge from alluvial sediments, and their waters are used for irrigation in or around Preston and Lund, Nevada.

Geologic Setting

The Preston Springs Group is located south of Preston Big Spring and discharges from alluvium that has been dissected by the same complex of northwest-striking faults (Figure 3-50).

Discharge

Discharge is measured semiannually by USGS. Available data for these three springs are listed in Appendix B. On September 13, 2006 the following discharge measurements were made by the USGS: Arnoldson Spring, 3.45 cfs (1,548 gpm); Nicholas Spring, 2.89 cfs (1,297 gpm); and Cold Spring, 0.79 cfs (355 gpm).

Diversions and Water Use

The discharge from the Preston Springs Group is divided between the Preston and Lund Irrigation Companies by many aqueducts, pipes, and other water conveyance accoutrements. The Lund Irrigation Company was formed in 1907 and the Preston Irrigation Company was formed in 1911. The formation of these companies was a formality because the Preston and Lund area had been using the water for agriculture before 1890 (Jones, 1994). In 1938, the irrigation companies completely or partially used the following springs: Preston Big, Lund, Nicholas, Cold, Horsley, and Arnoldson. The combined irrigated acreage for the two companies during this year was 2,600 acres, with crops consisting mainly of alfalfa, other grains, and potatoes (Smith, 1938; Malone, 1931).

3.4.5 Lund Spring

General Setting

Lund Spring is located at the extreme southeast corner of Lund, Nevada, just east of a large set of corrals. The entire flow of the spring is diverted by a series of Cippoletti weirs. The spring pool is nearly 50 ft in diameter. Discharge from the pool forms a channel on the northwest end of the pool. Along the right bank of the channel is dense vegetation, including willows and other plants. The bed of the channel is heavily overgrown with moss and other aquatic plants (Figure 3-53).

Geologic Setting

Lund Spring discharges from the fault contact between the alluvium and Permian-Pennsylvanian Ely Limestone. The spring discharge is coincident with a range-front fault forming the western side of a horst block. The beds of the Ely Limestone dip in an eastward direction (Figure 3-54).

Flow is towards the top of the photograph.

Figure 3-53
Lund Spring Orifice Pool

Discharge

During 2006 the USGS conduc ted semiannual discharge measurements at Lund Spring. The discharges were measured April 27, 2006 (9.47 cfs or 4,250 gpm) and September 13, 2006 (12.1 cfs or 5,431 gpm) (USGS, 2006).

During the site visit when these discharge measurements were taken, the Cippoletti weirs had slight algal growth. Therefore, the measurement was rated as good rather than excellent.

Diversion and Water Use

The entire flow of Lund Spring is diverted approximately 150 ft downstream of the orifice pool by the three Cippoletti weirs (Figure 3-55). This spring is used in conjunction with other local springs to irrigate 2,000 acres (Muth, 1958).

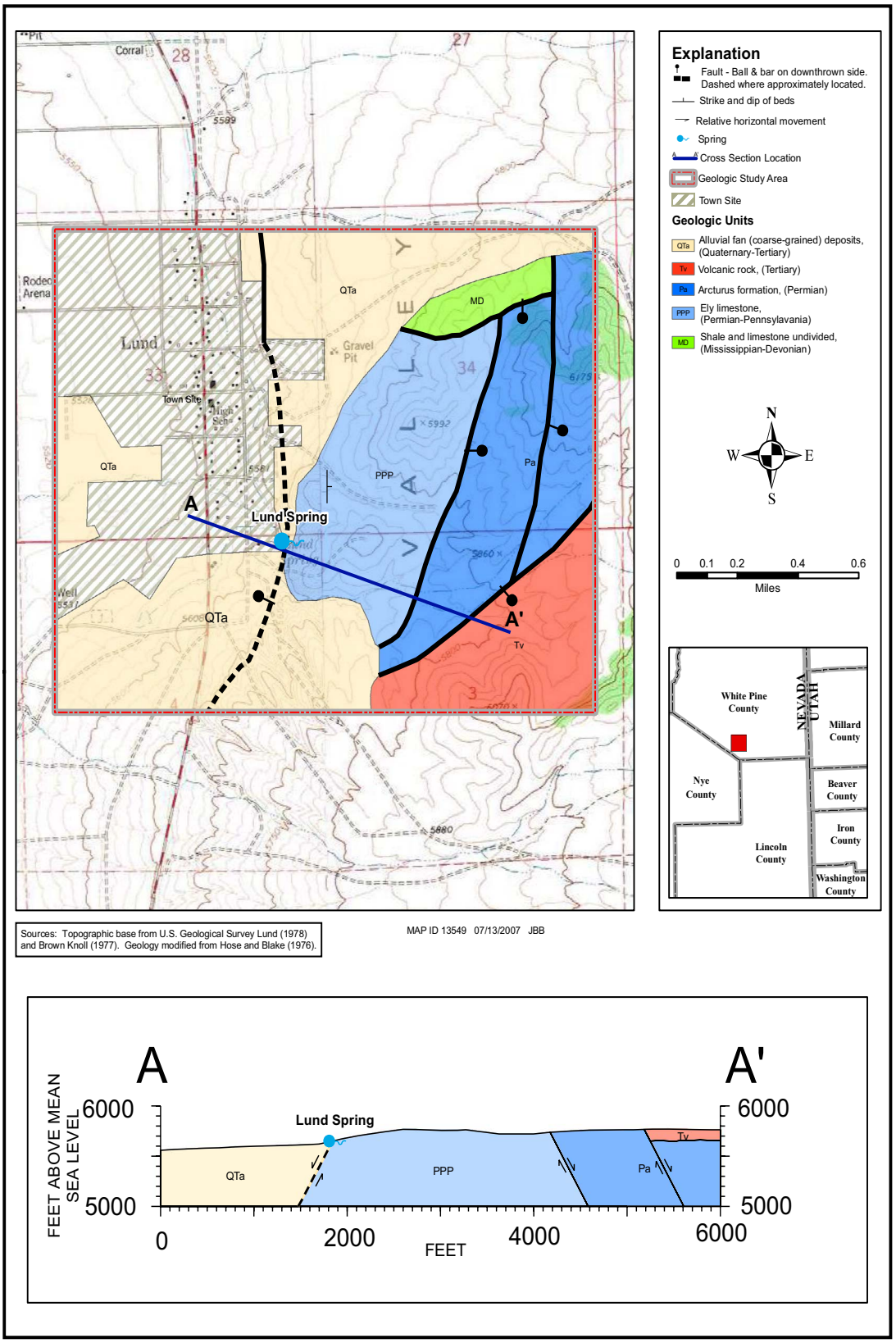


Figure 3-54
Geologic Map and Cross Section of Lund Spring, White Pine County, Nevada

Figure 3-55
View Looking Downstream at the Lund Irrigation Company's Diversion Structure on Lund Spring

3.4.6 Shingle Spring

General Location

Shingle Spring is 50 ft sout h of Shingle Pass Road and approximately 4 mi e ast of SR 318 in a densely forested area. The spring is locat ed in the mountain block approximately 6,600 ft-amsl. Its discharge area has been modified to capture water for livestock watering (Figure 3-56).

Geologic Setting

The spring discharge area is in alluvium below a low hill of undifferentiated volcanic rocks (Tshantz and Pampeyan, 1970).

Discharge

Bunch and Harrill (1984) estimated that Shingle Spring discharge was 0.004 cfs (2 gpm) in August, 1979. A volumetric discharge measurement of approximately 0.001 cfs (0.35 gpm) was taken on September 14, 2004, whe re the spr ing discharges into a w atering trough. The water temperature during this measurement was 17°C. September 7, 2007 the spring was observed to be dry.

Figure 3-56
Discharge Area of Shingle Spring at Shingle Pass, Egan Range

Diversions and Water Use

Shingle Spring is diverted by piping to a large stock tank. No open water was observed at the spring orifice; it is assumed that some kind of collection gallery at the source has been installed to transfer water to the stock tank nearly 50 ft to the east.

3.4.7 Butterfield Spring

General Location

Butterfield Spring is located on private land controlled by the Rocking 13 Ranch located approximately 1 mi west of SR 318 near Sunnyside, Nevada.

Geologic Setting

Butterfield Spring discharges from Quaternary alluvial deposits. Along the eastern side of White River Valley.

Discharge

Discharge from Butterfield Spring is measured biannually by USGS. USGS records indicate that the discharge from the spring ranges from 2.0 to 4.2 cfs (900 to 1,890 gpm). In 2006 the measured discharge at Butterfield Springs was 2.84 cfs (1,275 gpm) in April and 2.62 cfs (1,176 gpm) in September. Discharge measurements are listed in Appendix B.

Diversions and Water Use

The spring appears to be captured by a small reservoir near the ranch. From the ranch, the spring discharges down the alluvial fan and is used by livestock and wildlife.

3.4.8 Flag Springs Group

The Flag Springs Group consists of three different springs: Flag Springs Nos. 1, 2, and 3.

General Setting

The Flag Springs Group is located at the Nevada Division of Wildlife (NDOW) Headquarters for the Wayne Kirsch Wildlife Management Area. The three springs discharge from coarse alluvial gravels in an area 900 ft wide to 1,200 ft long.

Geologic Setting

The Flag Springs Group discharges from Quaternary alluvial deposits.

Discharge

The discharge of Flag Spring No. 1 and Flag Spring No. 3 is measured biannually by USGS. In 2006, the following discharge measurements were made by the USGS at the Flag Springs Group: Flag Spring 1, April 28th 2.4 cfs (1,077 gpm); Flag Spring 2, April 28th 2.65 cfs (1,189 gpm); Flag Spring 3, April 28th 2.19 cfs (983 gpm). Discharge measurements are listed in Appendix B.

Diversions and Water Use

From the ranch, the spring discharges into Sunnyside Creek. It then flows into the Adams-McGill Reservoir, where it is used by livestock and wildlife.

3.4.9 Hardy Springs Group

The Hardy Springs Group consists of the Upper Hardy Springs Group and Hardy Spring Northwest as shown in Figure 3-45.

General Setting

The Hardy Springs Group is approximately 16 mi south of Lund, Nevada and 1.5 mi west of SR 318 (Figure 3-57). The springs discharge from alluvial sediments consisting mainly of fine-grained material. The Upper Hardy Springs Group is comprised of five individual spring orifices that discharge into a main channel that joins the White River.

Figure 3-57
Hardy Spring Northwest, Looking Northeast toward the Egan Range

Geologic Setting

The Hardy Springs Group discharge from Quaternary alluvial deposits. Paleozoic carbonate rocks are present 2 mi to the east in the Egan Range.

Discharge

Discharge was measured at the confluence of the upper group of springs and also at one individual spring located northwest of the upper group. In several of these spring pools, there is a thick layer of fine silt that has settled 0.2 to 0.4 ft below the water's surface. Several of the spring pools appear to boil as water discharges from the orifice. During the September 14, 2005 field investigation, the water regularly discharged through the silt layer through small underwater mud fountains. Large, intermittent eruptions occur for 20 to 30 seconds, after which the "boiling" effect ceases temporarily for a few seconds and then resumes. While this intermittent discharge was observed at the spring, it was not observed in the flume discharge measurements located approximately 20 ft downstream. The pulsating effect was probably dampened by the aquatic vegetation in the channel between the orifice and the flume.

Discharge was measured at the Hardy Spring Northwest and below the confluence of the upper spring group. Total discharge at the Hardy Spring Northwest was measured using a modified Parshall 3-in. flume; the upper spring group was measured using a pygmy current meter. The measured discharges were 0.011 cfs and 0.455 cfs (5 and 204 gpm), respectively. With additional springs contributing to the flow, it is estimated that the total flow into the White River channel is approximately 0.75 to 1.0 cfs (336 to 449 gpm).

Diversions and Water Use

A small diversion was observed 100 to 150 ft downstream of the confluence of the upper group. Currently, the diversion is in disrepair but could be used again if needed. The entire flow of the upper group can be either diverted into an aqueduct that flows directly west or allowed to flow along its current course.

3.4.10 Moorman Spring

General Setting

Moorman Spring is located approximately 20 mi southwest of Lund, Nevada, in White River Valley (Figure 3-58). The spring is located on the Rocking 13 Ranch. The spring pool has been enhanced through anthropogenic activities.

Moorman Spring forms a small pool, approximately 30 ft long and 15 to 20 ft wide, behind an old irrigation diversion structure. The spring discharges from the alluvium along a fault scarp. The pool is partially encircled by a man-made berm that appears to have been used to contain the spring in a reservoir. There are dense grasses in and around the spring area, and the spring pool has moderate algal growth along the edges and bottom. The main orifice of the spring is in the southwestern corner of the spring pool. The area around the spring is fine-grained material that has little to no cementation. A head gate and two aqueducts artificially control Moorman Spring's pool elevation, and all diversion works are in poor condition. The aqueducts discharge northward then turn west and discharge to a large shallow reservoir. From the reservoir, the water discharges into an approximately 2 ft wide channel that continues south for a several miles. Vegetation around the spring consists of grasses and sage brush.

Geologic Setting

Moorman Spring sets in a highly dissected alluvial fan. The Guilmette limestone formation of Devonian age is exposed approximately 2 to 3 mi west of the spring (Kleinhampl and Ziony, 1985). Because of its close proximity to outcrops, a shallow depth to bedrock is possible, especially with the highly dissected alluvium around the site. The site itself is a tufa mound cut by several northeast-trending faults (Figure 3-59). The mound is approximately 10 ft high and forms a subcircular shape around the spring complex. The fault that cuts the mound projects to the southwest along the spring channel for approximately 3 mi.

Figure 3-58
Orifice Pool of Moorman Spring, White River Valley, Nevada

Discharge

The discharge at Moorman Spring is measured semiannually by USGS; the discharge measurements are listed in Appendix B. Since 1985, the average discharge at Moorman Spring has been approximately 0.500 cfs, and the discharge measurements appear relatively constant.

There are two channels joining to form a larger channel that is heavily overgrown with rushes and other aquatic plants. During the 2006 water year the USGS made the following discharge measurements at Moorman Spring: April 27th, 0.53 cfs (238 gpm); September 13th, 0.46 cfs (206 gpm).

Diversions and Water Use

Moorman Spring is diverted approximately 25 ft downstream of the orifice. The pool is controlled by a 1 ft wide head gate that regulates and directs the two aqueducts' discharge. The system appears to have been designed to allow flow to the western aqueduct to be completely shut off, diverting the entire flow to the eastern aqueduct. Raising the head gate would allow the entire flow to be diverted to a large reservoir located several hundred yards to the west. From this reservoir, the discharge could be regulated from the earthen dam at the south end of the reservoir. The diversion structures in both

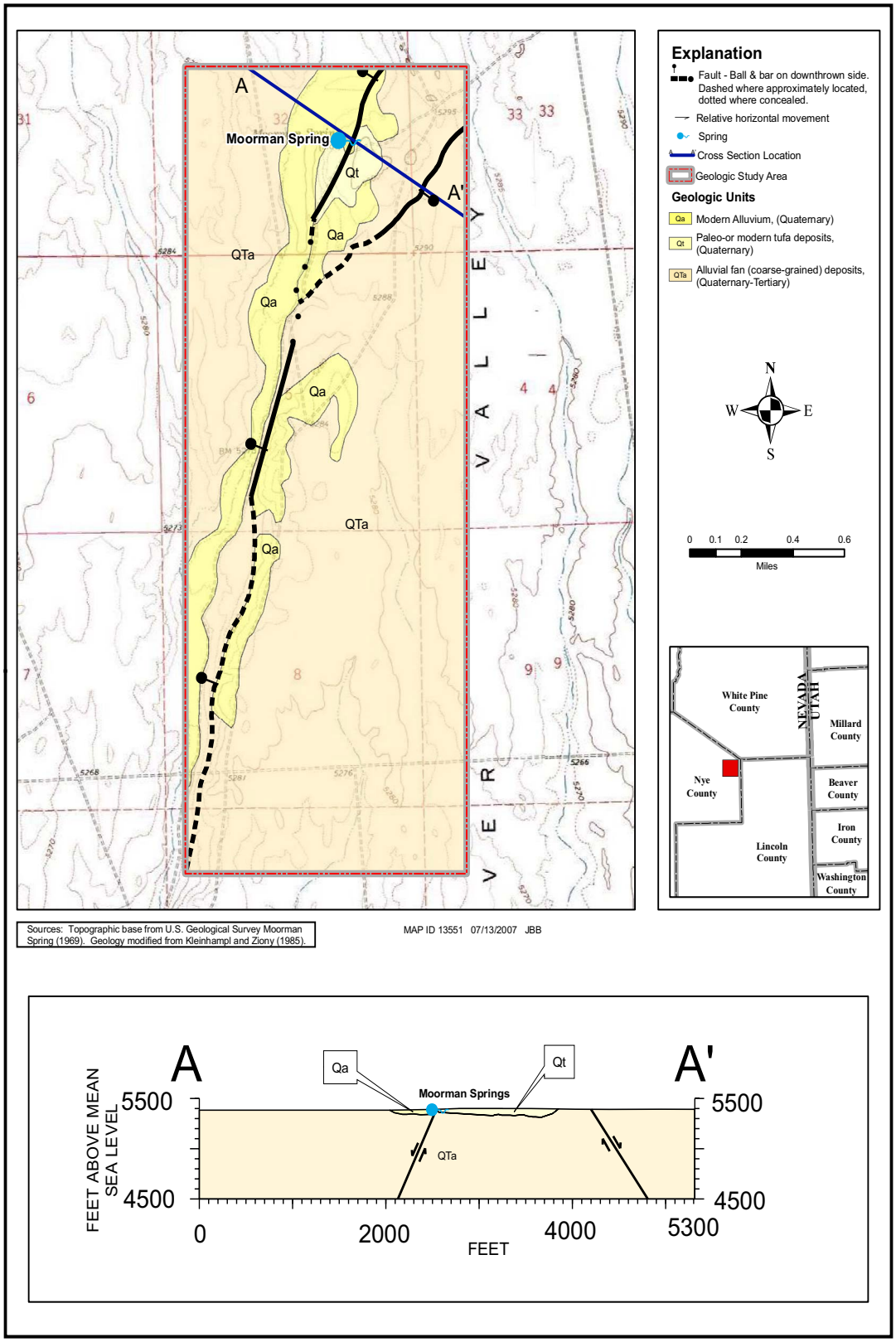


Figure 3-59
Geologic Map and Cross Section of Moorman Spring, Nye County, Nevada

the reservoir and at the spring pool appeared in poor and possibly inoperable condition during the 2004 field investigation. Currently, the water appears to be used for livestock and wildlife.

3.4.11 Hot Creek Spring

General Setting

Hot Creek Spring is in southern White River Valley, approximately 0.75 mi northeast of Hot Creek Butte and 2 mi west of Adams-McGill Reservoir. The Adams-McGill Reservoir is on the Wayne Kirch Wildlife Management Area, administered by NDOW.

Hot Creek Spring forms a large, irregularly shaped pool approximately 65 ft wide by 75 ft long. At the orifice, the pool was measured to be 22 ft deep (Figure 3-60). Hot Creek Spring is the only major spring visited during the field investigations that is undisturbed at the orifice. The spring discharge area is approximately 5 acres in size and is covered by dense grasses. The channel has moderate growth of rushes. The spring discharge forms Hot Creek, which flows southeast to the Adams-McGill Reservoir. At one point in time, it was possible to divert the flow of Hot Creek to Dacey Reservoir in the northeast. The vegetation in and around the spring consists mainly of grasses and reeds.

Figure 3-60
Underwater View (Field of View is 20 ft Wide) of the Hot Creek Spring Main Orifice

Geologic Setting

The Hot Creek Spring tufa mound is exposed to the northwest of the spring complex, which has been cut by northeast-trending faults. The area's most common feature is the large amount of tufa/travertine deposits. When isolated from a spring complex, these deposits are not easily identified as being related either to the spring or to the Pleistocene lake deposits. A prominent northeast-trending ridge of Paleozoic rocks is exposed to the southwest of the Hot Creek Spring complex. The oldest rock on the ridge is the Pogonip Limestone of Ordovician age, followed by the Eureka Quartzite and Ely Springs Dolomite of Ordovician age, and the Sevy Dolomite of Devonian age. These are the most recognizable Paleozoic units in the study area. The rocks dip approximately 25 degrees to the east, striking north 10 degrees east. The ridge forms a prominent northeast-striking horst with distinctive faults flanking the horst. The fault with the greatest influence on Hot Creek Spring is located on the east side of the horst and projects through the principal discharge area in the spring. This west-northwest fault of the horst influences springs approximately 1 mi southwest of the ridge (Figure 3-61). The presence of these Paleozoic rocks in the center of the White River Valley strongly suggest that this is one of the shallowest basins in all of central Nevada.

Discharge

Past discharge measurements had been made semiannually by the USGS. During the 2006 water year, the USGS installed a gaging station on Hot Creek Spring. The measurements are listed in Appendix B. Discharge is measured 50 to 60 ft below the earthen dam and swimming area (Figure 3-62). The channel bottom is soft and is made of fine material to fine sand, with steep grass-lined banks. April 28, 2006 the USGS measured the discharge as 14.0 cfs (6,284 gpm).

Diversions and Water Use

Currently, there are no active diversions on Hot Creek Spring. However, at one time, the total flow of the spring could be diverted northeast to the Dacey Reservoir. The diversion works consist of an earthen dam, a 24-in. diameter galvanized pipe, and a head gate. These works are located approximately 1,200 ft downstream of the spring pool. The dam was constructed across Hot Creek Spring, and the head gate was used to direct and regulate the amount of discharge to each reservoir. The water from Hot Creek Spring discharges to Hot Creek, which flows eastward to Adams-McGill Reservoir and supplies water for livestock and wildlife (Figure 3-62).

3.5 Pahranagat Valley (HA 209)

Pahranagat Valley is located in southern Lincoln County, Nevada, and comprises part of the White River Flow System. The valley is approximately 42 mi long and about 11 mi wide. The valley is bounded by the South Pahroc Range to the east, the Pahranagat Range to the west, and the Hiko Range in the north. In the south, the valley is truncated by the east-northeast-trending Pahranagat Shear Zone.

U.S. Highway 93 travels one-third of the way up the center of the valley and intersects SR 318 and SR 375. SR 318 traverses north to Pahroc and White River valleys, while U.S. Highway 93 continues to Dry Lake Valley to the east. SR 375 traverses west to Tikaboo Valley North. Pahranagat Valley

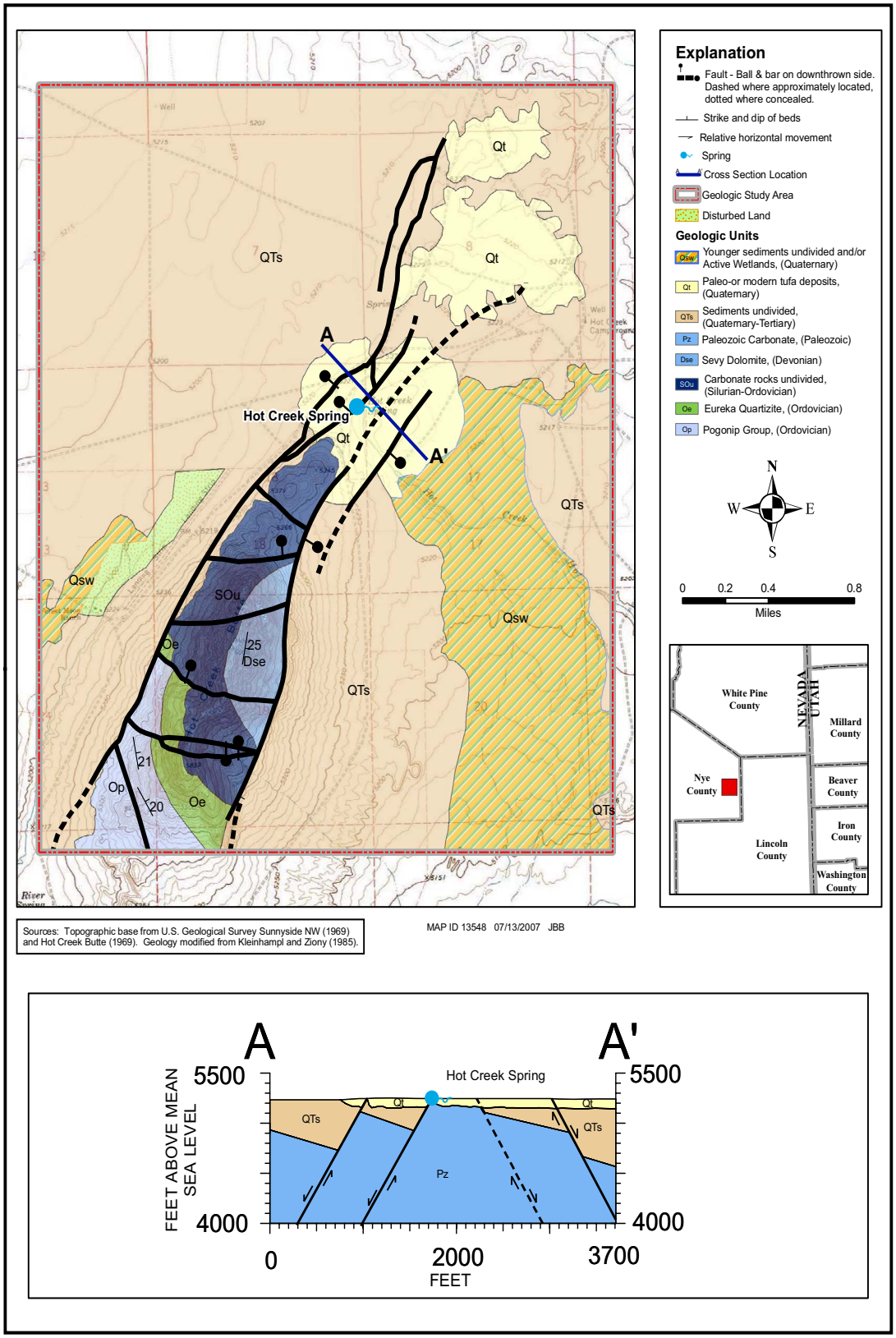


Figure 3-61
Geologic Map and Cross Section of Hot Creek Spring, Nye County, Nevada

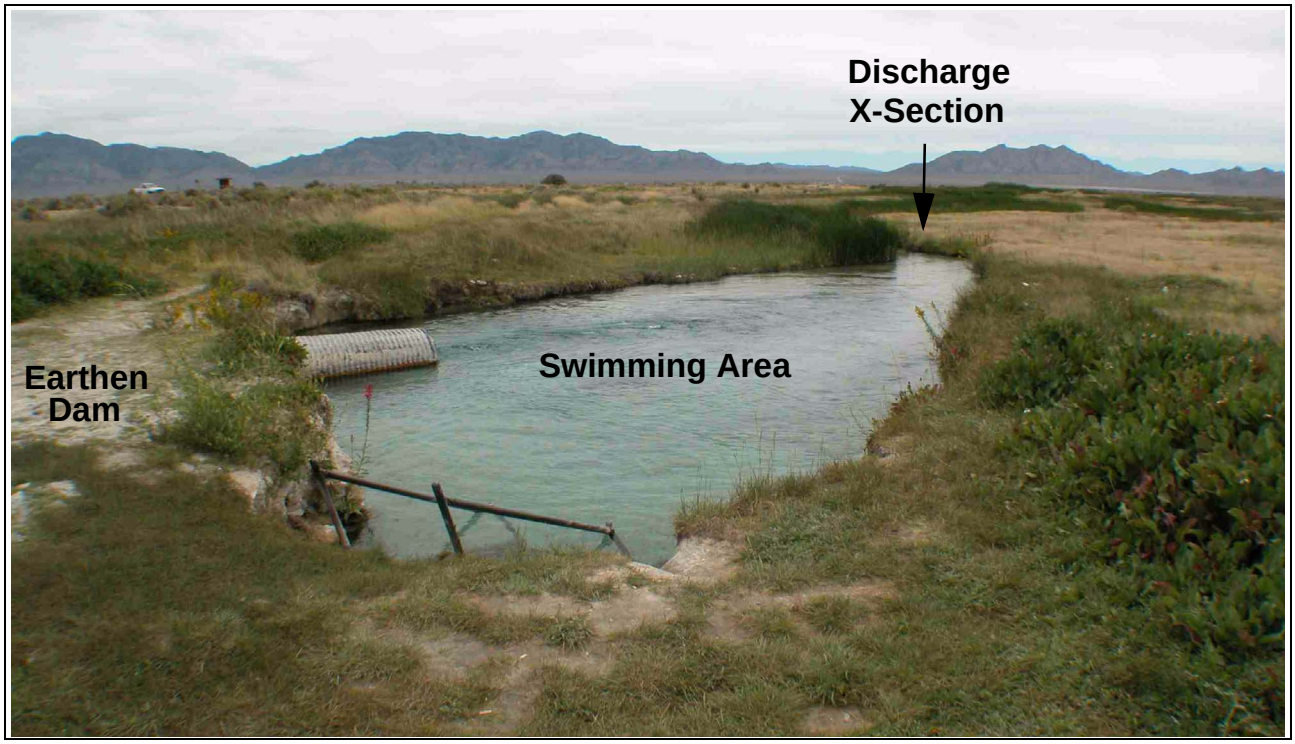


Figure 3-62
Looking East and Downstream of the Old Diversion Structure on Hot Creek Spring

has three population centers: the towns of Alamo, Ash Springs, and Hiko. The economy of the area is primarily based on agriculture and ranching. In the Paiute Indian language "Pahranagat" translates to "valley of many waters" (Hardman and Miller, 1934).

Although there are many springs and seeps found throughout the valley, this study inventoried 6 springs in Pahranagat Valley, 5 are discussed in detail in the following sections. Figure 3-63 provides the locations of these springs and their magnitudes of flow and temperature. Two springs of third-order magnitude (Hiko and Crystal Springs) and one spring of second magnitude (Ash Springs) discharge approximately 25,400 afy (35 cfs) into the valley; this is consistent with the estimate made by Eakin (1963).

3.5.1 Hiko Spring

General Setting

Hiko Spring is on the Cannon Ranch approximately one-half mile northeast of Hiko, Nevada, in the north end of Pahranagat Valley (Figure 3-64). The water at Hiko Spring has been in constant use since approximately 1865 when a camp was established. In 1866, a five-stamp mill was established at Hiko, and the population grew. Hiko was Lincoln County's seat from 1867 to 1871, when it was moved to Pioche, Nevada. Only one of the original buildings is still intact at the original Hiko town site. The spring discharges from the base of the Hiko Range and is used for domestic, agricultural, and wildlife purposes (State of Nevada, 2004b).

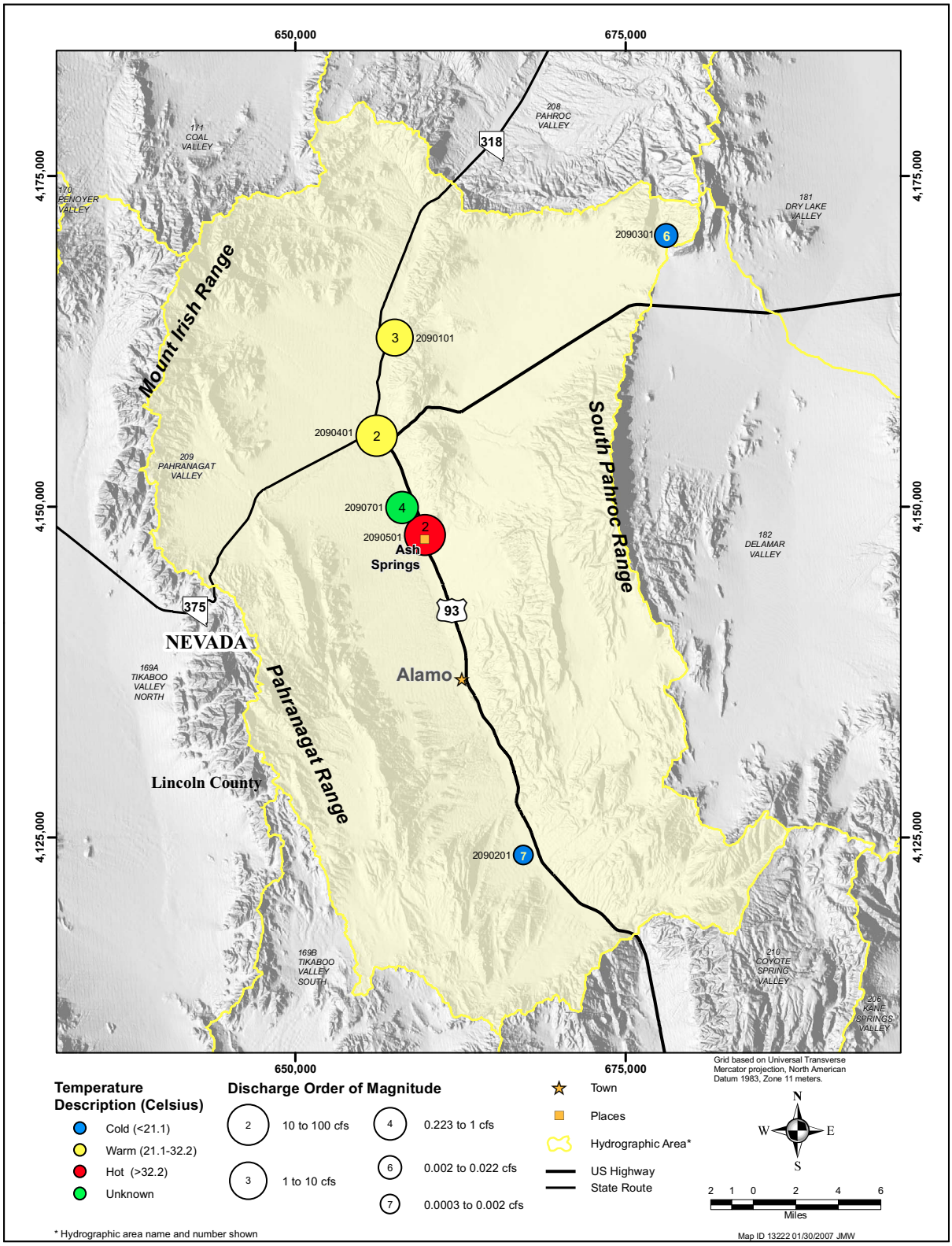


Figure 3-63
Map Showing the Location, Magnitude of Discharge, and Temperature of Selected Springs in Pahranagat Valley, Nevada

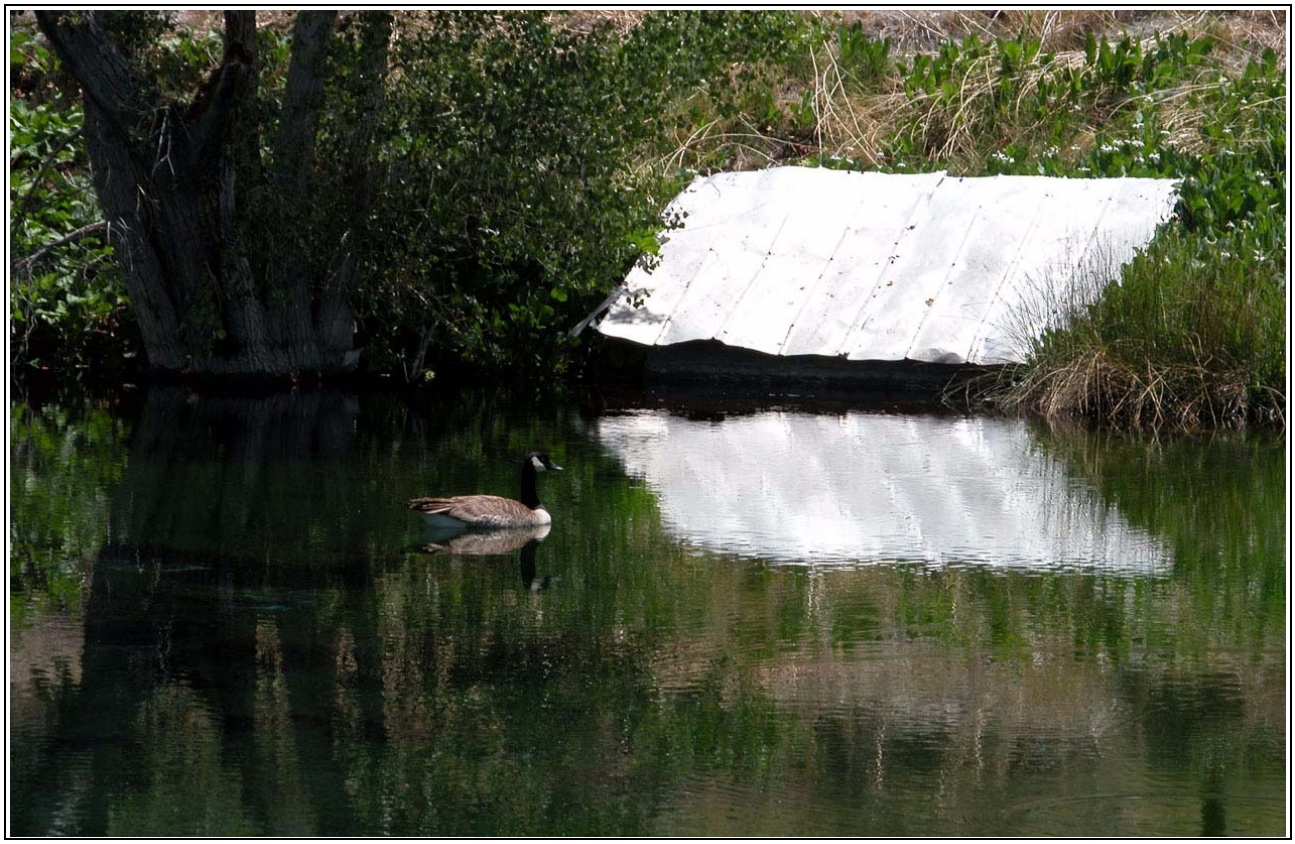


Figure 3-64
Hiko Spring Reservoir and Springhouse

Geologic Setting

The rock immediately east of the orifice is a 20-ft-thick, heavily faulted and brecciated, brown, fine-grained limestone and limy-dolomite, with an attitude of north 32 degrees east. The brown limestone contains many white high-angle calcite veins, perhaps the locations of former orifices. The brown limestone is faulted against (on the north), and apparently overlain by, a yellow-weathering thin- to medium-bedded limestone that dips northeast and is at least 50 ft thick. This yellow limestone is rich in fossils, dominated by spiriferoid brachiopods; some corals were also found. The fault strikes about north 40 degrees east and controls the spring, although at the orifice the rock appears to be a faulted, eastward-plunging anticline. The yellow rock was mapped by Tschanz and Pampeyan (1970) as a down-faulted block of Devonian Guilmette Formation (Dg), and their descriptions of this unit and its fossils are the same as the descriptions listed previously. The brown limestone may have been mapped as Devonian Simonson Dolomite by Tschanz and Pampeyan (1970), but it is not clear on their map. The map also shows it as Guilmette Formation, faulted down against a high hill of Simonson Dolomite farther to the east. A spring mound (Qs) forms a hill about 100 yards southwest of the spring pool. North and south of the spring, a possible north-striking fault appears to cut off the western edge of older fan deposits (Qfo) and may pass through the spring mound and continue southward as the same fault one-half mile east of Crystal Springs. In addition, a major north-striking range-front fault, downthrown on the west side, is present about one-half mile to the east of Hiko Spring (Figure 3-65).

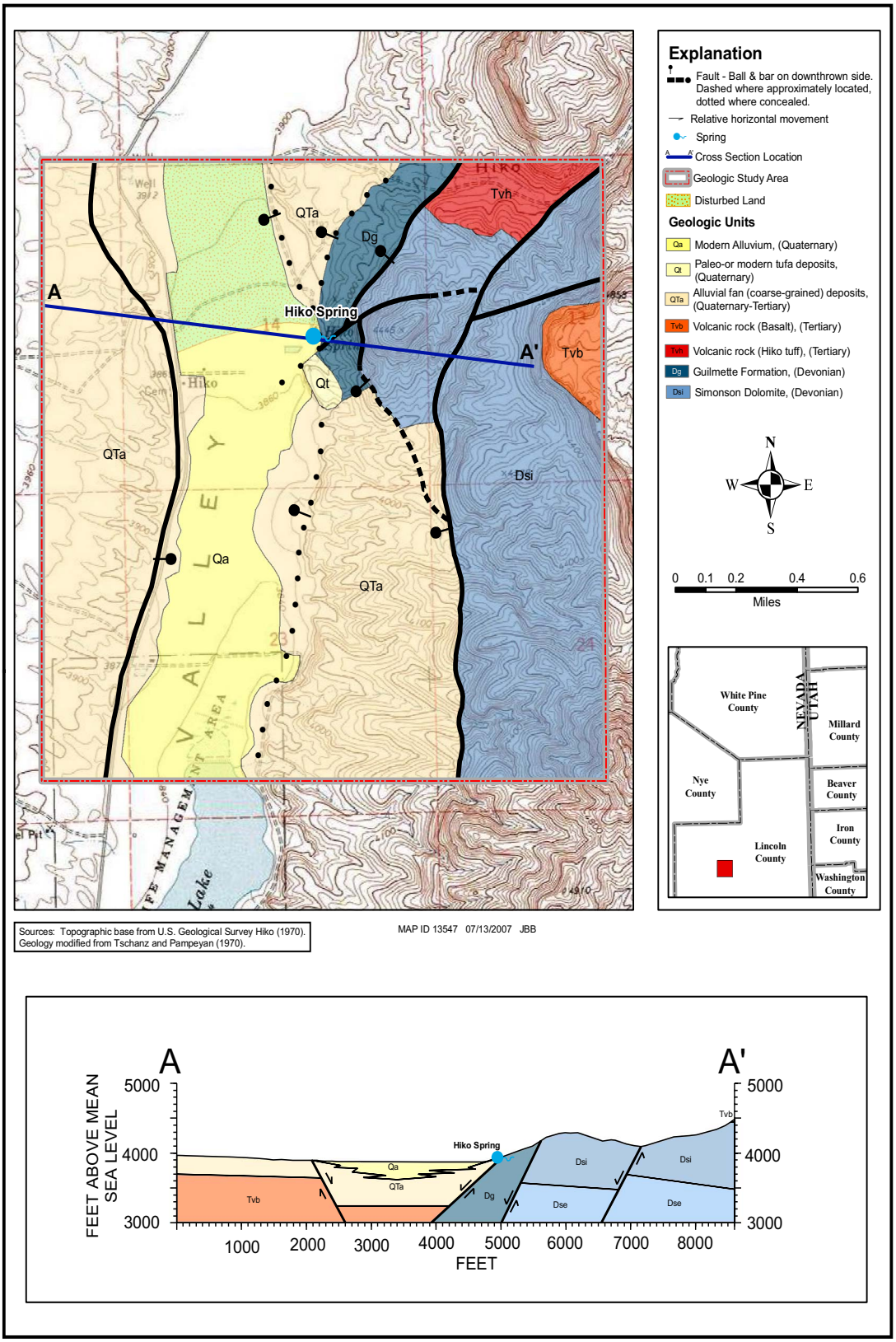


Figure 3-65
Geologic Map and Cross Section of Hiko Spring, Lincoln County, Nevada

Discharge

An average discharge of approximately 6.5 cfs (2,917 gpm) was reported at Hiko Spring from 1934 to 1943 (Smith, 1938, 1942, and 1944). During 1963 a discharge of 5.36 cfs (2,406 gpm) was reported by Eakin (1963). This lower value may have been caused by the poor condition of the diversion structure. During the field investigation on July 19, 2004, it was determined that a measurement could not be made because of the diversion works configuration. However, by correlating past discharge rates of Hiko Spring and the past and current discharge rates of Crystal and Ash springs, the discharge rate of Hiko is estimated to be 6 cfs (2,693 gpm).

Spring discharge measurements are listed in Appendix B. However, there is a possible error in the measurements reported by Carpenter (1915) and Hardman and Miller (1934) for Hiko Spring and Crystal Springs. Carpenter (1915) reported discharges to be 9 cfs and 7 cfs (4,040 and 3,140 gpm), respectively. While Carpenter's (1915) descriptions of the springs are correct, it is possible that he assigned the wrong discharge value to each spring (i.e., since 1938, Crystal Springs flow has been greater than Hiko Spring). This apparent reversal happens again with the 1931 measurements of Hardman and Miller (1934), who reported Hiko Spring's discharge is 11.96 cfs (5,370 gpm) and Crystal Springs' discharge is 5.96 cfs (2,680 gpm).

Diversions and Water Use

In 1939, a dam was constructed in front of the spring orifice to form a reservoir. The dam had three equally-sized flumes installed at the same elevation to automatically divide the water equally among the water-right holders. Only two of the wooden flumes were operated simultaneously so that the water-right holders could each receive half of the total spring flow. In 1939, small springs at the base of the dam were reported (Smith, 1940).

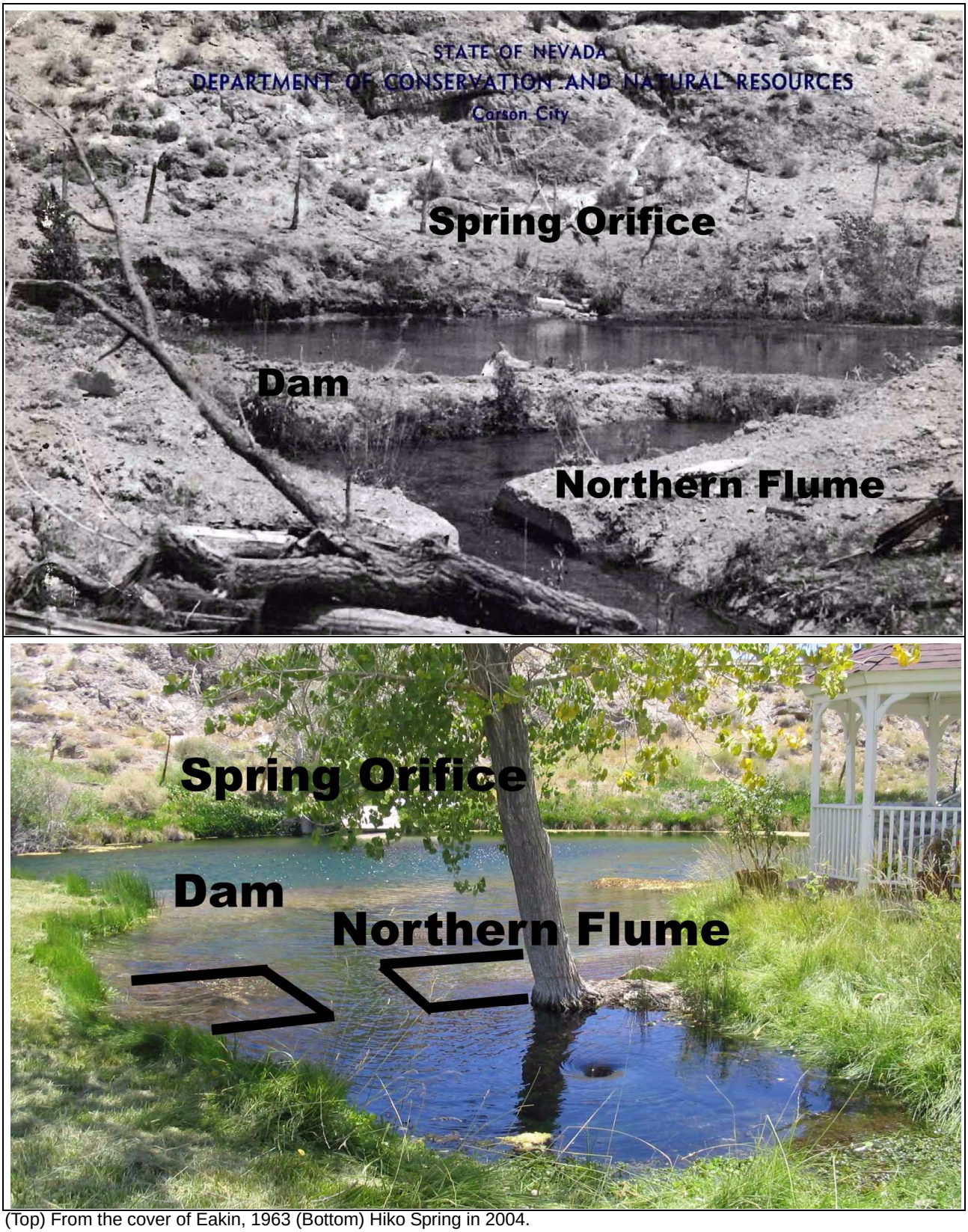
The water was diverted using this diversion system until approximately 1980, when a new dam was constructed and the old diversion ditches were converted to pipelines (Figure 3-66). Currently, several pipes enter a submerged springhouse/box located at the orifice. Occasionally, a pump can be heard pumping water from the spring for domestic uses.

3.5.2 Crystal Springs

General Setting

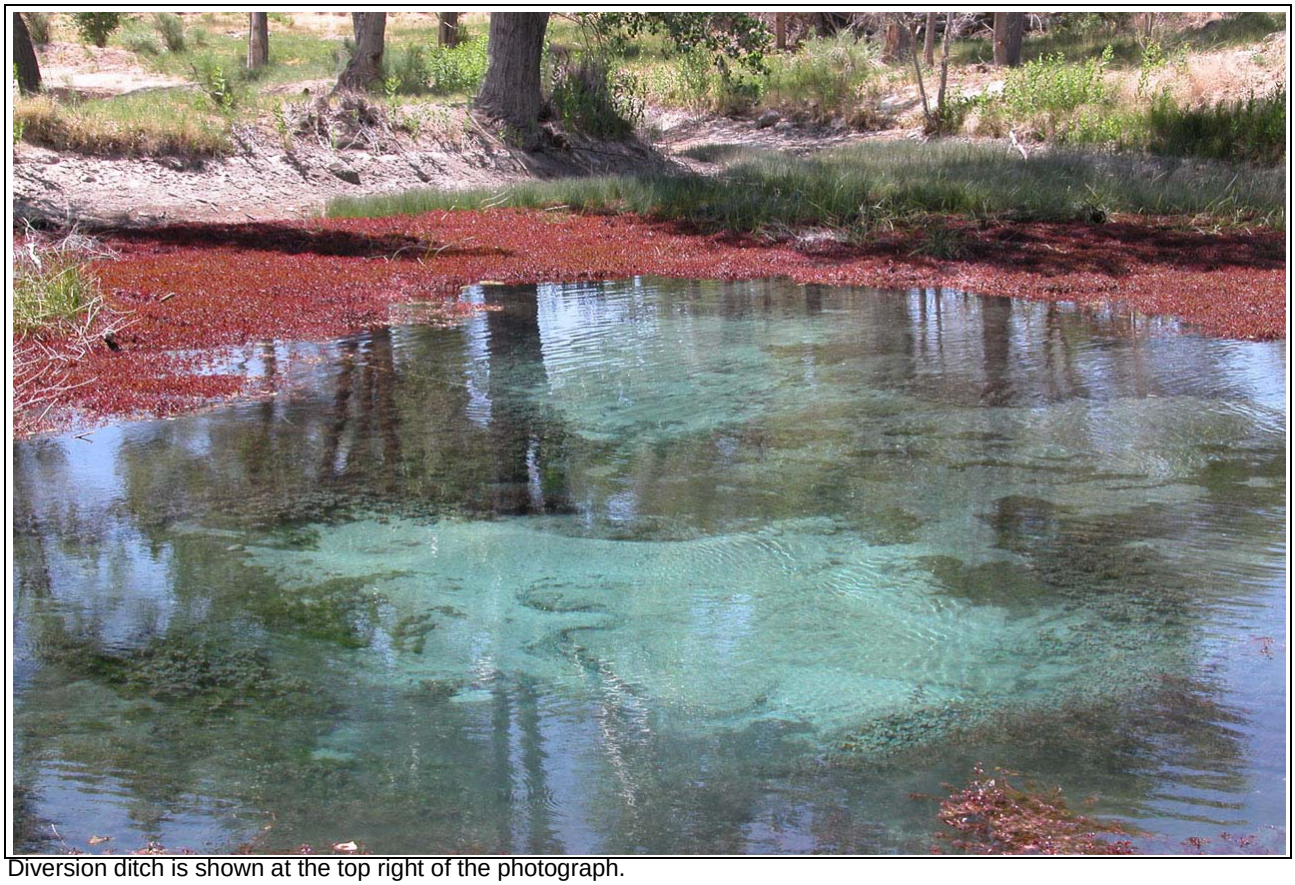
Crystal Springs is located approximately a quarter mile west of the SR 318/SR 375 Junction and one-half mile west of the U.S. Highway 93/SR 318 Junction in Lincoln County. Crystal Springs is located approximately 4 mi south of Hiko, Nevada, and 5 mi north of Ash Springs, Nevada (Figure 3-67).

With the discovery of silver in Pahranagat Valley in 1865, Lincoln County was created. Crystal Springs was designated as the provisional county seat in 1866. This locale, used as a watering place and campsite, was the principal stopover on the Mormon Trail alternate route (State of Nevada 2004a).



(Top) From the cover of Eakin, 1963 (Bottom) Hiko Spring in 2004.

Figure 3-66
Hiko Spring Diversion Structure



Diversion ditch is shown at the top right of the photograph.

Figure 3-67
Crystal Springs Reservoir and Orifice

Geologic Setting

The Crystal Springs are approximately 2 mi west of the Hiko Range. The main orifice discharges from bedrock on the east side of a small hill of limestone and sandstone. On the east side of the hill, the rock is largely a fault breccia in which blocks of westward-dipping rock protrude from a mass of breccia. The rocks on the east side of the hill (the lowest part of the sequence) consist of 50 ft of dirty medium-grayish-brown, resistant, finely crystalline, well-bedded limestone and interbedded thin-bedded limestone and dark-brown sandstone in which ripple marks, cross-beds, and soft-sediment deformation structures are present. Mottled, apparent burrows are common in the limestone. The top of the hill includes a 10-ft-thick, light tan, resistant sandstone/quartzite that resembles the Ordovician Eureka Quartzite. It is overlain by 20 ft of interbedded limestone and sandstone and, in turn, by 30 ft of limestone that makes up the western side of the hill. South of the top of the hill, a north 45 degrees east steeply dipping fault places the sandstone sequence against limestone south of the fault. The unit underlying the hill is correlated with the upper part of the Ordovician Pogonip Group (Op), which underlies the Eureka Quartzite in the area. This upper part of the Pogonip Group has been mapped as the Antelope Valley Limestone in areas to the south (Tschanz and Pampeyan, 1970). The main fault that places the hill against alluvium to the east is assumed to strike north and underlie the spring complex east of the hill. It is shown as such on Figure 3-68. The age of the fault cannot be determined and is assumed to be Pliocene or late Miocene. About one-half

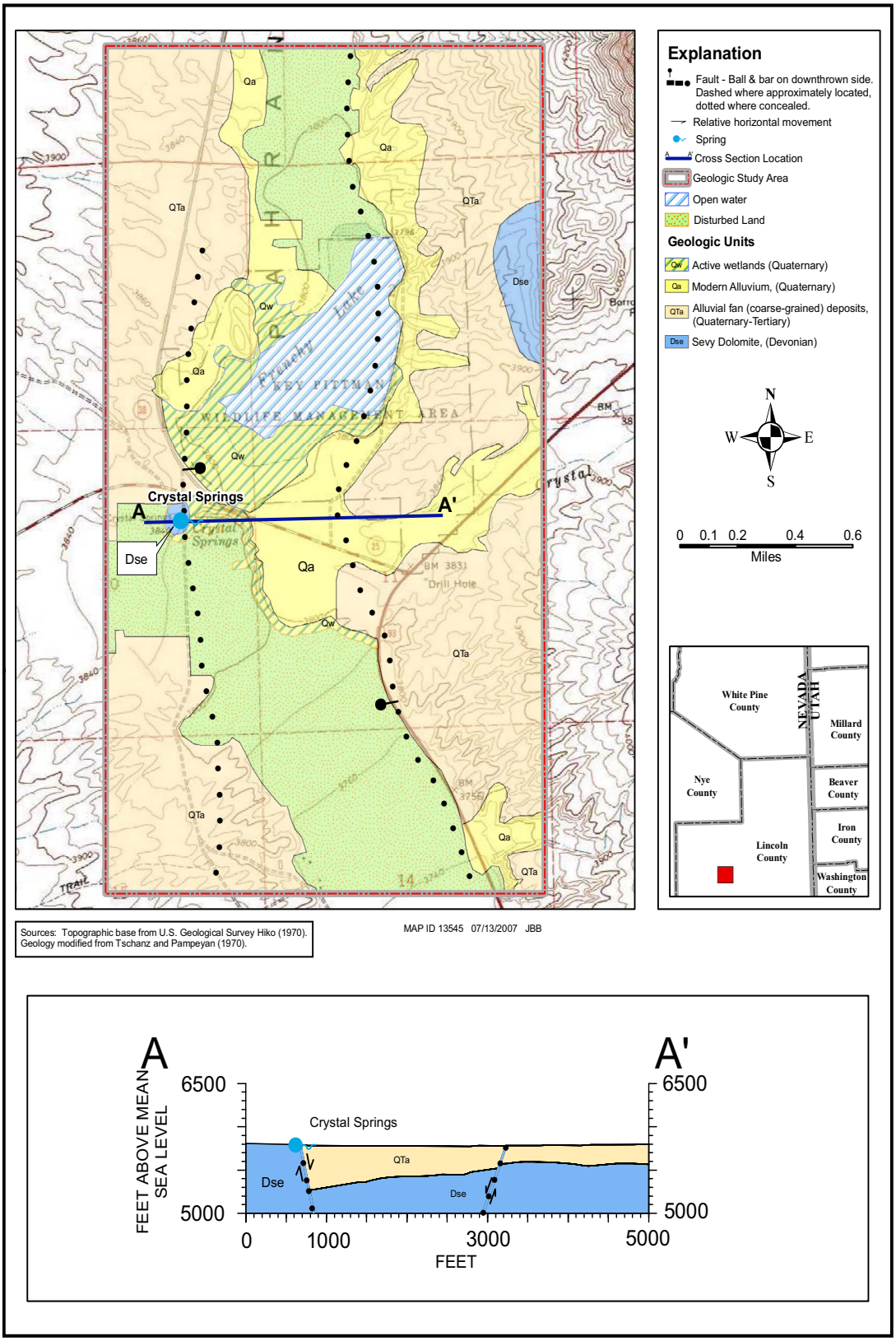


Figure 3-68
Geologic Map and Cross Section of Crystal Spring, Lincoln County, Nevada

mile to the east of Crystal Springs (just east of U.S. Highway 93), middle to early Pleistocene older fan deposits (Qfo) are cut by a fault that is downthrown on the west side and are overlain by young fan deposits (Qfy); the fault thus is early to middle Pleistocene. Two miles to the east, the west side of the Hiko Range is bounded by a north-striking normal fault with down throw to the west side; the range here contains west-dipping Sevy Dolomite (Tschanz and Pampeyan, 1970). This fault is overlain by older fan deposits, so is likely pre-Quaternary.

Discharge

Discharge at Crystal Springs is currently measured with a permanently installed 4-ft Parshall flume and a continuous stage recorder operated by USGS. The discharge at Crystal Springs has been documented with miscellaneous measurements since 1912 and with a continuous recording gage since late 1985. The periods of record for the gage are from 1985 to 1988, 1990 to 1994, and 1998 to present (Figure 3-69). In 2004 the USGS installed a gaging station on the irrigation diversion.

The Crystal Springs discharge measurements range from 1 to 14 cfs (450 to 6,280 gpm). The reason for this large difference is that the combined discharge from the main orifices is intermittently diverted to an irrigation ditch supplying agricultural uses to the south. The diversion structure and its operation are discussed in detail in the subsequent section. Except for leakage from the dam or flow seeping through the banks containing the secondary spring orifice, the entire flow may be diverted for irrigation.

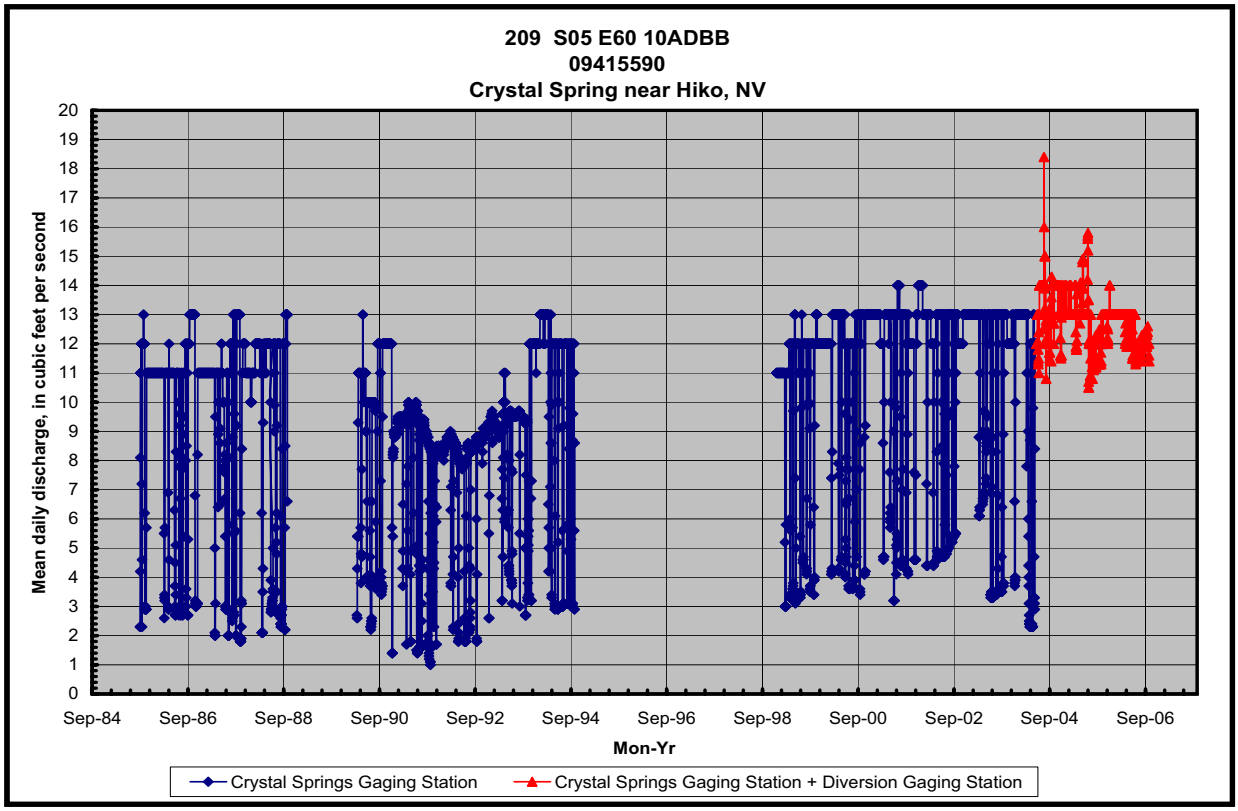


Figure 3-69
Published Mean Daily Values for Crystal Springs near Hiko, Nevada

The continuous record at Crystal Springs is heavily biased due to the irrigation diversion located approximately a quarter of a mile upstream of the gaging station. While the gage was accurately recording data, it was not recording the entire flow. At times the recording of partial discharge of a spring may be useful, it is misleading when trying to determine the spring's historical discharge. In 2004, a supplemental gage on the diversion channel was installed to correct this problem and in 2005 the first data from this gage was published by the USGS. Water years 1990 through 1993 and 1999 were not used in the analysis of this spring. The water years 1990 and 1999 were incomplete years and 1991 to 1993 appear to have been diverted every day. When examining the mean daily values previous to October 6, 1991 the undiverted mean daily discharge is 12 cfs (5,386 gpm) the mean daily value does not reach this value again until October 19, 1993. During this time period the maximum daily discharge is 11 cfs for 7 days in April 1993. The most probable cause for this decline in discharge was a problem with the diversion. Data from 2005, 2006, and the period of record are summarized below (Table 3-2).

Table 3-2
Annual Discharges at Crystal Spring

Water Year	Crystal Springs (09415590)		Crystal Springs Diversion (09415589)		Total Combined Discharge	Days Diverted	Percentage of Year Diverted (%)	Percent of Annual Discharge Diverted (%)
	Annual Discharge (afy)	Average Annual Discharge (cfs)	Annual Discharge (afy)	Average Annual Discharge (cfs)				
2005[a]	8,110	11.2	1,230	1.70	9,340	78	21	13
2006[b]	8,190	11.3	923	1.28	9,113	67	18	10
2005-2006 Average	8,150	11.2	1,080	1.49	9,226	72	20	12
Average for the period of record[c]	7,855	10.8	1,090	1.51	8,945	75	21	12

[a]Water Years 1990, 1991, 1992, 1993 and 1999 are excluded as explained in the text.
[b]Data from USGS Water Resources Data - Nevada Water years 2005 and 2006.
[c]These values are extrapolated from the Crystal Springs gaging station record published by the USGS.

Diversions and Water Use

The water users of Crystal Springs organized into the Alamo Irrigation Company in 1922. The irrigation ditches were lined with concrete to minimize losses and allowed easier cleaning (Smith, 1948).

The diversion system consists of a small earthen dam and a single head gate to control the spring's discharge. When the head gate is closed, the entire spring flow is diverted into an irrigation canal and is used for irrigation along Pahranagat Valley's western side. When the head gate is open, the entire discharge continues down the main channel and is used for irrigation.

3.5.3 Ash Springs

General Setting

Ash Springs is located in Ash Springs, Nevada, and is approximately 600 ft east of U.S. Highway 95. The spring is used for irrigation, domestic supply, and recreation and consists of many orifices that extend more than a quarter mile along the north-south-trending Hiko Fault. The spring area was developed in the 1970s and through the 1980s as a privately owned resort. The main orifice is on public land administered by the BLM and has a large picnic area and swimming pool (Figure 3-70).

Figure 3-70
Main Pool and Orifice of Ash Springs

Geologic Setting

The bedrock about 20 ft east of the main pool was mapped as the Devonian Sevy Dolomite (Tschanz and Pampeyan, 1970). It is a light gray, resistant, fine-grained, well-bedded dolomite with an attitude of north 30 degrees east 26 degrees west. The bedrock forms a low, northeast-north-trending fault scarp along the springs. The trace of the fault and the local geology are shown on Figure 3-71. The faulting brecciated the bedrock along most of this scarp. Sitting on the dolomite just east of the main pool is a small (about 6 × 10 ft in plan view) eroded mass of light gray and tan, resistant, porous, spring carbonate (limestone that fizzes violently in acid). It also is likely early Pleistocene. Bedrock pieces and dikes of carbonate are scattered along most of the range front east of the springs. A hill of tufa deposits, presumably early Quaternary and about 30 ft high and at least 300 × 100 ft in plan, lies just south of the spring complex, south of the burned-out lunchroom of the old resort and just east of

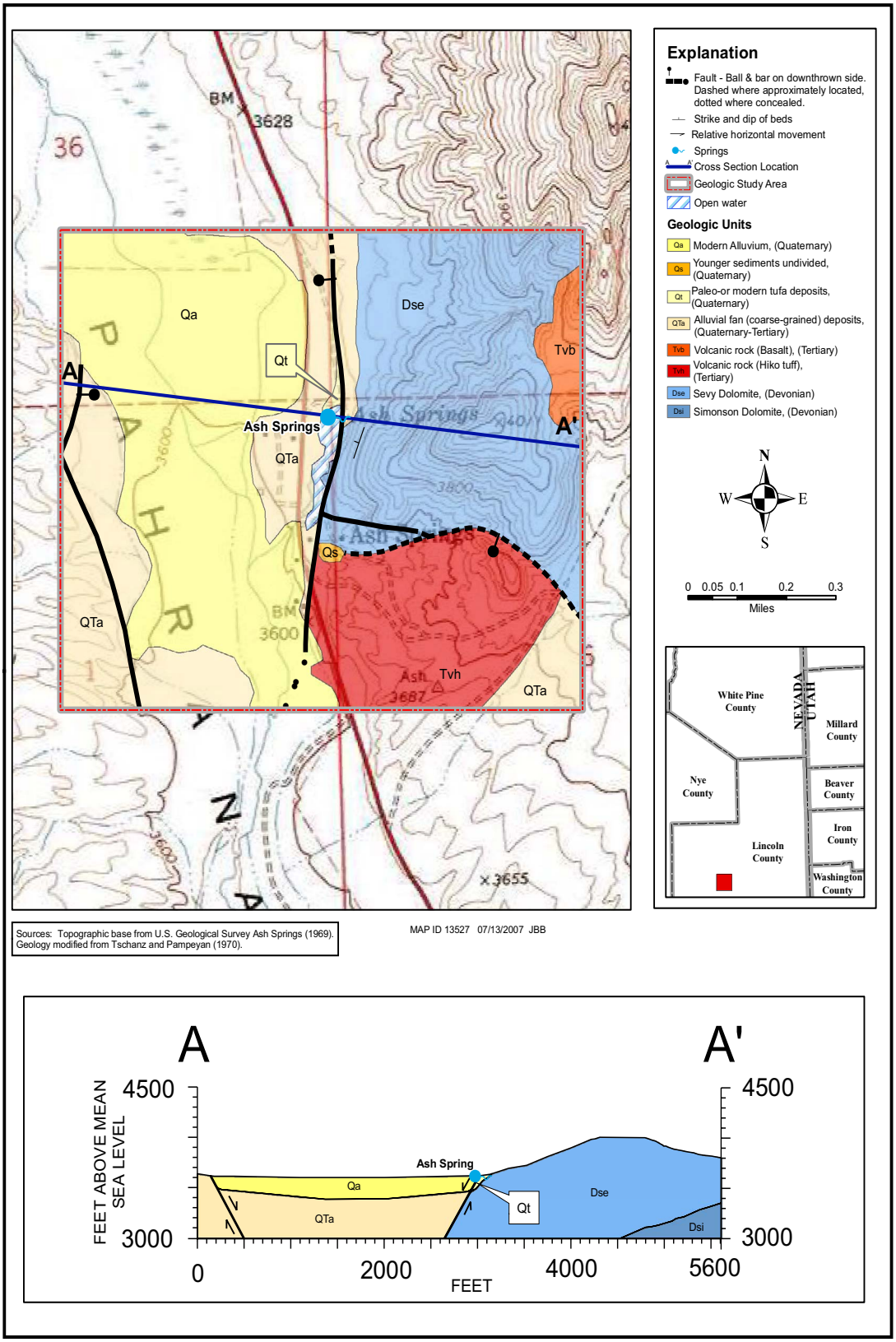
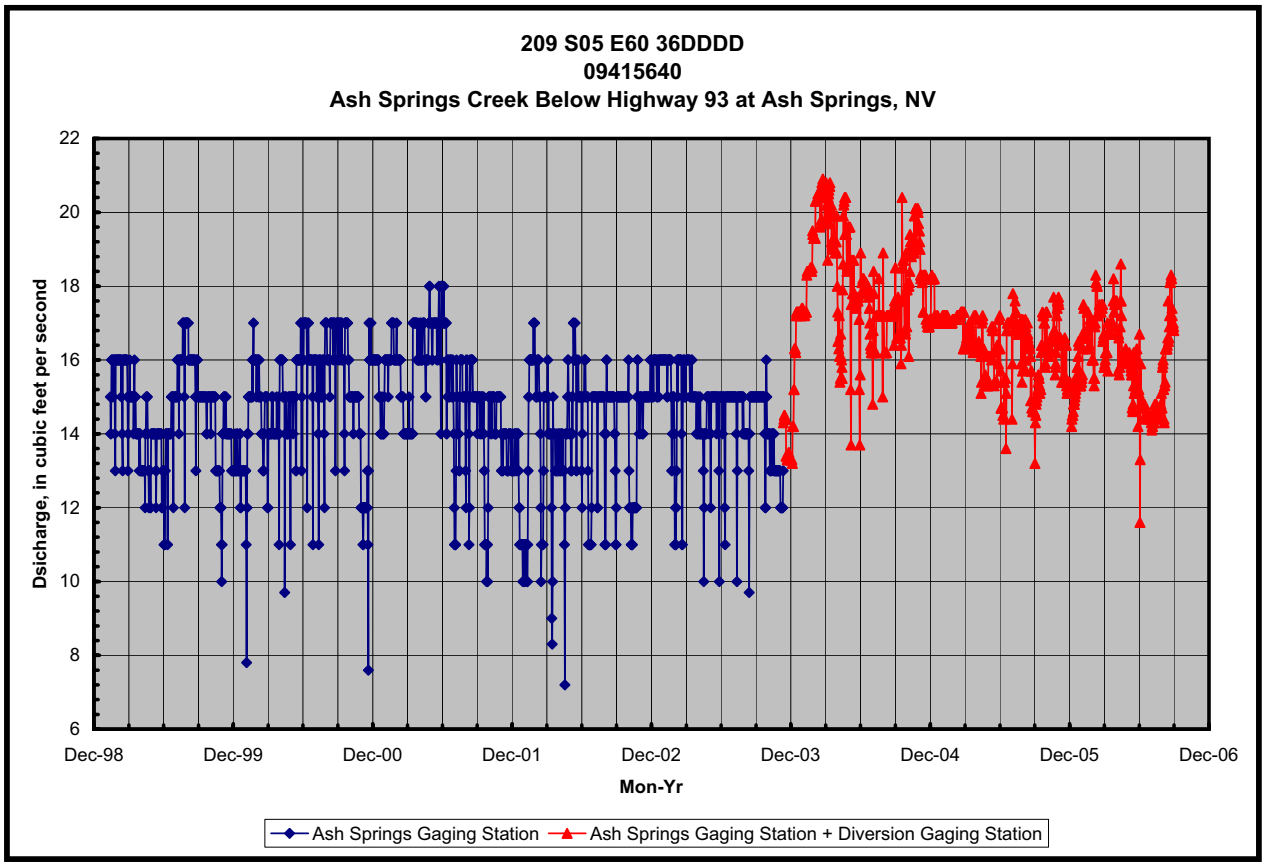


Figure 3-71
Geologic Map and Cross Section of Ash Springs, Lincoln County, Nevada

U.S. Highway 93. Low hills east and southeast of this spring mound consist of Hiko Tuff, an 18-Ma ash-flow tuff derived from the Caliente caldera complex to the east (Rowley et al., 1995). These volcanic rocks are faulted down against the Sevy Dolomite to the north along generally east-striking faults. The main fault passes through a small canyon to the east and through the large spring mound. A parallel fault to the north, with brecciated Sevy Dolomite and spring limestone north and south of it, has an attitude of north 80 degrees east. This was mapped in a small canyon just east of the bathhouse.

Discharge

Discharge at Ash Springs has been measured intermittently since 1912, similar to Hiko Spring and Crystal Springs. Prior to the 2004 water year, only the discharge in the main channel was measured by the USGS. Like the discharge record for Crystal Springs, the discharge record for Ash Springs consists only of a partial record because a portion of the flow was intermittently diverted for agricultural purposes above the gage. Currently, the USGS operates gaging stations on both the main channel and on the diversion channel. Figure 3-72 shows a hydrograph of the spring discharge at Ash Springs. However, there may be some natural variations in the spring's discharge. A notable example of this was reported by Smith (1944).



Large variations in flow are diversions above the gage.

Figure 3-72
Hydrograph of Published Ash Springs Mean Daily Discharge Values

Donald K. Perry, Water Commissioner for the Pahranagat Lake and Tributaries, reported that on July 4, 1943, the spring increased in discharge from 17.36 to 18.56 cfs (7,790 to 8,330 gpm) and remained at this discharge until he left the valley on September 3, 1943. He described this event as "very unusual" and that the spring had been known to decrease in discharge, but this was the first time it had shown any increase in discharge.

Discharge data are summarized below in Table 3-3.

Table 3-3
Annual Discharges at Ash Springs

Water Year	Ash Springs (09415640)		Ash Springs Diversion (09415639)		Total Combined Discharge (afy)	Days Diverted	Percentage of Year Diverted (%)	Percentage of Annual Discharge Diverted (%)
	Annual Discharge (afy)	Average Annual Discharge (cfs)	Annual Discharge (afy)	Average Annual Discharge (cfs)				
2005[a]	10,080	13.9	2,190	3.03	12,270	365	100	18
2006[a]	8,780	12.1	2,810	3.88	11,590	365	100	24
2005-2006 average	9,430	13.0	2,500	3.46	11,930	365	100	21
Average for the period of record	10,360	14.3	2,221[b]	3.07[b]	12,581[b]	--	--	18[b]

[a] Data from USGS Water Resources Data-Nevada Water Years 2005 and 2006.
[b] Period of record for Ash Springs Diversion gage is December 12, 2003 to present. The missing days for the 2004 water year were estimated.

The spring currently discharges into a channel that is incised 4 to 6 ft in the alluvial sediments. The spring's main pool is fed by a series of pipes and originates from the buried orifice. The spring area is approximately a quarter mile long and is controlled by a head gate near U.S. Highway 93. From this head gate, the flow can be diverted into another channel that transfers water to different parts of the valley for irrigation.

Diversions and Water Use

Ash Springs has been diverted to supply agricultural uses since the early 20th century, much like Crystal Springs and Hiko Spring. Currently, the springs are used to supply domestic needs to the gas station east of U.S. Highway 93 and for recreation, wildlife, and agricultural uses. The discharge record reflects these diversions, so all the data reported reflects only the water that passed the gaging station, not what was actually discharged from the springs. Since late 2003, this problem has been corrected by the installation of a supplemental gage at the irrigation diversion. The domestic diversion for the gas station is still reflected in the discharge record.

3.5.4 Solar Panel Spring

General Setting

Solar Panel Spring also known as Cottonwood Spring is approximately 9.5 mi south of Alamo, Nevada and 1 mi west of U.S. Highway 93 on the U.S. Fish and Wildlife Service (USFWS) Pahranagat Wildlife Refuge (Figure 3-63), and 1.5 mi south of the Refuge Headquarters along the Corn Creek/Alamo Road.

The spring pool is approximately 20 ft in diameter and 3 to 5 ft below the surrounding land surface. The pool is about 1 to 2 ft deep. The pool is heavily overgrown with cattails and other types of aquatic vegetation. A metal catwalk extends from the western edge of the spring to the 12-in. stilling well, which is accessed via a trap door. A ring of vegetation consisting primarily of broad leafy plants and grasses surrounds the pool. A small grove of six to ten Cottonwood trees is located along the northern edge of the spring area (Figure 3-73).

Figure 3-73
Solar Panel Spring Discharge Area

Geologic Setting

The spring discharges from alluvium just east of a small terrace that is most likely a fault scarp.

Discharge

Measurements of discharge and water temperature were conducted at Solar Panel Spring during the May 24, 2004 field investigation. The discharge was estimated at 0.25 to 1.0 gpm, and the water temperature was 20.3°C. The discharge was measured approximately 15 yards downstream of the spring's orifice near a permanently installed 3-in. flume. The channel reach from the orifice to the flume is heavily overgrown with cattails and other aquatic plants and is incised approximately 1 to 1.5 ft below land surface. The width of the channel is about the same as the flume. The heavily overgrown channel controls the flow from the spring pool.

Other devices at the spring include an unknown type of probe installed in a stilling well and a 30-degree V-notch weir plate. All of these devices, including the 3-in. Parshall flume, were in poor condition. The probe in the stilling well was disconnected from the power source, and the stilling well was overgrown with cattails. Water no longer passes over the 30-degree V-notch weir plate, and it is also overgrown. The Parshall flume was no longer level and also overgrown. It is estimated that 50 percent of the flow was by passing the flume at the time of the field investigation.

During the Spring of 2007 the USFWS reinstalled the 3-in. Parshall Flume and have recorded variable flow rates of .027 cfs (12 gpm) in April 2007 and less than 0.002 cfs (< 1 gpm) in June of 2007. They measured a temperature of 16°C, and anticipate the release of this data in mid 2008 (USFWS, written communication).

Diversions and Water Use

No diversions were observed during the field investigation. The spring's water is used for wildlife.

3.5.5 Pahroc Spring

General Setting

Pahroc Spring is located in the southern Pahroc Mountains, 30 mi west of Caliente, Nevada, and 15 mi east of Hiko, Nevada. In 1915, Pahroc Spring was listed as an important source of water while crossing Delamar and Dry Lake valleys (Carpenter, 1915). However, one of the earliest descriptions (1898) of Pahroc Spring is found in the journal of Carl A. Purpus, who while he was collecting plants for the University of California herbarium, described the spring as "a meager spring that trickled from under a rock" (Purpus, 1898). A complete listing of the reported discharge from Pahroc Spring is listed in Appendix B.

Geologic Setting

Pahroc Spring discharges from Tertiary volcanic rocks.

Discharge

Carpenter (1915) reported the spring's discharge as 0.004 cfs (2 gpm) in 1912. Bunch and Harrill (1984) reported discharge of 0.009 cfs (4 gpm). On July 19, 2004, the spring's discharge was

estimated at 0.022 cfs (10 gpm). The discharge area is 200 ft wide and has dense vegetation, making it hard to obtain an accurate discharge estimate.

Diversions and Water Use

Water from Pahroc Spring is currently used for livestock and wildlife. Ruins of an old stone cabin and stone corrals are located at the spring. The water was used by travelers between the mines near Pioche, Nevada, and Pahranagat Valley (Carpenter, 1915).

3.6 Cave Valley (HA 180)

Cave Valley is a narrow valley located between White River and Lake valleys, with portions of the basin residing in both White Pine and Lincoln counties. Cave Valley comprises a portion of the White River Flow System. The valley trends in a north-south direction, typical of the Basin and Range Province. Cave Valley is approximately 40 mi long and averages approximately 12 mi in width. The valley is bounded in the east by the southern portion of the Schell Creek Range and the smaller Fairview Range, and in the west by the Egan Range. The southern portion of the valley is truncated where the Egan and Schell Creek ranges merge. Ranching is the principal economic activity in the valley. Historically, there was limited mining activity from 1870 to 1940s associated with the Cave Mining District, which was formed on March 17, 1869, and produced a small amount of ore from the area. Cave Valley is accessible using improved gravel roads that enter the valley through Shingle Pass (west side from SR 318), Sidehill Pass (east side from U.S. Highway 93), and other smaller and less maintained dirt roads. This study inventoried 2 springs in Cave Valley. Figure 3-74 shows the locations of these springs and their magnitudes of flow and temperature. A description of each of these springs is provided in the following sections.

3.6.1 Cave Spring

General Setting

Cave Spring is located at the far southwest corner of a low northeast-southwest-trending hill approximately 3 mi southeast of Parker Station, Nevada, and 65 mi northwest of Bristol Wells, Nevada (Figure 3-74). The area was listed by Hose et al. (1976) as having abundant water (Cave Spring).

Geologic Setting

Tschanz and Pampeyan (1970) mapped the ridge north of the spring as Cambrian Pole Canyon limestone flanked by and faulted down against Cambrian Pioche shale. In addition to these two faults, there is a northeast-striking fault that is intersected by an east-west fault that dips 72 degrees to the north. This fault has been trenched where a dipping angle of 72 degrees was obtained. The limestone and possibly shale dip 30 to 32 degrees to the southeast and strike north 45 degrees east. The limestones are thin- to medium-bedded oolitic limestone with corals. This unit could correlate with the lower part of the Highland Peak Formation. Between the spring orifice and ridge of

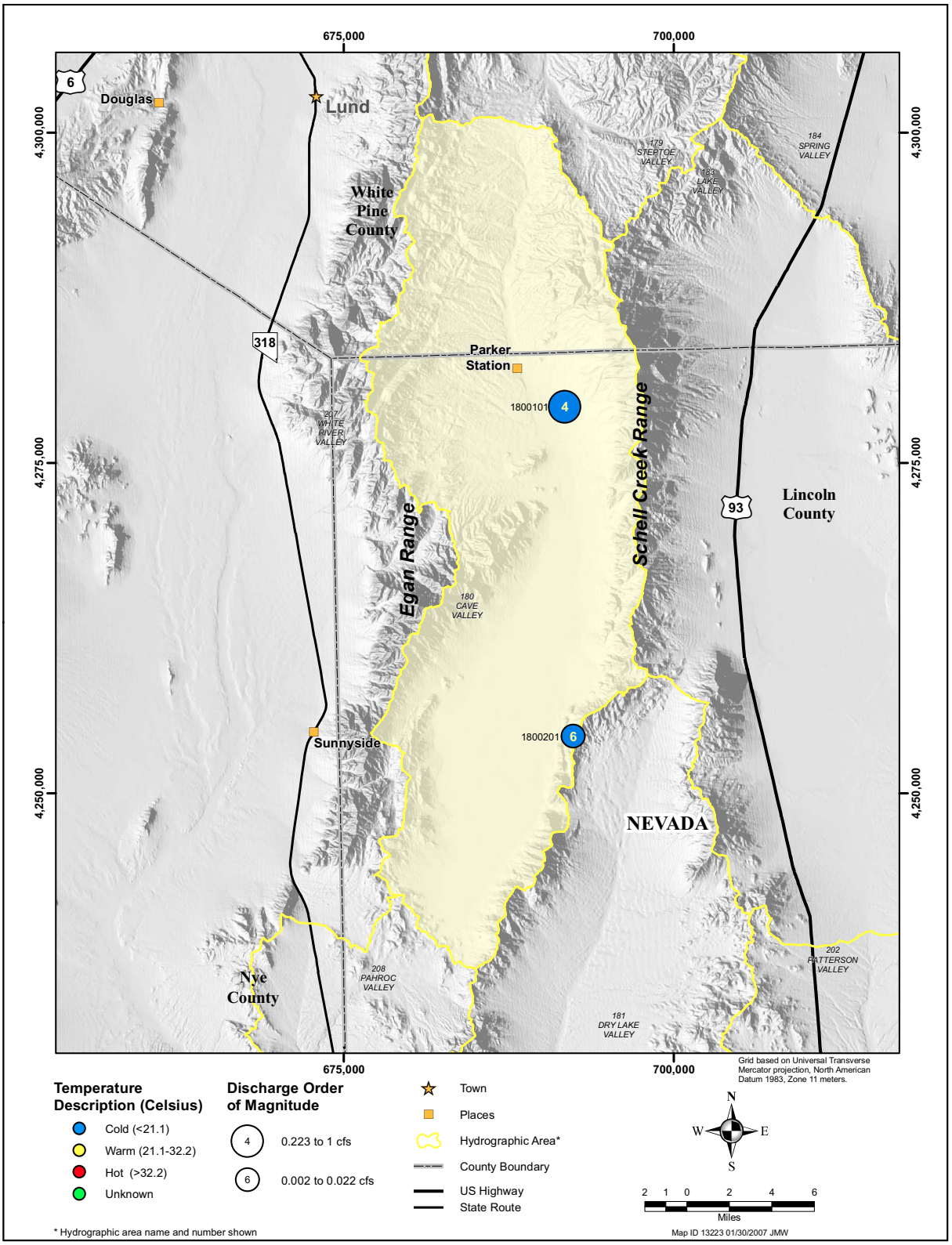


Figure 3-74
Map Showing the Location, Magnitude of Discharge, and Temperature of Selected Springs in Cave Valley, Nevada

Cambrian rocks, there is a large basin-range fault that drops this section into the valley floor (Figure 3-75).

Discharge

The spring discharges from Pole Canyon Limestone into a small creek incised 3 to 4 ft into the alluvium. In 1968, Mifflin (1968) described the spring discharge as variable, although it is not clear whether the reported discharge was measured, estimated, or based on another investigator's data. Bed material during periods of high flow is coarse angular limestone gravels; in periods of low flow the coarse material is covered with fine material and moss (Figure 3-76).

Discharge was measured at Cave Spring three times during separate field sessions in June, July, and September of 2004. All measurements were taken within 50 ft of the orifice. The measurements decreased in discharge during each visit. The measured discharges on June 23, July 16, and July 29, 2004, were 0.233, 0.081, and 0.022 cfs (105, 36 and 10 gpm), respectively. On September 14, 2004, the spring was again visited and was observed to be dry. During the 2006 water year the discharge of Cave Spring was measured 3 times. In October 2006 it was 0.033 cfs or approximately 15 gpm. In July and September of 2007 the spring was observed to be dry. The decrease in discharge rates during the summer months and the cold temperature of the water indicate that this spring is fed solely by local precipitation.

Diversions and Water Use

Currently, there are no active diversions at the spring. Historically, it appears that a small, hand-dug well was placed in the stream channel and used to divert water by pump. The water now flows freely down the channel into a small reservoir in the center of the valley and is used for livestock.

3.6.2 Sidehill Spring

General Setting

Sidehill Spring is located on the western flank of the Egan Range approximately 3.5 mi north of Sidehill Pass on the east side of Cave Valley (Figure 3-77). The spring area appears to have been modified by heavy equipment to increase the spring discharge yield. An area approximately 200 ft long has been disturbed. A fence was built to isolate the spring from livestock and wildlife, but much of the fence has been knocked down.

Geologic Setting

The spring discharges from volcanic tuffs.

Discharge

On June 21, 2004, a spring discharge of 0.006 cfs (3 gpm) was measured from a discharge pipe inside a buried 500-gallon propane tank used as a collection box. Based on field observations, this measurement likely represented only about three quarters of the total discharge.

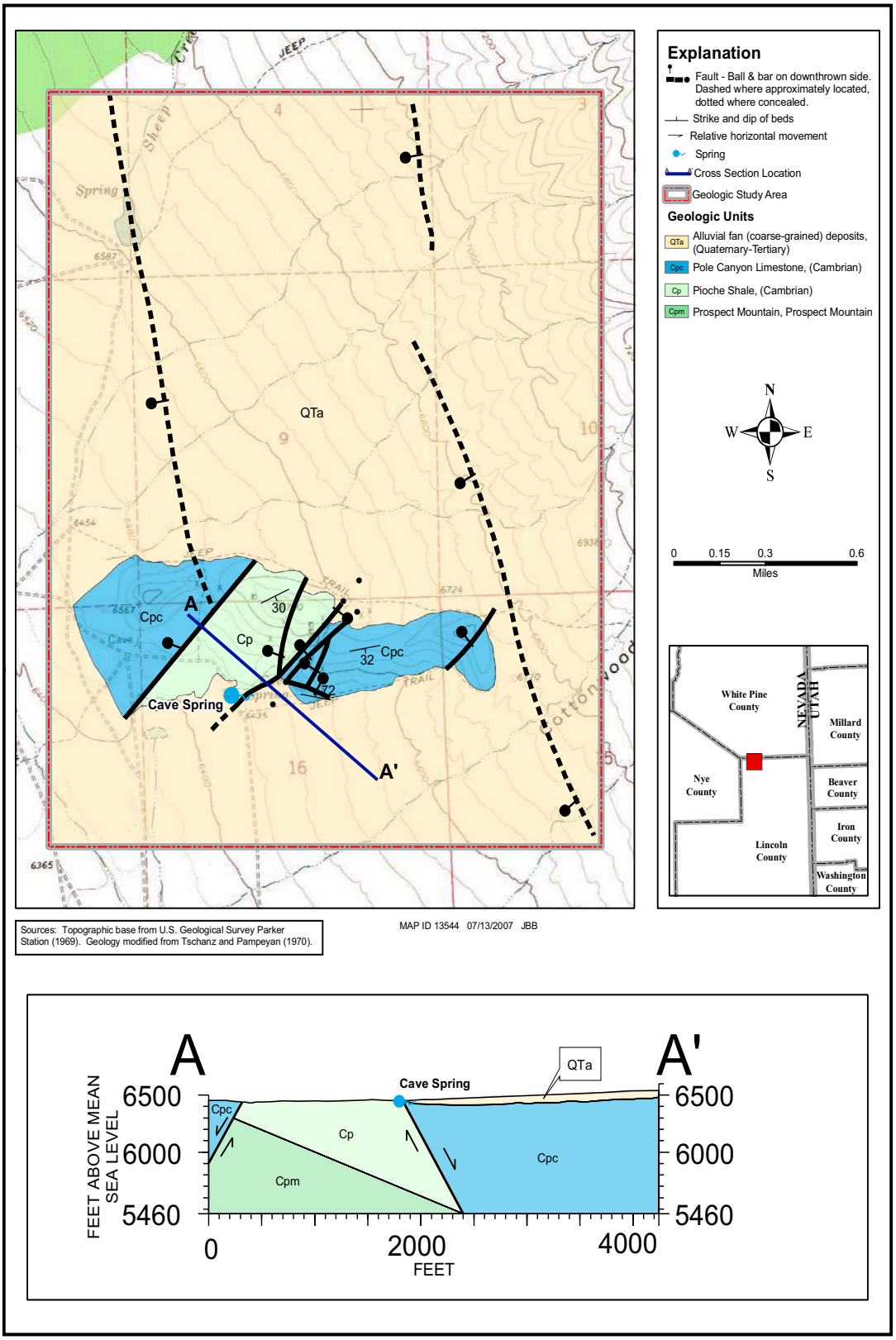


Figure 3-75
Geologic Map and Cross Section of Cave Spring, Lincoln County, Nevada

(Top) October 1962, discharge is estimated at less than 10 gpm.
(Bottom) June 29, 2004, discharge is 0.022 cfs (10 gpm).

Figure 3-76
Cave Spring

Figure 3-77
View Looking Northwest at Sidehill Spring Discharge Area

Diversions and Water Use

The water is piped from the disturbed area into the tank described previously. The discharge is then routed through another pipe to a large livestock tank on the valley floor, suggesting that the water is used for livestock watering.

3.7 Delamar Valley (HA 182)

Delamar Valley is located in central Lincoln County, with Pahranagat Valley to the west, Dry Lake Valley to the north, and Kane Springs and Coyote Spring valleys to the south. It comprises a portion of the southern third of the White River Flow System. The valley is bounded in the east by the Delamar Mountains and on the west by the Pahroc Range. The valley is approximately 25 mi long and averages 17 mi wide.

Gold was discovered in Delamar Valley in 1891 at a location later known as Helene, Nevada. In 1893, gold was discovered about two miles to the south at a location later known as Delamar. Production of gold stopped around 1909, and both towns were deserted over the next few years (Tschanz and Pampeyan, 1970).

Water had been developed from several of the small mountain block springs which include Squaw, Baker, Nesbit and Horn springs, (Carpenter, 1915) to support mining activities in Delamar Valley. Because the volume of water developed from these springs proved to be too small, an attempt was made to drill a well in Delamar Valley to augment the spring supply. The well was drilled to a total

depth of 900 ft without encountering any water. Unsuccessful in acquiring groundwater, the mines installed a pumping plant in Stine, Nevada, and pumped the water from Meadow Valley Wash to Delamar Valley via a 3.5-in. pipe. A second pipeline was installed within a year. The pipelines required three pump stations to lift the water over the 2,100 ft of elevation change from Meadow Valley Wash to Delamar Valley.

Delamar Valley is accessible using improved gravel roads that intersect U.S. Highway 93 and enter the valley from the north, south, and west (Alamo). This study inventoried one spring in Delamar Valley. Figure 3-78 provides the location of this spring and its magnitude of flow and temperature. A description of this spring is provided in the following sections.

3.7.1 Grassy Spring

General Setting

Grassy Spring is located approximately 4.5 mi north of Helene, Nevada, and 40 mi south of Bristol Wells, Nevada, along the western flank of the Delamar Mountains (Figure 3-79).

Geologic Setting

The spring discharges from alluvial sediments near where they are in contact with volcanic rocks.

Discharge

During a field investigation on June 2, 2004, the discharge of the spring was measured at less than 0.001 cfs (0.5 gpm). The discharge was measured volumetrically at the livestock tank, approximately 300 ft west of the spring.

Diversions and Water Use

The spring is currently used for livestock. The discharge is captured at the source and is transferred to a livestock tank through a 1-in. diameter black polyvinyl tubing.

3.8 Dry Lake Valley (HA 181)

Dry Lake Valley has sometimes been known as Bristol Valley and Desert Valley in the past (Carpenter, 1915). The valley is in Lincoln County and is part of the White River Flow System. Carpenter (1915) reported that the only permanent water sources in Dry Lake Valley consisted of the Bristol Well and Bailey, Maloy, and Coyote springs. The valley is approximately 60 mi long and averages approximately 20 mi wide. The valley is bounded in the west by the southern extension of the Schell Creek Range. The Pahroc, Fairview, Bristol and Highland Peak ranges bound the valley to the east.

Dry Lake Valley is accessible using improved gravel roads that enter the valley from the south from U.S. Highway 93, and from the east from U.S. Highway 93 in Lake Valley through Bristol Pass. This

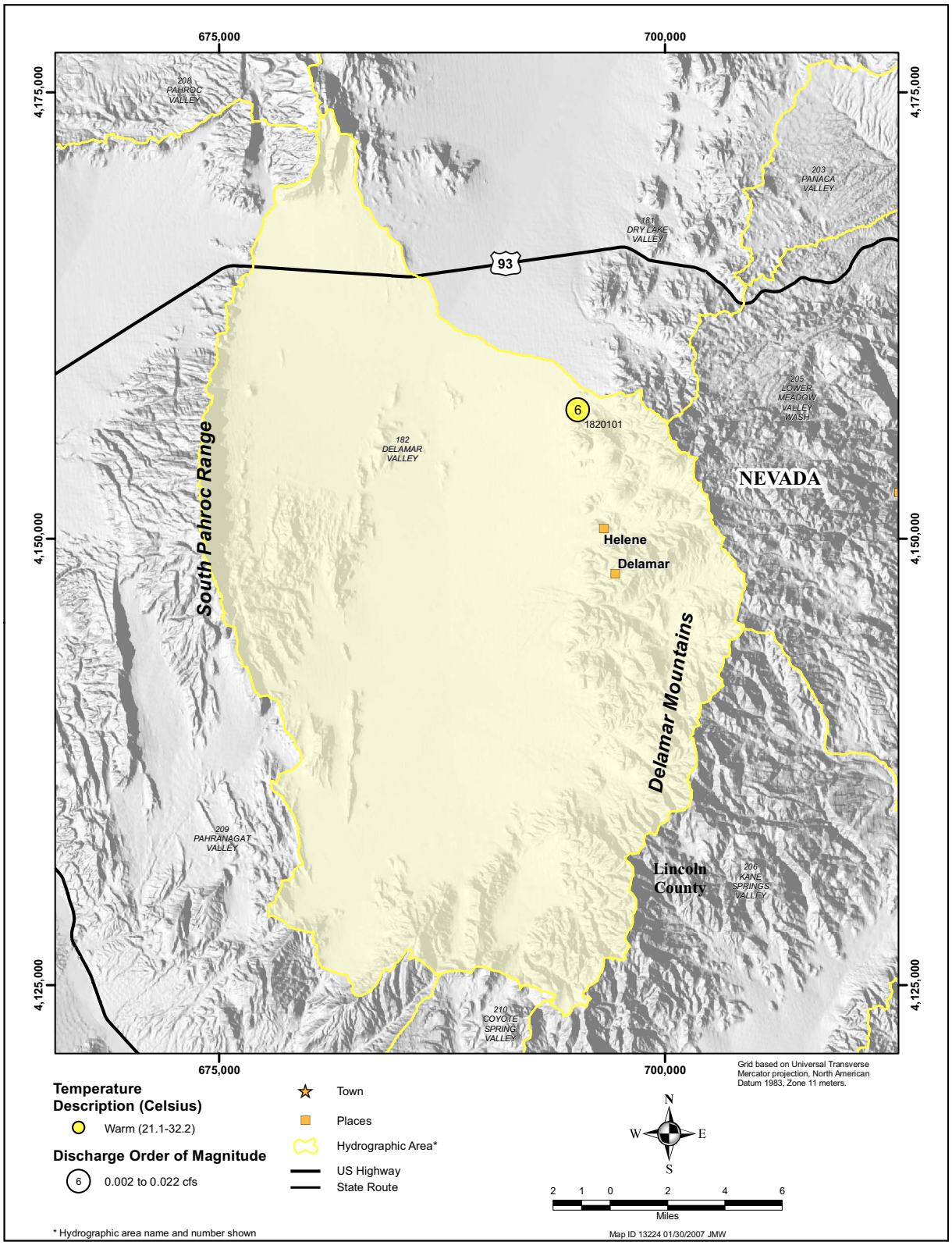


Figure 3-78
Map Showing the Location, Magnitude of Discharge, and Temperature of Grassy Spring in Delamar Valley, Nevada

Figure 3-79
Discharge Area of Grassy Spring, Delamar Valley, Lincoln County

study inventoried four springs in Dry Lake Valley. Figure 3-80 shows the locations of these springs and their flow and temperature. A description of each of these springs is provided in the following sections of this report.

3.8.1 Bailey Spring

General Setting

Bailey Spring is approximately 5.5 mi northwest of Bristol Wells. There are two spring orifices and an old homestead located at the spring site (Figure 3-81). Both orifices have been excavated.

Geologic Setting

Bailey Spring emanates from Tertiary volcanic rocks along a small fault.

Discharge

In 1912, a discharge of about 0.007 cfs (3 gpm) was reported (Carpenter, 1915). In May 1980, the discharge was reported to be 0.004 cfs (2 gpm) (Bunch and Harrill, 1984). During a field investigation conducted on June 3, 2004, the discharge was measured with a 3-in. Parshall flume. A discharge of less than 0.001 cfs (0.03 gpm) was recorded at this time. The water temperature in 2004 was measured at 13°C.

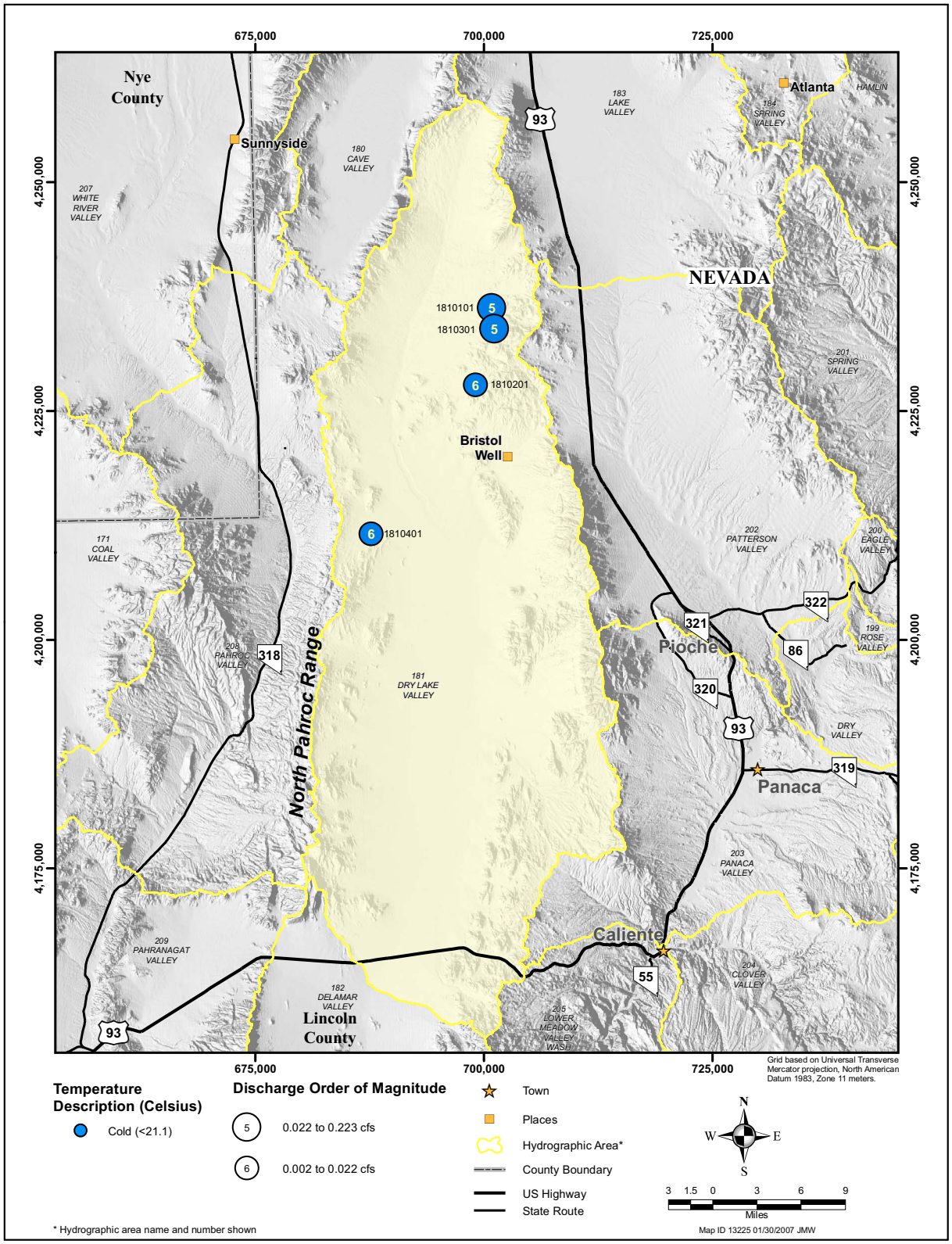


Figure 3-80
Map Showing the Location, Magnitude of Discharge, and Temperature of Selected Springs in Dry Lake Valley, Nevada

Figure 3-81
Discharge Area at Bailey Spring, Dry Lake Valley, Nevada

Diversions and Water Use

During the 2004 field investigation, the spring's only observable discharge use was for wildlife. There is a small abandoned homestead at Bailey Spring.

3.8.2 Meloy Spring

General Setting

Meloy Spring is approximately 6 mi north of Bailey Spring. An old homestead is located at the spring. The spring discharges below an outcrop of volcanic rock and has been modified to increase its yield. The orifice area is overgrown with wild rose bushes, making it inaccessible to measure discharge or collect water-chemistry samples.

Geologic Setting

Meloy Spring discharges from the base of small scarp in Tertiary volcanic rocks.

Discharge

In May 1980, the spring's discharge was measured at 0.183 (82 gpm) cfs. In 1997, SNWA estimated the discharge as 0.1 cfs (45 gpm). The site was not accessible in 2004.

Diversions and Water Use

According to Carpenter (1915), Meloy Spring was used as a watering place for travelers. The water is currently used for livestock and wildlife.

3.8.3 Coyote Spring

General Setting

Coyote Spring (Figure 3-82) is located approximately 8 mi west-southwest of Bristol Wells and lies at the center of a large homestead/compound. In 1912, the spring area was described by Carpenter (1915) as "a house and corral have been built near the spring, but neither appears to have been used for some time." Currently, a similar description can be applied; the ranch/homestead appears abandoned and/or only used intermittently.

Geologic Setting

The spring discharges from the base of a scarp approximately 15 ft high, in volcanic rocks.

Discharge

Discharge was measured at 0.011 cfs (5 gpm) in 1912 and at 0.002 cfs (0.9 gpm) in August 1979. On June 3, 2004, discharge was measured at 0.11 gpm (less than 0.001 cfs). By June 21, 2004, the discharge rate had declined to 0.02 gpm (less than 0.001 cfs).

Diversions and Water Use

There are two distinct orifices at Coyote Spring, and each has tubing that routes the discharge to a large concrete livestock tank (Figure 3-83). In the past, water was used for livestock; however, currently the spring area looks unused by livestock.

3.8.4 Littlefield Spring

General Setting

Littlefield Spring is located approximately 3 mi northwest of Bailey Spring. Recent development in the spring area includes a new fence around the spring area and surface grading near the spring (Figure 3-84). This spring is the only inventoried spring in Dry Lake Valley that did not have a homestead associated with it.

Geologic Setting

The spring discharges from the alluvium near an outcrop of volcanic rock.

Figure 3-82
Coyote Spring in Dry Lake Valley, Nevada

Figure 3-83
Stock Tank and Diversion Pipe at Coyote Spring, Dry Lake Valley, Nevada

Figure 3-84
Discharge Area at Littlefield Spring, Dry Lake Valley, Nevada

Discharge

This spring had a reported discharge of 0.022 cfs (10 gpm) in May 1980 (Bunch and Harrill, 1984). During a June 3, 2004 field investigation, the discharge was measured at 0.026 cfs (12 gpm) and the temperature was 15°C.

Diversions and Water Use

There were neither diversions near the orifice of the spring nor along the road. The spring had recently been fenced with barbed wire, and it appeared that the area was freshly graded.

3.9 Black Mountain Area (HA 215)

The Black Mountains Area is bounded by the Colorado River (Lake Mead) in the east, the Black Mountains in the southwest, and the Muddy Mountains in the northwest. The most dominant features are the Muddy Mountains, Bitter Spring Valley, and the large washes of Gypsum, Callville, Echo, and Valley of Fire. This study inventoried two springs in the Black Mountain Area. Figure 3-85 shows the locations of these springs and their magnitudes of flow and temperature. A description of each of these springs is provided in the following sections.

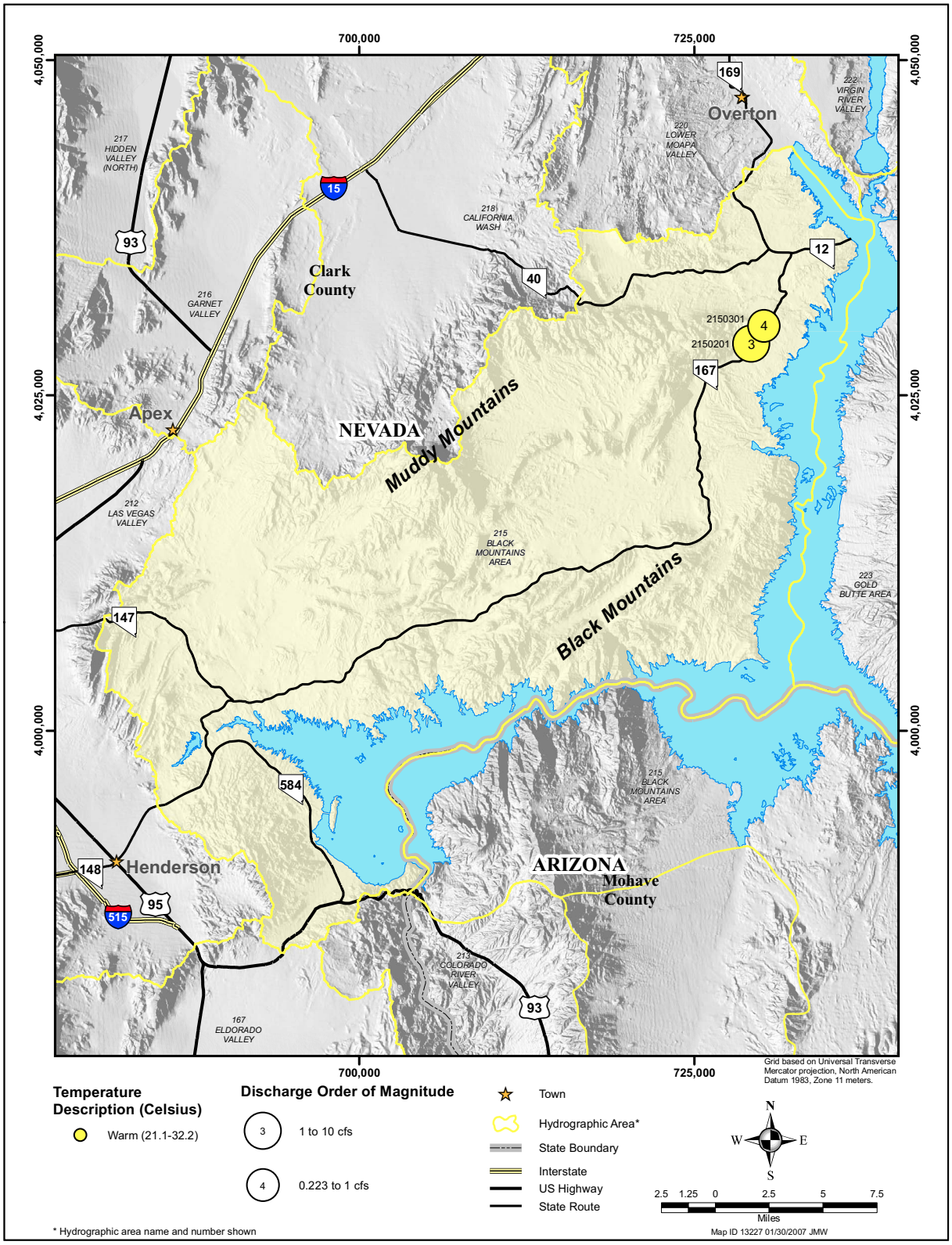
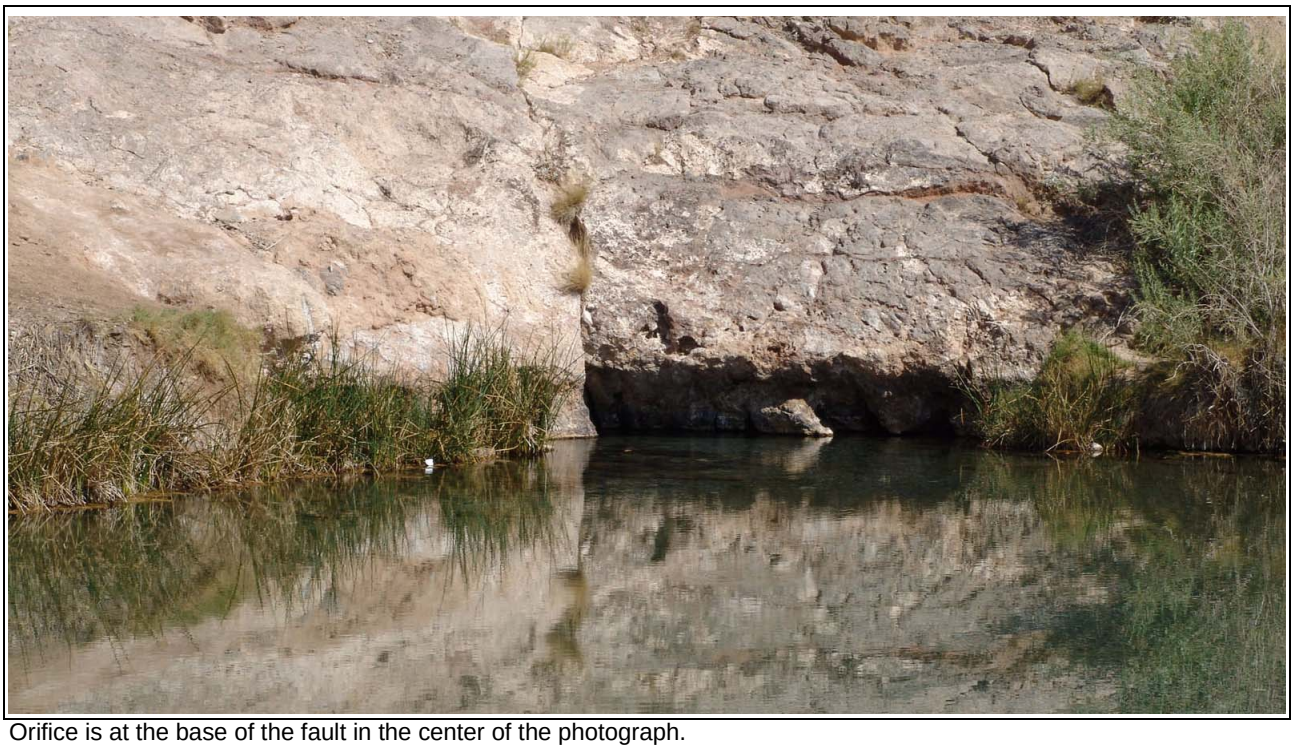


Figure 3-85
Map Showing the Location, Magnitude of Discharge, and Temperature of Selected Springs in the Black Mountains Area, Nevada

3.9.1 Rogers Spring

General Setting

Rogers Spring is located approximately 14 mi south of Over ton, Nevada, at mi le marker 40 along North Shore Road in the Lake Mead National Recreation Area (Figure 3-86). The spring is open to the public for recreational purposes.



Orifice is at the base of the fault in the center of the photograph.

Figure 3-86
Orifice at Rogers Spring, in Black Mountains Area, Nevada

Geologic Setting

Rogers Spring discharges along a major Basin and Range fault separating the Tertiary Muddy Creek Formation from Paleozoic carbonate rocks. Paleo-orifices can be observed 50 ft above the current orifice.

Discharge

Discharge at Rogers Spring is measured by the USGS Gaging Station No. 09419550-Rogers Spring near Overton Beach, Nevada, which is a 1-ft fiberglass flume equipped with a continuous data logger. The current gage replaced the old gaging station located 10 ft upstream, which was a stilling well with the natural channel being the control. From 1985 to 2006, the average annual discharge of Rogers Spring was 1.66 cfs (745 gpm). The minimum and maximum average annual discharges are 1.47 and 1.88 cfs (660 and 844 gpm), recorded in 1992 and 1993, respectively (Figure 3-87). The 2006 annual discharge was 1,210 afy and the average daily discharge was 1.68 cfs (754 gpm).

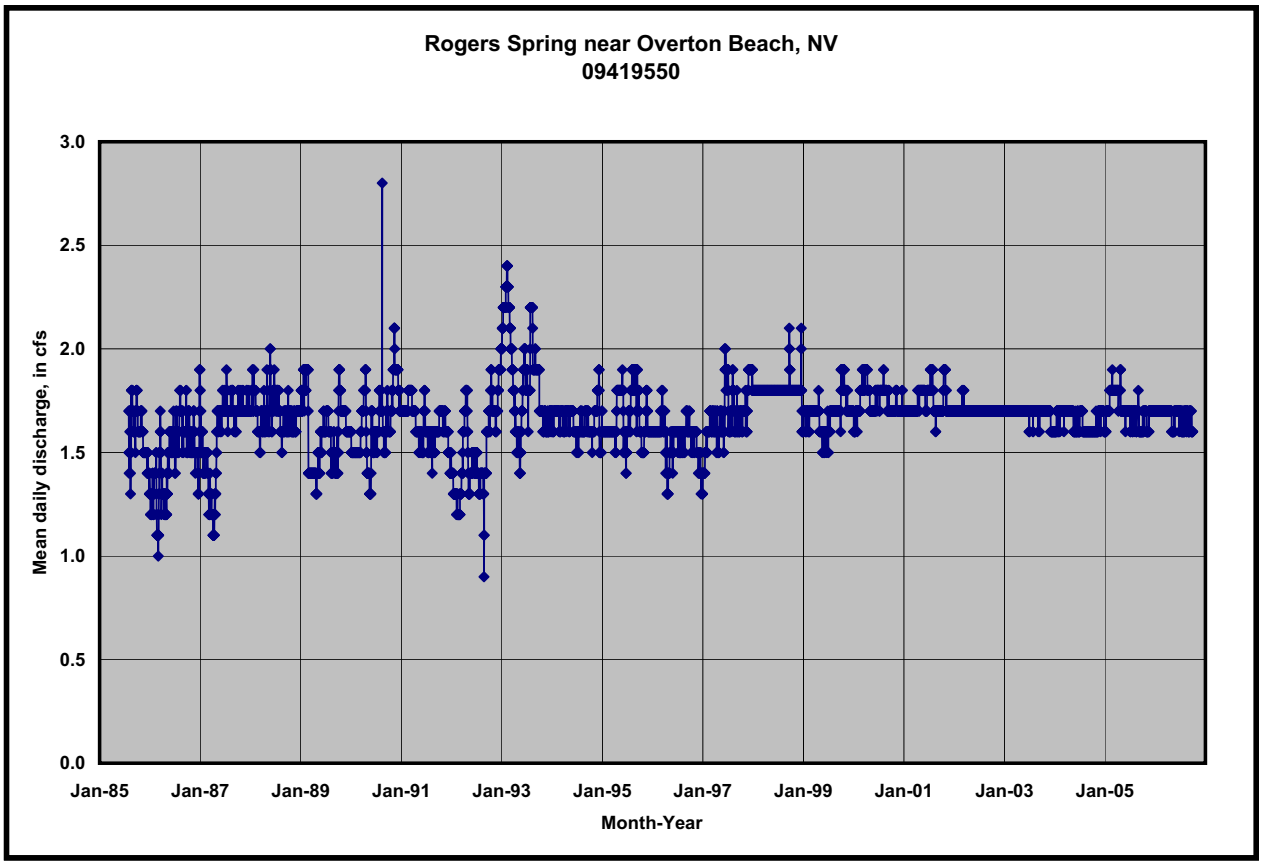


Figure 3-87
Hydrograph of Rogers Spring near Overton Beach, Nevada

Diversions and Water Use

Rogers Spring discharges directly from a fault in the carbonate rocks into a small reservoir used for recreational bathing. The pool's dimensions are approximately 100 ft wide, 150 ft long, and averages about 2 ft deep. The pool's elevation is controlled artificially by a rock and concrete spillway, and the reservoir's water elevation frequently changes when swimmers construct dams across the control.

3.9.2 Blue Point Spring

General Setting

Blue Point Spring is located approximately 13 mi south of Overton, Nevada, at mile marker 41 along North Shore Road in the Lake Mead National Recreation Area. The spring is open to the public for limited recreational opportunities.

Geologic Setting

Blue Point Spring discharges from th e same fault that affects Rogers S pring to the southwest (Figure 3-88).

Gage house is in the center of the photograph.

Figure 3-88
Discharge Area of Blue Point Spring, in Black Mountains Area, Nevada

Discharge

The spring discharges from below a large mesquite tree and bubbles up from the bed of the channel. The pool is heavily overgrown with bullrushes (Figure 3-89). The orifice is incised in the channel approximately 4 ft and the active portion of the channel is approximately 2 ft wide. USGS, in cooperation with the National Park Service, operates USGS Gaging Station No. 09419547-Blue Point Spring near Valley of Fire State Park, Nevada. The station is a stilling well equipped with a continuous stage recorder and is approximately 30 ft downstream of the orifice. The channel has a 90-degree V-notch weir plate as a control, which is in fair to poor condition. The weir plate is made of mild steel and is heavily corroded. The approach to the weir is a concrete channel that has heavy algal growth along its sides and bottom.

The average annual discharge reported by USGS is 0.55 cfs (398 gpm) for water year 2006. The minimum and maximum average annual discharge during the period of record were 0.50 and 0.57 cfs, respectively (224 and 256 gpm), recorded in 2002 and 2001 (Figure 3-90). The mean annual discharge for the period of record is 0.55 cfs or 397 afy.

Diversions and Water Use

Both above and below the weir is a natural channel, and there are no diversions above the gage.

Figure 3-89
Blue Point Spring Weir Plate and Concrete Channel, Showing Heavy Algae Growth

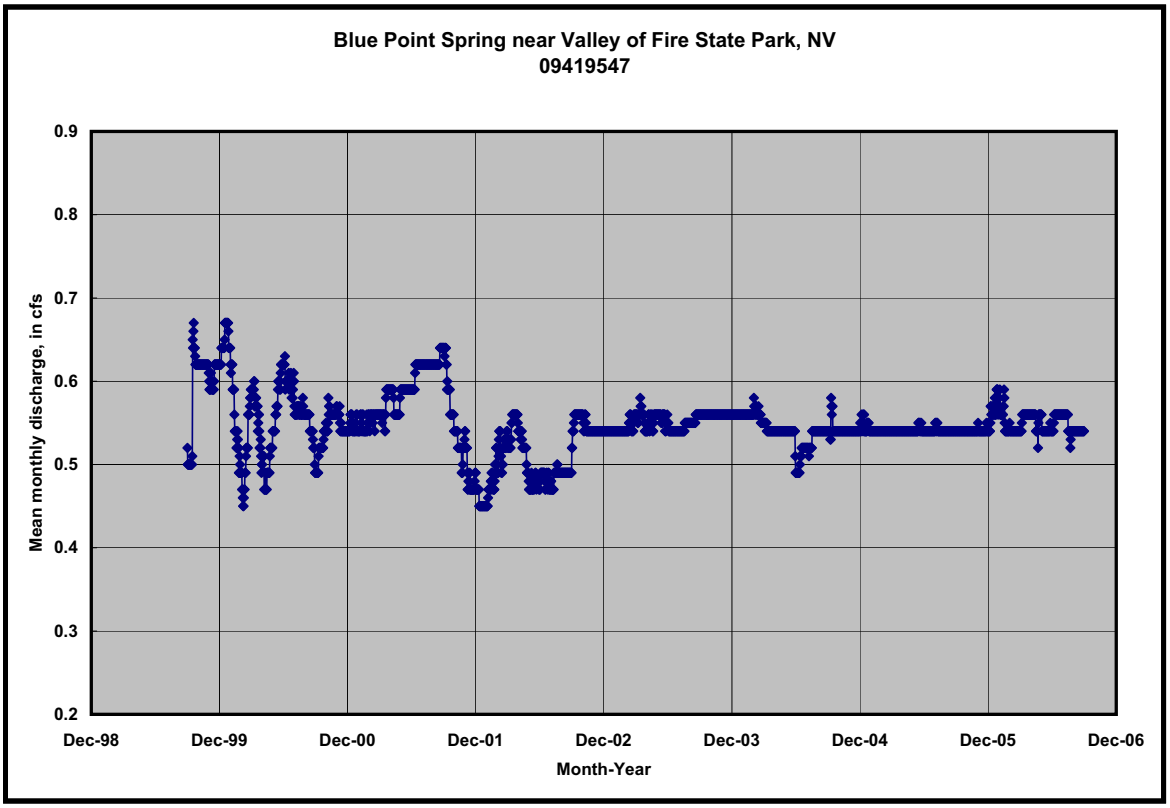


Figure 3-90
Hydrograph of Blue Point Spring near Valley of Fire State Park, Nevada

3.10 Muddy River Springs Area (Upper Moapa Valley HA 219)

The Muddy River Springs Area contains the largest thermal springs in Nevada (Garside and Schilling, 1979). There are six major spring groups within the area: Cardy Lamb, Baldwin, Pipeline Jones/Apcar, Big Muddy, Pederson, and Plummer (Beck et al., 2006). The Muddy Springs Area is one of the lowest discharge points and potential terminus of the White River Flow System. However, there has been speculation that a portion of the regional flow reaches the Colorado River (USFWS, 2006). The Muddy Springs form the headwaters of the Muddy River. From 1913 to 1918, the average daily discharge of the Muddy River near Moapa, Nevada, was 46.9 cfs and the average annual discharge was approximately 34,000 afy (Wells, 1960). The average annual discharge from 1914 to 1962 was reported as 33,700 afy (46.5 cfs) (Eakin, 1964). An estimated 2,000 to 3,000 afy was being consumed by irrigation and phreatophytes between the spring area and the gaging station (Eakin, 1964). Figure 3-91 provides a hydrograph of mean monthly discharge at the Muddy River near Moapa, Nevada. The decline in the hydrograph in the late 1950s to early 1960s is the result of surface water diversions and alluvial groundwater pumping.

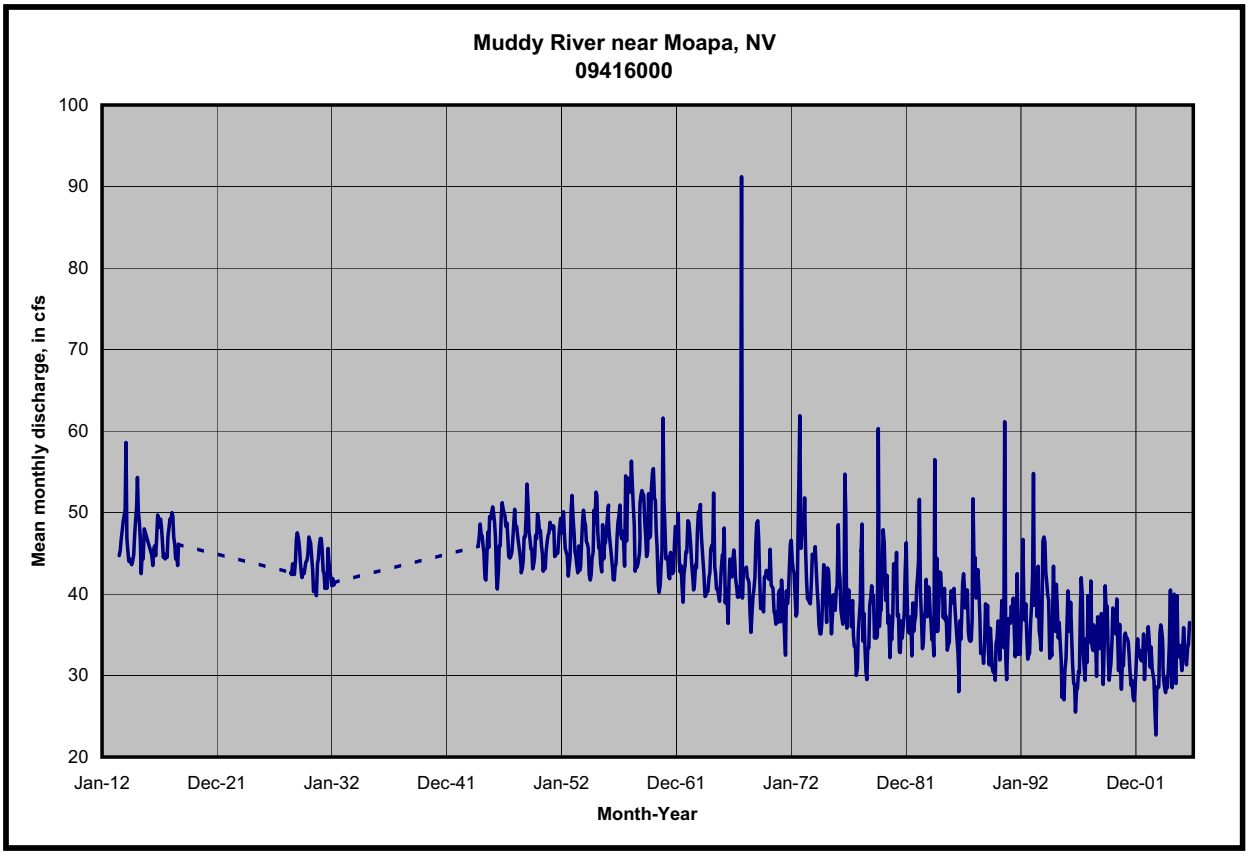


Figure 3-91
Hydrograph of Mean Monthly Discharge at Muddy River near Moapa, Nevada

3.10.1 Cardy Lamb Group

This group of springs is the farthest north and west group of springs of the Muddy River Springs Area. Several springs discharge into a man-made pool that was once used for recreational purposes. The pool is no longer used for recreation but is occasionally used as storage for irrigation downstream.

3.10.2 Baldwin Spring

The Moapa Valley Water District (MVWD) has developed Baldwin Spring into a public water supply. When the spring is used by the MVWD, it is piped into MVWD's distribution system and passes through a flow meter, and the water diversion is reported to NDWR. Water not placed into MVWD's distribution system is allowed to flow into the natural channel and can be measured several hundred feet downstream by a 3-ft Parshall flume.

3.10.3 Pipeline Jones/Apcar Spring

Pipeline Jones/Apcar Spring was developed in 1954 when the Moapa Valley Water Company and Overton Water District (now MVWD) used a dragline to improve the discharge of the spring (Beck et al., 2006). The spring currently discharges about 1.5 to 1.6 cfs (673 to 718 gpm) with MVWD diverting 1.0 cfs (449 gpm) of the total flow for municipal use. The undiverted portion flows east into Apcar stream which continues to gain water from subsurface seepage along the entire stream (USFWS, 2006).

3.10.4 Big Muddy Spring

Big Muddy Spring is the largest of all the springs. The USGS operates a gage (USGS Station Number 09415900) at the LDS farm. Mean annual discharges range from 7.18 cfs in 1991 to 8.44 cfs cfs in 1999 and the mean annual discharge over the period of record is 7.74 cfs or 5,610 afy. In 2006 the mean annual discharge was 7.24 cfs or 5,240 af.

The data for this gage is problematic due to the unmeasured church diversion upstream of the gage (Figure 3-92). The water is diverted from the spring to fill a swimming pool (Figure 3-93) and is then discharged back into the channel below the gage. The spring pool has been modified with a diversion gate and is drained weekly to clean it for recreational swimming. These diversions are reflected in the gage record.

3.10.5 Pederson Group

The Pederson Group of springs is made up of two main springs, Pederson Spring (Figure 3-94, top) and Pederson East Spring, and several smaller springs below the two main springs. Discharges are measured continuously at Pederson and Pederson East springs and semi-annually at springs M-11, M-12, and M-13. Both Pederson and Pederson East springs were formerly used for recreational purposes. The Pederson Spring record has been the subject of much discussion. The aluminum weir was found to be severely warped and it is speculated this happened when a fire burned through the

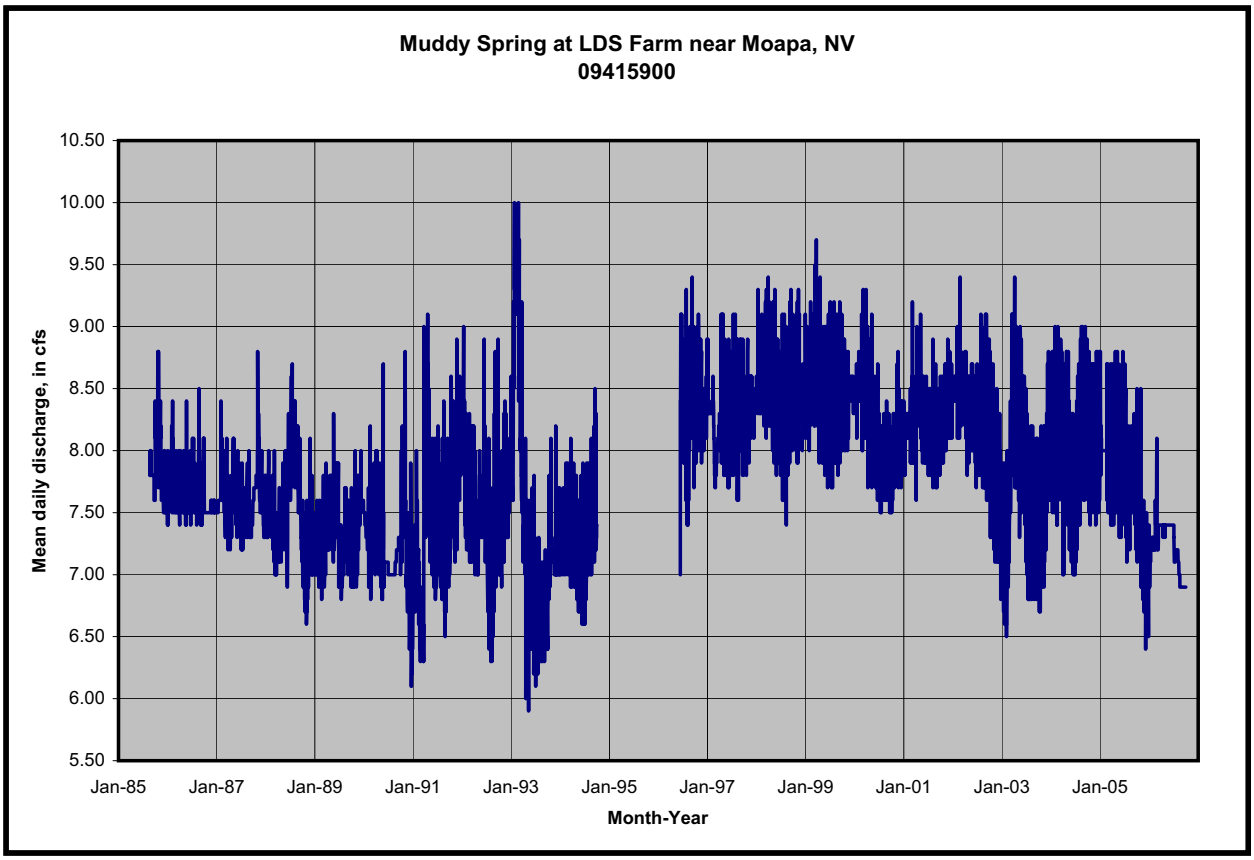


Figure 3-92
Hydrograph of Muddy Spring at LDS Farm near Moapa, Nevada

area in 1994 (Figure 3-94, bottom). Regardless of the cause of the warping of the weir its accuracy was altered. Then in 2002/2003 the weir began to leak and as a result, the gage was not recording the entire flow. USFWS began restoring the springs in 2002, and through a cooperative effort between USGS, USFWS, NDWR, and SNWA the Pederson gage was rehabilitated in early 2004, with a new control structure and since then correctly reports the discharge. The annual mean discharge for Pederson Spring is 0.22 cfs or 161 afy. The minimum and maximum discharges for the period of record are 0.19 cfs in (85 gpm) 1989 and 0.27 cfs (121 gpm) in 2006. The annual discharge for 2006 was 197 af. The annual mean discharge for Pederson East Spring is 0.22 cfs or 156 afy. The minimum and maximum discharges for the period of record are 0.19 cfs in (85 gpm) 2004 and 0.24 cfs (108 gpm) in 2006. The annual discharge for 2006 was 175 af. Except for an unmeasured diversion, the total discharge of the Pederson Group is measured at USGS Gaging Station No. 09415920-Warm Springs west near Moapa, Nevada (Figures 3-95, 3-96, and 3-97). The mean annual discharge, for the period of record, at the gage is 3.68 cfs (2,670 afy); the minimum discharge was 3.38 cfs (1,517 gpm) measured in 1992; the maximum discharge was 3.96 cfs (1,777 gpm) measured in 1998. In the 2006 water year the mean annual discharge was reported to be 3.90 cfs or 2,830 af.

M-11, M-12, and M-13 are three springs located over a linear distance of 150 ft. M-19 is located near these springs. The magnitude of the discharge from these four springs changes from year to year.

The main orifice can be seen in the top photograph.

Figure 3-93
Muddy Spring Pool Fed by Big Muddy Spring at the LDS Recreation Area

(Top) Looking north at the Pederson Spring Group. (Bottom) The warped weir plate at Pederson Spring. Photos taken before replacement of the weir.

Figure 3-94
View of Pederson Spring Group and Flow at Pederson Spring

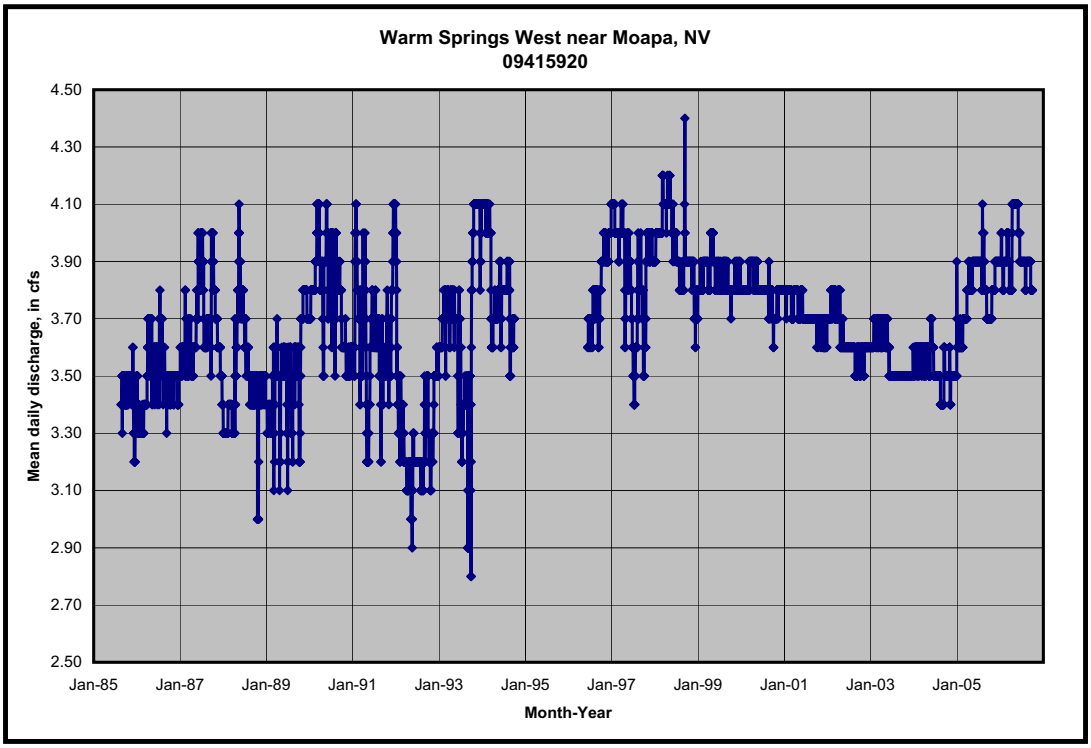


Figure 3-95
Hydrograph of Warm Springs West near Moapa, Nevada

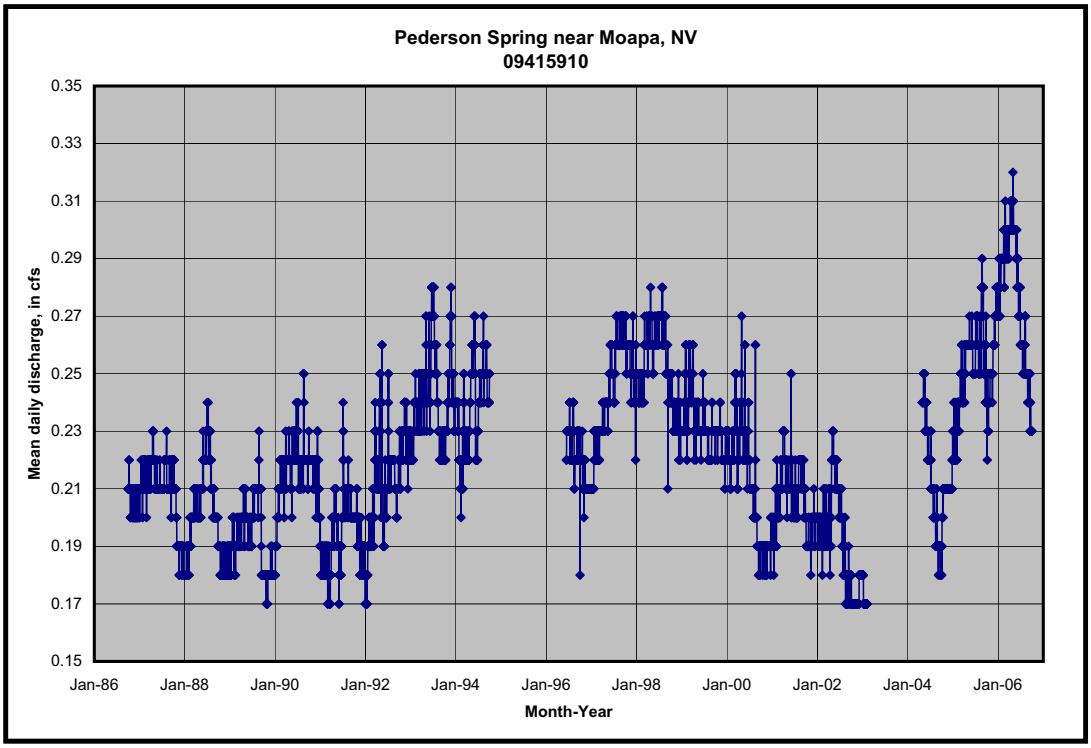


Figure 3-96
Hydrograph of Pederson Spring near Moapa, Nevada

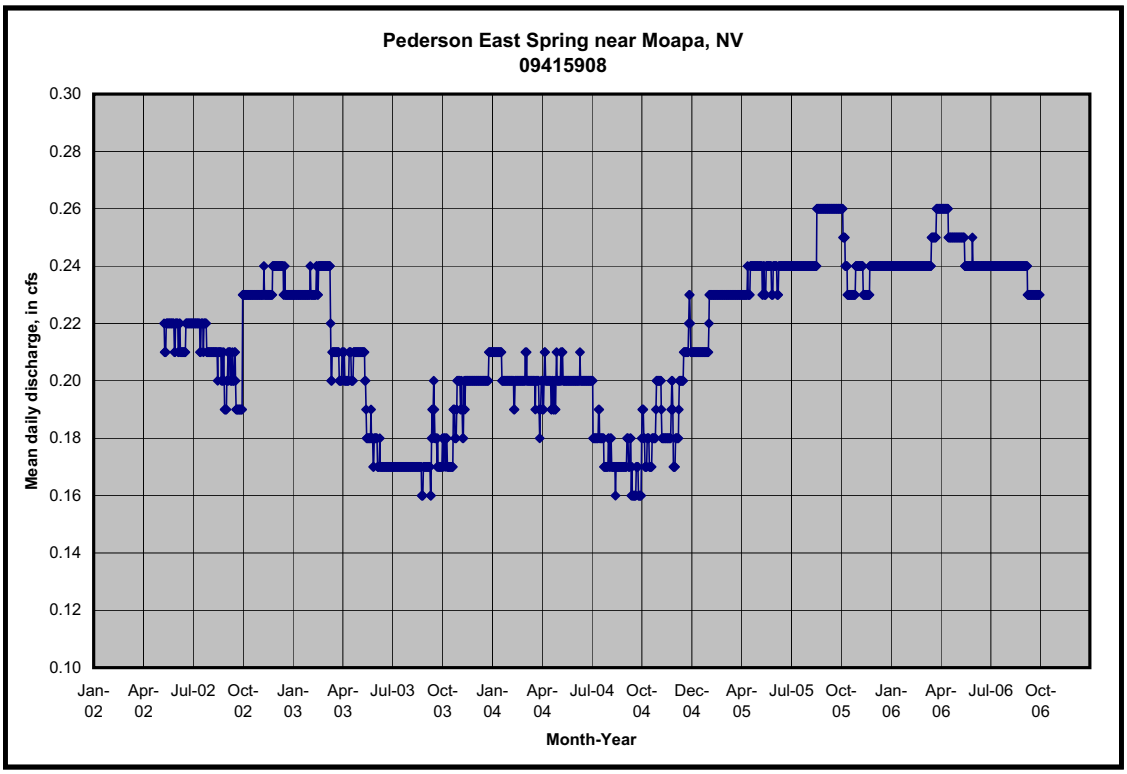


Figure 3-97
Hydrograph of Pederson East Spring near Moapa, Nevada

The data does not indicate any pattern to the discharge as might be expected. These data are presented in Table 3-4 and on Figure 3-95.

Based on the quality of available data, determining historical discharge trends are problematic. While there are periods of good measurements, there have been unmeasured diversions above some of the gaging stations or other problems with there controls. The semiannual data should be used with caution when performing any analysis.

3.10.6 Plummer Group

The Plummer Group of springs that were used primarily for recreation and are now being restored by USFWS. Discharge is measured semiannually by USGS at several sites. The total discharge from the Plummer Group and Pederson Group of springs is gaged at USGS Gaging Station No. 09415927-Warm Springs Confluence at Iverson flume near Moapa, Nevada. The mean daily discharge at the gage is 8.72 cfs (3,910 gpm).

Geologic Setting

Muddy River Springs Area is composed of several spring complexes in and near the community of Moapa, Nevada. Field mapping of the main areas of springs indicates that there are several north-south, high-angle normal subparallel faults west of and within the area of the springs. The

Table 3-4
Comparison of Discharges of Four Springs in the Pederson Spring Group near Moapa, Nevada

Spring	April Discharge (gpm)	September Discharge (gpm)	Net Change, April to September (gpm)	Percent Difference, April to September
Water Year 2001[a]				
M-11	427	669	242	44%
M-12	158	149	-9	-6%
M-13	417	330	-87	-23%
M-19	414	370	-44	-11%
Water Year 2003				
M-11	471	458	-13	-3%
M-12	114	130	16	13%
M-13	303	350	47	14%
M-19	473	435	-38	-8
Water Year 2004				
M-11	350	370	20	6
M-12	140	140	0	0
M-13	260	480	220	59
M-19	330	430	100	26
Water Year 2007[b]				
M-11	391	446	55	13
M-12	141	254	113	57
M-13	489	203	-286	-83
M-19	458	320	-138	-35

[a]In Water Year 2002, the springs were measured only in April. In Water Year 2005, the springs were not measured. In Water Year 2006, the springs were measured in January and September.
[b]Water Year 2007 data is provisional.

position of the faults explain the locations of the various spring complexes and the distribution of the modern and paleo-spring deposits. All of the springs in this area emerge from alluvium; however, this alluvium appears to have minimal thickness, and Permian and Pennsylvanian carbonate rocks are exposed within a mile. The faults serve as conduits from the carbonate rocks to the spring orifices, which are in the hanging wall of the structures (Donovan et al., 2004).

Diversions and Water Use

Diversions from Baldwin and Apcar springs have averaged a combined total of approximately 1,400 afy. The MVWD diverts the two springs for municipal supply. Nevada Power Company can divert up to about 3,500 afy from the Muddy River just above the Moapa gaging station. There are other small agricultural diversions from the other springs, but these amounts have not been quantified.

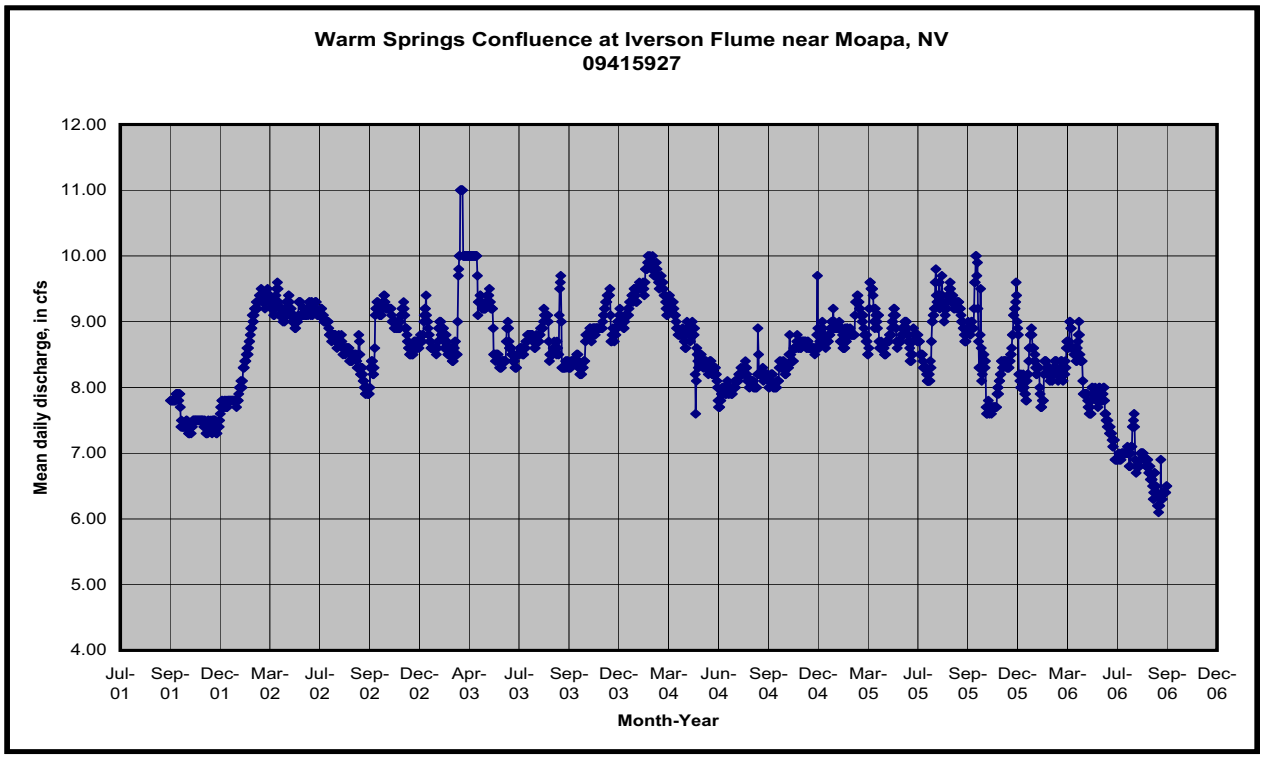


Figure 3-98
Hydrograph of Warm Spring Confluence at Iverson Flume near Moapa, Nevada

3.11 Panaca Valley (HA 203)

Panaca Valley is approximately 25 mi long and 20 mi wide near Panaca, in Lincoln County, Nevada. The valley is bounded on the west by the Highland and Chief ranges, on the north by the Pioche Hills, on the east by the Dew Mountain, on the south by the Cedar Range, and drains to the south into Lower Meadow Valley Wash via Meadow Valley Wash. U.S. Highway 93 traverses the Panaca Valley in a north-south direction. This study inventoried two springs in Panaca Valley. Figure 3-99 shows the location of these springs and their magnitudes of flow and temperature. A description of each of these springs is listed in the following sections of this report.

3.11.1 Panaca Spring

General Description

Panaca Spring is a warm spring a little more than a mile north of Main Street (SR 319), Panaca, Nevada. The spring discharges to a small reservoir to the west of the spring that is dammed on its west end.

Geologic Setting

The spring discharges from bedrock at the southwest end of the Pioche Hills. The main orifice is submerged beneath a heavily vegetated marsh that makes up the northeastern end of the spring pool.

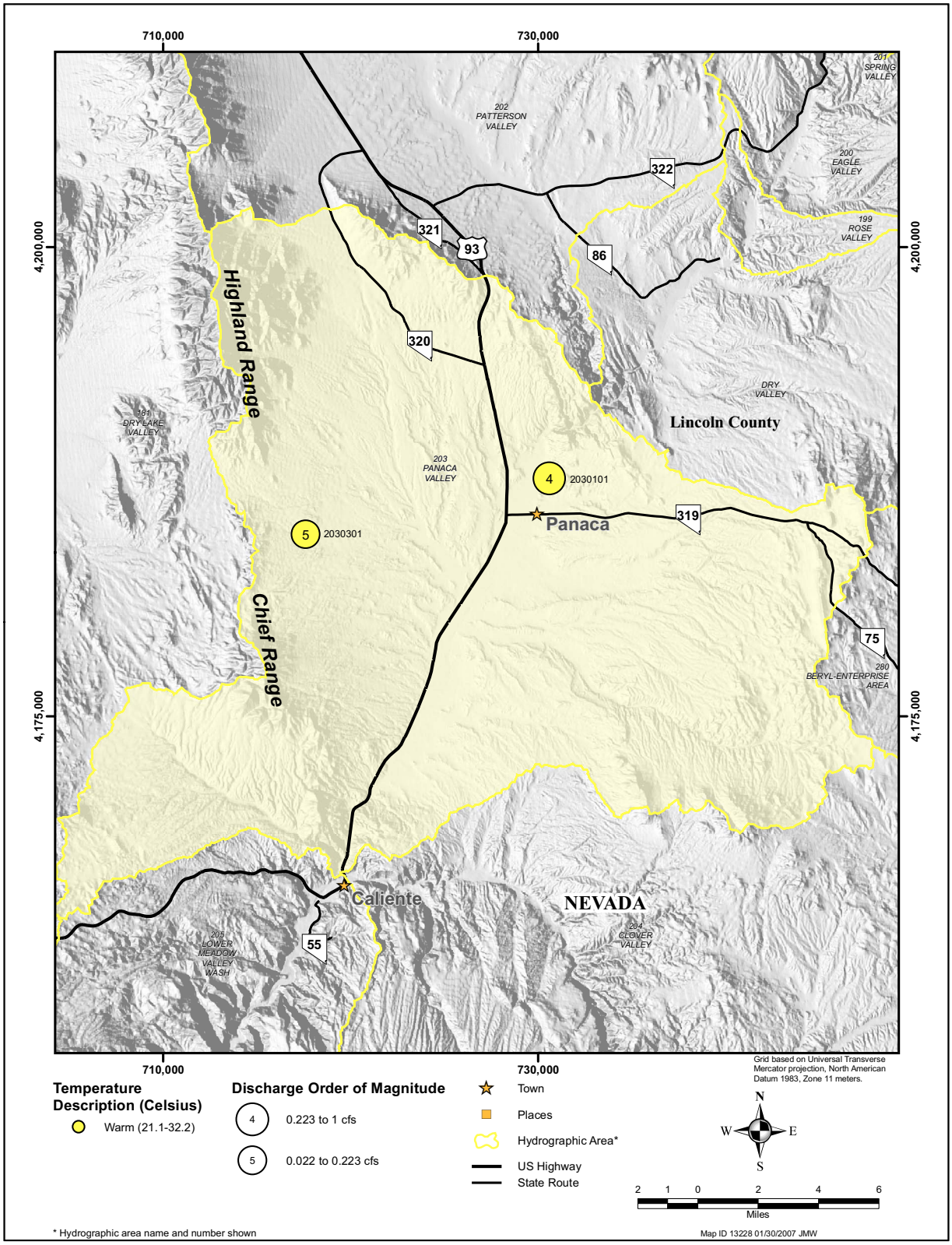


Figure 3-99
Map Showing the Location, Magnitude of Discharge, and Temperature of Selected Springs in Panaca Valley, Nevada

The bedrock at the east end of the spring is gray to black, resistant, well-bedded, thin- to medium-bedded limestone of the Cambrian Highland Peak Formation (Tschanz and Pampeyan, 1970). The rock underlies a bedrock prong that extends west from the main part of this small range. The west end of the prong is faulted along a north 80 degrees west high-angle fault against the main part of the prong. The trace of the fault is easily visible, about 30 ft east of the spring pool. This fault passes through the southern edge of the prong and then through the middle of the marshy southeast part of the spring pool area and on into the range.

The rock along the trace of the fault is brecciated and poorly exposed, but a northern splay of this fault is exposed. Several parallel faults can be seen in the range. These are shown on Figure 3-100. The trace of the Pioche Hills is northwesterly. Several miles to the north, the range-front fault on its west side is clearly visible. It is likely that faults of the same strike occur near the warm springs, and a fault of the same northwesterly strike is interpreted just west of the prong.

Discharge

Hardman and Miller (1934) reported the discharge on October 5, 1912, as 4.0 cfs. Phoenix (1948) reported a discharge, measured in 1948, of approximately 8.02 cfs (3,600 gpm) and a temperature of approximately 30.5°C. Rush (1964) reported a discharge of 10.88 cfs (4,880 gpm) on October 28, 1963. From 1987 to the present, no discharge greater than 2 cfs (898 gpm) has been reported. During a field investigation of Panaca Spring on July 19, 2004, a discharge of 0.5 cfs (224 gpm) was estimated. During 2006 the USGS measured a discharge of 10.2 and 10.6 cfs (4578-4758 gpm). The large variability in the discharge measurements suggests that additional measurements are needed to reduce the uncertainty of the discharge (Figure 3-101).

Diversions and Water Use

Water is stored in a small reservoir created by a concrete dam approximately 150 ft below the spring orifice. The dam has three outlets that divert water to different users in the valley. One outlet is left partially open and acts as a spillway for the dam. Water from the spring is used for agriculture and livestock watering, and the reservoir is used for recreational purposes.

3.11.2 Bennett Spring

General Setting

Bennett Springs is approximately 13 mi south of Pioche, Nevada, and 8 mi west of Panaca, Nevada. The springs emanate from the western flank of the Chief Range along a concealed fault (Garside and Schilling, 1979). A small concrete dam forms the eastern edge of the spring pool. The entire 100×150 ft pool is surrounded by cottonwood trees and mostly filled with aquatic plants (Figure 3-102). A nonfunctioning head gage is located on the northeastern edge of the pool. Approximately 200 ft northeast of the spring pool is a small orchard (Figure 3-103) associated with the old homestead located near the spring. While early reports list Bennett Springs as being an important watering place, no discharge measurements were made (Carpenter, 1915).

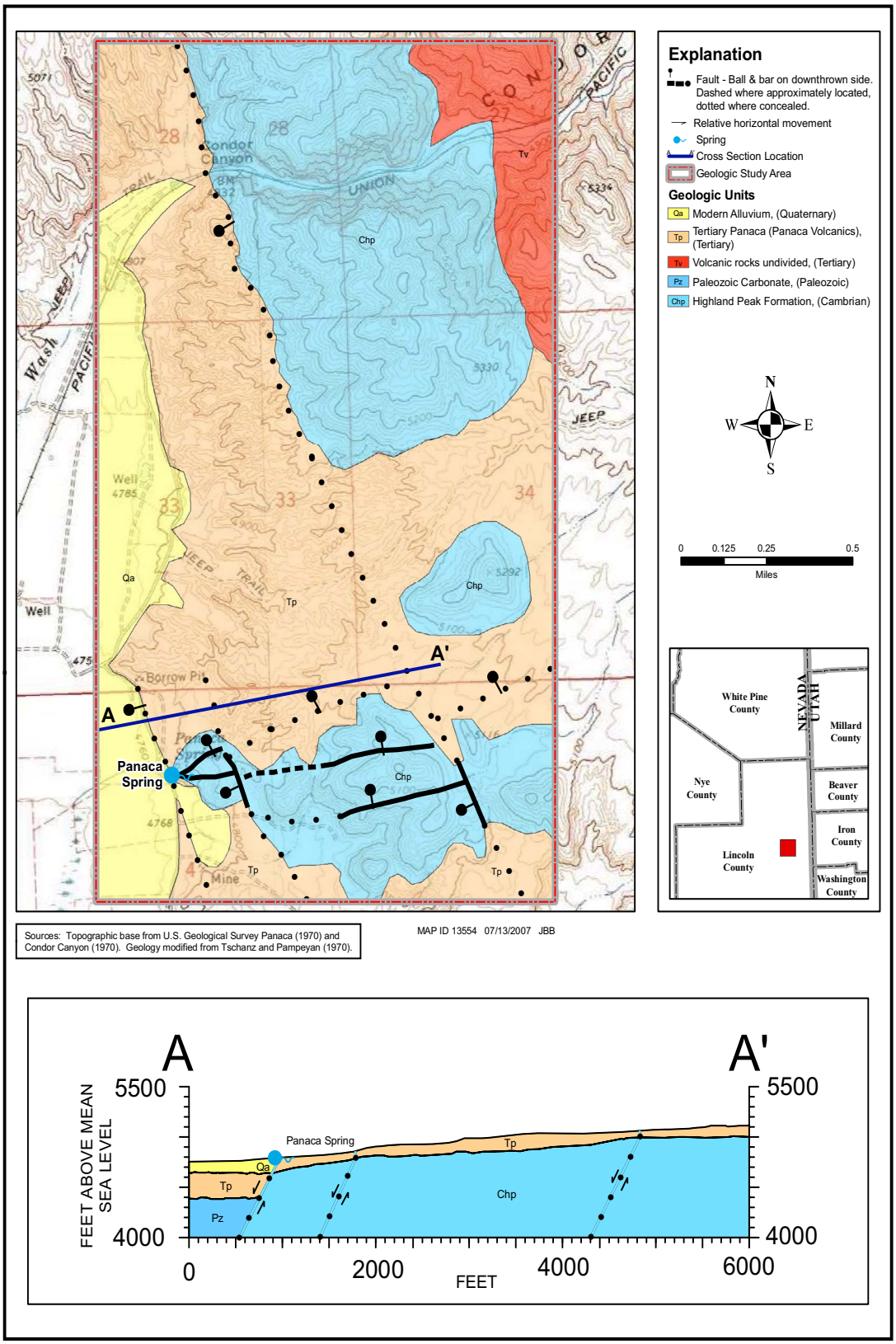


Figure 3-100
Geologic Map and Cross Section of Panaca Spring, Lincoln County, Nevada

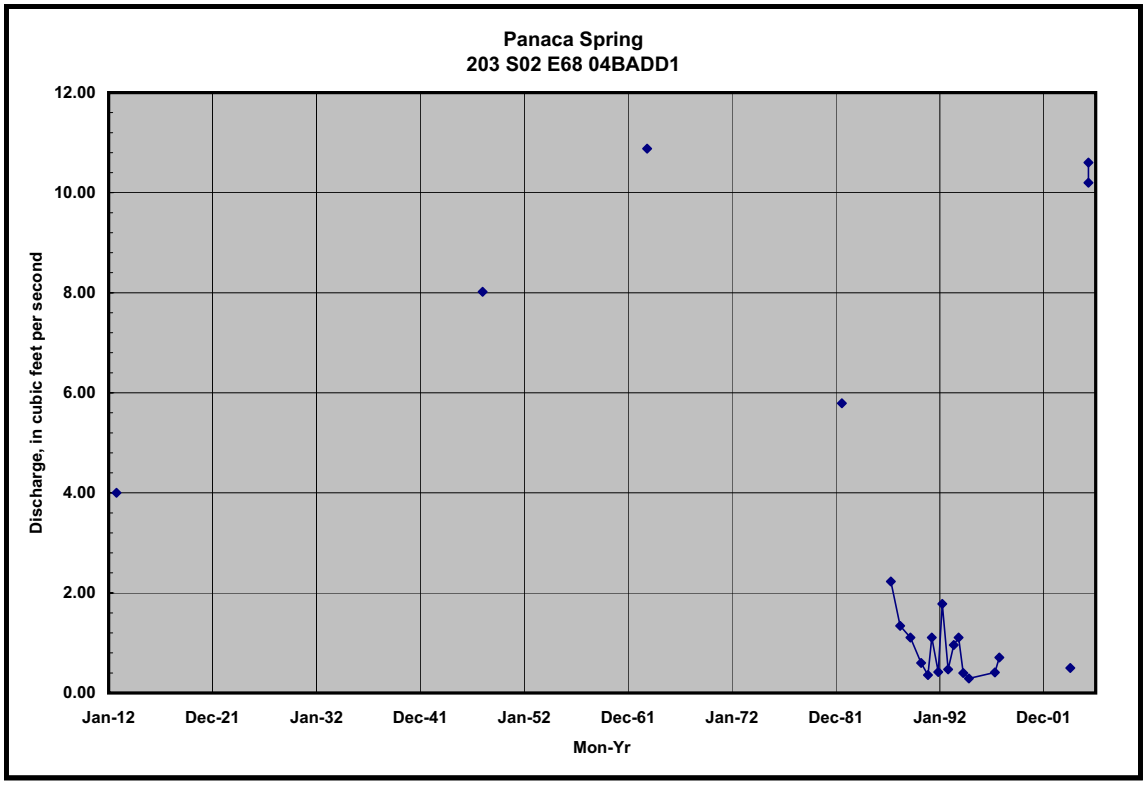


Figure 3-101
Hydrograph of Panaca Spring Discharge Measurements, 1912 to 2006

Figure 3-102
Pool of Bennett Spring, Panaca Valley, Nevada

Figure 3-103
Bennett Spring Orchard, Panaca Valley, Nevada

Geologic Setting

According to Phoenix (1948), the spring's discharge is from Quaternary gravels near Tertiary volcanic rocks along a buried fault.

Discharge

The first published record about Bennett Spring reported a discharge measurement of 0.022 cfs or about 10 gpm (Phoenix, 1948). Garside and Schilling (1979) reported a discharge of 0.022 cfs and a temperature of 29.4°C. Because of channel conditions observed during the May 17, 2005 field investigation, the discharge was estimated at 0.05 cfs (22 gpm) and the temperature was 21°C.

Diversions and Water Use

The diversions at Bennett Springs consist of a small concrete dam along the eastern side of the spring pool and a head gate on the northeastern end of the dam. Water is no longer regulated by the head gate and flows freely over portions of the dam into Bennett Wash. The small orchard at the site was probably irrigated by the waters from the spring. Phoenix (1948) reported that the water from the spring was used for agriculture and livestock watering. Observations made during the 2005 field investigation suggest that the water from the spring is currently being used for livestock watering and wildlife.

3.12 Lake Valley (HA 183)

Lake Valley is approximately 40 mi long and 20 mi wide and located in eastern Nevada. The northern quarter of the valley is located in White Pine County and the southern three quarters are in Lincoln County. The valley is bounded by the Fortification Range on the northeast and east, by the Wilson Creek Range on the southeast, by the Ely Range on the southwest, and by the Schell Creek Range on the west and northwest. U.S. Highway 93 is located along the western side of Lake Valley and runs the length of the valley in a north-south direction. This study inventoried 4 springs in Lake Valley 1 is discussed below. Figure 3-104 shows the location of these springs and their magnitude of flow and temperature.

3.12.1 Geyser Spring

General Setting

Geyser Spring is located on the eastern flank of the Schell Creek Range in Lincoln County, Nevada. The spring discharges from the alluvial slope that contains primarily quartzite boulders and cobbles. The area is forested with juniper trees. Discharge from the spring is periodic and because its discharge increases and decreases, it resembles a geyser. One theory explaining this phenomenon is that the spring is plumbed by fractures that act as a siphon in the rock (Meinzer, 1942). According to Meinzer (1942), there is only one spring of this type in Nevada (Figure 3-105).

Geologic Setting

Geyser Spring has a single orifice along a north-south-trending basin-range frontal fault. The sediments are all terrace gravels, predominately of Ordovician Eureka Quartzite and Cambrian Prospector Mountain Quartzite, with some shales of indeterminate age. There are no outcrops in the vicinity of the spring (Figure 3-106).

Discharge

There have been many discharge measurements taken of Geyser Spring. On October 24, 1912, Geyser Spring was reported at 1.0 cfs and the temperature was 12.2°C (Hardman and Miller, 1934). In 1950, USGS made a series of discharge measurements approximately 75 ft west of U.S. Highway 93 near the headquarters of the Geyser Ranch. These are depicted in Figure 3-107. On August 4, 1963, a series of measurements were taken approximately 150 ft downstream of the orifice. These are depicted in Figure 3-107. From 1985 to 1994, miscellaneous discharge measurements were taken at Geyser Spring by USGS and are provided in Appendix B.

On June 23, 2004, a discharge of 0.922 cfs (414 gpm) was measured 50 ft downstream of the orifice. During this investigation, no additional measurements were made to observe the cyclical action of the spring. During the 2004 site visit, a partially buried 6-in. flume was found in the channel (Figure 3-108). It has not been determined when the flume was installed or by whom. Because of its cyclical nature, the miscellaneous measurements do not help to determine the spring's average discharge.

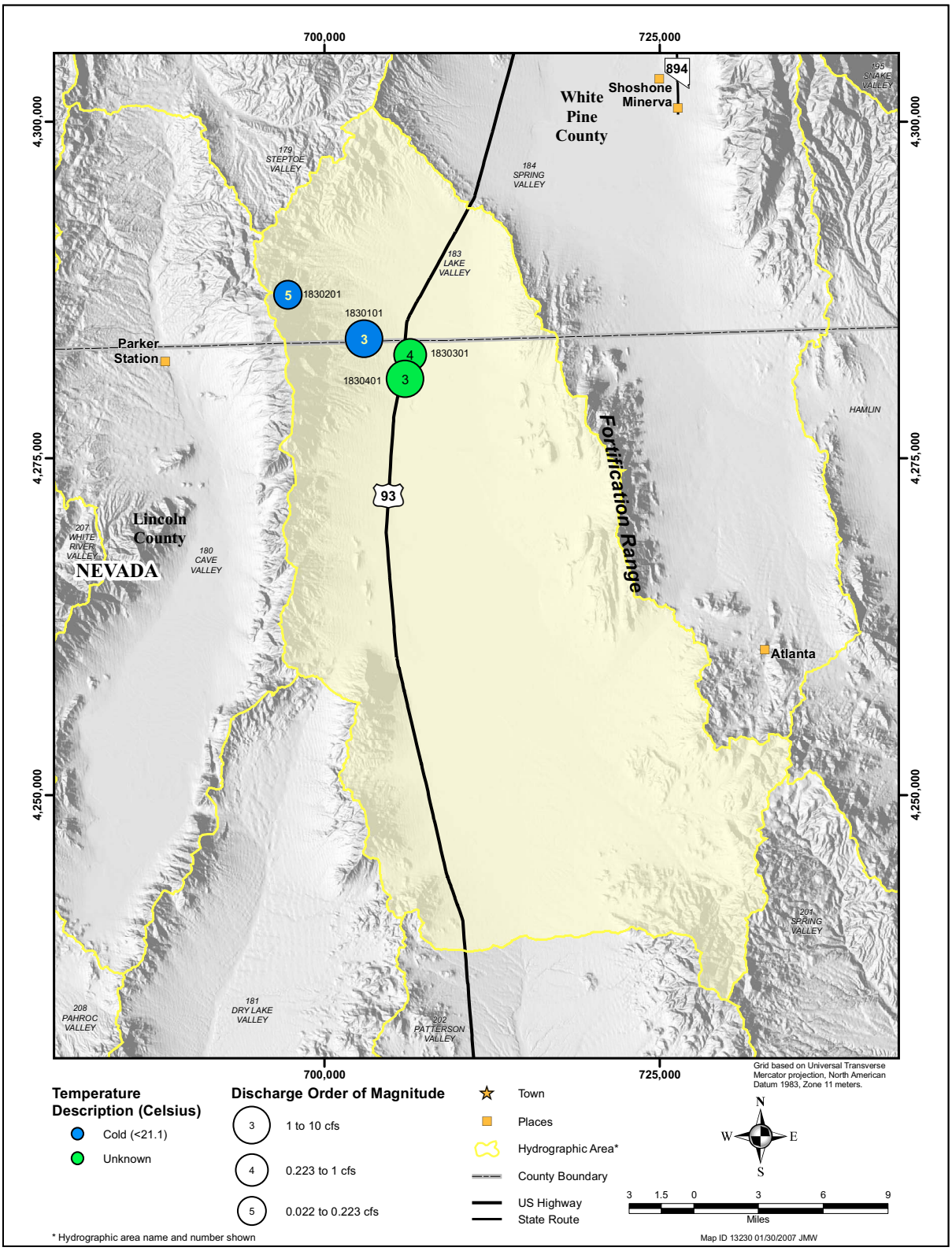


Figure 3-104
Map Showing the Location, Magnitude of Discharge, and Temperature of Geyser Spring in Lake Valley, Nevada

Figure 3-105
Orifice Pool of Geyser Spring, Lake Valley, Nevada

During December 2005 the USGS installed the Geyser Creek at Spring Orifice near Minerva, Nevada gaging (10245100) station (USGS, 2006).

Diversions and Water Use

Geyser Spring forms Geyser Creek, which flows eastward in an unlined channel and into two small reservoirs at the Geyser Ranch at U.S. Highway 93. From these reservoirs, water is released for irrigation and livestock watering on the valley floor.

3.13 Fish Springs Flat (HA 258)

Fish Springs Flat encompasses about 590 mi^2 in Tooele, Juab, and Millard Counties in Utah. The valley is bounded by the Fish Springs Range on the west, the Dugway and Thomas Ranges and Drum Mountains on the east, the Little Drum Mountains on the southeast and a low divide between Swasey Mountain and the Little Drum Mountains form the southern boundary. Fish Springs Flat opens to the Great Salt Lake Desert to the north (Bolke and Sumsion, 1978). Callao, Utah is located approximately 25 miles to the west of Fish Springs and Delta, Utah is approximately 78 mi to the southeast. The Fish Springs National Wildlife Refuge (NWR) was founded in 1959 and is located in the northwest corner of Fish Springs Flat (USFWS, 2004). Located in Fish Springs Flat, are several springs. The largest group in located on and near the NWR, and are described by Mundorff (1970) as the Fish Springs Group which consists of Wilson Hot Springs (a.k.a. Wilson Health Springs), Cold Spring, (C-11-14) 4bbb-S1, Big Spring (a.ka. North Spring), Deadman Spring, Walter Spring and

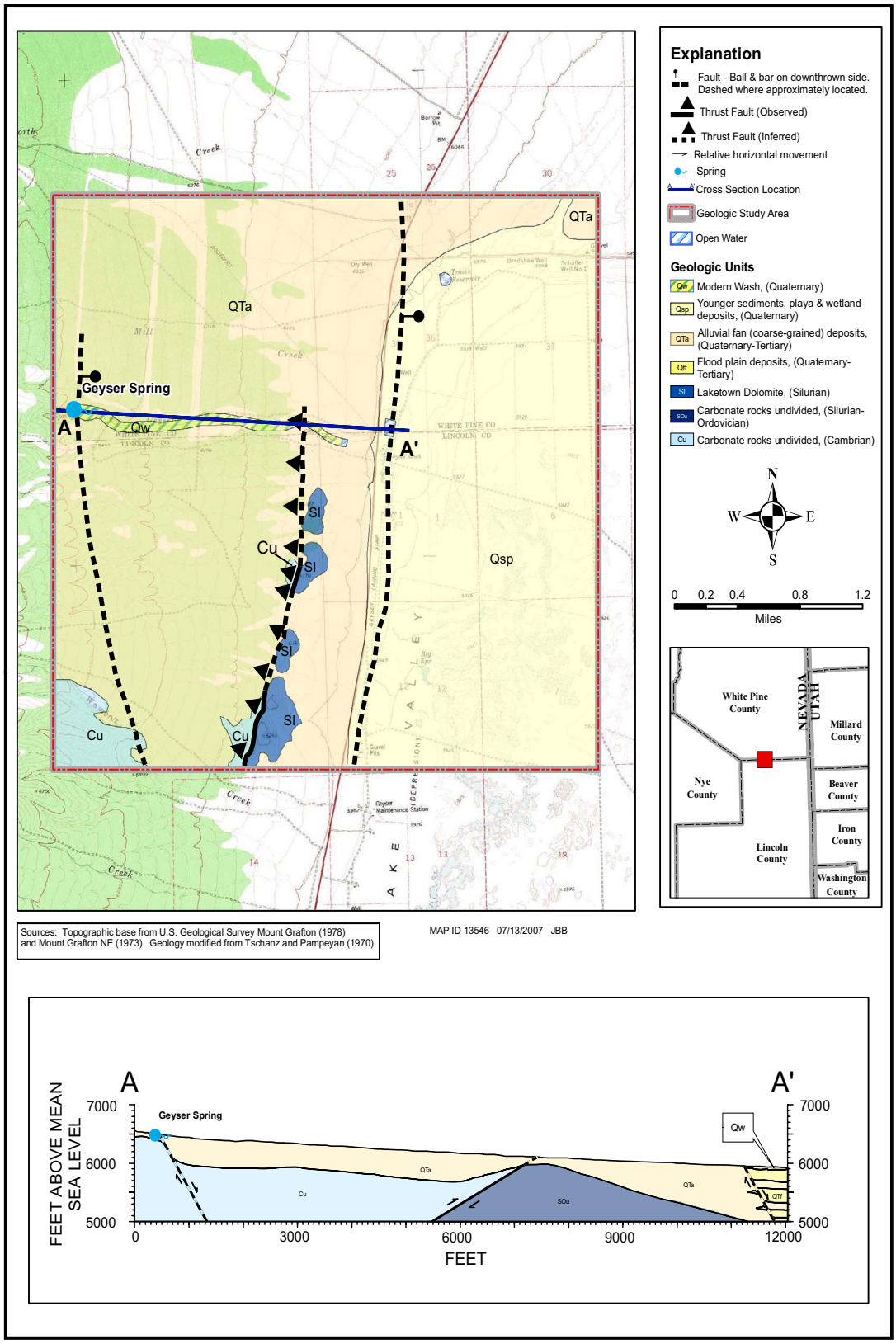
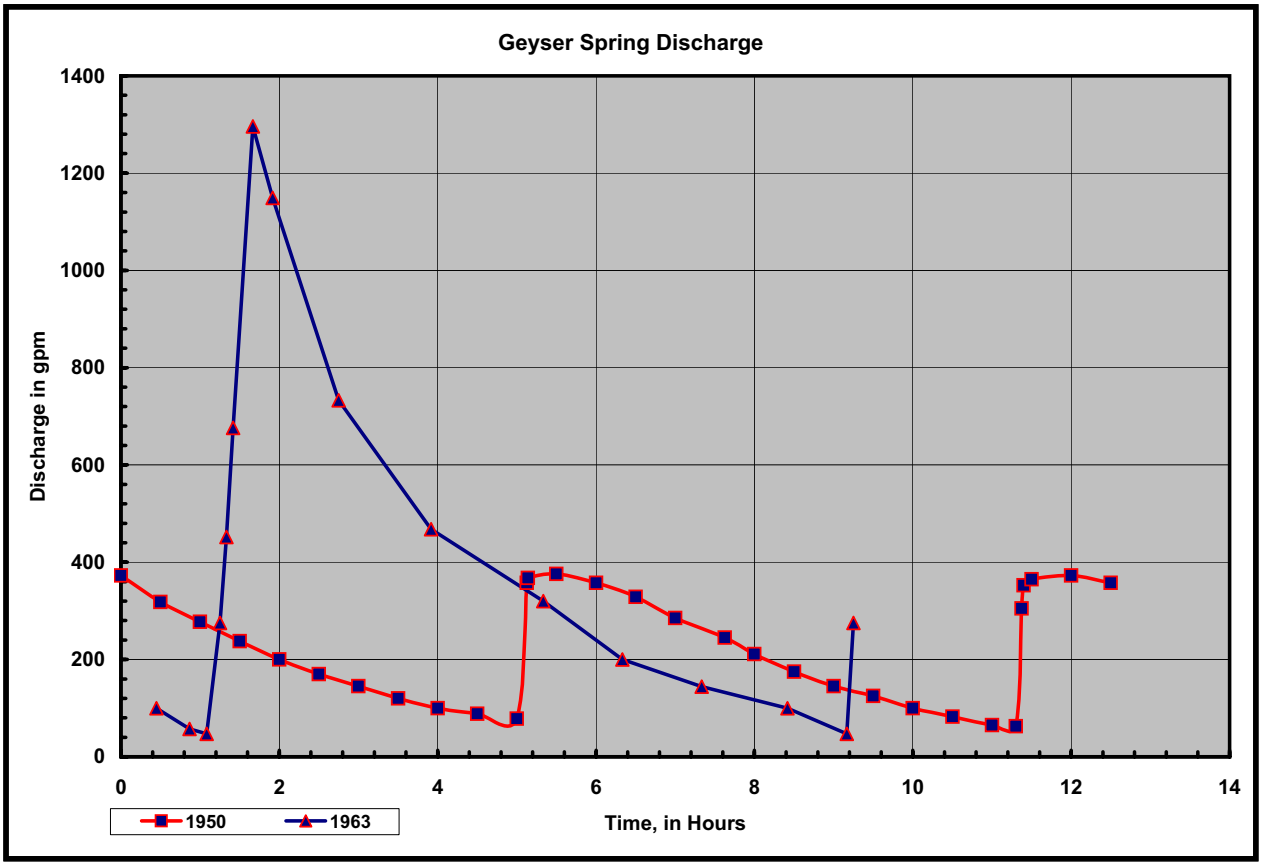


Figure 3-106
Geologic Map and Cross Section of Geyser Spring, Lincoln County, Nevada



Note: Extrapolated from Eakin (1963, Figure 3)

Figure 3-107
Hydrograph of Geyser Spring Discharge, March 30, 1950 and August 5, 1963

Fish Springs (House, Mirror, Thomas, Middle, Lost, Crater, South, and Percy Springs). The total discharge from the Fish Springs Group of Springs is about 21,000 afy or 28.69 cfs (USFWS, 2004). Bolke and Sumsion (1978) estimate the remaining springs in Fish Springs Flat account for 600 afy or 1.3 cfs. In this report the Fish Springs Group will be further subdivided into the Wilson Hot Springs Group, Cold Springs Group and North Springs Group and the Fish Springs Group. The Wilson Hot Springs Group and Cold Springs Group are actually in the Snake Valley hydrographic area, but due to their close proximity to Fish Springs Flat, and the fact that other authors have treated them as part of the same spring system as Fish Springs, they will be discussed in this section (Figure 3-109).

3.13.1 Wilson Hot Springs Group

General Location

The Wilson Hot Springs Group also known as Wilson Health Springs is located approximately 4.5 mi northwest of the NWR and approximately 15 mi east of Callao, Utah at the north end of the Fish Springs Range.

Figure 3-108
Partially Buried 6-in. Parshall Flume Found in Channel below Geyser Spring Lake Valley, Nevada

Geologic Setting

Wilson Hot Springs consists of several springs that discharge along a northeast-trending line from the north end of the Fish Springs Range. Several of the mounds discharge from mounds of various heights (Mundorff, 1970) and (Meinzer, 1911). Meinzer (1911) observed that the larger mounds had smaller discharges than springs that had a smaller or no mound at all, thus the springs must be at hydrostatic equilibrium. Mundorff, 1970 speculates that the high water temperature could be due to a localized, elevated geothermal gradient in the area.

Discharge

Published discharge data at Wilson Hot Springs is sparse. The range in discharge of the 5 springs listed in Bolke and Sumsion (1978) is <1 gpm to 60 gpm (<0.001 cfs to 0.134 cfs). The temperature of the springs range from 55.6 to 60.6°C.

Diversions and Water Use

The hot waters of at least one of the springs supplied a bath house in the early 1900s, but today the springs are used by wildlife (Meinzer, 1911).

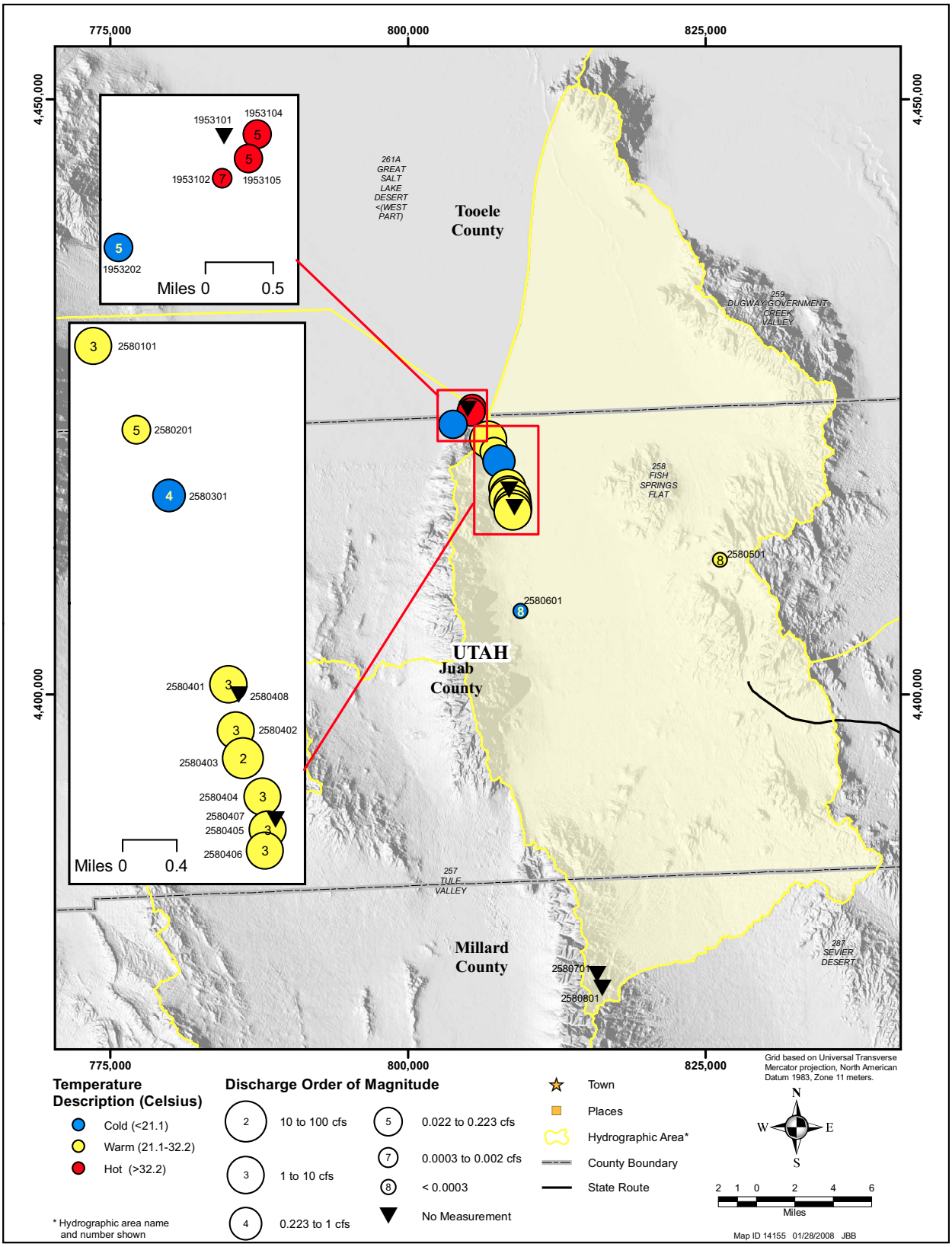


Figure 3-109
Map Showing the Location, Magnitude of Discharge, and Temperature of Fish Springs Group, UT

3.13.2 Cold Springs Group

General Location

The cold springs group is located approximately 0.50 mi south of the Wilson Springs Group, 14.5 mi east of Callao, Utah and 4 mi northwest of the NWR at the north end of the Fish Springs Range.

Geologic Setting

The Cold Springs Group discharge from a thin layer of alluvium with the ultimate source likely being the Paleozoic Carbonate rocks immediately to the south, which make up the northern Fish Spring Range.

Discharge

The western spring of the Cold Springs Group was measured on August 24, 1976 and had a reported discharge of 20 gpm or 0.045 cfs. No published discharge record of Cold Spring could be located.

Diversions and Water Use

From published literature it appears that these springs are unused and only wildlife currently uses them.

3.13.3 North Springs Group

General Location

The North Springs Group consists of 3 springs, North (Big Spring), Deadman and Walter Springs. These springs are locate on the northeast flank of the Fish Springs Range and North Spring is approximately 1 mi southeast of Wilson Hot Springs. North Spring is also reported as Big Springs in Meinzer (1911) and Mundorff (1970).

Geologic Setting

The North Springs Group discharge from alluvium with the source water likely coming from the Paleozoic Carbonate rocks in the Fish Springs Range, directly to the west.

Discharge

Bolke and Sumison (1978) report discharges of 3,140 gpm (7 cfs), 100 gpm (0.22 cfs), and 150 gpm (0.33 cfs) at North Spring, Deadman Spring and Walter Spring respectively. They report that the variability of North Springs discharge is about 15 percent based on a gage height record from 1965 to 1968.

Diversions and Water Use

The North Spring Group is used for wildlife purposes on the NWR.

3.13.4 Fish Springs Group

General Location

The Fish Springs Group is located entirely on the NWR, about 24 mi east of Callao, Utah and 78 mi northwest of Delta, Utah. The springs discharge along a fault s carp in the quaternary alluvial deposits. The source of the water is likely the Paleozoic Carbonate rocks of the Fish Springs Range to the west.

Geologic Setting

Springs that belong to the Fish Springs Group discharge along a north-northwest line along a inferred or concealed fault (Bolke and Sumison, 1978).

Discharge

A combined discharge of 33.5 cfs (15,050 gpm) in July and August 1976 was reported by Bolke and Sumison (1978). Discharges ranged from 1.90 cfs (850 gpm) at House Spring to 12 cfs (5,400 gpm) at Middle Spring.

Diversions and Water Use

Water use at the Fish Springs group helps irrigate land and support wildlife at the NWR.

4.0 SUMMARY

Using standardized data collection techniques, a large variety of springs were inventoried in eastern Nevada and western Utah. To supplement the field observations, an extensive literature search was conducted. From the field observations, it has been determined that the vast majority of springs have been modified to some extent since settlers first arrived in the area.

Springs were selected for inventory based on their topographic location, spatial distribution, discharge, geologic conditions, and data availability. Data regarding discharge, geologic setting, and diversions and water use were collected in the field when possible. Detailed geologic maps were prepared at selected springs based on topographic and geologic setting.

The amount of available data varies from spring to spring and appears to be independent of spring size, temperature, or any other physical characteristic. For example, for Hot Creek Spring in White River Valley there is very little early discharge data available, yet it has a large average discharge of 11.0 cfs. Conversely, Cold, Arnoldson, and Nicholas springs, also located in White River Valley, have discharges of 1.32, 3.60, and 2.64 cfs, respectively, and have a relatively complete record from the early 1900s to the present.

Spring development began in the 1860s when the population of eastern Nevada increased after discoveries of gold and silver deposits. Since then, springs have been modified to facilitate the beneficial use of their waters, including their channels and discharge areas. Some modifications range from an extensive diversion network, such as at Lund, Preston Big, Hiko, Crystal, and Ash springs, to the construction of a simple, small impoundment several yards downstream of the orifice, such as at Willow Spring in northern Spring Valley. The condition of these diversion works varies from new and improved facilities, such as at Panaca and Lund springs, to diversion works that appear to be unused and long since abandoned, such as at Moorman and Hardy springs in White River Valley.

Most of the inventoried springs are currently used for agricultural purposes, such as livestock water supply and irrigation for crops. In the past, uses for spring waters have included watering places for travelers, municipal and domestic, mining and milling, agricultural, wildlife and recreation. The Pederson and Plumber Groups of springs have undergone several iterations of development. Originally used for agricultural purposes, they later were turned into a recreational destination. Currently they have undergone extensive restoration to eliminate any trace of their previous uses. Other springs, like Hot Creek in White River Valley, support populations of endangered species, while Shoshone Pond supports an expatriated population of endangered species. Spring Creek Spring in Snake Valley supplies water for the NDOW fish-rearing station.

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Appendix A

Spring Locations

Table A.1-1
Spring Locations
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Hydrographic Area	Report Spring ID	Local Number	Site Name	UTM Easting[a] (m)	UTM Northing[b] (m)	Elevation[b] (ft-amsl)	Geologic Summary	Alias	Discharge Magnitude	Temperature Classification
179	1790701	179 N16 E63 29AAAA	Murry Springs	681,314	4,344,366	6,562	Spring discharges from Pennsylvanian Ely Limestone formation	---	3	Cold
179	1792001	179 N16 E64 21	McGill Spring	691,240	4,364,955	6,562	Spring discharges from valley alluvium between two parallel faults.	---	2	Warm
179	1792301	179 N23 E63 6C	Cherry Creek Hot Springs	679,565	4,417,460	6,797	Springs discharge from alluvium, east of Tertiary Intrusive rocks.	Young's Hot Spring, John Salvi Hot Spring, 179 N23 E63 06CCC 1 Spring	5	Hot
179	1792401	179 N22 E63 35AD	Cow Trim Spring	688,200	4,400,350	5,971	Spring discharges from alluvium in center of valley.	---	8	Cold
179	1792501	179 N21 E63 25BA	Monte Neva Hot Springs	688,116	4,393,119	6,011	Spring discharges from fault in alluvium, 2 miles east of Devonian Carbonate Rocks.	Melvin, Goodrich	3	Hot
179	1792601	179 N21 E63 12DC	Cold Spring	688,748	4,396,434	5,458	Spring discharges from alluvial fan 1.5 miles east of normal fault.	---	Dry	Cold
180	1800101	180 N09 E64 16AC	Cave Spring	691,760	4,279,249	6,488	Spring discharges from Pole Canyon limestone.	Cave Valley Spring	4	Cold
180	1800201	180 S07 E64 33CD	Sidehill Spring	692,407	4,254,280	6,527	Spring discharges from tuffs and tuffaceous sediments.	---	6	Cold
181	1810101	181 N05 E65 32AD	Meloy Spring	700,888	4,236,201	6,174	Spring discharges at the base of a hill from Tertiary ashflow tuff and interbedded airflow tuff.	Maloy Spring	5	Cold
181	1810201	181 N04 E65 30DB	Bailey Spring	699,080	4,227,795	6,086	Spring discharges from Lower Pennsylvanian Limestone	---	6	Cold
181	1810301	181 N04 E65 04DBD	Littlefield Spring	701,112	4,233,949	6,146	Spring discharges near the base of a small hill from a thin veneer of alluvium overlying Tertiary ashflow tuff and interbedded airflow tuff	Little Field	5	Cold
181	1810401	181 N02 E63 13CAC	Coyote Spring	687,693	4,211,513	5,220	Spring discharges from a thin veneer of alluvium 300 yds. east of outcrop of Tertiary ashflow tuff w/ interbedded airflow tuff	---	6	Cold
182	1820101	182 S05 E64 02CB	Grassy Spring	695,124	4,157,193	5,783	Spring discharges from hillslope comprised of Tertiary andesitic/dacitic lava flows/flow breccias	DR-20	6	Warm
183	1830101	183 N09 E65 04DB	Geyser Springs	702,990	4,283,851	6,494	Spring discharges from alluvium, mid-alluvial fan, 0.4 miles east of a normal fault	---	3	Cold

Table A.1-1
Spring Locations
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Hydrographic Area	Report Spring ID	Local Number	Site Name	UTM Easting[a] (m)	UTM Northing[b] (m)	Elevation[b] (ft-amsl)	Geologic Summary	Alias	Discharge Magnitude	Temperature Classification
183	1830201	183 N10 E65 19C	North Creek Springs	697,324	4,287,127	8,202	Spring discharges from Middle Cambrian/Late Proterozic sedimentary rocks	---	5	Cold
183	1830301	183 N09 E65 04DC	Unnamed spring flowing north	706,418	4,282,630	5,978	Spring discharges from valley alluvium 0.3 miles east of normal fault; Silurian and Upper Ordovician dolomite outcrop 0.6 mi. to the west	Unnamed spring flowing N	4	---
183	1830401	183 N09 E65 04DC	Unnamed spring flowing south	706,019	4,280,858	5,978	Spring discharges from valley alluvium 0.2 miles east of normal fault; Silurian and Upper Ordovician dolomite outcrop 0.6 mi. to the west	Unnamed spring flowing S	3	---
184	1840705	184 N20 E66 30CC	Kalamazoo Spring	706,665	4,382,371	6,956	Spring discharges from fault zone in Paleozoic Carbonate rocks near their contact with preCambrian Clastic rocks.	Dos Tetones Spring Creek above Kalamazoo Creek	3	Cold
184	1845501	184 N21 E66 15BC	Willow Spring	713,830	4,397,068	5,982	Spring discharges from scarp in valley alluvium 0.7 miles west of normal fault	---	6	Cold
184	1845601	184 N14 E67 32AC	Willard Springs	718,691	4,323,976	5,755	Spring discharges from scarp, 3.0 miles west of Cambrian sedimentary units with Jurassic-age intrusions; normal faults lie 2.5 miles east and 2.5 miles west	---	6	Cold
184	1845701	184 N17 E67 25DB	North Millick Spring	725,523	4,354,156	5,590	Spring discharges from alluvium 1.9 miles west of normal fault	---	4	Cold
184	1845702	184 N17 E67 25CD	South Millick Spring	725,031	4,353,754	5,592	Spring discharges from alluvium 2.1 miles west of normal fault	So. Mulick Spr., S. Mulick	4	Cold
184	1845801	184 N15 E67 29DB	South Bastian Spring	718,388	4,334,865	5,660	Spring discharges from alluvium in center of valley	---	6	Cold
184	1845802	184 N15 E67 29DC	South Bastian Spring 2	718,361	4,334,397	5,669	Spring discharges from alluvium in center of valley (Middle spring)	---	7	Cold
184	1845901	184 N14 E67 04DB	Layton Spring	720,204	4,331,794	5,698	Spring discharges from alluvial scarp, 1.9 miles west of normal fault; Middle Cambrian/late Proterozoic sedimentary rocks are 2.2 miles to the east	---	7	Cold

Table A.1-1
Spring Locations
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Hydrographic Area	Report Spring ID	Local Number	Site Name	UTM Easting[a] (m)	UTM Northing[b] (m)	Elevation[b] (ft-amsl)	Geologic Summary	Alias	Discharge Magnitude	Temperature Classification
184	1846001	184 N12 E67 18AD	North Spring	717,768	4,309,388	5,763	Spring discharges from alluvium 0.6 miles east of normal fault	---	6	Warm
184	1846101	184 N12 E67 02AB	The Cedars	723,712	4,312,911	5,783	Spring discharges from mid-valley scarp, in alluvium	Cedar #1, Cedar #2	5	Warm
184	1846201	184 N11 E68 05CA	Swallow Springs	728,597	4,302,920	6,080	Spring discharges from alluvium, 0.5 miles east are Upper/Middle Cambrian limestones	184 N11 E68 05CA 1 Spring	4	Cold
184	1846401	184 N11 E67 23DA	Blind Spring	724,717	4,298,025	5,773	Spring discharges north of old spring mounds, in alluvium 1.1 miles west of normal fault	---	8	Cold
184	1846501	184 N10 E68 15AB	Lower Murphy Wash Spring	731,810	4,290,564	6,560	Spring discharges at the base of Riepe Spring Limestone and Ely Limestone	---	6	Cold
184	1846601	184 N21 E66 09BB	Osborne Springs	711,959	4,398,798	6,127	Spring discharges from scarp in valley alluvium 1.1 miles west of normal fault	---	6	Cold
184	1846701	184 N09 E67 15BD	Indian Springs East	721,971	4,280,083	6,380	Spring discharges from Tertiary ash-flow tuff w/ interbedded airfall tuff	Indian Springs East	5	Cold
184	1846702	184 N09 E67 15BA	Indian Springs West	722,213	4,280,791	6,209	Spring discharges from alluvium overlying Tertiary ash-flow tuff w/ interbedded airfall tuff	---	8	Cold
184	1847001	184 N15 E67 30BD	Four Wheel Drive Spring	716,255	4,335,256	5,754	Spring discharges from alluvium in valley basin	---	5	Cold
184	1847101	184 N18 E66 01DC	Keegan Spring	714,906	4,369,756	5,617	Spring discharges from valley alluvium 1.5 miles east of normal fault/exposed metamorphosed Precambrian basement rock	---	4	Cold
184	1847201	184 N11 E67 12DB	Minerva Spring	726,101	4,301,025	5,825	Spring discharges from valley alluvium 1.9 miles west of normal fault and 1.5 miles north of parallel normal fault; to the east are Precambrian limestones	---	4	Cold
184	1847301	184 N15 E68 08AC	Rock Spring	726,798	4,340,204	6,364	Spring discharges from alluvium overlying Middle/Lower Ordovician quartzite and metamorphosed Precambrian basement rock	---	5	Cold

Table A.1-1
Spring Locations
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Hydrographic Area	Report Spring ID	Local Number	Site Name	UTM Easting[a] (m)	UTM Northing[b] (m)	Elevation[b] (ft-amsl)	Geologic Summary	Alias	Discharge Magnitude	Temperature Classification
184	1847401	184 N22 E66 17CA	Stonehouse Spring	710,511	4,406,507	6,256	Spring discharges from valley alluvium 0.3 miles east of normal fault	---	8	Cold
184	1847501	184 N12 E67 26AC	The Seep	724,060	4,306,263	5,764	Spring discharges from alluvium in valley basin	---	6	Warm
184	1847701	184 N15 E67 09BBB	Unnamed 5 Spring	718,911	4,340,641	5,645	Spring discharges from alluvium in center of valley	---	---	Cold
195	1951302	195 N13 E69 10DD	Rowland Spring at Great Basin Nation Park near Baker, NV	741,778	4,321,448	6,580	Spring discharges from alluvium overlying Upper/Middle Cambrian limestone	Rowland Spring	5	Cold
195	1951901	195 N10 E70 33B	Big Springs	749,422	4,287,293	5,568	Spring discharges from scarp, in alluvium, 0.6 miles east of normal fault; one mile to the west is outcrop of Sevy Dolomite	---	3	Cold
195	1952001	195 (C-15-19) 31CB	Warm Creek near Gandy, UT	756,007	4,371,984	5,156	Spring discharges from valley alluvium 1.6 miles west of normal fault	Warm Spring Creek	2	Warm
195	1952401	195 (C-19-20) 24 CB	Caine Spring	755,138	4,336,186	5,028	Spring dischargers from alluvium, two miles to the west Lower Cambrian rocks outcrop	---	6	Cold
195	1952701	195 (C-18-18) 16AB	Knoll Spring	769,378	4,348,105	4,869	Spring discharges from valley alluvium 0.7 miles northwest of normal fault	---	6	Cold
195	1952801	195 (C-14-19) 23BD	Coyote Spring	761,146	4,385,850	5,092	Spring discharges from valley alluvium 0.2 miles from normal fault	---	5	Cold
195	1953101	195 (C-10-14) 33C	Wilson Hot Spring 1	805,047	4,423,960	4,293	Spring discharges from alluvium 0.8 miles east and 1.2 miles west of two normal faults	Wilson Health Spring, (C-10-14) 33c-S1	---	Hot
195	1953102	195 (C-10-14) 33CDC	Wilson Hot Spring 2	805,030	4,423,459	4,293	Spring discharges from alluvium 0.8 miles east and 1.2 miles west of two normal faults	Wilson Health Spring, (C-10-14) 33cdc-S1	7	Hot
195	1953103	195 (C-10-14) 33CDD	Wilson Hot Spring 3	805,163	4,423,580	4,293	Spring discharges from alluvium 1.1 miles east and 1.2 miles west of two normal faults	Wilson Health Spring, (C-10-14) 33cdd-S1	6	Hot
195	1953104	195 (C-10-14) 33DBA	Wilson Hot Spring 4	805,477	4,423,985	4,298	Spring discharges from alluvium 1.2 miles east and 0.9 miles west of two normal faults	Wilson Health Spring, (C-10-14) 33dba-S1	5	Hot
195	1953105	195 (C-10-14) 33DCB	Wilson Hot Spring 5	805,343	4,423,694	4,298	Spring discharges from alluvium 1.1 miles east and 1.2 miles west of two normal faults	Wilson Health Spring, (C-10-14) 33dcb-S1	5	Hot

Table A.1-1
Spring Locations
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Hydrographic Area	Report Spring ID	Local Number	Site Name	UTM Easting[a] (m)	UTM Northing[b] (m)	Elevation[b] (ft-amsl)	Geologic Summary	Alias	Discharge Magnitude	Temperature Classification
195	1953201	195 (C-11-14) 4AB	Cold Spring	805,007	4,422,425	4,303	Spring discharges from contact between alluvium and Devonian carbonate sedimentary rocks; lies between two parallel normal faults	(C-11-14) 4AB-S1	---	Cold
195	1953202	195 (C-11-14) 04BBB	(C-11-14)4bbb-S1	803,797	4,422,636	4,298	Spring discharges from alluvium 164 yds. from contact with Devonian carbonate sedimentary rocks; lies 0.5 miles southeast of normal fault	Unnamed Spring USGS Tech Report 64, (C-11-14) 4bbb-S1	5	Cold
195	1953401	195 (C-16-18) 16DAD	Foote Res. Spring	769,356	4,367,388	4,825	Spring discharges from valley alluvium 2.0 miles west of Permian Arcturus formation outcrop and 0.5 miles east of normal fault	---	3	---
195	1953701	195 (C-17-19) 21	Kell Spring	759,929	4,356,001	4,910	Spring discharges from valley alluvium 1.6 miles east of normal fault	---	4	---
195	1953801	195 (C-19-17) 02AB	Conger Spring	782,909	4,342,951	6,760	Spring discharges from outcrop at contact between Permian/Pennsylvanian limestone and Missippian Chainman Shale formation	195 (C-18-16) 31	6	---
195	1953901	195 (C-18-18) 08A	Unnamed Spring	768,130	4,350,397	4,853	Spring discharges from valley alluvium 2.2 miles northwest of normal fault	195 (C-18-18) 8a	6	---
203	2030101	203 S02 E68 04BADD	Panaca Spring	730,624	4,187,657	4,799	Spring discharges at fault contact with Middle Cambrian limestone	---	4	Warm
203	2030301	203 S02 E67 07CD	Bennett Springs	717,613	4,184,673	5,216	Spring discharges from alluvium 0.8 miles east of normal fault	---	5	Warm
207	2070501	207 N06 E61 18AADA	Hot Creek Spring	661,573	4,249,541	5,225	Spring discharges from alluvium 300 yds. E of normal fault and 200 yds. NE of Sevy Dolomite	NDW-Hot Creek Spring	2	Warm
207	2070601	207 N12 E61 12DCCD	Arnoldson Spring	667,919	4,308,473	5,625	Spring discharges from alluvium in the center of the valley	Preston Irrigation	3	Warm
207	2070701	207 N12 E61 12BDAD	Cold Spring	667,609	4,309,454	5,653	Spring discharges from alluvium in the center of the valley	---	3	Warm

Table A.1-1
Spring Locations
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Hydrographic Area	Report Spring ID	Local Number	Site Name	UTM Easting[a] (m)	UTM Northing[b] (m)	Elevation[b] (ft-amsl)	Geologic Summary	Alias	Discharge Magnitude	Temperature Classification
207	2070901	207 N12 E61 02ACAB	Preston Big Spring	666,296	4,311,153	5,732	Springs discharge from alluvium 0.8 miles east of normal fault	Preston Big Spring near Preston, Nevada	3	Warm
207	2071001	207 N11 E62 04AABA	Lund Spring	673,266	4,302,019	5,608	Spring discharges from contact between alluvium and Pennsylvanian Ely Limestone	---	3	Cold
207	2071101	207 N09 E61 32DABC	Moorman Spring	662,053	4,273,440	5,299	Springs discharge from valley alluvium	Morman Spring	4	Hot
207	2071201	207 N08 E63 19AA	Shingle Spring	679,925	4,267,716	6,434	Spring discharges from alluvium 100 yds downslope of ashflow tuff w/ interbedded airflow tuff outcrop	---	6	Cold
207	2071301	207 N07 E62 33BCCC	Flag Springs 3	672,579	4,254,416	5,294	Spring discharges near the toe of a alluvial fan 0.5 miles west of normal fault	---	3	Warm
207	2071302	207 N07 E62 33BCCB	Flag Springs 2	672,576	4,254,570	5,285	Spring discharges near the toe of a alluvial fan 0.5 miles west of normal fault	---	3	Warm
207	2071303	207 N07 E62 33BCAB	Flag Springs 1	672,719	4,254,696	5,294	Spring discharges near the toe of a alluvial fan 0.5 miles west of normal fault	---	3	Warm
207	2071401	207 N07 E62 28ABDC	Butterfield Spring	673,530	4,256,472	5,324	Spring discharges from valley alluvium 0.4 miles west of normal fault	---	3	---
207	2071501	207 N09 E61 13CB	Hardy Springs	667,553	4,278,196	5,354	Springs discharge from valley alluvium	West Immigrant Spring	4	Cold
207	2071502	207 N09 E61 13CB	Hardy Spring NW	667,352	4,278,196	5,349	Springs discharge from valley alluvium	---	6	Cold
207	2071601	207 N12 E61 12DBDD	Nicholas Spring	668,104	4,308,847	5,635	Spring discharges from alluvium in the center of the valley	---	3	Warm
207	2071701	207 N12 E61 32CC	Douglas Spring	660,653	4,301,764	5,900	Spring discharges from Tertiary low-silicate rhyolite lava flows/volcanic domes	Springs at Douglas	4	Cold
207	2071801	207 N13 E60 33AB	Williams Hot Spring	653,089	4,312,874	6,300	Spring discharges from alluvium overlying Tertiary rhyolite lava flows/volcanic domes	Warm Spring	5	Warm

Table A.1-1
Spring Locations
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Hydrographic Area	Report Spring ID	Local Number	Site Name	UTM Easting[a] (m)	UTM Northing[b] (m)	Elevation[b] (ft-amsl)	Geologic Summary	Alias	Discharge Magnitude	Temperature Classification
207	2071901	207 N06 E60 25BDAD	Moon River Spring	658,908	4,246,394	5,223	Spring discharges from alluvium overlying the Pogonip Group formation and Middle/Lower Ordovician quartzite 0.6 miles northwest of normal fault	---	3	---
207	2072001	207 N09 E62 19DB	Emigrant Springs	669,895	4,276,841	5,480	Spring discharges from valley alluvium 0.5 miles southwest of normal fault	---	3	---
209	2090101	209 S04 E60 14DBAB	Hiko Springs	657,549	4,162,744	3,875	Spring discharges from Simonson Dolomite	---	3	Warm
209	2090201	209 S08 E61 23BABD	Solar Panel Spring	667,262	4,123,643	3,238	Spring discharges from fine-grained alluvial sediments at the toe of a small hill	---	7	Cold
209	2090301	209 S03 E62 25AB	Pahroc Spring	678,091	4,170,481	5,400	Spring discharges from Tertiary ashflow tuff w/ interbedded airfall tuff	---	6	Cold
209	2090401	209 S05 E60 10AD	Crystal Springs	656,165	4,155,348	3,803	Spring discharges from a small hill of Sevy Dolomite in the center of the valley	09415590 Crystal Spring near Hiko, Nevada	2	Warm
209	2090501	209 S06 E61 01AD	Ash Springs	659,684	4,147,460	3,622	Springs discharge from Sevy Dolomite	09415640 Ash Springs Creek below Highway 93 at Ash Springs, Nevada	2	Hot
209	2090701	209 S05 E60 26DAD 1	Brownie Spring	658,088	4,149,897	3,695	Spring discharges from alluvium in moderately-faulted valley (4 parallel faults within 3 mile radius)	209 S05 E60 26DAD 1 Brownie Spring	4	---
215	2150201	215 S18 E67 12DD	Rogers Spring	729,274	4,028,821	1,594	Spring discharges from the contact between the Muddy Creek formation and Paleozoic carbonate rocks.	---	3	Warm
215	2150301	215 S19 68E 07AB	Blue Point Spring	730,235	4,030,173	1,550	Spring discharges from the Muddy Creek formation near contacts with Jurassic sedimentary rocks, Middle/Lower Ordovician dolomites, and Tertiary alluvial, fluvial and lacustrine sediments; in association w/ inferred shear fault.	---	4	Warm
219	2190101	219 S14 E65 21BA	Pederson East Spring	703,965	4,065,062	1,800	Spring discharges from a thin veneer of alluvium near outcrops of Pennsylvanian, Mississippian, Permian carbonate rocks.	09415908 Pederson East Spring near Moapa, Nevada	5	Warm

Table A.1-1
Spring Locations
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Hydrographic Area	Report Spring ID	Local Number	Site Name	UTM Easting[a] (m)	UTM Northing[b] (m)	Elevation[b] (ft-amsl)	Geologic Summary	Alias	Discharge Magnitude	Temperature Classification
219	2190201	219 S14 E65 21BA	Pederson Spring	704,008	4,065,088	1,811	Spring discharges from a thin veneer of alluvium near out crops Pennsylvanian, Mississippian, Permian carbonate rocks.	09415910 Pederson Spring near Moapa, Nevada	5	Warm
219	2190301	219 S14 E65 16DD	Jones Spring	703,714	4,065,661	1,784	Spring discharges from a thin veneer of alluvium near outcrops of Pennsylvanian, Mississippian, Permian carbonate rocks.	---	3	Warm
219	2190401	219 S14 E65 16DB	Baldwin Spring	703,257	4,066,270	1,798	Spring discharges from a thin veneer of alluvium near outcrops of Pennsylvanian, Mississippian, Permian carbonate rocks.	09415875 Baldwin Springs near Moapa, Nevada	3	Warm
219	2190501	219 S14 E65 16DA	Muddy Spring	704,018	4,066,348	1,747	Spring discharges from a thin veneer of alluvium near outcrops of Pennsylvanian, Mississippian, Permian carbonate rocks.	09415900 Muddy Spring at L.D.S. Farm near Moapa, Nevada	2	Warm
219	2190601	219 S14 E65 15CC	Iverson Flume	704,571	4,065,302	1,757	Gaging station	---	3	---
219	2190701	219 S14 E65 21AABB1	M-11	704,070	4,065,194	1,800	Spring discharges from a thin veneer of alluvium near outcrops of Pennsylvanian, Mississippian, Permian carbonate rocks.	---	4	Warm
219	2190801	219 S14 E65 21AABB4	M-12	704,021	4,065,162	1,800	Spring discharges from a thin veneer of alluvium near outcrops of Pennsylvanian, Mississippian, Permian carbonate rocks.	---	5	Warm
219	2190901	219 S14 E65 21AABB3	M-13	704,022	4,065,131	1,800	Spring discharges from a thin veneer of alluvium near outcrops of Pennsylvanian, Mississippian, Permian carbonate rocks.	---	5	Warm
219	2191001	219 S14 E65 21AAAA1	M-15	704,318	4,065,200	1,780	Spring discharges from a thin veneer of alluvium near outcrops of Pennsylvanian, Mississippian, Permian carbonate rocks.	---	3	Warm

Table A.1-1
Spring Locations
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Hydrographic Area	Report Spring ID	Local Number	Site Name	UTM Easting[a] (m)	UTM Northing[b] (m)	Elevation[b] (ft-amsl)	Geologic Summary	Alias	Discharge Magnitude	Temperature Classification
219	2191101	219 S14 E65 21AAAB2	M-16	704,268	4,065,198	1,780	Spring discharges from a thin veneer of alluvium near outcrops of Pennsylvanian, Mississippian, Permian carbonate rocks	---	4	Warm
219	2191201	219 S14 E65 21AABB5	M-19	704,047	4,065,101	1,800	Spring discharges from a thin veneer of alluvium near outcrops of Pennsylvanian, Mississippian, Permian carbonate rocks.	---	4	Warm
219	2191301	219 S14 E65 21 1	M-20	704,368	4,065,170	1,778	Spring discharges from a thin veneer of alluvium near outcrops of Pennsylvanian, Mississippian, Permian carbonate rocks.	---	4	Warm
219	2191401	219 S14 E65 21AAAA2	Warm Springs East	704,294	4,065,137	1,790	Confluence of Plummer Group of springs, which discharge from a thin veneer of alluvium near outcrops of Pennsylvanian, Mississippian, Permian carbonate rocks	---	4	Warm
219	2191501	219 S14 E65 21	Warm Springs West	704,211	4,065,272	1,772	Gaging Station, Confluence of Pederson Group of springs, which discharge from a thin veneer of alluvium near outcrops of Pennsylvanian, Mississippian, Permian carbonate rocks	09415920 Warm Springs West near Moapa, Nevada	3	Warm
219	2191701	219 S14 E65 16ABB 1	M-10	703,637	4,066,695	1,722	Spring discharges from a thin veneer of alluvium near outcrops of Pennsylvanian, Mississippian, Permian carbonate rocks	---	4	Warm
258	2580101	258 (C-11-14) 03DBD	North Springs	806,770	4,421,366	4,303	Spring discharges from alluvium 0.6 miles west of normal fault	(C-11-14) 3dbd-S1, Big Spring	3	Warm
258	2580201	258 (C-11-14) 03DBD	Deadman Spring	807,286	4,420,367	4,310	Spring discharges from alluvium 0.3 miles east of preCambrian outcrop and 0.3 miles west of normal fault	(C-11-14) 3dbd-S1	5	Warm
258	2580301	258 (C-11-14) 11CDB	Walter Spring	807,675	4,419,580	4,308	Spring discharges from alluvium 252 yds. west of normal fault	(C-11-14) 11cdb-S1	4	Cold
258	2580401	258 (C-11-14) 23ACA	House Spring	808,385	4,417,323	4,315	Spring discharges from alluvium 0.4 miles east of normal fault	(C-11-14) 23aca-S1	3	Warm

Table A.1-1
Spring Locations
(Page 10 of 10)

Hydrographic Area	Report Spring ID	Local Number	Site Name	UTM Easting[a] (m)	UTM Northing[b] (m)	Elevation[b] (ft-amsl)	Geologic Summary	Alias	Discharge Magnitude	Temperature Classification
258	2580402	258 (C-11-14) 23DBD	Thomas Spring	808,479	4,416,770	4,315	Spring discharges from alluvium 0.5 miles east of normal fault	(C-11-14) 23dbd-S1	3	Warm
258	2580403	258 (C-11-14) 23DDC	Middle Spring	808,564	4,416,434	4,315	Spring discharges from alluvium 0.6 miles east of normal fault	(C-11-14) 23ddc-S1	2	Warm
258	2580404	258 (C-11-14) 26AAA	Lost Spring	808,796	4,415,980	4,310	Spring discharges from alluvium 0.8 miles east of normal fault	(C-11-14) 26aaa-S1	3	Warm
258	2580405	258 (C-11-14) 26ADD	South Spring	808,860	4,415,581	4,310	Spring discharges from alluvium 0.9 miles east of normal fault	(C-11-14) 26add-S1	3	Warm
258	2580406	258 (C-11-14) 26DAA	Percy spring	808,823	4,415,332	4,315	Spring discharges from alluvium 0.9 miles east of normal fault	(C-11-14) 26daa-S1	3	Warm
258	2580407	258 (C-11-14) 26AD	Crater Spring	808,950	4,415,708	4,305	Spring discharges from alluvium 0.9 miles east of normal fault	---	---	---
258	2580408	258 (C-11-14) 23AD	Mirror Spring	808,509	4,417,204	4,315	Spring discharges from alluvium 0.5 miles east of normal fault	---	---	---
258	2580501	258 (C-12-12) 10CBC	Wildhorse Spring	826,240	4,411,270	5,300	Spring discharges from Tertiary high-silica rhyolite lava flows/volcanic domes	(C-12-12) 10cbc-S1	7	Warm
258	2580601	258 (C-12-14) 23DCC	Cane Spring	809,493	4,406,988	4,333	Spring discharges from valley alluvium 1.7 miles east of normal fault	(C-12-14) 23dcc-S1	8	Cold
258	2580701	258 (C-15-13) 29DDC	Lost Spring	815,918	4,376,475	6,800	Spring discharges from Upper/Middle Cambrian limestone	(C-15-13) 29ddc-S1	---	---
258	2580801	258 (C-15-13) 33CBC	North Spring Canyon Spring	816,354	4,375,386	6,700	Spring discharges from Upper/Middle Cambrian limestone	(C-15-13) 33cbc-S1, North Spring	---	---

Note: See Section 2.2.1 for discharge magnitude description. See Section 2.2.2 for temperature classification description.
[a]Coordinates are in UTM Zone 11 and North American Datum of 1983
[b]Elevations are in North American Vertical Datum of 1988

Appendix B

Discharge Measurement for Selected Springs

B.1.0 DISCHARGE MEASUREMENT OF SELECTED SPRINGS

Table B.1-1 shows the discharge measurements of selected springs for this study.

Table B.1-1
Discharge Measurement of Selected Springs
(Page 1 of 69)

Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
179	1790701	03/01/1918	3,828	8.53	--	R	--	Clark and Riddell, 1920	
179	1790701	06/18/1918	5,413	12.1	--	R	--	Clark and Riddell, 1920	
179	1790701	01/11/1982	4,000	8.91	--	R	--	USGS-NWIS, 2006	
179	1790701	01/15/1985	5,000	11.1	--	R	--	USGS-NWIS, 2006	
179	1790701	01/31/1986	4,000	8.91	--	R	--	USGS-NWIS, 2006	
179	1790701	02/12/1987	5,000	11.1	--	R	--	USGS-NWIS, 2006	
179	1790701	02/23/1988	4,200	9.36	--	R	--	USGS-NWIS, 2006	
179	1790701	03/14/1989	3,300	7.35	--	R	--	USGS-NWIS, 2006	
179	1790701	10/26/1991	1,600	3.56	--	R	--	USGS-NWIS, 2006	
179	1790701	12/03/1991	1,600	3.56	--	R	--	USGS-NWIS, 2006	
179	1790701	03/19/1992	1,600	3.56	--	R	--	USGS-NWIS, 2006	
179	1790701	10/15/1992	1,100	2.45	--	R	--	USGS-NWIS, 2006	
179	1790701	04/05/1993	2,600	5.79	--	R	--	USGS-NWIS, 2006	
179	1790701	09/20/1993	2,900	6.46	--	R	--	USGS-NWIS, 2006	
179	1790701	03/23/1994	1,781	3.97	--	R	--	USGS-NWIS, 2006	
179	1790701	09/08/1994	2,937	6.54	--	R	--	USGS-NWIS, 2006	
179	1792001	10/01/1965	5,000	11.1	--	R	--	USGS-NWIS, 2006	
179	1792001	10/07/1965	4,758	10.6	--	R	--	USGS, 1966	Spring flow.
179	1792001	01/12/1982	4,400	9.80	--	R	--	USGS-NWIS, 2006	
179	1792001	07/06/1983	5,000	11.1	--	R	--	USGS-NWIS, 2006	
179	1792001	10/27/1983	5,000	11.1	--	R	--	USGS-NWIS, 2006	
179	1792001	06/13/1984	2,700	6.02	--	R	--	USGS-NWIS, 2006	
179	1792001	01/15/1985	5,000	11.1	--	R	--	USGS-NWIS, 2006	
179	1792001	05/26/1985	5,000	11.1	--	R	--	USGS-NWIS, 2006	
179	1792001	11/02/1985	6,000	13.4	--	R	--	USGS-NWIS, 2006	
179	1792001	02/04/1986	5,000	11.1	--	R	--	USGS-NWIS, 2006	
179	1792001	02/12/1987	6,000	13.4	--	R	--	USGS-NWIS, 2006	
179	1792001	08/11/1987	4,000	8.91	--	R	--	USGS-NWIS, 2006	
179	1792001	02/22/1988	6,000	13.4	--	R	--	USGS-NWIS, 2006	
179	1792001	03/13/1989	5,000	11.1	--	R	--	USGS-NWIS, 2006	
179	1792001	03/20/1990	5,000	11.1	--	R	--	USGS-NWIS, 2006	

Table B.1-1
Discharge Measurement of Selected Springs
(Page 2 of 69)

Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
179	1792001	11/05/1990	5,000	11.1	--	R	--	USGS-NWIS, 2006	
179	1792001	03/01/1991	5,000	11.1	--	R	--	USGS-NWIS, 2006	
179	1792001	11/06/1991	4,400	9.80	--	R	--	USGS-NWIS, 2006	
179	1792001	03/19/1992	4,400	9.80	--	R	--	USGS-NWIS, 2006	
179	1792001	10/15/1992	5,000	11.1	--	R	--	USGS-NWIS, 2006	
179	1792001	04/05/1993	4,100	9.13	--	R	--	USGS-NWIS, 2006	
179	1792001	09/20/1993	4,400	9.80	--	R	--	USGS-NWIS, 2006	
179	1792001	03/23/1994	4,277	9.53	--	R	--	USGS-NWIS, 2006	
179	1792001	09/08/1994	4,345	9.68	--	R	--	USGS-NWIS, 2006	
179	1792301	08/29/1917	35.9	0.080	--	R	47-57	Clark and Riddell, 1920	Discharge is combined flow of 3 springs
179	1792301	06/07/1983	43.1	0.100	--	R	--	USGS-NWIS, 2006	
179	1792301	06/20/1983	35.0	0.080	--	R	--	USGS-NWIS, 2006	
179	1792301	07/05/1983	26.0	0.060	--	R	--	USGS-NWIS, 2006	
179	1792301	07/18/1983	26.0	0.060	--	R	--	USGS-NWIS, 2006	
179	1792301	08/02/1983	29.2	0.070	--	R	--	USGS-NWIS, 2006	
179	1792301	08/13/1983	29.2	0.070	--	R	--	USGS-NWIS, 2006	
179	1792301	07/14/2004	44.9	0.100	P	E	--	SNWA	Two pools to the north and one pool to the south discharge to a common pond.
179	1792401	06/22/2004	Dry	Dry	E	--	--	SNWA	
179	1792501	08/21/1917	624	1.39	--	R	78.8	Clark and Riddell, 1920	
179	1792501	06/22/2004	673	1.50	P	E	76	SNWA	
179	1792601	06/22/2004	Dry	Dry	E	--	--	SNWA	
180	1800101	05/24/1966	400	0.890	--	R	--	Hess and Mifflin, 1978	
180	1800101	06/15/1968	400	0.890	--	R	--	USGS-NWIS, 2006	
180	1800101	03/01/1980	1,000	2.23	--	R	12	Bunch and Harrill, 1984	
180	1800101	06/23/2004	105	0.233	G	C	12.3	SNWA	
180	1800101	07/16/2004	36.4	0.081	E	F	13	SNWA	
180	1800101	07/29/2004	9.90	0.022	F	C	--	SNWA	
180	1800101	09/14/2004	Dry	Dry	E	--	--	SNWA	
180	1800101	07/26/2005	359	0.799	F	C	12	SNWA	
180	1800101	10/12/2006	14.8	0.033	P	E	--	SNWA	
180	1800101	07/09/2007	Dry	Dry	E	--	--	SNWA	

Table B.1-1
Discharge Measurement of Selected Springs
(Page 3 of 69)

Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
180	1800101	09/07/2007	Dry	Dry	E	--	11.6	SNWA	
180	1800201	08/01/1979	--	--	--	R	17	Bunch and Harrill, 1984	
180	1800201	03/01/1980	1.00	0.00	--	R	--	Bunch and Harrill, 1984	Discharge is < 1 gpm
180	1800201	06/21/2004	2.70	0.006	P	V	15	SNWA	
181	1810101	03/01/1963	20.0	0.040	--	R	--	USGS-NWIS, 2006	
181	1810101	05/01/1980	82.0	0.180	--	R	--	USGS-NWIS, 2004	
181	1810101	07/13/1997	44.9	0.100	P	E	19.3	SNWA	
181	1810201	10/18/1912	3.00	0.010	--	R	--	Carpenter, 1915	
181	1810201	05/01/1980	2.00	0.00	--	R	--	Bunch and Harrill, 1984	Reported as 2-3 gpm
181	1810201	06/03/2004	0.400	0.001	E	F	13	SNWA	
181	1810301	05/01/1980	10.0	0.020	--	R	--	Bunch and Harrill, 1984	
181	1810301	06/03/2004	11.7	0.026	E	F	15	SNWA	
181	1810301	07/25/2005	59.7	0.130	E	F	17.9	SNWA	
181	1810401	10/18/1912	5.00	0.010	--	R	--	Carpenter, 1915	
181	1810401	08/01/1979	1.00	0.002	--	R	--	Bunch and Harrill, 1984	
181	1810401	06/03/2004	0.100	0.00	G	V	18	SNWA	
181	1810401	06/21/2004	Dry	Dry	E	V	--	SNWA	
181	1810401	07/14/2005	0.520	0.001	G	V	18	SNWA	
182	1820101	05/01/1980	7.00	0.020	--	R	11	Bunch and Harrill, 1984	
182	1820101	06/02/2004	0.100	0.00	F	V	20.5	SNWA	
182	1820101	07/14/2005	6.00	0.013	G	V	21.2	SNWA	
182	1820101	07/25/2005	5.40	0.012	F	V	--	SNWA	
183	1830101	10/24/1912	449	1.00	--	R	12.2	Hardman and Miller, 1934	
183	1830101	08/04/1963	1,153	2.57	--	R	--	USGS, 1963	Discharge measured at 18:26
183	1830101	08/04/1963	736	1.64	--	R	--	USGS, 1963	Discharge measured at 14:52
183	1830101	08/04/1963	673	1.50	--	R	--	USGS, 1963	Discharge measured at 18:12 (discharge was a field estimate)
183	1830101	08/04/1963	471	1.05	--	R	--	USGS, 1963	Discharge measured at 15:28
183	1830101	08/04/1963	449	1.00	--	R	--	USGS, 1963	Discharge measured at 18:08 (discharge was a field estimate)
183	1830101	08/04/1963	323	0.720	--	R	--	USGS, 1963	Discharge measured at 16:08

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
183	1830101	08/04/1963	197	0.440	--	R	--	USGS, 1963	Discharge measured at 16:39
183	1830101	08/04/1963	144	0.320	--	R	--	USGS, 1963	Discharge measured at 17:09
183	1830101	08/04/1963	94.3	0.210	--	R	--	USGS, 1963	Discharge measured at 17:35
183	1830101	08/04/1963	67.3	0.150	--	R	--	USGS, 1963	Discharge measured at 17:58
183	1830101	07/27/1982	633	1.41	--	R	--	USGS, 1982	
183	1830101	03/23/1985	633	1.41	--	R	--	USGS, 1985	
183	1830101	01/31/1986	426	0.950	--	R	--	USGS, 1986	
183	1830101	02/12/1987	323	0.720	--	R	--	USGS, 1987	
183	1830101	08/11/1987	444	0.990	--	R	--	USGS, 1987	
183	1830101	02/25/1988	301	0.670	--	R	--	USGS, 1988	
183	1830101	03/16/1989	579	1.29	--	R	--	USGS, 1989	
183	1830101	03/21/1990	310	0.690	--	R	--	USGS, 1990	
183	1830101	11/07/1990	229	0.510	--	R	--	USGS, 1991	
183	1830101	03/02/1991	180	0.400	--	R	--	USGS, 1991	
183	1830101	10/21/1991	171	0.380	--	R	--	USGS, 1992	
183	1830101	10/16/1992	197	0.440	--	R	--	USGS, 1993	
183	1830101	04/07/1993	2,424	5.40	--	R	--	USGS, 1993	
183	1830101	09/21/1993	283	0.630	--	R	--	USGS, 1993	
183	1830101	03/25/1994	435	0.970	--	R	--	USGS, 1994	
183	1830101	09/09/1994	449	1.00	--	R	--	USGS, 1994	
183	1830101	06/23/2004	414	0.922	G	C	10.8	SNWA	
183	1830201	08/04/1963	40.4	0.090	--	R	--	USGS, 1963	
183	1830201	07/27/1982	700	1.56	--	R	--	USGS-NWIS, 2006	
183	1830201	03/23/1985	440	0.980	--	R	--	USGS-NWIS, 2006	
183	1830201	01/31/1986	390	0.870	--	R	--	USGS-NWIS, 2006	
183	1830201	02/12/1987	310	0.690	--	R	--	USGS-NWIS, 2006	
183	1830201	08/11/1987	500	1.11	--	R	--	USGS-NWIS, 2006	
183	1830301	08/06/1963	431	0.960	--	R	--	USGS, 1963	
183	1830401	08/06/1963	974	2.17	--	R	--	USGS, 1963	
184	1840705	08/09/2001	1,176	2.62	F	C	--	SNWA	
184	1840705	08/07/2003	1,113	2.48	F	C	12	SNWA	
184	1840705	07/28/2005	403	0.897	F	C	--	SNWA	

Table B.1-1
Discharge Measurement of Selected Springs
(Page 5 of 69)

Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
184	1840705	07/17/2007	947	2.11	E	F	--	SNWA	
184	1840705	08/28/2007	839	1.87	E	F	--	SNWA	
184	1840705	10/09/2007	821	1.83	E	F	11.9	SNWA	
184	1840705	11/27/2007	781	1.74	E	F	--	SNWA	
184	1845501	07/14/2004	1.80	0.004	E	F	--	SNWA	
184	1845501	08/17/2006	35.9	0.080	F	F	14.9	SNWA	
184	1845501	08/28/2007	4.00	0.009	G	F	16.6	SNWA	
184	1845501	10/09/2007	4.00	0.009	E	F	10.4	SNWA	
184	1845501	11/27/2007	6.70	0.015	E	F	10.6	SNWA	
184	1845601	07/15/2004	0.00	0.00	E	--	--	SNWA	Spring is stagnant water.
184	1845601	03/27/2007	3.00	0.001	P	E	7.9	SNWA	
184	1845701	06/24/2004	196	0.436	G	C	15.5	SNWA	
184	1845701	07/28/2005	328	0.730	G	C	--	SNWA	
184	1845701	08/16/2006	321	0.715	F	C	--	SNWA	
184	1845701	03/27/2007	325	0.724	F	C	--	SNWA	
184	1845701	05/08/2007	293	0.652	F	C	14.0	SNWA	
184	1845701	06/12/2007	266	0.592	P	C	16.4	SNWA	
184	1845701	07/23/2007	264	0.588	P	C	18.4	SNWA	
184	1845701	08/27/2007	287	0.639	P	C	16.4	SNWA	
184	1845701	10/08/2007	290	0.647	F	C	14.3	SNWA	
184	1845701	11/29/2007	270	0.602	F	C	10.9	SNWA	
184	1845702	07/12/1966	200	0.450	--	R	12.7	Hess and Mifflin, 1978	Reported by Mifflin as So. Mulick Spr. Data more closely matches the discharge for N. Millick Spring
184	1845702	07/15/2004	458	1.02	F	C	13.4	SNWA	
184	1845702	07/28/2005	624	1.39	G	C	--	SNWA	
184	1845702	08/16/2006	557	1.24	P	C	--	SNWA	
184	1845702	02/14/2007	469	1.04	P	C	10.2	SNWA	
184	1845702	03/27/2007	610	1.36	F	C	11.3	SNWA	
184	1845702	05/08/2007	727	1.62	G	C	15.7	SNWA	
184	1845702	06/12/2007	489	1.09	P	C	15.5	SNWA	

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
184	1845702	07/23/2007	448	0.998	P	C	15.8	SNWA	
184	1845702	08/27/2007	471	1.05	P	C	15.1	SNWA	
184	1845702	09/25/2007	512	1.14	F	C	--	SNWA	
184	1845702	10/08/2007	561	1.25	F	C	13.0	SNWA	
184	1845702	11/29/2007	453	1.01	F	C	10.6	SNWA	
184	1845801	07/15/2004	3.91	0.009	G	V	12.9	SNWA	
184	1845801	08/03/2005	4.76	0.011	G	V	12	SNWA	
184	1845801	08/16/2006	0.500	0.001	F	V	--	SNWA	
184	1845802	08/16/2006	0.575	0.001	G	V	14.5	SNWA	
184	1845901	07/14/2004	Dry	Dry	E	--	--	SNWA	
184	1845901	08/03/2005	Dry	Dry	E	--	--	SNWA	
184	1845901	08/16/2006	0.300	0.001	E	V	21.9	SNWA	
184	1845901	03/27/2007	1.00	0.002	E	V	8.6	SNWA	
184	1845901	08/27/2007	0.300	0.001	E	V	22.0	SNWA	
184	1845901	10/08/2007	0.500	0.001	E	V	15.3	SNWA	
184	1845901	11/26/2007	0.557	0.001	E	V	9.0	SNWA	
184	1846001	06/22/2004	10.0	0.020	P	E	22.7	SNWA	
184	1846001	02/12/2007	0.00	0.00	E	--	--	SNWA	Spring was frozen.
184	1846101	07/28/2004	74.5	0.170	P	E	23.8	SNWA	"Discharge is estimated. Only half the flow from Cedar #2 could be measured, (.018 cfs +(2 x .074 cfs))=.166 cfs"
184	1846101	05/07/2007	33.7	0.075	G	F	23.9	SNWA	
184	1846101	06/11/2007	28.3	0.063	E	F	23.9	SNWA	
184	1846101	07/16/2007	36.7	0.082	F	V	23.8	SNWA	
184	1846101	08/27/2007	28.9	0.064	E	V	24.5	SNWA	
184	1846101	10/08/2007	20.6	0.046	P	F	23.7	SNWA	
184	1846201	07/12/1966	275	0.610	--	R	9.4	Hess and Mifflin, 1978	
184	1846201	06/15/1980	360	0.800	--	R	--	USGS-NWIS, 2004	
184	1846201	07/28/2004	340	0.760	G	C	10	SNWA	
184	1846201	07/27/2005	511	1.14	G	C	--	SNWA	
184	1846201	08/16/2006	435	0.970	F	C	12.6	SNWA	
184	1846201	02/16/2007	416	0.927	F	C	10.7	SNWA	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
184	1846201	03/27/2007	453	1.01	G	C	--	SNWA	
184	1846201	05/07/2007	467	1.04	G	C	11.0	SNWA	
184	1846201	06/11/2007	371	1.01	F	C	10.2	SNWA	
184	1846201	07/16/2007	402	0.896	F	C	10.3	SNWA	
184	1846201	08/27/2007	411	0.915	P	C	13.8	SNWA	
184	1846201	10/08/2007	300	0.668	F	C	12.2	SNWA	
184	1846201	11/29/2007	337	0.751	F	C	10.7	SNWA	
184	1846401	07/28/2004	0.00	0.00	E	--	--	SNWA	
184	1846401	06/11/2007	0.00	0.00	E	--	25.3	SNWA	
184	1846401	08/27/2007	0.00	0.00	E	--	--	SNWA	
184	1846401	10/08/2007	0.00	0.00	E	--	13.0	SNWA	
184	1846401	11/26/2007	0.00	0.00	E	--	2.2	SNWA	
184	1846501	08/16/2006	1.00	0.002	G	V	13.6	SNWA	
184	1846601	08/17/2006	2.70	0.006	G	F	13.2	SNWA	
184	1846701	08/14/2006	12.1	0.027	G	V	--	SNWA	
184	1846701	03/26/2007	12.8	0.028	E	V	--	SNWA	
184	1846701	05/07/2007	8.90	0.020	P	V	--	SNWA	
184	1846701	06/11/2007	11.0	0.024	G	V	14.4	SNWA	
184	1846701	07/23/2007	12.2	0.027	P	V	15.1	SNWA	
184	1846701	08/27/2007	10.4	0.023	P	V	15.6	SNWA	
184	1846701	10/08/2007	8.10	0.018	G	F	14.7	SNWA	
184	1846701	11/26/2007	13.9	0.031	E	F	14.1	SNWA	
184	1846702	08/14/2006	4.90	0.011	G	F	14.3	SNWA	
184	1846702	03/26/2007	Dry	Dry	E	--	--	SNWA	
184	1846702	05/07/2007	Dry	Dry	E	--	--	SNWA	
184	1846702	06/11/2007	Dry	Dry	E	--	--	SNWA	
184	1846702	07/23/2007	Dry	Dry	E	--	--	SNWA	
184	1846702	08/27/2007	Dry	Dry	E	--	--	SNWA	
184	1846702	10/08/2007	Dry	Dry	E	--	--	SNWA	
184	1846702	11/26/2007	Dry	Dry	E	--	--	SNWA	
184	1847001	08/28/2007	16.2	0.036	G	F	15.1	SNWA	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
184	1847001	10/09/2007	15.7	0.035	G	F	14.3	SNWA	
184	1847101	08/29/2007	260	0.580	P	C	14.4	SNWA	
184	1847101	10/10/2007	237	0.529	P	C	11.8	SNWA	
184	1847101	11/28/2007	203	0.453	F	C	8.1	SNWA	
184	1847201	06/15/1968	300	0.670	--	R	--	USGS-NWIS, 2006	
184	1847201	08/27/2007	380	0.846	P	E	--	SNWA	
184	1847201	10/08/2007	40.8	0.091	P	F	--	SNWA	
184	1847201	11/29/2007	310	0.691	F	C	--	SNWA	
184	1847301	08/27/2007	11.7	0.026	E	F	20.7	SNWA	
184	1847301	08/27/2007	8.10	0.018	E	F	--	SNWA	
184	1847301	10/08/2007	13.9	0.031	E	F	15.8	SNWA	
184	1847301	11/30/2007	15.7	0.035	E	F	9.0	SNWA	
184	1847401	08/28/2007	0.00	0.00	E	--	--	SNWA	
184	1847401	10/09/2007	0.00	0.00	E	--	3.6	SNWA	
184	1847401	11/27/2007	--	--	--	--	--	SNWA	Frozen
184	1847501	10/08/2007	4.50	0.010	P	F	23.6	SNWA	
184	1847501	11/29/2007	--	--	--	--	--	SNWA	Frozen
184	1847701	08/28/2007	--	--	E	--	15.9	SNWA	
184	1847701	10/09/2007	--	--	E	--	15	SNWA	
184	1847701	11/27/2007	--	--	E	--	11.8	SNWA	
195	1951302	07/22/2003	1,566	3.49	G	R	10	Elliott et al., 2006	
195	1951302	10/07/2003	1,198	2.67	G	R	9	Elliott et al., 2006	
195	1951302	08/04/2005	1,562	3.48	F	C	9.8	SNWA	
195	1951302	10/11/2006	26.5	0.059	F	A	--	SNWA	
195	1951901	11/03/1964	3,600	8.00	--	R	17.7	Hood and Rush, 1965	
195	1951901	09/30/1965	4,000	8.91	--	R	16	Hess and Mifflin, 1978	"Reported flows up to 25 cfs (Mifflin, 1968)"
195	1951901	11/18/1972	4,003	8.92	--	R	--	Walker, 1972	
195	1951901	07/17/1991	3,447	7.68	--	R	--	USGS, 1991	
195	1951901	10/28/2004	4,802	10.7	G	C	--	SNWA	
195	1951901	10/28/2004	4,802	10.7	G	R	--	Squires, 2004	
195	1951901	04/06/2005	3,838	8.55	--	R	--	USGS-NWIS, 2006	
195	1951901	05/10/2005	3,995	8.90	--	R	--	USGS-NWIS, 2006	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
195	1951901	05/26/2005	4,161	9.27	--	R	--	USGS-NWIS, 2006	
195	1951901	08/03/2005	4,129	9.20	F	C	--	SNWA	
195	1951901	08/04/2005	3,986	8.88	--	R	--	USGS-NWIS, 2006	
195	1951901	09/14/2005	4,143	9.23	--	R	--	USGS-NWIS, 2006	
195	1951901	11/29/2005	4,578	10.2	--	R	--	USGS-NWIS, 2006	
195	1951901	01/05/2006	4,623	10.3	--	R	--	USGS-NWIS, 2006	
195	1951901	03/09/2006	3,941	8.78	--	R	--	USGS-NWIS, 2006	
195	1951901	10/09/2006	4,668	10.4	G	A	--	SNWA	
195	1951901	03/29/2007	5,072	11.3	F	C	--	SNWA	
195	1951901	05/15/2007	4,663	10.4	F	C	--	SNWA	
195	1951901	06/18/2007	4,802	10.7	P	C	--	SNWA	
195	1951901	07/24/2007	4,623	10.3	F	C	--	SNWA	
195	1951901	08/30/2007	4,668	10.4	P	C	--	SNWA	
195	1951901	10/10/2007	4,466	9.95	P	C	--	SNWA	
195	1951901	12/06/2007	3,837	8.55	F	C	--	SNWA	
195	1951901	01/07/2008	4,093	9.12	F	C	--	SNWA	
195	1951903	08/03/2005	2,469	5.50	F	C	--	SNWA	
195	1951903	10/09/2006	3,142	7.00	G	A	16.9	SNWA	
195	1951903	02/21/2007	3,824	8.52	F	C	17.3	SNWA	
195	1951903	03/29/2007	2,922	6.51	F	C	17.4	SNWA	
195	1951903	05/15/2007	2,868	6.39	F	C	17.7	SNWA	
195	1951903	06/18/2007	2,904	6.47	P	C	17.8	SNWA	
195	1951903	07/24/2007	2,724	6.07	F	C	17.8	SNWA	
195	1951903	08/30/2007	3,039	6.77	P	C	19.4	SNWA	
195	1951903	10/10/2007	2,738	6.10	F	C	17.5	SNWA	
195	1951903	12/06/2007	2,145	4.78	F	C	16.9	SNWA	
195	1951903	01/07/2008	2,356	5.25	F	C	17.1	SNWA	
195	1951904	08/03/2005	1,661	3.70	F	C	--	SNWA	
195	1951904	10/09/2006	1,535	3.42	G	A	16.9	SNWA	
195	1951904	03/29/2007	2,132	4.75	F	C	17.4	SNWA	
195	1951904	05/15/2007	1,795	4.00	F	C	17.7	SNWA	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
195	1951904	06/18/2007	1,899	4.23	P	C	17.7	SNWA	
195	1951904	07/24/2007	1,890	4.21	F	C	--	SNWA	
195	1951904	08/30/2007	1,638	3.65	F	C	18.2	SNWA	
195	1951904	10/10/2007	1,728	3.85	P	C	17.5	SNWA	
195	1951904	12/06/2007	1,692	3.77	F	C	17.3	SNWA	
195	1951904	01/07/2008	1,737	3.87	F	C	17.1	SNWA	
195	1952001	08/14/1964	6,284	14.0	--	R	--	USGS, 1964	Spring flow.
195	1952001	11/03/1964	3,600	8.00	--	R	27.2	Hood and Rush, 1965	"May have been measured near the main orifice, suspected partial discharge"
195	1952001	08/01/1979	6,194	13.8	--	R	--	ERTEC, 1981	Reported as 6200 gpm
195	1952001	06/22/2004	3,780	8.42	F	C	27	SNWA	25' DS of orifice this is ~10 ft above swimmers dam
195	1952001	10/30/2004	6,714	15.0	F	R	--	Squires, 2004	
195	1952001	08/04/2005	7,990	17.8	G	C	--	SNWA	At diversion
195	1952001	08/04/2005	6,960	15.5	F	C	--	SNWA	75' DS of orifice this is below swimmers dam
195	1952001	08/23/2005	8,708	19.4	--	R	--	USGS-NWIS, 2006	
195	1952001	08/23/2005	8,707	19.4	G	R	--	USGS-NWIS, 2006	
195	1952001	08/31/2005	8,079	18.0	--	R	--	USGS-NWIS, 2006	
195	1952001	08/31/2005	8,079	18.0	G	R	--	USGS-NWIS, 2006	
195	1952001	08/31/2005	7,675	17.1	--	R	--	USGS-NWIS, 2006	
195	1952001	08/31/2005	7,675	17.1	G	R	--	USGS-NWIS, 2006	
195	1952001	10/04/2005	8,259	18.4	--	R	--	USGS-NWIS, 2006	
195	1952001	10/04/2005	8,258	18.4	G	R	--	USGS-NWIS, 2006	
195	1952001	10/14/2005	7,630	17.0	--	R	--	USGS-NWIS, 2006	
195	1952001	10/14/2005	7,630	17.0	G	R	--	USGS-NWIS, 2006	
195	1952001	11/17/2005	8,034	17.9	--	R	--	USGS-NWIS, 2006	
195	1952001	11/17/2005	8,034	17.9	G	R	--	USGS-NWIS, 2006	
195	1952001	12/01/2005	7,540	16.8	--	R	--	USGS-NWIS, 2006	
195	1952001	12/01/2005	7,540	16.8	G	R	--	USGS-NWIS, 2006	
195	1952001	12/01/2005	7,316	16.3	--	R	--	USGS-NWIS, 2006	
195	1952001	12/01/2005	7,316	16.3	G	R	--	USGS-NWIS, 2006	
195	1952001	12/29/2005	7,810	17.4	--	R	--	USGS-NWIS, 2006	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
195	1952001	12/29/2005	7,810	17.4	G	R	--	USGS-NWIS, 2006	
195	1952001	01/31/2006	7,765	17.3	--	R	--	USGS-NWIS, 2006	
195	1952001	01/31/2006	7,765	17.3	G	R	--	USGS-NWIS, 2006	
195	1952001	04/13/2006	7,451	16.6	--	R	--	USGS-NWIS, 2006	
195	1952001	04/13/2006	7,451	16.6	F	R	--	USGS-NWIS, 2006	
195	1952001	05/16/2006	7,899	17.6	G	R	--	USGS-NWIS, 2006	
195	1952001	07/11/2006	7,675	17.1	G	R	--	USGS-NWIS, 2006	
195	1952001	07/11/2006	7,675	17.1	G	R	--	USGS-NWIS, 2006	
195	1952001	08/15/2006	7,810	17.4	G	R	--	USGS-NWIS, 2006	
195	1952001	10/03/2006	7,316	16.3	G	R	--	USGS-NWIS, 2006	
195	1952001	04/02/2007	8,214	18.3	G	C	25.6	SNWA	
195	1952001	05/10/2007	8,124	18.1	G	C	26.1	SNWA	
195	1952001	06/20/2007	7,630	17.0	G	C	27.7	SNWA	
195	1952001	07/25/2007	7,496	16.7	G	C	27.3	SNWA	
195	1952001	08/30/2007	6,643	14.8	F	C	27.9	SNWA	
195	1952001	10/11/2007	7,540	16.8	G	C	26.0	SNWA	
195	1952001	12/05/2007	7,001	15.6	G	C	25.0	SNWA	
195	1952001	01/09/2008	6,822	15.2	G	C	24.5	SNWA	
195	1952401	07/14/2004	5.00	0.010	P	E	14.4	SNWA	
195	1952701	10/12/2006	3.30	0.007	E	V	19.7	SNWA	
195	1952701	07/25/2007	3.50	0.008	G	V	--	SNWA	
195	1952801	10/11/2006	59.7	0.133	E	F	15.2	SNWA	
195	1952801	02/22/2007	52.5	0.117	G	F	--	SNWA	
195	1952801	03/30/2007	45.8	0.102	G	F	--	SNWA	
195	1952801	05/09/2007	33.7	0.075	E	F	--	SNWA	
195	1952801	06/20/2007	25.6	0.057	E	F	21.9	SNWA	
195	1952801	07/25/2007	22.9	0.051	E	F	21.2	SNWA	
195	1952801	08/30/2007	13.9	0.031	G	F	25.7	SNWA	
195	1952801	10/11/2007	18.0	0.040	E	F	18.1	SNWA	
195	1952801	12/05/2007	24.7	0.055	E	F	12.4	SNWA	
195	1952801	01/09/2008	22.9	0.051	E	F	8.5	SNWA	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
195	1953101	07/12/1967	--	--	--	R	60.5	Bolke and Sumsion, 1978	Water is unused
195	1953102	08/24/1976	1.00	0.002	--	R	55.6	Bolke and Sumsion, 1978	Discharge reported as <1 gpm; value is an estimate. Water is unused
195	1953103	08/24/1976	10.0	0.022	--	R	58.9	Bolke and Sumsion, 1978	Water is unused
195	1953104	08/24/1976	60.0	0.134	--	R	60.6	Bolke and Sumsion, 1978	Water is unused
195	1953105	08/24/1976	30.0	0.067	--	R	60.0	Bolke and Sumsion, 1978	Water is unused
195	1953201	06/07/1974	--	--	--	R	--	Bolke and Sumsion, 1978	Water is unused
195	1953202	08/24/1976	20.0	0.045	--	R	18.0	Bolke and Sumsion, 1978	Water is unused
195	1953401	10/15/1964	1,300	2.90	--	R	--	Hood and Rush, 1965	
195	1953701	01/01/1964	120	0.267	--	R	--	Hood and Rush, 1965	
195	1953801	01/01/1965	1.00	0.002	--	R	--	Hood and Rush, 1965	Reported date refers to the publication; no other date or source was listed
195	1953901	10/15/1964	2.00	0.004	--	R	--	Hood and Rush, 1965	
203	2030101	10/05/1912	1,795	4.00	--	R	--	Hardman and Miller, 1934	
203	2030101	01/01/1948	3,600	8.02	--	R	--	Phoenix, 1948	No date given for measurement.
203	2030101	10/28/1963	4,900	10.9	--	R	--	Rush, 1964	
203	2030101	07/28/1982	2,600	5.79	--	R	--	USGS-NWIS, 2004	
203	2030101	04/15/1987	1,000	2.23	--	R	--	USGS-NWIS, 2004	
203	2030101	03/09/1988	601	1.34	--	R	--	USGS, 1988	
203	2030101	02/28/1989	498	1.11	--	R	--	USGS, 1989	
203	2030101	03/13/1990	269	0.600	--	R	--	USGS, 1990	
203	2030101	11/06/1990	162	0.360	--	R	--	USGS, 1991	
203	2030101	03/21/1991	498	1.11	--	R	--	USGS, 1991	
203	2030101	11/07/1991	188	0.420	--	R	--	USGS, 1992	
203	2030101	03/24/1992	781	1.74	--	R	--	USGS, 1992	
203	2030101	10/16/1992	210	0.470	--	R	--	USGS-NWIS, 2004	
203	2030101	05/05/1993	430	0.960	--	R	--	USGS-NWIS, 2004	
203	2030101	10/20/1993	500	1.11	--	R	--	USGS-NWIS, 2004	
203	2030101	10/28/1993	494	1.10	--	R	--	USGS, 1994	
203	2030101	03/30/1994	184	0.410	--	R	--	USGS, 1994	
203	2030101	10/18/1994	126	0.280	--	R	--	USGS, 1995	
203	2030101	04/17/1997	183	0.410	--	R	--	USGS-NWIS, 2004	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
203	2030101	09/23/1997	318	0.710	--	R	--	USGS-NWIS, 2004	
203	2030101	07/19/2004	224	0.500	P	E	--	SNWA	
203	2030101	04/20/2006	4,758	10.6	--	R	--	USGS, 2006	
203	2030101	04/20/2006	4,578	10.2	--	R	--	USGS, 2006	
203	2030301	01/01/1948	10.0	0.022	--	R	21.1	Phoenix, 1948	
203	2030301	05/17/2005	22.4	0.050	P	E	21	SNWA	
207	2070501	04/06/1935	6,885	15.3	--	R	--	Maxey and Eakin, 1949	
207	2070501	12/07/1961	6,000	13.4	--	R	--	USGS-NWIS, 2004	
207	2070501	07/23/1982	6,000	13.4	--	R	--	USGS-NWIS, 2004	
207	2070501	07/26/1982	4,847	10.8	--	R	--	USGS, 1982	
207	2070501	01/16/1985	4,143	9.23	--	R	--	USGS, 1985	
207	2070501	02/01/1985	11,000	24.5	--	R	--	USGS-NWIS, 2004	Discharge appears high cfs may have been entered as gpm.
207	2070501	02/03/1986	4,143	9.23	--	R	--	USGS, 1986	
207	2070501	02/11/1987	6,328	14.1	--	R	--	USGS, 1987	
207	2070501	08/12/1987	3,519	7.84	--	R	--	USGS, 1987	
207	2070501	02/23/1988	7,002	15.6	--	R	--	USGS, 1988	
207	2070501	03/14/1989	3,999	8.91	--	R	--	USGS, 1989	
207	2070501	03/23/1990	6,400	14.3	--	R	--	USGS, 1990	
207	2070501	11/08/1990	5,000	11.1	--	R	--	USGS, 1991	
207	2070501	03/04/1991	6,001	13.4	--	R	--	USGS, 1991	
207	2070501	10/23/1991	2,783	6.20	--	R	--	USGS, 1992	
207	2070501	03/18/1992	4,197	9.35	--	R	--	USGS, 1992	
207	2070501	10/14/1992	4,084	9.10	--	R	--	USGS, 1993	
207	2070501	05/03/1993	3,950	8.80	--	R	--	USGS, 1993	
207	2070501	10/19/1993	494	1.10	--	R	--	USGS-NWIS, 2004	Discharge appears low.
207	2070501	03/29/1994	1,257	2.80	--	R	--	USGS, 1994	
207	2070501	10/19/1994	5,386	12.0	--	R	--	USGS, 1995	
207	2070501	04/17/1997	6,330	14.1	--	R	--	USGS-NWIS, 2004	
207	2070501	09/25/1997	5,430	12.1	--	R	--	USGS-NWIS, 2004	
207	2070501	04/29/1998	4,578	10.3	--	R	--	USGS-NWIS, 2004	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2070501	09/22/1998	4,670	10.4	--	R	--	USGS-NWIS, 2004	
207	2070501	04/07/1999	4,760	10.6	--	R	--	USGS-NWIS, 2004	
207	2070501	09/13/1999	6,910	15.4	--	R	--	USGS-NWIS, 2004	
207	2070501	04/20/2000	3,480	7.75	--	R	--	USGS-NWIS, 2004	
207	2070501	09/14/2000	3,520	7.84	--	R	--	USGS-NWIS, 2004	
207	2070501	04/17/2001	4,850	10.8	--	R	--	USGS-NWIS, 2004	
207	2070501	09/13/2001	4,800	10.7	--	R	--	USGS-NWIS, 2004	
207	2070501	04/16/2002	4,940	11.0	--	R	--	USGS-NWIS, 2004	
207	2070501	09/17/2002	4,940	11.0	--	R	--	USGS-NWIS, 2004	
207	2070501	04/24/2003	4,420	9.85	--	R	--	USGS-NWIS, 2004	
207	2070501	08/05/2003	6,150	13.7	P	C	32	SNWA	
207	2070501	09/11/2003	4,760	10.6	--	R	--	USGS-NWIS, 2004	
207	2070501	04/23/2004	4,670	10.4	--	R	--	USGS-NWIS, 2004	
207	2070501	09/24/2004	4,580	10.2	--	R	--	USGS, 2004	
207	2070501	06/30/2005	4,246	9.46	--	R	--	USGS-NWIS, 2007	
207	2070501	09/22/2005	4,847	10.8	--	R	--	USGS-NWIS, 2007	
207	2070501	04/28/2006	6,283	14.0	--	R	--	USGS, 2006	
207	2070501	08/02/2006	6,418	14.3	--	R	--	USGS, 2006	
207	2070501	08/15/2006	6,104	13.6	--	R	--	USGS, 2006	
207	2070501	09/14/2006	6,283	14.0	--	R	--	USGS, 2006	
207	2070601	10/27/1910	1,409	3.14	--	R	--	Maxey and Eakin, 1949	
207	2070601	06/15/1913	1,643	3.66	--	R	--	Maxey and Eakin, 1949	
207	2070601	06/15/1922	1,580	3.52	--	R	--	Maxey and Eakin, 1949	
207	2070601	05/07/1935	1,459	3.25	--	R	--	Maxey and Eakin, 1949	
207	2070601	03/06/1936	1,732	3.86	--	R	--	Maxey and Eakin, 1949	
207	2070601	03/29/1936	1,728	3.85	--	R	--	Maxey and Eakin, 1949	
207	2070601	03/30/1936	1,728	3.85	--	R	--	Maxey and Eakin, 1949	
207	2070601	04/07/1936	1,719	3.83	--	R	--	Maxey and Eakin, 1949	
207	2070601	04/29/1936	1,706	3.80	--	R	--	Maxey and Eakin, 1949	
207	2070601	05/05/1936	1,706	3.80	--	R	--	Maxey and Eakin, 1949	
207	2070601	05/07/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	05/12/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2070601	05/16/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	05/19/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	05/23/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	05/26/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	05/30/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	06/02/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	06/05/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	06/09/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	06/16/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	06/19/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	06/23/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	06/27/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	07/07/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	07/12/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	07/19/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	07/26/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	08/04/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	08/15/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	08/25/1936	1,714	3.82	--	R	--	Maxey and Eakin, 1949	
207	2070601	05/09/1947	1,400	3.12	--	R	22	USGS-NWIS, 2004	
207	2070601	11/13/1966	1,380	3.07	--	R	22.2	Hess and Mifflin, 1978	
207	2070601	01/19/1982	1,804	4.02	--	R	--	USGS, 1982	
207	2070601	07/30/1984	1,499	3.34	--	R	--	USGS-NWIS, 2004	
207	2070601	01/21/1985	1,822	4.06	--	R	--	USGS, 1985	
207	2070601	02/01/1986	1,580	3.52	--	R	--	USGS, 1986	
207	2070601	02/23/1988	1,800	4.01	--	R	--	USGS, 1988	
207	2070601	03/14/1989	1,499	3.34	--	R	--	USGS, 1989	
207	2070601	04/04/1990	1,499	3.34	--	R	--	USGS, 1990	
207	2070601	11/06/1990	498	1.11	--	R	--	USGS, 1991	
207	2070601	03/03/1991	399	0.890	--	R	--	USGS, 1991	
207	2070601	10/24/1991	1,786	3.98	--	R	--	USGS, 1992	

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2070601	03/19/1992	1,854	4.13	--	R	--	USGS, 1992	
207	2070601	10/15/1992	1,885	4.20	--	R	--	USGS, 1993	
207	2070601	05/04/1993	1,571	3.50	--	R	--	USGS, 1993	
207	2070601	10/19/1993	1,436	3.20	--	R	--	USGS, 1994	
207	2070601	03/30/1994	1,571	3.50	--	R	--	USGS, 1994	
207	2070601	10/20/1994	1,706	3.80	--	R	--	USGS, 1995	
207	2070601	05/20/1997	1,490	3.32	--	R	--	USGS-NWIS, 2004	
207	2070601	09/24/1997	1,630	3.63	--	R	--	USGS-NWIS, 2004	
207	2070601	04/30/1998	2,410	5.37	--	R	--	USGS-NWIS, 2004	
207	2070601	09/23/1998	1,800	4.01	--	R	--	USGS-NWIS, 2004	
207	2070601	04/08/1999	1,830	4.08	--	R	--	USGS-NWIS, 2004	
207	2070601	09/14/1999	1,540	3.43	--	R	--	USGS-NWIS, 2004	
207	2070601	04/19/2000	1,600	3.56	--	R	--	USGS-NWIS, 2004	
207	2070601	09/13/2000	1,360	3.03	--	R	--	USGS-NWIS, 2004	
207	2070601	04/18/2001	1,450	3.23	--	R	--	USGS-NWIS, 2004	
207	2070601	09/12/2001	1,580	3.52	--	R	--	USGS-NWIS, 2004	
207	2070601	04/17/2002	1,480	3.30	--	R	--	USGS-NWIS, 2004	
207	2070601	09/18/2002	1,320	2.94	--	R	--	USGS-NWIS, 2004	
207	2070601	04/23/2003	1,130	2.52	--	R	--	USGS-NWIS, 2004	
207	2070601	09/10/2003	1,850	4.12	--	R	--	USGS-NWIS, 2004	
207	2070601	04/22/2004	1,250	2.79	--	R	--	USGS-NWIS, 2004	
207	2070601	04/27/2006	1,481	3.30	--	R	--	USGS, 2006	
207	2070601	09/13/2006	1,548	3.45	--	R	--	USGS, 2006	
207	2070701	10/27/1910	462	1.03	--	R	--	Maxey and Eakin, 1949	
207	2070701	05/07/1935	588	1.31	--	R	--	Maxey and Eakin, 1949	
207	2070701	03/06/1936	601	1.34	--	R	--	Maxey and Eakin, 1949	
207	2070701	03/29/1936	628	1.40	--	R	--	Maxey and Eakin, 1949	
207	2070701	03/30/1936	628	1.40	--	R	--	Maxey and Eakin, 1949	
207	2070701	04/07/1936	633	1.41	--	R	--	Maxey and Eakin, 1949	
207	2070701	04/29/1936	633	1.41	--	R	--	Maxey and Eakin, 1949	
207	2070701	05/05/1936	619	1.38	--	R	--	Maxey and Eakin, 1949	
207	2070701	05/07/1936	619	1.38	--	R	--	Maxey and Eakin, 1949	

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2070701	05/12/1936	624	1.39	--	R	--	Maxey and Eakin, 1949	
207	2070701	05/16/1936	646	1.44	--	R	--	Maxey and Eakin, 1949	
207	2070701	05/19/1936	624	1.39	--	R	--	Maxey and Eakin, 1949	
207	2070701	05/23/1936	619	1.38	--	R	--	Maxey and Eakin, 1949	
207	2070701	05/26/1936	583	1.30	--	R	--	Maxey and Eakin, 1949	
207	2070701	05/30/1936	601	1.34	--	R	--	Maxey and Eakin, 1949	
207	2070701	06/02/1936	669	1.49	--	R	--	Maxey and Eakin, 1949	
207	2070701	06/05/1936	628	1.40	--	R	--	Maxey and Eakin, 1949	
207	2070701	06/09/1936	628	1.40	--	R	--	Maxey and Eakin, 1949	
207	2070701	06/16/1936	628	1.40	--	R	--	Maxey and Eakin, 1949	
207	2070701	06/19/1936	619	1.38	--	R	--	Maxey and Eakin, 1949	
207	2070701	06/23/1936	633	1.41	--	R	--	Maxey and Eakin, 1949	
207	2070701	06/27/1936	615	1.37	--	R	--	Maxey and Eakin, 1949	
207	2070701	07/07/1936	619	1.38	--	R	--	Maxey and Eakin, 1949	
207	2070701	07/12/1936	619	1.38	--	R	--	Maxey and Eakin, 1949	
207	2070701	07/18/1936	619	1.38	--	R	--	Maxey and Eakin, 1949	
207	2070701	07/19/1936	628	1.40	--	R	--	Maxey and Eakin, 1949	
207	2070701	07/26/1936	619	1.38	--	R	--	Maxey and Eakin, 1949	
207	2070701	08/04/1936	624	1.39	--	R	--	Maxey and Eakin, 1949	
207	2070701	08/15/1936	624	1.39	--	R	--	Maxey and Eakin, 1949	
207	2070701	08/25/1936	628	1.40	--	R	--	Maxey and Eakin, 1949	
207	2070701	05/09/1947	781	1.74	--	R	--	Maxey and Eakin, 1949	
207	2070701	11/13/1966	780	1.74	--	R	21.7	Hess and Mifflin, 1978	
207	2070701	01/19/1982	768	1.71	--	R	--	USGS, 1982	
207	2070701	07/30/1984	440	0.980	--	R	--	USGS-NWIS, 2004	
207	2070701	01/17/1985	404	0.900	--	R	--	USGS, 1985	
207	2070701	01/21/1985	440	0.980	--	R	--	USGS-NWIS, 2004	
207	2070701	02/01/1986	498	1.11	--	R	--	USGS, 1986	
207	2070701	02/23/1988	1,000	2.23	--	R	--	USGS-NWIS, 2004	
207	2070701	03/14/1989	1,499	3.34	--	R	--	USGS, 1989	
207	2070701	04/04/1990	911	2.03	--	R	--	USGS, 1990	

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2070701	11/09/1990	382	0.850	--	R	--	USGS, 1991	
207	2070701	03/05/1991	601	1.34	--	R	--	USGS, 1991	
207	2070701	10/24/1991	1,005	2.24	--	R	--	USGS, 1992	
207	2070701	03/19/1992	799	1.78	--	R	--	USGS, 1992	
207	2070701	10/15/1992	148	0.330	--	R	--	USGS, 1993	
207	2070701	05/04/1993	18.0	0.040	--	R	--	USGS, 1993	
207	2070701	10/19/1993	103	0.230	--	R	--	USGS, 1994	
207	2070701	03/30/1994	135	0.300	--	R	--	USGS, 1994	
207	2070701	10/20/1994	108	0.240	--	R	--	USGS, 1995	
207	2070701	04/23/2003	380	0.850	--	R	--	USGS-NWIS, 2004	
207	2070701	04/23/2003	350	0.780	--	R	--	USGS-NWIS, 2004	
207	2070701	09/10/2003	680	1.52	--	R	--	USGS-NWIS, 2004	
207	2070701	04/22/2004	260	0.580	--	R	--	USGS-NWIS, 2004	
207	2070701	07/01/2005	633	1.41	--	R	--	USGS, 2005	
207	2070701	09/21/2005	660	1.47	--	R	--	USGS, 2005	
207	2070701	04/27/2006	503	1.12	--	R	--	USGS, 2006	
207	2070701	09/13/2006	355	0.790	--	R	--	USGS, 2006	
207	2070901	03/27/1905	3,573	7.96	--	R	--	Maxey and Eakin, 1949	
207	2070901	10/27/1910	2,787	6.21	--	R	--	Maxey and Eakin, 1949	
207	2070901	08/16/1913	3,411	7.60	--	R	--	Maxey and Eakin, 1949	
207	2070901	10/16/1914	3,142	7.00	--	R	--	Maxey and Eakin, 1949	
207	2070901	06/24/1916	3,591	8.00	--	R	--	Maxey and Eakin, 1949	
207	2070901	05/07/1935	3,187	7.10	--	R	--	Maxey and Eakin, 1949	
207	2070901	08/13/1935	3,236	7.21	--	R	--	Maxey and Eakin, 1949	
207	2070901	03/06/1936	3,806	8.48	--	R	--	Maxey and Eakin, 1949	
207	2070901	03/30/1936	3,636	8.10	--	R	--	Maxey and Eakin, 1949	
207	2070901	04/07/1936	3,730	8.31	--	R	--	Maxey and Eakin, 1949	
207	2070901	04/29/1936	3,766	8.39	--	R	--	Maxey and Eakin, 1949	
207	2070901	05/02/1936	3,721	8.29	--	R	--	Maxey and Eakin, 1949	
207	2070901	05/05/1936	3,671	8.18	--	R	--	Maxey and Eakin, 1949	
207	2070901	05/07/1936	3,680	8.20	--	R	--	Maxey and Eakin, 1949	
207	2070901	05/12/1936	3,604	8.03	--	R	--	Maxey and Eakin, 1949	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2070901	05/16/1936	3,716	8.28	--	R	--	Maxey and Eakin, 1949	
207	2070901	05/19/1936	3,743	8.34	--	R	--	Maxey and Eakin, 1949	
207	2070901	05/23/1936	3,703	8.25	--	R	--	Maxey and Eakin, 1949	
207	2070901	05/26/1936	3,846	8.57	--	R	--	Maxey and Eakin, 1949	
207	2070901	05/30/1936	3,815	8.50	--	R	--	Maxey and Eakin, 1949	
207	2070901	06/02/1936	3,824	8.52	--	R	--	Maxey and Eakin, 1949	
207	2070901	06/05/1936	3,779	8.42	--	R	--	Maxey and Eakin, 1949	
207	2070901	06/09/1936	3,730	8.31	--	R	--	Maxey and Eakin, 1949	
207	2070901	06/16/1936	3,833	8.54	--	R	--	Maxey and Eakin, 1949	
207	2070901	06/19/1936	3,770	8.40	--	R	--	Maxey and Eakin, 1949	
207	2070901	06/23/1936	3,815	8.50	--	R	--	Maxey and Eakin, 1949	
207	2070901	06/27/1936	3,784	8.43	--	R	--	Maxey and Eakin, 1949	
207	2070901	07/07/1936	3,918	8.73	--	R	--	Maxey and Eakin, 1949	
207	2070901	07/12/1936	3,770	8.40	--	R	--	Maxey and Eakin, 1949	
207	2070901	07/18/1936	3,891	8.67	--	R	--	Maxey and Eakin, 1949	
207	2070901	07/19/1936	3,824	8.52	--	R	--	Maxey and Eakin, 1949	
207	2070901	07/26/1936	3,815	8.50	--	R	--	Maxey and Eakin, 1949	
207	2070901	08/04/1936	3,828	8.53	--	R	--	Maxey and Eakin, 1949	
207	2070901	08/15/1936	3,815	8.50	--	R	--	Maxey and Eakin, 1949	
207	2070901	08/25/1936	3,784	8.43	--	R	--	Maxey and Eakin, 1949	
207	2070901	05/14/1937	3,815	8.50	--	R	--	Maxey and Eakin, 1949	
207	2070901	08/16/1939	3,743	8.34	--	R	--	Maxey and Eakin, 1949	
207	2070901	09/05/1939	3,909	8.71	--	R	--	Maxey and Eakin, 1949	
207	2070901	12/01/1939	3,694	8.23	--	R	--	Maxey and Eakin, 1949	
207	2070901	03/24/1941	3,743	8.34	--	R	--	Maxey and Eakin, 1949	
207	2070901	06/16/1941	3,766	8.39	--	R	--	Maxey and Eakin, 1949	
207	2070901	04/16/1943	4,057	9.04	--	R	--	Maxey and Eakin, 1949	
207	2070901	05/17/1944	4,026	8.97	--	R	--	Maxey and Eakin, 1949	
207	2070901	07/27/1945	3,851	8.58	--	R	--	Maxey and Eakin, 1949	
207	2070901	05/08/1947	3,878	8.64	--	R	--	Maxey and Eakin, 1949	
207	2070901	05/09/1947	3,878	8.64	--	R	--	Maxey and Eakin, 1949	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2070901	11/13/1966	3,900	8.69	--	R	21.1	Hess and Mifflin, 1978	
207	2070901	01/19/1982	3,236	7.21	--	R	--	USGS, 1982	
207	2070901	07/22/1982	3,400	7.57	--	R	--	USGS-NWIS, 2004	
207	2070901	08/25/1982	3,630	8.09	--	R	--	USGS-NWIS, 2004	
207	2070901	12/09/1982	3,900	8.69	--	R	--	USGS-NWIS, 2004	
207	2070901	01/19/1983	3,703	8.25	--	R	--	USGS-NWIS, 2004	
207	2070901	03/23/1983	3,429	7.64	--	R	--	USGS-NWIS, 2004	
207	2070901	04/27/1983	3,631	8.09	--	R	--	USGS-NWIS, 2004	
207	2070901	05/19/1983	3,254	7.25	--	R	--	USGS-NWIS, 2004	
207	2070901	06/28/1983	3,246	7.22	--	R	--	USGS-NWIS, 2004	
207	2070901	08/02/1983	3,505	7.81	--	R	--	USGS-NWIS, 2004	
207	2070901	09/14/1983	3,312	7.38	--	R	--	USGS-NWIS, 2004	
207	2070901	10/27/1983	3,263	7.27	--	R	--	USGS-NWIS, 2004	
207	2070901	12/08/1983	3,330	7.42	--	R	--	USGS-NWIS, 2004	
207	2070901	01/19/1984	3,137	6.99	--	R	--	USGS-NWIS, 2004	
207	2070901	03/07/1984	3,110	6.93	--	R	--	USGS-NWIS, 2004	
207	2070901	04/12/1984	3,128	6.97	--	R	--	USGS-NWIS, 2004	
207	2070901	05/17/1984	3,137	6.99	--	R	--	USGS-NWIS, 2004	
207	2070901	06/27/1984	3,402	7.58	--	R	--	USGS-NWIS, 2004	
207	2070901	08/02/1984	3,348	7.46	--	R	--	USGS-NWIS, 2004	
207	2070901	09/19/1984	3,407	7.59	--	R	--	USGS-NWIS, 2004	
207	2070901	11/08/1984	3,362	7.49	--	R	--	USGS-NWIS, 2004	
207	2070901	12/12/1984	3,856	8.59	--	R	--	USGS-NWIS, 2004	
207	2070901	01/17/1985	3,800	8.47	--	R	--	USGS-NWIS, 2004	
207	2070901	03/22/1985	3,582	7.98	--	R	--	USGS-NWIS, 2004	
207	2070901	03/22/1985	3,299	7.35	--	R	--	USGS-NWIS, 2004	
207	2070901	04/19/1985	3,591	8.00	--	R	--	USGS-NWIS, 2004	
207	2070901	05/25/1985	3,649	8.13	--	R	--	USGS-NWIS, 2004	
207	2070901	07/29/1985	3,645	8.12	--	R	--	USGS-NWIS, 2004	
207	2070901	08/29/1985	3,218	7.17	--	R	--	USGS-NWIS, 2004	
207	2070901	10/24/1985	3,223	7.18	--	R	--	USGS-NWIS, 2004	
207	2070901	10/24/1985	3,205	7.14	--	R	--	USGS-NWIS, 2004	

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2070901	11/02/1985	3,609	8.04	--	R	--	USGS-NWIS, 2004	
207	2070901	11/02/1985	3,505	7.81	--	R	--	USGS-NWIS, 2004	
207	2070901	02/11/1987	3,627	8.08	--	R	--	USGS, 1987	
207	2070901	08/11/1987	3,460	7.71	--	R	--	USGS, 1987	
207	2070901	02/23/1988	4,040	9.00	--	R	--	USGS-NWIS, 2004	
207	2070901	03/14/1989	4,201	9.36	--	R	--	USGS, 1989	
207	2070901	03/22/1990	3,800	8.46	--	R	--	USGS-NWIS, 2004	
207	2070901	11/06/1990	3,999	8.91	--	R	--	USGS, 1991	
207	2070901	03/03/1991	3,501	7.80	--	R	--	USGS, 1991	
207	2070901	10/24/1991	3,541	7.89	--	R	--	USGS, 1992	
207	2070901	03/19/1992	3,802	8.47	--	R	--	USGS, 1992	
207	2070901	10/15/1992	4,084	9.10	--	R	--	USGS, 1993	
207	2070901	05/04/1993	3,770	8.40	--	R	--	USGS, 1993	
207	2070901	10/20/1993	4,084	9.10	--	R	--	USGS, 1994	
207	2070901	03/30/1994	3,770	8.40	--	R	--	USGS, 1994	
207	2070901	10/20/1994	4,040	9.00	--	R	--	USGS, 1995	
207	2070901	05/20/1997	4,330	9.64	--	R	--	USGS-NWIS, 2004	
207	2070901	09/24/1997	3,430	7.64	--	R	--	USGS-NWIS, 2004	
207	2070901	04/30/1998	3,890	8.66	--	R	--	USGS-NWIS, 2004	
207	2070901	09/23/1998	3,830	8.53	--	R	--	USGS-NWIS, 2004	
207	2070901	04/08/1999	4,710	10.5	--	R	--	USGS, 1999	
207	2070901	09/14/1999	3,380	7.53	--	R	--	USGS-NWIS, 2004	
207	2070901	02/18/2000	3,280	7.31	--	R	--	USGS-NWIS, 2004	
207	2070901	04/04/2000	3,650	8.12	--	R	--	USGS-NWIS, 2004	
207	2070901	06/20/2000	3,510	7.82	--	R	--	USGS-NWIS, 2004	
207	2070901	07/20/2000	3,480	7.76	--	R	--	USGS-NWIS, 2004	
207	2070901	08/02/2000	3,600	8.03	--	R	--	USGS-NWIS, 2004	
207	2070901	08/07/2000	3,480	7.76	--	R	--	USGS-NWIS, 2004	
207	2070901	09/13/2000	3,520	7.85	--	R	--	USGS-NWIS, 2004	
207	2070901	10/18/2000	3,500	7.80	--	R	--	USGS-NWIS, 2004	
207	2070901	12/20/2000	3,640	8.10	--	R	--	USGS-NWIS, 2004	

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2070901	03/16/2001	3,540	7.94	--	R	--	USGS-NWIS, 2004	
207	2070901	04/18/2001	3,590	8.03	--	R	--	USGS-NWIS, 2004	
207	2070901	04/18/2001	3,600	8.00	--	R	--	USGS-NWIS, 2004	
207	2070901	05/02/2001	3,300	7.36	--	R	--	USGS-NWIS, 2004	
207	2070901	06/20/2001	3,400	7.60	--	R	--	USGS-NWIS, 2004	
207	2070901	06/20/2001	3,393	7.56	--	R	--	USGS-NWIS, 2004	
207	2070901	08/01/2001	3,420	7.62	--	R	--	USGS-NWIS, 2004	
207	2070901	08/01/2001	3,420	7.34	--	R	--	USGS-NWIS, 2004	
207	2070901	09/12/2001	3,360	7.49	--	R	--	USGS-NWIS, 2004	
207	2070901	10/02/2001	3,490	7.81	--	R	--	USGS-NWIS, 2004	
207	2070901	10/02/2001	3,500	7.78	--	R	--	USGS-NWIS, 2004	
207	2070901	12/19/2001	3,460	7.80	--	R	--	USGS-NWIS, 2004	
207	2070901	12/19/2001	3,500	7.70	--	R	--	USGS-NWIS, 2004	
207	2070901	01/22/2002	3,410	7.94	--	R	--	USGS-NWIS, 2004	
207	2070901	01/22/2002	3,420	7.62	--	R	--	USGS-NWIS, 2004	
207	2070901	04/17/2002	3,190	7.20	--	R	--	USGS-NWIS, 2004	
207	2070901	04/17/2002	3,230	7.10	--	R	--	USGS-NWIS, 2004	
207	2070901	05/30/2002	2,960	7.00	--	R	--	USGS-NWIS, 2004	
207	2070901	05/30/2002	3,140	6.60	--	R	--	USGS-NWIS, 2004	
207	2070901	07/18/2002	3,280	7.69	--	R	--	USGS-NWIS, 2004	
207	2070901	07/18/2002	3,370	7.43	--	R	--	USGS-NWIS, 2004	
207	2070901	09/18/2002	3,280	7.34	--	R	--	USGS-NWIS, 2004	
207	2070901	10/16/2002	3,320	7.55	--	R	--	USGS-NWIS, 2004	
207	2070901	10/16/2002	3,410	7.39	--	R	--	USGS-NWIS, 2004	
207	2070901	12/05/2002	3,140	6.95	--	R	--	USGS-NWIS, 2004	
207	2070901	02/05/2003	3,230	7.24	--	R	--	USGS-NWIS, 2004	
207	2070901	03/19/2003	3,100	7.08	--	R	--	USGS-NWIS, 2004	
207	2070901	03/19/2003	3,190	6.91	--	R	--	USGS-NWIS, 2004	
207	2070901	04/23/2003	3,220	7.65	--	R	--	USGS-NWIS, 2004	
207	2070901	04/23/2003	3,430	7.18	--	R	--	USGS-NWIS, 2004	
207	2070901	06/25/2003	3,460	8.00	--	R	--	USGS-NWIS, 2004	
207	2070901	06/25/2003	3,590	7.70	--	R	--	USGS-NWIS, 2004	

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2070901	08/06/2003	4,223	9.41	F	C	21	SNWA	
207	2070901	09/10/2003	3,410	8.17	--	R	--	USGS-NWIS, 2004	
207	2070901	09/10/2003	3,680	7.60	--	R	--	USGS-NWIS, 2004	
207	2070901	10/28/2003	3,510	7.82	--	R	--	USGS-NWIS, 2004	
207	2070901	10/28/2003	3,330	7.42	--	R	--	USGS-NWIS, 2004	
207	2070901	12/10/2003	3,390	7.58	--	R	--	USGS-NWIS, 2004	
207	2070901	12/10/2003	3,400	7.56	--	R	--	USGS-NWIS, 2004	
207	2070901	02/11/2004	3,430	7.64	--	R	--	USGS-NWIS, 2004	
207	2070901	04/21/2004	3,285	7.32	--	R	--	USGS-NWIS, 2004	
207	2071001	10/27/1910	2,406	5.36	--	R	19	Maxey and Eakin, 1949	
207	2071001	10/26/1912	2,406	5.36	--	R	--	Carpenter, 1915	
207	2071001	03/16/1935	4,574	10.2	--	R	--	Maxey and Eakin, 1949	
207	2071001	03/16/1935	4,192	9.34	--	R	--	Maxey and Eakin, 1949	Spring orifice lowered
207	2071001	03/06/1936	2,868	6.39	--	R	--	Maxey and Eakin, 1949	
207	2071001	01/23/1937	3,240	7.22	--	R	--	Maxey and Eakin, 1949	
207	2071001	05/17/1944	3,654	8.14	--	R	--	Maxey and Eakin, 1949	
207	2071001	05/09/1947	4,300	9.58	--	R	--	USGS-NWIS, 2004	
207	2071001	05/09/1947	4,259	9.49	--	R	--	Maxey and Eakin, 1949	
207	2071001	06/15/1966	2,800	6.24	--	R	19	Hess and Mifflin, 1978	
207	2071001	01/18/1982	3,137	6.99	--	R	--	USGS, 1982	
207	2071001	01/17/1985	5,296	11.8	--	R	--	USGS, 1985	
207	2071001	02/01/1986	2,473	5.51	--	R	--	USGS, 1986	
207	2071001	02/11/1987	4,937	11.0	--	R	--	USGS, 1987	
207	2071001	02/23/1988	2,500	5.57	--	R	--	USGS, 1988	
207	2071001	03/14/1989	2,002	4.46	--	R	--	USGS, 1989	
207	2071001	03/22/1990	2,100	4.68	--	R	--	USGS, 1990	
207	2071001	11/09/1990	3,200	7.13	--	R	--	USGS, 1991	
207	2071001	03/03/1991	4,398	9.80	--	R	--	USGS, 1991	
207	2071001	10/24/1991	3,294	7.34	--	R	--	USGS, 1992	
207	2071001	03/19/1992	2,837	6.32	--	R	--	USGS, 1992	
207	2071001	10/14/1992	4,533	10.1	--	R	--	USGS, 1993	

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2071001	05/04/1993	3,501	7.80	--	R	--	USGS, 1993	
207	2071001	10/19/1993	3,860	8.60	--	R	--	USGS, 1994	
207	2071001	03/30/1994	3,860	8.60	--	R	--	USGS, 1994	
207	2071001	10/19/1994	2,872	6.40	--	R	--	USGS, 1995	
207	2071001	05/20/1997	2,990	6.66	--	R	--	USGS-NWIS, 2004	
207	2071001	09/24/1997	2,580	5.75	--	R	--	USGS-NWIS, 2004	
207	2071001	04/29/1998	3,240	7.22	--	R	--	USGS-NWIS, 2004	
207	2071001	09/23/1998	4,340	9.67	--	R	--	USGS-NWIS, 2004	
207	2071001	04/08/1999	3,830	8.53	--	R	--	USGS-NWIS, 2004	
207	2071001	09/14/1999	4,310	9.60	--	R	--	USGS-NWIS, 2004	
207	2071001	04/19/2000	4,010	8.93	--	R	--	USGS-NWIS, 2004	
207	2071001	09/13/2000	4,890	10.9	--	R	--	USGS-NWIS, 2004	
207	2071001	04/18/2001	3,280	7.31	--	R	--	USGS-NWIS, 2004	
207	2071001	09/13/2001	4,120	9.18	--	R	--	USGS-NWIS, 2004	
207	2071001	04/17/2002	3,670	8.18	--	R	--	USGS-NWIS, 2004	
207	2071001	09/18/2002	3,830	8.53	--	R	--	USGS-NWIS, 2004	
207	2071001	04/23/2003	3,070	6.84	--	R	--	USGS-NWIS, 2004	
207	2071001	08/06/2003	2,805	6.25	G	W	19.0	SNWA	
207	2071001	08/08/2003	2,805	6.25	G	W	--	SNWA	
207	2071001	09/10/2003	3,160	7.04	--	R	--	USGS-NWIS, 2004	
207	2071001	04/22/2004	3,190	7.11	--	R	--	USGS-NWIS, 2004	
207	2071001	06/24/2004	2,805	6.25	G	W	--	SNWA	
207	2071001	06/30/2005	4,412	9.83	--	R	--	USGS-NWIS, 2007	
207	2071001	09/21/2005	5,206	11.6	--	R	--	USGS-NWIS, 2007	
207	2071001	04/27/2006	4,252	9.47	--	R	--	USGS, 2006	
207	2071001	09/13/2006	5,433	12.1	--	R	--	USGS, 2006	
207	2071101	03/16/1935	4,574	10.2	--	R	--	Maxey and Eakin, 1949	Spring orifice lowered
207	2071101	09/15/1945	100	0.220	--	R	--	Miller and others, 1953	Possibly only half the flow
207	2071101	06/15/1949	1,900	4.23	--	R	--	Stearns et al., 1937	Measurement is likely 0.423 cfs
207	2071101	11/15/1966	1,900	4.23	--	R	37.8	Hess and Mifflin, 1978	"This is likely the wrong discharge, and is the same measurement as in 1949."
207	2071101	01/01/1968	225	0.500	--	R	37.0	Mifflin, 1968	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2071101	07/23/1982	265	0.590	--	R	--	USGS, 1982	
207	2071101	01/17/1985	256	0.570	--	R	--	USGS, 1985	
207	2071101	02/01/1986	240	0.530	--	R	--	USGS-NWIS, 2004	
207	2071101	02/11/1987	274	0.610	--	R	--	USGS, 1987	
207	2071101	02/23/1988	251	0.560	--	R	--	USGS, 1988	
207	2071101	03/14/1989	301	0.670	--	R	--	USGS, 1989	
207	2071101	03/22/1990	229	0.510	--	R	--	USGS, 1990	
207	2071101	11/08/1990	301	0.670	--	R	--	USGS, 1991	
207	2071101	03/05/1991	310	0.690	--	R	--	USGS, 1991	
207	2071101	10/24/1991	202	0.450	--	R	--	USGS, 1992	
207	2071101	03/19/1992	260	0.580	--	R	--	USGS, 1992	
207	2071101	10/15/1992	193	0.430	--	R	--	USGS, 1993	
207	2071101	05/04/1993	171	0.380	--	R	--	USGS, 1993	
207	2071101	10/19/1993	193	0.430	--	R	--	USGS, 1994	
207	2071101	03/29/1994	206	0.460	--	R	--	USGS, 1994	
207	2071101	10/19/1994	211	0.470	--	R	--	USGS, 1995	
207	2071101	04/17/1997	170	0.380	--	R	--	USGS-NWIS, 2004	
207	2071101	09/24/1997	234	0.520	--	R	--	USGS-NWIS, 2004	
207	2071101	04/29/1998	255	0.570	--	R	--	USGS-NWIS, 2004	
207	2071101	04/08/1999	248	0.550	--	R	--	USGS-NWIS, 2004	
207	2071101	09/15/1999	175	0.390	--	R	--	USGS-NWIS, 2004	
207	2071101	04/20/2000	230	0.510	--	R	--	USGS-NWIS, 2004	
207	2071101	09/13/2000	222	0.490	--	R	--	USGS-NWIS, 2004	
207	2071101	04/17/2001	207	0.460	--	R	--	USGS-NWIS, 2004	
207	2071101	09/13/2001	156	0.350	--	R	--	USGS-NWIS, 2004	
207	2071101	04/18/2002	221	0.490	--	R	--	USGS-NWIS, 2004	
207	2071101	04/24/2003	211	0.470	--	R	--	USGS-NWIS, 2004	
207	2071101	09/10/2003	220	0.490	--	R	--	USGS-NWIS, 2004	
207	2071101	04/22/2004	260	0.580	--	R	--	USGS-NWIS, 2004	
207	2071101	06/23/2004	231	0.513	P	C	--	SNWA	
207	2071101	09/22/2004	211	--	--	R	--	USGS, 2004	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2071101	06/30/2005	192	0.427	--	R	--	USGS, 2005	
207	2071101	09/21/2005	188	0.420	--	R	--	USGS, 2005	
207	2071101	04/27/2006	238	0.530	--	R	--	USGS, 2006	
207	2071101	09/13/2006	206	0.460	--	R	--	USGS, 2006	
207	2071201	08/01/1979	2.00	0.004	--	R	--	Bunch and Harrill, 1984	
207	2071201	09/14/2004	0.350	0.001	E	V	17.0	SNWA	
207	2071201	09/07/2007	Dry	Dry	E	--	--	SNWA	
207	2071301	01/01/1949	1,122	2.50	--	R	--	Maxey and Eakin, 1949	Reported as 7/62-32D1
207	2071301	07/24/1982	1,046	2.33	--	R	--	USGS, 1982	
207	2071301	01/16/1985	983	2.19	--	R	--	USGS, 1985	
207	2071301	02/04/1986	758	1.69	--	R	--	USGS, 1986	
207	2071301	02/11/1987	907	2.02	--	R	--	USGS, 1987	
207	2071301	02/23/1988	902	2.01	--	R	--	USGS, 1988	
207	2071301	03/14/1989	902	2.01	--	R	--	USGS, 1989	
207	2071301	03/22/1990	938	2.09	--	R	--	USGS, 1990	
207	2071301	11/08/1990	799	1.78	--	R	--	USGS, 1991	
207	2071301	03/04/1991	902	2.01	--	R	--	USGS, 1991	
207	2071301	10/23/1991	853	1.90	--	R	--	USGS, 1992	
207	2071301	03/18/1992	754	1.68	--	R	--	USGS, 1992	
207	2071301	10/14/1992	718	1.60	--	R	--	USGS, 1993	
207	2071301	05/03/1993	808	1.80	--	R	--	USGS, 1993	
207	2071301	10/19/1993	539	1.20	--	R	--	USGS, 1994	
207	2071301	03/29/1994	673	1.50	--	R	--	USGS, 1994	
207	2071301	10/19/1994	763	1.70	--	R	--	USGS, 1995	
207	2071301	04/17/1997	1,460	3.25	--	R	--	USGS-NWIS, 2004	
207	2071301	05/21/1997	978	2.18	--	R	--	USGS-NWIS, 2004	
207	2071301	09/29/1997	1,020	2.27	--	R	--	USGS-NWIS, 2004	
207	2071301	04/29/1998	1,140	2.54	--	R	--	USGS-NWIS, 2004	
207	2071301	09/23/1998	1,260	2.81	--	R	--	USGS-NWIS, 2004	
207	2071301	04/08/1999	754	1.68	--	R	--	USGS-NWIS, 2004	
207	2071301	09/13/1999	1,180	2.63	--	R	--	USGS-NWIS, 2004	
207	2071301	04/04/2000	1,180	2.63	--	R	--	USGS-NWIS, 2004	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2071301	09/14/2000	1,640	3.65	--	R	--	USGS-NWIS, 2004	
207	2071301	04/17/2001	1,000	2.23	--	R	--	USGS-NWIS, 2004	
207	2071301	09/13/2001	1,320	2.94	--	R	--	USGS-NWIS, 2004	
207	2071301	04/16/2002	1,000	2.23	--	R	--	USGS-NWIS, 2004	
207	2071301	05/30/2002	890	1.98	--	R	--	USGS-NWIS, 2004	
207	2071301	09/19/2002	1,300	2.90	--	R	--	USGS-NWIS, 2004	
207	2071301	04/24/2003	930	2.07	--	R	--	USGS-NWIS, 2004	
207	2071301	09/11/2003	800	1.78	--	R	--	USGS-NWIS, 2004	
207	2071301	04/23/2004	825	1.84	--	R	--	USGS-NWIS, 2004	
207	2071301	09/11/2004	810	1.80	--	R	--	USGS, 2004	
207	2071301	09/24/2004	785	1.75	--	R	--	USGS, 2004	
207	2071301	06/30/2005	1,109	2.47	--	R	--	USGS-NWIS, 2007	
207	2071301	09/22/2005	1,073	2.39	--	R	--	USGS-NWIS, 2007	
207	2071301	04/28/2006	983	2.19	--	R	--	USGS, 2006	
207	2071302	07/24/1982	1,154	2.57	--	R	--	USGS, 1982	
207	2071302	01/16/1985	1,284	2.86	--	R	--	USGS, 1985	
207	2071302	02/04/1986	1,203	2.68	--	R	--	USGS, 1986	
207	2071302	02/11/1987	1,584	3.53	--	R	--	USGS, 1987	
207	2071302	02/23/1988	1,598	3.56	--	R	--	USGS, 1988	
207	2071302	03/14/1989	1,302	2.90	--	R	--	USGS, 1989	
207	2071302	03/22/1990	220	0.490	--	R	--	USGS, 1990	
207	2071302	11/08/1990	1,001	2.23	--	R	--	USGS, 1991	
207	2071302	03/04/1991	1,001	2.23	--	R	--	USGS, 1991	
207	2071302	10/23/1991	1,257	2.80	--	R	--	USGS, 1992	
207	2071302	03/18/1992	1,333	2.97	--	R	--	USGS, 1992	
207	2071302	10/14/1992	1,302	2.90	--	R	--	USGS, 1993	
207	2071302	05/03/1993	1,436	3.20	--	R	--	USGS, 1993	
207	2071302	10/19/1993	1,302	2.90	--	R	--	USGS, 1994	
207	2071302	03/29/1994	1,391	3.10	--	R	--	USGS, 1994	
207	2071302	10/19/1994	1,302	2.90	--	R	--	USGS, 1995	
207	2071302	04/17/1997	1,460	3.25	--	R	--	USGS-NWIS, 2004	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2071302	09/29/1997	1,440	3.21	--	R	--	USGS-NWIS, 2004	
207	2071302	04/29/1998	1,570	3.50	--	R	--	USGS-NWIS, 2004	
207	2071302	09/23/1998	1,020	2.27	--	R	--	USGS-NWIS, 2004	
207	2071302	04/08/1999	1,280	2.85	--	R	--	USGS-NWIS, 2004	
207	2071302	09/13/1999	1,430	3.19	--	R	--	USGS-NWIS, 2004	
207	2071302	04/04/2000	1,400	3.12	--	R	--	USGS-NWIS, 2004	
207	2071302	09/14/2000	1,520	3.39	--	R	--	USGS-NWIS, 2004	
207	2071302	04/17/2001	1,440	3.21	--	R	--	USGS-NWIS, 2004	
207	2071302	09/13/2001	1,380	3.07	--	R	--	USGS-NWIS, 2004	
207	2071302	04/16/2002	1,390	3.10	--	R	--	USGS-NWIS, 2004	
207	2071302	09/16/2002	1,250	2.79	--	R	--	USGS-NWIS, 2004	
207	2071302	04/24/2003	1,380	3.07	--	R	--	USGS-NWIS, 2004	
207	2071302	09/11/2003	1,320	2.94	--	R	--	USGS-NWIS, 2004	
207	2071302	04/23/2004	1,095	2.44	--	R	--	USGS-NWIS, 2004	
207	2071302	09/24/2004	1,400	3.12	--	R	--	USGS, 2004	
207	2071302	06/30/2005	1,212	2.70	--	R	--	USGS-NWIS, 2007	
207	2071302	09/22/2005	1,203	2.68	--	R	--	USGS-NWIS, 2007	
207	2071302	04/28/2006	1,189	2.65	--	R	--	USGS, 2006	
207	2071303	07/25/1982	1,005	2.24	--	R	--	USGS, 1982	
207	2071303	01/16/1985	1,059	2.36	--	R	--	USGS, 1985	
207	2071303	02/04/1986	857	1.91	--	R	--	USGS, 1986	
207	2071303	02/11/1987	1,041	2.32	--	R	--	USGS, 1987	
207	2071303	02/23/1988	902	2.01	--	R	--	USGS, 1988	
207	2071303	03/14/1989	1,400	3.12	--	R	--	USGS, 1989	
207	2071303	03/22/1990	691	1.54	--	R	--	USGS, 1990	
207	2071303	11/09/1990	1,001	2.23	--	R	--	USGS, 1991	
207	2071303	03/04/1991	1,302	2.90	--	R	--	USGS, 1991	
207	2071303	10/23/1991	907	2.02	--	R	--	USGS, 1992	
207	2071303	03/18/1992	996	2.22	--	R	--	USGS, 1992	
207	2071303	10/14/1992	898	2.00	--	R	--	USGS, 1993	
207	2071303	05/03/1993	898	2.00	--	R	--	USGS, 1993	
207	2071303	10/19/1993	1,077	2.40	--	R	--	USGS, 1994	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2071303	03/29/1994	942	2.10	--	R	--	USGS, 1994	
207	2071303	10/19/1994	853	1.90	--	R	--	USGS, 1995	
207	2071303	04/17/1997	1,070	2.38	--	R	--	USGS-NWIS, 2004	
207	2071303	09/25/1997	1,090	2.43	--	R	--	USGS-NWIS, 2004	
207	2071303	04/29/1998	952	2.12	--	R	--	USGS-NWIS, 2004	
207	2071303	09/23/1998	1,570	3.50	--	R	--	USGS-NWIS, 2004	
207	2071303	04/08/1999	956	2.13	--	R	--	USGS-NWIS, 2004	
207	2071303	09/15/1999	1,010	2.25	--	R	--	USGS-NWIS, 2004	
207	2071303	04/04/2000	1,160	2.58	--	R	--	USGS-NWIS, 2004	
207	2071303	09/14/2000	1,180	2.63	--	R	--	USGS-NWIS, 2004	
207	2071303	04/17/2001	826	1.84	--	R	--	USGS-NWIS, 2004	
207	2071303	09/13/2001	1,080	2.41	--	R	--	USGS-NWIS, 2004	
207	2071303	04/16/2002	970	2.16	--	R	--	USGS-NWIS, 2004	
207	2071303	04/16/2002	960	2.14	--	R	--	USGS-NWIS, 2004	
207	2071303	09/19/2002	1,390	3.10	--	R	--	USGS-NWIS, 2004	
207	2071303	04/24/2003	871	1.94	--	R	--	USGS-NWIS, 2004	
207	2071303	09/11/2003	915	2.04	--	R	--	USGS-NWIS, 2004	
207	2071303	04/23/2004	950	2.12	--	R	--	USGS-NWIS, 2004	
207	2071303	09/24/2004	950	2.12	--	R	--	USGS, 2004	
207	2071303	06/30/2005	965	2.15	--	R	--	USGS-NWIS, 2007	
207	2071303	09/22/2005	907	2.02	--	R	--	USGS-NWIS, 2007	
207	2071303	04/28/2006	1,077	2.40	--	R	--	USGS, 2006	
207	2071401	01/01/1949	1,122	2.50	--	R	--	USGS-NWIS, 2004	Reported as 7/62-28B1
207	2071401	03/09/1966	900	2.01	--	R	--	USGS-NWIS, 2004	
207	2071401	07/25/1982	1,127	2.51	--	R	--	USGS, 1982	
207	2071401	01/16/1985	1,423	3.17	--	R	--	USGS, 1985	
207	2071401	02/04/1986	1,477	3.29	--	R	--	USGS, 1986	
207	2071401	02/11/1987	1,028	2.29	--	R	--	USGS, 1987	
207	2071401	08/12/1987	1,872	4.17	--	R	--	USGS, 1987	
207	2071401	02/23/1988	1,001	2.23	--	R	--	USGS, 1988	
207	2071401	03/14/1989	1,400	3.12	--	R	--	USGS, 1989	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2071401	03/22/1990	902	2.01	--	R	--	USGS, 1990	
207	2071401	11/08/1990	1,100	2.45	--	R	--	USGS, 1991	
207	2071401	03/04/1991	1,100	2.45	--	R	--	USGS, 1991	
207	2071401	10/23/1991	1,517	3.38	--	R	--	USGS, 1992	
207	2071401	03/18/1992	1,369	3.05	--	R	--	USGS, 1992	
207	2071401	10/14/1992	1,257	2.80	--	R	--	USGS, 1993	
207	2071401	05/03/1993	1,257	2.80	--	R	--	USGS, 1993	
207	2071401	10/19/1993	1,481	3.30	--	R	--	USGS, 1994	
207	2071401	03/29/1994	1,481	3.30	--	R	--	USGS, 1994	
207	2071401	10/19/1994	1,167	2.60	--	R	--	USGS, 1995	
207	2071401	04/17/1997	1,001	2.23	--	R	--	USGS-NWIS, 2004	
207	2071401	09/25/1997	1,300	2.90	--	R	--	USGS-NWIS, 2004	
207	2071401	04/29/1998	1,530	3.41	--	R	--	USGS-NWIS, 2004	
207	2071401	09/23/1998	1,500	3.34	--	R	--	USGS-NWIS, 2004	
207	2071401	04/08/1999	1,240	2.76	--	R	--	USGS-NWIS, 2004	
207	2071401	09/15/1999	1,210	2.70	--	R	--	USGS-NWIS, 2004	
207	2071401	04/20/2000	1,450	3.23	--	R	--	USGS-NWIS, 2004	
207	2071401	09/13/2000	1,490	3.32	--	R	--	USGS-NWIS, 2004	
207	2071401	04/17/2001	1,180	2.63	--	R	--	USGS-NWIS, 2004	
207	2071401	10/02/2001	1,330	2.96	--	R	--	USGS-NWIS, 2004	
207	2071401	04/16/2002	1,090	2.43	--	R	--	USGS-NWIS, 2004	
207	2071401	09/19/2002	1,250	2.79	--	R	--	USGS-NWIS, 2004	
207	2071401	04/24/2003	978	2.18	--	R	--	USGS-NWIS, 2004	
207	2071401	09/11/2003	978	2.18	--	R	--	USGS, 2003	
207	2071401	04/23/2004	1,020	2.27	--	R	--	USGS-NWIS, 2004	
207	2071401	09/24/2004	942	2.10	--	R	--	USGS, 2004	
207	2071401	06/30/2005	853	1.90	--	R	--	USGS-NWIS, 2007	
207	2071401	09/22/2005	1,001	2.23	--	R	--	USGS-NWIS, 2007	
207	2071401	04/27/2006	1,274	2.84	--	R	--	USGS, 2006	
207	2071401	09/14/2006	1,180	2.62	--	R	--	USGS, 2006	
207	2071501	11/14/1966	200	0.450	--	R	19.0	Hess and Mifflin, 1978	Reported as West Immigrant Spring
207	2071501	09/14/2004	200	0.445	F	C	15.0	SNWA	Discharge is confluence of five springs

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2071502	09/14/2004	4.90	0.011	E	F	17.0	SNWA	200 yds. West of Hardy Springs
207	2071601	10/27/1910	1,023	2.28	--	R	--	Maxey and Eakin, 1949	
207	2071601	05/07/1935	1,180	2.63	--	R	--	Maxey and Eakin, 1949	
207	2071601	03/06/1936	1,203	2.68	--	R	--	Maxey and Eakin, 1949	
207	2071601	03/29/1936	1,189	2.65	--	R	--	Maxey and Eakin, 1949	
207	2071601	03/30/1936	1,189	2.65	--	R	--	Maxey and Eakin, 1949	
207	2071601	04/07/1936	1,234	2.75	--	R	--	Maxey and Eakin, 1949	
207	2071601	04/29/1936	1,230	2.74	--	R	--	Maxey and Eakin, 1949	
207	2071601	05/05/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	05/07/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	05/12/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	05/16/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	05/19/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	05/23/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	05/26/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	05/30/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	06/02/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	06/05/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	06/09/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	06/16/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	06/19/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	06/23/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	06/27/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	07/07/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	07/12/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	07/18/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	07/19/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	07/26/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	08/04/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	08/15/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	
207	2071601	08/25/1936	1,212	2.70	--	R	--	Maxey and Eakin, 1949	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2071601	05/09/1947	1,122	2.50	--	R	71	USGS-NWIS, 2004	
207	2071601	11/13/1966	1,125	2.51	--	R	70	Hess and Mifflin, 1978	
207	2071601	01/19/1982	1,068	2.38	--	R	--	USGS, 1982	
207	2071601	07/30/1984	1,200	2.67	--	R	--	USGS-NWIS, 2004	
207	2071601	01/21/1985	965	2.15	--	R	--	USGS, 1985	
207	2071601	02/01/1986	1,086	2.42	--	R	--	USGS, 1986	
207	2071601	02/23/1988	1,598	3.56	--	R	--	USGS, 1988	
207	2071601	03/14/1989	301	0.670	--	R	--	USGS, 1989	Discharge appears low.
207	2071601	04/04/1990	1,100	2.45	--	R	--	USGS, 1990	
207	2071601	11/06/1990	1,302	2.90	--	R	--	USGS, 1991	
207	2071601	03/03/1991	1,499	3.34	--	R	--	USGS, 1991	
207	2071601	10/24/1991	1,167	2.60	--	R	--	USGS, 1992	
207	2071601	03/19/1992	108	0.240	--	R	--	USGS, 1992	
207	2071601	10/15/1992	1,346	3.00	--	R	--	USGS, 1993	
207	2071601	05/04/1993	1,346	3.00	--	R	--	USGS, 1993	
207	2071601	10/19/1993	1,257	2.80	--	R	--	USGS, 1994	
207	2071601	03/30/1994	898	2.00	--	R	--	USGS, 1994	
207	2071601	10/20/1994	1,302	2.90	--	R	--	USGS, 1995	
207	2071601	05/20/1997	1,190	2.65	--	R	--	USGS-NWIS, 2004	
207	2071601	09/24/1997	1,320	2.94	--	R	--	USGS-NWIS, 2004	
207	2071601	04/30/1998	1,360	3.03	--	R	--	USGS-NWIS, 2004	
207	2071601	09/23/1998	1,230	2.74	--	R	--	USGS-NWIS, 2004	
207	2071601	04/08/1999	1,310	2.92	--	R	--	USGS-NWIS, 2004	
207	2071601	09/14/1999	1,130	2.52	--	R	--	USGS-NWIS, 2004	
207	2071601	04/19/2000	1,260	2.81	--	R	--	USGS-NWIS, 2004	
207	2071601	09/13/2000	1,550	3.45	--	R	--	USGS-NWIS, 2004	
207	2071601	04/18/2001	952	2.12	--	R	--	USGS-NWIS, 2004	
207	2071601	09/12/2001	1,240	2.76	--	R	--	USGS-NWIS, 2004	
207	2071601	04/17/2002	1,270	2.83	--	R	--	USGS-NWIS, 2004	
207	2071601	09/18/2002	1,220	2.72	--	R	--	USGS-NWIS, 2004	
207	2071601	04/23/2003	1,260	2.81	--	R	--	USGS-NWIS, 2004	
207	2071601	09/10/2003	1,120	2.50	--	R	--	USGS-NWIS, 2004	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2071601	04/22/2004	1,200	2.67	--	R	--	USGS-NWIS, 2004	
207	2071601	09/23/2004	1,185	2.64	--	R	--	USGS, 2004	
207	2071601	07/01/2005	1,207	2.69	--	R	--	USGS, 2005	
207	2071601	07/01/2005	1,207	2.69	--	R	--	USGS-NWIS, 2007	
207	2071601	09/21/2005	1,207	2.69	--	R	--	USGS, 2005	
207	2071601	09/21/2005	1,207	2.69	--	R	--	USGS-NWIS, 2007	
207	2071601	04/27/2006	1,145	2.55	--	R	--	USGS, 2006	
207	2071601	09/13/2006	1,297	2.89	--	R	--	USGS, 2006	
207	2071701	07/26/2005	122	0.271	E	F	18.1	SNWA	
207	2071801	01/01/1935	50.0	0.110	--	R	51	Stearns et. Al., 1935	
207	2071801	12/16/1947	134	0.300	--	R	53	Maxey and Eakin, 1949	
207	2071801	07/26/2005	30.0	0.070	F	V	27.3	SNWA	
207	2071901	01/01/1949	900	2.01	--	R	--	USGS-NWIS, 2006	
207	2071901	08/01/1979	700	1.60	--	R	--	Ertec, 1981	
207	2071901	01/16/1985	1,800	4.01	--	R	--	USGS, 1985	
207	2071901	02/03/1986	1,854	4.13	--	R	--	USGS, 1986	
207	2071901	02/11/1987	1,777	3.96	--	R	--	USGS, 1987	
207	2071901	08/11/1987	1,840	4.10	--	R	--	USGS, 1987	
207	2071901	02/23/1988	2,199	4.90	--	R	--	USGS, 1988	
207	2071901	03/14/1989	2,298	5.12	--	R	--	USGS, 1989	
207	2071901	03/22/1990	1,899	4.23	--	R	--	USGS, 1990	
207	2071901	11/08/1990	1,800	4.01	--	R	--	USGS-NWIS, 2006	
207	2072001	01/01/1949	1,300	2.90	--	R	--	USGS-NWIS, 2006	
207	2072001	07/24/1982	1,000	2.23	--	R	--	USGS-NWIS, 2006	
207	2072001	01/17/1985	1,000	2.23	--	R	--	USGS-NWIS, 2006	
207	2072001	02/01/1986	1,400	3.12	--	R	--	USGS-NWIS, 2006	
207	2072001	03/26/1987	800	1.78	--	R	--	USGS-NWIS, 2006	
207	2072001	08/12/1987	800	1.78	--	R	--	USGS-NWIS, 2006	
207	2072001	02/23/1988	800	1.78	--	R	--	USGS-NWIS, 2006	
207	2072001	03/14/1989	600	1.34	--	R	--	USGS-NWIS, 2006	
207	2072001	03/22/1990	800	1.78	--	R	--	USGS-NWIS, 2006	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
207	2072001	11/08/1990	500	1.11	--	R	--	USGS-NWIS, 2006	
207	2072001	03/05/1991	900	2.01	--	R	--	USGS-NWIS, 2006	
207	2072001	10/24/1991	800	1.78	--	R	--	USGS-NWIS, 2006	
207	2072001	03/18/1992	800	1.78	--	R	--	USGS-NWIS, 2006	
207	2072001	10/14/1992	340	0.760	--	R	--	USGS-NWIS, 2006	
207	2072001	05/04/1993	900	2.01	--	R	--	USGS-NWIS, 2006	
207	2072001	10/19/1993	600	1.34	--	R	--	USGS-NWIS, 2006	
207	2072001	03/29/1994	500	1.11	--	R	--	USGS-NWIS, 2006	
207	2072001	10/20/1994	500	1.11	--	R	--	USGS-NWIS, 2006	
209	2090101	11/15/1912	4,039	9.00	--	R	--	Carpenter, 1915	Discharge likely confused with Crystal Springs
209	2090101	01/01/1931	5,368	12.0	--	R	--	Hardman and Miller, 1934	Discharge likely confused with Crystal Springs
209	2090101	01/01/1934	2,949	6.57	--	R	--	Smith, 1938	
209	2090101	01/01/1941	2,926	6.52	--	R	--	Smith, 1942	
209	2090101	01/01/1943	2,872	6.40	--	R	--	Smith, 1944	
209	2090101	03/10/1962	--	--	--	R	26.7	Eakin, 1963	
209	2090101	06/15/1963	2,406	5.36	--	R	--	USGS, 1963	Drainage area not determined
209	2090101	02/07/1965	2,877	6.41	--	R	--	USGS, 1965	
209	2090101	05/19/1965	2,886	6.43	--	R	--	USGS, 1965	
209	2090101	07/13/1965	2,953	6.58	--	R	--	USGS, 1965	
209	2090101	10/12/1965	2,832	6.31	--	R	--	USGS, 1966	
209	2090101	07/29/1982	2,935	6.54	--	R	--	USGS, 1982	
209	2090101	01/21/1985	3,034	6.76	--	R	--	USGS, 1985	
209	2090101	01/28/1986	2,729	6.08	--	R	--	USGS, 1986	
209	2090101	03/25/1987	2,590	5.77	--	R	--	USGS, 1987	
209	2090101	02/12/1988	2,801	6.24	--	R	--	USGS, 1988	
209	2090101	03/14/1990	1,930	4.30	--	R	--	USGS, 1990	
209	2090101	11/05/1990	2,998	6.68	--	R	--	USGS, 1991	
209	2090101	04/03/1991	2,199	4.90	--	R	--	USGS, 1991	
209	2090101	11/04/1991	1,903	4.24	--	R	--	USGS, 1992	
209	2090101	03/25/1992	2,370	5.28	--	R	--	USGS, 1992	
209	2090101	10/14/1992	2,872	6.40	--	R	--	USGS, 1993	
209	2090101	04/20/1993	1,975	4.40	--	R	--	USGS, 1993	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
209	2090101	10/19/1993	1,795	4.00	--	R	--	USGS, 1994	
209	2090101	03/29/1994	2,065	4.60	--	R	--	USGS, 1994	
209	2090101	10/18/1994	2,693	6.00	--	R	--	USGS, 1995	
209	2090101	04/16/1997	2,150	4.79	--	R	--	USGS, 1997	
209	2090101	09/23/1997	2,730	6.08	--	R	--	USGS, 1997	
209	2090101	07/19/2004	2,693	6.00	P	E	27	SNWA	
209	2090201	05/24/2004	0.300	0.00	P	E	20.3	SNWA	
209	2090301	11/15/1912	2.00	0.004	--	R	--	Carpenter, 1915	
209	2090301	05/01/1980	4.00	0.010	--	R	15	Bunch and Harrill, 1984	Reported in Delamar Valley
209	2090301	07/19/2004	10.0	0.020	P	E	--	SNWA	
209	2090401	11/16/1912	3,142	7.00	--	R	--	Carpenter, 1915	Discharge is likely confused with Hiko Spring
209	2090401	01/01/1931	2,675	5.96	--	R	--	Hardman and Miller, 1934	Discharge is likely confused with Hiko Spring
209	2090401	01/01/1934	4,470	9.96	--	R	--	Smith, 1938	
209	2090401	01/01/1941	4,345	9.68	--	R	--	Smith, 1942	
209	2090401	01/01/1943	4,264	9.50	--	R	--	Smith, 1944	
209	2090401	03/10/1962	--	--	--	R	27.8	Eakin, 1963	
209	2090401	04/15/1963	--	--	--	R	27.2	Eakin, 1963	
209	2090401	06/17/1963	7,630	17	--	R	--	Eakin, 1963	
209	2090401	06/17/1963	2,078	4.63	--	R	--	USGS, 1963	
209	2090401	07/29/1982	5,431	12.1	--	R	--	USGS, 1982	
209	2090401	01/21/1985	4,937	11.0	--	R	--	USGS, 1985	
209	2090401	06/11/1985	1,445	3.22	--	R	--	USGS-NWIS, 2004	
209	2090401	06/11/1985	1,001	2.23	--	R	--	USGS-NWIS, 2004	
209	2090401	07/26/1985	3,788	8.44	--	R	--	USGS-NWIS, 2004	
209	2090401	08/23/1985	4,892	10.9	--	R	--	USGS-NWIS, 2004	
209	2090401	08/23/1985	3,510	7.82	--	R	--	USGS-NWIS, 2004	
209	2090401	10/14/1985	1,162	2.59	--	R	--	USGS-NWIS, 2004	
209	2090401	12/11/1985	4,937	11.0	--	R	--	USGS-NWIS, 2004	
209	2090401	01/27/1986	4,937	11.0	--	R	--	USGS, 1986	
209	2090401	03/26/1986	4,713	10.5	--	R	--	USGS-NWIS, 2004	
209	2090401	07/17/1986	4,488	10.0	--	R	--	USGS-NWIS, 2004	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
209	2090401	03/26/1987	960	2.14	--	R	--	USGS-NWIS, 2004	
209	2090401	09/11/1987	4,713	10.5	--	R	--	USGS-NWIS, 2004	
209	2090401	11/19/1987	5,161	11.5	--	R	--	USGS-NWIS, 2004	
209	2090401	05/26/1988	1,284	2.86	--	R	--	USGS-NWIS, 2004	
209	2090401	02/28/1989	1,898	4.23	--	R	--	USGS, 1989	
209	2090401	03/14/1990	1,239	2.76	--	R	--	USGS, 1990	
209	2090401	04/19/1990	2,091	4.66	--	R	--	USGS-NWIS, 2004	
209	2090401	05/31/1990	1,378	3.07	--	R	--	USGS-NWIS, 2004	
209	2090401	07/10/1990	4,847	10.8	--	R	--	USGS-NWIS, 2004	
209	2090401	08/16/1990	1,768	3.94	--	R	--	USGS-NWIS, 2004	
209	2090401	10/04/1990	5,386	12.0	--	R	--	USGS-NWIS, 2004	
209	2090401	11/05/1990	5,431	12.1	--	R	--	USGS-NWIS, 2004	
209	2090401	11/15/1990	5,000	11.1	--	R	--	USGS, 1991	
209	2090401	12/18/1990	3,676	8.19	--	R	--	USGS-NWIS, 2004	
209	2090401	01/29/1991	3,425	7.63	--	R	--	USGS-NWIS, 2004	
209	2090401	03/20/1991	4,143	9.23	--	R	--	USGS-NWIS, 2004	
209	2090401	04/29/1991	893	1.99	--	R	--	USGS-NWIS, 2004	
209	2090401	06/14/1991	736	1.64	--	R	--	USGS-NWIS, 2004	
209	2090401	08/01/1991	4,147	9.24	--	R	--	USGS-NWIS, 2004	
209	2090401	09/19/1991	3,784	8.43	--	R	--	USGS-NWIS, 2004	
209	2090401	10/09/1991	3,591	8.00	--	R	--	USGS-NWIS, 2004	
209	2090401	11/04/1991	3,766	8.39	--	R	--	USGS, 1992	
209	2090401	12/08/1991	3,793	8.45	--	R	--	USGS-NWIS, 2004	
209	2090401	01/13/1992	3,820	8.51	--	R	--	USGS-NWIS, 2004	
209	2090401	02/24/1992	3,986	8.88	--	R	--	USGS-NWIS, 2004	
209	2090401	03/25/1992	3,842	8.56	--	R	--	USGS, 1992	
209	2090401	05/18/1992	3,519	7.84	--	R	--	USGS-NWIS, 2004	
209	2090401	06/30/1992	3,734	8.32	--	R	--	USGS-NWIS, 2004	
209	2090401	08/13/1992	3,739	8.33	--	R	--	USGS-NWIS, 2004	
209	2090401	10/05/1992	3,941	8.78	--	R	--	USGS-NWIS, 2004	
209	2090401	10/14/1992	4,354	9.70	--	R	--	USGS, 1993	
209	2090401	11/16/1992	4,048	9.02	--	R	--	USGS-NWIS, 2004	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
209	2090401	01/07/1993	4,358	9.71	--	R	--	USGS-NWIS, 2004	
209	2090401	03/01/1993	3,981	8.87	--	R	--	USGS-NWIS, 2004	
209	2090401	04/20/1993	4,129	9.20	--	R	--	USGS, 1993	
209	2090401	05/25/1993	4,062	9.05	--	R	--	USGS-NWIS, 2004	
209	2090401	06/15/1993	4,268	9.51	--	R	--	USGS-NWIS, 2004	
209	2090401	07/28/1993	4,075	9.08	--	R	--	USGS-NWIS, 2004	
209	2090401	08/31/1993	4,120	9.18	--	R	--	USGS-NWIS, 2004	
209	2090401	10/13/1993	2,558	5.70	--	R	--	USGS-NWIS, 2004	
209	2090401	10/19/1993	4,937	11.0	--	R	--	USGS, 1994	
209	2090401	11/22/1993	5,341	11.9	--	R	--	USGS-NWIS, 2004	
209	2090401	11/23/1993	3,968	8.84	--	R	--	USGS-NWIS, 2004	
209	2090401	01/05/1994	4,488	10.0	--	R	--	USGS-NWIS, 2004	
209	2090401	02/15/1994	5,431	12.1	--	R	--	USGS-NWIS, 2004	
209	2090401	02/15/1994	5,251	11.7	--	R	--	USGS-NWIS, 2004	
209	2090401	03/29/1994	1,840	4.10	--	R	--	USGS, 1994	
209	2090401	05/05/1994	5,790	12.9	--	R	--	USGS-NWIS, 2004	
209	2090401	06/21/1994	5,206	11.6	--	R	--	USGS-NWIS, 2004	
209	2090401	08/02/1994	5,341	11.9	--	R	--	USGS-NWIS, 2004	
209	2090401	10/04/1994	5,431	12.1	--	R	--	USGS-NWIS, 2004	
209	2090401	10/18/1994	4,488	10.0	--	R	--	USGS, 1995	
209	2090401	12/13/1994	5,386	12.0	--	R	--	USGS-NWIS, 2004	
209	2090401	04/16/1997	4,980	11.1	--	R	--	USGS, 1997	
209	2090401	09/23/1997	5,430	12.1	--	R	--	USGS, 1997	
209	2090401	04/29/1998	5,790	12.9	--	R	--	USGS, 1998	
209	2090401	09/22/1998	5,835	13.0	--	R	--	USGS-NWIS, 2004	
209	2090401	09/22/1998	5,830	13.0	--	R	--	USGS, 1998	
209	2090401	01/14/1999	4,937	11.0	--	R	--	USGS-NWIS, 2004	
209	2090401	01/14/1999	4,668	10.4	--	R	--	USGS-NWIS, 2004	
209	2090401	02/22/1999	1,387	3.09	--	R	--	USGS-NWIS, 2004	
209	2090401	04/14/1999	5,072	11.3	--	R	--	USGS-NWIS, 2004	
209	2090401	05/18/1999	5,386	12.0	--	R	--	USGS-NWIS, 2004	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
209	2090401	06/29/1999	5,251	11.7	--	R	--	USGS-NWIS, 2004	
209	2090401	07/12/1999	5,386	12.0	--	R	--	USGS-NWIS, 2004	
209	2090401	08/26/1999	5,521	12.3	--	R	--	USGS-NWIS, 2004	
209	2090401	10/14/1999	5,700	12.7	--	R	--	USGS-NWIS, 2004	
209	2090401	11/17/1999	5,341	11.9	--	R	--	USGS-NWIS, 2004	
209	2090401	01/18/2000	5,251	11.7	--	R	--	USGS-NWIS, 2004	
209	2090401	02/18/2000	5,700	12.7	--	R	--	USGS-NWIS, 2004	
209	2090401	03/30/2000	4,578	10.2	--	R	--	USGS-NWIS, 2004	
209	2090401	04/03/2000	2,015	4.49	--	R	--	USGS-NWIS, 2004	
209	2090401	05/17/2000	5,790	12.9	--	R	--	USGS-NWIS, 2004	
209	2090401	06/20/2000	1,638	3.65	--	R	--	USGS-NWIS, 2004	
209	2090401	08/08/2000	5,655	12.6	--	R	--	USGS-NWIS, 2004	
209	2090401	09/14/2000	1,580	3.52	--	R	--	USGS-NWIS, 2004	
209	2090401	10/05/2000	5,835	13.0	--	R	--	USGS-NWIS, 2004	
209	2090401	01/02/2001	5,790	12.9	--	R	--	USGS-NWIS, 2004	
209	2090401	02/16/2001	5,655	12.6	--	R	--	USGS-NWIS, 2004	
209	2090401	04/19/2001	5,925	13.2	--	R	--	USGS-NWIS, 2004	
209	2090401	06/20/2001	1,943	4.33	--	R	--	USGS-NWIS, 2004	
209	2090401	08/02/2001	5,835	13.0	--	R	--	USGS-NWIS, 2004	
209	2090401	09/11/2001	5,431	12.1	--	R	--	USGS-NWIS, 2004	
209	2090401	10/02/2001	5,431	12.1	--	R	--	USGS-NWIS, 2004	
209	2090401	12/04/2001	6,284	14.0	--	R	--	USGS-NWIS, 2004	
209	2090401	01/23/2002	5,925	13.2	--	R	--	USGS-NWIS, 2004	
209	2090401	04/18/2002	5,790	12.9	--	R	--	USGS-NWIS, 2004	
209	2090401	06/04/2002	2,101	4.68	--	R	--	USGS-NWIS, 2004	
209	2090401	07/16/2002	5,655	12.6	--	R	--	USGS-NWIS, 2004	
209	2090401	09/17/2002	5,835	13.0	--	R	--	USGS-NWIS, 2004	
209	2090401	10/17/2002	5,521	12.3	--	R	--	USGS-NWIS, 2004	
209	2090401	12/03/2002	5,655	12.6	--	R	--	USGS-NWIS, 2004	
209	2090401	02/04/2003	5,700	12.7	--	R	--	USGS-NWIS, 2004	
209	2090401	03/17/2003	2,769	6.17	--	R	--	USGS-NWIS, 2004	
209	2090401	04/22/2003	5,790	12.9	--	R	--	USGS-NWIS, 2004	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
209	2090401	04/22/2003	5,700	12.7	--	R	--	USGS-NWIS, 2004	
209	2090401	06/26/2003	1,499	3.34	--	R	--	USGS-NWIS, 2004	
209	2090401	09/09/2003	5,655	12.6	--	R	--	USGS-NWIS, 2004	
209	2090401	10/22/2003	5,655	12.6	--	R	--	USGS-NWIS, 2004	
209	2090401	12/03/2003	5,610	12.5	--	R	--	USGS-NWIS, 2004	
209	2090401	02/10/2004	5,835	13.0	--	R	--	USGS-NWIS, 2004	
209	2090401	08/05/2005	3,824	8.52	G	R	--	USGS, 2007	
209	2090401	08/05/2005	3,725	8.30	G	R	--	USGS, 2007	
209	2090401	03/22/2006	3,986	8.88	G	R	--	USGS, 2007	
209	2090401	04/25/2006	3,667	8.17	P	R	--	USGS, 2007	
209	2090401	05/06/2006	3,344	7.45	G	R	--	USGS, 2007	
209	2090401	06/26/2006	3,492	7.78	P	R	--	USGS, 2007	
209	2090501	11/16/1912	8,977	20.0	--	R	--	Carpenter, 1915	
209	2090501	01/01/1931	10,274	22.9	--	R	--	Hardman and Miller, 1934	
209	2090501	01/01/1934	8,662	19.3	--	R	--	Smith, 1938	
209	2090501	01/01/1941	7,002	15.6	--	R	--	Smith, 1942	Summation of 4 irrigation ditches
209	2090501	01/01/1942	7,002	15.6	--	R	--	Smith, 1942	Summation of 5 irrigation ditches
209	2090501	07/04/1943	7,810	17.4	--	R	--	Smith, 1944	
209	2090501	09/03/1943	8,348	18.6	--	R	--	Smith, 1944	
209	2090501	06/17/1963	7,630	17.0	--	R	--	USGS, 1963	
209	2090501	02/07/1965	7,810	17.4	--	R	--	USGS, 1965	
209	2090501	10/12/1965	7,720	17.2	--	R	--	USGS, 1966	
209	2090501	07/30/1982	7,361	16.4	--	R	--	USGS, 1982	
209	2090501	01/21/1985	7,271	16.2	--	R	--	USGS, 1985	
209	2090501	01/27/1986	8,887	19.8	--	R	--	USGS, 1986	
209	2090501	04/16/1987	7,944	17.7	--	R	--	USGS, 1987	
209	2090501	02/12/1988	7,002	15.6	--	R	--	USGS, 1988	
209	2090501	02/27/1989	7,989	17.8	--	R	--	USGS, 1989	
209	2090501	03/14/1990	6,961	15.5	--	R	--	USGS, 1990	
209	2090501	11/05/1990	7,998	17.8	--	R	--	USGS, 1991	
209	2090501	03/19/1991	10,000	22.3	--	R	--	USGS, 1991	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
209	2090501	11/04/1991	7,495	16.7	--	R	--	USGS, 1992	
209	2090501	03/25/1992	7,630	17.0	--	R	--	USGS, 1992	
209	2090501	10/14/1992	7,899	17.6	--	R	--	USGS, 1993	
209	2090501	04/20/1993	7,944	17.7	--	R	--	USGS, 1993	
209	2090501	10/19/1993	7,406	16.5	--	R	--	USGS, 1994	
209	2090501	03/29/1994	8,303	18.5	--	R	--	USGS, 1994	
209	2090501	10/18/1994	7,181	16.0	--	R	--	USGS, 1995	
209	2090501	04/16/1997	7,270	16.2	--	R	--	USGS, 1997	
209	2090501	09/23/1997	7,990	17.8	--	R	--	USGS, 1997	
209	2090501	04/28/1998	9,201	20.5	--	R	--	USGS, 1998	
209	2090501	09/22/1998	9,960	22.2	--	R	--	USGS, 1998	
209	2090501	02/22/1999	7,181	16.0	--	R	--	USGS-NWIS, 2004	
209	2090501	04/14/1999	6,149	13.7	--	R	--	USGS-NWIS, 2004	
209	2090501	05/18/1999	6,643	14.8	--	R	--	USGS-NWIS, 2004	
209	2090501	06/29/1999	4,982	11.1	--	R	--	USGS-NWIS, 2004	
209	2090501	07/12/1999	5,117	11.4	--	R	--	USGS-NWIS, 2004	
209	2090501	08/26/1999	7,585	16.9	--	R	--	USGS-NWIS, 2004	
209	2090501	10/14/1999	6,688	14.9	--	R	--	USGS-NWIS, 2004	
209	2090501	11/16/1999	5,386	12.0	--	R	--	USGS-NWIS, 2004	
209	2090501	01/20/2000	4,937	11.0	--	R	--	USGS-NWIS, 2004	
209	2090501	02/18/2000	6,777	15.1	--	R	--	USGS-NWIS, 2004	
209	2090501	03/30/2000	4,475	9.97	--	R	--	USGS-NWIS, 2004	
209	2090501	05/17/2000	6,328	14.1	--	R	--	USGS-NWIS, 2004	
209	2090501	07/11/2000	7,496	16.7	--	R	--	USGS-NWIS, 2004	
209	2090501	08/08/2000	6,777	15.1	--	R	--	USGS-NWIS, 2004	
209	2090501	09/14/2000	7,585	16.9	--	R	--	USGS-NWIS, 2004	
209	2090501	10/05/2000	7,720	17.2	--	R	--	USGS-NWIS, 2004	
209	2090501	01/02/2001	7,720	17.2	--	R	--	USGS-NWIS, 2004	
209	2090501	02/16/2001	7,496	16.7	--	R	--	USGS-NWIS, 2004	
209	2090501	04/19/2001	7,989	17.8	--	R	--	USGS-NWIS, 2004	
209	2090501	06/20/2001	7,092	15.8	--	R	--	USGS-NWIS, 2004	
209	2090501	08/02/2001	5,162	11.5	--	R	--	USGS-NWIS, 2004	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
209	2090501	09/11/2001	7,271	16.2	--	R	--	USGS-NWIS, 2004	
209	2090501	10/02/2001	6,912	15.4	--	R	--	USGS-NWIS, 2004	
209	2090501	12/04/2001	5,925	13.2	--	R	--	USGS-NWIS, 2004	
209	2090501	01/24/2002	4,758	10.6	--	R	--	USGS-NWIS, 2004	
209	2090501	04/18/2002	6,463	14.4	--	R	--	USGS-NWIS, 2004	
209	2090501	06/04/2002	5,880	13.1	--	R	--	USGS-NWIS, 2004	
209	2090501	07/16/2002	6,643	14.8	--	R	--	USGS-NWIS, 2004	
209	2090501	09/17/2002	6,553	14.6	--	R	--	USGS-NWIS, 2004	
209	2090501	10/17/2002	6,777	15.1	--	R	--	USGS-NWIS, 2004	
209	2090501	12/03/2002	6,688	14.9	--	R	--	USGS-NWIS, 2004	
209	2090501	02/04/2003	7,092	15.8	--	R	--	USGS-NWIS, 2004	
209	2090501	03/17/2003	7,271	16.2	--	R	--	USGS-NWIS, 2004	
209	2090501	04/22/2003	7,181	16.0	--	R	--	USGS-NWIS, 2004	
209	2090501	06/26/2003	6,912	15.4	--	R	--	USGS-NWIS, 2004	
209	2090501	09/09/2003	6,553	14.6	--	R	--	USGS-NWIS, 2004	
209	2090501	10/22/2003	6,777	15.1	--	R	--	USGS-NWIS, 2004	
209	2090501	12/03/2003	6,553	14.6	--	R	--	USGS-NWIS, 2004	
209	2090501	02/10/2004	7,047	15.7	--	R	--	USGS-NWIS, 2004	
209	2090501	05/06/2004	6,553	14.6	F	R	--	USGS-NWIS, 2007	
209	2090501	07/29/2004	6,373	14.2	F	R	--	USGS-NWIS, 2007	
209	2090501	09/21/2004	6,957	15.5	--	R	--	USGS-NWIS, 2007	
209	2090501	10/07/2004	6,867	15.3	F	R	--	USGS-NWIS, 2007	
209	2090501	03/17/2005	6,194	13.8	G	R	--	USGS-NWIS, 2007	
209	2090501	04/13/2005	5,655	12.6	G	R	--	USGS-NWIS, 2007	
209	2090501	06/23/2005	5,162	11.5	G	R	--	USGS-NWIS, 2007	
209	2090501	07/18/2005	3,923	8.74	G	R	--	USGS-NWIS, 2007	
209	2090501	09/20/2005	6,104	13.6	G	R	--	USGS-NWIS, 2007	
209	2090501	10/13/2005	6,418	14.3	G	R	--	USGS-NWIS, 2007	
209	2090501	10/24/2005	6,732	15.0	G	R	--	USGS-NWIS, 2007	
209	2090501	11/01/2005	4,802	10.7	G	R	--	USGS-NWIS, 2007	
209	2090501	12/06/2005	5,835	13.0	G	R	--	USGS-NWIS, 2007	

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
209	2090501	01/04/2006	5,700	12.7	G	R	--	USGS-NWIS, 2007	
209	2090501	02/22/2006	4,892	10.9	G	R	--	USGS-NWIS, 2007	
209	2090501	03/28/2006	4,892	10.9	F	R	--	USGS-NWIS, 2007	
209	2090501	06/06/2006	5,431	12.1	G	R	--	USGS-NWIS, 2007	
209	2090501	06/26/2006	5,565	12.4	P	R	--	USGS-NWIS, 2007	
209	2090501	08/30/2006	6,598	14.7	G	R	--	USGS-NWIS, 2007	
209	2090501	10/10/2006	6,418	14.3	G	R	--	USGS-NWIS, 2007	
209	2090501	11/09/2006	4,439	9.89	G	R	--	USGS-NWIS, 2007	
209	2090501	01/17/2007	9,740	21.7	F	R	--	USGS-NWIS, 2007	
209	2090701	06/01/1963	224	0.500	--	R	--	Eakin, 1963	Reported as 0.5-1.0 cfs estimate
215	2150201	09/28/1912	898	2.00	--	R	26.7	Hardman and Miller, 1934	
215	2150201	01/31/1966	880	1.96	--	R	26.7	Hess and Mifflin, 1978	
215	2150201	02/05/1968	800	1.78	--	R	--	USGS-NWIS, 2004	
215	2150201	05/18/1977	417	0.930	--	R	--	USGS, 1977	
215	2150201	08/03/1982	696	1.55	--	R	--	USGS, 1982	
215	2150201	01/23/1985	700	1.56	--	R	--	USGS, 1985	
215	2150201	07/24/1985	705	1.57	--	R	--	USGS-NWIS, 2004	
215	2150201	08/21/1985	768	1.71	--	R	--	USGS-NWIS, 2004	
215	2150201	10/15/1985	750	1.67	--	R	--	USGS-NWIS, 2004	
215	2150201	12/12/1985	642	1.43	--	R	--	USGS-NWIS, 2004	
215	2150201	01/28/1986	570	1.27	--	R	--	USGS-NWIS, 2004	
215	2150201	03/18/1986	346	0.770	--	R	--	USGS-NWIS, 2004	Measurement is likely Blue Point Spring.
215	2150201	04/22/1986	839	1.87	--	R	--	USGS-NWIS, 2004	
215	2150201	05/15/1986	624	1.39	--	R	--	USGS-NWIS, 2004	
215	2150201	06/12/1986	696	1.55	--	R	--	USGS-NWIS, 2004	
215	2150201	07/18/1986	732	1.63	--	R	--	USGS-NWIS, 2004	
215	2150201	08/25/1986	696	1.55	--	R	--	USGS-NWIS, 2004	
215	2150201	11/29/1986	646	1.44	--	R	--	USGS-NWIS, 2004	
215	2150201	12/22/1986	579	1.29	--	R	--	USGS-NWIS, 2004	
215	2150201	02/23/1987	718	1.60	--	R	--	USGS-NWIS, 2004	
215	2150201	03/25/1987	606	1.35	--	R	--	USGS-NWIS, 2004	
215	2150201	05/04/1987	714	1.59	--	R	--	USGS-NWIS, 2004	

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
215	2150201	05/29/1987	705	1.57	--	R	--	USGS-NWIS, 2004	
215	2150201	07/23/1987	983	2.19	--	R	--	USGS-NWIS, 2004	
215	2150201	08/28/1987	736	1.64	--	R	--	USGS-NWIS, 2004	
215	2150201	09/30/1987	871	1.94	--	R	--	USGS-NWIS, 2004	
215	2150201	10/28/1987	750	1.67	--	R	--	USGS-NWIS, 2004	
215	2150201	11/20/1987	772	1.72	--	R	--	USGS-NWIS, 2004	
215	2150201	12/22/1987	844	1.88	--	R	--	USGS-NWIS, 2004	
215	2150201	01/29/1988	853	1.90	--	R	--	USGS-NWIS, 2004	
215	2150201	04/18/1988	727	1.62	--	R	--	USGS-NWIS, 2004	
215	2150201	06/02/1988	673	1.50	--	R	--	USGS-NWIS, 2004	
215	2150201	06/28/1988	835	1.86	--	R	--	USGS-NWIS, 2004	
215	2150201	08/09/1988	776	1.73	--	R	--	USGS-NWIS, 2004	
215	2150201	09/20/1988	808	1.80	--	R	--	USGS-NWIS, 2004	
215	2150201	11/04/1988	754	1.68	--	R	--	USGS-NWIS, 2004	
215	2150201	01/25/1989	768	1.71	--	R	--	USGS-NWIS, 2004	
215	2150201	03/16/1989	651	1.45	--	R	--	USGS-NWIS, 2004	
215	2150201	05/09/1989	700	1.56	--	R	--	USGS-NWIS, 2004	
215	2150201	07/05/1989	750	1.67	--	R	--	USGS-NWIS, 2004	
215	2150201	08/07/1989	646	1.44	--	R	--	USGS-NWIS, 2004	
215	2150201	09/18/1989	637	1.42	--	R	--	USGS-NWIS, 2004	
215	2150201	10/04/1989	790	1.76	--	R	--	USGS-NWIS, 2004	
215	2150201	02/28/1990	736	1.64	--	R	--	USGS-NWIS, 2004	
215	2150201	04/23/1990	700	1.56	--	R	--	USGS-NWIS, 2004	
215	2150201	06/07/1990	785	1.75	--	R	--	USGS-NWIS, 2004	
215	2150201	08/16/1990	7,181	16.0	--	R	--	USGS-NWIS, 2004	
215	2150201	08/28/1990	673	1.50	--	R	--	USGS-NWIS, 2004	
215	2150201	10/02/1990	732	1.63	--	R	--	USGS-NWIS, 2004	
215	2150201	11/15/1990	902	2.01	--	R	--	USGS, 1991	
215	2150201	12/20/1990	768	1.71	--	R	--	USGS-NWIS, 2004	
215	2150201	01/30/1991	763	1.70	--	R	--	USGS-NWIS, 2004	
215	2150201	03/14/1991	790	1.76	--	R	--	USGS-NWIS, 2004	

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
215	2150201	04/23/1991	714	1.59	--	R	--	USGS-NWIS, 2004	
215	2150201	06/12/1991	646	1.44	--	R	--	USGS-NWIS, 2004	
215	2150201	06/25/1991	687	1.53	--	R	--	USGS-NWIS, 2004	
215	2150201	08/14/1991	592	1.32	--	R	--	USGS-NWIS, 2004	
215	2150201	09/03/1991	642	1.43	--	R	--	USGS-NWIS, 2004	
215	2150201	10/09/1991	763	1.70	--	R	--	USGS-NWIS, 2004	
215	2150201	11/20/1991	727	1.62	--	R	--	USGS-NWIS, 2004	
215	2150201	01/09/1992	619	1.38	--	R	--	USGS-NWIS, 2004	
215	2150201	02/24/1992	521	1.16	--	R	--	USGS-NWIS, 2004	
215	2150201	03/23/1992	512	1.14	--	R	--	USGS, 1992	
215	2150201	04/23/1992	839	1.87	--	R	--	USGS-NWIS, 2004	
215	2150201	05/04/1992	597	1.33	--	R	--	USGS-NWIS, 2004	
215	2150201	06/08/1992	718	1.60	--	R	--	USGS-NWIS, 2004	
215	2150201	07/20/1992	583	1.30	--	R	--	USGS-NWIS, 2004	
215	2150201	08/19/1992	624	1.39	--	R	--	USGS-NWIS, 2004	
215	2150201	10/05/1992	745	1.66	--	R	--	USGS-NWIS, 2004	
215	2150201	10/15/1992	839	1.87	--	R	--	USGS-NWIS, 2004	
215	2150201	11/19/1992	736	1.64	--	R	--	USGS-NWIS, 2004	
215	2150201	01/07/1993	956	2.13	--	R	--	USGS-NWIS, 2004	
215	2150201	02/09/1993	1,073	2.39	--	R	--	USGS-NWIS, 2004	
215	2150201	03/24/1993	803	1.79	--	R	--	USGS-NWIS, 2004	
215	2150201	04/14/1993	700	1.56	--	R	--	USGS-NWIS, 2004	
215	2150201	05/10/1993	615	1.37	--	R	--	USGS-NWIS, 2004	
215	2150201	06/14/1993	790	1.76	--	R	--	USGS-NWIS, 2004	
215	2150201	07/26/1993	781	1.74	--	R	--	USGS-NWIS, 2004	
215	2150201	09/03/1993	745	1.66	--	R	--	USGS-NWIS, 2004	
215	2150201	10/27/1993	835	1.86	--	R	--	USGS-NWIS, 2004	
215	2150201	10/27/1993	364	0.810	--	R	--	USGS-NWIS, 2004	
215	2150201	11/19/1993	714	1.59	--	R	--	USGS-NWIS, 2004	
215	2150201	01/06/1994	745	1.66	--	R	--	USGS-NWIS, 2004	
215	2150201	02/15/1994	776	1.73	--	R	--	USGS-NWIS, 2004	
215	2150201	04/06/1994	754	1.68	--	R	--	USGS-NWIS, 2004	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
215	2150201	05/16/1994	673	1.50	--	R	--	USGS-NWIS, 2004	
215	2150201	06/20/1994	646	1.44	--	R	--	USGS-NWIS, 2004	
215	2150201	07/29/1994	772	1.72	--	R	--	USGS-NWIS, 2004	
215	2150201	09/12/1994	794	1.77	--	R	--	USGS-NWIS, 2004	
215	2150201	10/18/1994	741	1.65	--	R	--	USGS-NWIS, 2004	
215	2150201	01/03/1995	687	1.53	--	R	--	USGS-NWIS, 2004	
215	2150201	04/03/1995	637	1.42	--	R	--	USGS-NWIS, 2004	
215	2150201	05/25/1995	844	1.88	--	R	--	USGS-NWIS, 2004	
215	2150201	06/21/1995	615	1.37	--	R	--	USGS-NWIS, 2004	
215	2150201	07/27/1995	768	1.71	--	R	--	USGS-NWIS, 2004	
215	2150201	08/02/1995	790	1.76	--	R	--	USGS-NWIS, 2004	
215	2150201	10/02/1995	700	1.56	--	R	--	USGS-NWIS, 2004	
215	2150201	11/20/1995	794	1.77	--	R	--	USGS-NWIS, 2004	
215	2150201	12/12/1995	700	1.56	--	R	--	USGS-NWIS, 2004	
215	2150201	01/17/1996	727	1.62	--	R	--	USGS-NWIS, 2004	
215	2150201	03/05/1996	512	1.14	--	R	--	USGS-NWIS, 2004	
215	2150201	04/15/1996	682	1.52	--	R	--	USGS-NWIS, 2004	
215	2150201	05/28/1996	678	1.51	--	R	--	USGS-NWIS, 2004	
215	2150201	07/08/1996	718	1.60	--	R	--	USGS-NWIS, 2004	
215	2150201	08/14/1996	660	1.47	--	R	--	USGS-NWIS, 2004	
215	2150201	10/03/1996	718	1.60	--	R	--	USGS-NWIS, 2004	
215	2150201	12/02/1996	642	1.43	--	R	--	USGS-NWIS, 2004	
215	2150201	12/26/1996	583	1.30	--	R	--	USGS-NWIS, 2004	
215	2150201	02/14/1997	763	1.70	--	R	--	USGS-NWIS, 2004	
215	2150201	04/04/1997	880	1.96	--	R	--	USGS-NWIS, 2004	
215	2150201	05/30/1997	691	1.54	--	R	--	USGS-NWIS, 2004	
215	2150201	07/08/1997	750	1.67	--	R	--	USGS-NWIS, 2004	
215	2150201	08/28/1997	776	1.73	--	R	--	USGS-NWIS, 2004	
215	2150201	10/02/1997	768	1.71	--	R	--	USGS-NWIS, 2004	
215	2150201	11/20/1997	768	1.71	--	R	--	USGS-NWIS, 2004	
215	2150201	12/30/1997	848	1.89	--	R	--	USGS-NWIS, 2004	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
215	2150201	03/02/1998	956	2.13	--	R	--	USGS-NWIS, 2004	
215	2150201	03/02/1998	871	1.94	--	R	--	USGS-NWIS, 2004	
215	2150201	03/31/1998	736	1.64	--	R	--	USGS-NWIS, 2004	
215	2150201	05/12/1998	750	1.67	--	R	--	USGS-NWIS, 2004	
215	2150201	05/15/1998	768	1.71	--	R	--	USGS-NWIS, 2004	
215	2150201	06/25/1998	808	1.80	--	R	--	USGS-NWIS, 2004	
215	2150201	07/28/1998	799	1.78	--	R	--	USGS-NWIS, 2004	
215	2150201	10/07/1998	821	1.83	--	R	--	USGS-NWIS, 2004	
215	2150201	11/19/1998	741	1.65	--	R	--	USGS-NWIS, 2004	
215	2150201	02/18/1999	651	1.45	--	R	--	USGS-NWIS, 2004	
215	2150201	04/28/1999	781	1.74	--	R	--	USGS-NWIS, 2004	
215	2150201	06/01/1999	839	1.87	--	R	--	USGS-NWIS, 2004	
215	2150201	07/21/1999	745	1.66	--	R	--	USGS-NWIS, 2004	
215	2150201	09/17/1999	803	1.79	--	R	--	USGS-NWIS, 2004	
215	2150201	10/06/1999	857	1.91	--	R	--	USGS-NWIS, 2004	
215	2150201	10/28/1999	821	1.83	--	R	--	USGS-NWIS, 2004	
215	2150201	10/28/1999	790	1.76	--	R	--	USGS-NWIS, 2004	
215	2150201	12/03/1999	741	1.65	--	R	--	USGS-NWIS, 2004	
215	2150201	12/03/1999	723	1.61	--	R	--	USGS-NWIS, 2004	
215	2150201	01/24/2000	745	1.66	--	R	--	USGS-NWIS, 2004	
215	2150201	03/07/2000	763	1.70	--	R	--	USGS-NWIS, 2004	
215	2150201	04/05/2000	794	1.77	--	R	--	USGS-NWIS, 2004	
215	2150201	05/11/2000	741	1.65	--	R	--	USGS-NWIS, 2004	
215	2150201	06/24/2000	759	1.69	--	R	--	USGS-NWIS, 2004	
215	2150201	08/01/2000	808	1.80	--	R	--	USGS-NWIS, 2004	
215	2150201	09/07/2000	776	1.73	--	R	--	USGS-NWIS, 2004	
215	2150201	10/02/2000	754	1.68	--	R	--	USGS-NWIS, 2004	
215	2150201	11/13/2000	781	1.74	--	R	--	USGS-NWIS, 2004	
215	2150201	01/04/2001	768	1.71	--	R	--	USGS-NWIS, 2004	
215	2150201	02/14/2001	808	1.80	--	R	--	USGS-NWIS, 2004	
215	2150201	03/30/2001	871	1.94	--	R	--	USGS-NWIS, 2004	
215	2150201	06/18/2001	844	1.88	--	R	--	USGS-NWIS, 2004	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
215	2150201	08/03/2001	763	1.70	--	R	--	USGS-NWIS, 2004	
215	2150201	09/07/2001	759	1.69	--	R	--	USGS-NWIS, 2004	
215	2150201	10/02/2001	916	2.04	--	R	--	USGS-NWIS, 2004	
215	2150201	11/15/2001	521	1.16	--	R	--	USGS-NWIS, 2004	
215	2150201	12/07/2001	664	1.48	--	R	--	USGS-NWIS, 2004	
215	2150201	01/25/2002	664	1.48	--	R	--	USGS-NWIS, 2004	
215	2150201	03/06/2002	705	1.57	--	R	--	USGS-NWIS, 2004	
215	2150201	04/11/2002	570	1.27	--	R	--	USGS-NWIS, 2004	
215	2150201	05/31/2002	687	1.53	--	R	--	USGS-NWIS, 2004	
215	2150201	07/16/2002	772	1.72	--	R	--	USGS-NWIS, 2004	
215	2150201	09/05/2002	907	2.02	--	R	--	USGS-NWIS, 2004	
215	2150201	10/18/2002	925	2.06	--	R	--	USGS-NWIS, 2004	
215	2150201	11/20/2002	624	1.39	--	R	--	USGS-NWIS, 2004	
215	2150201	12/19/2002	934	2.08	--	R	--	USGS-NWIS, 2004	
215	2150201	01/29/2003	763	1.70	--	R	--	USGS-NWIS, 2004	
215	2150201	03/13/2003	606	1.35	--	R	--	USGS-NWIS, 2004	
215	2150201	04/23/2003	969	2.16	--	R	--	USGS-NWIS, 2004	
215	2150201	06/04/2003	624	1.39	--	R	--	USGS-NWIS, 2004	
215	2150201	07/09/2003	588	1.31	--	R	--	USGS-NWIS, 2004	
215	2150201	08/07/2003	754	1.68	--	R	--	USGS-NWIS, 2004	
215	2150201	10/15/2003	696	1.55	--	R	--	USGS-NWIS, 2004	
215	2150201	12/03/2003	561	1.25	--	R	--	USGS-NWIS, 2004	
215	2150201	02/08/2004	727	1.62	--	R	--	USGS-NWIS, 2004	
215	2150201	03/03/2004	727	1.62	--	R	--	USGS-NWIS, 2004	
215	2150201	05/07/2004	754	1.68	--	R	--	USGS-NWIS, 2004	
215	2150201	05/19/2004	776	1.73	--	R	--	USGS-NWIS, 2004	
215	2150201	06/29/2004	727	1.62	--	R	--	USGS-NWIS, 2004	
215	2150201	08/11/2004	754	1.68	--	R	--	USGS-NWIS, 2004	
215	2150201	10/06/2004	664	1.48	--	R	--	USGS-NWIS, 2004	
215	2150301	11/27/1945	400	0.890	--	R	26.7	Hess and Mifflin, 1978	
215	2150301	06/15/1967	150	0.330	--	R	--	USGS-NWIS, 2004	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
215	2150301	05/18/1977	247	0.550	--	R	--	USGS, 1977	
215	2150301	12/15/1998	98.7	0.220	--	R	--	USGS-NWIS, 2004	
215	2150301	02/18/1999	162	0.360	--	R	--	USGS-NWIS, 2004	
215	2150301	04/28/1999	206	0.460	--	R	--	USGS-NWIS, 2004	
215	2150301	06/01/1999	215	0.480	--	R	--	USGS-NWIS, 2004	
215	2150301	07/22/1999	215	0.480	--	R	--	USGS-NWIS, 2004	
215	2150301	09/17/1999	184	0.410	--	R	--	USGS-NWIS, 2004	
215	2150301	09/29/1999	292	0.650	--	R	--	USGS-NWIS, 2004	
215	2150301	09/30/1999	256	0.570	--	R	--	USGS-NWIS, 2004	
215	2150301	10/13/1999	224	0.500	--	R	--	USGS-NWIS, 2004	
215	2150301	10/28/1999	283	0.630	--	R	--	USGS-NWIS, 2004	
215	2150301	10/28/1999	260	0.580	--	R	--	USGS-NWIS, 2004	
215	2150301	12/03/1999	265	0.590	--	R	--	USGS-NWIS, 2004	
215	2150301	01/24/2000	301	0.670	--	R	--	USGS-NWIS, 2004	
215	2150301	03/07/2000	202	0.450	--	R	--	USGS-NWIS, 2004	
215	2150301	04/05/2000	283	0.630	--	R	--	USGS-NWIS, 2004	
215	2150301	05/11/2000	215	0.480	--	R	--	USGS-NWIS, 2004	
215	2150301	06/27/2000	283	0.630	--	R	--	USGS-NWIS, 2004	
215	2150301	08/01/2000	269	0.600	--	R	--	USGS-NWIS, 2004	
215	2150301	09/07/2000	233	0.520	--	R	--	USGS-NWIS, 2004	
215	2150301	10/02/2000	220	0.490	--	R	--	USGS-NWIS, 2004	
215	2150301	11/13/2000	256	0.570	--	R	--	USGS-NWIS, 2004	
215	2150301	01/04/2001	242	0.540	--	R	--	USGS-NWIS, 2004	
215	2150301	02/14/2001	242	0.540	--	R	--	USGS-NWIS, 2004	
215	2150301	03/30/2001	251	0.560	--	R	--	USGS-NWIS, 2004	
215	2150301	06/18/2001	269	0.600	--	R	--	USGS-NWIS, 2004	
215	2150301	08/03/2001	283	0.630	--	R	--	USGS-NWIS, 2004	
215	2150301	09/07/2001	269	0.600	--	R	--	USGS-NWIS, 2004	
215	2150301	10/02/2001	292	0.650	--	R	--	USGS-NWIS, 2004	
215	2150301	11/15/2001	229	0.510	--	R	--	USGS-NWIS, 2004	
215	2150301	12/07/2001	224	0.500	--	R	--	USGS-NWIS, 2004	
215	2150301	01/25/2002	211	0.470	--	R	--	USGS-NWIS, 2004	

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
215	2150301	03/06/2002	224	0.500	--	R	--	USGS-NWIS, 2004	
215	2150301	04/24/2002	269	0.600	--	R	--	USGS-NWIS, 2004	
215	2150301	05/31/2002	211	0.470	--	R	--	USGS-NWIS, 2004	
215	2150301	07/16/2002	220	0.490	--	R	--	USGS-NWIS, 2004	
215	2150301	09/05/2002	220	0.490	--	R	--	USGS-NWIS, 2004	
215	2150301	10/18/2002	224	0.500	--	R	--	USGS-NWIS, 2004	
215	2150301	11/20/2002	139	0.310	--	R	--	USGS-NWIS, 2004	
215	2150301	12/19/2002	224	0.500	--	R	--	USGS-NWIS, 2004	
215	2150301	01/29/2003	126	0.280	--	R	--	USGS-NWIS, 2004	
215	2150301	03/13/2003	184	0.410	--	R	--	USGS-NWIS, 2004	
215	2150301	04/23/2003	175	0.390	--	R	--	USGS-NWIS, 2004	
215	2150301	06/04/2003	211	0.470	--	R	--	USGS-NWIS, 2004	
215	2150301	07/09/2003	233	0.520	--	R	--	USGS-NWIS, 2004	
215	2150301	08/07/2003	175	0.390	--	R	--	USGS-NWIS, 2004	
215	2150301	10/15/2003	175	0.390	--	R	--	USGS-NWIS, 2004	
215	2150301	12/03/2003	283	0.630	--	R	--	USGS-NWIS, 2004	
215	2150301	03/03/2004	206	0.460	--	R	--	USGS-NWIS, 2004	
215	2150301	05/07/2004	224	0.500	--	R	--	USGS-NWIS, 2004	
215	2150301	06/29/2004	126	0.280	--	R	--	USGS-NWIS, 2004	
215	2150301	06/29/2004	121	0.270	--	R	--	USGS-NWIS, 2004	
215	2150301	06/29/2004	98.7	0.220	--	R	--	USGS-NWIS, 2004	
215	2150301	08/11/2004	193	0.430	--	R	--	USGS-NWIS, 2004	
215	2150301	10/13/2004	233	0.520	--	R	--	USGS-NWIS, 2004	
219	2190101	07/11/2002	126	0.280	--	R	--	USGS-NWIS, 2004	
219	2190101	09/13/2002	98.7	0.220	--	R	--	USGS-NWIS, 2004	
219	2190101	10/10/2002	58.4	0.130	--	R	--	USGS-NWIS, 2004	
219	2190101	12/09/2002	44.9	0.100	--	R	--	USGS-NWIS, 2004	
219	2190101	02/06/2003	40.4	0.090	--	R	--	USGS-NWIS, 2004	
219	2190101	03/11/2003	103	0.230	--	R	--	USGS-NWIS, 2004	
219	2190101	04/23/2003	98.7	0.220	--	R	--	USGS-NWIS, 2004	
219	2190101	06/18/2003	44.9	0.100	--	R	--	USGS-NWIS, 2004	

Table B.1-1
Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2190101	07/16/2003	89.8	0.200	--	R	--	USGS-NWIS, 2004	
219	2190101	08/25/2003	89.8	0.200	--	R	--	USGS-NWIS, 2004	
219	2190101	08/25/2003	76.3	0.170	--	R	--	USGS-NWIS, 2004	
219	2190101	10/07/2003	89.8	0.200	--	R	--	USGS-NWIS, 2004	
219	2190101	12/15/2003	85.3	0.190	--	R	--	USGS-NWIS, 2004	
219	2190101	03/01/2004	89.8	0.200	--	R	--	USGS-NWIS, 2004	
219	2190101	04/06/2004	94.3	0.210	--	R	--	USGS-NWIS, 2004	
219	2190101	05/18/2004	94.3	0.210	--	R	--	USGS-NWIS, 2004	
219	2190101	06/28/2004	76.3	0.170	--	R	--	USGS-NWIS, 2004	
219	2190101	08/12/2004	76.3	0.170	--	R	--	USGS-NWIS, 2004	
219	2190101	10/13/2004	71.8	0.160	--	R	--	USGS-NWIS, 2004	
219	2190101	12/08/2004	80.8	0.180	--	R	--	USGS-NWIS, 2004	
219	2190101	02/19/2005	80.3	0.179	G	R	--	USGS-NWIS, 2006	
219	2190101	04/12/2005	93.4	0.208	G	R	--	USGS-NWIS, 2006	
219	2190101	06/08/2005	108	0.241	G	R	--	USGS-NWIS, 2006	
219	2190101	07/28/2005	113	0.252	G	R	--	USGS-NWIS, 2006	
219	2190101	09/07/2005	97.8	0.218	G	R	--	USGS-NWIS, 2006	
219	2190101	10/14/2005	96.1	0.214	G	R	--	USGS-NWIS, 2006	
219	2190101	12/09/2005	99.6	0.222	G	R	--	USGS-NWIS, 2006	
219	2190101	01/13/2006	101	0.225	G	R	--	USGS-NWIS, 2006	
219	2190101	03/30/2006	113	0.252	F	R	--	USGS-NWIS, 2006	
219	2190101	05/17/2006	119	0.265	G	R	--	USGS-NWIS, 2006	
219	2190101	07/12/2006	110	0.244	G	R	--	USGS-NWIS, 2006	
219	2190101	08/25/2006	107	0.239	F	R	--	USGS-NWIS, 2006	
219	2190101	10/02/2006	93.4	0.208	F	R	--	USGS-NWIS, 2006	
219	2190101	12/12/2006	79.0	0.176	P	R	--	USGS, 2007	
219	2190101	01/30/2007	95.2	0.212	F	R	--	USGS, 2007	
219	2190101	03/12/2007	107	0.239	F	R	--	USGS, 2007	
219	2190101	05/16/2007	107	0.238	F	R	--	USGS, 2007	
219	2190201	10/25/1994	103	0.230	--	R	--	USGS, 1995	
219	2190201	07/11/2002	89.8	0.200	--	R	--	USGS-NWIS, 2004	
219	2190201	09/11/2002	80.8	0.180	--	R	--	USGS-NWIS, 2004	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2190201	10/10/2002	80.8	0.180	--	R	--	USGS-NWIS, 2004	
219	2190201	11/06/2002	76.3	0.170	--	R	--	USGS-NWIS, 2004	
219	2190201	12/10/2002	80.8	0.180	--	R	--	USGS-NWIS, 2004	
219	2190201	02/06/2003	76.3	0.170	--	R	--	USGS-NWIS, 2004	
219	2190201	03/11/2003	76.3	0.170	--	R	--	USGS-NWIS, 2004	
219	2190201	04/03/2003	76.3	0.170	--	R	--	USGS-NWIS, 2004	
219	2190201	04/03/2003	71.8	0.160	--	R	--	USGS-NWIS, 2004	
219	2190201	04/03/2003	62.8	0.140	--	R	--	USGS-NWIS, 2004	
219	2190201	04/03/2003	62.8	0.140	--	R	--	USGS-NWIS, 2004	
219	2190201	04/03/2003	62.8	0.140	--	R	--	USGS-NWIS, 2004	
219	2190201	04/03/2003	58.4	0.130	--	R	--	USGS-NWIS, 2004	
219	2190201	05/28/2003	71.8	0.160	--	R	--	USGS-NWIS, 2004	
219	2190201	07/16/2003	67.3	0.150	--	R	--	USGS-NWIS, 2004	
219	2190201	08/28/2003	53.9	0.120	--	R	--	USGS-NWIS, 2004	
219	2190201	10/07/2003	44.9	0.100	--	R	--	USGS-NWIS, 2004	
219	2190201	12/15/2003	44.9	0.100	--	R	--	USGS-NWIS, 2004	
219	2190201	03/01/2004	49.4	0.110	--	R	--	USGS-NWIS, 2004	
219	2190201	04/06/2004	53.9	0.120	--	R	--	USGS-NWIS, 2004	
219	2190201	08/12/2004	89.8	0.200	--	R	--	USGS-NWIS, 2004	
219	2190201	10/13/2004	85.3	0.190	--	R	--	USGS-NWIS, 2004	
219	2190201	12/08/2004	94.3	0.210	--	R	--	USGS-NWIS, 2004	
219	2190201	02/19/2005	112	0.250	F	R	--	USGS-NWIS, 2006	
219	2190201	04/12/2005	108	0.240	G	R	--	USGS-NWIS, 2006	
219	2190201	06/08/2005	112	0.250	G	R	--	USGS-NWIS, 2006	
219	2190201	07/28/2005	121	0.270	G	R	--	USGS-NWIS, 2006	
219	2190201	09/07/2005	130	0.290	F	R	--	USGS-NWIS, 2006	
219	2190201	10/14/2005	112	0.250	G	R	--	USGS-NWIS, 2006	
219	2190201	12/06/2005	126	0.280	G	R	--	USGS-NWIS, 2006	
219	2190201	01/13/2006	121	0.270	G	R	--	USGS-NWIS, 2006	
219	2190201	03/30/2006	128	0.286	F	R	--	USGS-NWIS, 2006	
219	2190201	07/12/2006	121	0.270	G	R	--	USGS-NWIS, 2006	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2190201	08/25/2006	112	0.250	F	R	--	USGS-NWIS, 2006	
219	2190201	10/20/2006	113	0.252	F	R	--	USGS-NWIS, 2006	
219	2190201	12/12/2006	98.3	0.219	F	R	--	USGS-NWIS, 2007	
219	2190201	01/30/2007	111	0.248	F	R	--	USGS-NWIS, 2007	
219	2190201	03/12/2007	134	0.299	F	R	--	USGS-NWIS, 2007	
219	2190201	05/16/2007	115	0.257	F	R	--	USGS-NWIS, 2007	
219	2190301	07/15/1992	512	1.14	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	08/15/1992	390	0.870	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	09/15/1992	467	1.04	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	11/15/1992	592	1.32	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	12/15/1992	471	1.05	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	01/15/1993	471	1.05	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	02/15/1993	480	1.07	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	03/15/1993	453	1.01	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	04/15/1993	561	1.25	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	05/15/1993	516	1.15	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	06/15/1993	682	1.52	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	07/15/1993	359	0.800	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	08/15/1993	426	0.950	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	09/15/1993	453	1.01	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2190301	10/15/1993	440	0.980	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	11/15/1993	440	0.980	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	04/15/1994	781	1.74	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	05/15/1994	548	1.22	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	06/15/1994	530	1.18	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	07/15/1994	646	1.44	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	08/15/1994	646	1.44	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	09/15/1994	664	1.48	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	10/15/1994	310	0.690	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	11/15/1994	426	0.950	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	12/15/1994	503	1.12	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	01/15/1995	673	1.50	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	02/15/1995	435	0.970	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	03/15/1995	422	0.940	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	04/15/1995	449	1.00	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	05/15/1995	718	1.60	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	06/15/1995	462	1.03	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2190301	07/15/1995	449	1.00	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	08/15/1995	413	0.920	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	09/15/1995	467	1.04	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	10/15/1995	422	0.940	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	11/15/1995	426	0.950	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	12/15/1995	422	0.940	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	01/15/1996	395	0.880	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	02/15/1996	390	0.870	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	03/15/1996	417	0.930	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	04/15/1996	422	0.940	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	05/15/1996	413	0.920	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	06/15/1996	431	0.960	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	07/15/1996	440	0.980	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	08/15/1996	408	0.910	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	09/15/1996	462	1.03	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	10/15/1996	435	0.970	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	11/15/1996	440	0.980	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	12/15/1996	404	0.900	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2190301	01/15/1997	417	0.930	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	02/15/1997	408	0.910	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	03/15/1997	440	0.980	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	04/15/1997	417	0.930	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	05/15/1997	431	0.960	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	06/15/1997	399	0.890	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	07/15/1997	413	0.920	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	08/15/1997	431	0.960	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	09/15/1997	453	1.01	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	10/15/1997	449	1.00	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	11/15/1997	390	0.870	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	12/15/1997	408	0.910	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	01/15/1998	440	0.980	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	02/15/1998	413	0.920	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	03/15/1998	408	0.910	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	04/15/1998	422	0.940	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	05/15/1998	539	1.20	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2190301	06/15/1998	462	1.03	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	07/15/1998	431	0.960	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	08/15/1998	462	1.03	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	09/15/1998	435	0.970	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	10/15/1998	458	1.02	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	11/15/1998	480	1.07	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	12/15/1998	431	0.960	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	01/15/1999	476	1.06	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	02/15/1999	453	1.01	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	03/15/1999	440	0.980	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	04/15/1999	413	0.920	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	05/15/1999	449	1.00	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	06/15/1999	435	0.970	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	07/15/1999	426	0.950	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	08/15/1999	399	0.890	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	09/15/1999	413	0.920	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	10/15/1999	301	0.670	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	11/15/1999	453	1.01	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2190301	12/15/1999	390	0.870	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	01/15/2000	435	0.970	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	02/15/2000	404	0.900	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	03/15/2000	431	0.960	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	04/15/2000	390	0.870	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	05/15/2000	382	0.850	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	06/15/2000	386	0.860	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	07/15/2000	404	0.900	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	08/15/2000	408	0.910	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	09/15/2000	382	0.850	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	10/15/2000	382	0.850	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	11/15/2000	489	1.09	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	12/15/2000	377	0.840	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	01/15/2001	480	1.07	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	02/15/2001	422	0.940	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	03/15/2001	453	1.01	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	04/15/2001	417	0.930	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2190301	05/15/2001	431	0.960	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	06/15/2001	462	1.03	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	07/15/2001	404	0.900	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	08/15/2001	462	1.03	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	09/15/2001	395	0.880	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	10/15/2001	408	0.910	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	11/15/2001	440	0.980	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	12/15/2001	525	1.17	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	01/15/2002	390	0.870	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	02/15/2002	417	0.930	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	03/15/2002	431	0.960	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	04/15/2002	404	0.900	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	05/15/2002	404	0.900	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	06/15/2002	444	0.990	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	07/15/2002	399	0.890	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	08/15/2002	449	1.00	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	09/15/2002	364	0.810	--	R	--	Moapa Valley Water District	Average monthly discharge based on totalizing meter readings
219	2190301	10/01/2004	1,225	2.73	G	F	--	SNWA	

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Discharge Measurement of Selected Springs
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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2190401	01/13/2006	443	0.987	--	R	--	USGS, 2006	
219	2190401	09/11/2006	1,688	3.76	--	R	--	USGS, 2006	
219	2190501	08/01/1982	3,582	7.98	--	R	--	USGS, 1982	
219	2190501	01/22/1985	3,133	6.98	--	R	--	USGS, 1985	
219	2190501	01/28/1986	3,384	7.54	--	R	--	USGS, 1986	
219	2190501	07/16/2002	3,591	8.00	--	R	--	USGS-NWIS, 2004	
219	2190501	09/13/2002	3,636	8.10	--	R	--	USGS-NWIS, 2004	
219	2190501	10/01/2002	3,568	7.95	--	R	--	USGS-NWIS, 2004	
219	2190501	12/16/2002	3,272	7.29	--	R	--	USGS-NWIS, 2004	
219	2190501	02/06/2003	2,967	6.61	--	R	--	USGS-NWIS, 2004	
219	2190501	03/24/2003	2,962	6.60	--	R	--	USGS-NWIS, 2004	
219	2190501	06/11/2003	3,757	8.37	--	R	--	USGS-NWIS, 2004	
219	2190501	07/22/2003	3,142	7.00	--	R	--	USGS-NWIS, 2004	
219	2190501	09/09/2003	3,218	7.17	--	R	--	USGS-NWIS, 2004	
219	2190501	10/07/2003	3,218	7.17	--	R	--	USGS-NWIS, 2004	
219	2190501	12/15/2003	1,432	3.19	--	R	--	USGS-NWIS, 2004	
219	2190501	03/01/2004	2,554	5.69	--	R	--	USGS-NWIS, 2004	
219	2190501	05/03/2004	2,518	5.61	--	R	--	USGS-NWIS, 2004	
219	2190501	05/18/2004	3,420	7.62	--	R	--	USGS-NWIS, 2004	
219	2190501	06/30/2004	3,312	7.38	--	R	--	USGS-NWIS, 2004	
219	2190501	08/12/2004	3,514	7.83	--	R	--	USGS-NWIS, 2004	
219	2190501	10/13/2004	3,371	7.51	--	R	--	USGS-NWIS, 2004	
219	2190501	12/09/2004	3,420	7.62	--	R	--	USGS-NWIS, 2004	
219	2190501	02/18/2005	2,859	6.37	P	R	--	USGS-NWIS, 2006	
219	2190501	04/12/2005	3,528	7.86	F	R	--	USGS-NWIS, 2006	
219	2190501	06/08/2005	3,101	6.91	P	R	--	USGS-NWIS, 2006	
219	2190501	07/26/2005	2,886	6.43	P	R	--	USGS-NWIS, 2006	
219	2190501	09/07/2005	3,088	6.88	P	R	--	USGS-NWIS, 2006	
219	2190501	10/14/2005	1,876	4.18	G	R	--	USGS-NWIS, 2006	
219	2190501	12/06/2005	3,348	7.46	F	R	--	USGS-NWIS, 2006	
219	2190501	03/10/2006	3,299	7.35	P	R	--	USGS-NWIS, 2006	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2190501	05/17/2006	3,353	7.47	P	--	--	USGS-NWIS, 2006	
219	2190501	07/12/2006	3,187	7.10	P	R	--	USGS-NWIS, 2006	
219	2190501	08/25/2006	3,101	6.91	F	R	--	USGS-NWIS, 2006	
219	2190501	10/18/2006	2,733	6.09	F	R	--	USGS-NWIS, 2006	
219	2190501	01/10/2007	3,097	6.90	F	R	--	USGS, 2007	
219	2190501	03/12/2007	3,766	8.39	P	R	--	USGS-NWIS, 2007	
219	2190601	07/11/2002	4,004	8.92	--	R	--	USGS-NWIS, 2004	
219	2190601	09/13/2002	3,869	8.62	--	R	--	USGS-NWIS, 2004	
219	2190601	10/01/2002	3,577	7.97	--	R	--	USGS-NWIS, 2004	
219	2190601	12/09/2002	3,941	8.78	--	R	--	USGS-NWIS, 2004	
219	2190601	01/27/2003	3,941	8.78	--	R	--	USGS-NWIS, 2004	
219	2190601	03/11/2003	4,044	9.01	--	R	--	USGS-NWIS, 2004	
219	2190601	04/21/2003	4,183	9.32	--	R	--	USGS-NWIS, 2004	
219	2190601	06/11/2003	3,972	8.85	--	R	--	USGS-NWIS, 2004	
219	2190601	07/14/2003	3,905	8.70	--	R	--	USGS-NWIS, 2004	
219	2190601	08/27/2003	3,802	8.47	--	R	--	USGS-NWIS, 2004	
219	2190601	10/07/2003	3,770	8.40	--	R	--	USGS-NWIS, 2004	
219	2190601	12/15/2003	4,138	9.22	--	R	--	USGS-NWIS, 2004	
219	2190601	03/01/2004	4,363	9.72	--	R	--	USGS-NWIS, 2004	
219	2190601	04/06/2004	4,197	9.35	--	R	--	USGS-NWIS, 2004	
219	2190601	05/18/2004	3,833	8.54	--	R	--	USGS-NWIS, 2004	
219	2190601	06/30/2004	3,532	7.87	--	R	--	USGS-NWIS, 2004	
219	2190601	08/12/2004	3,653	8.14	--	R	--	USGS-NWIS, 2004	
219	2190601	10/13/2004	3,555	7.92	--	R	--	USGS-NWIS, 2004	
219	2190601	12/09/2004	4,048	9.02	--	R	--	USGS-NWIS, 2004	
219	2190701	09/01/1963	1,700	3.79	--	R	--	USGS-NWIS, 2004	
219	2190701	03/12/1987	600	1.34	--	R	--	USGS-NWIS, 2004	
219	2190701	02/03/1988	500	1.11	--	R	--	USGS-NWIS, 2004	
219	2190701	02/08/1989	310	0.690	--	R	--	USGS, 1989	
219	2190701	03/28/1990	512	1.14	--	R	--	USGS, 1990	
219	2190701	11/07/1990	498	1.11	--	R	--	USGS, 1991	
219	2190701	03/13/1991	700	1.56	--	R	--	USGS, 1991	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2190701	11/13/1991	489	1.09	--	R	--	USGS, 1992	
219	2190701	04/01/1992	444	0.990	--	R	--	USGS, 1992	
219	2190701	10/13/1992	539	1.20	--	R	--	USGS, 1993	
219	2190701	04/15/1993	539	1.20	--	R	--	USGS, 1993	
219	2190701	10/22/1993	435	0.970	--	R	--	USGS, 1994	
219	2190701	04/06/1994	269	0.600	--	R	--	USGS, 1994	
219	2190701	10/25/1994	494	1.10	--	R	--	USGS, 1995	
219	2190701	04/14/1997	803	1.79	--	R	--	USGS-NWIS, 2004	
219	2190701	10/02/1997	287	0.640	--	R	--	USGS-NWIS, 2004	
219	2190701	04/13/1999	485	1.08	--	R	--	USGS-NWIS, 2004	
219	2190701	04/13/1999	445	0.990	--	R	--	USGS-NWIS, 2004	
219	2190701	09/07/1999	503	1.12	--	R	--	USGS, 1999	
219	2190701	04/14/2000	530	1.18	--	R	--	USGS-NWIS, 2004	
219	2190701	09/12/2000	530	1.18	--	R	--	USGS-NWIS, 2004	
219	2190701	04/26/2001	427	0.950	--	R	--	USGS-NWIS, 2004	
219	2190701	09/17/2001	669	1.49	--	R	--	USGS-NWIS, 2004	
219	2190701	04/22/2002	527	1.17	--	R	--	USGS, 2002	
219	2190701	04/21/2003	471	1.05	--	R	--	USGS-NWIS, 2004	
219	2190701	09/16/2003	458	1.02	--	R	--	USGS-NWIS, 2004	
219	2190701	04/20/2004	350	0.780	--	R	--	USGS, 2004	
219	2190701	09/21/2004	370	0.824	--	R	--	USGS, 2004	
219	2190701	01/13/2006	184	0.411	--	R	--	USGS, 2006	
219	2190701	09/11/2006	380	0.847	--	R	--	USGS, 2006	
219	2190801	03/12/1987	440	0.980	--	R	--	USGS-NWIS, 2004	
219	2190801	02/03/1988	50.0	0.110	--	R	--	USGS-NWIS, 2004	
219	2190801	02/08/1989	71.8	0.160	--	R	--	USGS, 1989	
219	2190801	03/28/1990	31.4	0.070	--	R	--	USGS, 1990	
219	2190801	11/07/1990	89.8	0.200	--	R	--	USGS, 1991	
219	2190801	03/13/1991	35.9	0.080	--	R	--	USGS, 1991	
219	2190801	11/13/1991	44.9	0.100	--	R	--	USGS, 1992	
219	2190801	04/01/1992	35.9	0.080	--	R	--	USGS, 1992	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2190801	10/13/1992	22.4	0.050	--	R	--	USGS, 1993	
219	2190801	04/15/1993	121	0.270	--	R	--	USGS, 1993	
219	2190801	10/22/1993	18.0	0.040	--	R	--	USGS, 1994	
219	2190801	04/06/1994	26.9	0.060	--	R	--	USGS, 1994	
219	2190801	10/25/1994	40.4	0.090	--	R	--	USGS, 1995	
219	2190801	04/28/1998	96.0	0.210	--	R	--	USGS-NWIS, 2004	
219	2190801	09/22/1998	152	0.340	--	R	--	USGS-NWIS, 2004	
219	2190801	04/13/1999	127	0.280	--	R	--	USGS-NWIS, 2004	
219	2190801	04/13/1999	125	0.280	--	R	--	USGS-NWIS, 2004	
219	2190801	09/07/1999	153	0.340	--	R	--	USGS-NWIS, 2004	
219	2190801	04/14/2000	167	0.370	--	R	--	USGS-NWIS, 2004	
219	2190801	09/12/2000	146	0.330	--	R	--	USGS-NWIS, 2004	
219	2190801	04/26/2001	158	0.350	--	R	--	USGS-NWIS, 2004	
219	2190801	09/17/2001	149	0.330	--	R	--	USGS-NWIS, 2004	
219	2190801	04/22/2002	173	0.380	--	R	--	USGS, 2002	
219	2190801	04/21/2003	114	0.250	--	R	--	USGS-NWIS, 2004	
219	2190801	09/16/2003	130	0.290	--	R	--	USGS-NWIS, 2004	
219	2190801	04/20/2004	140	0.312	--	R	--	USGS, 2004	
219	2190801	09/21/2004	140	0.312	--	R	--	USGS, 2004	
219	2190801	01/13/2006	49.0	0.109	--	R	--	USGS, 2006	
219	2190801	09/11/2006	146	0.326	--	R	--	USGS, 2006	
219	2190901	01/28/1986	350	0.780	--	R	--	USGS-NWIS, 2004	
219	2190901	03/12/1987	270	0.600	--	R	--	USGS-NWIS, 2004	
219	2190901	02/02/1988	250	0.560	--	R	--	USGS-NWIS, 2004	
219	2190901	02/08/1989	130	0.290	--	R	--	USGS, 1989	
219	2190901	03/28/1990	148	0.330	--	R	--	USGS, 1990	
219	2190901	11/07/1990	238	0.530	--	R	--	USGS, 1991	
219	2190901	03/13/1991	130	0.290	--	R	--	USGS, 1991	
219	2190901	11/13/1991	184	0.410	--	R	--	USGS, 1992	
219	2190901	04/01/1992	247	0.550	--	R	--	USGS, 1992	
219	2190901	10/13/1992	121	0.270	--	R	--	USGS, 1993	
219	2190901	04/15/1993	171	0.380	--	R	--	USGS, 1993	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2190901	10/22/1993	148	0.330	--	R	--	USGS, 1994	
219	2190901	04/06/1994	256	0.570	--	R	--	USGS, 1994	
219	2190901	10/25/1994	274	0.610	--	R	--	USGS, 1995	
219	2190901	04/14/1997	327	0.730	--	R	--	USGS-NWIS, 2004	
219	2190901	10/02/1997	462	1.03	--	R	--	USGS-NWIS, 2004	
219	2190901	04/28/1998	274	0.610	--	R	--	USGS-NWIS, 2004	
219	2190901	09/22/1998	342	0.760	--	R	--	USGS-NWIS, 2004	
219	2190901	04/13/1999	243	0.540	--	R	--	USGS-NWIS, 2004	
219	2190901	04/13/1999	237	0.530	--	R	--	USGS-NWIS, 2004	
219	2190901	09/07/1999	328	0.730	--	R	--	USGS-NWIS, 2004	
219	2190901	04/14/2000	363	0.810	--	R	--	USGS-NWIS, 2004	
219	2190901	09/12/2000	361	0.800	--	R	--	USGS-NWIS, 2004	
219	2190901	04/26/2001	417	0.930	--	R	--	USGS-NWIS, 2004	
219	2190901	09/17/2001	330	0.740	--	R	--	USGS-NWIS, 2004	
219	2190901	04/22/2002	436	0.970	--	R	--	USGS, 2002	
219	2190901	04/21/2003	303	0.670	--	R	--	USGS-NWIS, 2004	
219	2190901	09/16/2003	350	0.780	--	R	--	USGS-NWIS, 2004	
219	2190901	04/20/2004	260	0.579	--	R	--	USGS, 2004	
219	2190901	09/21/2004	480	1.07	--	R	--	USGS, 2004	
219	2190901	01/13/2006	245	0.545	--	R	--	USGS, 2006	
219	2190901	09/11/2006	521	1.16	--	R	--	USGS, 2006	
219	2191001	02/09/1988	1,198	2.67	--	R	--	USGS, 1988	
219	2191001	03/28/1990	830	1.85	--	R	--	USGS, 1990	
219	2191001	11/07/1990	902	2.01	--	R	--	USGS, 1991	
219	2191001	11/13/1990	902	2.01	--	R	--	USGS, 1991	
219	2191001	03/13/1991	1,198	2.67	--	R	--	USGS, 1991	
219	2191001	11/13/1991	426	0.950	--	R	--	USGS, 1992	
219	2191001	04/01/1992	543	1.21	--	R	--	USGS, 1992	
219	2191001	10/13/1992	583	1.30	--	R	--	USGS, 1993	
219	2191001	04/15/1993	763	1.70	--	R	--	USGS, 1993	
219	2191001	10/22/1993	718	1.60	--	R	--	USGS, 1994	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2191001	04/06/1994	763	1.70	--	R	--	USGS, 1994	
219	2191001	10/25/1994	853	1.90	--	R	--	USGS, 1995	
219	2191001	04/14/1997	660	1.47	--	R	--	USGS, 1997	
219	2191001	10/25/1997	696	1.55	--	R	--	USGS, 1998	
219	2191001	04/28/1998	880	1.96	--	R	--	USGS, 1998	
219	2191001	09/22/1998	768	1.71	--	R	--	USGS, 1998	
219	2191001	04/14/2000	579	1.29	--	R	--	USGS, 2000	
219	2191001	09/11/2000	615	1.37	--	R	--	USGS, 2000	
219	2191001	04/26/2001	660	1.47	--	R	--	USGS, 2001	
219	2191001	09/17/2001	642	1.43	--	R	--	USGS, 2001	
219	2191001	04/22/2002	722	1.61	--	R	--	USGS, 2002	
219	2191001	04/21/2003	607	1.35	--	R	--	USGS, 2003	
219	2191001	09/16/2003	623	1.39	--	R	--	USGS, 2003	
219	2191001	04/20/2004	870	1.94	--	R	--	USGS, 2004	
219	2191001	09/21/2004	920	2.05	--	R	--	USGS, 2004	
219	2191001	01/13/2006	28.0	0.062	--	R	--	USGS, 2006	
219	2191001	09/11/2006	10.8	0.024	--	R	--	USGS, 2006	
219	2191101	02/14/1989	162	0.360	--	R	--	USGS, 1989	
219	2191101	03/28/1990	80.8	0.180	--	R	--	USGS, 1990	
219	2191101	11/07/1990	98.7	0.220	--	R	--	USGS, 1991	
219	2191101	03/13/1991	89.8	0.200	--	R	--	USGS, 1991	
219	2191101	11/13/1991	80.8	0.180	--	R	--	USGS, 1992	
219	2191101	04/01/1992	112	0.250	--	R	--	USGS, 1992	
219	2191101	10/13/1992	89.8	0.200	--	R	--	USGS, 1993	
219	2191101	04/15/1993	31.4	0.070	--	R	--	USGS, 1993	
219	2191101	10/22/1993	62.8	0.140	--	R	--	USGS, 1994	
219	2191101	04/06/1994	89.8	0.200	--	R	--	USGS, 1994	
219	2191101	10/25/1994	94.3	0.210	--	R	--	USGS, 1995	
219	2191101	04/28/1998	118	0.260	--	R	--	USGS, 1998	
219	2191101	09/22/1998	140	0.310	--	R	--	USGS, 1998	
219	2191101	01/14/2000	128	0.290	--	R	--	USGS, 2000	
219	2191101	09/11/2000	114	0.250	--	R	--	USGS, 2000	

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Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2191101	04/26/2001	107	0.240	--	R	--	USGS, 2001	
219	2191101	09/17/2001	143	0.320	--	R	--	USGS, 2001	
219	2191101	04/22/2002	161	0.360	--	R	--	USGS, 2002	
219	2191101	04/21/2003	116	0.260	--	R	--	USGS, 2003	
219	2191101	09/16/2003	114	0.250	--	R	--	USGS, 2003	
219	2191101	04/20/2004	90.0	0.200	--	R	--	USGS, 2004	
219	2191101	09/21/2004	120	0.270	--	R	--	USGS, 2004	
219	2191101	01/13/2006	660	1.47	--	R	--	USGS, 2006	
219	2191101	09/11/2006	188	0.418	--	R	--	USGS, 2006	
219	2191201	04/28/1998	440	0.980	--	R	--	USGS-NWIS, 2004	
219	2191201	09/22/1998	369	0.820	--	R	--	USGS-NWIS, 2004	
219	2191201	04/13/1999	436	0.970	--	R	--	USGS-NWIS, 2004	
219	2191201	04/13/1999	433	0.960	--	R	--	USGS-NWIS, 2004	
219	2191201	09/07/1999	392	0.870	--	R	--	USGS-NWIS, 2004	
219	2191201	04/14/2000	443	0.990	--	R	--	USGS-NWIS, 2004	
219	2191201	09/12/2000	360	0.800	--	R	--	USGS-NWIS, 2004	
219	2191201	04/26/2001	414	0.920	--	R	--	USGS-NWIS, 2004	
219	2191201	09/17/2001	370	0.820	--	R	--	USGS-NWIS, 2004	
219	2191201	04/22/2002	427	0.950	--	R	--	USGS, 2002	
219	2191201	04/21/2003	473	1.05	--	R	--	USGS-NWIS, 2004	
219	2191201	09/16/2003	435	0.970	--	R	--	USGS-NWIS, 2004	
219	2191201	04/20/2004	330	0.735	--	R	--	USGS, 2004	
219	2191201	09/21/2004	430	0.958	--	R	--	USGS, 2004	
219	2191201	01/13/2006	316	0.703	--	R	--	USGS, 2006	
219	2191201	09/11/2006	552	1.23	--	R	--	USGS, 2006	
219	2191301	04/19/1999	343	0.760	--	R	--	USGS, 1999	
219	2191301	04/19/1999	336	0.750	--	R	--	USGS, 1999	
219	2191301	09/07/1999	295	0.660	--	R	--	USGS, 1999	
219	2191301	04/14/2000	326	0.730	--	R	--	USGS, 2000	
219	2191301	09/11/2000	309	0.690	--	R	--	USGS, 2000	
219	2191301	04/26/2001	254	0.570	--	R	--	USGS, 2001	

Table B.1-1
Discharge Measurement of Selected Springs
(Page 66 of 69)

Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2191301	09/17/2001	284	0.630	--	R	--	USGS, 2001	
219	2191301	04/22/2002	245	0.550	--	R	--	USGS, 2002	
219	2191301	04/21/2003	323	0.720	--	R	--	USGS, 2003	
219	2191301	09/16/2003	354	0.790	--	R	--	USGS, 2003	
219	2191301	04/20/2004	380	0.850	--	R	--	USGS, 2004	
219	2191301	09/21/2004	320	0.710	--	R	--	USGS, 2004	
219	2191301	01/13/2006	351	0.781	--	R	--	USGS, 2006	
219	2191301	09/11/2006	956	2.13	--	R	--	USGS, 2006	
219	2191401	08/02/1982	1,225	2.73	--	R	--	USGS, 1982	
219	2191401	01/22/1985	1,059	2.36	--	R	--	USGS, 1985	
219	2191401	01/28/1986	983	2.19	--	R	--	USGS, 1986	
219	2191401	03/12/1987	1,059	2.36	--	R	--	USGS, 1987	
219	2191401	11/13/1991	893	1.99	--	R	--	USGS, 1992	
219	2191401	04/01/1992	794	1.77	--	R	--	USGS, 1992	
219	2191401	10/13/1992	1,122	2.50	--	R	--	USGS, 1993	
219	2191401	04/15/1993	1,077	2.40	--	R	--	USGS, 1993	
219	2191401	10/22/1993	1,167	2.60	--	R	--	USGS, 1994	
219	2191401	04/06/1994	1,122	2.50	--	R	--	USGS, 1994	
219	2191401	10/25/1995	274	0.610	--	R	--	USGS, 1995	
219	2191401	04/14/1997	318	0.710	--	R	--	USGS, 1997	
219	2191401	10/02/1997	462	1.03	--	R	--	USGS, 1998	
219	2191401	04/28/1998	274	0.610	--	R	--	USGS, 1998	
219	2191401	09/22/1998	342	0.760	--	R	--	USGS, 1998	
219	2191401	09/07/1999	951	2.12	--	R	--	USGS, 1999	
219	2191401	04/14/2000	1,140	2.54	--	R	--	USGS, 2000	
219	2191401	09/11/2000	1,110	2.47	--	R	--	USGS, 2000	
219	2191401	04/26/2001	1,080	2.41	--	R	--	USGS, 2001	
219	2191401	09/17/2001	1,240	2.76	--	R	--	USGS, 2001	
219	2191401	04/22/2002	1,293	2.88	--	R	--	USGS, 2002	
219	2191401	04/21/2003	948	2.11	--	R	--	USGS, 2003	
219	2191401	09/16/2003	1,021	2.27	--	R	--	USGS, 2003	
219	2191401	04/20/2004	1,475	3.29	--	R	--	USGS, 2004	

Table B.1-1
Discharge Measurement of Selected Springs
(Page 67 of 69)

Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2191401	09/21/2004	1,780	3.97	--	R	--	USGS, 2004	
219	2191401	01/13/2006	1,311	2.92	--	R	--	USGS, 2006	
219	2191401	09/11/2006	1,486	3.31	--	R	--	USGS, 2006	
219	2191501	07/31/1982	1,638	3.65	--	R	--	USGS, 1982	
219	2191501	07/31/1982	1,600	3.56	--	R	--	USGS-NWIS, 2004	
219	2191501	07/31/1982	1,500	3.34	--	R	--	USGS-NWIS, 2004	
219	2191501	01/22/1985	1,364	3.04	--	R	--	USGS, 1985	
219	2191501	08/22/1985	1,600	3.56	--	R	--	USGS-NWIS, 2004	
219	2191501	10/15/1985	1,454	3.24	--	R	--	USGS, 1986	
219	2191501	12/11/1985	1,535	3.42	--	R	--	USGS, 1986	
219	2191501	01/28/1986	1,620	3.61	--	R	--	USGS, 1986	
219	2191501	04/01/1992	1,400	3.12	--	R	--	USGS, 1992	
219	2191501	07/11/2002	1,086	2.42	--	R	--	USGS-NWIS, 2004	
219	2191501	09/13/2002	1,203	2.68	--	R	--	USGS-NWIS, 2004	
219	2191501	10/10/2002	1,346	3.00	--	R	--	USGS-NWIS, 2004	
219	2191501	12/09/2002	1,526	3.40	--	R	--	USGS-NWIS, 2004	
219	2191501	02/06/2003	1,373	3.06	--	R	--	USGS-NWIS, 2004	
219	2191501	03/11/2003	1,643	3.66	--	R	--	USGS-NWIS, 2004	
219	2191501	04/23/2003	1,683	3.75	--	R	--	USGS-NWIS, 2004	
219	2191501	06/11/2003	1,625	3.62	--	R	--	USGS-NWIS, 2004	
219	2191501	07/17/2003	1,607	3.58	--	R	--	USGS-NWIS, 2004	
219	2191501	08/27/2003	1,719	3.83	--	R	--	USGS-NWIS, 2004	
219	2191501	10/07/2003	1,553	3.46	--	R	--	USGS-NWIS, 2004	
219	2191501	12/15/2003	1,522	3.39	--	R	--	USGS-NWIS, 2004	
219	2191501	03/01/2004	1,988	4.43	--	R	--	USGS-NWIS, 2004	
219	2191501	04/06/2004	1,679	3.74	--	R	--	USGS-NWIS, 2004	
219	2191501	05/18/2004	1,499	3.34	--	R	--	USGS-NWIS, 2004	
219	2191501	06/30/2004	1,382	3.08	--	R	--	USGS-NWIS, 2004	
219	2191501	08/12/2004	1,293	2.88	--	R	--	USGS-NWIS, 2004	
219	2191501	10/13/2004	1,333	2.97	--	R	--	USGS-NWIS, 2004	
219	2191501	12/09/2004	1,418	3.16	--	R	--	USGS-NWIS, 2004	

Table B.1-1
Discharge Measurement of Selected Springs
(Page 68 of 69)

Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
219	2191501	02/18/2005	1,436	3.20	P	R	--	USGS-NWIS, 2006	
219	2191501	04/12/2005	1,539	3.43	P	R	--	USGS-NWIS, 2006	
219	2191501	06/08/2005	1,593	3.55	G	R	--	USGS-NWIS, 2006	
219	2191501	07/28/2005	1,248	2.78	F	R	--	USGS-NWIS, 2006	
219	2191501	08/08/2005	16,696	37.2	--	R	--	USGS-NWIS, 2006	
219	2191501	09/07/2005	1,508	3.36	F	R	--	USGS-NWIS, 2006	
219	2191501	10/14/2005	1,522	3.39	G	R	--	USGS-NWIS, 2006	
219	2191501	12/06/2005	1,266	2.82	G	R	--	USGS-NWIS, 2006	
219	2191501	01/30/2006	1,382	3.08	F	R	--	USGS-NWIS, 2006	
219	2191501	03/29/2006	1,369	3.05	F	R	--	USGS-NWIS, 2006	
219	2191501	05/17/2006	1,441	3.21	F	R	--	USGS-NWIS, 2006	
219	2191501	07/12/2006	1,513	3.37	F	R	--	USGS-NWIS, 2006	
219	2191501	08/25/2006	1,382	3.08	F	R	--	USGS-NWIS, 2006	
219	2191501	10/04/2006	16,203	36.1	--	R	--	USGS-NWIS, 2006	
219	2191501	10/25/2006	1,266	2.82	F	R	--	USGS-NWIS, 2006	
219	2191501	12/07/2006	16,293	36.3	--	R	--	USGS, 2007	
219	2191501	12/12/2006	1,297	2.89	P	R	--	USGS, 2007	
219	2191501	02/02/2007	1,791	3.99	F	R	--	USGS, 2007	
219	2191501	03/12/2007	1,315	2.93	P	R	--	USGS, 2007	
219	2191701	04/20/2004	280	0.624	--	R	--	USGS, 2004	
219	2191701	09/21/2004	300	0.668	--	R	--	USGS, 2004	
219	2191701	01/13/2006	248	0.553	--	R	--	USGS, 2006	
219	2191701	09/18/2006	283	0.630	--	R	--	USGS, 2006	
258	2580101	08/24/1976	3,140	7.00	--	R	23.5	Bolke and Sumison, 1978	Water is used for wildlife
258	2580201	08/24/1976	100	0.223	--	R	23.0	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580201	11/15/1979	5.00	0.011	--	R	--	Ertec, 1981	Discharge was estimated
258	2580301	07/22/1976	150	0.334	--	R	--	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580301	08/23/1976	--	--	--	R	20.5	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580401	03/26/1956	--	--	--	R	24.0	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580401	07/22/1976	850	1.89	--	R	--	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580401	08/24/1976	--	--	--	R	20.0	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580402	03/26/1956	--	--	--	R	25.0	Bolke and Sumsion, 1978	Water is used for wildlife

Table B.1-1
Discharge Measurement of Selected Springs
(Page 69 of 69)

Hydrographic Area	Report Spring ID	Date	Discharge (gpm)	Discharge (cfs)	Measurement Rated as: (E,G,F,P)	Method	Water Temp. (°C)	Data Source	Remarks
258	2580402	07/22/1976	2,400	5.35	--	R	--	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580402	08/24/1976	--	--	--	R	27.0	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580403	03/26/1956	--	--	--	R	22.0	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580403	08/24/1976	5,400	12.0	--	R	27.0	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580404	03/26/1956	--	--	--	R	25.5	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580404	07/22/1976	1,100	2.45	--	R	--	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580404	08/24/1976	--	--	--	R	26.0	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580405	03/26/1956	--	--	--	R	21.0	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580405	07/22/1976	3,600	8.02	--	R	--	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580405	08/24/1976	--	--	--	R	27.5	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580406	07/22/1976	1,700	3.79	--	R	--	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580406	08/24/1976	--	--	--	R	26.0	Bolke and Sumsion, 1978	Water is used for wildlife
258	2580501	08/23/1976	1.00	0.002	--	R	22.0	Bolke and Sumsion, 1978	Discharge reported as less than 1 gpm; value is an estimate. Water is used for livestock
258	2580601	08/24/1976	--	--	--	R	20.0	Bolke and Sumsion, 1978	Water is unused. Discharge diffuses over a large area

Discharge Method Codes: C = current meter; E = estimated; F = flume; R = reported; V = volumetric; W = Weir

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Appendix C

Example Forms

Form: SNWA_SIS 06/04

SOUTHERN NEVADA WATER AUTHORITY

SNWA Site Inventory Sheet

Party _____ USGS Site ID _____
Date/Time _____ Basin Name _____
Site ID _____ 100K Map Name _____
Local Number _____ Photots yes / no GPS yes / no

Contact Information

Name _____
Affiliation _____
Phone # _____
Address _____
_____

Road Log _____

_____
_____
_____
_____
_____

Well Information

MP Desc. _____
_____
Casing Size _____
Well Type _____
Well Use _____
Pump yes / no
Pump Type _____

Surface Water Information

Spring or Stream
X-section Desc. _____
_____
Q Measured yes / no
Diversion Desc. _____
_____
_____

General Site Location

Detailed Site Schematic

Completed by: _____ Date: _____.
Checked by: _____ Date: _____.

Page _____ of _____.

Figure C.1-1
Site Inventory Form

G-174
9-275-F
(Apr. 93)

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

Meas. No .....

Comp. by .....

Sta. No. ..... **DISCHARGE MEASUREMENT NOTES** Checked by .....

Date ..... , 20 ..... Party .....

Width ..... Area ..... Vel. ..... G.H. ..... Disch. .....

Method ..... No. secs. ..... G.H. change ..... in ..... hrs. Susp. .....

Method coef. ..... Hor. angle coef. ..... Susp. coef. ..... Meter No. .....

Type of meter ..... Date rated ..... Tag checked .....

Meter ..... ft. above bottom of wt. Spin before meas. ..... after .....

Meas. Plots ..... % diff. from ..... rating. Levels obtained .....

GAGE READINGS						WATER QUALITY MEASUREMENTS
Time	Inside	____	____	____	Outside	No ..... Yes ..... Time .....
						Samples Collected
						No ..... Yes ..... Time .....
						Method Used
						EDI ..... EWI ..... Other .....
						SEDIMENT SAMPLES
						No ..... Yes ..... Time .....
						Method Used
						EDI ..... EWI ..... Other .....
Weighted M.G.H.						BIOLOGICAL SAMPLES
G.H. correction						Yes ..... Time .....
Correct M.G.H.						No ..... Type .....

Check bar. chain found ..... changed to ..... at .....

Wading, cable, ice, boat, upstr., downstr., side bridge ..... feet, mile, above, below gage.

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%): based on the following cond:

Flow .....

Cross section .....

Control .....

Gage operating ..... Weather .....

Intake/Orifice cleaned ..... Air ..... °C@..... Water ..... °C@ .....

Record removed ..... Extreme Indicator: Max ..... Min. .....

Manometer N_2 Pressure Tank ..... Feed ..... Bbl rate ..... per min.....

CSG checked ..... Stick reading .....

Observer .....

HWM ..... outside, in well

Remarks .....

G. H. of zero flow ..... ft. Sheet No. ..... of .....sheets

ALL-WEATHER WRITING PAPER

RICKLY HYDROLOGICAL CO. COLUMBUS, OH
(614) 297-9877 - FAX (614) 297-9878

.0 .10 .20 .30 .40 .50 .60 .70 .75

River at -

Angle coefficient	Dist. from initial point	Width	Depth	Observation depth	Revolutions	Time in seconds	VELOCITY At Point	VELOCITY Mean in verticle	Adjusted for hor. angle or	Area	Discharge

.80 .85 .90 .92 .94 .96 .97 .98 .99 .100 .99 .98 .97 .96 .94 .92 .90 .85 .80

.0 .10 .20 .30 .40 .50 .60 .70 .75

Figure C.1-2
Discharge Measurement Form (Pages 1 and 2)

Appendix D

U.S. Forest Service Springs Survey Report

(as provided by the USFS)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Nevada State Office
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Scott Ellis, ENSR
Penny Woods, BLM-Nevada State Office

From: Robert Boyd, BLM-Nevada State Office Robert A. Boyd 1/10/07

Subject: Distribution of spring inventory information for Forest Service lands in the Ely District

The Forest Service and Eastern Nevada Landscape Coalition recently completed an inventory of springs and seeps on lands managed by the Forest Service-Ely District. Hydrologic, chemical, biologic, and physical data were also collected during this inventory. The data and summary reports are being provided on the enclosed CD. This information should be included with datasets being compiled and analyzed for the Clark, Linclon, and White Pine County Groundwater Development Project. Please forward this information to appropriate members of your technical staff.

U. S. D. A. Forest Service
Level 1 Survey of Springs on the Ely Ranger District
2006 Final Survey Report

Prepared by
Eastern Nevada Landscape Coalition
1500 Avenue F
P. O. Box 150226
Ely, NV 89315

November 6, 2006

ABSTRACT

As part of a collaborative working agreement, the U. S. D. A. Forest Service (USFS) and the Eastern Nevada Landscape Coalition (ENLC) began a Level 1 survey of springs within the Humboldt-Toiyabe National Forest, primarily on Forest lands within the vicinity of proposed groundwater withdrawal wells for the Southern Nevada Water Authority. The areas within the Forest that ENLC focused on for the spring surveys were divided into three separate units: South Snake Management Unit, Eastside Schell Management Unit, and Mount Moriah Management Unit. The ENLC survey crews surveyed for and monitored known and unknown springs in the South Snake Range and Eastside Schell Management Units. A USFS backcountry ranger monitored springs within the Mount Moriah Management Unit that occurred along recreational trails. By the end of the 2006 field season, the ENLC spring survey crews monitored 53 known and 148 unknown springs within the South Snake Range and Eastside Schell Management Units. Of the areas covered in the surveys, ENLC recommends future surveys be conducted within the following drainages which the survey crews were unable to survey in 2006: North Fork Cleve Creek, northwesternmost reaches of Cleve Creek, drainages north of Cleve Creek along the east slope of Black Mountain, and Taft Creek.

INTRODUCTION

In 2006, the U. S. D. A. Forest Service (USFS) and the Eastern Nevada Landscape Coalition (ENLC) collaborated together to initiate a Level 1 survey of springs within the Humboldt-Toiyabe National Forest. The purpose of the Level 1 survey of springs was to locate known and unknown springs within the Forest and collect baseline data characterizing the attributes of these springs. For the 2006 field season, ENLC focused surveying efforts primarily in the Forest lands that may be affected by proposed groundwater withdrawal activities of the Southern Nevada Water Authority in Spring Valley.

METHODOLOGY

Spring Survey Methods

In order to maximize the spring survey crews' efforts, three primary project areas were delineated: South Snake Management Unit (South Snake MU), Eastside Schell Management Unit (Eastside Schell MU), and the Mount Moriah Management Unit (Mount Moriah MU) (Figure 1). For the South Snake MU, ENLC focused primarily on areas deemed by a U. S. Geological Survey report to be susceptible to groundwater withdrawal activities (Figure 2). For the Eastside Schell MU, ENLC surveyed areas east of the ridgeline from Connors Pass northward towards Taft Creek. Once hunting season made surveying the more southern drainages hazardous, the survey crews moved northward to Kalamazoo Creek and began surveying its drainage for the last week of the field season.

Within the delineated areas of both the South Snake MU and Eastside Schell MU, ENLC crews surveyed for known and unknown springs by focusing on drainages within which the presence of water was likely. Crews typically began surveying a drainage at the Forest boundary and followed any flowing water to its source. The crews thoroughly searched the landscape for plant assemblages normally associated with the presence of water, using binoculars in areas not easily navigated. When water-associated plant assemblages were spotted, the crew would hike to the location and search the vegetation for surface water and then determine whether the presence of the surface water was an actual spring. The crews also located and collected data on known springs as they encountered them during their surveys for unknown springs.

Spring monitoring in the Mount Moriah MU was performed by April Johnson, a USFS backcountry ranger, as part of the USFS Ely Ranger District's wilderness monitoring protocol. For the wilderness monitoring protocol, the primary focus was to collect baseline data on springs that occur near established recreational trails within the wilderness (Figure 3). Areas located away from trails that would not be accessed by recreationalists were not surveyed for known and unknown springs. Due to time constraints and equipment availability, April Johnson performed only portions of the monitoring protocol. A total of 34 springs, two (2) known and 32 previously unknown, were inventoried along the recreational trails (Table 1). The data site number for springs collected as part of the wilderness monitoring protocol are preceded by "MM" in the Spring Inventory database in order to highlight entries that are incomplete.

In addition to performing surveys on USFS lands surrounding Spring Valley, the ENLC crews monitored seven known springs in the White Pine Range to collect baseline data for a juniper removal project and provide several reference points for spring monitoring outside the areas deemed susceptible to groundwater withdrawal in Spring Valley. As the area surrounding the White Pine Range is not believed to be highly susceptible to groundwater withdrawal activities in Spring Valley, the crews monitored a select few known springs and did not perform surveys for unknown springs. The monitoring data for the springs is included in the Spring Inventory database.

Spring Monitoring Protocol

Once a spring was located, the ENLC crews basically followed the protocol outlined by the USFS in its Spring Ecosystem Inventory Protocol (Appendix A). Due to unforeseen circumstances, the crews were unable to follow portions of the protocol but were able to learn or develop alternative methods in order to obtain information regarding the attributes of interest. The following is a description of alterations to the protocol originally provided.

Site ID Number: The UTM Zone was not included in the site ID number in the database.

GPS Datum: For the 2006 field season, the Forest Service provided ENLC with two Trimble Geo XM GPS units and ArcPad 7.0 for navigation and the collection of UTM coordinates. From 6/13/206 through 6/26/2006, the crews were still learning how to use the GPS software and did not collect the UTM coordinates on the GPS. For the ArcGIS layer which contains points for all of the monitored springs, the coordinates for springs monitored during this period were entered into an Excel file to create a layer within ArcGIS. The shapefile was then merged with all field-collected coordinates. The crews were able to collect the UTM coordinates in NAD 83 but were unable to determine how to differentially correct the coordinates with the software they chose to use. The crews were also unable to determine where the GPS unit displayed information regarding DGPS and WAAS but were able to obtain PDOP values (see Appendix C for definitions of acronyms).

Elevation: The elevation recorded was obtained from the GPS unit used in the field.

Orifice Geomorphic Type: Using both field observations and digitized geology maps in ArcGIS, the crews were able to differentiate between Tubular, Contact, Fault, and Sinkhole types. When none of these types were correct, the crews frequently experienced difficulty in differentiating between Seepage and Fracture/Joint orifice. In instances where the crews were uncertain, they listed both in the database entry with a question mark following each type name.

Primary Lithology of Source: In the field, the crews tested rocks within or immediately adjacent to the spring for limestone by physically splitting the rock and placing a drop of 10% hydrochloric acid on the newly exposed surface. The presence or absence of limestone was recorded on the datasheet. The geological unit for the spring location was later referenced in ArcGIS and recorded in the database.

Discharge: Initially the crews attempted several methods for measuring the discharge rate of the springs before selecting two that were relatively easy to implement in the backcountry given the nature and size of most springs encountered. The two methods most frequently used were the volumetric measurements ("calibrated bucket-and-pipe") procedure and the dye tracer procedure. The volumetric measurements procedure is described in the USFS Spring Ecosystem Inventory Protocol and was frequently used for springs with very small discharges that could easily be measured with containers as small as 130 mL. If a crew was unable to direct all of the water into the pipe, they visually estimated the percentage of the discharge that was not included in the measurement.

The dye tracer procedure was frequently used for springs with larger discharges or with substrate compositions that thwarted any efforts to channel and direct the water flow. The dye tracer procedure is similar to the float velocity procedure described in the USFS Spring Ecosystem Inventory Protocol in that beginning and ending points for measurement within the stream are first designated and the length, average width, and average depth of the area are then measured to obtain an estimated water volume. The dye tracer is dropped into the water flow at the beginning point and the time required for the dye tracer to reach the ending point is recorded.

In some instances, the discharge rate was either so small the crew was unable to detect any measurable flow or so dispersed or diffuse that they were unable to find any method available to them to effectively measure the discharge. In these instances, the crew noted they were unable to measure the discharge and described the reasons why in the "Notes" section.

Water Chemistry: For the 2006 field season, the ENLC crews were provided with two Horiba U-10 Water Quality meters and one Horiba U-22XD Water Quality meter to obtain the pH, dissolved oxygen, temperature, and electrical conductivity of the water. In the beginning of the field season, the crews experienced difficulties with the Horiba U-10 meters provided and the measurements recorded, particularly for pH and dissolved oxygen, may not have been correct. When the crews were aware of these problems, they recorded in the "Notes" section the difficulties experienced. For several weeks, one crew did not have a water quality meter as both Horiba U-10 meters were sent to the company for repairs. During this time period, the crew used a HACH Dissolved Oxygen test kit Model OX-2P, pH test strips, and a thermometer to obtain water chemistry values. Throughout the season, the crews recorded the make and model of water quality meter or test kits used in the database.

In addition to experiencing problems with the meters, the crews frequently found that they were unable to submerge the meters' probes fully into the water in the springs or spring brooks. This was generally due to insufficient water present or difficult substrates. Throughout the field season, the crews filled a 750 mL container with water collected as close to the spring orifice as possible and submerged the meters' probes in the container. After 8/03/2006, they also submerged the probe directly into any springs with sufficient water in order to compare whether there was a difference between measurements in the container and in the flowing water. Both sets of measurements were recorded in the database

with the columns with the phrase “in flow” added to the heading titles for measurements obtained from submergence in the spring.

Some information requested in the protocol was not available to the ENLC crews. The crews were unable to find sources for the INFRA Reference Number and Water Rights Number and Status for developed and/or known springs. In instances where water is diverted, the crews frequently could not locate either the Point of Diversion or the Point of Use, especially when the water was being channeled into underground pipes and diverted to unknown, distant locations.

ACCOMPLISHMENTS

By the end of the 2006 field season, ENLC field crews monitored 53 known and 148 unknown springs in the South Snake and Eastside Schell MU’s (Table 1). In the South Snake MU, the crews monitored twelve (12) known and 90 unknown springs in the areas demarcated by the U. S. Geological Survey as susceptible to groundwater withdrawal (Figure 4). The crews completed spring surveys in the South Snake MU for the following drainages: Baker Creek, western half of Board Creek, Dry Canyon, Hub Mine Basin, Mill Creek, Pine Creek, Ridge Creek, Shingle Creek, Snake Creek, Spring Creek, Weaver Creek, and Williams Canyon. The crews were unable to identify any springs in either Dry Canyon or the western half of Board Creek. Big Wash, located south of Snake Creek, was the only drainage deemed susceptible to groundwater withdrawal activities in the South Snake MU for which ENLC crews were unable to perform spring surveys. This was due to the crew’s inability to access the drainage.

In the Eastside Schell MU, the crews monitored 41 known and 58 unknown springs (Figure 5). Crews completed surveys for springs throughout the Bastian Springs, Cooper Canyon, Ranger Creek and South Taft Creek drainages. Most of the Cleve Creek drainage was completed by the ENLC crew but they were unable to finish the westernmost sections of the drainage due to the onset of hunting season. In the crew’s surveys, they encountered two (2) known spring locations, one in Ranger Creek and one in Cleve Creek, for which they were unable to locate any spring within the vicinity. The crew could not locate the known spring in Ranger Creek as heavy bank trampling of nearby streams by cattle created a very large, muddy track of land where the spring was to occur. The known spring in Cleve Creek that the crew could not locate was depicted to have been either within or adjacent to an active stream channel and may no longer exist due to channel movement. Even though neither spring was present to monitor, the crew still collected general information with regards to the known springs’ supposed locations along with a note that the known spring no longer existed and included both of these springs in the Spring Inventory database. Neither spring was included in the ArcGIS shapefiles for monitored springs.

As part of ENLC’s final report, ENLC is providing the following data in electronic form:

- Spring Inventory Access database
- ArcGIS shape files containing spring location data and delineated areas surveyed
- Spring monitoring photos
- Spring monitoring photos master list in Excel

All of the data files include data collected in the Mount Moriah MU by April Johnson and the seven known springs monitored in the White Pine Range.

FUTURE AREAS FOR SURVEYS

The ENLC field crews recommend the following areas for future surveys given observations made in the field. The northwestern fork of Cleve Creek and Kraft Canyon need to be completed as the crews were unable to continue working in the area due to hunting season. Crews were unable to perform surveys in the North Fork Cleve Creek drainage due to its inaccessibility and hazardous terrain. This area would still be worth surveying given the presence of several known springs in the drainage and the fact that the majority of the water in Cleve Creek originates from the North Fork. The crews were also unable to access the drainages north of Cleve Creek along the east slope of Black Mountain due to daily time constraints. These drainages, including Freehill, Vipoint, and Stephens, contain water-associated plant assemblages and known springs and are worth investigating. Future spring survey crews would likely need to camp overnight within the vicinity of the drainages in order to access them in a safe and timely manner. The ENLC also recommends a complete survey of Taft Creek as the drainage contains water-associated plant assemblages and the crews observed an aqueduct originating from the drainage.

TABLES AND FIGURES

Table 1. Total number of known and unknown springs monitored in 2006 per drainage in the South Snake Range and Eastside Schell Management Units

Management Unit Drainage	# of Known Springs Monitored	# of Unknown Springs Monitored	Total Springs Monitored
South Snake			
Baker Creek	0	14	14
Hub Mine Basin	1	5	6
Mill Creek	0	2	2
Pine Creek	0	5	5
Raised Spring area	1	1	2
Ridge Creek	0	3	3
Shingle Creek	0	12	12
Snake Creek	0	6	6
Spring Creek	0	7	7
Weaver Creek	10	25	35
Williams Canyon	0	10	10
South Snake Total	**12**	**90**	**102**
Eastside Schell			
Bastian Springs	3	0	3
Cleve Creek	17	29	46
Cooper Canyon	10	8	18
Kalamazoo Creek	3	3	6
Taft Creek	8	18	26
Eastside Schell Total	**41**	**58**	**99**
Mount Moriah*	2	32	**34**
White Pine Range*	7	NA	**7**
	Total springs surveyed		**242**

*Data from the Mount Moriah and White Pine Management Units were collected for separate projects but still included in the Level 1 Survey of Springs database.

Figure 1. 2006 Level 1 U. S. D. A. Forest Service Level 1 Survey of Springs Project Management Units within the Humboldt-Toiyabe National Forest, NV.

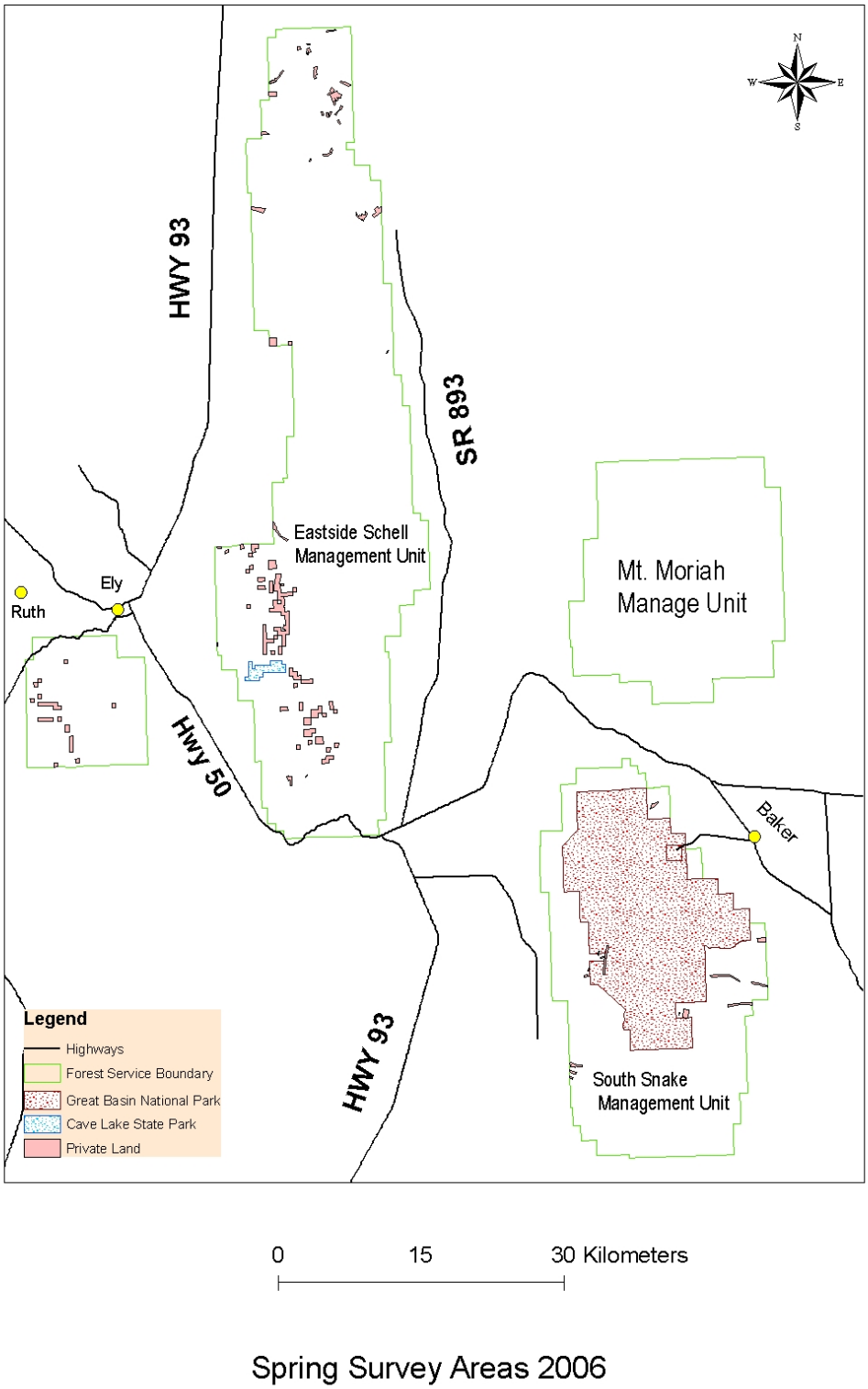


Figure 2. (PDF file from USGS report): Generalized areas where surface-water resources likely or potentially are susceptible to ground-water withdrawals in adjacent valleys, Great Basin National Park area, Nevada.

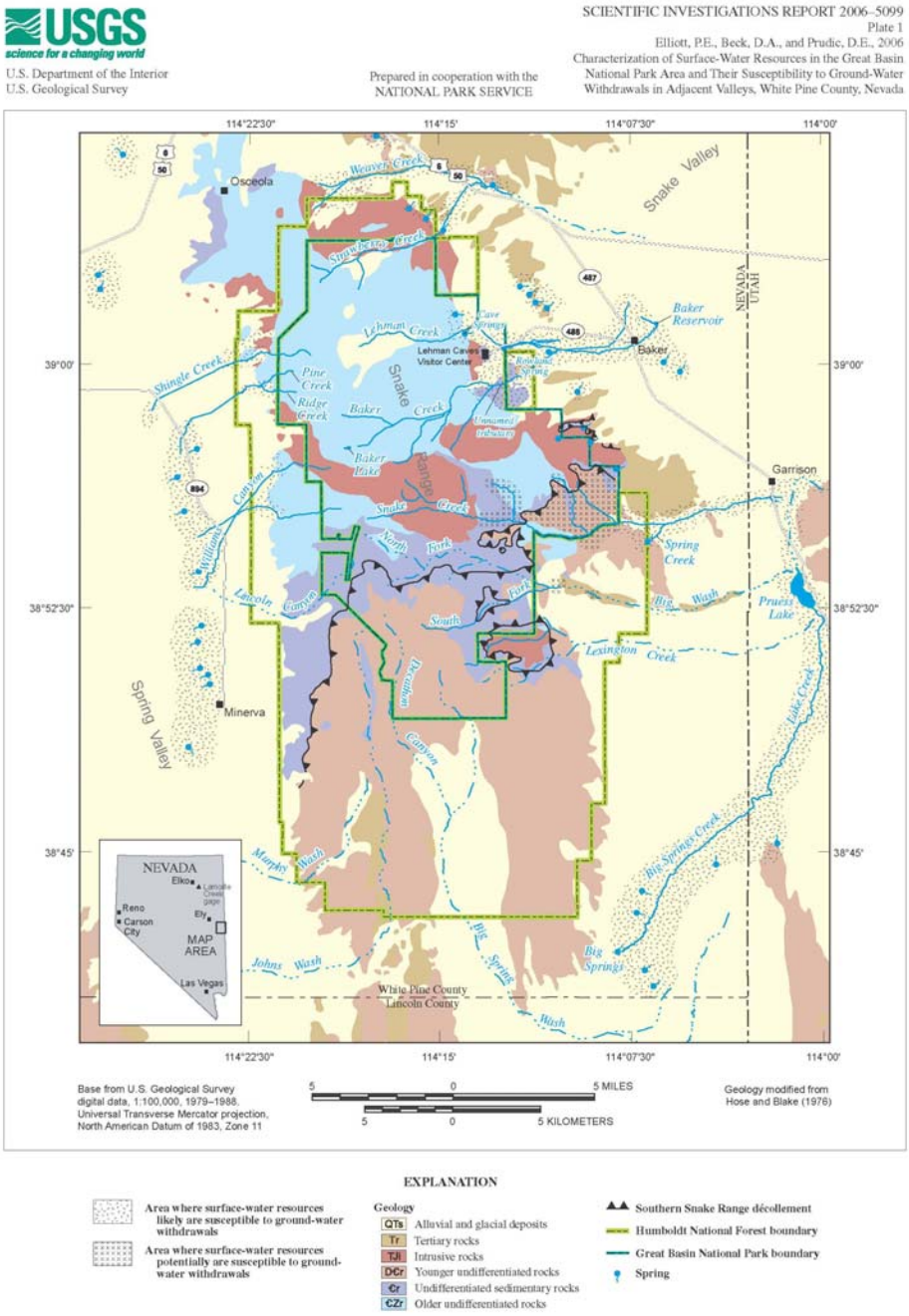


Figure 3. Springs inventoried in 2006 by the U. S. D. A. Forest Service backcountry ranger in the Humboldt-Toiyabe National Forest Mount Moriah Management Unit, NV, for the wilderness monitoring program.

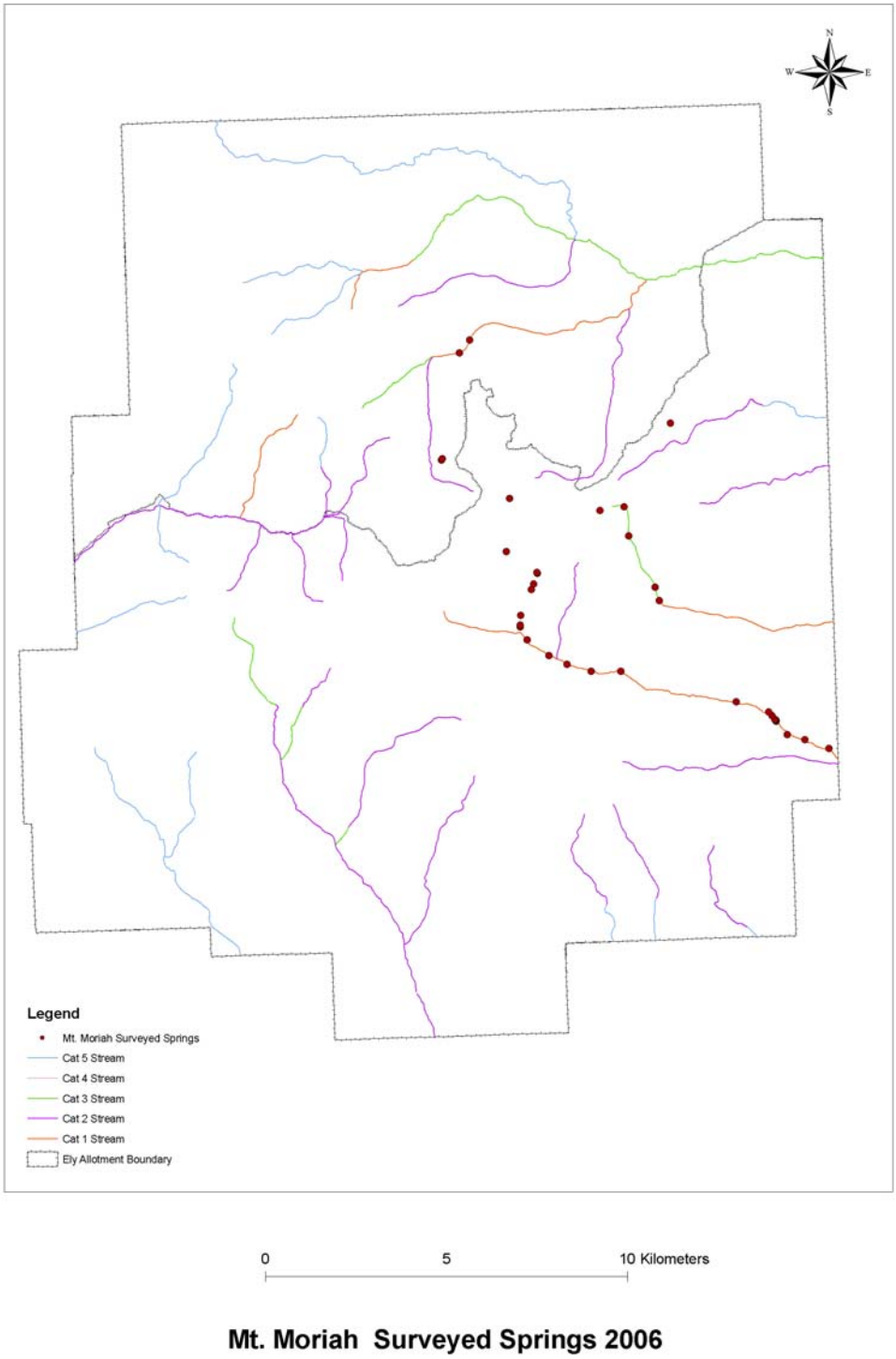


Figure 4. Springs monitored in 2006 by the Eastern Nevada Landscape Coalition spring survey crews in the Humboldt-Toiyabe National Forest South Snake Management Unit, NV.

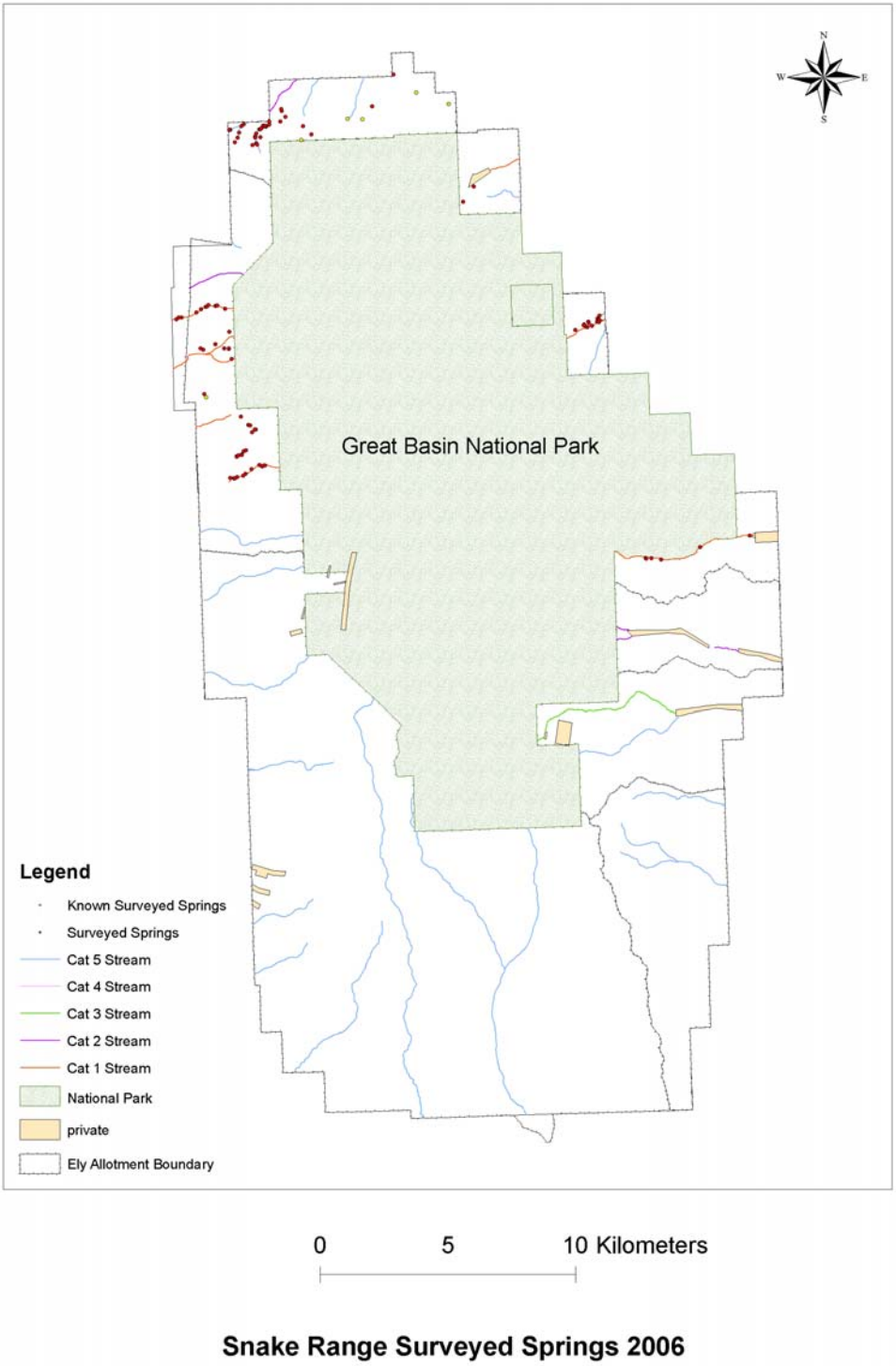
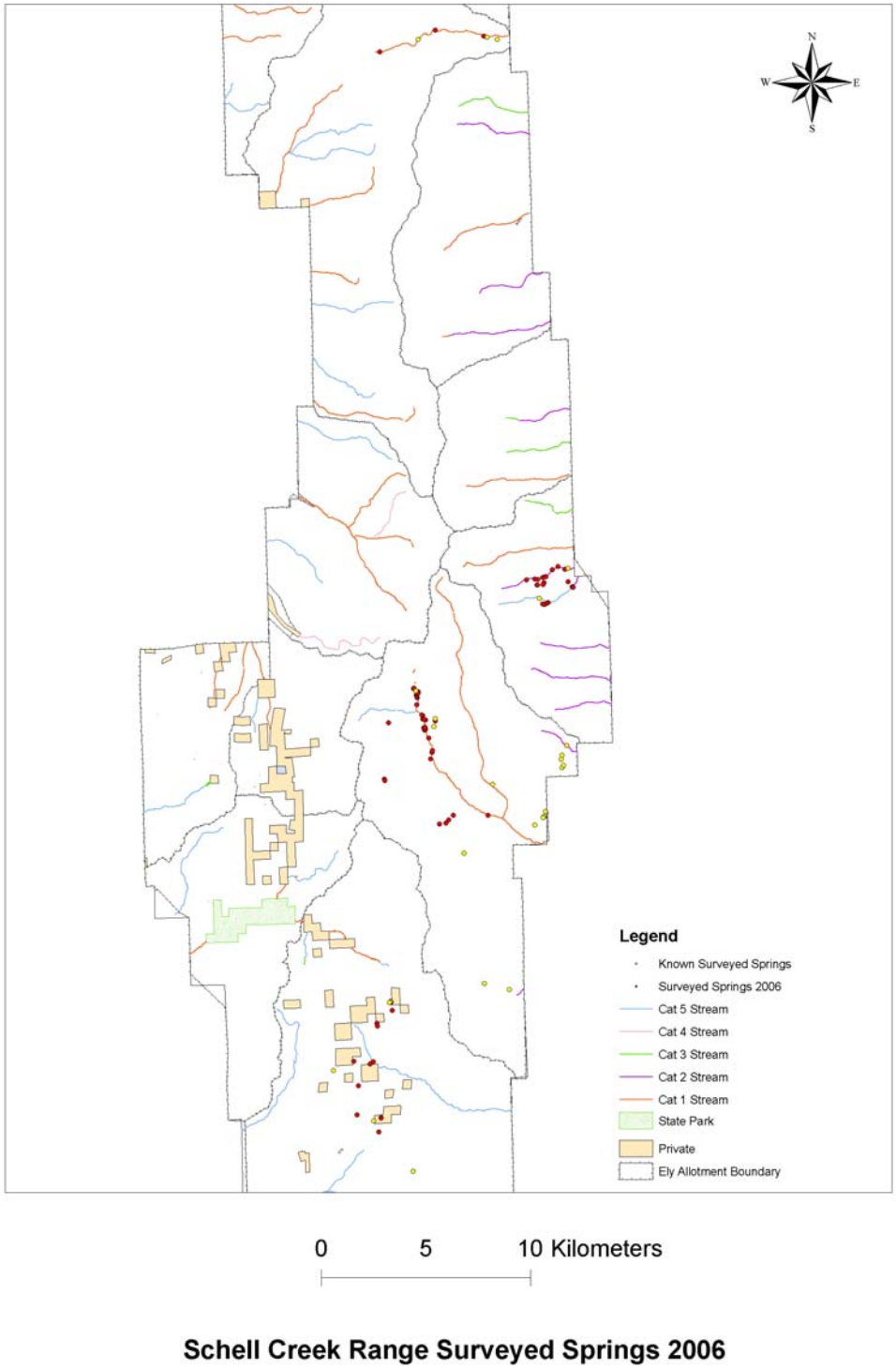


Figure 5. Springs monitored in 2006 by the Eastern Nevada Landscape Coalition spring survey crews in the Humboldt-Toiyabe National Forest Eastside Schell Management Unit, NV.



APPENDIX A. USDA FOREST SERVICE SPRING ECOSYSTEM INVENTORY PROTOCOL

DRAFT INTERIM PROTOCOL

USDA Forest Service
Ground-Water Resource Inventory and Monitoring Protocol

Level I Spring Ecosystem Inventory

Introduction

The Spring Ecosystem Inventory Protocol is a component of the *Draft Ground-Water Resource Inventory and Monitoring Plan* intended for use with the Aquatic Ecological Unit Inventory (AEUI) (Hixson et al. 2004) and Terrestrial Ecological Unit Inventory (TEUI) (Winthers et al. 2005) Technical Guide protocols. All data collection will comply with method validation, quality assurance, responsibilities, interagency coordination, and data management and storage requirements as specified in FSM 1940 and FSH 1909. All data will be stored in the Natural Resource Information System (NRIS) with springs organized within the Hydrologic Unit hierarchy.

The hierarchical structure defined by Maxwell et al. (1995) forms the framework for TEUI, AEUI, as well as the Ground-Water Resource Inventory and Monitoring Plan. This structure provides the basic sample unit for data collection and statistical analysis using common terminology. This basic unit is called an Aquatic Ecological Unit (AEU), or Aquatic Unit (AU). Aquifer sites, including springs, sinks, gaining stream reaches, and fens, are the smallest aquatic ecological unit for ground water systems.

Aquifer sites are potential sites of ground-water development and ecological damage and function as major linkages between surface and ground water and their biota. Mapping these features permits these major linkages to be evaluated and enhances protection of water quality and aquatic biota in both systems. Aquifer sites are commonly mapped at the 1:12,000 to 1:24,000 scale.

This protocol is based on protocols described by Sada et al. (2001), Sada and Pohlmann (2005), and Springer et al. (2005). These Level I data elements will, in many cases, require modification due to varying ecological, climatic, and geomorphic conditions in different regions of the country.

The Forest Service has developed goals for maintaining values such as biodiversity and watershed health, and information compiled during Level I inventories provides insight into the condition and biotic potential of individual springs.

In Appendix III is an example of how to use descriptions of biological and physical characteristics to prioritize the management and restoration of individual springs in Clark County, Nevada (Sada et al. 2003). This effort prioritized springs using matrix analyses by

ranking biotic and abiotic elements of each spring (compiled during Level I and Level II inventories), and considering factors important to management.

Purpose of spring inventory and database

The purpose of this inventory and database is to provide fundamental water use and ground-water dependent ecosystem inventory information vital for making Forest Service spring ecosystem and water resource decisions at the Forest or District level. The electronic spring database will provide managers with information about the WHAT, WHERE, CONDITION, and RESOURCE IMPACTS of springs. To acquire the necessary information, a simple form-based, GIS-linked, field inventory must be completed. The inventory is designed to obtain only the minimum essential reconnaissance information required to identify the location, the type and condition of the springs, the location and type of use, aquatic resource concerns, and maintenance needs. Inventory information will be entered into an electronic database to facilitate information display, storage, and analysis. The survey information acquired through this inventory system provides information needed to make water and ecosystem management decisions and has direct application in administering spring water-related special-use permits.

A corporate spring inventory and database has multiple benefits:

1. It provides an electronic depository of spring and other ground-water dependent ecosystem information in a format compatible and accessible by all National Forests.
2. It gives managers the ability to generate GIS-based maps that display the spatial distribution of springs and other ground-water dependent ecosystems at watershed, Forest, and Regional scales.
3. It provides managers with the ability to query individual sites for pertinent resource information useful for making management decisions by directly linking to existing databases, such as State water rights systems, the Forest Service's INFRA, WUTS (water uses and water rights tracking system), and NRIS databases.
4. It provides managers with a database that facilitates the management of easements and special use permits related to springs by identifying facilities that need immediate maintenance to stop ongoing resource damage.
5. It improves the ability to make decisions about future water uses and allocations because it provides for a comprehensive picture of water movement, linkages, and resource impacts and conditions at multiple scales.

Levels of Inventory

Three hierarchical elements comprise the spring inventory and monitoring program described (Level I, Level II, and Level III). Following an office assessment to review previous work on springs within the management unit to be inventoried, the Level I inventory (Appendix I) is conducted to qualitatively locate and characterize springs and other ground-water dependent ecosystem resources within the management unit. These inventories provide qualitative information describing spring characteristics, spring condition attributed to natural

factors and current management practices, and guidance for future management. Level I inventories may be conducted periodically to qualitatively determine temporal changes in biotic and abiotic characteristics a spring, but Level II inventories should be conducted when quantitative monitoring and assessment information is needed. Level II inventories quantitatively describe aquatic habitat, aquatic and riparian communities, and water chemistry. These inventories are limited to priority springs in a management unit that have been identified during Level I inventories. Level II inventories are the core of spring monitoring programs, and they are conducted on a regular basis to determine temporal variation in biotic communities, physiochemical aspects of the environment, and the response of springs to changes in management. When threats to springs with high resource values are identified, Level III inventories may be conducted. These inventories compile highly quantitative information that describes spatial and temporal variation in physiochemical characteristics of springs and the structure of their aquatic macroinvertebrate, vertebrate, and riparian communities. Level III studies also quantitatively describe the abundance, distribution, and habitat preferences for important organisms, and they should be implemented when there are requirements for long term monitoring to address legal challenges, public involvement in controversial management, and to quantitatively assess trends in the status of rare species.

Each of these inventories may be incorporated into monitoring programs to address management issues, and to evaluate management priorities. Level I inventories may be conducted periodically (every 5 to 10 years) to qualitatively assess the condition or extent of change in spring environments and important biota over comparatively long periods of time. Level II inventories quantify water chemistry, the physical environment, and the structure and functional characteristics of aquatic and riparian communities, and they constitute a rigorous monitoring program. These inventories require highly trained personnel to identify plants and animals, and to analyze water chemistry. Selection of sites and the frequency of Level II inventories may differ as a function of management questions and funding. They may be conducted annually for several years to quantify temporal variation in their biota and environments then reduced to once every five years if variability is low and the status of conditions is relatively secure. Level II inventories may also assess long-term changes in spring conditions over a large management area by including springs that are important for management and a number that are randomly selected. The number of springs used during this type of monitoring program should be determined with input from a statistician. Level III inventories are highly quantitative monitoring programs that are conducted at a limited number of sites where detailed information is needed. These inventories should be conducted at site determined by a team of hydrologists and aquatic and riparian ecologists.

Level I Inventory Protocol

Level I inventories survey isolated water features, that include 1) natural springs and seeps (groundwater that flows onto the land surface through natural processes), 2) hand and mechanically dug wells (groundwater that flows onto the land surface because of vertically oriented human excavation), 3) artificial surface water expressions or qanats, (groundwater that flows onto the land surface because of horizontally oriented human excavation), and

flowing adits, 4) ground water emerging in stream channels that supports perennial reaches of streams, and 5) fens which are peat forming ground-water fed wetlands (see Appendix II for more information on fens). Level I inventories are designed to inventory springs by accurately locating them, characterizing salient aspects of their aquatic and riparian environments, and recording the presence of important species. These inventories are reconnaissance level observations that focus on assessing biotic potential to facilitate management and prioritize the relative importance of individual springs within a management area. This information is not highly detailed or is it accumulated in a rigorous manner that allows statistical analysis. Accumulation of highly quantified data requires much more detail, time, and substantially greater funding than is necessary for Level I inventories.

Level I inventories are designed to accumulate basic information describing the biological and physiochemical characteristics of each spring, identify the influence of current management on spring condition, and to guide the management prioritization of individual springs. Basic elements of these inventories recognize that:

- Springs are often difficult to locate, and existing map coordinates may be inaccurate.

- General biotic and abiotic characteristics of a spring can often be determined with relative ease, and without accumulating highly detailed information.

- Biotic and abiotic characteristics of springs are influenced by elevation, spring size, aquifer type, disturbance stressors (natural and anthropogenic), and physiochemical characteristics of aquatic and riparian environments. It is not necessary to quantify these features with detailed accuracy to determine the ecological characteristics of a spring.

- Generally, the taxonomic richness of aquatic and riparian communities is correlated with spring size (larger springs have greater discharge, deeper and wider aquatic habitat, and longer spring brooks) support more aquatic and riparian species than small springs. Ephemeral springs support a distinct, fishless and depauperate aquatic macroinvertebrate community, and riparian communities with low diversity. Persistent springs support aquatic and riparian communities that are more diverse.

- Taxonomic richness and functional characteristics of riparian and aquatic communities are correlated with the amount of environmental stress. Springs highly stressed by anthropogenic disturbances (including excessive livestock grazing, diversion, impoundment, etc.) or natural factors (e.g., affected by scouring floods, periodically dry, naturally high water temperatures or elevated solute concentrations) have fewer species, and more species that are tolerant of harsh conditions (often non-native riparian species and pollution tolerant aquatic macroinvertebrates) than minimally disturbed springs.

Although there are a number of individual elements recorded in Level I inventories, they fall into five categories, which are: 1) Recording inventory date and spring location, 2) Recording several water chemistry parameters, 3) Estimating physical characteristics of the aquatic and riparian environment (e.g., spring brook length, discharge, water depth, vegetative cover, and substrate composition, etc.), 4) Qualitatively assessing the amount a

spring has been altered from natural condition, and 5) Identifying the presence or absence of important animals and plants.

Background Assessment

Springs are valuable resources to the public and the agency. As a result, they have been the subject of a wide variety of resource management programs. Many have been developed for recreational use, (e.g., picnic and camping, roadside facilities, etc.) and to support municipalities and livestock management. Water chemistry data have been collected at some springs during ground water studies, and some have been modified for conservation of rare crenobiontic species. As a result, records are often maintained at State and Federal agencies that shows location, development features, water chemistry, etc. This information should be compiled and organized into a database before field studies are initiated. One of the most valuable data sources for springs are water rights inventories that have identified springs for stockwater, wildlife use, and at recreational sites.

Field Inventory Preparation

Field personnel must be trained by qualified personnel to accurately conduct Level I inventories. This can be accomplished by a classroom and field season that expose field personnel to a wide diversity of spring sizes, types, and disturbances. Field personnel must be supervised to insure data are being properly collected, recorded, and filed. Training must also include safety instruction to prepare field personnel for working in remote regions where water is scarce. A Job Hazard Analysis should be developed for the field work.

Planning and preparation are necessary to conduct Level I inventories. Before going to the field, all equipment must be organized and tested, spare equipment purchased (e.g., batteries), and field forms printed and placed in a protective binder. Additional planning and preparation are necessary if many springs are to be inventoried over several days before returning to the office. Preliminary work should include studying maps and filling in the field form with information that can be compiled before the beginning of a field trip (e.g., spring name, map location, county, state, etc.).

Field Equipment

Limited equipment is needed for Level I inventories. All equipment should be sturdy and able to tolerate rugged conditions of being carried in a backpack or exposed to dust. All equipment should be checked prior to beginning a field trip, extra batteries should be carried, and directions and tools to calibrate instruments should be carried into the field. Calibration frequency and methods should follow manufacturer recommendations. Records must be kept and recorded in a metadata file to describe the manufacturer and model of all equipment used during field inventories. Key equipment necessary for Level I inventories includes:

Inventory form. Copies of the Level I inventory form or, more preferably, a field data recorder should be carried into the field. If forms are used, they should be printed onto ‘write in the rain’ paper.

Maps. Locating springs requires using maps of different scales. Road maps are needed to direct travel on paved roads that lead to remote areas. Greater detail that is provided by USGS topographic maps is necessary to locate dirt roads and geographic features that may be important for navigation to a specific site. While it is often convenient to use 7.5 minute topographic maps, the number required for broad inventories often make using these burdensome. The 100,000:1 scale maps are often sufficient. Maps should be reviewed prior to field work to maximize inventory efficiency.

GPS unit, included with a hand-held data logging system is preferred to minimize recording error.

Dissolved oxygen, pH, conductivity, and temperature meters. Preferred meters are those that are rugged, easy to calibrate, and a single instrument can measure multiple parameters.

Stop watch and several different size containers of known volume (no larger than 2 liters).

Current meter and wading rod.

Portable weir or flume.

100 meter measuring tape and metric ruler.

Geologic map, 10X hand lens, and acid bottle for determining geologic setting.

Camera

Kick-net, dipnet, aquarium net, or kitchen strainer

Forceps

Whirlpak bags, kill jar, and 15 mL glass vials filled with 70% ethyl alcohol for collections of plants, aquatic macroinvertebrates, and insects.

Water sampling equipment (if required).

Preventing Inter-Wetland Translocation of Foreign Material

Isolated springs and wetlands, especially in arid regions, can be occupied by distinctive aquatic communities. While inter-wetland translocation of vertebrates and invertebrates may occur via natural factors, such as transport via waterfowl and mammals, it is also caused by human activities such as recreational bathing, wildlife management, release of aquarium life, and scientific investigation. When caused by humans, translocation frequently results in establishment of non-native species, which has typically been detrimental to native fauna and ecosystem health. Translocation of macroinvertebrates and disease occur readily because many forms are able to live outside of water for extended periods of time. Translocation of

vertebrates is less likely because they require a conscious effort to provide suitable habitat during transport, i.e. sufficient amounts of water to permit respiration and prevent over heating.

This Standard Operating Procedure describes mechanical and chemical methods to prevent accidental translocations that may occur during spring inventories. These methods must be employed upon completion of inventories at each isolated site and before additional inventories are conducted. There are two types of isolated sites: 1) individual, isolated springs, and 2) spring provinces where there is either continuous or periodic (e.g., seasonal) connectivity between springs that naturally permits inter-spring movement of life.

Equipment

- 10 % Clorox solution contained within a leak-proof, plastic bottle (approximately 250 ml that can be carried to remote sites, or 1 L that can be carried in a vehicle).

- Toothbrush and scrub brush (size is unimportant, but the bristles should be stiff and durable. A small brush may be carried to remote sites, and larger brushes may be used when there is vehicle support.

Methods

Every precaution should be taken to avoid wadding and getting shoes wet, which can be accomplished easily during Level I inventories because most springs are small and extensive biological sampling is not an element of the protocol. When wading is necessary, rubber boots must be worn (either hip boots or 'irrigator boots'). Upon completing the inventory, they should be rinsed in water from the spring to remove mud, vegetation, and all other material. Dry the boots, then wash boots in the Clorox solution, and dry again before entering another spring. Precautions should also be taken when shoes are kept dry and wading does not occur. This can be accomplished by using a small scrub brush to buff the soles and sides of shoes and remove all material that may have been gathered from the spring.

Equipment used to collect biological samples is the most likely translocation vector. After completing inventories at each isolated site, all equipment must be: 1) vigorously shaken to remove as much material as possible, 2) treated with Clorox by either dipping into a container and/or using a toothbrush to scrub surfaces and clean crevices where macroinvertebrates may be hidden, and 3) dried in the sun before initiating subsequent spring inventories.

APPENDIX 1

Spring Inventory Form and Instructions

Instructions for Spring Inventory Form

The following elements comprise a Level I spring inventory and are recorded on the data sheet or preferably on an electronic data recorder. All Level I information should be compiled at the spring source, and include the upper 50 m of aquatic habitat (at larger springs). All of the aquatic habitat should be included at springs with spring brooks less than 50 m long.

Site ID Number: The combined UTM zone, easting, and northing readings are the site identifier that is unique for the spring (e.g. 12 4508428N 597017E) in the North American Datum of 1983 (NAD83).

Site Name: This is best determined from a topographic map. Use an official or locally acknowledge spring name, if there is one. If the site is unnamed, record it as 'unnamed' with a brief geographical description that indicates its approximate location, e.g., 'unnamed spring in Willow Canyon'.

Date: Record the month, day, and year in the format MM-DD-YYYY the inventory is conducted.

State: Record the standardized two-letter abbreviation (e.g., CA = California) where the spring is located.

County: Record the county where the spring is located.

Forest: Record the Forest on which the spring is located.

District: Record the District on which the spring is located.

Field Inspection Crew: First initial and last name of individuals conducting inventory. Record the name of the crew leader first.

Start Time: Record the time the inventory is begun using military time.

Drainage Basin and HUC: Record the 6th level (12 digit) Hydrologic Unit Code (HUC) where the spring is located. If the spring is located within a river drainage, list the river drainage basin. If it occurs in an endorheic basin, identify the valley. This information must be compiled from maps, and it may be done while in the field or in the office.

INFRA reference number: If there is a development it should be in the INFRA database.

USGS Quad(s): Name of 1:24000 USGS quad(s) where spring is located.

GPS Make and Model: Record make and model of the Global Position System unit used. Take a picture of the GPS unit and record the photo number.

Global Position System location, and datum: Record the UTM zone in the North American Datum of 1983 (NAD83) of the spring/seep source. Document GPS files in a GPS log. All GIS data layers created from GPS files must include Geospatial metadata. Record PDOP or 'plus or minus' the number of feet/meters as metrics indicating accuracy of the GPS reading. Record if DGPS or WAAS was being received.

Access: The ease at which the public could visit a spring. Categories 1 through 5. Category 1 = inaccessible sites, access only by cross country hiking, Category 2 = sites that can be accessed only by arduous trail hike (e.g., greater than 5 miles), Category 3 = sites accessed by easy trail hike (e.g., 1-5 miles), Category 4 = sites easily accessed by walking less than 1 mile, and Category 5 = sites immediately adjacent to paved road.

Elevation: Use a hand-held meter, GPS system, or interpolate spring elevation from a USGS topographic map. There may be substantial error in all of these measurements, but these data are adequate to 'characterize' site elevation. For more accurate elevations, estimate them from 10-m Digital Elevation Model. Record methods used for elevation in notes section.

Source Location and Photos: Record the location of the spring in both Township and Range and UTM coordinates. Take at least two photos, one looking upstream viewing the spring source, and one looking downstream along the spring brook. At larger springs, take a photo of the source and a second from a distant area that encompasses as much of the riparian area as possible. At developed springs take photos of structures. Photos should be labeled by Site ID number, photo number, date, time, site name, and UTM coordinates for each photo. Photos should be taken using a digital camera. Maintain a photo log with digital photograph number and description. Take a photo of the GPS unit displaying location and time.

PHYSICAL CHARACTERISTICS

Geomorphic Setting: Choose the best descriptor of the geomorphic setting of the subaerial emergence environment. **Channel -** in active channel and may support a perennial or gaining reach of stream; **Floodplain -** on floodplain above banks of active channel; **Stream Terrace -** one of a series of level surfaces in a stream valley, flanking and more or less parallel to the stream channel, originally occurring at or below, but now above, the level of the stream, and representing the dissected remnants of an abandoned flood plain, stream bed, or valley floor; **Cliff -** Any high, very steep to perpendicular or overhanging face of rock; a precipice; **Flat -** in flat area with no discernable channel; **Hill Slope -** on side of long slope; **Saddle -** a low point in the crest line of a ridge, commonly on a divide between the heads of streams flowing in opposite directions; **Draw -** a sag or troughlike depression leading up from a valley to a gap between two hills; **Bench -** a long, narrow, relatively level or gently inclined strip or platform of land, earth, or rock, bounded by steeper slopes above and below; a (non-stream) terrace or step-like ledge breaking the continuity of a slope; **Ravine -** a small, narrow, deep depression, usually carved by running water; esp. the narrow excavated channel of a mountain stream

Slope Position: Choose the best descriptor of the slope position of the subaerial emergence environment. **Shoulder -** the convex part of a mountain or hill immediately below the summit; **Backslope -** the part of the mountain or hill slope between shoulder and foot;

Footslope - the base of the mountain or hill slope; the first obvious slope break above the drainage channel, this is a very common location for springs to emerge; **Toeslope -** the lowest nearly level part of a slope immediately adjacent to the drainage channel.

Orifice Geomorphic Type: Identify the geomorphic type for the spring orifice(s) from the following choices (Fetter, 2000). **Seepage** - groundwater exposed or discharged from numerous small openings in poorly consolidated and permeable material; **Fracture/Joint** - groundwater exposed or discharged from bedrock fractures or joints; **Tubular -** groundwater discharged from solution passages or tunnels; **Contact** - flow discharged along a stratigraphic contact (e.g., a hanging garden); **Fault –** groundwater exposed or discharged from a fault; **Sinkhole** - formed where water dissolves the limestone beneath the surface and creates a sinkhole. If the sinkhole is deep enough for the water table to reach the surface, then a sinkhole spring is formed.

Spring Type: Choose the best descriptor for the spring type. **Rheocrene** - a spring that discharges into a defined channel; **Limnocrene -** a spring that discharges into a ponded or pooled habitat before flowing into a defined channel; **Helocrene -** similar to a Limnocrene, but marshy and comparatively shallow, not an open pond or pool; **Mound** - emerges from a carbonate precipitate mound; **Fen -** peat forming wetland fed by ground water. Indicate if the fen is patterned (contains a series of pools) (see Appendix II); **Stream Baseflow** - emerges in the bottom of a stream channel and maintains a perennial reach of stream; **Hillslope** - emerges from a non-vertical hillslope at 30-60 degree slope and usually has indistinct or multiple sources; **Hanging Garden** - complex, multi-habitat springs emerging along geologic contacts and seep, drip, or pour onto underlying walls; **Gushette** - pour from cliff faces; **Geyser** - periodic thermal spring resulting from expansive force of super-heated steam within constricted subsurface channels; **Cave** - emerges entirely within a cave environment and not directly connected to surface flow; or unknown. In some areas, springs have been altered by native peoples or settlers by excavating the source to create a **Qanat**, which is a type of hand-dug well. Where these occur, water is regionally scarce. **Sinking Stream** - ground water recharge locations formed by solution of bedrock or semi-consolidated sediments. Also record if a site is a mechanically dug **Well** (usually with rock, metal, or plastic casing), a flowing mine **Adit,** or a **Hot Spring.** Record **Other** when the source is something else, such as a cliff face, boil, etc. Examples of disturbances that prevent identifying spring type include impoundment by dikes, sources in a spring box, or dredging and filling to capture water in a pipe leading to a trough. Spring alterations and spring condition are assessed, and recorded, in the "Site Condition" section below. If further description is necessary, it can be summarized in the Notes Section.

Primary Lithology of Source: Describe the primary lithology of the aquifer from which the spring water is emanating. Springs frequently emerge from talus or other unconsolidated material at the base of a slope. If this is the case try to determine the upgradient geologic unit that the spring water is origination from.

Discharge: Record discharge rate and units, and the method and instrument used to determine discharge.

It is difficult to estimate the discharge of most springs because they are small, water is usually shallow and broadly and unevenly spread over a wide area, and areas with moving water are often very limited. Because discharge often changes throughout the day, seasonally, or annually, this minimizes the effectiveness of single measurements to precisely quantify long-term discharge characteristics. These estimates combined with water width, depth, and spring brook lengths provide information to characterize spring discharge rates.

Measurement of spring discharge will vary from site to site. Therefore a variety of methods for measuring discharge are presented and discussed. The field investigator will first need to evaluate and determine the appropriate methods on a case-by-case basis. The following table lists the various instruments recommended for a range of discharge conditions. Three additional methods (with lower accuracy) are listed (float velocity and visual estimation) but are not recommended to be used - unless as last resort.

Recommended Approaches to Discharge Measurement

Discharge (gpm)	Discharge (metric)	Instrument(s)
No discernable	No discernable	Depression
< 0.12	< 10 mL/s	Depression, volumetric
0.12 to 1.0	10 to 100 mL/s	Weir, Volumetric
1.0 to 10.	0.10 to 1.0 L/s	Weir, Flume
10 to 100	1.0 to 10. L/s	Weir, Flume
100 to 448.8	10. to 100. L/s	Flume
448.8 to 4,488	0.10 to 1.0 m^3/s	Current meter
4,488 to 44, 880	1.0 to 10. m^3/s	Current meter
> 44,880	> 10. m^3/s	Current meter

Note: of all of the instruments listed, the flume is the largest and most difficult to pack into backcountry. It should only be used in the back country if it is essential to obtain an accurate measurement or if the spring has a discharge magnitude making a flume the optimal instrument.

Measure the quantity of water discharging from the spring with one of the methods listed above and described below. The name, serial number (if available), and accuracy of the instrument used to measure discharge should be recorded as well as any other important observations. Important observations may include the markers of any recent high discharges, such as high water marks, oriented vegetation or debris on or above the channel or floodplain. If there is a single channel, measure discharge in this single channel as close as possible to the spring orifice. If there are multiple channels, and if they all converge to a single channel, measure discharge in the single channel as close as possible to the confluence of all of the multiple channels.

- *Portable weir plate procedure (Buchanan and Somers, 1969):* The weir has a "v" notch, or other regular geometric shape through which all discharge in the channel must be focused. The weir should have a scale on the weir which directly reads discharge and have a solid plate below the notch which is driven into the loose material of the stream bed material.

Weirs do not work in bedrock channels or channels with bed material coarser than fine gravel without a significant amount of channel modification. To use a weir in a bedrock channel or channel material coarser than gravel, the channel must be significantly modified for weir emplacement. Once placed in the channel, the weir is leveled using a bubble level. The top of the weir plate is made horizontal and the plate must be plumb. Flow through the weir is allowed to stabilize prior to measurement. Gage height is recorded 3 to 5 times over a 3 to 5 minute interval, as appropriate. The mean is calculated from the three replicated and recorded. The volumetric discharge (L/s) is calculated using a standard equation specific to the weir plate being used. The accuracy of the weir is dependent on the size of the notch in the weir and the resolution of the scale on the weir.

- *Current meter procedure (Buchanan and Somers, 1969):* Typically, current meters are necessary in springs or in wide channels or high discharge channels where flow can not be routed into a weir or a flume. Measurement locations are selected in a straight reach where the streambed is free of large rocks, weeds, and protruding obstructions that create turbulence; and with a flat streambed profile to eliminate vertical components of velocity.

  In the making of a discharge measurement, the cross section of the channel is divided into 20 to 30 partial sections, and the area and mean velocity of each section is measured separately. A partial section is a rectangle whose depth is equal to the measured depth at the location and whose width is equal to the sum of half the distances of the adjacent verticals. At each vertical, the following observations are recorded on the data sheet, (1) the distance to a reference point on the bank along the tag line, (2) the depth of flow, (3) the velocity as indicated by the current meter. The velocity should be measured at a depth which is 0.6 of the depth from the surface of water in the channel. The discharge of each partial section is calculated as the product of mean velocity times depth at the vertical times the sum of half the distances to adjacent verticals. The sum of the discharges of each partial section is the total discharge.

  Measurements are made by wading the stream with the current meter along the tag line. The person wading the channel should stand downstream of the velocity meter. Because of the safety involved in wading a channel, the person wading should not wade in too deep of water or should not use hip waders in swift water without the use of a safety rope or other appropriate safety gear.

- *Portable Parshall Cutthroat Flume procedure (Buchanan and Somers, 1969):* Flumes work best in low gradient channels with fine-grained bed material. Flumes may be heavy and difficult to pack into back country. The wing walls of the flume are pointed upstream in the channel in such a fashion as to focus as much flow as possible through the regular profile of the opening of the flume. The flume requires free fall of water out the downstream end of the flume. The flume is set in a channel of loose material. A bubble level is used to make sure the flume is level. The floor of the upstream section is leveled both longitudinally and transversely. Flow is allowed to stabilize prior to measurement. Gage height is recorded 3 - 5 times over a 3-minute interval. A standard rating curve for the flume is used to translate gage height to discharge. The mean value for discharge (L/s) is calculated

and recorded. Accuracy of the instrument is dependent on the scale on the flume. On some occasions, it may not be possible to capture 100 % of the discharge in the flume. If less than 100 % of the discharge is captured by the flume, the percent of flow captured by the flume should be estimated by for each of the 3 to 5 measurements and recorded. A correction to the discharge measurement should be made to account for the percent of discharge not captured by the flume.

- *Volumetric measurements procedure (Buchanan and Somers, 1969):* Volumetric measurements are typically used where there is a pour off, or other features that allow flow to be easily captured in a volumetric container. A temporary earthen dam is constructed using earth and nonpermeable materials. Water is diverted through the temporary earthen dam with a temporary pipe or constructed channel. Flow is allowed to stabilize prior to measurement. A volumetric container is used to catch discharge from pipe. The time to fill the container is recorded. Flow is recorded 3 to 5 times over a 3 to 5-minute interval, as appropriate. The mean value is calculated (ml/s) and recorded on the datasheet. Accuracy of the instrument is dependent on the accuracy of the volumetric container. A suite of varying size of containers appropriate for first to second magnitude discharge springs should be taken to the field site. When not used for volumetric measurements, the containers can be used to help pack various other field gear used for the rapid assessment.

- *Depression/sump procedure**:*** This method is typically used for unmeasurable springs with little to no surface expression of flow. A depression is constructed in the seep area. The volume of depression is calculated using volumetric calibration or calculation. The volumetric containers used for the volumetric measurement may be used to estimate the volume of the depression. The depression is evacuated, and the time required to fill depression is recorded. This procedure is repeated 3 to 5 times and the mean value is recorded as the measurement.

- *Float velocity procedure (Buchanan and Somers, 1969) (only recommended as last resort):* Two cross sections are selected and marked with flagging along a reach of straight channel. The distance between the two sections is measured with the measuring tape. The width and depth of each channel cross section is measured with the tape measure and recorded. Cross section locations are separated to allow for a travel time of >20 sec float time (if possible). A float (i.e., an object with the density of an orange is ideal) is placed in the stream channel and allowed to reach stream velocity before the upstream cross section is crossed. The position of the float relative to the channel sides is noted. The float is timed between the two cross sections. The position of the float is noted as it crossed the downstream cross section. This procedure is repeated 3 to 5 times, as the float is placed at different locations across the channel at the upstream cross-section. The velocity of the float is equal to the distance between the cross sections divided by the travel time. The mean value of surface horizontal velocity (m/s) is calculated. To convert mean surface velocity to mean vertical velocity a coefficient of 0.85 is multiplied by the mean surface velocity. Discharge (m^3/s) is calculated by multiplying the value of mean velocity by the average area of the section of the stream channel measured.

Float Method	

Reach length:		
Trial	Time elapsed	Velocity (reach length/time)
#1		
#2		
#3		
Average velocity x 0.85:		

- *The visual estimate procedure (only recommended as last resort):* Site conditions, such as dense vegetation cover, steep or flat slope, diffuse discharge into a marshy area, and dangerous access sometimes do not allow for a direct measurement of discharge by the techniques listed above. Although visual estimation is imprecise, it may be the only method possible for some springs. Photographs should be taken to record the surface area wetted or covered by water and observations recorded on the datasheet. Also, it should be noted if another method could be recommended for future site visits to measure discharge.

Habitat Size: The habitat is the area dominated by obligate and facultative vegetation types. In order to measure the area of spring habitat either use a 100 meter tape to measure the length and width of a site or pace the length and width with a known gate. Measuring habitat size should be conducted with as little disturbance to the site as possible. If a habitat type is inaccessible estimate the area.

Spring Brook Length: Use a tape to measure distance from the spring source (upstream limit of surface water) to the downstream limit of surface water or where it enters a larger channel. In some case this nay be a considerable distance and can be best measured from maps.

Average Water Depth: A qualitative estimate of the vertical distance from substrate to water surface that is found throughout the aquatic habitat.

Average Water Width: A qualitative estimate of the distance covered by water (and perpendicular to its flow) that lies between banks of the spring brook, less islands, emergent rocks, etc. (This is formally described as the length of wetted contact between flowing or standing water and the spring brook bank in a vertical plane at right angles to the direction of flow).

Percent of Emergent Cover: Estimate to the nearest 10 percent the vegetative, debris, or other material that arises within the water width and covers the water surface. Conduct ocular estimate calibration at the beginning of inventory projects and periodically throughout the life of the project.

Percent of Vegetative Bank Cover: Estimate to the nearest 10 percent the proportion of spring brook banks that is covered by live vegetation. Conduct ocular estimate calibration at the beginning of inventory projects and periodically throughout the life of the project.

Spring Brook Incision. Rate banks as being incised (positive) when bank angle >60 degrees from vertical, and not incised (negative) when bank angles are <60 degrees from vertical. For spring brooks, bank incision is generally an indicator of stability and the absence of trampling activities.

Substrate Method: Rocord the method used to determine substrate composition. The Wolman Pebble Count procedure as described in Bunte and Abt (2001) can be used to obtain a representative sample of the particle size distribution and the median diameter. Alternatively, visually describe the substrate by the proportional composition of materials.

Substrate Composition: Substrate size distributions can provide an indication of relative suitability of the spring brook habitat for various aquatic organisms. Changes in particle size distribution can be correlated with impact of land management activities and natural disturbance. Describe the substrate by the proportional composition of materials, where materials are classified as: Fines (<0.05 mm), Sand (0.05 mm - 2 mm), Gravel (2 mm - 64 mm), Cobble (64 mm - 256 mm), Boulder (>256 mm), bedrock, or peat. Size is defined as the intermediate dimension (b-axis), as would pass through a sieve. Record the presence of peat (peat is present in fens).

WATER CHEMISTRY

Field water-quality measurements from spring sites should be taken as close to the orifice as possible. Basic sampling strategy should be guided by the USGS National field manual for the collection of water-quality data (U.S. Geological Survey, variously dated). Laboratory analysis must be done by certified labs using Standard Methods for the Examination of Water and Wastewater (WEF, AWWA, APHA 1998). Note any red/orange staining or discoloration that could indicate acid rock drainage. Also note the presence of light-colored travertine precipitates that could indicate deep circulation of water.

Dissolved Oxygen Concentration: Measure D.O. in mg/liter using a field meter. The meter should be kept clean, with fresh batteries, and calibrated daily following the manufacture's recommendation. All water chemistry parameters should be measured as close to the spring source as possible and in flowing water if available. Note the location of the measurement if not taken at the source.

Water Temperature. Water temperature is an important factor structuring aquatic communities, and may give insight into source waters. This measurement (record in degrees Centigrade) is easily taken with a meter used to measure dissolved oxygen or conductivity, and it is necessary to calibrate some analytical meters (e.g., conductivity). Calibration is not necessary for temperature measurements using a high quality meter.

pH: pH is the measure of hydrogen ion activity, which indicates the acid/basic qualities of water. Low (<6.5) and high (>8.0) ph environments are stressful to aquatic life. pH can be measured using a hand-held field meter that can be calibrated (such as Oakton, pHtestr2). The meter should be kept clean, with fresh batteries, and calibrated daily following the

manufacture's recommendation. These meters generally have a limited life, and a backup meter should always be carried.

Conductivity: (also called electrical conductance) Conductivity is measurement of the ability of an aqueous solution to carry an electrical current. This ability is dependent on the amount of dissolved ions, and is therefore an indicator of total dissolved solids in the solution. Conductivity provides insight into water sources and it is important to aquatic life because of requirements to maintain osmoregulatory balance. Conductivity is measured using a filed meter and recorded in microsiemens/centimeter (uS/cm). The meter should be kept clean, with fresh batteries, and calibrated daily following the manufacture's recommendation. Most high quality meters do not require frequent calibration.

BIOLOGY

Important Animals: Note the presence of important animals and identify the species, if possible (most field personnel will be unable to identify species, but the presence of animals within any of the groups on the form should be recorded). Important species occupy a wide variety of habitats, and they may be very scarce or abundant. Most species can be easily captured using a kitchen sieve to sample aquatic vegetation, debris, or the substrate. Each species prefers a distinct microhabitat, and sampling must collect from all types of habitat that occur in a spring. Note presence of other important species, such as bats. List species only when identification is certain. Circle species on the list provided. Modify the list to include appropriate species if necessary. Macroinvertebrates can be collected or photographed for later identification.

Important Native Vegetation: The Regional vegetation steward should develop a list to include appropriate taxa for the ecoregion to be inventoried. The Natural Resources Conservation Service (NRCS) PLANTS database symbols are the standard national coding system for plants and can be accessed at http://plants.usda.gov/. NRCS PLANTS has symbols for the Genus level when species cannot be determined. All plant symbols in the NRCS PLANTS database are valid choices. Some typical spring habitat species include rushes [Family Juncaceae], cattails (*Typha* sp.), reeds (*Scirpus* sp.), watercress (*Rorippa* sp.), spikerush (*Eleocharis* sp.), sedges (*Carex* sp.), yerba mansa (*Anemopsis californic*a), mesquite (*Prosopis* sp.), wild rose (*Rosa* sp.), cottonwood (*Populus freemonti*i), willow (*Salix* sp.), or other wetland obligate or facultative vegetation in the spring brook or riparian zone. Important moss species may also be identified, particularly for fens, such as sphagnum moss (*Spagnum spp.)*, mosses belonging to the genus *Meesia*, sundew (*Drosera spp*.), as well as brown mosses (see Appendix II).

Important Vegetation: The Regional vegetation steward should develop a list to include appropriate taxa for the ecoregion to be inventoried. The Natural Resources Conservation Service (NRCS) PLANTS database symbols are the standard national coding system for plants and can be accessed at http://plants.usda.gov/. All plant symbols in the NRCS PLANTS database are valid choices. Some typical spring habitat species include rushes [Family Juncaceae], cattails (*Typha* sp.), reeds (*Scirpus* sp.), watercress (*Rorippa* sp.), spikerush (*Eleocharis* sp.), sedges (*Carex* sp.), yerba mansa (*Anemopsis californic*a),

mesquite (*Prosopis* sp.), wild rose (*Rosa* sp.), cottonwood (*Populus freemonti*i), willow (*Salix* sp.), or other wetland obligate or facultative vegetation in the spring brook or riparian zone.

Non-Native Species: Note the presence of non-native species of plants and animals. Non-native plants that most likely occur at arid land springs include salt cedar (*Tamarisk* sp.), palm trees (Family Arecaceae), arundo (*Arundo dona*x), and white top (*Cardaria pubescen*s). The most likely non-native animals include mosquito fish (*Gambusia affinin*s), bass (*Micropterus* sp.), trout, crayfish, red-rimmed melania (*Melanoides tuberculat*a).

Collections Made: Record any plants or animals collected for further identification. Record collection number, examiner, and date on the collection. Assigning collection numbers allow samples to be easily related back to field forms or database entries later.

SITE CONDITION

Site Condition: Categorize each spring as undisturbed, slightly, moderately, or highly disturbed, and circle the appropriate category on the inventory form. Springs with these levels of disturbance appear as follows:

- *Undisturbed* springs have been unaffected by recent or historical factors or activities. All evidence of trampling by domestic livestock, diversion, fire, or drying is absent. Since most springs have been altered by humans, drought, fire, or flood, these types of springs are rare and most undisturbed springs are naturalizing from past disturbances.

- *Slightly Disturbed* springs exhibit little evidence that vegetation or soil have been disturbed. Vegetation shows slight signs of browsing and foraging, and animal footprints and scat are present by not prominent. Recreation may be evident, but its impact on riparian or aquatic environments is minimal. Evidence of fire or flooding in the distant past may be visible but these events occur infrequently; riparian vegetation is vigorous.

- *Moderately Disturbed* springs exhibit evidence of recent, comparatively high disturbance. Use by native and non-native ungulates, and recreation has reduced vegetation height and coverage from natural conditions. Vegetation covers, hoof prints, footprints, and scat are common. Where there has been diversion, spring box may be present but at least 50% of natural discharge remains within the natural spring brook. Neither the spring nor spring brook has been impounded. Where flooding or fire is apparent, >50% of the spring brook banks are covered by vegetation; flood and fire are infrequent and the spring in naturalizing.

- *Highly Disturbed* springs have little similarity to undisturbed springs. <50% of their banks are covered by vegetation, their spring brooks contain <50% of natural discharge, they are impounded or dredged, or spring boxes collect water. All impounded springs are highly disturbed because flow has been interrupted and functional characteristics of the aquatic system highly altered. Hoof prints and scat are abundant where ungulate use is heavy, and campsites are large, trashy, and vehicle use evident. These activities have decreased

vegetative cover of spring brook banks to <50%. Riparian vegetation is sparse at springs recently affected by fire or flooding, there is recent evidence of elevated discharge, and spring brooks are usually incised.

Disturbance Type: This evaluation qualitatively identifies 1) disturbance factors stressing a spring. Harsh chemical conditions are not noted in this section, but can be easily determined from water quality and conductance measurements. Determine factors causing stress by looking for evidence of natural and human caused disturbances. Influences of flooding are indicated by location of a spring in the bottom of a gully, presence of a naturally incised channel, and usually a paucity of vegetation. The presence of pipes, dikes, or spring box indicates modifications for diversion. Abundance of hoof prints and droppings, and evidence of grazing indicates ungulate use of a spring. The presence of campsites and trash indicates recreation. The most common stressing factors are shown on the field form, and the appropriate factor(s) should be circled. Disturbance may be influenced by multiple factors such as, intensive livestock grazing around a trough, heavy recreation use along a spring brook (that tramples vegetation) where water is channelized away from areas used for picnicking. Circle each appropriate factor. If other factors are evident, circle "Other" and briefly describe in the Notes Section.

WATER USES

Water Right No. and Status: Record as none, applied, permit number, or water right number.

Tributary To: If the spring brook enters another stream, record the name of the stream.

Volume and Percent Diverted: Record the volume and percent of water being diverted to troughs, tanks etc. at time of inspection. Circle whether you estimate (visual) or measure (e.g. flow meter). Inspect flow upstream and downstream of diversion as well as water in the conveyance to determine percentage being diverted. Estimate to the nearest 10%.

Point of Diversion (POD): GPS the location of the point of diversion.

Point of Use (POU): GPS the location of the point of use.

Development Type: Record the type and size and condition of troughs, spring boxes, ponds, and piping, etc.

Uses: Circle the type of use.

Condition and Maintenance Needs of Developments: Record the condition and maintenance needs of troughs, spring boxes, ponds, and piping, etc. An evaluation of the type, condition and maintenance needs of fencing and gates is important in maintaining desired spring conditions. Fencing specifications vary for different types of animals to be excluded. For instance, wild horses and burro exclusion require higher fencing standards than cattle. Fencing requirements also vary for bighorn sheep verses antelope.

Record Notes to include additional pertinent information. This may include observations further describing site condition, use of the spring by other animals (e.g., bats, deer, etc.), clarification of difficulties in accessing the spring, etc.

Directions to Site. Give precise access directions to the site beginning with a landmark (e.g., a named point on the topographic map, a major highway, marked trailhead) readily locatable on a 7.5 minute topographic map as the starting point. Use clear sentences that will be understandable to someone who is unfamiliar with the area and has only your directions to follow. Give distances and use compass directions. Be aware of the ambiguity of words like "above", "near", beyond", "on the back side of", "past". If site locations lack major landmark features as guides, use township, range and sections from the topographic maps. Although the sample spring sites will not be permanently marked, others may want to be able to relocate them for long-term monitoring purposes. Careful documentation of the access route, obvious landmarks and vegetation is therefore extremely important.

Draw a Sketch of the Spring. This is very important in spring provinces where sample sites may be close to one another and map/GPS coordinates weakly describe the relative location of sample sites. The following items will be captured and documented on the sketch map for each site:

- Approximate locations/dimensions of each geomorphic/habitat surface
- Spring orifice and paleo-spring orifice
- Channel location
- Channel structural controls
- Pool locations
- GPS Reading Location
- Photo Points
- Location of Water Quality Measurements
- Indication of north (true or magnetic)

1.

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APPENDIX II

Identifying Fens

Identifying Fens

Nationwide classification of wetlands in the USA is presently defined by the National Wetland Inventory system (Cowardin et al. 1979), where fens and bogs are included in the palustrine system, but little is said to distinguish fens as a unique entity. Peatlands are generally divided into two main categories, bogs and fens, although the use of these terms varies (Bedford and Goodwin 2003). For the purposes of this protocol fens are separate from bogs based upon their hydrologic characteristics. Bogs are fed almost entirely by atmospheric precipitation, while fens are fed primarily by ground water, although they receive precipitation as well. Fens are wetlands distinguished by their strong connection to ground water. A wetland whose vegetation, water chemistry, and soil development are not determined, in large part, by the flows of ground water to is not a fen.

Many different definitions for fens exist. Some emphasize water source; others emphasize water chemistry, vegetation, or type of substrate. For the purposes of this protocol, we define fens as **wetlands that develop where a relatively constant supply of ground water to the plant rooting zone maintains saturated conditions most of the time and the water chemistry reflects the mineralogy of the surrounding and underlying soils and geological materials** (Bedford and Godwin 2003). Like many factors structuring ecosystems, the degree to which ground water dominates fen water budgets is a continuum. In all cases however, the influence of ground water exceeds that of precipitation and surface water, either in quantity or in terms of effects on water chemistry in the plant rooting zone. Fens do not experience prolonged inundation and generally have carbon accumulating substrates (Amon et al. 2002).

Distribution

Most basically, fens are ground-water-driven systems. Their hydrology, water and soil chemistry, and vegetation, as well as their function in the landscape, are determined in large part by the fact that they occur where ground water discharges to the plant rooting zone (Bedford and Godwin 2003). Fens tend to occur where climate and hydrogeologic setting sustain flows to the plant-rooting zone of mineral-rich ground water. They may occur on slopes, in depressions, or on flats (Brinson 1993). Frequently, fens occur at stratigraphic and/or topographic breaks that create hydrologic gradients causing ground water to reach the land surface.

In the United States, fens occur in almost every state but are more common in the glaciated Midwest (Amon et al. 2002) and Northeast, as well as portions of the Appalachian Mountains and mountainous West (Cooper and Andrus 1994; Chadde et al. 1998). Fens were found only at higher elevations in the southern, drier part of the U.S. The average elevation of the fens on the Inyo and Sequoia National Forests is 3,000 to 3,200 m, on the Lassen and Plumas National Forests fens occur at an average elevation of 1,700 m, (Cooper and Wolf 2005) and above 2700 m on the Ashley and Wasatch-Cache National Forests.

Water Chemistry

Fens may be acidic to alkaline, have pH ranging from 3.5 to 8.4, and may support calcicole or calcifuge plant species (Bedford and Godwin 2003). Depending on the flow rates and chemistry of ground water reaching the plant rooting zone, fens may be slightly acidic (poor fens), circumneutral (rich fens), or strongly alkaline (extreme rich fens, marl fens). Poor fens may arise either because ground water accounts for only a small fraction of their annual water budget or because ground water inputs move through non-calcareous materials with low solubility (e.g., gneiss, granite) or low buffering capacity (e.g., sand, quartz). In areas where ground water is supersaturated with respect to iron, iron hydroxides or iron sulfides may precipitate in the plant rooting zone and have a low pH typical of poor fens. Some fens, have so much iron in discharging ground water that ‘‘bog iron’’ (i.e., goethite, an iron oxyhydroxide) is precipitated.

At the other end of the continuum, extreme rich fens and marl fens arise where carbonates precipitate at the fen surface. Fens receiving high flows of calcium-rich water are called calcareous fens and support a distinct flora of plant species called calcicoles because of their affinity for calcium-rich sites (Almendinger and Leete 1998a and b, Olivero 2001). As ground water rich in calcium bicarbonate discharges to the surface at high rates, decreases in the partial pressure of CO_2 cause carbonates, such as calcite and calcium or magnesium carbonate (marl), to form in the plant rooting zone (Boyer and Wheeler 1989). Calcareous fens are confined to areas where the bedrock consists of limestone, dolomite, or sandstone containing dolomite and limestone. Rich fens lie in the middle of this continuum.

Vegetation

Fens are among the most floristically diverse of all wetland types, supporting a large number of rare and uncommon bryophytes and vascular plant species, as well as uncommon animals including mammals, reptiles, land snails, butterflies, skippers, and dragonflies (Bedford and Godwin 2003). In general, the vegetation of fens is dominated by bryophytes, sedges (Carex and several other genera of the Cyperaceae), dicotyledonous herbs, and grasses. The vegetation of poor fens associated with peatlands more closely resembles that of bogs, with Sphagnum mosses and ericaceous shrubs dominant. Rich fens, however, are dominated by sedges and brown mosses (mostly Amblestegiaceae), with many distinctive species of dicotyledonous herbs.

Fen Landforms

In general, fens occur at stratigraphic and/or topographic breaks that create hydrologic gradients causing ground water to reach the land surface. Fens form in several geomorphic settings, (1) basins/lake edge, (2) slopes, (3) spring mounds, (4) geologic contacts and (5) valley floors (Amon et al 2002; Cooper and Wolf 2005). Basin or lake edge fens originated as lakes or ponds, and formed as the pond was filled with partially decomposed plant remains (Fig. 3). They are typically flat, and open water may occur. Basin fens are widespread, may be quite large, and typically have floating mats that quake. *Sphagnum spp. is* common, as well as vascular plants.

Sloping fens are a very common type, and form at the base of hills where ground water discharges to the surface, as illustrated in Figure 1. Sloping fens can also occur on hillslopes where ground water discharges from alluvial fans, glacial moraines, permeable fault or fracture systems and other aquifers. Slopes can be steep or gentle, and although small pools may occur, large areas of open water are never present. This type of fen is common in the mountains of the western U.S.

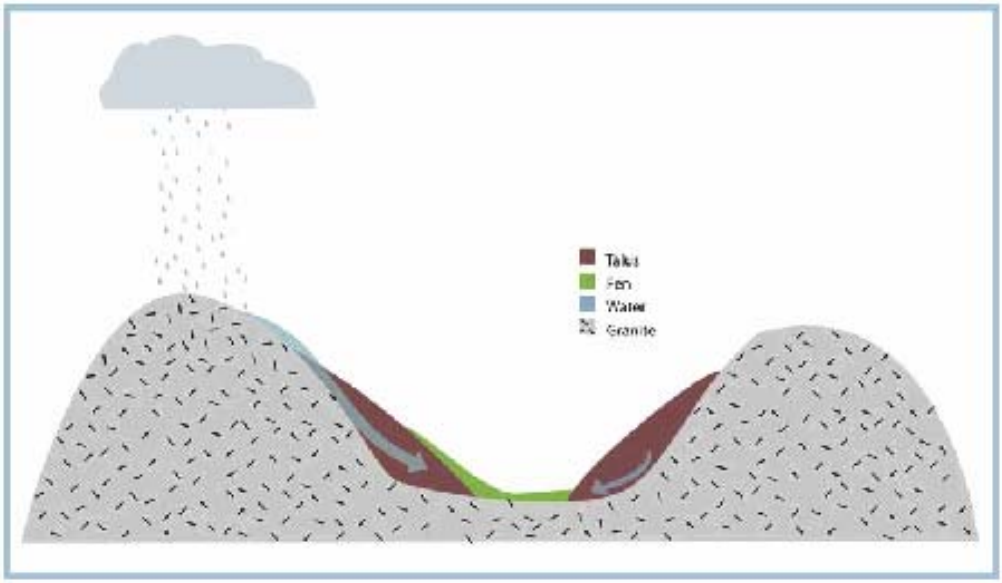

Figure 1. Sloping fen complex, green areas, at toe of slopes. (from Cooper and Wolk 2005)

Spring mounds, which are localized points of groundwater discharge, often support small fens (Fig. 2). Many spring mound fens are only tens of m in diameter, but they are morphologically and ecologically distinct. Spring mound fens may form within a sloping fen complex, and indicate a location of strong upward groundwater discharge and may also form over aquifer windows where a breach in a less permeable unit exposes a confined aquifer below (Fig. 3).

Fens may form at a contact between two rock types particularly where a highly permeable rock unit overlies an impermeable unit. Infiltrating ground water can be prevented from downward movement by the presence of a less permeable unit, forcing the water to move laterally where it can be discharged at the sloped surface. Fens of this type are common in the southern Cascade Range where ground water discharges from the bottom of lava beds.

Patterned fens are a unique type of fen characterized by a series of raised, linear hummocks oriented perpendicularly to the slope of the fen. These ridges, or strings, are separated from one another by linear pools of water known as flarks.

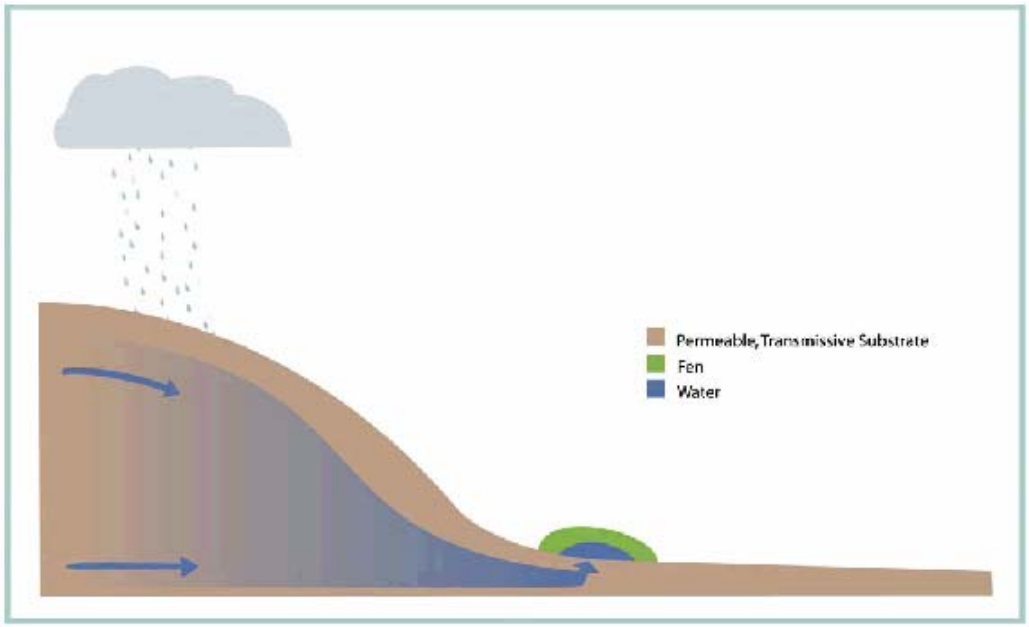

Figure 2. Diagram of spring mound fen. (from Cooper and Wolk 2005)

Disturbances and Condition of Fens

Few estimates of loss and current extent exist, but where estimates are available, they indicate extensive loss, fragmentation, and degradation. Two main types of disturbances to fens are hydrologic disturbances, and vegetation changes (Cooper and Wolk 2005). The development of channels that act as ditches can lead to drying of fens resulting in the oxidation of peat, and tree invasion. This is the most serious type of impact to fens, as sites are no longer saturated for long duration to the soil surface, and function more as wet meadows then fens. The peat body is then susceptible to burning during local forest fires. Floristic changes due to hoof punching and invasive species result from high livestock use. An additional concern is that logging should not occur within a distance that is one tree height of fens, because the additional of wood is a key component of fen organic matter, creates diverse habitat, and influences the hydrologic regime of fens by blocking drainages. Application of impermeable surfaces in the recharge area, and water withdrawal from the aquifer may alter the depth to water table and thus influence moisture in the root zone. Road building and pipelines alter the natural hydrologic
regime. With ground water no longer controlling the surface hydrology, rainfall can flush away mineral richness, and oxygen can penetrate into surface layers, eventually producing a non-fen successional environment (Siegel 1992).

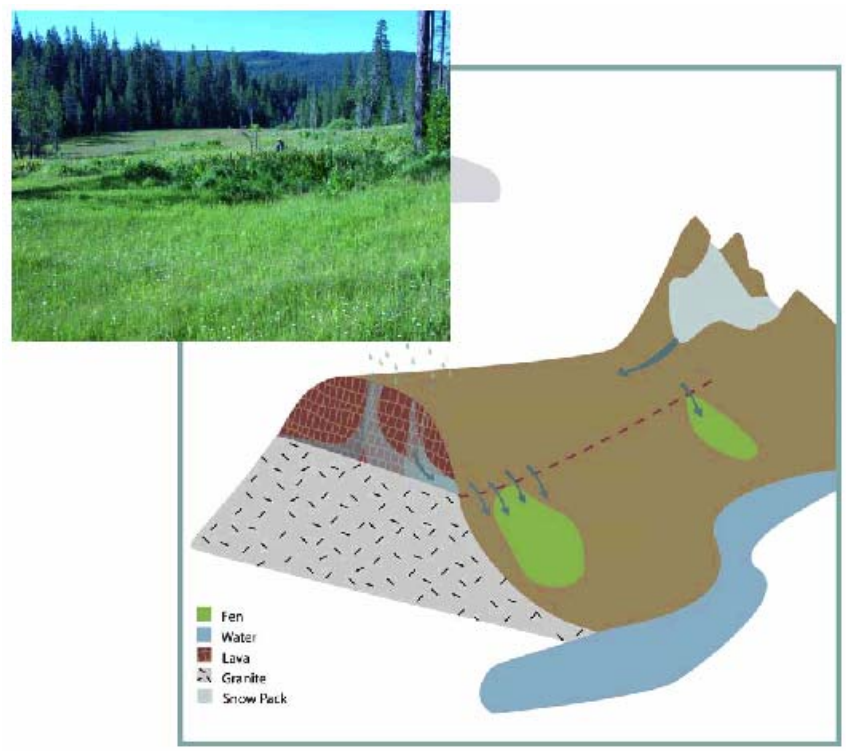

Figure 2. Diagram of fen formed where ground water discharges at the contact between two rock units. Inset photograph shows a fen, where large volumes of ground water flow from lava beds to the right of the photo. (from Cooper and Wolk 2005)

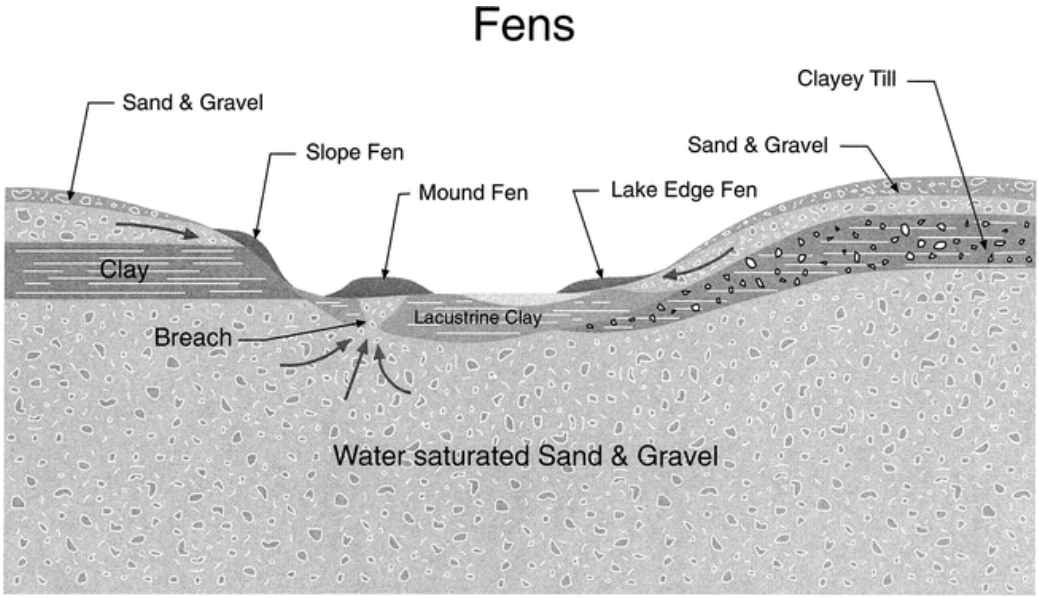

Figure 3. Geologic settings for Midwestern USA fens. Permeable deposits transmit ground water to the surface on hillsides to form slope fens, upward through openings in confining strata to form mound fens, and to the perimeter of lakes to form lake edge fens. (from Amon et al. 2002)

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APPENDIX III

Using Inventory Data to Set Management and Restoration Priorities

Management goals can be integrated with descriptions of biological and physical characteristics to prioritize spring management and restoration programs. The Forest Service has developed goals for maintaining values such as biodiversity and watershed health, and information compiled during Level I inventories provides insight into the condition and biotic potential of individual springs.

An example of this integration comes from recent work to prioritize the management and restoration of individual springs in Clark County, Nevada (Sada et al. 2003). This effort prioritized springs using matrix analyses by ranking biotic and abiotic elements of each spring (compiled during Level I and Level II inventories), and considering factors important to management. Matrix elements used to evaluate the management priority of individual springs are shown in Table 1 and elements to prioritize restoration are shown in Table 2. These examples are provided as one means to prioritize management and restoration. This method could be easily modified to evaluate priorities where other goals are guiding resource management. The matrix analyses is used as a process to reveal the relative importance of springs along a gradient of resource values and needs. In context of this gradient, additional planning is usually necessary to prioritize specific implementation programs within constraints such as funding and public involvement.

Matrix Analysis

Matrix I (Table 1) ranked the relative importance of each spring's resources to values at other springs in the Clark County. Elements in this matrix included rare species, factors indicating taxonomic richness (e.g., spring size, amount of disturbance [cultural and natural], the rarity of spring habitats across the landscape, land ownership, and the potential of conflicting uses that may affect biotic integrity. In this analysis, higher priority springs had higher matrix and resource values, and included larger springs (that generally do not dry during droughts), springs supporting critical crenobiontic species and high species richness. Higher priority springs were also in public ownership where management activities can be conducted, and springs where uses did not affect biotic integrity. Lower priority springs had lower matrix values and did not support critical species, had lower taxonomic richness (because they were small, subjected to scouring floods, etc.), periodically dried, occurred on private lands, and were affected by overwhelming uses that degraded their biotic integrity and minimized chances of restoring to natural character.

Matrix II (Table 2) ranks restoration priorities by considering habitat condition in addition to the elements used in Matrix I. Higher restoration priority is indicated by higher matrix values, which are given to springs with higher resource values and where restoration programs can achieve more rapid and effective success. Therefore, moderately disturbed springs with high resource values are given higher restoration priority than minimally disturbed springs with high resource values, and highly degraded springs with low resource value. Lower priority is assigned to the springs with lower resource values and higher

disturbance where restoration may have minimal influence on riparian and aquatic communities.

Management priority rankings ranged from a maximum of 65 down to 20 in Clark County. Highest management priority springs were occupied by covered species, and they were relatively large, persistent, and in relatively good condition. Lower priority springs were small (many were ephemeral), not occupied by covered species, and they were highly disturbed by natural and anthropogenic factors. Clark County spring restoration priority values ranged from 100 down to 32. Highest rankings were generally assigned to springs that were also ranked highly in the management priority ranking. However, there was weak correlation between management priority and restoration priority rankings, which indicated that Matrix I and Matrix II analyses are necessary to rank management and restoration priorities.

Table 1. Elements and ranking values for Matrix I to rank the relative value of resources at springs. Each spring is ranked by evaluating each matrix element and summing the ranking values for all elements. Elements are described below.

Matrix I Criteria	**Ranking Value**
Presence of Rare Aquatic Species [1]	Present = 10, Absent = 0
Rarity Across Landscape [2]	Rare = 10, Sparse = 5, Common = 2
Spring Brook Length [3]	> 500 m = 10, < 500 > 200 = 7, < 200 > 50 = 5, < 50 = 2
Scouring [4]	None = 10, Occasional = 5, Frequent = 2
Aquatic Habitat Persistence [5]	Persistent = 10, Ephemeral = 2
Resource Threats [6]	High = 2, Medium = 10, Low = 7
Land Ownership [7]	Public = 10, Private = 3
Conflicting Uses [8]	< 1 = 10, 2-3 = 5, >3 = 2

2. Springs with rare plants or crenobiontic species are ranked 10, springs without rare species are ranked 0.

3. Spring rarity is a subjective scale of density across the landscape. In southern Nevada, density is comparatively high in spring provinces, moderate along the much of the east side of the Spring Mountains, and scarce in areas such as the west side of the Spring Mountain, in the McCullogh Range and Muddy Mountains.

4. Length is the distance of the spring brook from the source to the end of contiguous flowing surface water.

5. Scouring is based on the potential of scouring due to flooding. Frequent scouring may have a lower resource value and recovery potential.

6. Persistence is the long-term presence of surface water. It is indicated by riparian systems with obligate wetland species and macroinvertebrate communities that include large numbers of Ephemeropterans, Plectopterans, or Trichopterans. Riparian vegetation associated with non-persistent waters include more facultative wetland and upland species and macroinvertebrate communities are dominated by water boatman (corixids), diving beetles, and other highly vagile, invasive species. If spring snails are present, the spring has long-term persistence. Springs that dry have low recovery potential as aquatic habitats, but they may be important to amphibians.

7. Threats is a subjective evaluation of the likelihood that current activities will further degrade spring resource quality or keep it in a degraded condition. High threats usually mean a spring will be more difficult to restore. Low threats means land managers will likely want to keep the spring in its existing condition.

8. Ownership is either private, State, or Federal (public land).

9. Conflicting Uses is a subjective ranking of how current uses conflict with management objectives. In the Spring Mountains there are three primary types of conflicting uses: (1) introduced grazing, (2) diversions, (3) recreation. If none of these are present the ranking is 0. If one of these conflicting uses is present the ranking is 7. If two conflicting uses are present the ranking is 5, and if three are present the ranking is 2.

Table 2. Elements and ranking values for Matrix II to rank the restoration priority of springs. Each spring is ranked by evaluating each matrix element and summing the ranking values for all elements. Elements are as described for Matrix I, and below for elements used in only Matrix II.

Matrix II Criteria	**Analysis Scale**
Presence of Rare Aquatic Species [1]	Present = 10, Absent = 0
Rarity Across Landscape [2]	Rare = 10, Sparse = 5, Common = 2
Spring Brook Length [3]	> 500 m = 10, < 500 > 200 = 7, < 200 > 50 = 5, < 50 = 2
Scouring [4]	None = 10, Occasional = 5, Frequent = 2
Aquatic Habitat Persistence [5]	Persistent = 10, Ephemeral = 2
Resource Threats [6]	High = 2, Medium = 10, Low = 7
Land Ownership [7]	Public = 10, Private = 3
Conflicting Uses [8]	< 1 = 10, 2-3 = 5, >3 = 2
Habitat Condition [9]	Slight/Unmodified = 5, Moderate = 10, High = 2
Recoverability [10]	High = 10, Medium = 5, Low = 2

10. Habitat condition ratings are described in Level I protocol guidelines. Moderately disturbed springs receive higher ranking because restoration activities are more necessary than at slightly an undisturbed springs. Highly disturbed springs receive lower ranking because many of them are so badly disturbed that restoration is a very long-term process that requires substantial resources.

Recoverability includes the physical and biological aspects necessary to recover a spring. It does not include cost, feasibility, staffing needs, or political considerations.

References

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APPENDIX B. USDA FOREST SERVICE LEVEL 1 SPRING SURVEY DATASHEET

USDA Forest Service
Level I Spring Inventory Field Form

SITE ID#_____ **SITE NAME** _____ **DATE**_____

STATE _____ COUNTY _____FOREST_____DISTRICT_____

FIELD CREW _____

START TIME_____DRAINAGE & HUC CODE (6th) _____

INFRA NO._____ USGS QUAD(s)_____

GPS Make and Model_____ GPS Photo Number_____DGPS _____

WAAS_____ UTM ZONE _____ PDOP _____+ - _____ DATUM: NAD_____

ACCESS_____ ELEVATION (m)_____

SOURCE LOCATION: T_____ R_____SEC_____QQ_____ UTM_____N_____E

PHYSICAL CHARACTERISTICS

GEOMORPHIC SETTING (Circle): Channel, Floodplain, Stream Terrace, Cliff, Flat, Hill Slope, Saddle, Draw, Bench, Ravine

Other_____

SLOPE POSITION (circle): Shoulder, Backslope, Footslope, Toeslope

ORIFICE GEOMORPHIC TYPE (circle): Seepage, Fracture/Joint, Tubular, Contact, Fault, Sinkhole

SPRING TYPE (circle): Rheocrene, Limnocrene, Helocrene, Mound, Fen, Stream Baseflow, Hillslope, Hanging Garden, Gushette, Geyser, Cave, Dry, Qanat, Well, Adit, Hot Spring, Sinking Stream, Other_____

PRIMARY LITHOLOGY OF SOURCE_____

DISCHARGE_____ (units) _____ METHOD & INSTRUMENT USED_____

HABITAT SIZE (circle) <10 m^2 10 -100 m^2 100 -1000 m^2 0.1 -1 ha 1 -10 ha 10 -100 ha >100 ha

SPRING BROOK LENGTH (m) _____AVERAGE WATER DEPTH (cm) _____ AVERAGE WATER WIDTH (m) _____

EMERGENT COVER (%) _____ VEGETATIVE BANK COVER (%)_____

SPRING BROOK INCISION (circle) >60 degrees from vertical, <60 degrees from vertical

SUBSTRATE METHOD (circle): Wolman Pebble Count, Visual Estimate, Other_____

SUBSTRATE COMPOSITION (%): fines (<0.05 mm)_____ sand (0.05 mm - 2 mm)_____ gravel (2 mm – 64 mm)_____ cobble (64 mm - 256 mm)_____ boulder (>256 mm)_____ bedrock_____peat_____

WATER CHEMISTRY

DO (mg/L) _____TEMPERATURE (°C) _____ pH _____ CONDUCTIVITY (µS) _____

BIOLOGY

IMPORTANT ANIMALS (circle): None, Springsnails (Scarce; Common; Abundant), Fish, Clams, Amphipods, Amphibians, Riffle Beetles, Crayfish, Red-Rimmed Melania, Ostracodes, incidental sitings of mammals, birds, and reptiles, Other _____

_____

_____

SITE ID#_____ SITE NAME _____ DATE_____

IMPORTANT VEGETATION (Use NRCS PLANTS database symbols) _____

_____

_____

OTHER NON-NATIVE SPECIES_____

COLLECTIONS MADE_____

SITE CONDITION

SITE CONDITION (circle): undisturbed, slight, moderate, high

DISTURBANCE TYPE (circle): livestock, recreation, diversion, residence, drying, fire, flooding, dredging

Other_____

_____

WATER USES

WATER RIGHTS NO. /STATUS_____TRIBUTARY TO_____

VOLUME DIVERTED_____(units)_____ % DIVERTED_____ (Circle) estimated measured

POD: T_____ R_____SEC_____QQ_____ UTM _____N_____E

POU: T_____ R_____SEC_____QQ_____ UTM _____N_____E

DEVELOPMENT TYPE (circle): tank, trough, pond, guzzler, spring box, fencing, piping,

Other_____

_____

USES (circle): Livestock, Wildlife, Domestic, Recreation, Irrigation, In stream, Municipal, Mining, Other _____

_____

CONDITION AND MAINTENANCE NEEDS OF DEVELOPMENTS_____

_____

_____

NOTES_____

_____

_____

_____

DIRECTIONS TO SITE_____

_____

_____

SITE ID#_____ SITE NAME _____ DATE_____

Sketch – Provide general sketch of spring, developments, and setting (provide scale and north arrow)

SITE ID#_____ SITE NAME _____ DATE_____

PHOTO LOG

Project:		
Photographers Name:	Date:	☐ Digital ☐Film

No.	Digital #	Time	Northing	Easting	Description
					Looking upstream including the spring source
					Looking downstream

Digital Picture number is the number assigned by the computer when pictures are downloaded

APPENDIX C. DEFINITION OF GPS DATUM ACRONYMS

DGPS (Differential Global Positioning System) is a technique to increase the accuracy of the location data reported by the GPS. This technique requires that the receiving or roving GPS unit be able to receive signals from a second GPS receiver located at a known location or base station. The base station signal provides corrected information with regards to the satellites' data and allows the receiving GPS to more accurately report location data. Differential GPS can give location data within several centimeters of accuracy and is typically used in survey work.

PDOP (Position Dilution of Precision) is a ranking system of the position of the satellites relative to each other. Satellites positioned evenly spaced throughout the sky receive good rankings, the best with at least one satellite located directly above the receiving GPS and three other satellites located along the horizon equidistant from each other. PDOP values start at 1 as the best and can go on indefinitely, although a value greater than 8 is generally considered very poor.

WAAS (Wide Area Augmentation System) is a technique to increase the accuracy of location data by providing GPS signal corrections. It utilizes a network of satellites and ground stations in the United States to monitor satellite data. Two master stations, one on each coast, sends a signal with corrected information regarding the GPS satellite positions. WAAS is currently being developed for the Federal Aviation Administration to increase precision in airplane takeoffs and landings and can give location data within a few meters of accuracy.

Appendix E

Springs Inventory

E.1.0 PROJECT BASINS SPRINGS INVENTORY

Table E.1-1 contains a listing of springs inventoried by either USGS or DRI that were not part of the selected springs chosen for fur ther study by SNWA. Table E.1-2 contains a listing of springs that were included in the National Hydrography Dataset, Geographic Names Information System, or contained on USGS 1:24,000 topographic maps. The springs within both of these tables are located within the Project Basins of Spring, Snake, Cave, Dry Lake, Delamar, and Coyote Springs valleys.

Table E.1-1
Additional USGS and DRI Inventoried Springs within the Project Basins
(Page 1 of 2)

Site Number	Site Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 180 Cave Valley					
180 N08 E64 25CA 1	Spring Schell Creek 1, SC-1	696,793	4,265,779	7,048	DRI
381658114523300	Lackawanna Springs	685,714	4,239,318	--	USGS
383556114545901	Big Spring-Egan Range, ER-4 (DRI)	681,373	4,274,318	--	USGS
384034114463601	Sheep Spring	693,335	4,283,174	--	USGS
385007114530301	Chimney Rock Spring	683,574	4,300,617	--	USGS
Hydrographic Area 181 Dry Lake Valley					
181 N01 E63 21CA 1	Deadman Spring, PR-5	683,347	4,200,439	5,400	DRI
181 N01 E63 22AD 1	Hamilton Spring, PR-2	685,632	4,200,787	5,300	DRI
181 N01 E63 28CB 1	Unnamed Spring, PR-4	682,958	4,198,637	5,400	DRI
181 S01 E64 06DB 1	Rattlesnake Spring, PR-8	689,192	4,195,827	5,500	DRI
181 S03 E63 06DA 1	Little Boulder Spring, PR-6	680,501	4,175,979	6,000	DRI
181 S04 E64 25DD 1	Red Rock Spring, DR-1	698,430	4,160,145	6,100	DRI
181 S04 E65 16BA 1	Oak Spring, DR-9	702,129	4,164,508	4,729	DRI
375443114550501	Black Rock Spring, PR-3	682,943	4,198,083	5,523	USGS
381443114421201	Unknown (NDWR Reconnaissance Report 16)	700,939	4,236,197	6,154	USGS
381706114413201	Unknown	701,770	4,239,950	6,244	USGS
381758114401601	North Mud Spring	703,576	4,241,599	6,404	USGS
381824114404201	Horse Corral Spring	702,925	4,242,385	6,364	USGS
382555114442201	Unknown	697,240	4,256,155	6,324	USGS
Hydrographic Area 182 Delamar Valley					
182 S05 E65 06DC 1	Cottonwood Spring, DR-18	699,122	4,156,520	6,750	DRI
182 S05 E65 20AC 1	Abandoned Spring, DR-19	700,760	4,152,669	6,600	DRI
Hydrographic Area 184 Spring Valley					
383645114265401	Cottonwood Spring	722,098	4,276,858	6,624	USGS
391516114292001	Unknown	716,602	4,348,010	5,704	USGS
384944114235101	Minerva Spring	725,842	4,300,999	5,804	USGS
385052114234501	Shoshone Spring	725,927	4,303,100	5,784	USGS
385403114202501	Mount Wheeler Mine Spring	730,577	4,309,127	7,965	USGS
390907114340001	Bastian Spring	710,196	4,336,450	6,697	USGS
392438114190801	Sp NE Face Mount Wheeler	730,759	4,365,760	--	USGS
393347114361801	Kalamazoo Creek Spring	706,815	4,382,117	7,204	USGS
394059114363301	North Creek Spring	704,918	4,395,982	8,004	USGS
395204114354101	Egan Creek Springs	705,647	4,415,842	6,654	USGS
393603114335801	Muncy Creek Spring	708,900	4,386,277	7,004	USGS

Table E.1-1
Additional USGS and DRI Inventoried Springs within the Project Basins
(Page 2 of 2)

Site Number	Site Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 195 Snake Valley					
391457113524101	(C-18-18)16abb-S1	769,340	4,349,065	4,874	USGS
385434114063901	Spring Creek Spring	750,448	4,310,689	6,124	USGS
390025114112001	Rowland Spring	743,344	4,321,299	6,304	USGS
390403113580301	254 1 Spring	762,294	4,328,637	5,009	USGS
391557113515601	(C-18-18) 3cca-S1	770,355	4,350,953	4,875	USGS
391859113595201	Kell Spring	758,759	4,356,178	4,944	USGS
392411113514301	(C-16-18)22cab-S1	770,137	4,366,197	4,807	USGS
393949113562301	(C-13-19)25bab-S1	762,454	4,394,891	5,584	USGS
392455113522601	Foote Reservoir Spring	769,061	4,367,518	4,829	USGS
392737114021201	(C-15-19)31cbd-S1	754,869	4,372,030	5,241	USGS
392815113593001	(C-15-19)31bc -S1	758,714	4,373,340	5,304	USGS
392952113544801	(C-15-18)19aba-S1	765,351	4,376,559	4,799	USGS
393501113572701	(C-14-19)23bdb-S1	761,230	4,385,958	5,089	USGS
393949113550001	(C-13-18)30abb-S1	764,432	4,394,959	5,284	USGS
394101114033701	Pleasant Valley Spring	752,038	4,396,765	6,004	USGS
394117113582601	(C-13-19)15acc-S1	759,431	4,397,505	6,564	USGS
394131113533301	(C-13-18)17aad-S1	766,397	4,398,176	5,284	USGS
394134113544201	(C-13-18)18aad-S1	764,750	4,398,211	5,784	USGS
394212114025701	Indian Spring	752,919	4,398,986	7,004	USGS
394235113585801	(C-13-19) 3ccc-S1	758,588	4,399,885	8,464	USGS
394428113543801	(C-12-18)30ddd-S1	764,660	4,403,580	7,454	USGS
394428113582101	(C-12-19)27dcd-S1	759,351	4,403,399	8,915	USGS
395055113484301	(C-11-17)19ccb-S1	772,686	4,415,811	5,599	USGS
395119113513901	(C-11-18)22bdc-S1	768,477	4,416,403	8,084	USGS
395138113450301	(C-11-17)22bab-S1	777,868	4,417,325	4,643	USGS
395141113511401	(C-11-18)22aba-S1	769,047	4,417,102	7,754	USGS
395247113490901	(C-11-18)12dcb-S1	771,945	4,419,243	6,264	USGS
395457113473000	(C-10-17)32bca-S1	774,153	4,423,336	5,260	USGS
363854114072701	Dud Spring	752,867	4,341,137	4,394	USGS
390010114184001	Theresa Lake Feeder Spring	732,773	4,320,517	--	USGS
395914113464201	(C-10-17) 5add-S1	775,007	4,431,302	4,889	USGS
394152113562101	(C-13-19)12cad-S1	762,372	4,398,685	6,644	USGS
Hydrographic Area 210 Coyote Springs Valley					
363830115041201	Wamp Spring	672,461	4,056,852	5,483	USGS
364050115103401	Sawmill Spring	662,891	4,060,981	8,124	USGS
365642115062101	Lamp Spring	668,590	4,090,442	5,683	USGS

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 1 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 180 - Cave Valley				
Lewis Well (Spring)	680,098	4,244,303	6,259	National Hydrography Dataset
Wolf Hole Spring (Dry)	678,115	4,246,267	7,069	Geographic Names Information System/National Hydrography Dataset
Horse Spring	680,402	4,248,398	6,490	
Rosebud Spring	697,429	4,266,810	7,481	
Unnamed Spring	686,803	4,269,631	7,210	24K Topographic Map
Quartzite Spring	695,170	4,271,188	6,601	Geographic Names Information System/National Hydrography Dataset
Big Travis Spring	680,543	4,278,447	7,206	
Little Travis Spring	683,834	4,278,596	6,882	Geographic Names Information System
Canyon Spring	696,280	4,278,989	8,062	
Cottonwood Spring	677,457	4,279,255	8,237	Geographic Names Information System/National Hydrography Dataset
Lewis Spring	684,709	4,279,680	6,772	
Cabin Spring	695,211	4,279,954	7,587	Geographic Names Information System
Unnamed Spring	677,969	4,280,271	8,091	National Hydrography Dataset
Mahogany Spring	696,432	4,280,616	8,997	Geographic Names Information System
Wall Spring	695,195	4,281,558	7,945	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	679,355	4,281,658	7,893	National Hydrography Dataset
Unnamed Spring	690,800	4,281,694	6,645	
Unnamed Spring	679,029	4,281,726	7,769	
Unnamed Spring	688,155	4,282,043	6,541	
Haggerty Spring	682,274	4,282,162	7,082	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	687,780	4,282,759	6,520	24K Topographic Map
Unnamed Spring	687,706	4,282,801	6,523	National Hydrography Dataset
Unnamed Spring	680,853	4,283,095	7,367	
Unnamed Spring	691,607	4,283,234	6,961	
Unnamed Spring	679,352	4,284,109	7,642	24K Topographic Map
Brush Spring	694,284	4,285,811	8,357	Geographic Names Information System/National Hydrography Dataset
Quartzite Spring	693,832	4,286,460	8,188	Geographic Names Information System
Sagahen Spring	694,271	4,287,645	8,085	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	680,099	4,287,657	7,786	National Hydrography Dataset
Unnamed Spring	680,703	4,288,215	7,447	
Willow Spring	681,042	4,290,397	7,551	Geographic Names Information System/National Hydrography Dataset
Wildcat Spring	694,376	4,290,517	8,327	
Unnamed Spring	682,747	4,292,351	7,270	National Hydrography Dataset
Unnamed Spring	682,289	4,292,516	7,311	
Robbers Roost Spring	692,697	4,293,649	7,535	Geographic Names Information System/National Hydrography Dataset
Carter Spring	679,993	4,294,650	8,210	
Currant Spring	681,314	4,296,717	7,902	Geographic Names Information System
Sagahen Spring	681,998	4,297,864	8,036	Geographic Names Information System/National Hydrography Dataset
Silver Spring	683,900	4,297,889	7,560	
Blind Spring	683,881	4,299,272	7,465	Geographic Names Information System

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 2 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 181 - Dry Lake Valley				
Pine Spring	699,705	4,158,329	6,520	Geographic Names Information System/National Hydrography Dataset
Canyon Number Two Spring	701,332	4,158,329	6,658	
Canyon Spring	700,131	4,158,551	6,467	
Moon Spring	699,177	4,159,318	6,291	Geographic Names Information System
Cyclone Spring	700,466	4,160,628	6,278	Geographic Names Information System/National Hydrography Dataset
Tyler Spring	700,585	4,162,631	6,095	
Seven Oaks Spring	697,857	4,162,923	5,739	
West Oak Spring	701,570	4,164,393	5,880	
Nelson Spring	703,686	4,165,657	6,016	
Long Point Spring	695,455	4,167,874	4,863	Geographic Names Information System
Dana Spring	702,394	4,171,166	5,500	Geographic Names Information System/National Hydrography Dataset
Cliff Springs	702,404	4,171,838	5,458	
Cliff Springs	702,418	4,171,898	5,444	
Rabbit Spring	702,478	4,172,387	5,385	
Brinkerhoff Spring	680,944	4,176,862	5,846	Geographic Names Information System
Porphory Spring	704,031	4,177,134	5,546	Geographic Names Information System/National Hydrography Dataset
Pine Spring	682,515	4,177,786	5,952	Geographic Names Information System
Klondike Spring	711,330	4,178,007	5,783	Geographic Names Information System/National Hydrography Dataset
Rye Grass Spring	685,592	4,178,064	5,192	Geographic Names Information System
George Roger Spring	711,513	4,178,528	5,798	
Mustang Spring	683,121	4,178,529	5,521	Geographic Names Information System/National Hydrography Dataset
West Side Spring	684,078	4,178,930	5,396	Geographic Names Information System
Mustang Spring	683,423	4,180,785	5,508	
Wheatgrass Spring	683,997	4,181,440	5,393	Geographic Names Information System/National Hydrography Dataset
Pace Spring	683,578	4,181,690	5,447	
Rattlesnake Spring	682,109	4,188,524	5,484	
Sand Spring	689,089	4,191,186	4,774	Geographic Names Information System
Two and One Half Spring	688,739	4,194,758	4,806	
Ely Springs	704,838	4,198,323	5,466	
Ely Springs	704,943	4,198,339	5,515	National Hydrography Dataset
Ely Springs	705,321	4,198,589	5,630	
Ely Springs	705,193	4,198,596	5,575	
Delmues Spring	706,663	4,199,574	5,948	Geographic Names Information System
Tex Spring	704,120	4,200,403	5,649	Geographic Names Information System/National Hydrography Dataset
Coal Spring	685,084	4,200,858	5,410	
Iron Tank Spring	706,440	4,201,442	6,098	Geographic Names Information System
Smith Spring	706,754	4,202,878	5,811	
Reindeer Spring	706,751	4,203,118	5,763	
Bullfrog Spring	706,123	4,203,657	5,620	

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 3 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 181 - Dry Lake Valley (Continued)				
Unnamed Spring	684,940	4,206,182	6,013	National Hydrography Dataset
Unnamed Spring	709,664	4,206,794	6,503	
Cabin Spring	685,814	4,207,521	5,741	Geographic Names Information System/National Hydrography Dataset
Simpson Spring	708,461	4,207,674	6,230	
Blind Mountain Spring	708,155	4,210,125	6,455	Geographic Names Information System/National Hydrography Dataset
Stonewall Spring	687,214	4,211,562	5,230	Geographic Names Information System
Coyote Spring	690,622	4,220,065	5,073	
Unnamed Spring	700,279	4,225,481	6,023	24K Topographic Map
Peers Spring	704,241	4,225,485	6,065	National Hydrography Dataset
Hornsilver Spring	701,784	4,226,107	6,087	Geographic Names Information System
Fox Cabin Spring	705,876	4,226,467	6,080	Geographic Names Information System/National Hydrography Dataset
Scotty Spring	702,943	4,226,637	6,278	
Lower Fairview Spring	705,382	4,227,849	6,215	
Upper Fairview Spring	704,510	4,229,028	6,376	
Indian Spring	703,023	4,231,335	6,555	
Robinson Spring	700,789	4,231,911	6,199	
ChokeCherry Spring	703,908	4,234,145	6,606	
Unnamed Spring	704,940	4,238,185	6,621	National Hydrography Dataset
Lone Cedar Spring	703,921	4,238,859	6,455	Geographic Names Information System
Rye Grass Seep	702,414	4,239,199	6,348	
Unnamed Spring	704,989	4,239,407	6,667	National Hydrography Dataset
By Pass Seep	701,710	4,239,457	6,275	Geographic Names Information System
One Trough Spring	704,217	4,240,522	6,709	
Unnamed Spring	702,189	4,240,557	6,380	24K Topographic Map
South Mud Spring	702,256	4,241,026	6,318	Geographic Names Information System/National Hydrography Dataset
Big Mud Springs	689,576	4,241,368	6,397	
Tribolata Spring	703,848	4,241,484	6,695	Geographic Names Information System
Hidden Seep Spring	702,187	4,241,503	6,285	
North Mud Spring	702,779	4,241,683	6,395	Geographic Names Information System/National Hydrography Dataset
Grass Patch Spring	704,088	4,242,107	6,677	Geographic Names Information System
Steward Spring	702,116	4,248,254	7,120	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	692,261	4,250,174	6,404	National Hydrography Dataset
Mule Shoe Spring	693,840	4,253,787	6,396	Geographic Names Information System
Jasper Spring	693,747	4,254,310	6,457	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	694,619	4,254,685	6,444	National Hydrography Dataset
Unnamed Spring	694,741	4,254,766	6,452	
Unnamed Spring	694,024	4,254,779	6,533	
Unnamed Spring	694,105	4,254,795	6,570	
Unnamed Spring	694,160	4,254,934	6,573	

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 4 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 181 - Dry Lake Valley (Continued)				
Unnamed Spring	695,253	4,255,579	6,531	National Hydrography Dataset
Chris Spring	697,423	4,255,696	6,303	Geographic Names Information System/National Hydrography Dataset
Cris Spring	695,951	4,256,401	6,771	
Hydrographic Area 182 - Delamar Valley				
Stewart Spring	696,087	4,129,340	5,526	Geographic Names Information System
Holly Spring	693,976	4,132,681	5,324	
Jumbo Spring	697,317	4,132,856	6,214	National Hydrography Dataset/Geographic Names Information System
Ben Hur Spring	693,936	4,134,401	5,577	Geographic Names Information System
Jumbo Spring	697,856	4,136,467	5,732	
Bruno Spring	693,378	4,139,619	5,026	
Horn Spring	701,031	4,141,537	6,336	
Mona Spring	701,260	4,142,453	6,183	
Unnamed Spring	701,589	4,142,763	6,177	National Hydrography Dataset
Tunnel Spring	701,445	4,142,965	6,155	National Hydrography Dataset/Geographic Names Information System
Tunnel Number Three Spring	700,441	4,143,804	5,858	Geographic Names Information System
Tunnel Number Two Spring	701,410	4,144,204	5,926	
Tunnel Number One Spring	701,405	4,144,543	5,956	
Joshua Spring	701,559	4,145,351	6,091	
Blyth Spring	703,026	4,147,489	6,227	National Hydrography Dataset/Geographic Names Information System
Old Indian Spring	691,927	4,148,324	5,027	Geographic Names Information System
New Indian Spring	692,004	4,148,826	5,055	
Twin Spring	674,934	4,148,884	6,298	National Hydrography Dataset/Geographic Names Information System
Rye Patch Spring	674,914	4,149,403	6,393	Geographic Names Information System
Blythe Spring	696,236	4,149,754	5,681	
Boulder Spring	674,598	4,151,800	6,459	
East Boulder Spring	678,111	4,152,799	5,296	
Coyote Spring	700,472	4,152,822	6,603	National Hydrography Dataset/Geographic Names Information System
Robinson Seep	699,466	4,154,783	6,730	
Cottonwood Springs	689,005	4,156,114	4,921	Geographic Names Information System
Sawyer Spring	691,202	4,157,009	5,163	
Hughie Spring	688,342	4,158,267	4,927	
Six Mile Spring	676,944	4,161,453	4,994	
Hydrographic Area 184 - Spring Valley				
White Rock-Bailey Springs	730,005	4,255,343	7,297	Geographic Names Information System/National Hydrography Dataset
Brown Water Spring	731,247	4,255,752	7,068	
Unnamed Spring	735,264	4,258,044	6,948	National Hydrography Dataset
Bradshaw Spring	735,373	4,258,398	6,921	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	732,688	4,258,544	6,805	24K Topographic Map

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 5 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 184 - Spring Valley (Continued)				
Silver Park Springs	729,881	4,258,828	7,079	Geographic Names Information System/National Hydrography Dataset
Silver Park Springs	730,129	4,258,933	7,052	National Hydrography Dataset
Silver Park Springs	730,159	4,259,003	7,048	
Cow Heaven Spring (dry)	724,149	4,267,275	6,691	Geographic Names Information System/National Hydrography Dataset
Basin Spring	723,388	4,269,189	6,688	
Pipe Spring	722,685	4,272,884	6,860	National Hydrography Dataset
Wild Horse Spring	721,185	4,275,755	7,709	Geographic Names Information System
Deer Spring	723,717	4,276,768	6,315	Geographic Names Information System/National Hydrography Dataset
Indian Springs	722,006	4,279,581	6,526	National Hydrography Dataset
Indian Springs	721,961	4,280,067	6,358	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	721,692	4,280,150	6,327	National Hydrography Dataset
Unnamed Spring	731,678	4,290,591	6,543	
Unnamed Spring	733,511	4,294,046	7,325	
South Fox Spring	714,767	4,294,390	5,791	Geographic Names Information System
Unnamed Spring	735,611	4,295,016	7,629	National Hydrography Dataset
Unnamed Spring	734,311	4,295,131	7,597	
Unnamed Spring	734,733	4,296,657	7,940	
Unnamed Spring	735,207	4,297,264	7,889	
Black Spring	705,025	4,301,298	7,304	Geographic Names Information System
Unnamed Spring	725,822	4,301,583	5,831	24K Topographic Map
Unnamed Spring	725,637	4,301,939	5,822	
Unnamed Spring	725,848	4,302,043	5,838	
Unnamed Spring	725,459	4,302,109	5,813	
Unnamed Spring	725,455	4,302,420	5,822	National Hydrography Dataset
Unnamed Springs	725,407	4,302,498	5,818	24K Topographic Map
Unnamed Spring	728,679	4,302,864	6,136	
Unnamed Spring	728,640	4,302,929	6,124	
South Spring	716,341	4,303,423	5,780	Geographic Names Information System
Willow Spring	705,390	4,303,465	7,681	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	705,220	4,303,621	7,788	National Hydrography Dataset
Unnamed Spring	725,163	4,303,877	5,798	24K Topographic Map
Unnamed Spring	725,152	4,303,955	5,800	
Unnamed Spring	725,141	4,304,048	5,803	
Unnamed Spring	725,220	4,304,573	5,807	National Hydrography Dataset
Unnamed Spring	725,227	4,304,768	5,805	
Unnamed Spring	725,205	4,304,917	5,810	
Basin Spring	706,723	4,306,330	7,542	Geographic Names Information System/National Hydrography Dataset
The Seep	723,833	4,306,337	5,761	24K Topographic Map
Unnamed Spring	731,004	4,309,431	7,962	National Hydrography Dataset
Bennett Spring	704,272	4,311,098	8,447	Geographic Names Information System/National Hydrography Dataset

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 6 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 184 - Spring Valley (Continued)				
Unnamed Spring	724,009	4,311,265	5,769	24K Topographic Map
Unnamed Spring	723,988	4,311,293	5,768	
Unnamed Spring	723,804	4,313,255	5,812	
Worthington Spring	726,492	4,314,844	6,487	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	724,321	4,314,862	5,941	24K Topographic Map
Unnamed Spring	724,683	4,315,277	6,023	
Unnamed Spring	726,993	4,315,280	6,635	National Hydrography Dataset
Unnamed Spring	729,859	4,315,830	7,920	24K Topographic Map
Unnamed Spring	729,515	4,316,217	7,941	National Hydrography Dataset
Raised Spring	727,819	4,317,082	7,086	Geographic Names Information System/National Hydrography Dataset
Stevens Springs	703,665	4,318,075	8,105	
Limerock Spring	705,184	4,318,299	7,458	
Unnamed Spring	729,281	4,322,988	8,559	24K Topographic Map
Unnamed Spring	718,834	4,324,432	5,747	National Hydrography Dataset
Unnamed Spring	718,486	4,324,971	5,741	
Ohio Spring	727,669	4,325,303	8,119	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	728,137	4,325,556	8,780	National Hydrography Dataset
Unnamed Spring	727,327	4,325,746	8,611	
Unnamed Spring	727,553	4,325,751	8,596	
Unnamed Spring	726,995	4,325,816	8,399	
Allen Spring	705,658	4,327,959	7,314	Geographic Names Information System/National Hydrography Dataset
Jacks Spring	727,031	4,328,502	8,065	
Unnamed Spring	703,893	4,329,764	8,184	National Hydrography Dataset
Unnamed Spring	726,279	4,330,020	7,258	
Unnamed Spring	726,020	4,330,126	7,131	
Crethers Springs	703,700	4,330,197	7,933	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	726,158	4,330,584	7,193	National Hydrography Dataset
Unnamed Spring	726,169	4,330,736	7,174	
Unnamed Springs	703,060	4,332,320	7,346	
Unnamed Spring	702,117	4,332,386	7,746	
Unnamed Springs	703,045	4,332,394	7,341	
Unnamed Spring	718,375	4,334,128	5,674	24K Topographic Map
Unnamed Spring	718,332	4,334,386	5,671	
Aspen Spring	702,126	4,334,539	7,847	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	703,809	4,334,967	7,758	24K Topographic Map
Unnamed Spring	716,257	4,335,258	5,754	
Unnamed Spring	718,242	4,335,328	5,657	
Unnamed Spring	704,392	4,335,968	8,287	
Unnamed Spring	704,428	4,335,990	8,264	

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 7 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 184 - Spring Valley (Continued)				
Unnamed Spring	704,477	4,336,033	8,245	24K Topographic Map
Unnamed Spring	701,394	4,336,034	8,649	
Unnamed Spring	703,408	4,336,069	8,135	National Hydrography Dataset
Unnamed Spring	715,616	4,336,213	5,762	24K Topographic Map
East Canyon Spring	704,707	4,336,293	8,283	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	702,439	4,336,432	8,149	National Hydrography Dataset
Unnamed Spring	718,340	4,336,449	5,644	24K Topographic Map
Unnamed Spring	717,417	4,336,584	5,676	
Bastian Spring	710,123	4,336,590	6,704	Geographic Names Information System/National Hydrography Dataset
Upper Bastian Spring	708,962	4,336,823	7,507	
Unnamed Spring	729,604	4,337,169	7,024	National Hydrography Dataset
Unnamed Spring	728,802	4,337,447	6,839	
Unnamed Stream	717,151	4,337,950	5,660	
Turnley Spring	728,697	4,338,048	6,775	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	727,556	4,339,380	6,445	National Hydrography Dataset
Unnamed Spring	727,875	4,339,689	6,519	
Unnamed Spring	727,179	4,339,692	6,380	
Rock Spring	726,805	4,340,219	6,367	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	728,193	4,340,332	6,652	National Hydrography Dataset
Unnamed Spring	728,104	4,340,528	6,641	
Unnamed Spring	718,917	4,340,645	5,645	24K Topographic Map
Unnamed Spring	719,735	4,342,149	5,617	
Unnamed Spring	719,585	4,342,321	5,621	
Unnamed Spring	719,098	4,342,428	5,641	
Unnamed Spring	719,033	4,342,581	5,643	
Cottonwood Spring	707,980	4,343,083	7,769	Geographic Names Information System/National Hydrography Dataset
Granite Spring	728,251	4,343,711	6,790	
Unnamed Spring	712,012	4,344,293	6,422	National Hydrography Dataset
Unnamed Spring	711,412	4,344,447	6,773	
Unnamed Spring	719,128	4,344,545	5,622	24K Topographic Map
Kolcheck Springs	711,801	4,344,805	6,740	Geographic Names Information System/National Hydrography Dataset
Kolcheck Springs	711,859	4,344,848	6,735	
Unnamed Spring	719,084	4,345,016	5,613	24K Topographic Map
Unnamed Spring	718,904	4,345,089	5,620	
Unnamed Spring	711,928	4,345,093	6,745	
Reservoir Basin Spring	732,436	4,345,225	7,800	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	718,594	4,345,253	5,638	24K Topographic Map
Unnamed Spring	718,475	4,345,371	5,640	National Hydrography Dataset
Unnamed Spring	718,537	4,345,461	5,634	
Unnamed Spring	718,835	4,345,473	5,614	

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 8 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 184 - Spring Valley (Continued)				
Unnamed Spring	718,455	4,345,571	5,636	National Hydrography Dataset
Unnamed Spring	732,758	4,345,635	7,515	24K Topographic Map
Unnamed Spring	719,211	4,345,735	5,601	
Unnamed Spring	718,124	4,345,812	5,654	National Hydrography Dataset
Unnamed Spring	710,151	4,345,825	7,014	24K Topographic Map
Unnamed Spring	718,096	4,345,906	5,657	National Hydrography Dataset
Unnamed Spring	713,255	4,346,254	6,462	24K Topographic Map
Unnamed Spring	718,729	4,346,262	5,601	National Hydrography Dataset
Unnamed Spring	713,419	4,346,278	6,422	24K Topographic Map
Unnamed Spring	713,517	4,346,319	6,354	National Hydrography Dataset
Unnamed Spring	709,412	4,346,413	7,222	24K Topographic Map
Smudge Spring	730,466	4,346,732	6,765	Geographic Names Information System/National Hydrography Dataset
Indian Springs	713,615	4,346,948	6,456	National Hydrography Dataset
Indian Springs	713,745	4,347,050	6,396	Geographic Names Information System/National Hydrography Dataset
Indian Springs	713,766	4,347,107	6,402	
Unnamed Spring	719,100	4,347,177	5,593	24K Topographic Map
Unnamed Spring	717,932	4,347,189	5,598	
Unnamed Spring	712,696	4,347,303	7,190	National Hydrography Dataset
Chokecherry Spring	731,996	4,347,479	6,919	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	706,440	4,347,755	7,302	24K Topographic Map
Unnamed Spring	712,651	4,347,777	7,622	National Hydrography Dataset
Unnamed Spring	721,580	4,348,226	5,587	24K Topographic Map
Unnamed Spring	721,547	4,348,623	5,586	National Hydrography Dataset
Unnamed Spring	716,984	4,348,823	5,594	24K Topographic Map
Fera Ninetysix Spring	707,610	4,348,884	8,654	Geographic Names Information System
Unnamed Spring	738,566	4,348,920	9,300	National Hydrography Dataset
Unnamed Spring	720,873	4,349,031	5,581	24K Topographic Map
Pete Spring	706,552	4,349,178	8,076	National Hydrography Dataset/Geographic Names Information System
Kraft Spring	702,872	4,349,399	9,643	
Unnamed Spring	706,091	4,349,476	7,764	24K Topographic Map
Unnamed Spring	716,940	4,349,599	5,593	
North Cleve Spring	709,395	4,349,640	9,285	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	717,025	4,349,934	5,594	24K Topographic Map
Unnamed Spring	717,091	4,350,085	5,593	
Unnamed Spring	717,201	4,350,232	5,593	
Unnamed Spring	717,287	4,350,318	5,592	
Unnamed Spring	707,210	4,350,326	9,038	
Unnamed Spring	717,193	4,350,346	5,594	National Hydrography Dataset
Unnamed Spring	717,274	4,350,363	5,593	24K Topographic Map
Unnamed Spring	717,291	4,350,465	5,593	

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 9 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 184 - Spring Valley (Continued)				
Unnamed Spring	717,221	4,350,538	5,595	National Hydrography Dataset
Unnamed Spring	739,553	4,350,571	9,157	24K Topographic Map
Unnamed Spring	717,324	4,350,628	5,594	
Unnamed Spring	717,152	4,350,657	5,605	National Hydrography Dataset
Unnamed Spring	717,336	4,350,685	5,594	24K Topographic Map
Unnamed Spring	717,393	4,350,738	5,594	
Unnamed Spring	705,776	4,350,783	8,421	
Unnamed Spring	717,373	4,350,800	5,593	
Unnamed Spring	717,360	4,350,832	5,594	
Unnamed Spring	717,168	4,350,845	5,609	
Unnamed Spring	705,744	4,350,873	8,436	
Unnamed Spring	739,701	4,351,238	9,113	
Unnamed Spring	705,695	4,351,298	8,769	National Hydrography Dataset
Unnamed Spring	708,088	4,351,400	8,673	24K Topographic Map
Unnamed Spring	717,716	4,351,559	5,589	
Unnamed Spring	711,928	4,351,580	8,322	
Unnamed Spring	705,637	4,351,805	9,030	National Hydrography Dataset
Unnamed Spring	705,682	4,351,886	9,190	
Unnamed Spring	705,339	4,352,005	9,061	
Unnamed Spring	705,437	4,352,005	9,157	
Unnamed Spring	717,936	4,352,046	5,587	24K Topographic Map
Unnamed Spring	717,540	4,352,495	5,592	National Hydrography Dataset
Unnamed Spring	723,152	4,352,540	5,577	24K Topographic Map
Unnamed Spring	717,511	4,352,544	5,593	
Unnamed Spring	717,507	4,352,605	5,591	
Unnamed Spring	723,275	4,352,687	5,575	
Unnamed Spring	723,291	4,352,691	5,576	
Unnamed Spring	723,389	4,352,736	5,577	
Unnamed Spring	717,479	4,352,752	5,585	National Hydrography Dataset
Unnamed Spring	723,332	4,352,752	5,575	24K Topographic Map
Unnamed Spring	723,491	4,352,830	5,577	
Unnamed Spring	723,630	4,353,063	5,576	
Unnamed Spring	717,530	4,353,079	5,585	
Unnamed Spring	723,672	4,353,145	5,575	
Unnamed Spring	736,573	4,353,168	9,027	
Unnamed Spring	717,553	4,353,177	5,587	
Unnamed Spring	711,554	4,353,187	8,508	
Unnamed Spring	723,996	4,353,194	5,583	
Unnamed Spring	724,362	4,353,400	5,583	
Unnamed Spring	718,151	4,353,465	5,567	

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 10 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 184 - Spring Valley (Continued)				
Unnamed Spring	724,561	4,353,481	5,584	24K Topographic Map
Unnamed Spring	724,568	4,353,527	5,584	
Unnamed Spring	717,321	4,353,563	5,602	
Unnamed Spring	717,364	4,353,602	5,597	
Unnamed Spring	724,548	4,353,612	5,583	
Unnamed Spring	724,610	4,353,668	5,584	
Unnamed Spring	717,373	4,353,782	5,588	
Unnamed Spring	724,672	4,353,805	5,582	
Unnamed Spring	717,315	4,353,811	5,595	
Unnamed Spring	717,351	4,353,821	5,588	
Unnamed Spring	724,741	4,353,854	5,582	
Unnamed Spring	724,764	4,353,900	5,582	
Unnamed Spring	717,328	4,354,034	5,586	National Hydrography Dataset
Unnamed Spring	735,635	4,354,125	8,527	24K Topographic Map
Unnamed Spring	712,975	4,354,158	7,269	
Unnamed Spring	733,335	4,354,301	7,384	
Unnamed Spring	735,492	4,354,301	8,475	
Unnamed Spring	733,292	4,354,354	7,351	
Unnamed Spring	732,949	4,354,360	7,168	
Unnamed Spring	717,001	4,354,488	5,611	
Unnamed Spring	717,351	4,354,494	5,576	
Unnamed Spring	717,213	4,354,615	5,582	
Unnamed Spring	735,367	4,354,628	8,591	
Unnamed Spring	735,387	4,354,645	8,605	
Unnamed Spring	717,200	4,354,667	5,582	
Unnamed Spring	735,452	4,354,667	8,692	
Fourmile Spring	732,106	4,354,681	6,836	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	717,122	4,354,707	5,583	24K Topographic Map
Unnamed Spring	716,939	4,354,710	5,597	
Unnamed Spring	731,842	4,354,713	6,736	National Hydrography Dataset
Unnamed Spring	731,789	4,354,726	6,724	
Unnamed Spring	716,922	4,354,736	5,596	24K Topographic Map
Unnamed Spring	731,407	4,354,743	6,579	National Hydrography Dataset
Unnamed Spring	717,151	4,354,765	5,582	24K Topographic Map
Unnamed Spring	717,076	4,354,775	5,584	
Unnamed Spring	716,887	4,354,779	5,596	National Hydrography Dataset
Unnamed Spring	717,056	4,354,788	5,584	24K Topographic Map
Unnamed Spring	716,851	4,354,801	5,596	
Unnamed Springs	731,763	4,354,841	6,720	National Hydrography Dataset
Unnamed Spring	731,786	4,354,870	6,731	

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 11 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 184 - Spring Valley (Continued)				
Unnamed Spring	716,893	4,354,873	5,592	24K Topographic Map
Unnamed Spring	716,916	4,354,883	5,591	
Unnamed Spring	716,909	4,354,935	5,590	
Unnamed Spring	716,932	4,355,020	5,587	
Unnamed Spring	716,896	4,355,033	5,588	
Unnamed Spring	717,158	4,355,033	5,576	
Unnamed Spring	717,105	4,355,037	5,578	
Unnamed Spring	711,482	4,355,324	8,288	
Unnamed Spring	717,220	4,355,360	5,571	
Unnamed Spring	713,138	4,355,831	6,961	National Hydrography Dataset
Unnamed Spring	716,951	4,356,651	5,593	24K Topographic Map
Unnamed Spring	716,954	4,356,772	5,592	
Unnamed Spring	711,075	4,357,545	7,927	
Unnamed Spring	732,467	4,357,572	7,143	National Hydrography Dataset
Unnamed Spring	716,951	4,357,710	5,600	24K Topographic Map
Unnamed Spring	733,061	4,358,055	7,618	National Hydrography Dataset
Sixmile Spring	733,222	4,358,060	7,715	Geographic Names Information System
Unnamed Spring	733,692	4,358,236	8,166	National Hydrography Dataset
Fera One Hundred Two Spring	712,683	4,358,365	6,920	Geographic Names Information System
Fera One Hundred Six Spring	712,241	4,359,440	7,054	
Unnamed Spring	716,944	4,359,742	5,582	24K Topographic Map
Unnamed Spring	732,493	4,360,675	7,708	National Hydrography Dataset
Unnamed Spring	707,922	4,360,678	9,127	24K Topographic Map
Unnamed Spring	707,977	4,360,767	9,181	
Unnamed Spring	710,343	4,360,989	7,679	
Unnamed Spring	716,479	4,361,405	5,608	
Unnamed Spring	716,402	4,361,559	5,612	
Unnamed Spring	708,401	4,361,575	9,326	
Unnamed Spring	709,941	4,362,249	8,435	
Unnamed Spring	716,363	4,362,512	5,612	National Hydrography Dataset
Unnamed Spring	716,475	4,363,315	5,578	24K Topographic Map
Eightmile Spring	733,828	4,363,395	8,072	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	716,411	4,363,655	5,582	24K Topographic Map
Unnamed Spring	716,405	4,363,700	5,583	
Unnamed Spring	716,379	4,363,770	5,584	
Unnamed Spring	708,834	4,364,332	8,893	
Unnamed Spring	716,286	4,364,634	5,579	
Unnamed Spring	716,116	4,364,804	5,587	
Unnamed Spring	716,058	4,364,887	5,589	
Unnamed Spring	716,976	4,365,258	5,564	National Hydrography Dataset

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 12 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 184 - Spring Valley (Continued)				
Unnamed Spring	708,943	4,365,789	8,809	24K Topographic Map
Unnamed Spring	714,938	4,365,821	5,649	
Unnamed Spring	714,919	4,365,924	5,647	
Unnamed Spring	715,050	4,366,049	5,613	
Unnamed Spring	714,980	4,366,062	5,624	
Unnamed Spring	714,758	4,366,065	5,654	
Unnamed Spring	715,057	4,366,087	5,609	
Unnamed Spring	714,823	4,366,094	5,644	
Unnamed Spring	714,813	4,366,126	5,641	
Cottonwood Springs	732,326	4,366,129	7,534	Geographic Names Information System
Unnamed Spring	714,829	4,366,222	5,633	24K Topographic Map
Unnamed Spring	714,739	4,366,283	5,642	
Unnamed Spring	714,871	4,366,338	5,619	
Unnamed Spring	714,752	4,366,511	5,628	
Unnamed Spring	714,685	4,367,329	5,638	National Hydrography Dataset
Unnamed Spring	714,630	4,367,355	5,644	
Unnamed Spring	714,630	4,367,455	5,642	
Unnamed Springs	714,576	4,367,609	5,650	
Unnamed Springs	714,637	4,367,666	5,639	
Unnamed Spring	706,845	4,367,788	9,132	24K Topographic Map
Unnamed Spring	707,997	4,367,859	8,551	
Unnamed Springs	714,592	4,367,869	5,646	
Unnamed Spring	707,872	4,367,965	8,576	
Unnamed Spring	714,939	4,369,091	5,617	
Unnamed Spring	714,949	4,369,115	5,616	
Unnamed Spring	714,918	4,369,201	5,618	National Hydrography Dataset
Unnamed Spring	714,921	4,369,345	5,616	
Unnamed Spring	714,894	4,369,601	5,617	
Unnamed Spring	714,959	4,369,707	5,612	
Unnamed Spring	714,956	4,369,861	5,609	
Unnamed Springs	705,658	4,370,454	9,174	24K Topographic Map
Unnamed Spring	714,767	4,370,799	5,614	National Hydrography Dataset
Unnamed Spring	714,774	4,371,017	5,616	
Unnamed Spring	714,678	4,371,266	5,625	
Unnamed Spring	714,574	4,372,539	5,623	24K Topographic Map
Unnamed Spring	714,245	4,372,578	5,649	National Hydrography Dataset
Unnamed Spring	714,240	4,372,665	5,650	
Unnamed Spring	714,240	4,372,819	5,655	
Unnamed Spring	714,333	4,372,909	5,649	
Unnamed Spring	707,262	4,372,956	8,354	24K Topographic Map

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 13 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 184 - Spring Valley (Continued)				
Unnamed Spring	714,396	4,373,036	5,646	National Hydrography Dataset
Unnamed Spring	714,385	4,373,134	5,651	
Unnamed Spring	714,645	4,373,173	5,630	
Unnamed Spring	714,503	4,373,285	5,642	
Unnamed Spring	714,596	4,373,323	5,637	
Unnamed Spring	714,429	4,373,386	5,654	24K Topographic Map
Unnamed Spring	714,604	4,373,447	5,639	National Hydrography Dataset
Unnamed Spring	714,692	4,373,455	5,631	
Unnamed Spring	714,681	4,373,578	5,637	
Unnamed Spring	710,724	4,373,740	6,694	
Unnamed Spring	731,290	4,374,018	7,774	24K Topographic Map
Unnamed Spring	715,262	4,374,035	5,610	National Hydrography Dataset
Unnamed Spring	715,155	4,374,148	5,612	
Unnamed Spring	715,555	4,374,222	5,605	24K Topographic Map
Unnamed Spring	715,114	4,374,233	5,614	
Unnamed Spring	715,218	4,374,244	5,611	
Unnamed Spring	715,171	4,374,454	5,614	
Unnamed Spring	715,136	4,374,487	5,618	
Unnamed Spring	715,029	4,374,619	5,631	National Hydrography Dataset
Unnamed Spring	737,398	4,378,564	7,317	24K Topographic Map
Unnamed Spring	709,356	4,378,868	7,007	
Cain Springs	738,480	4,380,667	6,964	Geographic Names Information System
Unnamed Spring	738,425	4,380,875	6,955	24K Topographic Map
Unnamed Spring	702,482	4,381,896	8,795	
Unnamed Spring	709,047	4,382,115	6,494	
Fera Ninety Four Spring	703,737	4,383,701	8,010	Geographic Names Information System
Ice Cream Springs	703,424	4,384,021	8,131	
Muncy Spring	711,666	4,385,896	5,966	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	702,086	4,388,686	8,833	24K Topographic Map
Teapot Spring	701,903	4,388,944	8,840	
Unnamed Spring	701,856	4,389,572	8,816	
Unnamed Spring	702,496	4,389,736	8,794	
Unnamed Spring	703,316	4,389,793	8,326	
Teapot Spring	701,909	4,389,853	8,799	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	703,231	4,389,881	8,408	24K Topographic Map
Unnamed Spring	702,095	4,389,897	8,852	
Unnamed Spring	701,717	4,390,111	8,962	
Unnamed Spring	701,685	4,390,143	8,970	
Unnamed Spring	739,016	4,390,259	7,001	
Unnamed Spring	703,407	4,390,688	8,768	

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
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Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 184 - Spring Valley (Continued)				
Unnamed Spring	702,732	4,390,742	8,898	24K Topographic Map
Mike Springs	739,850	4,391,938	7,261	National Hydrography Dataset/Geographic Names Information System
Unnamed Spring	703,223	4,392,090	8,457	24K Topographic Map
Unnamed Spring	703,068	4,392,096	8,495	
Fera Ninety Five Spring	706,521	4,392,147	7,347	Geographic Names Information System
Unnamed Spring	703,040	4,392,329	8,564	24K Topographic Map
Unnamed Spring	702,384	4,393,197	8,697	
Unnamed Spring	701,709	4,393,591	8,488	
Unnamed Spring	701,545	4,393,748	8,559	
Unnamed Spring	701,551	4,393,811	8,529	
Unnamed Spring	701,633	4,393,947	8,480	
Unnamed Spring	740,818	4,394,161	7,568	
Unnamed Spring	702,869	4,394,231	8,377	
Unnamed Spring	739,724	4,394,493	7,593	
Unnamed Spring	739,730	4,394,549	7,600	
Unnamed Spring	705,209	4,395,474	7,517	
Unnamed Spring	702,668	4,395,540	8,467	
Fera One Hundred Five Spring	706,330	4,395,984	7,615	Geographic Names Information System
Unnamed Spring	740,903	4,396,192	7,893	24K Topographic Map
Unnamed Spring	713,496	4,396,276	5,984	
Unnamed Spring	707,588	4,396,840	6,894	
Unnamed Spring	740,604	4,396,961	8,080	
Unnamed Spring	738,652	4,398,109	8,636	
Unnamed Spring	707,249	4,398,360	7,096	
Osborne Springs	711,965	4,398,793	6,120	
Osborne Springs	711,864	4,398,867	6,129	
Osborne Springs	711,996	4,398,885	6,120	Geographic Names Information System
Osborne Springs	711,873	4,398,928	6,132	National Hydrography Dataset
Unnamed Springs	711,930	4,399,040	6,131	
Osborne Springs	711,971	4,399,086	6,128	24K Topographic Map
Mud Springs	707,350	4,399,477	7,022	Geographic Names Information System
Sliderock Spring	703,143	4,399,756	9,397	
Unnamed Spring	705,405	4,400,182	7,727	24K Topographic Map
Unnamed Spring	704,795	4,401,540	7,494	
Unnamed Spring	702,375	4,401,736	9,221	
Unnamed Spring	704,717	4,401,969	7,445	
Pierce Ranch Spring	711,358	4,402,385	6,148	
Unnamed Spring	711,639	4,402,471	6,228	
Unnamed Spring	703,066	4,402,976	8,650	

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 15 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 184 - Spring Valley (Continued)				
Mud Springs	704,307	4,404,271	7,420	Geographic Names Information System
Unnamed Spring	707,335	4,404,860	6,707	24K Topographic Map
Unnamed Spring	710,889	4,405,106	6,231	
Unnamed Spring	701,945	4,405,356	8,197	
Unnamed Spring	702,008	4,405,410	8,153	
Unnamed Springs	702,277	4,405,436	8,053	
Unnamed Springs	702,119	4,405,439	8,109	
Unnamed Springs	702,217	4,405,451	8,064	
Unnamed Spring	702,923	4,405,643	7,809	
Unnamed Spring	702,950	4,405,694	7,834	
Unnamed Spring	703,036	4,405,720	7,785	
Dipping Tank Springs	716,266	4,405,865	7,032	Geographic Names Information System
Unnamed Spring	703,419	4,406,121	7,646	24K Topographic Map
Unnamed Spring	710,598	4,406,533	6,271	
Unnamed Spring	702,812	4,406,557	7,838	
Unnamed Sp[ring	710,204	4,406,628	6,269	
Unnamed Spring	702,292	4,406,635	7,906	
Unnamed Spring	702,618	4,406,665	7,817	
Unnamed Spring	702,334	4,406,683	7,866	
Unnamed Spring	702,549	4,406,683	7,835	
Unnamed Spring	702,400	4,406,734	7,834	
Unnamed Spring	702,468	4,406,805	7,799	
Unnamed Springs	710,341	4,406,813	6,272	
Unnamed Spring	702,510	4,406,847	7,765	
Unnamed Spring	702,570	4,406,847	7,740	
Unnamed Spring	704,319	4,406,901	7,401	
Unnamed Spring	704,417	4,406,952	7,371	
Unnamed Spring	710,161	4,407,133	6,277	
Crystal Spring	703,714	4,407,404	7,438	Geographic Names Information System
Basin Spring	701,860	4,407,623	7,635	24K Topographic Map
Basin Spring	702,104	4,407,719	7,533	Geographic Names Information System
Unnamed Spring	714,158	4,408,326	6,899	24K Topographic Map
Twin Springs	705,039	4,408,416	7,102	Geographic Names Information System
Golden Springs	712,765	4,408,416	6,635	
Unnamed Spring	712,413	4,408,515	6,629	National Hydrography Dataset
Unnamed Spring	714,275	4,408,806	7,017	24K Topographic Map
Unnamed Springs	705,608	4,409,164	6,901	
Unnamed Spring	701,747	4,409,198	7,405	
Unnamed Spring	701,877	4,409,221	7,363	
Unnamed Springs	712,412	4,409,227	6,700	National Hydrography Dataset

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 16 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 184 - Spring Valley (Continued)				
Garden Springs	712,742	4,409,255	6,777	Geographic Names Information System
Mud Spring	702,198	4,409,417	7,277	
Unnamed Spring	702,817	4,409,630	7,146	24K Topographic Map
Unnamed Spring	709,412	4,409,681	6,313	
Unnamed Spring	709,380	4,409,718	6,317	
Unnamed Spring	706,303	4,409,741	6,799	
Unnamed Spring	703,850	4,409,868	6,964	
Long Spring	715,740	4,410,777	7,618	Geographic Names Information System
Unnamed Spring	709,111	4,410,842	6,354	24K Topographic Map
Unnamed Spring	709,314	4,411,785	6,360	National Hydrography Dataset
Unnamed Spring	709,169	4,411,841	6,355	
Unnamed Spring	708,343	4,412,511	6,470	
Unnamed Spring	708,425	4,412,739	6,460	
Unnamed Spring	709,132	4,412,804	6,372	
Unnamed Spring	708,993	4,412,832	6,376	
Rock Springs	716,168	4,415,271	7,448	Geographic Names Information System
Unnamed Spring	700,395	4,415,287	8,317	24K Topographic Map
Unnamed Spring	700,243	4,415,316	8,195	
Upper Gulch Spring	700,154	4,415,477	8,130	Geographic Names Information System
Unnamed Spring	707,413	4,415,559	6,509	24K Topographic Map
Unnamed Spring	707,264	4,415,635	6,511	
Unnamed Spring	700,575	4,416,079	8,001	National Hydrography Dataset
Cold Spring	699,999	4,416,304	8,011	Geographic Names Information System
Sidehill Spring	699,663	4,416,506	7,961	
Unnamed Spring	699,331	4,417,040	7,790	24K Topographic Map
Unnamed Spring	699,214	4,417,081	7,819	
Unnamed Spring	699,442	4,417,087	7,749	
Unnamed Spring	699,572	4,417,122	7,728	
Dolans Trap Spring	703,183	4,422,808	7,945	Geographic Names Information System
Lost Spring	720,272	4,424,310	8,414	
Skull Spring	705,385	4,424,689	8,148	
Grouse Spring	704,781	4,424,953	8,214	
Mustang Spring	705,903	4,425,562	8,293	
Horse Spring	705,711	4,426,205	8,125	
Gravel Spring	705,428	4,426,239	8,280	
Unnamed Springs	718,702	4,426,451	7,601	24K Topographic Map
Middle Creek Spring	718,644	4,428,766	7,596	Geographic Names Information System
Unnamed Spring	719,651	4,429,159	7,846	24K Topographic Map
Unnamed Spring	719,025	4,429,182	7,688	
Unnamed Springs	719,063	4,429,447	7,736	

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
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Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 195 - Snake Valley				
South Little Springs	751,341	4,285,352	5,578	24K Topographic Map
North Little Springs	751,096	4,286,211	5,569	
Big Springs	749,794	4,287,127	5,565	National Hydrography Dataset
Unnamed Spring	750,264	4,289,436	5,550	
Unnamed Springs	750,270	4,289,589	5,567	
Unnamed Springs	750,525	4,290,642	5,552	
Unnamed Springs	750,516	4,290,765	5,548	
Unnamed Spring	750,688	4,291,192	5,548	
Tunnel Spring	780,518	4,292,285	7,069	Geographic Names Information System/National Hydrography Dataset
The Pots	754,648	4,292,411	5,475	
Needle Point Spring	758,117	4,293,839	5,460	
Unnamed Spring	756,740	4,295,857	5,429	National Hydrography Dataset
South Spring	745,256	4,298,826	7,452	Geographic Names Information System/National Hydrography Dataset
North Spring	745,027	4,299,638	7,647	
Unnamed Spring	743,353	4,302,228	7,891	24K Topographic Map
Unnamed Spring	740,818	4,303,680	8,413	National Hydrography Dataset
Unnamed Spring	741,084	4,303,713	8,378	24K Topographic Map
Unnamed Spring	740,998	4,303,780	8,329	
Unnamed Spring	745,688	4,303,973	6,947	
Unnamed Spring	745,578	4,304,053	6,942	
Unnamed Spring	745,604	4,304,116	7,073	National Hydrography Dataset
Unnamed Spring	744,006	4,304,256	7,428	24K Topographic Map
Unnamed Spring	741,084	4,304,643	8,175	National Hydrography Dataset
Unnamed Spring	741,048	4,304,743	8,266	24K Topographic Map
Lexington Spring	751,738	4,305,169	6,161	Geographic Names Information System
Unnamed Spring	740,254	4,305,714	8,028	National Hydrography Dataset
Clay Spring	760,875	4,306,147	5,446	24K Topographic Map
Unnamed Spring	740,765	4,306,347	7,768	
Unnamed Spring	743,114	4,307,338	7,007	National Hydrography Dataset
Unnamed Spring	743,796	4,307,613	6,900	24K Topographic Map
Big Wash Spring	736,112	4,310,513	9,564	Geographic Names Information System/National Hydrography Dataset
Tilford Spring	743,188	4,312,000	7,375	Geographic Names Information System
Unnamed Spring	742,542	4,312,278	7,684	National Hydrography Dataset
Unnamed Spring	734,378	4,312,489	10,264	24K Topographic Map
Unnamed Spring	734,821	4,313,514	10,407	National Hydrography Dataset
Unnamed Spring	735,017	4,313,900	10,459	
Unnamed Spring	734,145	4,313,912	10,770	
Clay Spring	748,339	4,314,670	6,427	Geographic Names Information System/National Hydrography Dataset

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 18 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 195 - Snake Valley (Continued)				
Unnamed Spring	733,760	4,314,869	10,700	24K Topographic Map
Unnamed Spring	736,990	4,314,888	9,518	
Unnamed Spring	737,446	4,314,894	9,710	
Unnamed Spring	744,330	4,315,564	7,516	National Hydrography Dataset
Unnamed Spring	741,904	4,315,653	8,408	
Unnamed Spring	739,038	4,315,824	8,211	24K Topographic Map
Unnamed Spring	739,057	4,315,919	8,183	National Hydrography Dataset
Unnamed Spring	741,204	4,315,928	8,474	
Mahogany Spring	746,764	4,316,126	6,464	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	745,040	4,316,240	6,888	24K Topographic Map
Unnamed Spring	745,988	4,316,665	6,476	National Hydrography Dataset
Unnamed Spring	737,181	4,316,711	8,845	24K Topographic Map
Unnamed Spring	738,943	4,316,785	8,253	National Hydrography Dataset
Unnamed Spring	735,352	4,316,861	9,530	
Unnamed Spring	735,689	4,316,944	9,316	
Unnamed Spring	746,319	4,317,078	6,324	
Unnamed Spring	744,235	4,317,241	6,892	
Unnamed Spring	736,098	4,317,608	9,316	24K Topographic Map
Unnamed Spring	743,596	4,317,678	6,926	National Hydrography Dataset
Kious Spring	746,028	4,318,999	6,020	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	743,302	4,320,407	6,386	National Hydrography Dataset
Unnamed Spring	751,840	4,320,410	5,204	24K Topographic Map
Unnamed Spring	732,461	4,321,205	10,271	
Bone Spring	745,149	4,321,451	5,921	Geographic Names Information System
Unnamed Spring	739,214	4,322,109	7,277	24K Topographic Map
Unnamed Spring	739,272	4,322,118	7,262	
Unnamed Spring	739,309	4,322,127	7,257	
Unnamed Spring	735,323	4,322,525	9,083	
Unnamed Spring	743,809	4,323,219	6,049	National Hydrography Dataset
Unnamed Spring	743,855	4,323,675	6,039	
Unnamed Spring	743,634	4,323,782	6,100	
Unnamed Spring	743,796	4,323,785	6,061	
Unnamed Spring	744,209	4,323,791	5,910	24K Topographic Map
Unnamed Spring	744,133	4,323,828	5,926	
Unnamed Spring	743,582	4,323,981	6,028	National Hydrography Dataset
Unnamed Spring	743,380	4,324,217	6,080	24K Topographic Map
Unnamed Spring	743,408	4,324,293	6,076	National Hydrography Dataset
Unnamed Spring	743,289	4,324,486	6,057	24K Topographic Map
Unnamed Spring	742,619	4,324,957	6,187	
Unnamed Spring	737,045	4,325,125	7,847	National Hydrography Dataset

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 19 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 195 - Snake Valley (Continued)				
Unnamed Spring	734,197	4,325,832	8,348	24K Topographic Map
Unnamed Spring	742,392	4,325,963	6,162	National Hydrography Dataset
Strawberry Spring	742,408	4,326,028	6,094	Geographic Names Information System
Unnamed Spring	742,102	4,326,092	6,235	National Hydrography Dataset
Unnamed Spring	733,552	4,326,440	7,854	24K Topographic Map
Unnamed Spring	735,320	4,326,471	7,746	
Unnamed Springs	732,015	4,327,146	7,851	
Unnamed Spring	729,127	4,327,323	8,464	
Unnamed Spring	728,846	4,327,696	8,428	
Unnamed Spring	738,117	4,327,791	6,673	
Unnamed Spring	738,041	4,327,806	6,685	
Unnamed Spring	738,020	4,327,816	6,687	
Unnamed Spring	730,170	4,327,831	7,788	
Unnamed Spring	738,004	4,327,852	6,688	
Unnamed Springs	730,760	4,328,002	7,725	
Unnamed Spring	737,946	4,328,017	6,637	
Unnamed Spring	733,994	4,328,097	7,537	
Unnamed Spring	733,379	4,328,100	7,568	
Unnamed Spring	737,328	4,328,681	6,673	National Hydrography Dataset
Unnamed Spring	729,130	4,330,235	7,756	24K Topographic Map
Monroe Spring	728,237	4,330,593	8,224	Geographic Names Information System
Unnamed Spring	740,722	4,330,686	5,970	24K Topographic Map
Mud Spring	729,333	4,331,032	7,617	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	756,684	4,331,280	5,076	National Hydrography Dataset
Unnamed Spring	756,528	4,331,448	5,076	
Unnamed Spring	744,200	4,332,549	5,841	
Willow Patch Spring	734,210	4,333,632	6,619	Geographic Names Information System/National Hydrography Dataset
Waking Spring	730,092	4,333,709	7,082	Geographic Names Information System
Unnamed Spring	755,580	4,333,975	5,057	24K Topographic Map
Want Spring	734,369	4,334,376	6,700	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	740,092	4,334,541	6,287	24K Topographic Map
Sacramento Springs	729,398	4,335,380	7,267	Geographic Names Information System
Unnamed Spring	754,756	4,335,571	5,060	National Hydrography Dataset
Unnamed Spring	754,815	4,335,697	5,056	
Pipe Spring	754,829	4,335,770	5,055	Geographic Names Information System
Pipe Spring	754,812	4,335,817	5,055	National Hydrography Dataset
Unnamed Spring	755,096	4,336,286	5,027	
Coyote Spring	744,829	4,337,273	6,507	Geographic Names Information System
Unnamed Spring	743,921	4,337,569	6,650	24K Topographic Map
Unnamed Spring	735,645	4,338,794	7,086	National Hydrography Dataset

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
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Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 195 - Snake Valley (Continued)				
Red Spring	749,073	4,339,758	6,444	Geographic Names Information System
Unnamed Spring	734,517	4,340,048	7,382	24K Topographic Map
Rhodes Spring	746,816	4,340,081	7,084	Geographic Names Information System
Unnamed Spring	758,388	4,340,529	4,969	National Hydrography Dataset
Rabbit Brush Spring	735,508	4,340,708	7,576	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	746,783	4,341,673	8,000	24K Topographic Map
Pipe Spring	734,769	4,342,287	8,002	Geographic Names Information System/National Hydrography Dataset
Rock Spring	734,447	4,342,604	8,073	
Unnamed Spring	733,149	4,342,765	8,083	24K Topographic Map
Conger Spring	782,909	4,342,976	6,701	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	737,180	4,343,157	7,817	24K Topographic Map
Unnamed Spring	736,904	4,343,577	7,832	National Hydrography Dataset
Unnamed Spring	754,045	4,343,703	5,539	
Unnamed Spring	731,685	4,344,072	8,309	
Miller Basin Spring	731,906	4,344,107	8,263	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	736,559	4,345,464	8,048	National Hydrography Dataset
Unnamed Spring	736,693	4,345,622	7,974	
Unnamed Spring	736,456	4,345,774	7,986	
Unnamed Spring	737,033	4,346,454	8,270	24K Topographic Map
Silver Creek Spring	735,533	4,348,066	8,979	Geographic Names Information System/National Hydrography Dataset
Unnamed Spring	769,380	4,348,116	4,877	National Hydrography Dataset
Horse Trap Spring	770,153	4,348,719	4,892	24K Topographic Map
Unnamed Spring	769,750	4,348,979	4,889	
Unnamed Spring	769,979	4,349,023	4,895	National Hydrography Dataset
Knoll Springs	769,356	4,349,037	4,866	24K Topographic Map
Unnamed Spring	769,434	4,349,070	4,867	National Hydrography Dataset
Unnamed Spring	769,443	4,349,108	4,866	24K Topographic Map
Unnamed Spring	769,437	4,349,210	4,867	National Hydrography Dataset
Unnamed Spring	769,724	4,349,257	4,876	
Unnamed Spring	769,791	4,349,339	4,877	
Unnamed Spring	769,826	4,349,454	4,876	24K Topographic Map
Tiarnleys Spring	743,143	4,349,719	9,757	Geographic Names Information System
Unnamed Spring	746,692	4,349,871	9,334	24K Topographic Map
Unnamed Spring	746,598	4,349,953	9,332	
Unnamed Spring	757,747	4,350,160	4,978	
Unnamed Spring	746,411	4,350,806	9,942	
North Knoll Spring	770,374	4,351,047	4,875	
Unnamed Spring	742,904	4,352,340	10,980	
Ungopah Spring	747,362	4,352,662	8,649	Geographic Names Information System
Unnamed Spring	742,424	4,352,668	10,949	24K Topographic Map

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
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Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 195 - Snake Valley (Continued)				
Unnamed Spring	757,970	4,354,474	4,927	National Hydrography Dataset
Unnamed Spring	740,024	4,354,599	9,193	24K Topographic Map
Unnamed Spring	758,001	4,354,756	4,938	National Hydrography Dataset
Unnamed Spring	757,999	4,354,841	4,941	
Unnamed Spring	740,701	4,355,095	9,029	24K Topographic Map
Unnamed Spring	754,321	4,355,248	5,417	
Unnamed Spring	757,819	4,355,355	4,961	National Hydrography Dataset
Unnamed Spring	735,345	4,356,024	9,144	24K Topographic Map
Unnamed Spring	739,068	4,356,133	8,685	
Mud Spring	735,575	4,356,468	8,884	National Hydrography Dataset/Geographic Names Information System
Unnamed Spring	741,154	4,357,156	8,622	24K Topographic Map
Unnamed Spring	736,701	4,357,623	8,625	National Hydrography Dataset
Chalk Spring	738,246	4,357,995	8,332	Geographic Names Information System
Unnamed Seeps	769,251	4,365,240	4,803	National Hydrography Dataset
Unnamed Seeps	769,415	4,365,310	4,804	
Unnamed Spring	733,894	4,366,658	9,396	
Ptomaine Springs	733,920	4,367,098	9,345	National Hydrography Dataset/Geographic Names Information System
Bishop Springs Area	769,238	4,367,128	4,816	Geographic Names Information System
Unnamed Spring	768,467	4,367,148	4,793	24K Topographic Map
Unnamed Spring	768,522	4,367,339	4,796	
Unnamed Spring	733,870	4,367,643	9,210	National Hydrography Dataset
Unnamed Spring	733,754	4,367,837	9,195	
Unnamed Spring	762,440	4,370,026	4,821	
Unnamed Spring	762,162	4,370,103	4,833	
Marble Spring	733,952	4,370,985	8,890	Geographic Names Information System
Cold Spring	761,945	4,371,702	4,860	24K Topographic Map
Unnamed Spring	763,349	4,372,026	4,805	National Hydrography Dataset
Unnamed Spring	764,674	4,372,251	4,781	
Unnamed Spring	764,447	4,372,333	4,781	
Unnamed Spring	764,328	4,372,556	4,784	
Unnamed Spring	764,419	4,372,633	4,781	
Unnamed Spring	764,484	4,372,709	4,781	
Unnamed Spring	764,390	4,372,754	4,783	
Unnamed Spring	764,315	4,372,806	4,784	
Unnamed Spring	764,308	4,372,915	4,783	
Unnamed Spring	764,318	4,373,114	4,781	
Unnamed Spring	764,379	4,373,178	4,781	
Unnamed Spring	764,318	4,373,254	4,781	
Unnamed Spring	764,311	4,373,464	4,784	
Unnamed Spring	764,405	4,374,086	4,781	

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 22 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 195 - Snake Valley (Continued)				
Unnamed Spring	764,389	4,374,195	4,781	National Hydrography Dataset
Unnamed Spring	764,434	4,374,283	4,781	
Unnamed Spring	764,517	4,374,342	4,781	
Unnamed Spring	764,609	4,374,505	4,781	
Unnamed Spring	764,798	4,374,628	4,781	
Unnamed Spring	763,989	4,374,775	4,802	
Unnamed Spring	764,957	4,374,874	4,781	
Unnamed Spring	765,149	4,375,190	4,781	
Unnamed Spring	765,114	4,375,545	4,781	
Unnamed Spring	765,249	4,376,172	4,781	
Unnamed Spring	765,197	4,376,250	4,781	
Unnamed Spring	767,101	4,378,289	4,787	24K Topographic Map
Unnamed Spring	767,155	4,378,457	4,785	National Hydrography Dataset
Unnamed Spring	767,749	4,380,146	4,781	24K Topographic Map
Unnamed Spring	767,796	4,380,292	4,781	National Hydrography Dataset
Unnamed Spring	767,740	4,380,481	4,781	24K Topographic Map
Unnamed Spring	766,417	4,381,536	4,781	
Unnamed Spring	766,369	4,381,609	4,781	
Tin Spring	748,446	4,381,951	6,149	Geographic Names Information System
Unnamed Spring	766,598	4,382,359	4,781	24K Topographic Map
Unnamed Spring	766,548	4,382,513	4,781	
Unnamed Spring	766,611	4,382,601	4,781	
Unnamed Spring	766,591	4,382,749	4,779	
Unnamed Spring	769,314	4,385,868	4,774	National Hydrography Dataset
Unnamed Spring	770,203	4,387,638	4,761	
Unnamed Spring	770,216	4,387,696	4,761	24K Topographic Map
Unnamed Spring	770,246	4,387,794	4,761	National Hydrography Dataset
Unnamed Spring	745,569	4,387,807	6,819	24K Topographic Map
Sulphur Spring	749,611	4,388,215	6,835	National Hydrography Dataset/Geographic Names Information System
Unnamed Spring	770,510	4,388,317	4,761	24K Topographic Map
Unnamed Spring	770,455	4,388,355	4,761	
Unnamed Spring	770,498	4,388,411	4,761	
Unnamed Spring	769,630	4,390,049	4,744	National Hydrography Dataset
Upper Sulphur Spring	750,177	4,390,731	7,395	National Hydrography Dataset/Geographic Names Information System
Unnamed Spring	769,583	4,390,734	4,744	24K Topographic Map
Unnamed Spring	743,629	4,390,953	7,272	
Unnamed Spring	769,673	4,391,125	4,741	National Hydrography Dataset
Unnamed Spring	747,307	4,392,402	8,121	24K Topographic Map
Mill Spring	743,991	4,393,062	7,822	Geographic Names Information System

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
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Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 195 - Snake Valley (Continued)				
Unnamed Spring	743,263	4,393,601	7,673	24K Topographic Map
Unnamed Spring	743,197	4,393,650	7,684	
Unnamed Spring	762,408	4,394,749	5,575	National Hydrography Dataset
Unnamed Spring	762,328	4,394,910	5,634	
Unnamed Spring	762,416	4,394,930	5,640	
Unnamed Spring	759,676	4,396,886	6,301	24K Topographic Map
Unnamed Spring	759,136	4,397,901	6,845	National Hydrography Dataset
Unnamed Spring	760,757	4,398,258	6,764	24K Topographic Map
Unnamed Spring	764,586	4,406,409	7,808	National Hydrography Dataset
Unnamed Spring	765,674	4,409,651	7,448	
Unnamed Spring	765,969	4,409,699	7,266	
Unnamed Spring	766,928	4,409,762	6,976	
Unnamed Spring	765,569	4,410,069	7,490	
Unnamed Spring	764,620	4,411,013	8,293	
Unnamed Spring	764,888	4,411,228	8,512	
Unnamed Spring	773,226	4,413,780	5,290	
Unnamed Spring	773,347	4,414,273	5,218	
Kent Spring	773,839	4,415,363	5,167	Geographic Names Information System
Unnamed Spring	766,838	4,418,421	8,193	National Hydrography Dataset
Unnamed Spring	769,038	4,419,705	7,709	
Unnamed Spring	766,398	4,419,953	8,020	
Unnamed Spring	767,662	4,420,046	7,780	
Unnamed Spring	765,368	4,420,391	8,438	
Unnamed Spring	766,167	4,420,443	8,140	
Unnamed Spring	766,131	4,420,533	8,152	24K Topographic Map
Unnamed Spring	764,569	4,420,580	8,731	National Hydrography Dataset
Unnamed Spring	765,316	4,420,599	8,517	
Unnamed Spring	782,268	4,421,344	4,329	
Unnamed Spring	782,320	4,421,437	4,328	
Unnamed Spring	783,269	4,421,569	4,321	
Unnamed Spring	782,157	4,421,589	4,328	
Unnamed Spring	782,177	4,421,633	4,328	
Unnamed Spring	782,084	4,421,689	4,328	
Unnamed Spring	782,198	4,421,719	4,328	
Unnamed Spring	782,111	4,421,733	4,328	
Unnamed Spring	782,088	4,421,776	4,328	
Unnamed Spring	782,200	4,422,219	4,323	
Unnamed Spring	780,793	4,422,256	4,335	
Unnamed Spring	805,007	4,422,426	4,315	

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
(Page 24 of 25)

Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 195 - Snake Valley (Continued)				
Unnamed Spring	780,582	4,422,429	4,336	24K Topographic Map
Unnamed Spring	780,670	4,422,449	4,334	
Unnamed Spring	780,927	4,422,470	4,331	
Unnamed Spring	780,946	4,422,513	4,331	
Unnamed Spring	771,284	4,422,542	6,509	National Hydrography Dataset
Unnamed Spring	780,786	4,422,556	4,332	24K Topographic Map
Unnamed Spring	780,852	4,422,561	4,331	
Unnamed Spring	780,454	4,422,570	4,337	
Unnamed Spring	780,577	4,422,586	4,333	
Unnamed Spring	780,645	4,422,586	4,333	
Unnamed Spring	780,736	4,422,622	4,331	
Unnamed Spring	803,794	4,422,633	4,301	National Hydrography Dataset
Unnamed Spring	780,734	4,422,663	4,331	24K Topographic Map
Unnamed Spring	803,428	4,422,781	4,286	National Hydrography Dataset
Big Spring	780,477	4,422,797	4,333	National Hydrography Dataset/Geographic Names Information System
Unnamed Spring	780,463	4,422,868	4,333	24K Topographic Map
Unnamed Spring	780,284	4,422,877	4,338	
Unnamed Spring	780,420	4,422,934	4,334	
Unnamed Spring	780,393	4,422,981	4,334	
Unnamed Spring	780,424	4,423,006	4,333	
Unnamed Spring	780,369	4,423,052	4,332	
Unnamed Spring	780,326	4,423,079	4,333	National Hydrography Dataset
Unnamed Spring	780,676	4,423,102	4,328	24K Topographic Map
Unnamed Spring	780,267	4,423,252	4,334	
Unnamed Spring	769,311	4,423,368	7,912	National Hydrography Dataset
Unnamed Spring	805,030	4,423,461	4,293	24K Topographic Map
Unnamed Spring	805,053	4,423,482	4,294	National Hydrography Dataset
Unnamed Spring	780,712	4,423,552	4,323	
Wilson Health Springs	805,158	4,423,580	4,298	National Hydrography Dataset/Geographic Names Information System
Unnamed Spring	805,339	4,423,700	4,298	National Hydrography Dataset
Unnamed Spring	780,712	4,423,946	4,322	
Unnamed Spring	805,476	4,423,987	4,294	
Unnamed Spring	771,088	4,426,073	6,695	
Unnamed Spring	771,361	4,426,114	6,541	
Unnamed Spring	776,054	4,427,852	4,771	
Unnamed Spring	776,054	4,427,881	4,767	24K Topographic Map
Unnamed Spring	776,024	4,427,911	4,772	
Unnamed Spring	776,021	4,427,937	4,770	
Unnamed Spring	775,962	4,427,944	4,787	National Hydrography Dataset

Table E.1-2
Additional Springs Inventoried from the National Hydrography Dataset, Geographic Names Information System, and USGS 1:24,000 Topographic Maps
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Spring Name	UTM Easting (m)	UTM Northing (m)	Elevation (ft-amsl)	Source
Hydrographic Area 195 - Snake Valley (Continued)				
Unnamed Spring	775,955	4,427,977	4,786	24K Topographic Map
Unnamed Spring	775,943	4,428,001	4,787	
Unnamed Spring	775,967	4,428,024	4,780	
Unnamed Spring	775,943	4,428,029	4,786	
Unnamed Spring	775,941	4,428,055	4,786	National Hydrography Dataset
Unnamed Spring	775,885	4,428,189	4,794	24K Topographic Map
Unnamed Spring	775,856	4,428,408	4,794	
Unnamed Spring	769,708	4,429,605	6,407	National Hydrography Dataset
Unnamed Spring	781,851	4,431,909	4,293	
Hydrographic Area 210 - Coyote Springs Valley				
Unnamed Spring	673,395	4,066,407	4,455	24K Topographic Map
Perkins Spring	680,345	4,073,201	2,827	Geographic Names Information System
Grapevine Spring	669,497	4,080,046	6,038	National Hydrography Dataset/Geographic Names Information System
Cherry Spring	669,264	4,081,017	5,824	
Lamb Spring	688,021	4,093,555	2,737	Geographic Names Information System
Granger Spring	688,983	4,094,019	2,803	
Coyote Spring	679,089	4,095,722	2,529	National Hydrography Dataset/Geographic Names Information System
Elderberry Spring	669,423	4,096,929	4,402	Geographic Names Information System
Coyote Springs	685,713	4,097,183	2,748	
Evergreen Spring	674,530	4,116,925	4,044	