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SOUTHERN NEVADA
WATER AUTHORITY

Water Resources Division

2009 Delamar, Dry Lake, and Cave Valleys Hydrologic Monitoring and Mitigation Plan Status and Data Report

March 2010

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Nevada State Engineer
and the DDC Stipulation
Executive Committee

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ACRONYMS

BLM	Bureau of Land Management
BRT	Biological Resource Team
DDC	Delamar, Dry Lake, and Cave valleys
DOI	U.S. Department of the Interior
EC	Executive Committee
EPA	U.S. Environmental Protection Agency
JFA	Joint Funding Agreement
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NDOW	Nevada Department of Wildlife
NDWR	Nevada Division of Water Resources
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NSE	Nevada State Engineer
NWS	National Weather Service
SNOTEL	SNOwpack TELemetry
SNWA	Southern Nevada Water Authority
SR	State Route
TRP	Technical Review Panel
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
WRCC	Western Regional Climate Center

ABBREVIATIONS

°C	degrees Celsius
afy	acre-feet per year
amsl	above mean sea level
bgs	below ground surface
cfs	cubic feet per second
cm	centimeter
ft	foot
gal	gallon

Abbreviations (Continued)

gpm	gallons per minute
in.	inch
L	liter
m	meter
mg	milligram
mi	mile
µg	microgram
µm	micrometer
µmho	micromho
µS	microsiemen
pmc	percent modern carbon

1.0 INTRODUCTION

The Southern Nevada Water Authority (SNWA) prepared this report to satisfy the requirements of the *Hydrologic Monitoring and Mitigation Plan for Delamar, Dry Lake, and Cave Valleys* (HMMP) (SNWA, 2009a), approved by the Nevada State Engineer (NSE) on December 22, 2009, as required by NSE Ruling Number 5875. The location of the project area associated with this report is presented in Figure 1-1. The hydrologic data collected in 2009 and the current status of each element of the HMMP are presented in this report.

This document also satisfies the hydrologic data reporting requirements for the Hydrologic Monitoring, Management, and Mitigation Plan associated with the U.S. Department of Interior (DOI) and SNWA Stipulation Agreement. The Plan contains all of the required hydrologic monitoring elements of the Stipulation agreement as well as monitoring related to non-federal water-right holders.

This is the third Delamar, Dry Lake, and Cave valleys (DDC) hydrologic data report. The *Delamar, Dry Lake, and Cave Valley Stipulation Agreement Hydrologic Monitoring Plan Status and Data Report* (SNWA, 2008) documented data collected in 2007 and historical data from selected existing monitor wells. The *Delamar, Dry Lake, and Cave Valley Stipulation Agreement Hydrologic Monitoring Plan Status and Data Report* (SNWA, 2009b) presented detailed descriptions and historical data up to 2008 from the hydrologic monitoring network, which was revised and expanded to meet the HMMP objectives.

1.1 Background

SNWA holds groundwater rights in DDC for municipal and domestic purposes under Permits 53987 through 53992 for the appropriation of groundwater resources in DDC. These permits were granted by the NSE in Ruling Number 5875 (Ruling) issued on July 9, 2008. The total combined duty under Permits 53987 and 53988 located in Cave Valley is limited to 4,678 afy. The total combined duty under Permits 53989 and 53990 located in Dry Lake Valley is limited to 11,584 afy. The total combined duty under Permits 53991 and 53992 located in Delamar Valley is limited to 2,493 afy. The Ruling required the development of a hydrologic monitoring and mitigation plan.

On January 7, 2008, prior to the water-right applications hearing, a Stipulation for Withdrawal of Protests (Stipulation) was established between SNWA and the DOI, on behalf of the Bureau of Indian Affairs, the Bureau of Land Management (BLM), the National Park Service, and the U.S. Fish and Wildlife Service (USFWS) (collectively referred to as the DOI Bureaus). The Stipulation requires that SNWA implement a hydrologic monitoring, management, and mitigation plan, which is presented in Exhibit A of the Stipulation. As part of the Stipulation, an Executive Committee (EC) was established to oversee its implementation. A Technical Review Panel (TRP), composed of

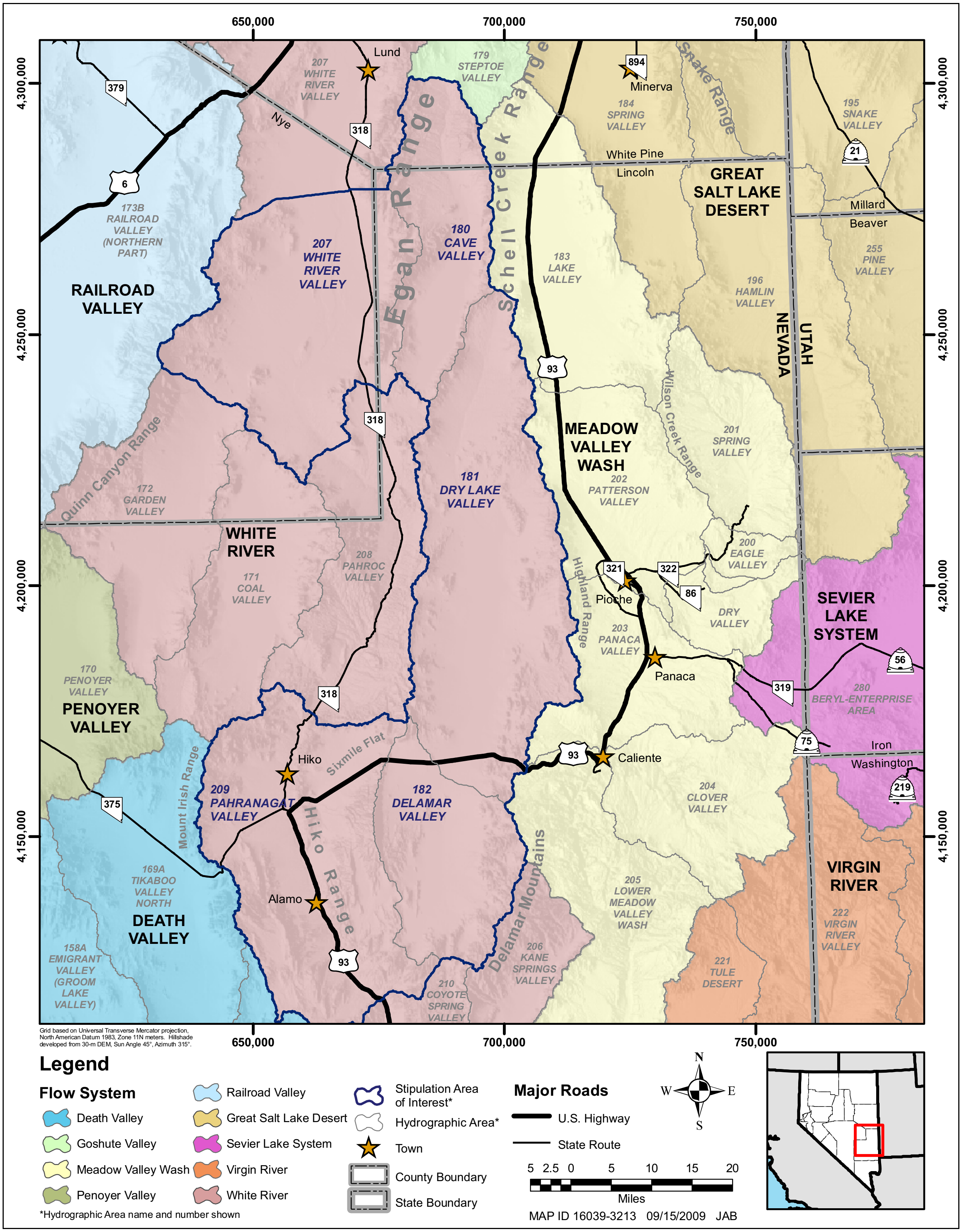


Figure 1-1
Primary Study Area Location

representatives of parties to the agreement, was also established to develop and oversee the implementation of the hydrologic monitoring, management, and mitigation plan, review program data, and modify the plan, if necessary.

The TRP, in consultation with the NSE, developed a hydrologic monitoring program that meets the requirements of the Stipulation and Ruling. The program is summarized in SNWA (2009a and b). An annual DDC HMMP status and data report is planned to be submitted to the EC and NSE, for each year in the future that the plan is in effect, to meet the reporting requirements of the Stipulation and NSE.

1.2 Major Activities Performed in 2009

Major activities associated with the HMMP performed in 2009 are as follows:

- Submitted the HMMP to the NSE, which was approved on December 22, 2009 and contains all the required hydrologic monitoring elements of the Stipulation agreement.
- Pursued BLM right-of-way access for three new monitor well-locations.
- Provided technical assistance to the Biological Resource Team (BRT) in preparation of the Biological Monitoring Plan.
- Finalized the groundwater and spring monitoring network locations.
- Performed a professional-grade survey on all existing wells included in the network.
- Fully instrumented all six locations selected for continuous monitoring. Performed routine physical water-level measurements on monitoring network wells. Initiated program monitoring of the following wells:
    - 383133115030201 (White River) (Quarterly)
    - 383307114471001 (Cave) (Quarterly)
    - 380531114354201 (Dry Lake) (Continuous)
    - 373803115050501 (Pahranagat) (Quarterly)
    - 373405115090001 (Pahranagat) (Quarterly)
    - 209 S07 E62 20AA 1 (Pahranagat) (Quarterly)
- Performed a field reconnaissance and historical data review of the spring network.
- Installed a flume at Hardy Springs.
- Installed a vault, a flow meter, and datalogger instrumentation to measure discharge through the pipeline from Hiko Spring.
- Installed a flume and continuous monitoring instrumentation on Middle Flag Spring (Flag Spring 2).

- Completed site visits of the eight local springs located in DDC.
- Maintained the SNWA data-exchange web site accessible by NSE, EC, TRP, and BRT. The web site contains project reports, monitoring network attributes, and hydrologic data. Data were posted on the site within 90 days of collection.

1.3 Report Scope

Section 2.0 of this report presents the hydrologic data collected from the groundwater, spring, and precipitation monitoring network associated with the HMMP. Section 3.0 presents anticipated activities in 2010. Section 4.0 documents report references. Appendix A through Appendix G present tables and graphs of various data discussed in the report. Photos documenting new network flume installations and current DDC spring conditions are also presented.

2.0 DDC HMMP Status and Data

The current status of the monitoring network and hydrologic data collected in 2009 for each major element of the DDC HMMP are provided in this section. Additionally, water-chemistry data from samples collected at Hiko and Hardy Springs in 2009 are included. Historical data are presented in previous SNWA annual reports (SNWA, 2008, 2009b).

2.1 Hydrologic Monitoring Program

The HMMP establishes a network to collect hydrologic data for the purposes of defining baseline hydrologic conditions prior to SNWA withdrawals in DDC and detect the effects of these withdrawals as pumping occurs. The network includes the monitor wells and springs within DDC and adjacent hydrographic areas that are presented on Figure 2-1.

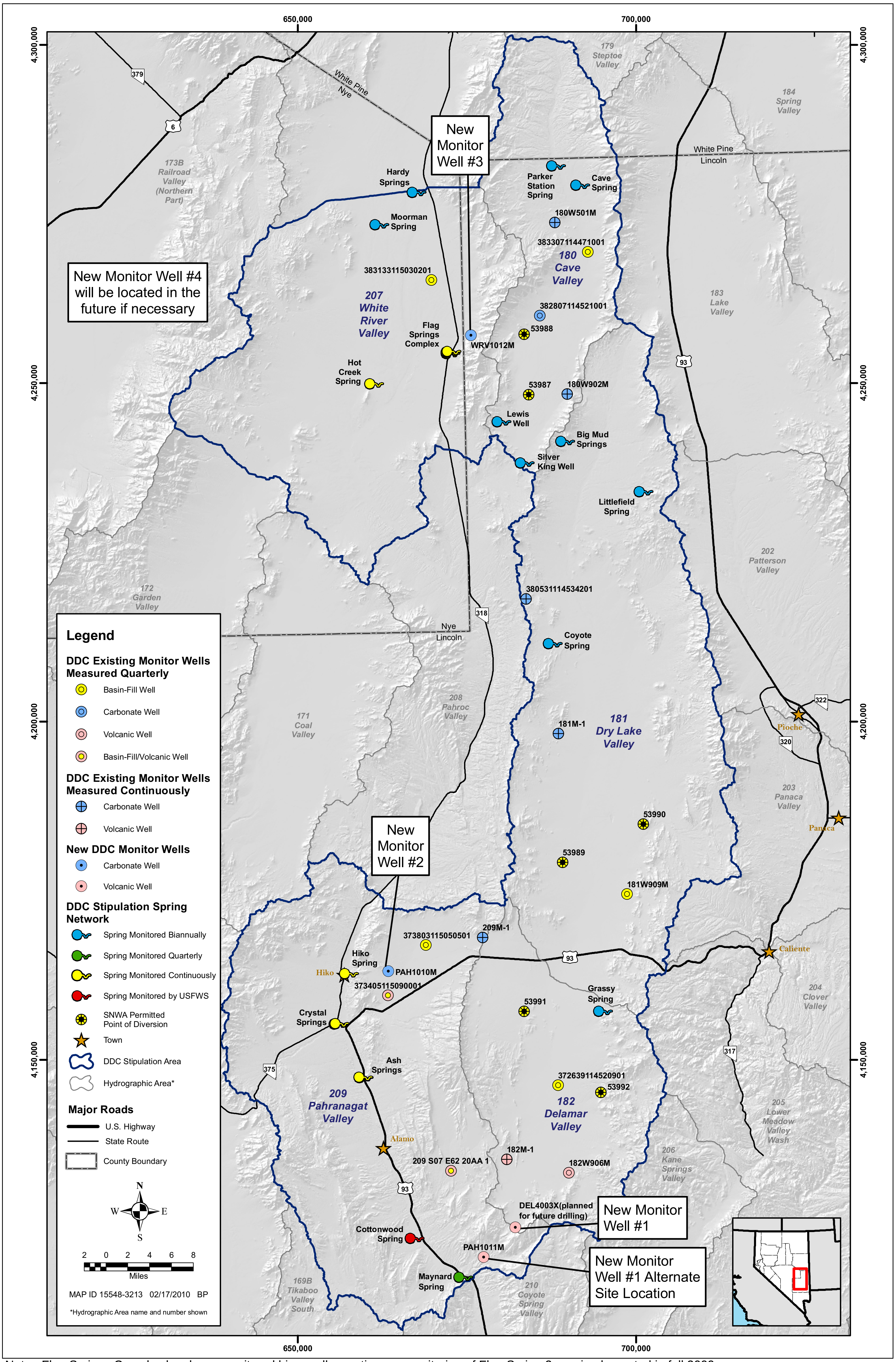
2.2 Monitor-Well Network

The HMMP includes monitoring of existing and new wells completed in the basin-fill, carbonate-rock, and volcanic-rock aquifers at strategic locations to provide representative data spatially across the program area. Monitor-well locations were selected with consideration of the hydrogeologic conditions at each location. Geologic reconnaissance, stratigraphic and structural field mapping, aerial photo analysis, surface geophysics, and a review of existing hydrogeologic data were performed to assist in well-site selection. This network will provide long-term monitoring and early warning of drawdown propagation, if any, induced by SNWA groundwater development that might adversely affect existing water-right holders and groundwater-dependent areas sustaining critical habitat for endangered and/or threatened species.

2.2.1 Existing-Well Monitoring Network

SNWA will record periodic water levels quarterly at nine representative monitor wells and continuously at six additional network well locations. This network includes seven SNWA wells, three private wells, four U.S. Geological Survey (USGS-MX) wells, and one BLM well located in DDC and the adjacent White River and Pahranagat hydrographic areas. The locations of the monitor wells in the network are shown on Figure 2-1. Well-location coordinates, construction attributes, and monitoring frequencies are presented in Table 2-1. A professional survey of location coordinates, ground-surface elevations, and top-of-casing measuring-point elevations of the wells has been completed.

SNWA constructed its seven monitor wells associated with this network in 2005. These consist of four 6-in.-diameter and three 12-in.-diameter monitor wells in DDC. Geologic analysis reports were



Note: Flag Springs Complex has been monitored biannually; continuous monitoring of Flag Spring 2 was implemented in fall 2009.

Figure 2-1
DDC Monitor-Well and Spring Network

Table 2-1
DDC Existing-Well Monitoring Network

Site Number	Station Local Number	Location[a]		Surface Elevation (ft amsl)	Completion Date	Drill Depth (ft bgs)	Well Depth (ft bgs)	Well Casing Diameter (in.)	Screened Interval (ft bgs)	Open Interval (ft bgs)	Aquifer	Monitor Frequency
		UTM Northing (m)	UTM Easting (m)									
180W902M	180W902M	4,248,355.59	689,816.08	5,984.89	10/19/2005	917	903	12	195-882	77-917	Carbonate	Continuous
382807114521001	180 N07 E63 14BADD 1 USGS-MX	4,259,963.15	685,737.56	6,012.39	9/30/1980	460	460	10	210-250, 375-435	40-460	Carbonate[b]	Quarterly
383307114471001	180 N08 E64 15BCBC1 USBLM (Harris Well)	4,269,378.23	692,859.57	6,162.55	---	---	---	7	---	---	Basin Fill	Quarterly
180W501M	180W501M	4,273,712.79	687,971.03	6,428.63	9/23/2005	1,215	1,212	6	788-1,192	54-1,215	Carbonate	Continuous
182W906M	182W906M	4,133,304.57	690,065.21	4,796.96	9/2/2005	1,735	1,703	6	1,275-1,678	130-1,735	Volcanic	Quarterly
182M-1	182M-1	4,135,293.37	680,867.32	4,597.78	7/10/2005	1,345	1,331	12	1,006-1,290	58-1,345	Volcanic	Continuous
372639114520901	182 S06 E63 12AD 1 USGS-MX	4,146,220.24	688,472.41	4,706.30	5/10/1980	1,215	1,195	10	920-980, 1,040-1,180	40-1,215	Basin Fill	Quarterly[c]
181W909M	181W909M	4,174,462.59	698,676.17	4,799.41	10/16/2007	1,285	1,260	12	637-1,240	183-1,285	Basin Fill	Quarterly
181M-1	181M-1	4,198,199.90	688,534.99	4,963.07	8/30/2005	1,501	1,471	6	765-1,451	58-1,501	Carbonate	Continuous
380531114534201	181 N03 E63 27CAA 1 USGS-MX	4,218,085.09	683,720.32	5,456.35	1/1/1981	2,395	2,395	10	---	775-2,395	Carbonate	Continuous[c]
209 S07 E62 20AA 1	209 S07 E62 20AA 1 (Dean Turley Well)	4,133,610.32	672,648.88	4,082.46	1/10/1981	695	695	8	600-695	55-695	Basin Fill/ Volcanic	Quarterly
373405115090001	209 S04 E61 28CD 1	4,159,504.38	663,314.66	4,230.58	9/19/1968	1,314	1,314	12	1,200-1,300	52-1,314	Basin Fill/ Volcanic	Quarterly
373803115050501	209 S04 E61 01AACB1	4,166,944.29	668,927.03	4,528.90	---	---	700	8	---	---	Basin Fill	Quarterly
209M-1	209M-1	4,168,065.79	677,323.46	5,097.30	8/4/2005	1,616	1,616	6	1,274-1,595	50-1,616	Carbonate	Continuous
383133115030201	207 N08 E62 30CD 1 USGS-MX	4,265,229.62	669,732.25	5,290.20	---	---	101	2	---	---	Basin Fill	Quarterly

[a]Professional survey complete on location and elevation. All coordinates are Universal Transverse Mercator, North American Datum, 1983, Zone 11.
[b]Carbonate bedrock was encountered at 265 ft bgs according to the well log.
[c]Well is monitored continuously by the USGS.
Well-construction data are based upon best available information from well logs, MX Project Report (Ertec Western Inc., 1981), and direct field measurements.
Monitoring frequency agreed to by the TRP. Additional water-level data in the study area may be collected by SNWA or USGS and reported in future data reports.

completed for each of the seven SNWA monitor wells included in the network (Eastman, 2007a through g). Copies of the reports have been posted on the SNWA shared data-repository web site.

Continuous water-level data were collected at the six designated monitor wells within the network. Site visits were conducted approximately every six weeks to obtain periodic water-level measurements and download continuous data for processing and analysis. Physical measurements of water levels were compared to pressure transducer data to ensure proper function and calibration of the instrumentation.

USGS collects continuous data at two USGS-MX wells within the network (182 S06 E63 12AD 1 USGS-MX [Delamar Well] and 181 N03 E63 27CAA 1 USGS-MX [N. Dry Lake]). USGS also collects continuous data at 181 S03 E64 12AC 1 USGS-MX (S. Dry Lake Well), which is not included in the network.

Periodic water-level measurements collected by SNWA in 2009 are presented in Appendix A. Historical and 2009 hydrographs for the nine existing DDC network wells that are monitored quarterly are also presented in Appendix A. Water-level data collected by SNWA and USGS at the six continuously monitored network wells are presented in Appendix B. Appendix B also includes tables presenting periodic and daily mean continuous water-level data as well as associated 2009 and historical hydrographs. SNWA continuous data were corrected for temperature. Historical USGS data are presented at the National Water Information System's website at http://waterdata.usgs.gov/nv/nwis/current/?type=gw.

2.2.2 New Monitor Wells

The installation of up to four new monitor wells is included in the monitoring plan. In 2009, two new sites and one contingency site were selected by the TRP and NSE. The location of the fourth well will be selected after more information is made available on the production well network configuration and baseline data are collected. New well location coordinates, estimates of surface elevation, and depth-to-groundwater measurements are presented in Table 2-2, and the locations are presented in Figure 2-1.

Table 2-2
New DDC Monitor Wells

Well Name	Location[a]		Estimated Surface Elevation (ft amsl)	Estimated Depth to Water (ft)
	UTM Northing (m)	UTM Easting (m)		
WRV1012M	4,257,087	675,519	5,794	420
PAH1010M	4,163,098	663,576	4,380	700
DEL4003X	4,125,223	682,153	4,738	1,450
PAH1011M (alternate site)	4,121,019	677,508	3,727	635

[a]All coordinates are Universal Transverse Mercator, North American Datum, 1983, Zone 11.

The northernmost new monitor well, WRV1012M, is located on the west side of the Egan Range northeast of Flag Spring in White River Valley. This well is anticipated to be completed in the Ely Springs Dolomite. The location was selected as a monitoring point between Flag Springs Complex and southern Cave Valley. The new well and other existing monitor wells in Cave Valley will provide baseline water-level data to evaluate the hydraulic gradient through Shingle Pass. The depth to groundwater is estimated to be approximately 420 ft bgs at this location.

The second new monitor well, PAH1010M, is located on the east side of the Hiko Range in Sixmile Flat in Pahranagat Valley. The site is located 3.5 mi east of Hiko Spring. The target completion zone is saturated fractured carbonate rocks within the middle to lower units of the Guilmette Formation and possibly the Simonson Dolomite. Carbonate bedrock is anticipated within 50 ft of land surface, and it is expected that rocks will be fractured at depth because of the movement along the range-front fault and ancillary normal faults. The depth to water in this area is estimated to be approximately 700 ft bgs.

Both WRV1012M and PAH1010M are located on BLM land, and National Environmental Policy Act of 1969 right-of-way applications have been submitted to BLM to gain access to the sites.

The third new monitor well will be installed at the well site of a proposed SNWA exploratory well, DEL4003X, which is located near the southern boundary of Delamar Valley within a structural feature of the Pahranagat Shear Zone. This well is anticipated to be completed in volcanic materials. An alternative site, PAH1011M, was identified and is also located along a major structural feature of the Pahranagat Shear Zone but southwest of the exploratory well site. Monitor well PAH1011M would be constructed in the future if a new future production well is constructed at, or in the immediate vicinity of, the proposed DEL4003X exploratory site. The right-of-way applications have been submitted to BLM for both of these locations.

2.2.3 Exploratory- and Production-Well Monitoring

The exploratory and production well monitoring section of the DDCHMM Plan states that SNWA shall record discharge and water levels in all completed SNWA production wells on a continuous basis. SNWA does not currently have any production wells associated with this project; however, continuous measurements will be collected from all future production wells. Water-level measurements are required in all SNWA exploratory wells at least quarterly.

Water-level data were collected from SNWA exploratory and test wells. Two SNWA wells, one 6-in.-diameter monitor well (CAV6002M2) and one 20-in.-diameter test well (CAV6002X), were installed in southern Cave Valley near Monitor Well 180W902M on October 13 and 28, 2007, respectively. Well-construction attributes and the locations of the additional SNWA wells are presented in Table 2-3 and Figure 2-2.

Water-level measurements were regularly collected from the wells in accordance with SNWA field operating procedures. Periodic water-level data and the associated hydrographs from the test and exploratory wells are presented in Appendix C.

Table 2-3
SNWA Exploratory Wells

Site Number	Station Local Number	Location[a]		Surface Elevation (ft amsl)	Completion Date	Drill Depth (ft bgs)	Well Depth (ft bgs)	Well Casing Diameter (in.)	Screened Interval (ft bgs)	Open Interval (ft bgs)	Aquifer	Monitor Frequency
		UTM Northing (m)	UTM Easting (m)									
CAV6002X	CAV6002X	4,248,307.58	689,819.01	5,987.97	10/28/2007	917	901	20	219-901	50-917	Carbonate	Quarterly
CAV6002M2	CAV6002M2	4,248,365.83	689,782.96	5,982.81	10/13/2007	893	885	6	159-882	50-893	Carbonate	Quarterly

[a]Professional survey complete on location and elevation. All coordinates are Universal Transverse Mercator, North American Datum, 1983, Zone 11.
Well-construction data are based upon best available information from well logs.

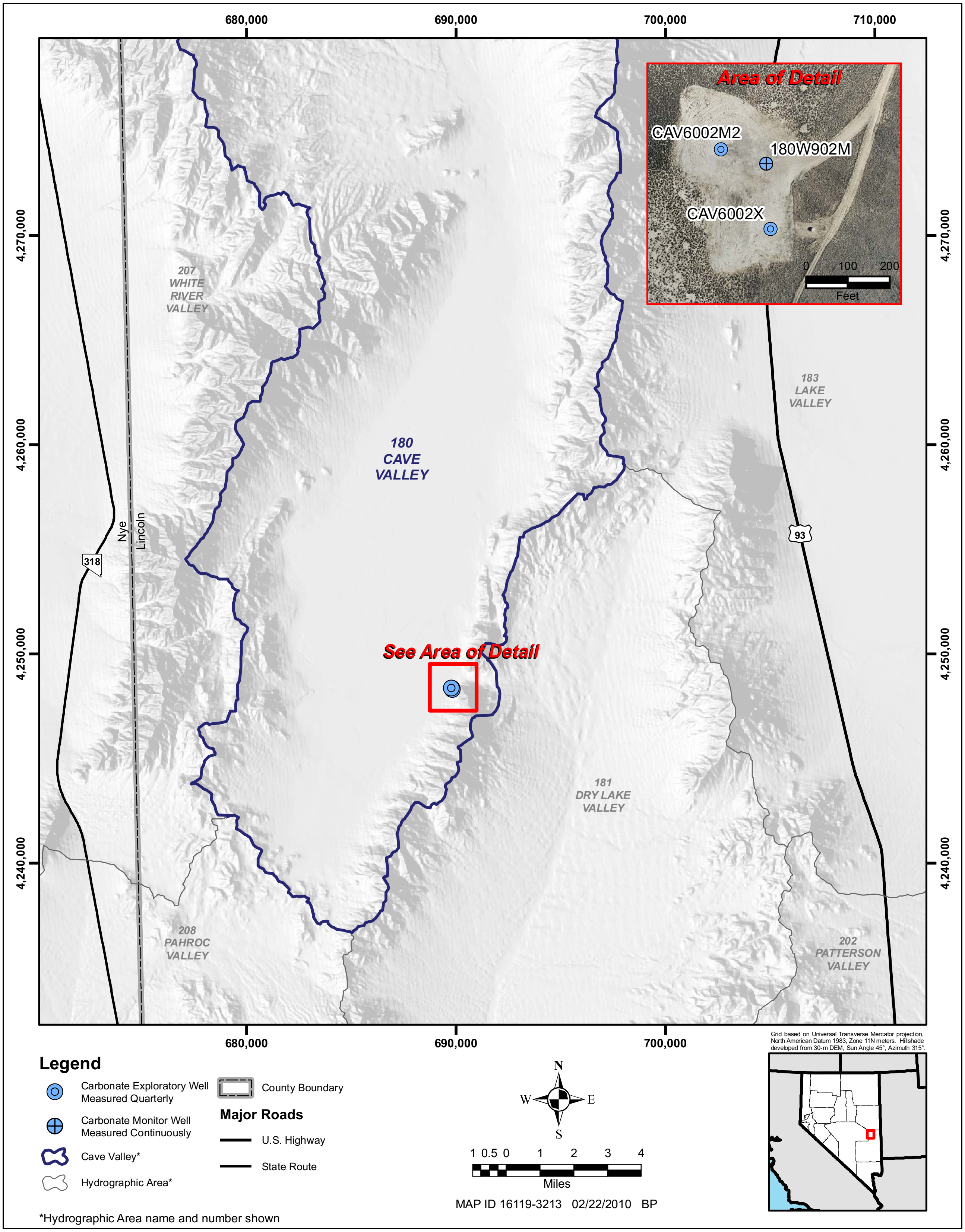


Figure 2-2
SNWA DDC Exploratory Wells

2.2.4 Well Performance and Aquifer Testing

A constant-rate pumping test will be performed on each future production test well to evaluate aquifer properties. The tests results may also identify boundary conditions and provide information on aquifer heterogeneity. Aquifer-testing results would be used to assess well performance, provide aquifer-property data for the groundwater flow model, and evaluate long-term pumping influence.

Well-performance step tests and 72-hour constant-rate tests have been performed on SNWA Test Well CAV6002X and Monitor Well 180W902M located in Cave Valley. These locations and test results are presented in SNWA (2009b).

2.3 Spring Monitoring Network

The HMMP spring monitoring program has two components which were implemented in 2009. The first component consists of nine springs in White River and Pahranagat valleys that are monitored for discharge. The second component consists of eight springs within DDC that are monitored biannually for discharge (if measurable), field water-quality parameters, and general physical conditions. The spring locations and monitoring frequency are listed in Table 2-4 and presented in Figure 2-3. Available historical data, photos, and descriptions of network springs are presented in *Delamar, Dry Lake, and Cave Valley Stipulation Agreement Hydrologic Monitoring Plan Status and Data Report* (SNWA, 2009b). Hydrologic data collected in 2009 along with available historical hydrographs for the spring network are presented in this report.

2.3.1 White River and Pahranagat Valleys Springs

Nine springs located in White River and Pahranagat valleys are included in the spring monitoring network. Five of these springs are currently being monitored through a joint funding agreement (JFA) between SNWA, the USGS, and the Nevada Division of Water Resources (NDWR). These springs are the Flag Springs Complex, Hot Creek, Moorman, Ash, and Crystal springs. The monitoring frequency of each spring is listed in Table 2-4. SNWA will monitor, or fund a mutually agreed-upon third party to monitor, these locations.

SNWA established spring discharge monitoring sites at Hardy and Hiko springs. SNWA and NSE coordinated to secure approval to install a flume at Hardy Springs, and a flow meter and data logger at Hiko Spring to obtain continuous data on the agricultural diversion pipeline to which the spring flow is diverted.

SNWA coordinated with the Nevada Department of Wildlife (NDOW) to install a flume and continuous-monitoring instrumentation at Flag Spring 2 (Middle Flag Spring). Flag Springs 1 and 3 will continue to be measured biannually.

Maynard Spring will be monitored quarterly by SNWA. SNWA will perform measurements at this site dependent upon continued property access. Cottonwood Spring will be monitored by USFWS, and data provided will be included in the annual SNWA data report.

Table 2-4
DDC Springs Monitoring Locations and Monitoring Frequency

Basin Number	Station Number	Station Name	Elevation[a]	Location[b] UTM Northing (m)	Location[b] UTM Easting (m)	Monitoring Frequency
180	1800101	Cave Spring	6,490	4,279,249	691,760	Biannual
	1800301	Parker Station Spring	6,490	4,282,096	688,179	
	381624114540302	USBLM Silver King Well	6,230	4,238,220	683,551	
	381943114562201	Lewis Well	6,260	4,244,297	680,106	
181	1810301	Littlefield Spring	6,150	4,233,949	701,112	Biannual
	1810401	Coyote Spring	5,220	4,211,513	687,693	
	1810501	Big Mud Springs	6,430	4,241,387	689,547	
182	1820101	Grassy Spring	5,790	4,157,193	695,124	
207	2070501	Hot Creek Spring near Sunnyside, NV	5,230	4,249,926	661,290	Continuous
	2071101	Moorman Spring	5,300	4,273,440	662,053	Biannual
	2071501	Hardy Springs	5,350	4,278,196	667,553	
209	2090101	Hiko Spring	3,880	4,162,744	657,549	Continuous
	2090201	Cottonwood Spring	3,240	4,123,643	667,261	Quarterly[c]
	2090801	Maynard Spring	3,110	4,117,909	674,444	Quarterly
Flag Springs Complex						
207	2071301	Flag Spring 3 (South)	5,290	4,254,416	672,579	Biannual
	2071302	Flag Spring 2 (Middle)	5,280	4,254,570	672,576	Continuous
	2071303	Flag Spring 1 (North)	5,290	4,254,696	672,719	Biannual
Crystal Springs						
209	09415589	Crystal Springs Diversion near Hiko, NV	3,820	4,155,336	656,011	Continuous
	2090401	Crystal Springs near Hiko, NV	3,800	4,155,348	656,165	
Ash Springs						
209	09415639	Ash Springs Diversion at Ash Springs, NV	3,600	4,147,415	659,716	Continuous
	2090501	Ash Springs	3,600	4,147,460	659,684	

[a]All elevations are rounded to the nearest 10 ft, North American Vertical Datum, 1988 (NAVD88). High-resolution Global Positioning System (GPS) will be used to determine elevations at a later date.
[b]All coordinates are Universal Transverse Mercator, North American Datum, 1983 (NAD83) Zone 11.
[c]Monitoring performed by USFWS. Data provided to SNWA will be presented in the annual data report.

2.3.1.1 Flag Springs Complex

The Flag Springs Complex is located in Nye County at the NDOW Headquarters for the Wayne Kirsch Wildlife Management Area approximately 60 mi south of Ely, Nevada, along Nevada State Route (SR) 318 (Figure 2-3). Three primary springs (South, Middle, and North) compose the Flag Springs Complex. Flag Springs discharge into Sunnyside Creek from the source in the NDOW headquarters area, then flows into the Adams-McGill Reservoir, where the water is used for livestock, wildlife, and recreation.

Monitoring at Flag Springs Complex currently consists of continuous monitoring of Flag Spring 2 (Middle Flag Spring), which was installed by SNWA in November 2009, and biannual monitoring of

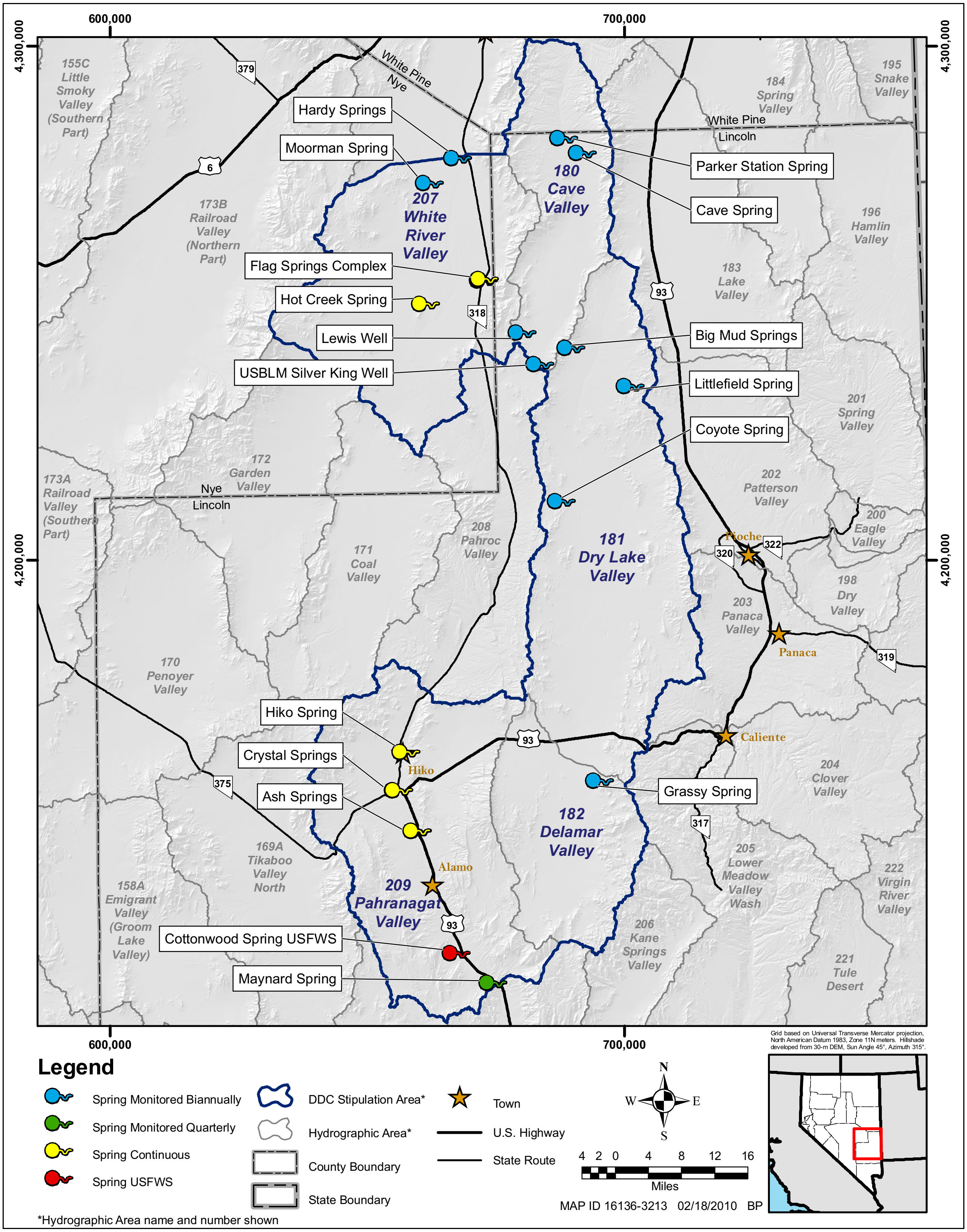


Figure 2-3
Locations of Springs Associated with the DDC HMMP

Flag Springs 1 and 3 (North and South Flag Spring) orifices. A photo of the flume and housing containing the continuous recording instrumentation is presented in Figure E-1.

The earliest reported discharge measurement of 2.5 cfs was taken at Flag Spring 1 in 1949 (Maxey and Eakin, 1949). The USGS, beginning in 1982, measured the discharge of the three springs annually. During 1992, the discharge measurements were increased to a biannual frequency that continued through the end of 1994. No discharge measurements were reported between 1995 and 1996. During 1997, the springs were again measured by the USGS biannually, which continued through 2008, as part of the JFA with SNWA and NDWR. Discharge measurements for 2009 and a historical hydrograph are presented in Appendix D.

2.3.1.2 Hardy Springs

Hardy Springs is located approximately 16 mi south of Lund, Nevada, and 1.5 mi west of SR 318 in White River Valley in Nye County (Figure 2-3). Hardy Springs is composed of five individual spring orifices that discharge into a main channel that is a tributary to the White River. In August 2009, SNWA installed a new flume to obtain biannual discharge measurements near the site of an old diversion approximately 100 to 150 ft downstream of the confluence of Hardy Springs. A photo of the new Hardy Springs flume is presented in Figure E-2. Hydrologic data collected in 2009 are presented in Appendix D.

2.3.1.3 Moorman Spring

Moorman Spring is located in White River Valley approximately 20 mi southwest of Lund, Nevada, in Nye County (Figure 2-3). The spring discharges from the alluvium along a fault scarp. The spring forms a small pool, approximately 30 ft long and 15 to 20 ft wide, behind an old irrigation diversion structure. The discharge at Moorman Spring is currently measured biannually through a SNWA, USGS, and NDWR JFA. Photo documentation of spring conditions is presented in Figure E-3.

In 1935, the reported discharge was 0.22 cfs (Stearns et al., 1937). The extremely low discharge was likely influenced by the extreme drought in the western United States during the mid-1930s. The same 1935 discharge measurement was again reported in Miller et al. (1953). Since 1935, the average discharge at Moorman Spring has been approximately 0.47 cfs, and the historical discharge measurements appear relatively constant. Discharge data collected at Moorman Spring during 2009 and a hydrograph of the historical data are presented in Appendix D.

2.3.1.4 Hot Creek Spring

Hot Creek Spring is located in southern White River Valley, approximately 36 mi southwest of Lund, Nevada, and 2 mi west of Adams-McGill Reservoir in Nye County (Figure 2-3). The spring discharge forms Hot Creek, which flows southeast to the Adams-McGill Reservoir. The spring and reservoir are located on the Wayne Kirch Wildlife Management Area, administered by NDOW. At one time, the flow of Hot Creek could be diverted to the Dacey Reservoir to the northeast. Spring discharge is currently being monitored continuously through a SNWA, USGS, and NDWR JFA.

A detailed description, site photos, and discussion of historical measurements at Hot Creek Spring are presented in SNWA (2009b). Data collected in 2009, along with historical data and mean daily discharge data from 2006 to 2009 are displayed in Appendix D. Historical data that are possibly anomalous are highlighted. Discharge measurements prior to 2006 were measured below the current gage, 50 to 60 ft below the ponded swimming area.

2.3.1.5 Ash Springs

Ash Springs is located in Ash Springs, Nevada, approximately 600 ft east of U.S. Highway 93 (Figure 2-3). The spring is used for irrigation, domestic supply, and recreation and is composed 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. Ash Springs discharge and irrigation diversion is currently measured through a SNWA, USGS, and NDWR JFA.

A detailed description, photos, and discussion of historical data collected at Ash Springs are presented in SNWA (2009b). A photo of the spring pool in summer 2009 is presented in Figure E-4. Hydrologic data collected during the 2009 water year, historical mean daily discharge, and a 30-day moving average of mean daily discharge values for Ash Springs are presented in Appendix D. The 30-day moving average of mean daily discharge values is used for Ash Springs due to the variability of the record.

2.3.1.6 Crystal Springs

Crystal Springs is located approximately a quarter mile west of the SR 318/SR 375 junction and a half mile west of the U.S. Highway 93/SR 318 junction in Lincoln County. Crystal Springs is approximately 4 mi south of Hiko, Nevada, and 5 mi north of Ash Springs, Nevada (Figure 2-3). This locale, used as a watering place and campsite, was the principal stopover on the Mormon Trail alternate route (State of Nevada, 2004). The main channel of the spring and irrigation diversion discharge is currently monitored through a SNWA, USGS, and NDWR JFA.

A detailed description and photo documentation of Crystal Springs are presented in SNWA (2009b), including a discussion of the historical data collected at the spring complex. Photos of the main channel and diversion channel gages in summer 2009 are presented in Figures E-5 and E-6, respectively. Hydrologic data collected during the 2009 water year, historical mean daily discharge, days of diversion, and annual discharge data are presented in Appendix D. The typical diversion rate from Crystal Springs ranges from 3 to 8 cfs. For the purposes of this report, days with a recorded diversion rate of less than 1 cfs were omitted from the count of days diverted.

2.3.1.7 Hiko Spring

Hiko Spring is located on the Cannon Ranch approximately a half mile northeast of Hiko, Nevada, in the north end of Pahranagat Valley (Figure 2-3) and has historically provided water for various uses. Hiko Spring discharges from the base of the Hiko Range and currently provides water for domestic, agricultural, and wildlife purposes. A photo of spring conditions in summer 2009 is presented in Figure E-7.

SNWA recently started monitoring discharge at Hiko Spring continuously with a new flow meter and data logger installed on the 18-in.-diameter discharge pipe located southwest of the spring (Figures E-8 and E-9). The work on the vault and meter was completed in June 2009. The concrete vault housing the meter was constructed in cooperation with the owners of the Cannon Ranch. Discharge data are collected 12 out of every 15 days during irrigation season when water is not being diverted above the flow meter for Cannon Ranch irrigation use. Discharge data indicate a discharge of 5.3 to 6.1 cfs depending upon the irrigation usage schedule. The irrigation usage schedule also appears to affect the level of the spring pool. Data will be further evaluated as more information is collected.

A detailed description and photo documentation of Hiko Spring are presented in SNWA (2009b), including a discussion of the historical data collected at the spring complex. Hydrologic data collected during the 2009 water year and a historical hydrograph are presented in Appendix D.

2.3.1.8 Maynard Spring

Maynard Spring is located off of U.S. Highway 93 about 14 mi southeast of Alamo, Nevada, and 2.5 mi southeast of Lower Pahranagat Lake on BLM land in Pahranagat Valley (Figure 2-3). The spring is composed of two springheads, referred to as North Maynard Spring and South Maynard Spring, which are separated by a distance of roughly 400 ft. A photo of Maynard Spring was presented in SNWA (2009b). Currently, there are multiple piezometers at North Maynard Spring. SNWA measured water levels in the piezometers quarterly, in cooperation with USFWS and BLM. SNWA will monitor water levels in these piezometers as long as they are accessible and maintain construction integrity. SNWA will coordinate with BLM and USFWS to establish water level monitoring points at Maynard Spring.

Both North and South Maynard springs are located within the Pahranagat Shear Zone and in Quaternary and Tertiary basin fill with welded ash-flow tuff and thin basalt flows and cinder cones nearby. According to Water-Rights Applications 62432 and 62433, both of the springs were observed on July 16, 1993, discharging at an estimated rate of 0.20 cfs (90 gpm) each. However, observations in 2009 indicated no measurable flow.

2.3.1.9 Cottonwood Spring

Cottonwood Spring is approximately 9.5 mi south of Alamo, Nevada, 1 mi west of U.S. Highway 93 on the USFWS Pahranagat Wildlife Refuge (Figure 2-3), and 1.5 mi south of the Refuge Headquarters along the Corn Creek/Alamo Road. As per Exhibit A of the Stipulation, USFWS is to provide data collected from Cottonwood Spring to the TRP. SNWA will work with USFWS to obtain and present the data in the annual data report.

No diversions were observed during the field investigation. The water at Cottonwood Spring is used for wildlife. Photo documentation and historical data reported for Cottonwood Spring is presented in SNWA (2009b).

2.3.2 DDC Springs Biannual Monitoring

Eight primary and one alternate spring monitoring locations were selected within the DDC valleys by the TRP in consultation with the NSE. These springs are generally characterized as being sourced in the mountain block and as having no hydraulic connection to the regional aquifer. However, biannual baseline monitoring was performed to document variability in spring conditions.

Springs included in the program are Grassy Spring in Delamar Valley; Coyote, Big Mud, and Littlefield springs in Dry Lake; Parker Station and Cave springs in northern Cave Valley; and Lewis Well and Silver King Well in southern Cave Valley. Spring locations are presented in Figure 2-3. Several of the springs (Grassy, Big Mud, Coyote, and Lewis Well) have been modified in the past with a collector system to transmit water to distribution points away from the spring. Silver King Well is a shallow dug well with a gravity discharge line to a stock water area.

Field visits to the sites are planned for the spring and fall of each year when site access conditions permit. Wetted area and discharge (if measurable) will be documented. Field water-quality will be measured, including pH, electrical conductivity, and temperature. Photographs will be used to document site conditions.

Physical descriptions, photos, and historical hydrologic and water-chemistry data for the springs are presented in SNWA (2009b).

A site visit was performed on September 29 and 30, 2009. Data collected during the visit and photo documentation are presented in Appendices D and E, respectively.

2.3.2.1 Cave Spring

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 2-3). 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 recharge. Biannual discharge measurements and conditions are being documented at the spring with permission from Cave Valley Ranch.

A detailed description and photo documentation of Cave Spring are presented in SNWA (2009b), including a discussion of historical data collected at the spring. Hydrologic data collected during the 2009 water year are presented in Appendix D. A photo of the spring, taken in May 2009, during high discharge is presented in Figure E-10. Photos of the spring taken in September 2009 are presented in Figures E-11 and E-12, and show that the spring was dry at this time.

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

2.3.2.2 Parker Station

Parker Station is in north-central Cave Valley, approximately 16 mi southeast of Lund, Nevada. Parker Station was once used as a stagecoach station. This site is located in Lincoln County, nearly a mile south of the White Pine/Lincoln County line.

Parker Station Spring lies on Cave Valley Ranch, LLC, property. Biannual discharge measurements and a description of the physical conditions will be documented at the flowing well and nearby spring with access permission from Cave Valley Ranch. A photo of spring discharge in the Parker Station Area in September 2009 is presented in Figure E-13.

2.3.2.3 Lewis Well

The Lewis Well is located in southern Cave Valley, approximately 36 mi south of Lund, Nevada, and 6 mi east of SR 318 (Figure 2-3). It is located at the base of the Egan Range on the eastern slope. The well was reportedly constructed in 1925 and was completed with a 42-in. steel casing to a depth of 26 ft.

Biannual discharge measurements and conditions will be documented. A photo of the springhead area for Lewis Well taken in September 2009 is presented in Figure E-14.

2.3.2.4 Silver King Well

Silver King Well is a hand-dug well located within Lincoln County, Nevada, in southern Cave Valley. It lies approximately 40 mi southeast of Lund, Nevada, and 34 mi northwest of Pioche, Nevada (Figure 2-3). The dug well may have been a modification to a historic spring. Water is discharged from the Silver King Well by gravity drainage through approximately 600 ft of 2-in. pipe into a partially buried trough. Photos of the Silver King Well and discharge area are presented in SNWA (2009b). Photos taken in September 2009 are presented in Figures E-15 and E-16. Discharge during the fall 2009 field visit was approximately 0.25 gpm.

Water-level data collected at the Silver King Well consist of two data points. A depth-to-water level on March 21, 1990, was reported as 8.9 ft bgs. The second depth-to-water measurement was made on August 25, 2003, and was reported as 7.95 ft bgs. A depth-to-water measurement on September 29, 2009, was 10.62 ft below the measuring point on the locked well cover.

2.3.2.5 Coyote Spring

Coyote Spring is approximately 8 mi west-southwest of Bristol Wells, Nevada (Figure 2-3), and lies at the center of an abandoned homestead compound. Two spring orifices exist at the site. Photos of

Coyote Spring and the discharge area are presented in SNWA (2009b). A photo taken in September 2009 is presented in Figure E-17.

Coyote Spring discharges from the base of a scarp approximately 15 ft high in volcanic rocks. The spring discharge is collected and piped to a large concrete tank. Discharge from Coyote Spring was measured at 5 gpm in 1912 and at 0.9 gpm in August 1979. On June 3, 2004, discharge was measured at 0.11 gpm. On June 21, 2004, the discharge rate was 0.02 gpm. Discharge on the September 30, 2009, field visit was approximately 0.4 gpm with a temperature of 14.7°C, pH of 6.51, and electrical conductivity of 369 µmhos/cm.

2.3.2.6 Big Mud Springs

Big Mud Springs is located in northern Dry Lake Valley nearly 40 mi southeast of Lund, Nevada, and 33 mi northwest of Pioche (Figure 2-3). The springs are located in the Schell Creek Range along Big Mud Pass approximately 7 mi north of Silver King Mountain. A wood fence is present at the springs. The area is surrounded by dense vegetation, such as junipers, willows, and wild roses. A collection basin is in place to help divert the spring discharge for stock watering.

Currently, two rubber tubes convey water from Big Mud Springs to a holding tank 0.25 mi to the south. The discharge from each hose was measured volumetrically using a quart bottle at the storage tank. A discharge of 2.49 gpm was measured at the storage tank on May 8, 2008. The temperature of the water was reported as 14.2°C, pH was 6.56, and electrical conductivity was 420 µmhos/cm. The water-quality data were collected at the springhead.

Photos of Big Mud Springs and water storage tanks are presented in SNWA (2009b). A photo taken in September 2009 is presented in Figure E-18. Water-quality parameters were measured at the spring pool; however, because the water may have been standing in the pool for an unknown period of time, the results are considered questionable. The water temperature, pH, and electrical conductivity were measured at 12.9°C, 6.81, and 456 µmhos/cm, respectively.

2.3.2.7 Littlefield Spring

Littlefield Spring is located approximately 3 mi south of Meloy Spring on the east side of Dry Lake Valley (Figure 2-3). A photo of the spring discharge area is presented in Figure E-19. Photos taken in September 2009 of the spring area, discharge channel, and discharge measuring point are presented in Figures E-20 to E-23. Recent development in the spring area includes a new fence around the spring discharge area and surface grading.

Littlefield Spring discharges from the alluvium near an outcrop of volcanic rock. This spring had a reported discharge of 0.02 cfs in May 1980 (Bunch and Harrill, 1984). During a June 3, 2004, field investigation, discharge and temperature were measured at 0.3 cfs and 15°C. No diversions exist near the spring. Littlefield Spring is unaltered by springhead collectors or diversion structures.

Discharge data collected on September 30, 2009 are presented in Appendix D, and the discharge was measured at 0.04 cfs. On this date, the temperature was 15.5°C, pH was 6.31, and electrical conductivity was 334 µmhos/cm.

2.3.2.8 Grassy Spring

Grassy Spring is located in Delamar Valley approximately 40 mi south of Bristol Wells, Nevada, along the western flank of the Delamar Mountains (Figure 2-3). Photos of Grassy Spring taken in September 2009 are presented in Figures E-24 and E-25. Grassy Spring is currently used for stock watering. The discharge is captured at the source and is transferred to livestock-watering tanks through black polyvinyl tubing.

The spring discharges from alluvial sediments in close contact with volcanic rocks. During a field investigation on June 2, 2004, the discharge of the spring was measured at 0.5 gpm. The discharge was measured volumetrically at the livestock tank, approximately 300 ft west of the spring. No standing water was observed during the site visit in September 2009.

2.4 Precipitation Station Network

Precipitation-station data from selected network sites with an established historical record in the vicinity of the study area were compiled and are presented in Appendix F. The precipitation network will assist in assessing climate variability in the vicinity of the project basins and discerning pumping effects from natural variability. The precipitation network stations are listed in Table 2-5 and presented on Figure 2-4.

The precipitation-station network includes the following:

- Six high-altitude precipitation stations maintained and operated by USGS through a JFA with SNWA and NDWR.
- Seven National Oceanic and Atmospheric Administration, National Weather Service (NOAA/NWS) Stations. Data were obtained through the Western Regional Climate Center (WRCC).
- One U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) SNOwpack TELemetry (SNOTEL) site located in the Egan Range. This site provides precipitation and snow-accumulation data.

As of this report, three NOAA/NWS precipitation sites are no longer in operation. The most recent Geyser Ranch, Key Pittman WMA, and Lake Valley Steward station measurements were reported in 2002, 1989, and 1998, respectively. Provisional 2009 precipitation data for the remaining sites, along with historical data and statistics, are presented in Appendix F. SNWA will continue to compile and report precipitation data from these sites as long as the data are made available and the stations are in operation.

Table 2-5
DDC-Precipitation Station Locations

Station Name	Location[a] UTM Northing (m)	UTM Easting (m)	Surface Elevation[b] (ft amsl)	Data Source
Ward Mountain	4,333,562	677,114	9,200	NRCS
Mt. Wilson	4,236,086	728,118	9,200	USGS
Geyser Ranch	4,282,815	706,113	6,020	WRCC
Hiko	4,157,377	657,455	3,940	WRCC
Key Pittman WMA	4,164,774	657,315	3,950	WRCC
Lake Valley Steward	4,243,927	705,365	6,350	WRCC
Lund, Nevada	4,302,024	673,483	5,570	WRCC
Pahranagat Wildlife Refuge	4,126,112	666,918	3,400	WRCC
Sunnyside	4,254,266	672,777	5,300	WRCC
Highland Peak	4,196,772	712,963	9,330	USGS
Quinn Canyon Range	4,228,798	620,297	9,050	USGS
Mt. Irish	4,168,657	641,845	8,610	USGS
Unnamed Peak S. of Chokecherry Peak	4,154,830	700,904	7,800	USGS
Unnamed Peak in S. Delamar Mountains	4,135,352	701,473	7,800	USGS

[a]All coordinates in Universal Transverse Mercator, North American Datum, 1983 (NAD83), Zone 11.
[b]Elevations are North American Vertical Datum, 1988 (NAVD88).

Data sources for precipitation information presented in this report are as follows:

- USGS data is cited from USGS National Water Information System (USGS, 2010)
- SNOTEL data is cited from USDA Natural Resources Conservation Service (USDA), 2010
- National Weather Service data is cited from Western Regional Climate Center (WRCC), 2010.

2.5 Water Chemistry

A summary of water-chemistry results from program wells and springs of the DDC monitoring network are presented in SNWA (2009b). The results represent samples collected recently by SNWA, USGS, and Desert Research Institute as well as those reported in historical reports dated as far back as 1912 (Carpenter, 1915). On July 2, 2009, water samples were collected from Hiko and Hardy springs and analyzed for a suite of chemical constituents; field measurement of pH, specific conductance, and water temperature were performed prior to collection. The results for these samples are presented in Appendix G.

Spring sampling and field measurement of the water-quality parameters were performed using the *National Field Manual for the Collection of Water-Quality Data* (USGS, 2007). All measurement equipment was calibrated according to the manufacturers' calibration procedures. Samples were sent

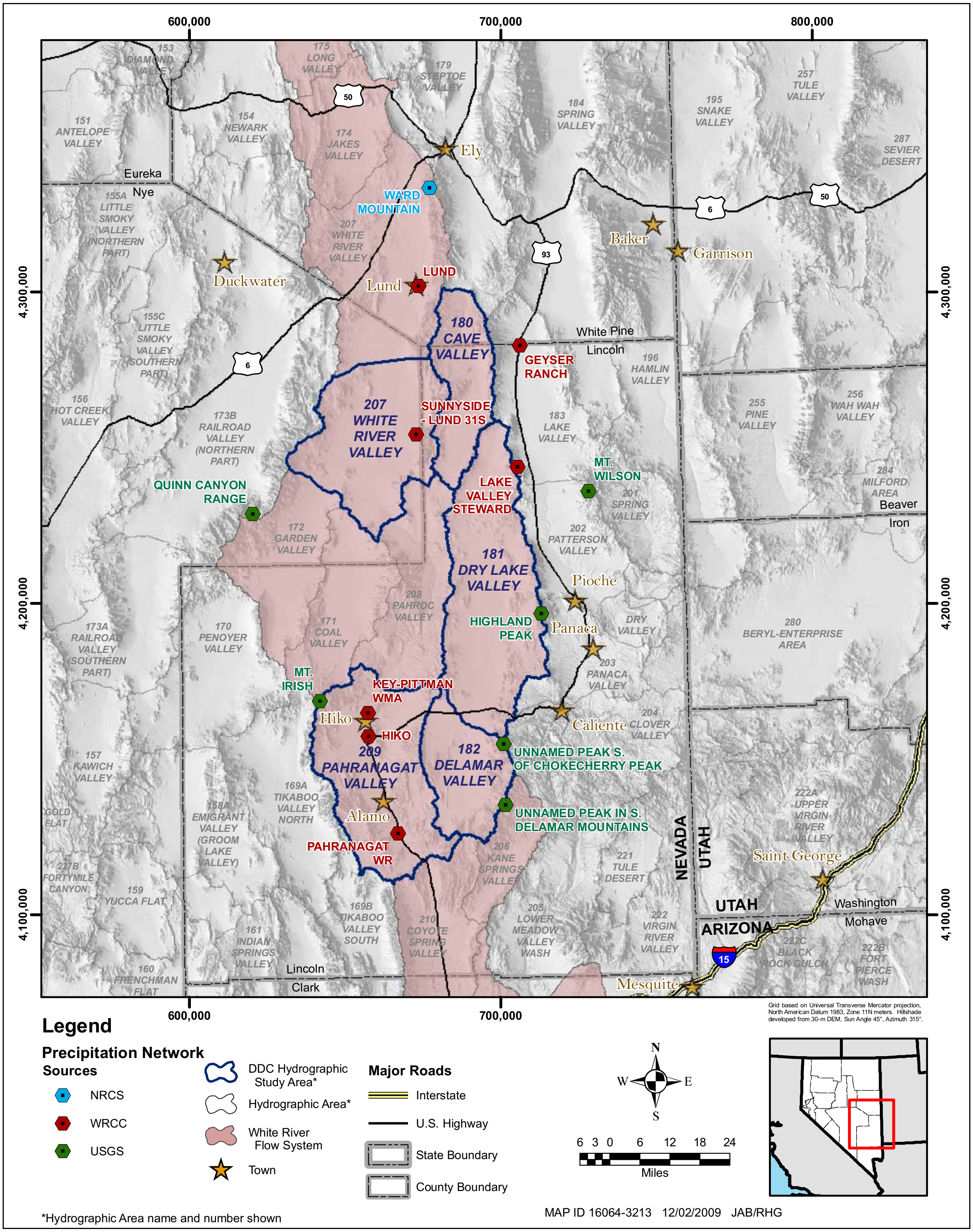


Figure 2-4
DDC Precipitation-Station Locations

to Weck Laboratories, Inc. (Weck), for analysis of major, minor, and trace constituents. Weck is certified by the State of Nevada and performs all analyses according to the U.S. Environmental Protection Agency (EPA) methods or methods published in *Standard Methods for the Examination of Water and Wastewater* (Eaton et al., 2005). The University of Waterloo's Environmental Isotope Laboratory performed the analysis of oxygen and hydrogen isotopes, and the University of Arizona's NSF-Arizona Accelerator Mass Spectrometry Laboratory performed the analysis of carbon isotopes.

The water from Hiko and Hardy springs did not exceed any of the national maximum contaminant levels (primary or secondary) for drinking water established by the EPA and authorized by the Safe Drinking Water Act (Appendix G). In most cases, the results are quite similar to those for several samples collected between 1912 and 1991 from Hiko Spring and a single sample collected in 1979 from Hardy Springs reported in SNWA (2009b). The waters are a calcium-magnesium-bicarbonate water type, which reflects water that has primarily interacted with carbonate minerals. An anomalously high concentration of sodium (65 mg/L) was reported by Fugro (1980) for Hardy Springs (SNWA, 2009b). The concentration of sodium in the recently collected sample, 5.9 mg/L, was more reasonable as indicated by the 2.2 percent charge balance. A high charge balance, 18 percent, brought the validity of the results for the earlier sample into question (SNWA, 2009b).

The groundwater and surface-water chemistry sampling program is anticipated to be implemented in 2010 to establish baseline conditions. The sampling program will consist of the collection of 10 samples from representative springs and monitor wells determined by the TRP in consultation with the NSE. Two sampling events will be performed at 6-month intervals. SNWA will collect and submit samples for chemical analysis for the water-chemistry parameters listed in Table 2-6. Subsequent sampling will be performed once every five years following the start of groundwater production by SNWA.

Table 2-6
Water-Chemistry Parameters

Field Parameters	Major Ions	Isotopes	Minor and Trace Elements
Water temperature	TDS	Oxygen-18	Arsenic
Air temperature	Calcium	Deuterium	Barium
pH	Sodium	Tritium	Cadmium
Electrical conductivity	Potassium	Chlorine-36[a]	Chromium
Dissolved oxygen	Chloride	Carbon-14[a]	Lead
	Bromide	Carbon-13[a]	Mercury
	Fluoride	Strontium-87[a]	Selenium
	Nitrate	Uranium-238[a]	Silver
	Phosphate		Manganese
	Sulfate		Aluminum
	Alkalinity		Iron
	Silica		Bromide
	Magnesium		Fluoride

[a]These parameters shall be included only in the first sampling event and shall not be included in any further water-chemistry sampling performed pursuant to this plan.

2.6 Data Reporting

A shared data-repository web site accessible by the NSE, EC, TRP, and BRT members was implemented in 2008. This site replaced the existing file transfer protocol (FTP) site and contains project reports, monitoring network data, and TRP logistical information. The web site will be used to distribute hydrologic monitoring plan data to the TRP within 90 days of collection. Data will also be submitted directly to the NSE on a quarterly basis in an approved electronic format.

A data and status report will be submitted annually to the TRP and NSE.

2.7 Proposed Schedule of Groundwater Withdrawals

No groundwater production is scheduled for the next two years with the exception of short-term development, well-performance testing, and aquifer testing of any new wells drilled during this time-frame. The duration of well-performance testing is usually one day. The duration of the constant-rate aquifer testing is usually under one week.

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3.0 ANTICIPATED 2010 SNWA DDC HMMP ACTIVITIES

Anticipated DDC HHMP-related activities in 2010 are summarized below. Some activities are contingent upon private or BLM access or TRP and NSE approval.

- Collect continuous and periodic groundwater data from the monitor-well network where appropriate property access has been granted.
- Continue to pursue BLM right-of-way access for the three new monitor well sites.
- Provide technical assistance to the BRT.
- Continue spring discharge measurements at network springs. Develop or refine monitoring methods for the DDC mountain-block and local springs.
- Update the SNWA shared data-repository web site to provide TRP with information on activities and to store data collected as part of the plan.
- Perform water-chemistry sampling and analysis at 10 locations selected by the TRP in consultation with the NSE.

SNWA will continue to work with the NSE and TRP participants to implement the HMMP and identify and address technical issues related to the program.

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Appendix A

Periodic Water-Level Measurement Data from the DDC Existing-Well Monitoring Network

Table A-1
Discrete Water-Level Measurement Data from the DDC Existing-Well Monitoring Network
(Page 1 of 3)

Site Number	Station Local Number	Well Depth (ft bgs)	Surface Elevation (ft amsl)	Water Level			
				Date	Depth to Water (ft bgs)	Well Status[a]	Measurement Method[b]
180W902M[c]	180W902M	903	5,984.89	1/20/2009	139.99	S	S
				4/16/2009	140.44	S	T
				5/18/2009	140.43	S	T
				6/29/2009	140.61	S	T
				8/10/2009	140.80	S	T
				9/21/2009	141.00	S	T
				11/2/2009	141.12	S	T
382807114521001	180 N07 E63 14BADD 1 USGS-MX	460	6,012.39	1/20/2009	217.90	S	T
				4/16/2009	218.04	S	T
				5/18/2009	217.76	S	T
				6/29/2009	217.75	S	T
				8/10/2009	217.82	S	T
				9/21/2009	217.92	S	T
				11/2/2009	217.87	S	T
383307114471001	180 N08 E64 15BCBC1 USBLM	---	6,162.55	1/20/2009	261.84	S	S
				2/24/2009	261.95	S	S
				4/16/2009	261.82	S	T
				5/18/2009	261.82	S	T
				6/29/2009	261.87	S	T
				8/10/2009	261.92	S	T
				9/21/2009	262.24	S	T
				11/2/2009	262.28	S	T
180W501M[c]	180W501M	1,212	6,428.63	1/20/2009	1,053.79	S	T
				4/16/2009	1,053.92	S	T
				5/18/2009	1,054.01	S	T
				6/29/2009	1,054.18	S	T
				8/3/2009	1,054.49	S	T
				8/10/2009	1,054.35	S	T
				9/21/2009	1,054.71	S	T
				11/2/2009	1,055.48	S	T
182W906M	182W906M	1,703	4,796.96	1/21/2009	1,315.95	S	T
				2/23/2009	1,316.04	S	T
				4/9/2009	1,315.46	S	T
				5/20/2009	1,315.62	S	T
				6/30/2009	1,315.93	S	T
				8/11/2009	1,316.02	S	T
				9/24/2009	1,315.94	S	T
				11/4/2009	1,316.14	S	T

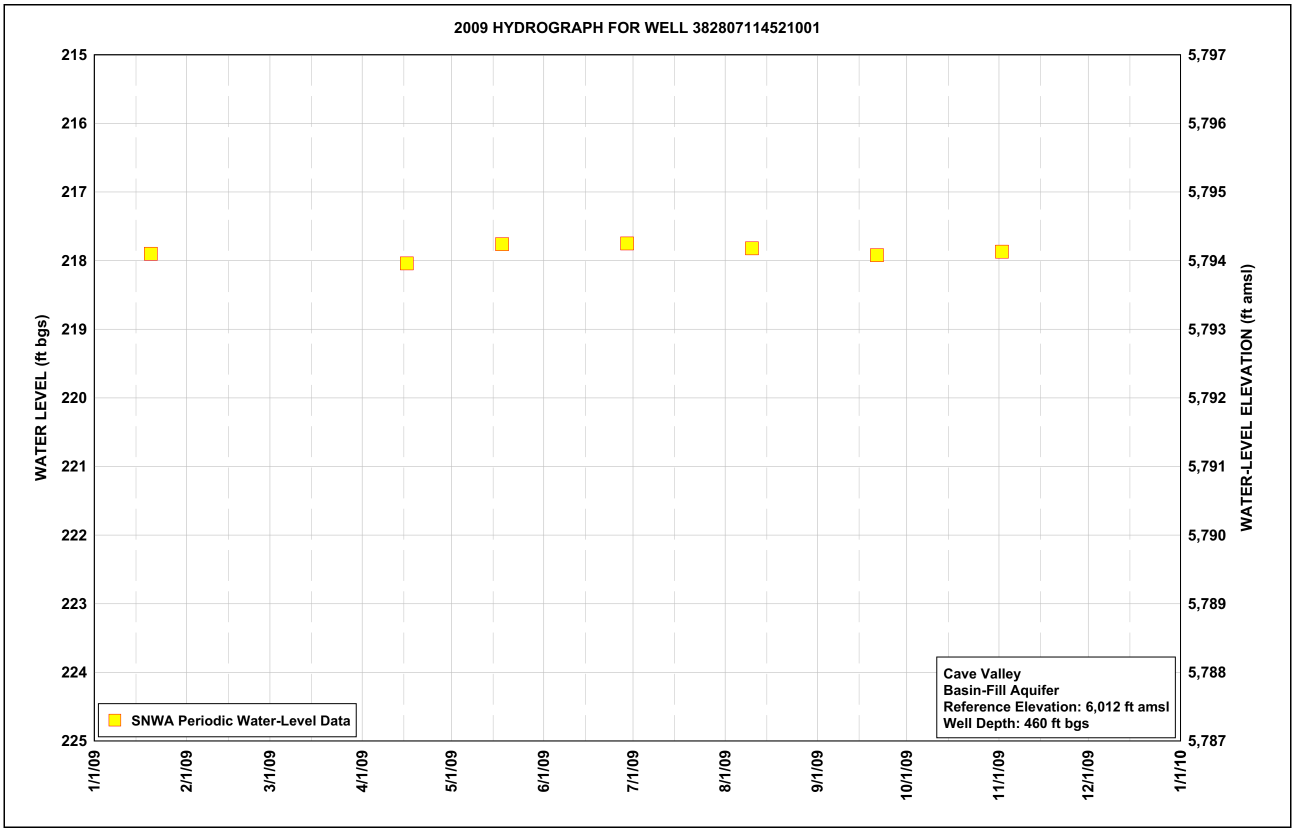
Table A-1
Discrete Water-Level Measurement Data from the DDC Existing-Well Monitoring Network
(Page 2 of 3)

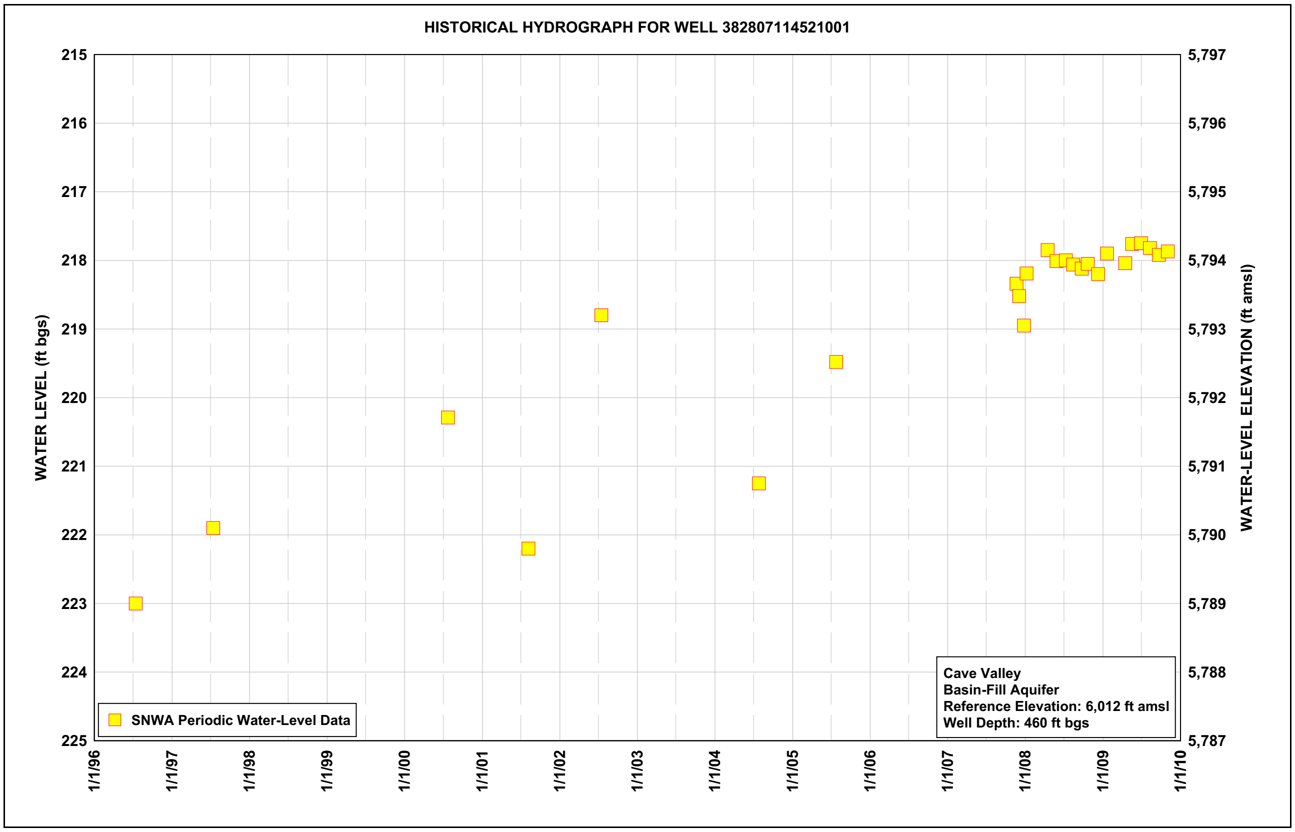
Site Number	Station Local Number	Well Depth (ft bgs)	Surface Elevation (ft amsl)	Water Level			
				Date	Depth to Water (ft bgs)	Well Status[a]	Measurement Method[b]
182M-1[c]	182M-1	1,331	4,597.78	1/21/2009	827.06	S	T
				2/24/2009	827.03	S	T
				4/9/2009	827.07	S	T
				5/20/2009	827.04	S	T
				6/1/2009	826.96	S	T
				6/302009	827.00	S	T
				8/11/2009	827.14	S	T
				9/24/2009	827.13	S	T
				11/4/2009	827.00	S	T
181W909M	181W909M	1,260	4,799.41	1/20/2009	497.06	S	T
				2/24/2009	496.93	S	T
				4/9/2009	496.77	S	T
				5/20/2009	496.86	S	T
				6/29/2009	496.81	S	T
				8/10/2009	496.99	S	T
				9/23/2009	497.07	S	T
				11/3/2009	496.91	S	T
181M-1[c]	181M-1	1,472	4,963.07	1/20/2009	675.48	S	T
				2/24/2009	675.34	S	T
				4/10/2009	675.26	S	T
				5/19/2009	675.20	S	T
				5/28/2009	675.36	S	T
				6/29/2009	675.22	S	T
				8/10/2009	675.52	S	T
				9/23/2009	675.44	S	T
				11/3/2009	675.37	S	T
380531114534201[c]	181 N03 E63 27CAA 1 USGS-MX	2,395	5,456.35	1/20/2009	845.81	S	T
				2/24/2009	845.72	S	T
				4/10/2009	845.38	S	T
				5/19/2009	845.50	S	T
				6/29/2009	845.52	S	T
				8/10/2009	845.24	S	T
				9/23/2009	845.69	S	T
				11/3/2009	845.61	S	T
209 S07 E62 20AA 1[d]	209 S07 E62 20AA 1	695	4,082.49	6/30/2009	599.85	S	T
				8/11/2009	599.91	S	T
				11/4/2009	599.89	S	T
373405115090001	209 S04 E61 28CD 1	980	4,230.58	1/20/2009	586.15	S	T
				2/23/2009	586.21	S	T
				4/10/2009	586.00	S	T
				5/18/2009	585.97	S	T
				6/29/2009	585.99	S	T
				8/11/2009	586.32	S	T
				9/23/2009	886.33	S	T
				11/4/2009	586.26	S	T

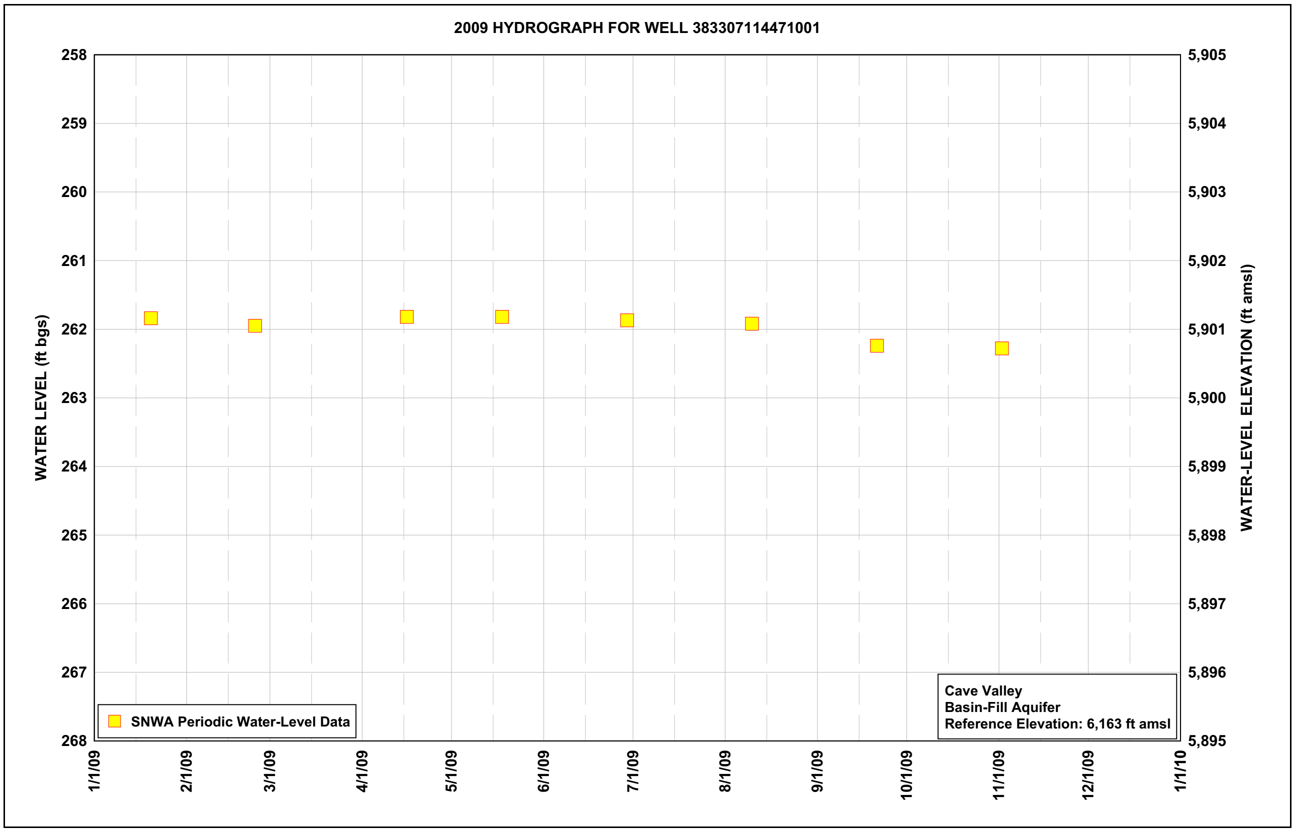
Table A-1
Discrete Water-Level Measurement Data from the DDC Existing-Well Monitoring Network
(Page 3 of 3)

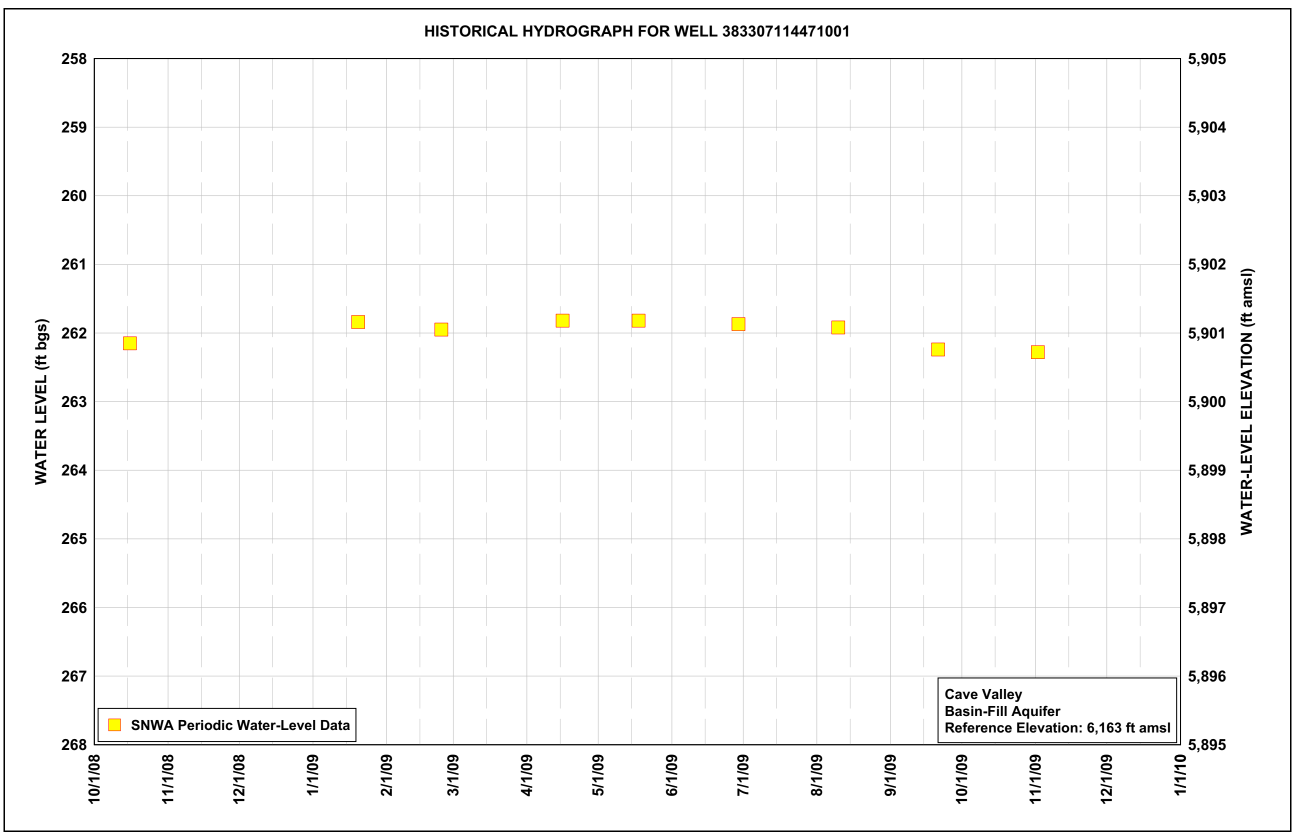
Site Number	Station Local Number	Well Depth (ft bgs)	Surface Elevation (ft amsl)	Water Level			
				Date	Depth to Water (ft bgs)	Well Status[a]	Measurement Method[b]
373803115050501	209 S04 E61 01AACB1	700	4,528.90	1/20/2009	785.35	S	T
				2/23/2009	785.54	S	T
				4/10/2009	785.24	S	T
				5/19/2009	785.43	S	T
				6/29/2009	785.33	S	T
				8/11/2009	785.69	S	T
				9/24/2009	785.61	S	T
				11/4/2009	785.56	S	T
209M-1[c]	209M-1	1,616	5,097.30	1/20/2009	1,200.24	S	T
				2/23/2009	1,200.34	S	T
				4/10/2009	1,200.02	S	T
				5/19/2009	1,200.18	S	T
				6/29/2009	1,200.05	S	T
				8/11/2009	1,200.35	S	T
				9/23/2009	1,200.16	S	T
				11/3/2009	1,200.11	S	T
383133115030201	207 N08 E62 30CD 1	101	5,290.20	1/20/2009	64.37	S	T
				2/24/2009	64.28	S	T
				4/13/2009	64.27	S	T
				5/18/2009	64.27	S	T
				6/29/2009	64.26	S	T
				8/10/2009	64.31	S	T
				9/21/2009	64.38	S	T
				11/2/2009	64.42	S	T
372639114520901	182 S06 E63 12AD 1 USGS-MX	1,195	4,706.30	1/21/2009	863.56	S	T
				2/23/2009	863.49	S	T
				4/9/2009	863.29	S	T
				5/20/2009	863.88	S	T
				6/30/2009	863.39	S	T
				8/11/2009	863.61	S	T
				9/24/2009	863.58	S	T
				11/4/2009	863.58	S	T

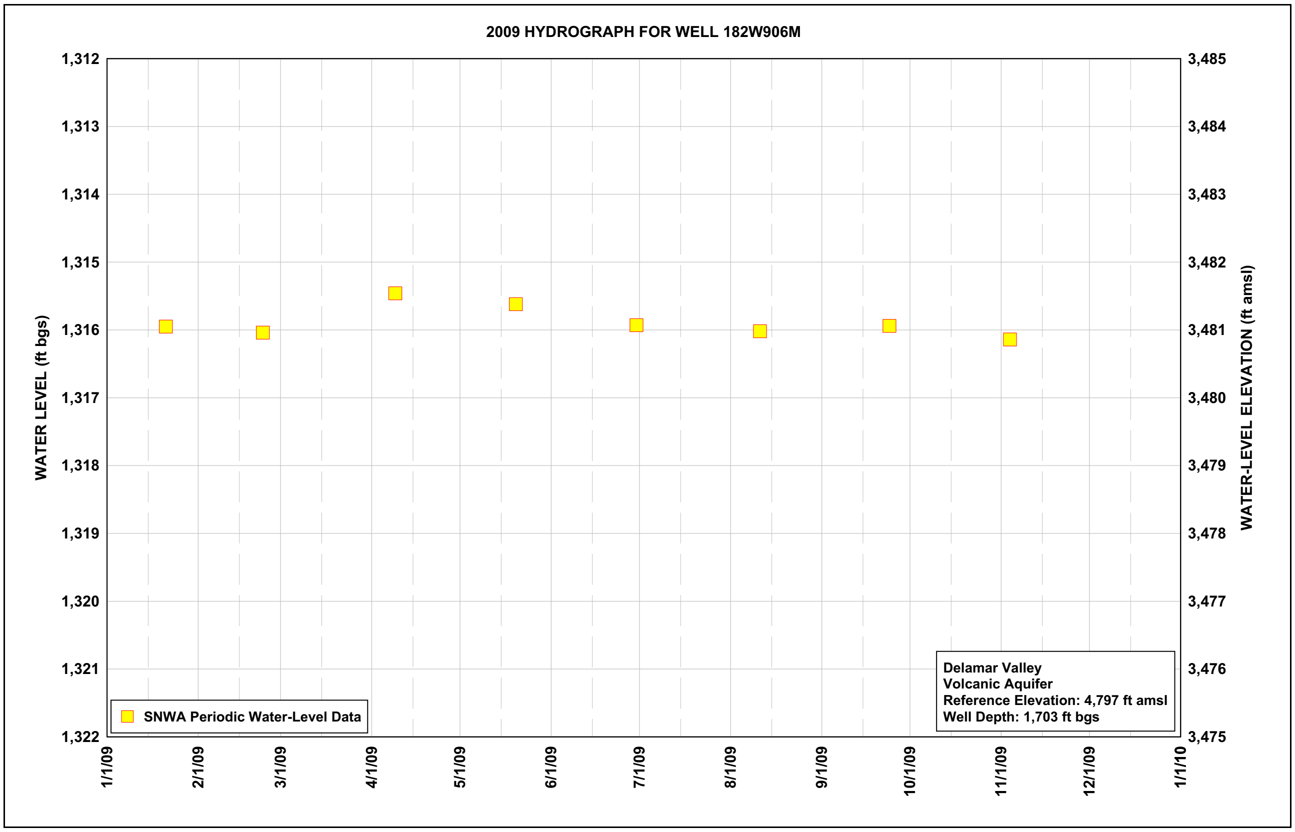
[a]S = Static conditions
[b]T = Electric tape measurement, S = Steel tape measurement
[c]2009 and historical hydrographs with periodic and continuous data are presented in Appendix B.
[d]No hydrograph presented due to limited data.
Note: SNWA tape calibration program started in August 2008.

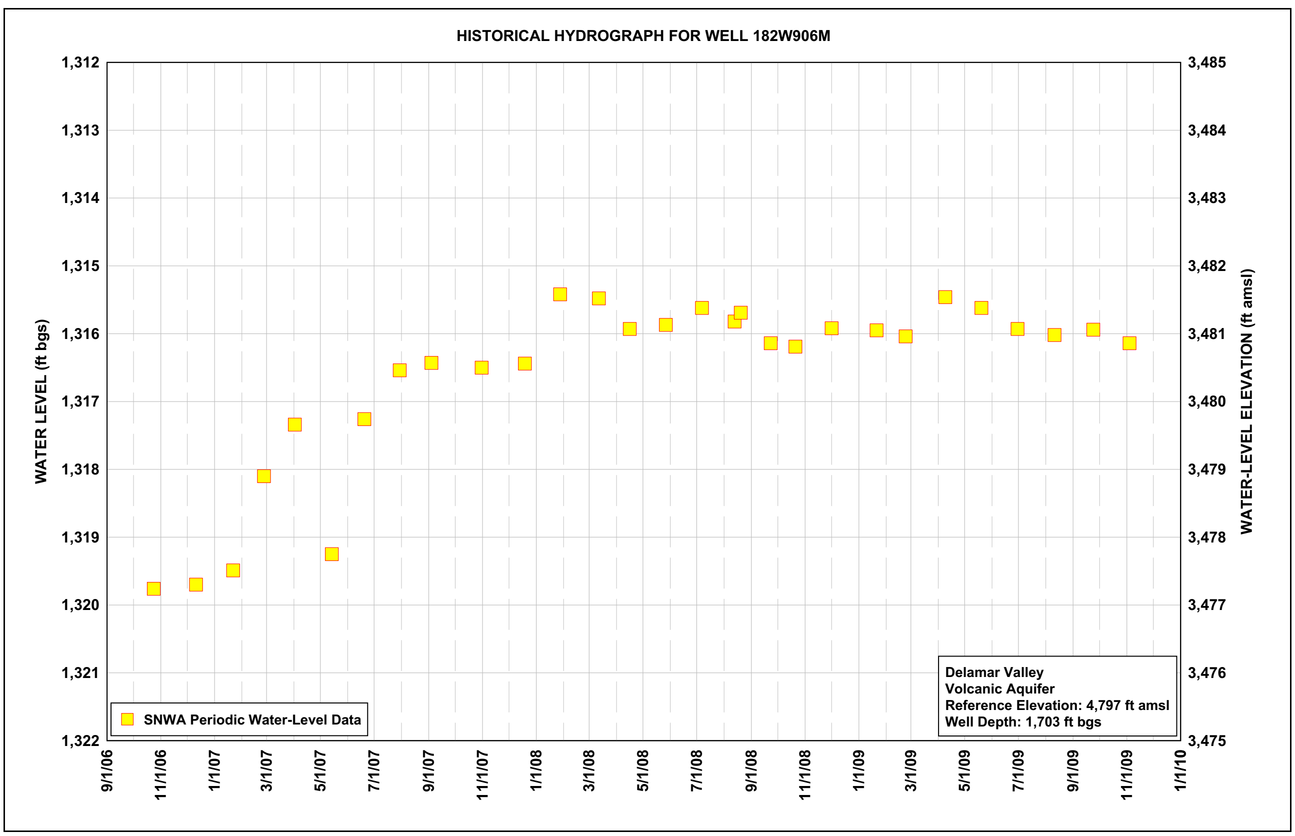

2009 HYDROGRAPH FOR WELL 382807114521001
WATER LEVEL (ft bgs)
215
216
217
218
219
220
221
222
223
224
225
WATER-LEVEL ELEVATION (ft amsl)
5,797
5,796
5,795
5,794
5,793
5,792
5,791
5,790
5,789
5,788
5,787
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
SNWA Periodic Water-Level Data
Cave Valley
Basin-Fill Aquifer
Reference Elevation: 6,012 ft amsl
Well Depth: 460 ft bgs

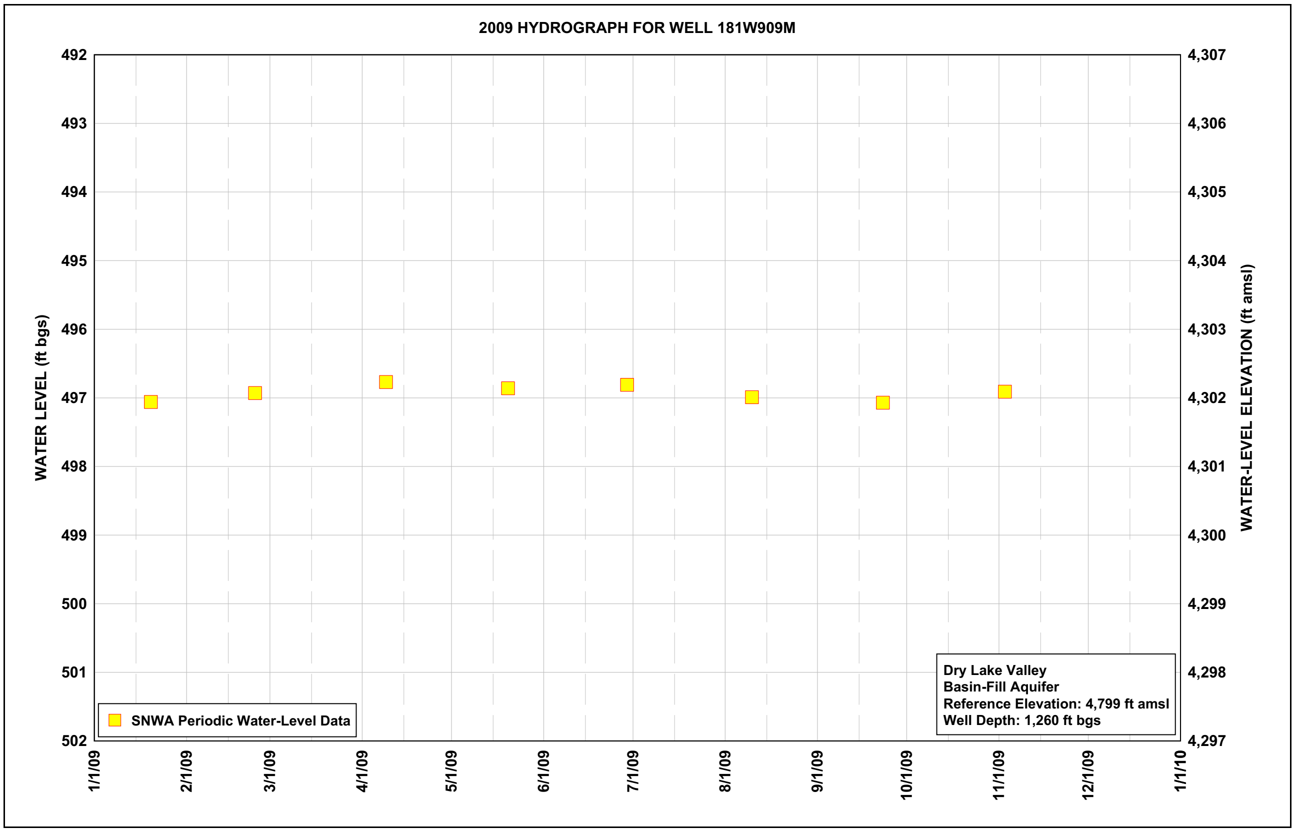

HISTORICAL HYDROGRAPH FOR WELL 382807114521001
WATER LEVEL (ft bgs)
215
216
217
218
219
220
221
222
223
224
225
WATER-LEVEL ELEVATION (ft amsl)
5,797
5,796
5,795
5,794
5,793
5,792
5,791
5,790
5,789
5,788
5,787
1/1/96
1/1/97
1/1/98
1/1/99
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
SNWA Periodic Water-Level Data
Cave Valley
Basin-Fill Aquifer
Reference Elevation: 6,012 ft amsl
Well Depth: 460 ft bgs

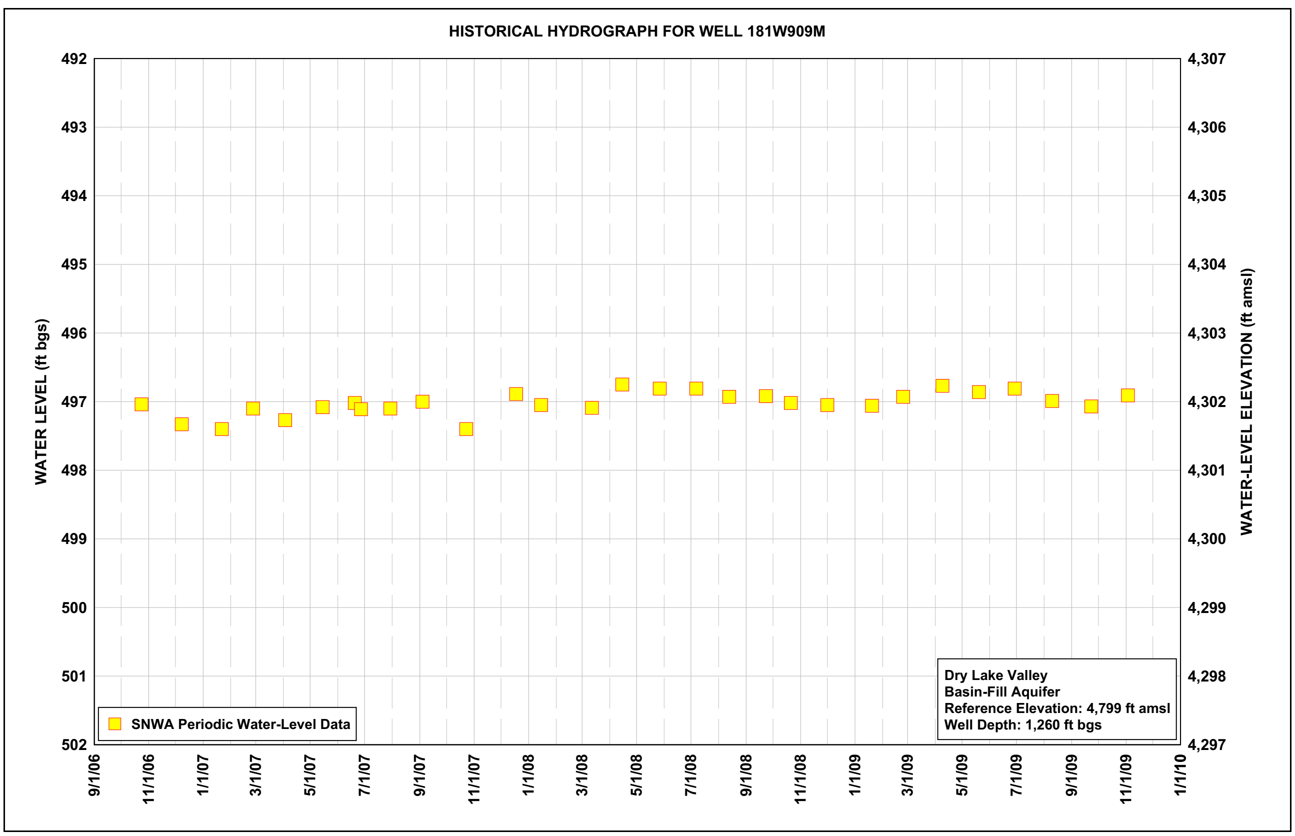

2009 HYDROGRAPH FOR WELL 383307114471001
WATER LEVEL (ft bgs)
258
259
260
261
262
263
264
265
266
267
268
WATER-LEVEL ELEVATION (ft amsl)
5,905
5,904
5,903
5,902
5,901
5,900
5,899
5,898
5,897
5,896
5,895
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
SNWA Periodic Water-Level Data
Cave Valley
Basin-Fill Aquifer
Reference Elevation: 6,163 ft amsl

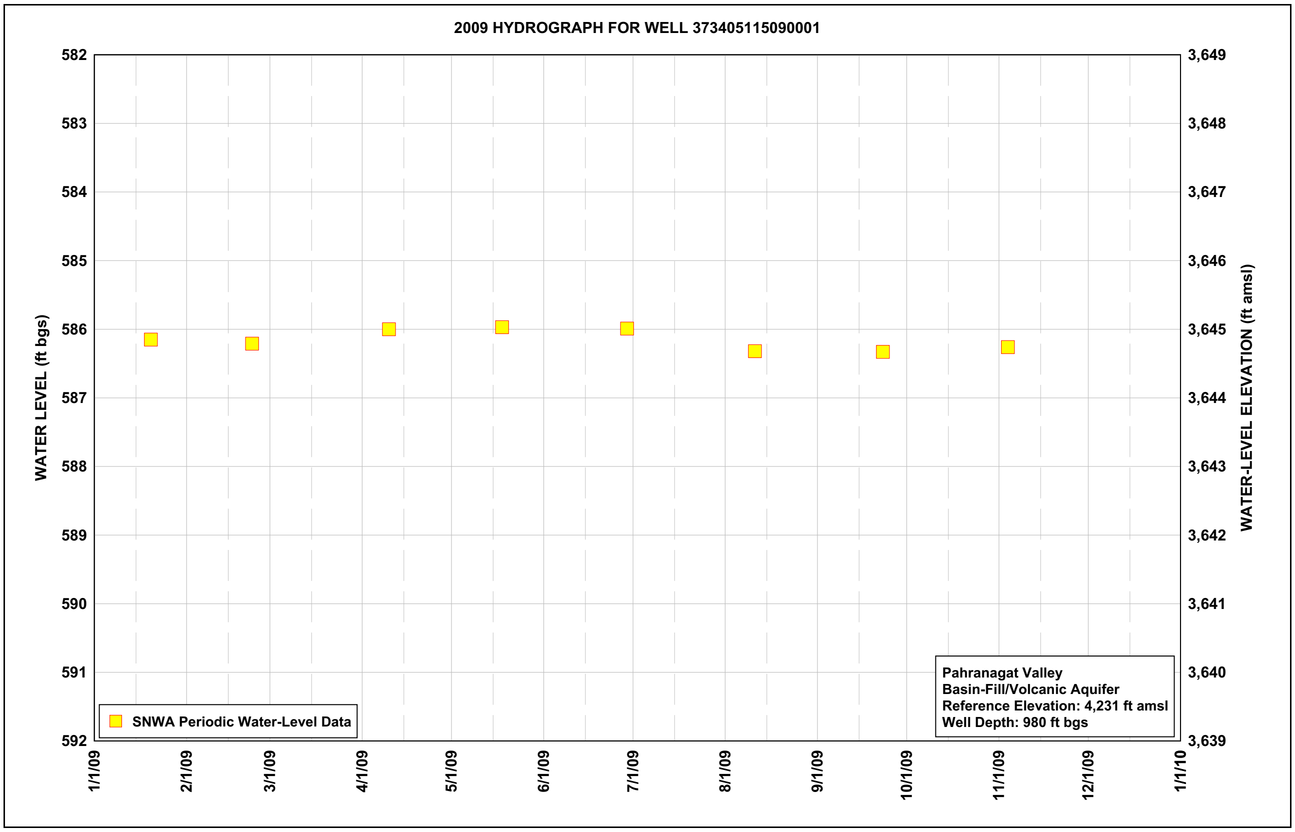

HISTORICAL HYDROGRAPH FOR WELL 383307114471001
WATER LEVEL (ft bgs)
258
259
260
261
262
263
264
265
266
267
268
WATER-LEVEL ELEVATION (ft amsl)
5,905
5,904
5,903
5,902
5,901
5,900
5,899
5,898
5,897
5,896
5,895
10/1/08
11/1/08
12/1/08
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
SNWA Periodic Water-Level Data
Cave Valley
Basin-Fill Aquifer
Reference Elevation: 6,163 ft amsl

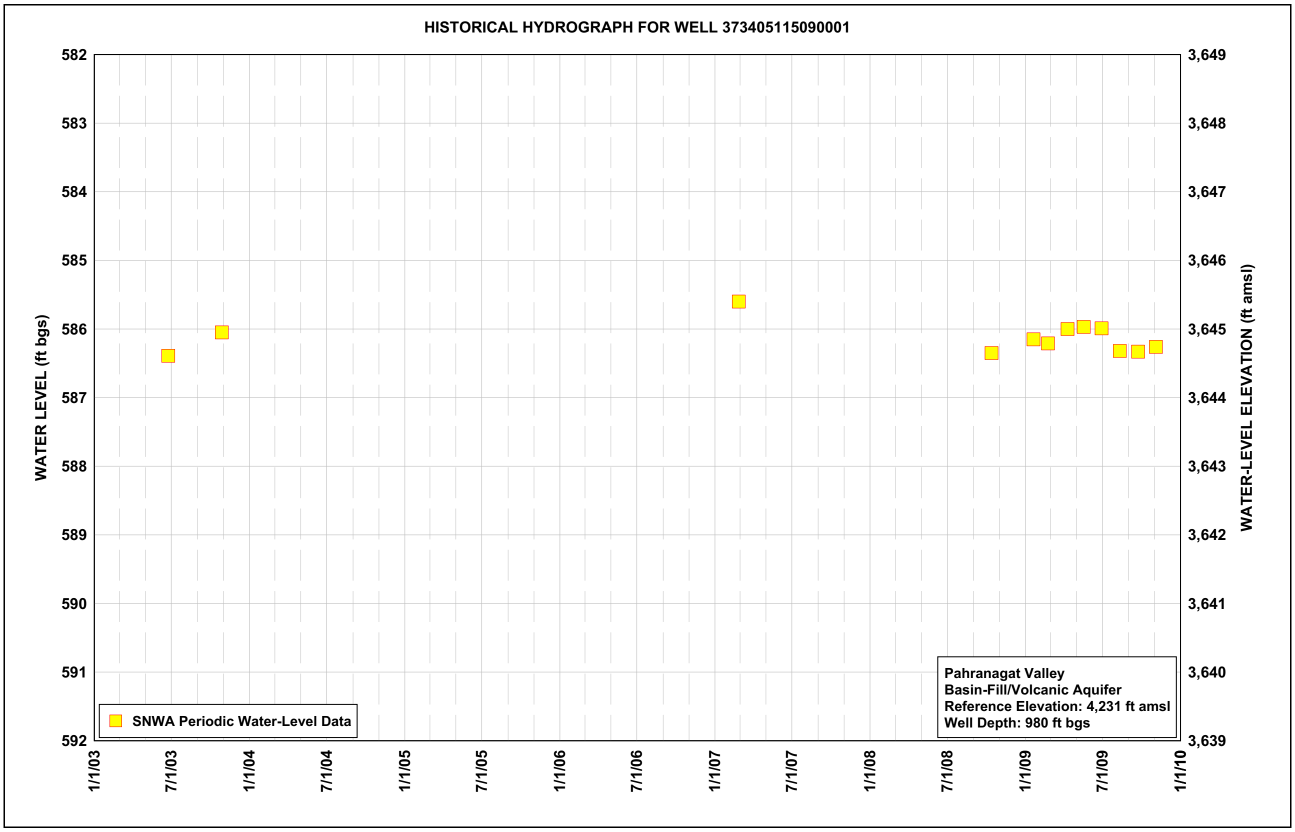

2009 HYDROGRAPH FOR WELL 182W906M
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
SNWA Periodic Water-Level Data
Delamar Valley
Volcanic Aquifer
Reference Elevation: 4,797 ft amsl
Well Depth: 1,703 ft bgs

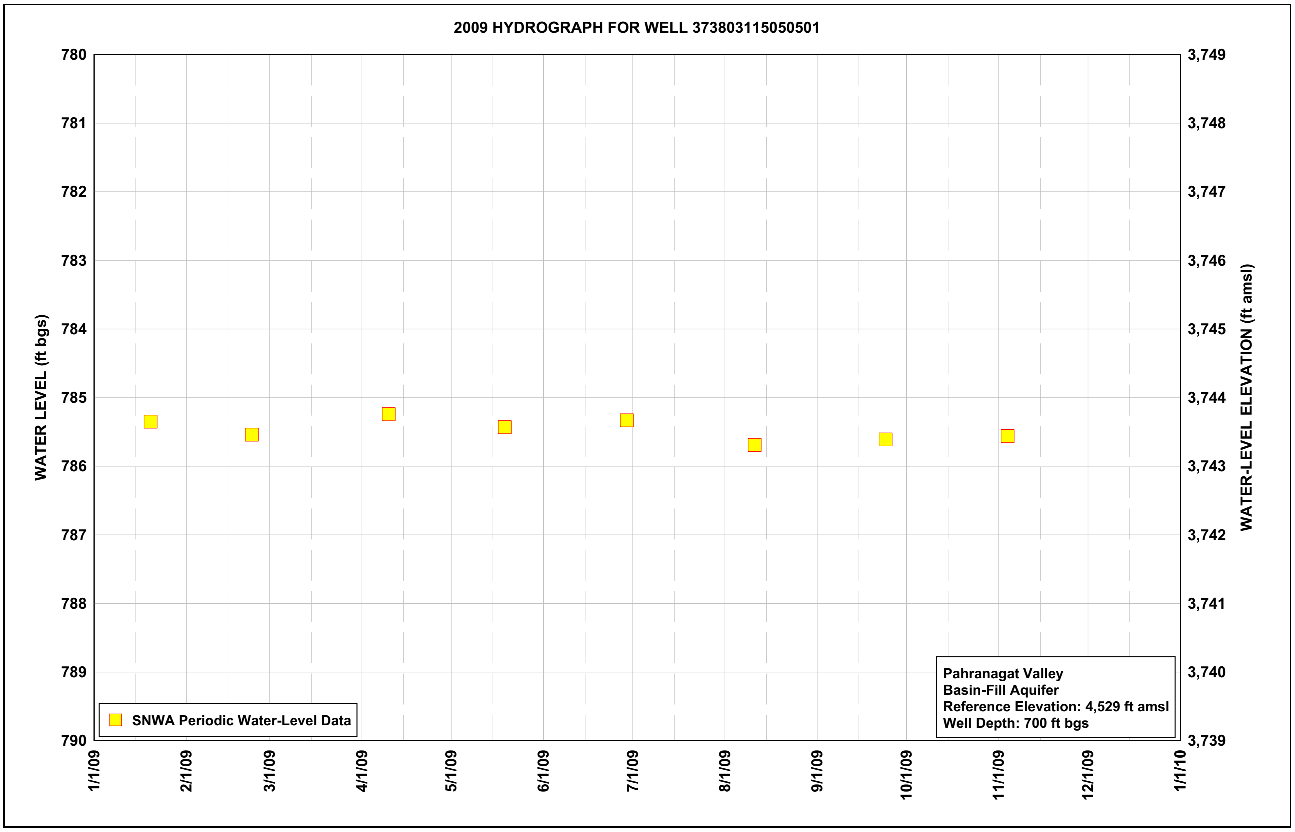

HISTORICAL HYDROGRAPH FOR WELL 182W906M
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
SNWA Periodic Water-Level Data
Delamar Valley
Volcanic Aquifer
Reference Elevation: 4,797 ft amsl
Well Depth: 1,703 ft bgs

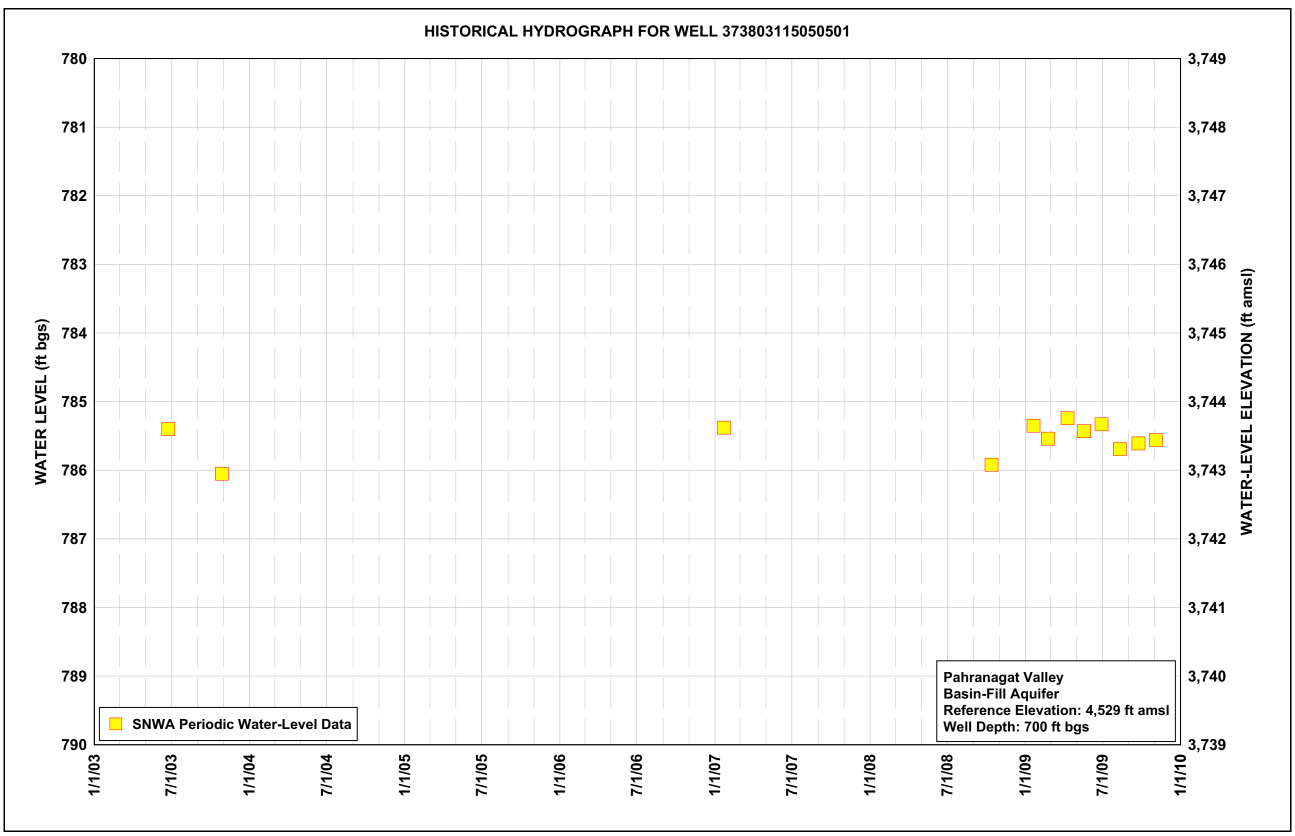

2009 HYDROGRAPH FOR WELL 181W909M
WATER LEVEL (ft bgs)
492
493
494
495
496
497
498
499
500
501
502
WATER-LEVEL ELEVATION (ft amsl)
4,307
4,306
4,305
4,304
4,303
4,302
4,301
4,300
4,299
4,298
4,297
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
SNWA Periodic Water-Level Data
Dry Lake Valley
Basin-Fill Aquifer
Reference Elevation: 4,799 ft amsl
Well Depth: 1,260 ft bgs

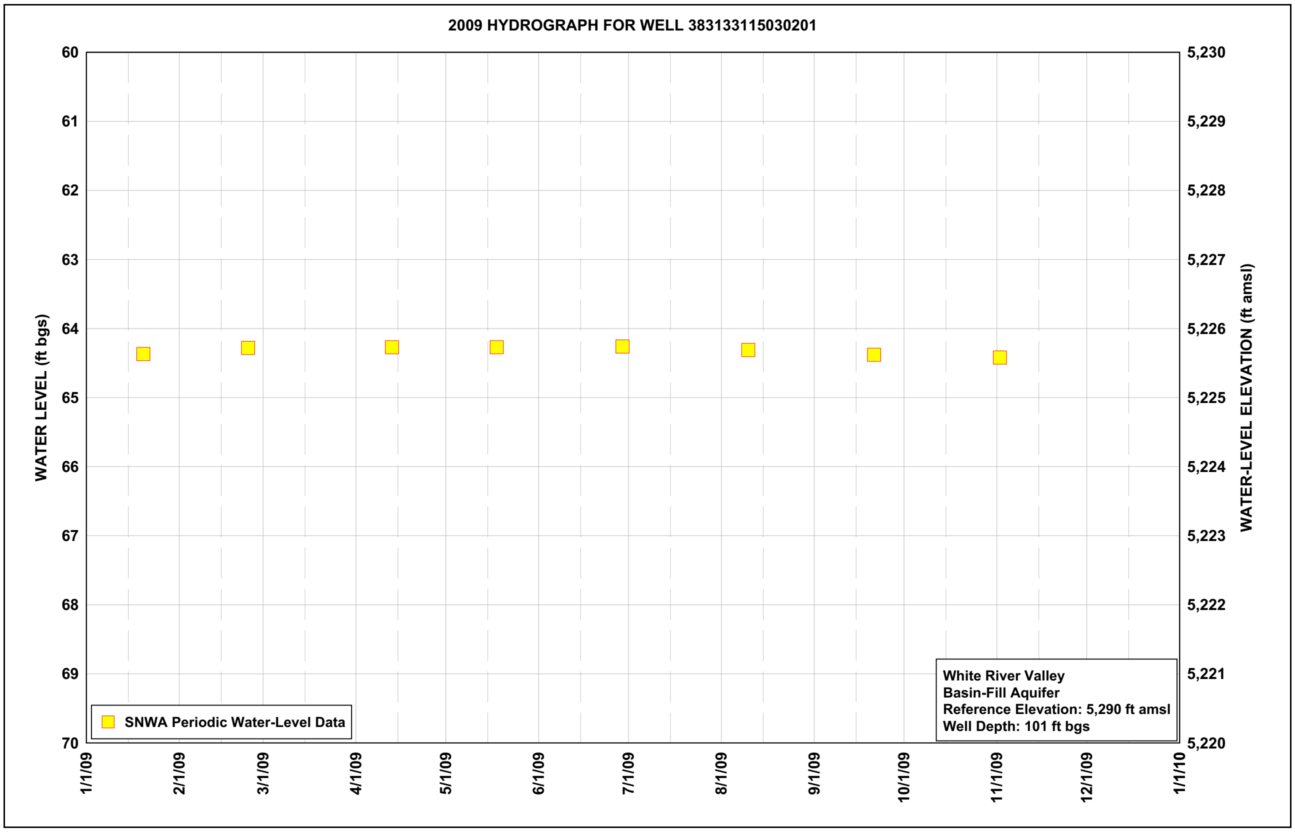

HISTORICAL HYDROGRAPH FOR WELL 181W909M
WATER LEVEL (ft bgs)
492
493
494
495
496
497
498
499
500
501
502
WATER-LEVEL ELEVATION (ft amsl)
4,307
4,306
4,305
4,304
4,303
4,302
4,301
4,300
4,299
4,298
4,297
9/1/06
11/1/06
1/1/07
3/1/07
5/1/07
7/1/07
9/1/07
11/1/07
1/1/08
3/1/08
5/1/08
7/1/08
9/1/08
11/1/08
1/1/09
3/1/09
5/1/09
7/1/09
9/1/09
11/1/09
1/1/10
SNWA Periodic Water-Level Data
Dry Lake Valley
Basin-Fill Aquifer
Reference Elevation: 4,799 ft amsl
Well Depth: 1,260 ft bgs

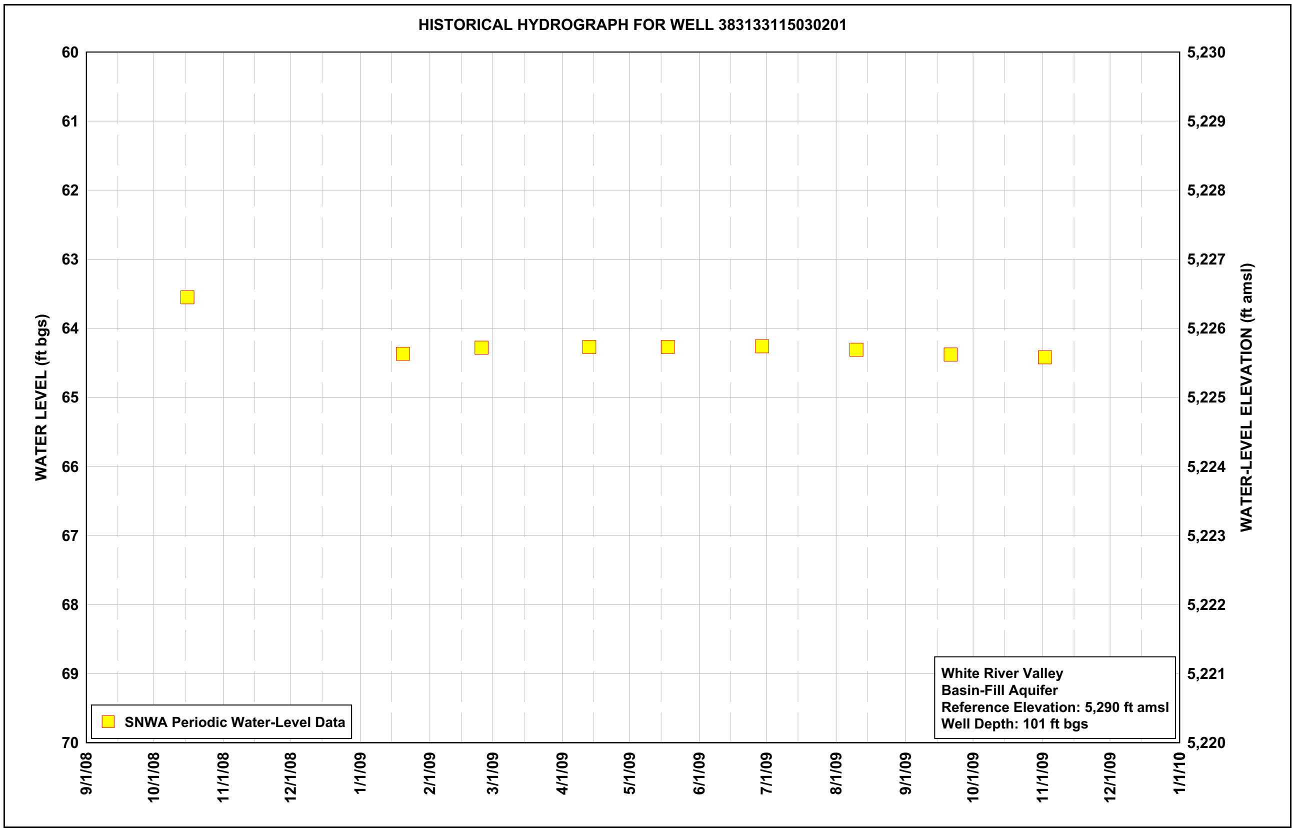

2009 HYDROGRAPH FOR WELL 373405115090001
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
582
583
584
585
586
587
588
589
590
591
592
3,649
3,648
3,647
3,646
3,645
3,644
3,643
3,642
3,641
3,640
3,639
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
SNWA Periodic Water-Level Data
Pahranagat Valley
Basin-Fill/Volcanic Aquifer
Reference Elevation: 4,231 ft amsl
Well Depth: 980 ft bgs

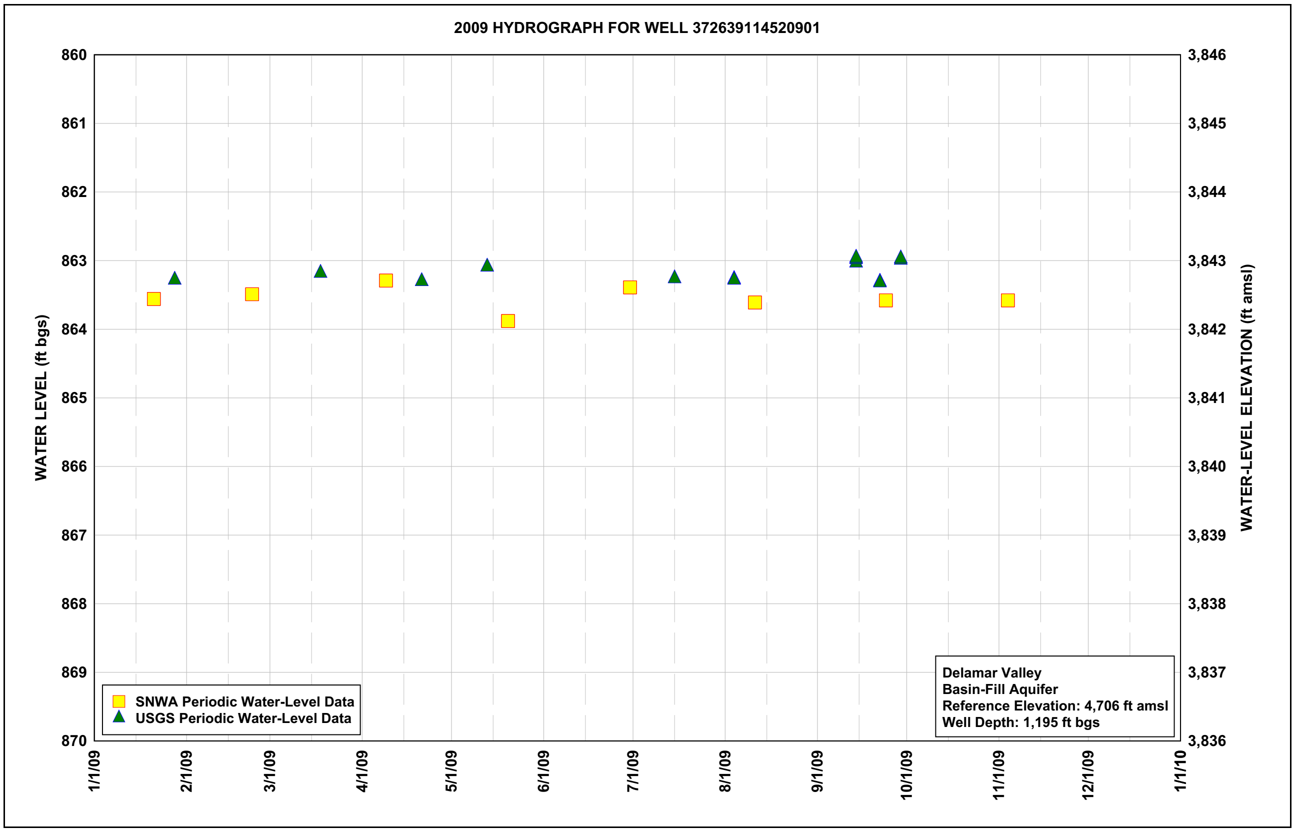

HISTORICAL HYDROGRAPH FOR WELL 373405115090001
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
582
583
584
585
586
587
588
589
590
591
592
3,649
3,648
3,647
3,646
3,645
3,644
3,643
3,642
3,641
3,640
3,639
1/1/03
7/1/03
1/1/04
7/1/04
1/1/05
7/1/05
1/1/06
7/1/06
1/1/07
7/1/07
1/1/08
7/1/08
1/1/09
7/1/09
1/1/10
SNWA Periodic Water-Level Data
Pahranagat Valley
Basin-Fill/Volcanic Aquifer
Reference Elevation: 4,231 ft amsl
Well Depth: 980 ft bgs

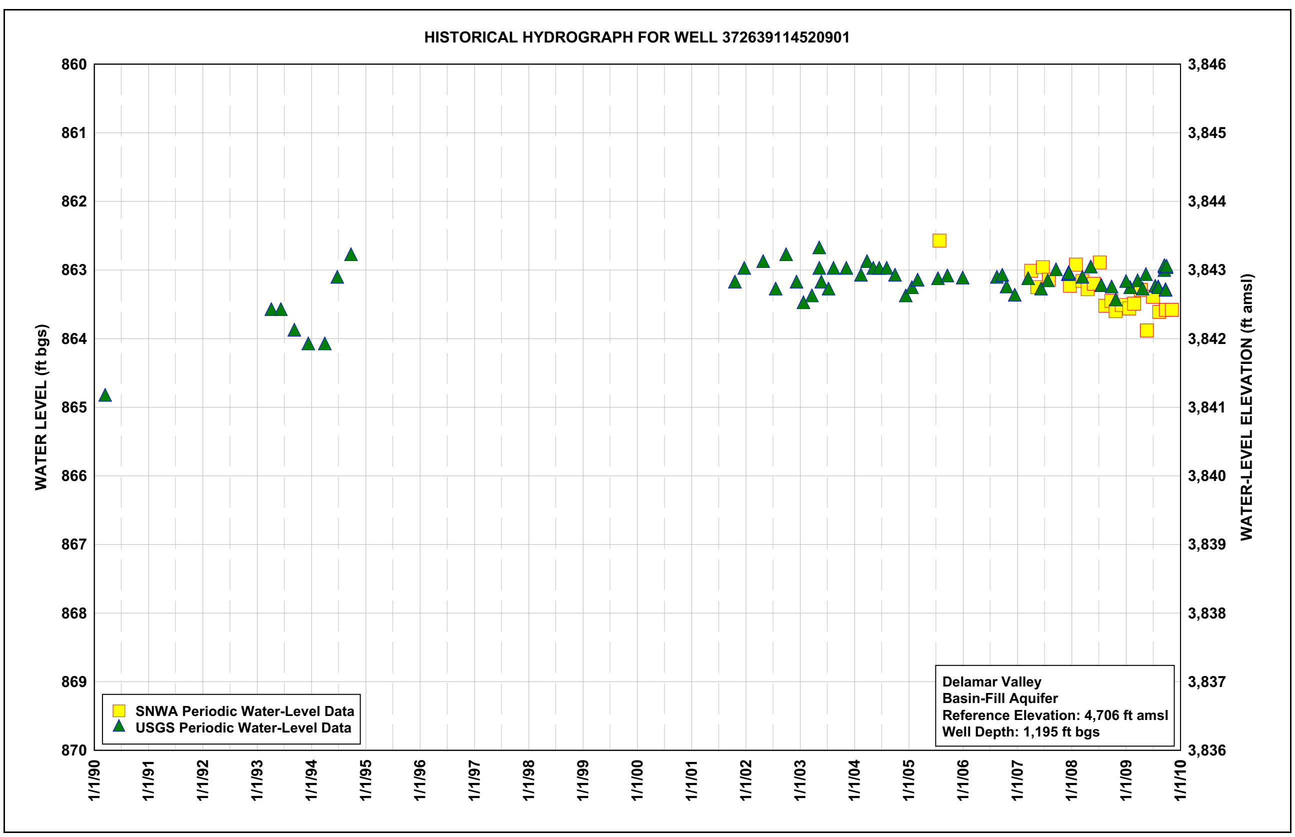

2009 HYDROGRAPH FOR WELL 373803115050501
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
780
781
782
783
784
785
786
787
788
789
790
3,749
3,748
3,747
3,746
3,745
3,744
3,743
3,742
3,741
3,740
3,739
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
SNWA Periodic Water-Level Data
Pahranagat Valley
Basin-Fill Aquifer
Reference Elevation: 4,529 ft amsl
Well Depth: 700 ft bgs


HISTORICAL HYDROGRAPH FOR WELL 373803115050501
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
780
781
782
783
784
785
786
787
788
789
790
3,749
3,748
3,747
3,746
3,745
3,744
3,743
3,742
3,741
3,740
3,739
1/1/03
7/1/03
1/1/04
7/1/04
1/1/05
7/1/05
1/1/06
7/1/06
1/1/07
7/1/07
1/1/08
7/1/08
1/1/09
7/1/09
1/1/10
SNWA Periodic Water-Level Data
Pahranagat Valley
Basin-Fill Aquifer
Reference Elevation: 4,529 ft amsl
Well Depth: 700 ft bgs


2009 HYDROGRAPH FOR WELL 383133115030201
WATER LEVEL (ft bgs)
60
61
62
63
64
65
66
67
68
69
70
WATER-LEVEL ELEVATION (ft amsl)
5,230
5,229
5,228
5,227
5,226
5,225
5,224
5,223
5,222
5,221
5,220
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
SNWA Periodic Water-Level Data
White River Valley
Basin-Fill Aquifer
Reference Elevation: 5,290 ft amsl
Well Depth: 101 ft bgs


HISTORICAL HYDROGRAPH FOR WELL 383133115030201
WATER LEVEL (ft bgs)
60
61
62
63
64
65
66
67
68
69
70
WATER-LEVEL ELEVATION (ft amsl)
5,230
5,229
5,228
5,227
5,226
5,225
5,224
5,223
5,222
5,221
5,220
9/1/08
10/1/08
11/1/08
12/1/08
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
SNWA Periodic Water-Level Data
White River Valley
Basin-Fill Aquifer
Reference Elevation: 5,290 ft amsl
Well Depth: 101 ft bgs


2009 HYDROGRAPH FOR WELL 372639114520901
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
SNWA Periodic Water-Level Data
USGS Periodic Water-Level Data
Delamar Valley
Basin-Fill Aquifer
Reference Elevation: 4,706 ft amsl
Well Depth: 1,195 ft bgs


HISTORICAL HYDROGRAPH FOR WELL 372639114520901
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
SNWA Periodic Water-Level Data
USGS Periodic Water-Level Data
Delamar Valley
Basin-Fill Aquifer
Reference Elevation: 4,706 ft amsl
Well Depth: 1,195 ft bgs

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Appendix B

Continuous Water-Level Measurement Data from the DDC Existing-Well Monitoring Network

B.1.0 MONITORING PROGRAM WELLS WITH CONTINUOUS TRANSDUCER DATA

Continuous data collection was performed in 2009 for the following monitor wells:

- Cave Valley Well 180W902M
- Cave Valley Well 180W501M
- Delamar Valley Well 182M-1
- Dry Lake Valley Well 181M-1
- Dry Lake Valley Well 380531114534201
- Pahranagat Valley Well 209M-1

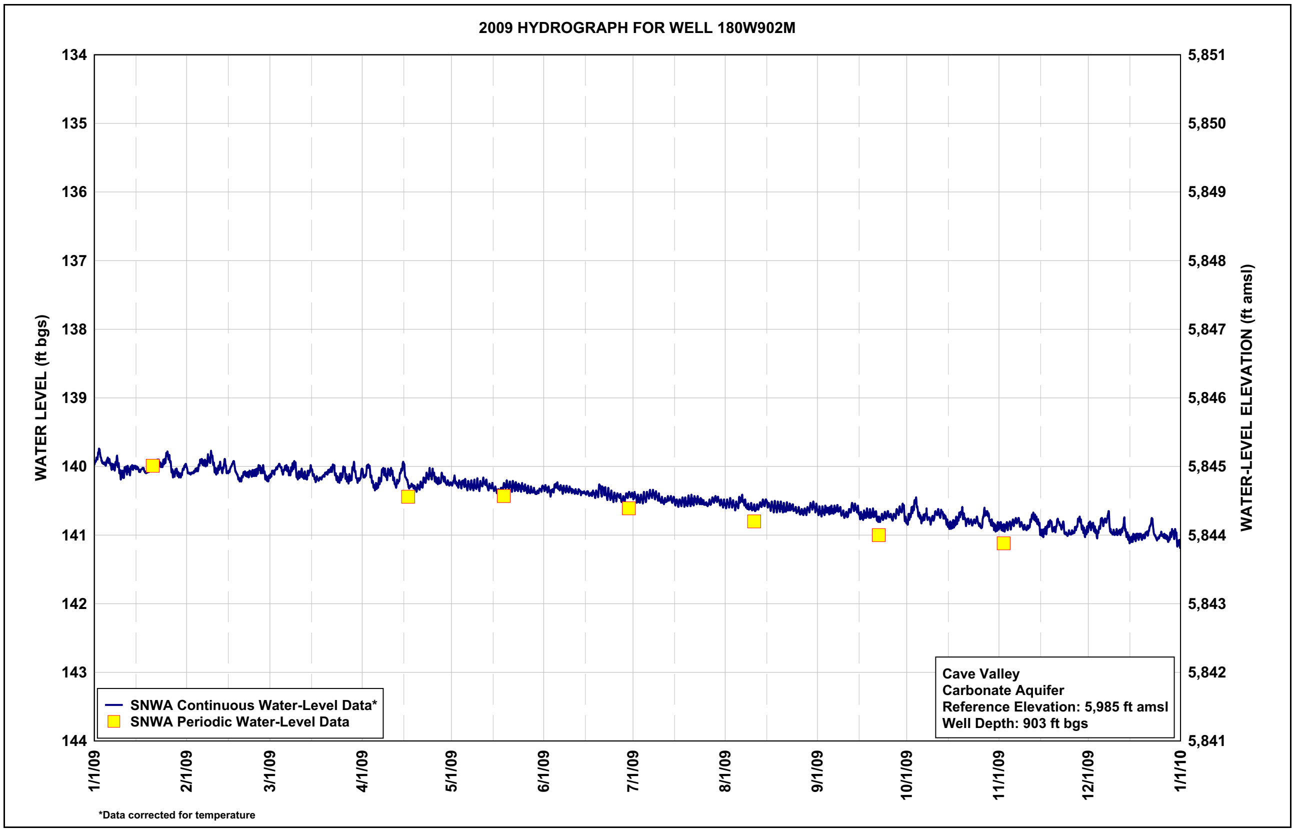
For these sites, two hydrographs are presented that include data collected in 2009 and historically. Continuous data have been corrected for temperature and transducer cable stretch. Additional data processing, including barometric pressure, may be applied in the future.

Table B-1
Cave Valley Well 180W902M, Calendar Year 2009
Water-Level Data, Daily Mean Values

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	139.92	140.07	140.11	140.12	140.23	140.32	140.43	140.55	140.65	140.77	140.86	140.86
2	139.81	140.10	140.07	140.06	140.22	140.34	140.47	140.53	140.66	140.68	140.89	140.87
3	139.91	140.08	140.01	140.05	140.25	140.37	140.47	140.55	140.65	140.56	140.87	140.95
4	139.96	140.04	140.00	140.23	140.26	140.32	140.46	140.57	140.64	140.59	140.85	140.94
5	139.91	139.95	140.07	140.29	140.24	140.28	140.45	140.53	140.63	140.74	140.83	140.80
6	139.97	139.94	140.03	140.24	140.28	140.31	140.42	140.47	140.64	140.76	140.80	140.80
7	140.00	139.95	140.08	140.13	140.28	140.34	140.40	140.53	140.61	140.71	140.79	140.73
8	139.94	139.90	140.02	140.08	140.28	140.33	140.42	140.58	140.64	140.76	140.85	140.92
9	140.06	139.86	140.00	140.12	140.26	140.34	140.45	140.59	140.69	140.77	140.89	140.97
10	140.11	140.03	140.13	140.08	140.29	140.35	140.49	140.61	140.71	140.71	140.90	140.97
11	140.06	140.05	140.10	140.15	140.24	140.36	140.51	140.61	140.68	140.68	140.82	140.96
12	140.05	140.01	140.13	140.26	140.24	140.37	140.49	140.58	140.60	140.69	140.73	140.90
13	140.03	139.99	140.13	140.17	140.30	140.37	140.47	140.54	140.60	140.72	140.77	140.91
14	140.01	140.05	140.05	140.01	140.29	140.38	140.49	140.53	140.63	140.80	140.86	141.03
15	140.03	140.05	140.10	140.10	140.33	140.38	140.52	140.56	140.72	140.86	140.97	141.06
16	140.06	139.96	140.18	140.26	140.36	140.41	140.53	140.58	140.72	140.84	140.94	141.03
17	140.04	140.05	140.18	140.28	140.35	140.39	140.52	140.59	140.69	140.80	140.86	141.02
18	140.08	140.17	140.16	140.30	140.30	140.40	140.52	140.59	140.70	140.74	140.83	141.01
19	140.04	140.17	140.12	140.32	140.27	140.35	140.51	140.59	140.69	140.68	140.91	141.02
20	140.01	140.10	140.08	140.28	140.28	140.33	140.50	140.61	140.70	140.76	140.83	140.98
21	139.97	140.12	140.05	140.23	140.29	140.36	140.50	140.60	140.76	140.80	140.85	140.92
22	139.94	140.10	140.03	140.17	140.29	140.41	140.49	140.60	140.75	140.81	140.87	140.82
23	139.98	140.10	140.17	140.12	140.30	140.42	140.51	140.60	140.72	140.81	140.98	141.01
24	139.93	140.08	140.17	140.11	140.31	140.45	140.52	140.63	140.70	140.78	140.98	141.05
25	139.83	140.03	140.09	140.17	140.31	140.44	140.54	140.64	140.73	140.85	140.97	141.00
26	139.93	140.05	140.12	140.21	140.34	140.43	140.54	140.66	140.74	140.80	140.93	141.02
27	140.10	140.14	140.18	140.18	140.35	140.48	140.50	140.67	140.69	140.67	140.82	141.05
28	140.08	140.17	140.12	140.17	140.36	140.45	140.48	140.65	140.65	140.72	140.82	141.02
29	140.12	---	140.04	140.24	140.38	140.41	140.49	140.60	140.61	140.82	140.94	140.97
30	140.09	---	140.19	140.25	140.35	140.42	140.53	140.57	140.74	140.88	140.94	141.01
31	140.00	---	140.13	---	140.32	---	140.55	140.61	---	140.88	---	141.12
Max	140.12	140.17	140.19	140.32	140.38	140.48	140.55	140.67	140.76	140.88	140.98	141.12
Min	139.81	139.86	140.00	140.01	140.22	140.28	140.40	140.47	140.60	140.56	140.73	140.73

Year 2009 Statistics: Year Max 141.12; Year Min 139.81

Note: Depth in ft bgs


2009 HYDROGRAPH FOR WELL 180W902M
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
134
135
136
137
138
139
140
141
142
143
144
5,851
5,850
5,849
5,848
5,847
5,846
5,845
5,844
5,843
5,842
5,841
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
SNWA Continuous Water-Level Data*
SNWA Periodic Water-Level Data
Cave Valley
Carbonate Aquifer
Reference Elevation: 5,985 ft amsl
Well Depth: 903 ft bgs
*Data corrected for temperature

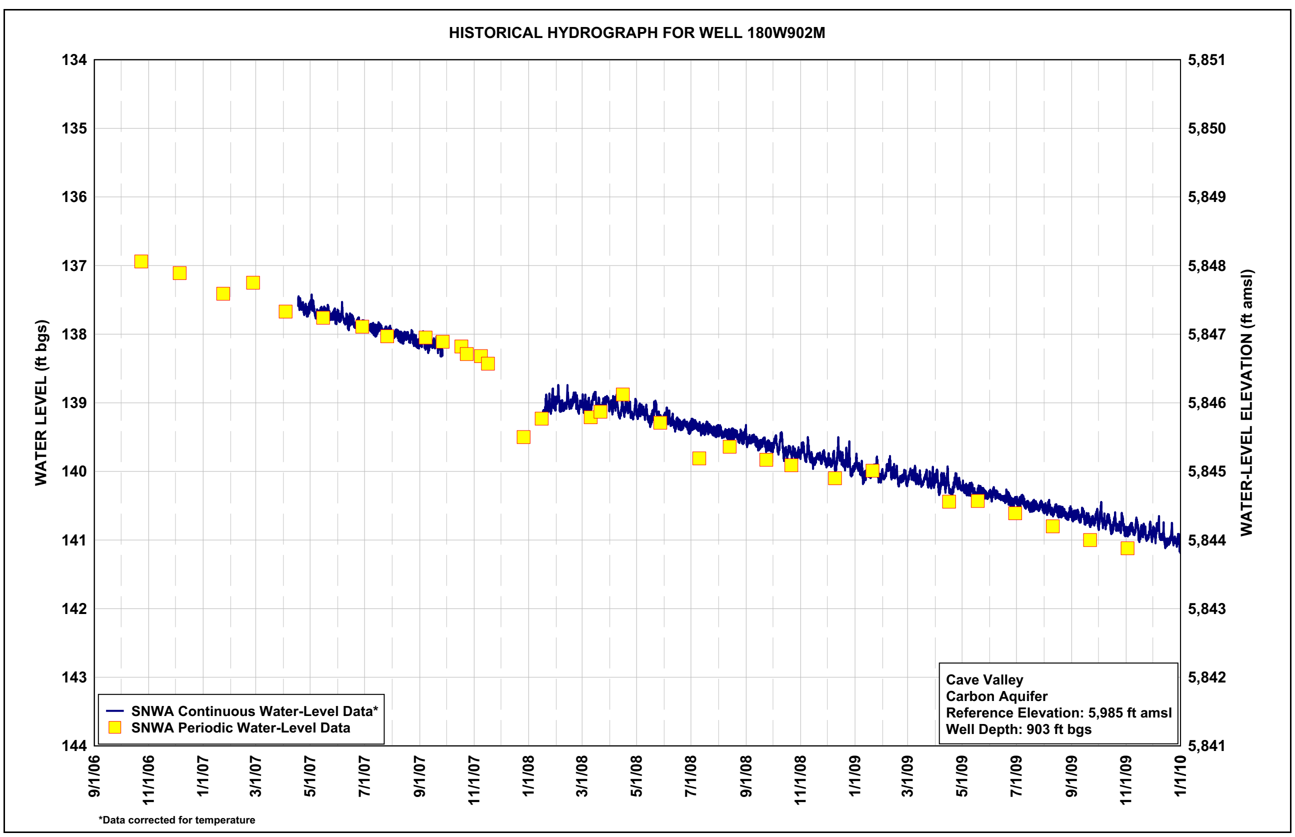
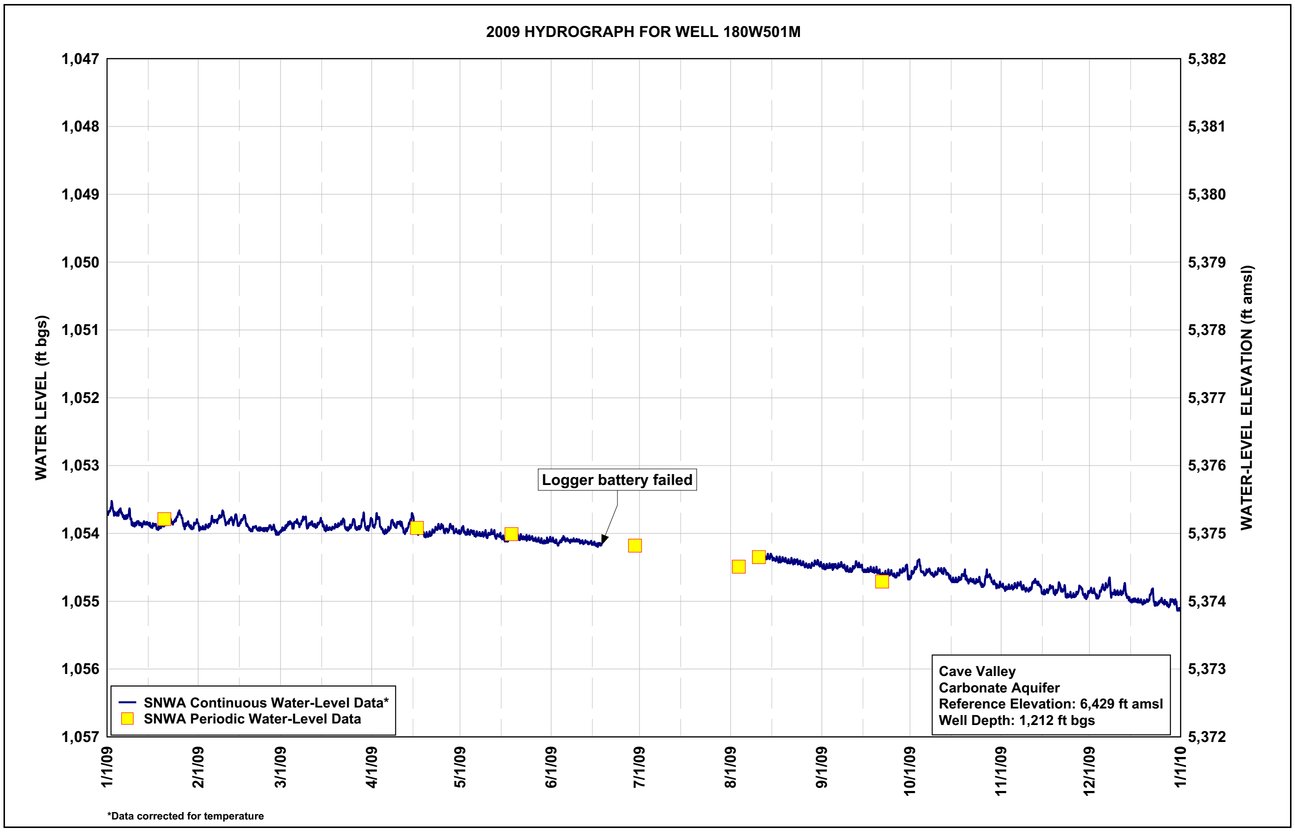

HISTORICAL HYDROGRAPH FOR WELL 180W902M
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
134
135
136
137
138
139
140
141
142
143
144
5,851
5,850
5,849
5,848
5,847
5,846
5,845
5,844
5,843
5,842
5,841
9/1/06
11/1/06
1/1/07
3/1/07
5/1/07
7/1/07
9/1/07
11/1/07
1/1/08
3/1/08
5/1/08
7/1/08
9/1/08
11/1/08
1/1/09
3/1/09
5/1/09
7/1/09
9/1/09
11/1/09
1/1/10
SNWA Continuous Water-Level Data*
SNWA Periodic Water-Level Data
Cave Valley
Carbon Aquifer
Reference Elevation: 5,985 ft amsl
Well Depth: 903 ft bgs
*Data corrected for temperature

Table B-2
Cave Valley Well 180W501M, Calendar Year 2009
Water-Level Data, Daily Mean Values

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	1,053.69	1,053.91	1,053.95	1,053.87	1,053.96	1,054.10	---	---	1,054.49	1,054.61	1,054.78	1,054.85
2	1,053.60	1,053.92	1,053.92	1,053.79	1,053.97	1,054.12	---	---	1,054.49	1,054.54	1,054.81	1,054.86
3	1,053.70	1,053.91	1,053.86	1,053.81	1,053.98	1,054.15	---	---	1,054.49	1,054.45	1,054.80	1,054.93
4	1,053.72	1,053.89	1,053.85	1,053.94	1,053.99	1,054.10	---	---	1,054.49	1,054.48	1,054.80	1,054.89
5	1,053.67	1,053.81	1,053.88	1,053.98	1,053.99	1,054.08	---	---	1,054.48	1,054.58	1,054.78	1,054.80
6	1,053.74	1,053.82	1,053.83	1,053.95	1,054.02	1,054.09	---	---	1,054.49	1,054.58	1,054.76	1,054.79
7	1,053.76	1,053.81	1,053.87	1,053.87	1,054.01	1,054.11	---	---	1,054.47	1,054.55	1,054.76	1,054.72
8	1,053.71	1,053.75	1,053.80	1,053.85	1,054.02	1,054.11	---	---	1,054.49	1,054.60	1,054.80	1,054.87
9	1,053.84	1,053.71	1,053.80	1,053.88	1,054.01	1,054.11	---	---	1,054.53	1,054.60	1,054.83	1,054.88
10	1,053.87	1,053.85	1,053.89	1,053.85	1,054.03	1,054.12	---	---	1,054.55	1,054.56	1,054.83	1,054.88
11	1,053.84	1,053.82	1,053.85	1,053.90	1,053.99	1,054.13	---	1,054.39	1,054.52	1,054.55	1,054.77	1,054.88
12	1,053.87	1,053.81	1,053.88	1,053.97	1,053.99	1,054.13	---	1,054.37	1,054.46	1,054.56	1,054.71	1,054.84
13	1,053.85	1,053.77	1,053.88	1,053.89	1,054.04	1,054.14	---	1,054.35	1,054.47	1,054.58	1,054.74	1,054.87
14	1,053.85	1,053.84	1,053.82	1,053.77	1,054.03	1,054.14	---	1,054.34	1,054.49	1,054.65	1,054.81	1,054.96
15	1,053.87	1,053.83	1,053.88	1,053.86	1,054.06	1,054.15	---	1,054.37	1,054.55	1,054.69	1,054.87	1,054.99
16	1,053.89	1,053.76	1,053.93	1,053.97	1,054.09	1,054.17	---	1,054.38	1,054.55	1,054.70	1,054.86	1,054.99
17	1,053.89	1,053.86	1,053.93	1,053.97	1,054.09	1,054.16	---	1,054.39	1,054.54	1,054.68	1,054.81	1,055.00
18	1,053.92	1,053.94	1,053.93	1,054.00	1,054.06	---	---	1,054.39	1,054.55	1,054.64	1,054.81	1,055.01
19	1,053.89	1,053.94	1,053.90	1,054.02	1,054.05	---	---	1,054.39	1,054.55	1,054.61	1,054.87	1,055.02
20	1,053.87	1,053.91	1,053.88	1,054.02	1,054.06	---	---	1,054.42	1,054.57	1,054.68	1,054.79	1,055.00
21	1,053.84	1,053.94	1,053.85	1,053.99	1,054.07	---	---	1,054.41	1,054.61	1,054.69	1,054.83	1,054.94
22	1,053.82	1,053.94	1,053.83	1,053.95	1,054.07	---	---	1,054.42	1,054.60	1,054.71	1,054.83	1,054.88
23	1,053.84	1,053.94	1,053.93	1,053.91	1,054.07	---	---	1,054.41	1,054.59	1,054.71	1,054.93	1,055.04
24	1,053.78	1,053.94	1,053.91	1,053.91	1,054.07	---	---	1,054.43	1,054.59	1,054.69	1,054.91	1,055.03
25	1,053.70	1,053.90	1,053.84	1,053.94	1,054.07	---	---	1,054.45	1,054.62	1,054.76	1,054.92	1,054.99
26	1,053.78	1,053.91	1,053.89	1,053.95	1,054.09	---	---	1,054.47	1,054.62	1,054.70	1,054.90	1,055.02
27	1,053.89	1,053.99	1,053.92	1,053.92	1,054.10	---	---	1,054.48	1,054.58	1,054.61	1,054.82	1,055.05
28	1,053.86	1,053.99	1,053.86	1,053.92	1,054.11	---	---	1,054.48	1,054.55	1,054.66	1,054.84	1,055.02
29	1,053.91	---	1,053.81	1,053.97	1,054.13	---	---	1,054.45	1,054.51	1,054.73	1,054.93	1,055.00
30	1,053.89	---	1,053.93	1,053.98	1,054.11	---	---	1,054.43	1,054.62	1,054.77	1,054.90	1,055.04
31	1,053.84	---	1,053.84	---	1,054.10	---	---	1,054.46	---	1,054.77	---	1,055.12
Max	1,053.92	1,053.99	1,053.95	1,054.02	1,054.13	1,054.17	---	1,054.48	1,054.62	1,054.77	1,054.93	1,055.12
Min	1,053.60	1,053.71	1,053.80	1,053.77	1,053.96	1,054.08	---	1,054.34	1,054.46	1,054.45	1,054.71	1,054.72

Year 2009 Statistics: Year Max 1,055.12; Year Min 1,053.60

Note: Depth in ft bgs


2009 HYDROGRAPH FOR WELL 180W501M
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
Logger battery failed
SNWA Continuous Water-Level Data*
SNWA Periodic Water-Level Data
Cave Valley
Carbonate Aquifer
Reference Elevation: 6,429 ft amsl
Well Depth: 1,212 ft bgs
*Data corrected for temperature

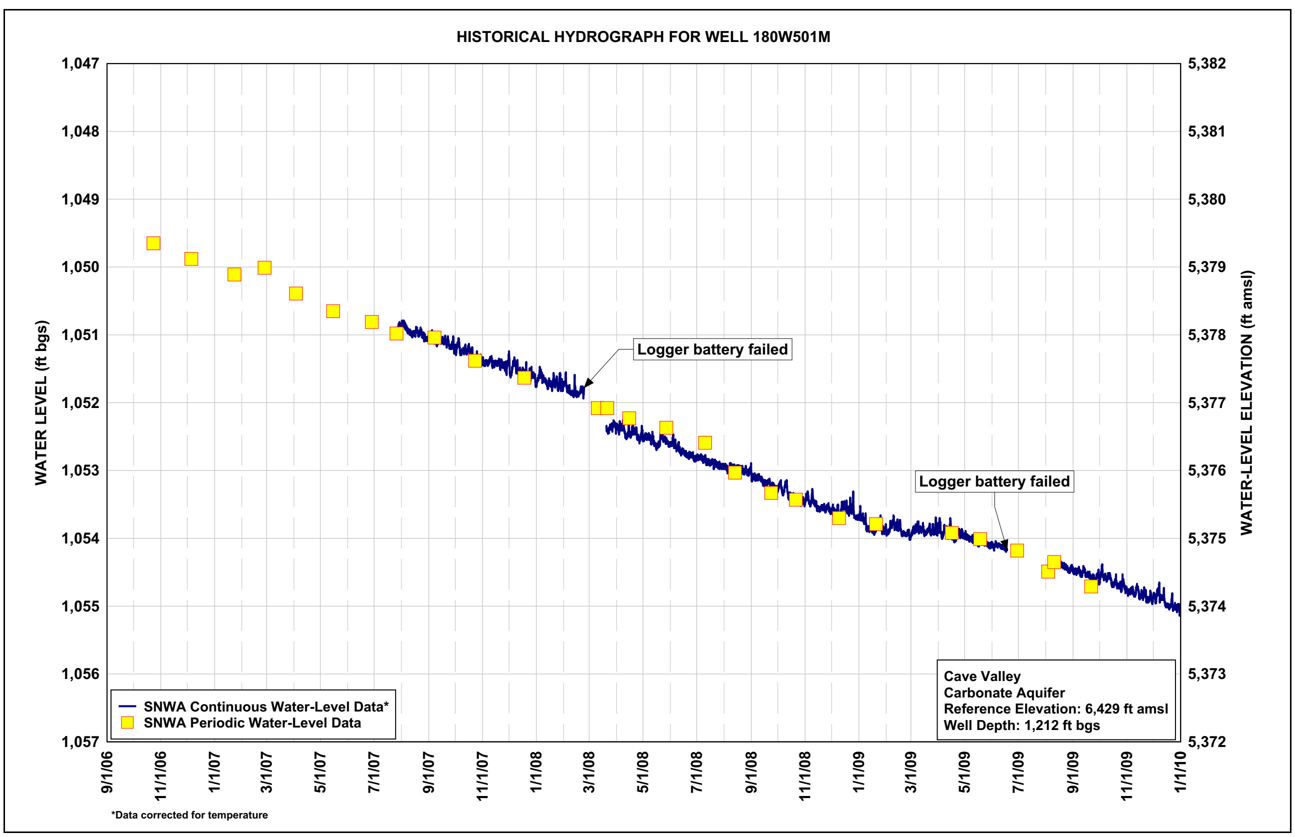
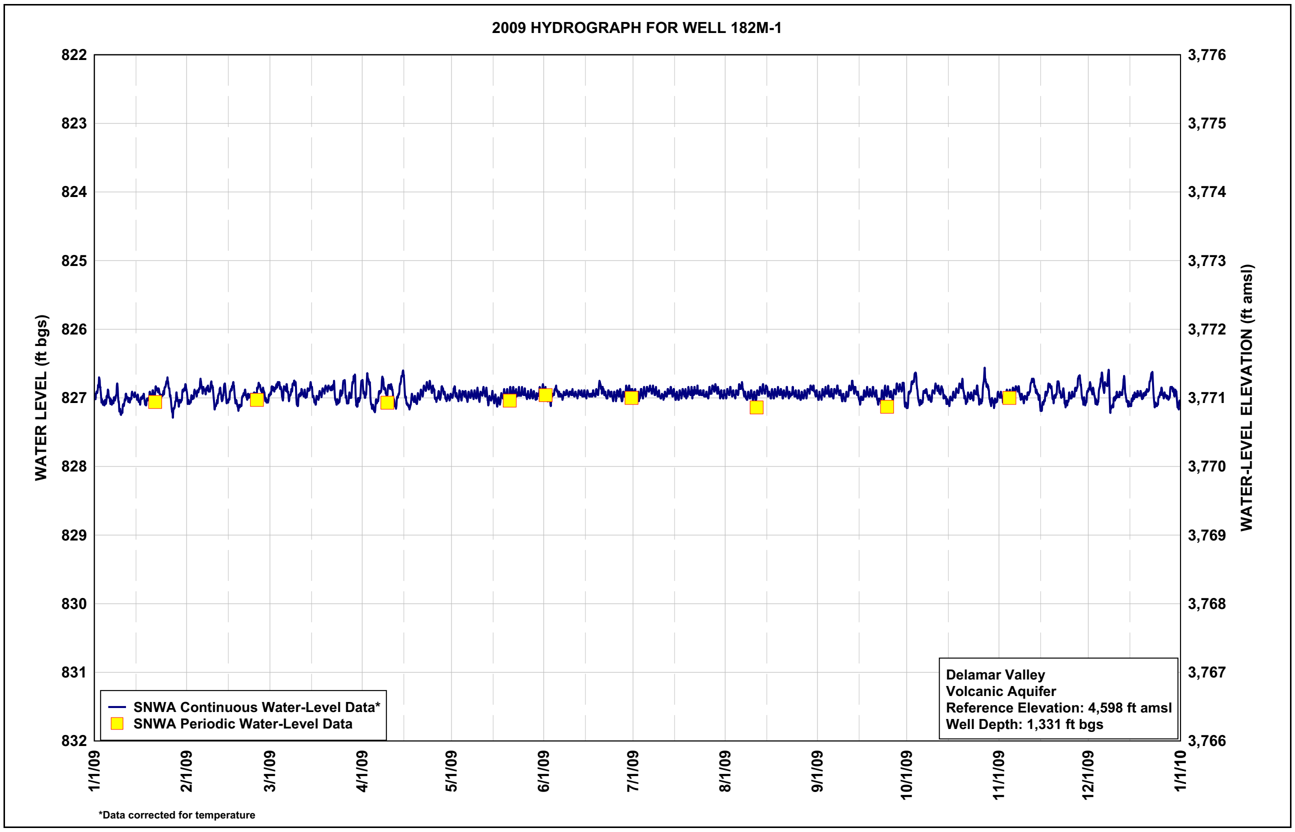

HISTORICAL HYDROGRAPH FOR WELL 180W501M
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
Logger battery failed
Logger battery failed
SNWA Continuous Water-Level Data*
SNWA Periodic Water-Level Data
Cave Valley
Carbonate Aquifer
Reference Elevation: 6,429 ft amsl
Well Depth: 1,212 ft bgs
*Data corrected for temperature

Table B-3
Delamar Valley Well 182M-1, Calendar Year 2009
Water-Level Data, Daily Mean Values

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	826.96	827.02	826.90	826.88	826.94	826.92	826.92	826.94	826.99	827.03	826.96	826.84
2	826.81	827.03	826.87	826.83	826.93	827.01	826.99	826.91	826.95	826.85	827.00	826.90
3	827.01	826.95	826.81	826.84	826.97	827.03	826.96	826.94	826.92	826.71	826.95	827.03
4	827.07	826.93	826.84	827.13	826.97	826.92	826.93	826.95	826.90	826.84	826.94	826.97
5	826.96	826.82	826.94	827.12	826.94	826.90	826.91	826.89	826.93	827.07	826.91	826.72
6	827.05	826.87	826.86	826.99	826.99	826.96	826.87	826.83	826.94	826.99	826.88	826.84
7	827.04	826.89	826.97	826.83	826.96	826.97	826.88	826.94	826.89	826.91	826.88	826.73
8	826.91	826.88	826.86	826.85	826.96	826.93	826.91	826.98	826.93	826.99	826.98	827.08
9	827.14	826.83	826.83	826.91	826.94	826.95	826.95	826.96	827.00	826.98	827.02	827.06
10	827.16	827.09	827.05	826.83	826.98	826.93	826.98	826.97	827.00	826.87	826.97	826.98
11	827.01	827.01	826.93	826.98	826.91	826.95	826.96	826.97	826.92	826.87	826.85	826.95
12	827.02	826.94	826.94	827.08	826.92	826.95	826.93	826.91	826.83	826.89	826.76	826.87
13	826.98	826.90	826.94	826.89	827.03	826.94	826.90	826.88	826.88	826.96	826.89	826.90
14	826.96	827.01	826.84	826.67	826.98	826.95	826.93	826.88	826.95	827.04	827.02	827.08
15	827.00	826.97	826.96	826.94	827.01	826.95	826.97	826.92	827.03	827.05	827.13	827.07
16	827.04	826.83	827.04	827.12	827.05	826.96	826.97	826.95	826.98	826.98	827.00	826.97
17	826.99	827.02	826.96	827.04	827.02	826.95	826.93	826.94	826.93	826.94	826.87	826.95
18	827.06	827.13	826.92	827.02	826.96	826.93	826.94	826.93	826.94	826.86	826.86	826.95
19	826.98	827.06	826.88	827.02	826.95	826.86	826.93	826.92	826.92	826.81	827.01	826.97
20	826.94	826.93	826.86	826.96	826.94	826.85	826.93	826.95	826.94	826.98	826.86	826.92
21	826.90	826.98	826.86	826.90	826.92	826.93	826.91	826.93	827.04	827.00	826.90	826.83
22	826.89	826.97	826.86	826.84	826.94	826.96	826.90	826.96	826.98	826.97	826.94	826.72
23	826.97	826.97	827.06	826.83	826.93	826.95	826.93	826.92	826.94	826.96	827.08	827.09
24	826.89	826.93	826.99	826.87	826.92	826.99	826.94	826.95	826.91	826.90	827.00	827.05
25	826.77	826.83	826.85	826.97	826.93	826.95	826.96	826.96	826.95	827.04	826.97	826.92
26	826.97	826.89	826.93	826.97	826.96	826.93	826.94	826.98	826.96	826.93	826.92	826.96
27	827.19	827.00	827.01	826.93	826.96	826.99	826.89	826.96	826.87	826.73	826.78	826.99
28	827.02	827.01	826.89	826.92	826.96	826.92	826.86	826.93	826.86	826.89	826.82	826.93
29	827.06	---	826.78	827.00	826.99	826.88	826.89	826.88	826.84	827.06	827.05	826.89
30	826.97	---	827.08	826.99	826.92	826.90	826.95	826.87	827.05	827.07	826.99	826.96
31	826.86	---	826.90	---	826.87	---	826.96	826.93	---	827.00	---	827.10
Max	827.19	827.13	827.08	827.13	827.05	827.03	826.99	826.98	827.05	827.07	827.13	827.10
Min	826.77	826.82	826.78	826.67	826.87	826.85	826.86	826.83	826.83	826.71	826.76	826.72

Year 2009 Statistics: Year Max 827.19; Year Min 826.67

Note: Depth in ft bgs


2009 HYDROGRAPH FOR WELL 182M-1
WATER LEVEL (ft bgs)
822
823
824
825
826
827
828
829
830
831
832
WATER-LEVEL ELEVATION (ft amsl)
3,776
3,775
3,774
3,773
3,772
3,771
3,770
3,769
3,768
3,767
3,766
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
SNWA Continuous Water-Level Data*
SNWA Periodic Water-Level Data
Delamar Valley
Volcanic Aquifer
Reference Elevation: 4,598 ft amsl
Well Depth: 1,331 ft bgs
*Data corrected for temperature

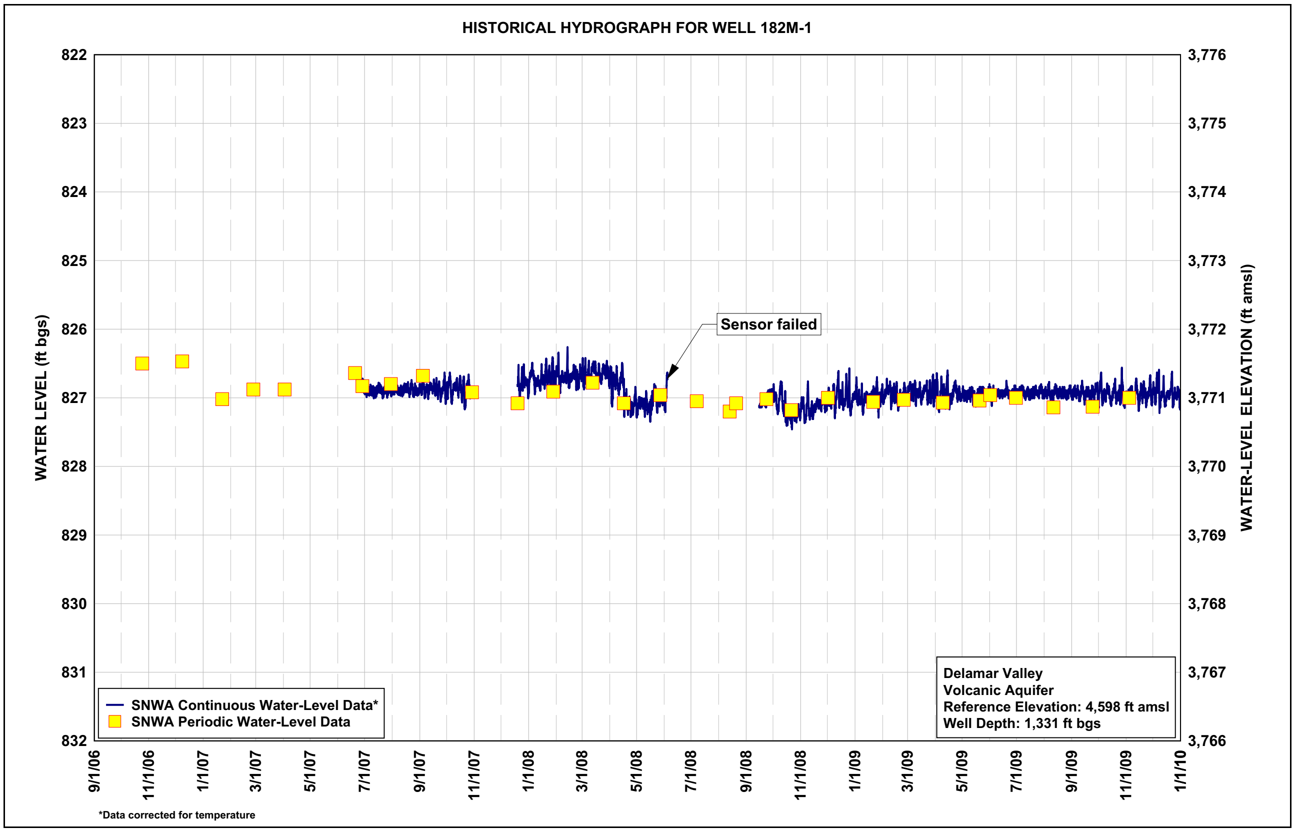
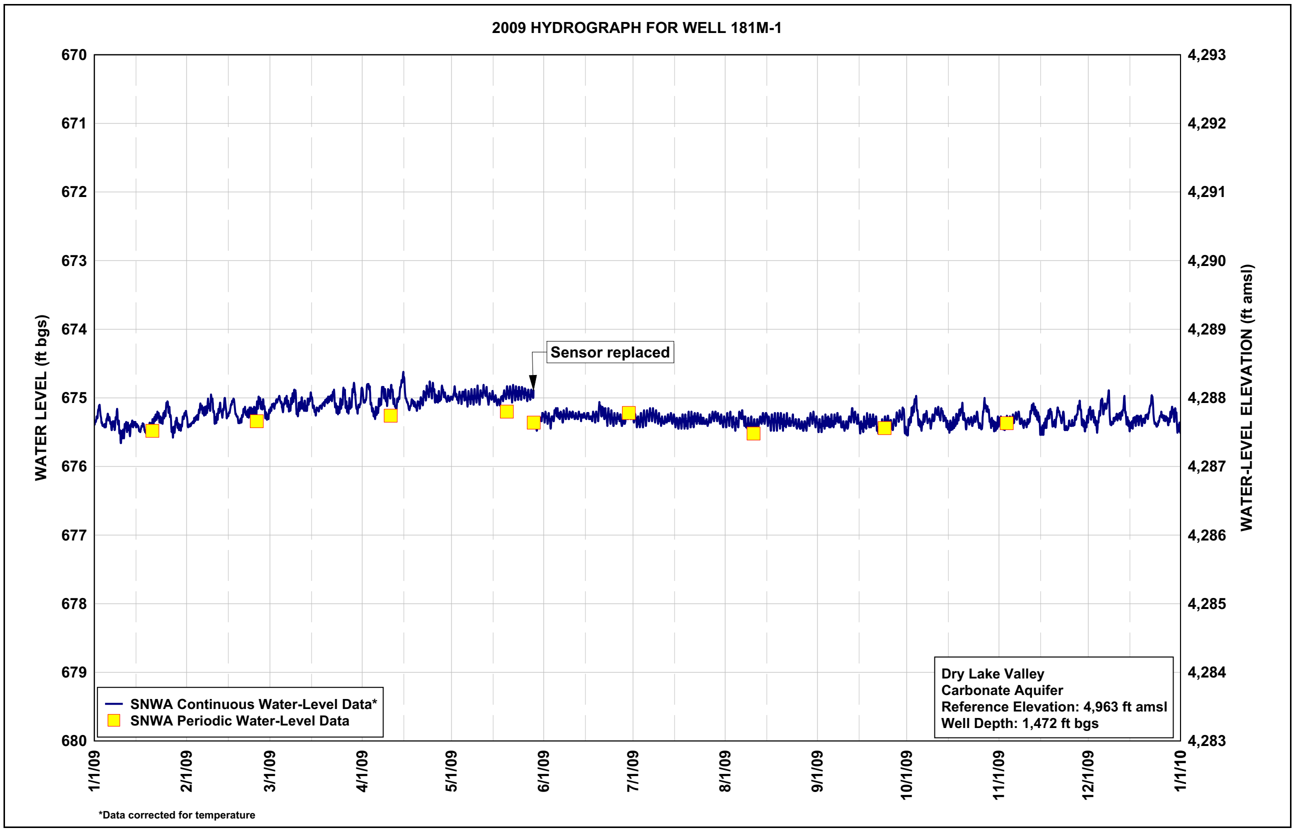

HISTORICAL HYDROGRAPH FOR WELL 182M-1
WATER LEVEL (ft bgs)
822
823
824
825
826
827
828
829
830
831
832
WATER-LEVEL ELEVATION (ft amsl)
3,776
3,775
3,774
3,773
3,772
3,771
3,770
3,769
3,768
3,767
3,766
Sensor failed
9/1/06
11/1/06
1/1/07
3/1/07
5/1/07
7/1/07
9/1/07
11/1/07
1/1/08
3/1/08
5/1/08
7/1/08
9/1/08
11/1/08
1/1/09
3/1/09
5/1/09
7/1/09
9/1/09
11/1/09
1/1/10
SNWA Continuous Water-Level Data*
SNWA Periodic Water-Level Data
Delamar Valley
Volcanic Aquifer
Reference Elevation: 4,598 ft amsl
Well Depth: 1,331 ft bgs
*Data corrected for temperature

Table B-4
Dry Lake Valley Well 181M-1, Calendar Year 2009
Water-Level Data, Daily Mean Values

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	675.33	675.37	675.15	675.00	674.98	675.27	675.29	675.33	675.40	675.43	675.35	675.21
2	675.17	675.39	675.11	674.92	674.94	675.30	675.35	675.31	675.39	675.26	675.39	675.25
3	675.34	675.33	675.03	674.91	674.99	675.34	675.32	675.34	675.36	675.11	675.35	675.36
4	675.41	675.29	675.03	675.17	674.99	675.26	675.31	675.38	675.34	675.17	675.34	675.32
5	675.29	675.16	675.13	675.22	674.96	675.21	675.29	675.32	675.34	675.38	675.31	675.09
6	675.37	675.18	675.05	675.12	675.01	675.26	675.25	675.25	675.35	675.35	675.28	675.15
7	675.39	675.17	675.13	674.97	674.99	675.27	675.25	675.33	675.30	675.26	675.25	675.03
8	675.28	675.11	675.03	674.93	674.99	675.25	675.26	675.38	675.33	675.34	675.35	675.31
9	675.48	675.05	674.99	675.00	674.96	675.26	675.30	675.37	675.40	675.34	675.39	675.34
10	675.54	675.29	675.18	674.92	675.00	675.25	675.34	675.39	675.41	675.24	675.37	675.29
11	675.42	675.25	675.09	675.00	674.92	675.27	675.34	675.39	675.35	675.21	675.26	675.27
12	675.44	675.17	675.12	675.11	674.91	675.27	675.31	675.35	675.25	675.24	675.14	675.19
13	675.40	675.13	675.11	674.96	675.02	675.27	675.29	675.30	675.28	675.28	675.23	675.19
14	675.38	675.21	675.01	674.74	674.97	675.26	675.32	675.29	675.32	675.37	675.34	675.37
15	675.41	675.19	675.09	674.91	675.01	675.26	675.35	675.33	675.42	675.42	675.47	675.40
16	675.46	675.05	675.19	675.11	675.06	675.28	675.36	675.35	675.39	675.38	675.39	675.33
17	675.41	675.20	675.15	675.09	675.04	675.27	675.34	675.34	675.35	675.34	675.27	675.32
18	675.49	675.33	675.12	675.09	674.97	675.27	675.35	675.34	675.35	675.26	675.24	675.31
19	675.42	675.30	675.07	675.11	674.94	675.20	675.33	675.33	675.34	675.18	675.37	675.34
20	675.36	675.19	675.03	675.07	674.92	675.18	675.33	675.35	675.35	675.32	675.25	675.28
21	675.30	675.23	675.00	675.01	674.94	675.23	675.32	675.34	675.45	675.35	675.26	675.19
22	675.26	675.20	674.98	674.93	674.94	675.28	675.30	675.36	675.42	675.34	675.29	675.06
23	675.32	675.20	675.16	674.89	674.94	675.28	675.32	675.34	675.37	675.34	675.45	675.37
24	675.25	675.16	675.13	674.89	674.93	675.32	675.34	675.37	675.34	675.28	675.40	675.37
25	675.12	675.06	675.00	674.98	674.93	675.30	675.36	675.38	675.38	675.40	675.39	675.26
26	675.26	675.10	675.05	675.00	674.96	675.29	675.34	675.41	675.39	675.32	675.34	675.30
27	675.48	675.22	675.13	674.96	674.96	675.35	675.29	675.41	675.31	675.12	675.19	675.32
28	675.37	675.25	675.03	674.93	675.11	675.31	675.27	675.38	675.27	675.22	675.20	675.29
29	675.42	---	674.91	675.02	675.39	675.25	675.28	675.32	675.23	675.36	675.39	675.22
30	675.37	---	675.15	675.01	675.33	675.26	675.33	675.30	675.42	675.41	675.36	675.28
31	675.24	---	675.02	---	675.27	---	675.34	675.34	---	675.38	---	675.43
Max	675.54	675.39	675.19	675.22	675.39	675.35	675.36	675.41	675.45	675.43	675.47	675.43
Min	675.12	675.05	674.91	674.74	674.91	675.18	675.25	675.25	675.23	675.11	675.14	675.03

Year 2009 Statistics: Year Max 675.54; Year Min 674.74

Note: Depth in ft bgs


2009 HYDROGRAPH FOR WELL 181M-1
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
670
671
672
673
674
675
676
677
678
679
680
4,293
4,292
4,291
4,290
4,289
4,288
4,287
4,286
4,285
4,284
4,283
Sensor replaced
SNWA Continuous Water-Level Data*
SNWA Periodic Water-Level Data
Dry Lake Valley
Carbonate Aquifer
Reference Elevation: 4,963 ft amsl
Well Depth: 1,472 ft bgs
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
*Data corrected for temperature

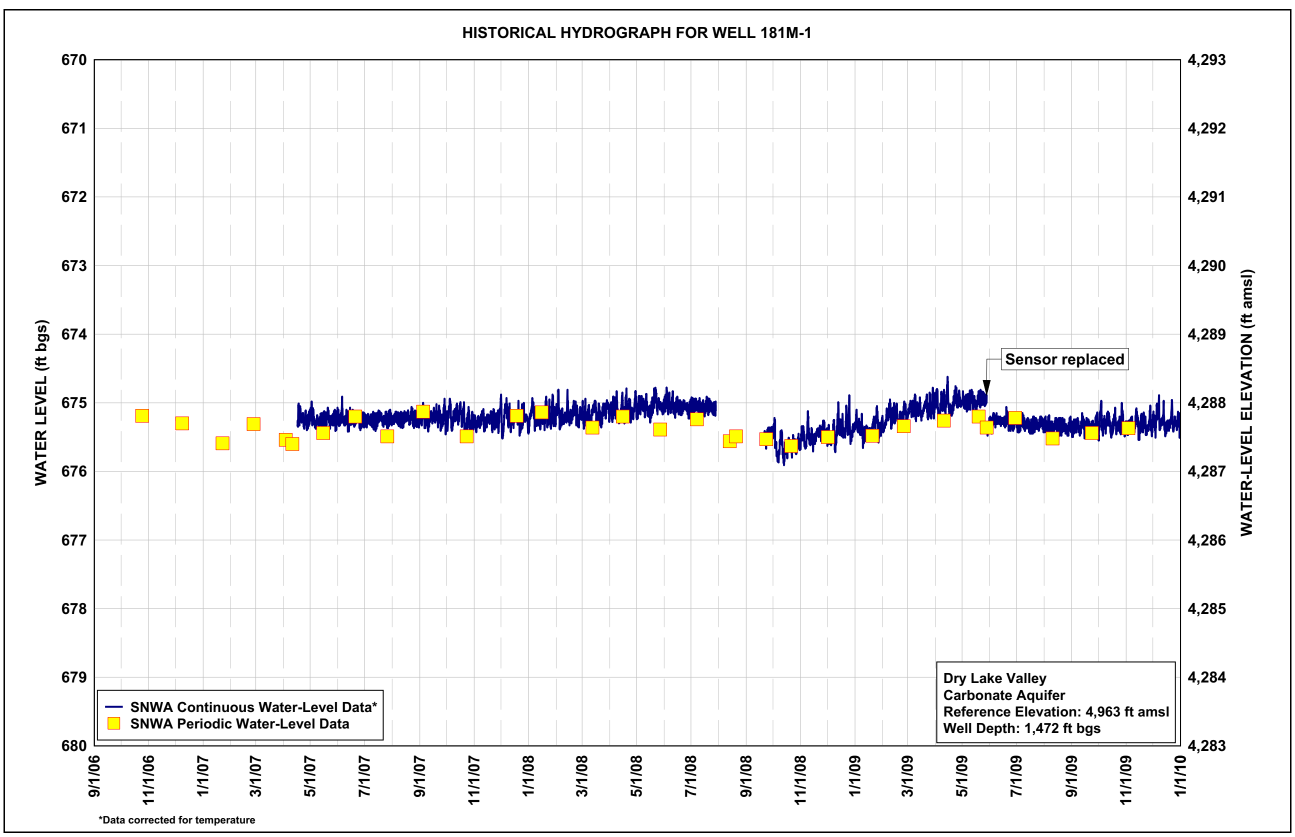
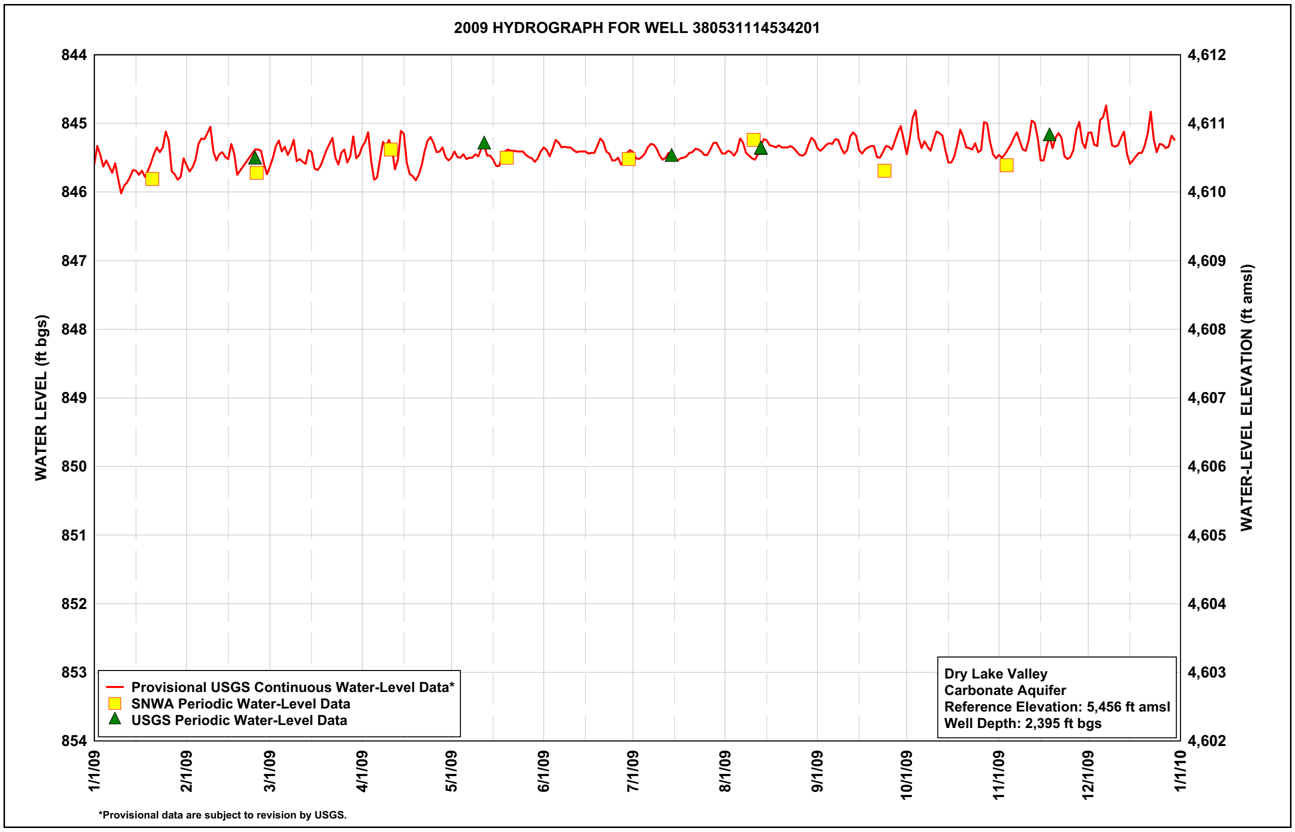

HISTORICAL HYDROGRAPH FOR WELL 181M-1
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
670
671
672
673
674
675
676
677
678
679
680
4,293
4,292
4,291
4,290
4,289
4,288
4,287
4,286
4,285
4,284
4,283
Sensor replaced
SNWA Continuous Water-Level Data*
SNWA Periodic Water-Level Data
Dry Lake Valley
Carbonate Aquifer
Reference Elevation: 4,963 ft amsl
Well Depth: 1,472 ft bgs
9/1/06
11/1/06
1/1/07
3/1/07
5/1/07
7/1/07
9/1/07
11/1/07
1/1/08
3/1/08
5/1/08
7/1/08
9/1/08
11/1/08
1/1/09
3/1/09
5/1/09
7/1/09
9/1/09
11/1/09
1/1/10
*Data corrected for temperature

Table B-5
Dry Lake Valley Well 380531114534201, Calendar Year 2009
Water-Level Data, Daily Mean Values

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	845.59	845.61	845.63	845.34	845.50	845.35	845.42	845.44	845.36	845.45	845.46	845.14
2	845.33	845.70	845.50	845.27	845.41	845.39	845.51	845.40	845.40	845.23	845.50	845.13
3	845.46	845.64	845.33	845.13	845.49	845.48	845.52	845.42	845.36	844.92	845.45	845.31
4	845.63	845.53	845.25	845.54	845.5	845.37	845.49	845.47	845.31	844.81	845.38	845.33
5	845.54	845.30	845.41	845.82	845.45	845.24	845.44	845.40	845.29	845.21	845.31	844.95
6	845.63	845.22	845.34	845.79	845.52	845.28	845.35	845.22	845.30	845.36	845.21	844.91
7	845.72	845.23	845.46	845.52	845.50	845.35	845.30	845.28	845.23	845.26	845.13	844.74
8	845.58	845.14	845.37	845.27	845.50	845.34	845.31	845.43	845.24	845.34	845.26	845.07
9	845.81	845.05	845.24	845.34	845.45	845.35	845.37	845.47	845.36	845.40	845.38	845.32
10	846.02	845.41	845.55	845.24	845.48	845.35	845.47	845.51	845.44	845.25	845.40	845.34
11	845.91	845.54	845.52	845.37	845.37	845.39	845.53	845.53	845.39	845.12	845.24	845.32
12	845.86	845.45	845.56	845.67	845.32	845.42	845.50	845.45	845.19	845.14	844.96	845.21
13	845.78	845.42	845.59	845.53	845.47	845.41	845.43	845.32	845.13	845.18	844.99	845.12
14	845.68	845.49	845.39	845.11	845.47	845.41	845.45	845.23	845.18	845.39	845.21	845.44
15	845.69	845.52	845.42	845.15	845.53	845.41	845.50	845.25	845.39	845.57	845.54	845.59
16	845.75	845.30	845.66	845.58	845.62	845.44	845.54	845.32	845.44	845.57	845.54	845.54
17	845.69	845.44	845.68	845.74	845.62	845.43	845.51	845.33	845.38	845.48	845.34	845.48
18	845.78	845.75	845.62	845.77	845.50	845.43	845.50	845.35	845.35	845.30	845.19	845.43
19	845.69	---	845.51	845.83	845.41	845.33	845.48	845.32	845.33	845.09	845.36	845.43
20	845.58	---	845.39	845.75	845.38	845.22	845.43	845.35	845.33	845.20	845.21	845.32
21	845.45	---	845.30	845.61	845.40	845.27	845.42	845.35	845.49	845.35	845.14	845.14
22	845.35	---	845.21	845.40	845.40	845.41	845.37	845.35	845.50	845.36	845.21	844.83
23	845.42	---	845.50	845.25	845.41	845.44	845.38	845.33	845.42	845.38	845.48	845.23
24	845.35	845.38	845.60	845.20	845.41	845.54	845.41	845.36	845.33	845.29	845.52	845.42
25	845.12	845.38	845.43	845.29	845.41	845.54	845.46	845.41	845.34	845.42	845.49	845.30
26	845.25	845.40	845.38	845.42	845.46	845.50	845.46	845.46	845.38	845.39	845.39	845.31
27	845.70	845.59	845.57	845.41	845.49	845.60	845.38	845.47	845.26	844.98	845.10	845.36
28	845.74	845.74	845.48	845.35	845.51	845.56	845.29	845.44	845.13	845.00	844.98	845.34
29	845.82	---	845.19	845.49	845.56	845.43	845.28	845.31	845.04	845.27	845.28	845.18
30	845.78	---	845.51	845.54	845.51	845.39	845.36	845.21	845.24	845.45	845.36	845.24
31	845.51	---	845.46	---	845.41	---	845.44	845.25	---	845.51	---	845.52
Max	846.02	845.75	845.68	845.83	845.62	845.60	845.54	845.53	845.50	845.57	845.54	845.59
Min	845.12	845.05	845.19	845.11	845.32	845.22	845.28	845.21	845.04	844.81	844.96	844.74

Year 2009 Statistics: Year Max 846.02; Year Min 844.74
Note: Depth in ft bgs


2009 HYDROGRAPH FOR WELL 380531114534201
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
844
845
846
847
848
849
850
851
852
853
854
4,612
4,611
4,610
4,609
4,608
4,607
4,606
4,605
4,604
4,603
4,602
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
Provisional USGS Continuous Water-Level Data*
SNWA Periodic Water-Level Data
USGS Periodic Water-Level Data
Dry Lake Valley
Carbonate Aquifer
Reference Elevation: 5,456 ft amsl
Well Depth: 2,395 ft bgs
*Provisional data are subject to revision by USGS.

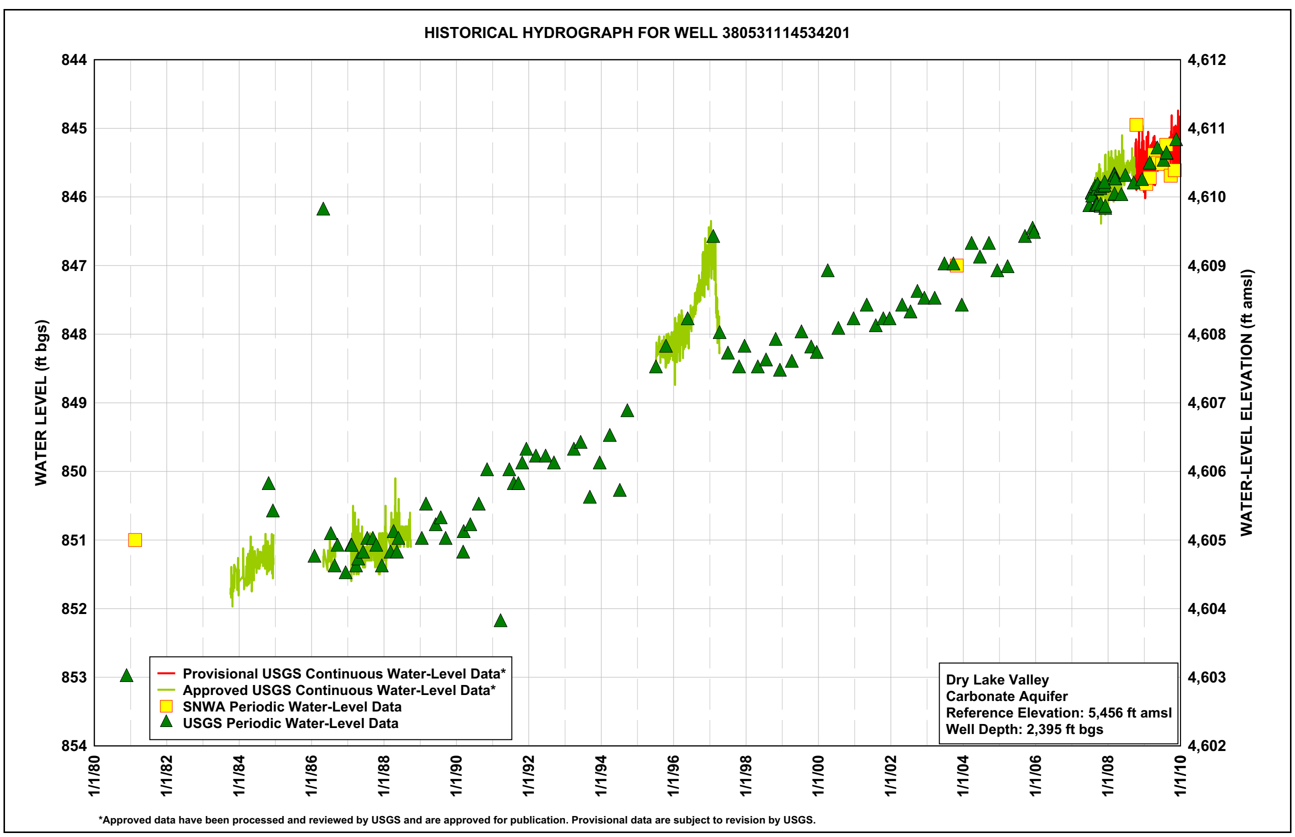
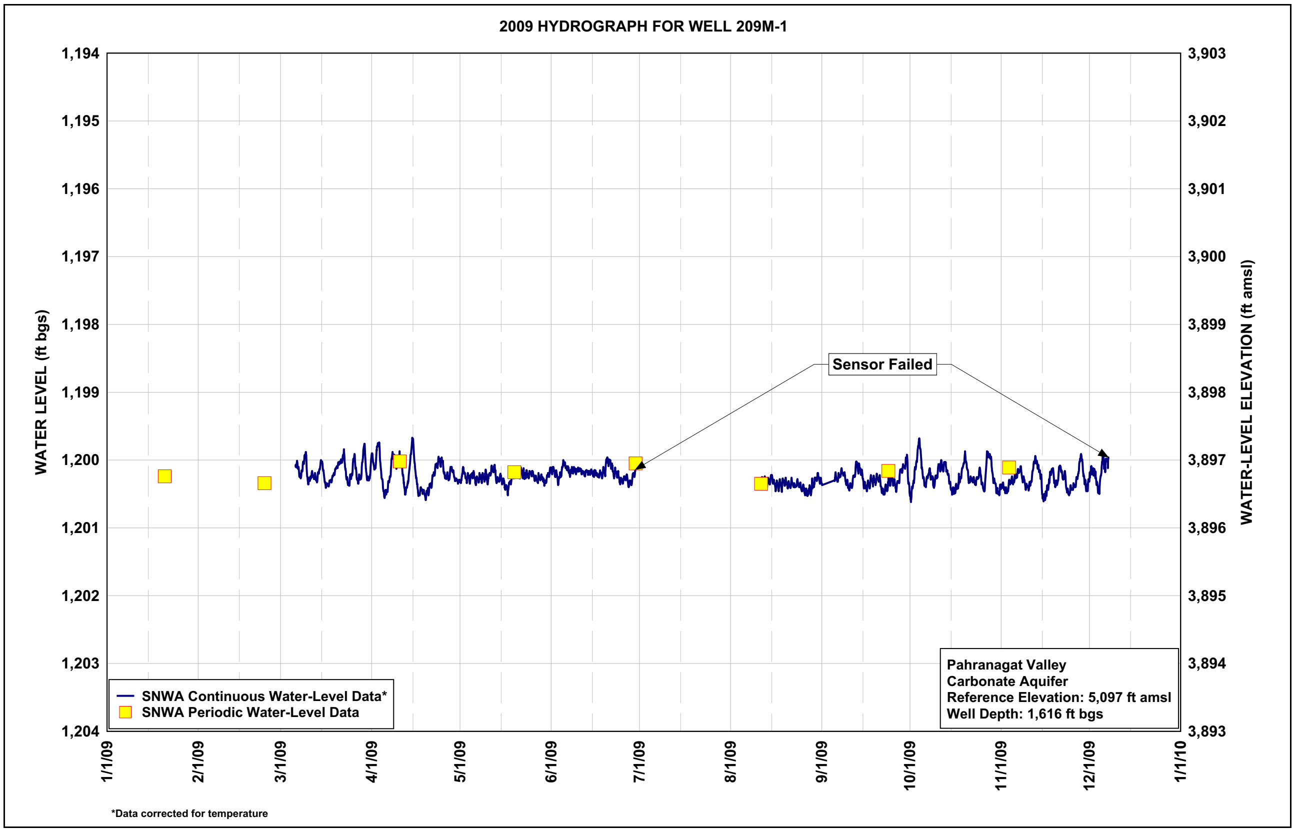
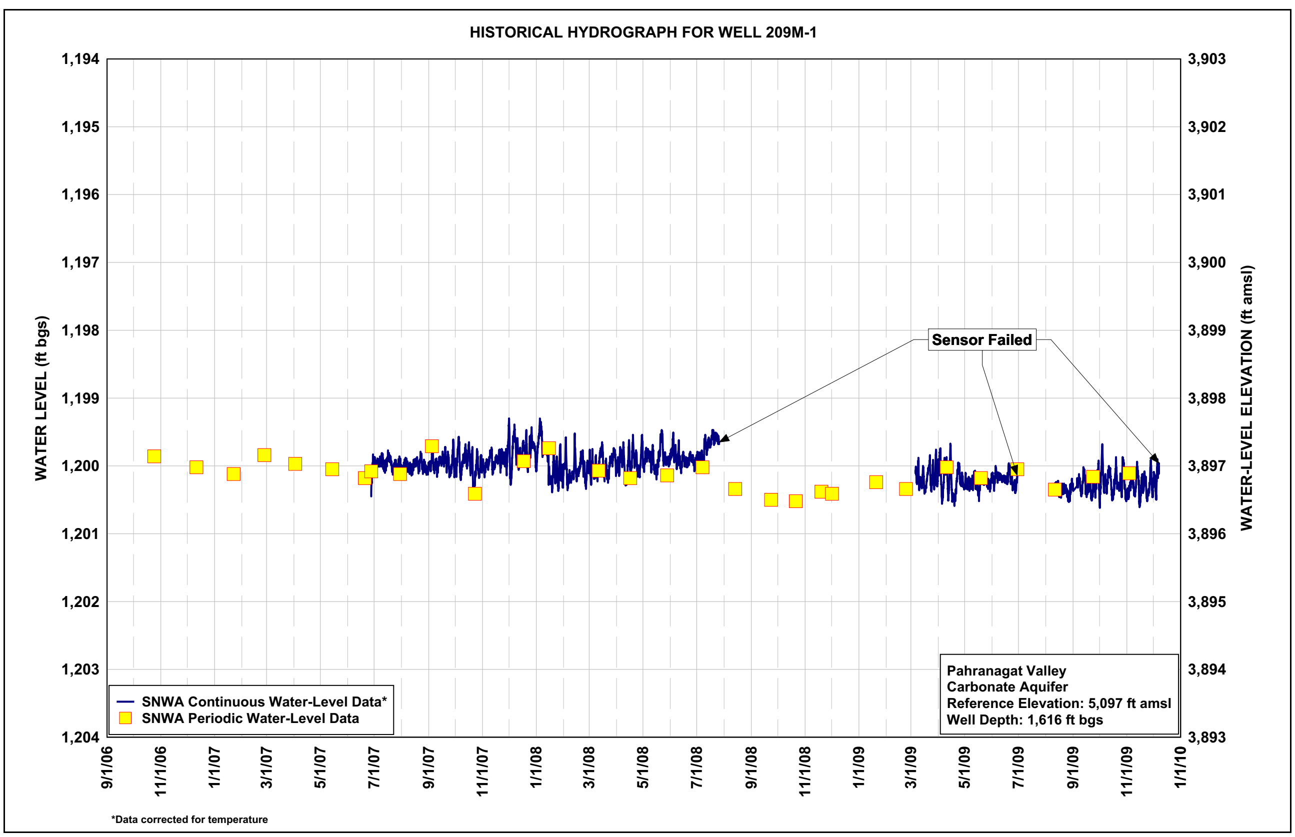

HISTORICAL HYDROGRAPH FOR WELL 380531114534201
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
844
845
846
847
848
849
850
851
852
853
854
4,612
4,611
4,610
4,609
4,608
4,607
4,606
4,605
4,604
4,603
4,602
1/1/80
1/1/82
1/1/84
1/1/86
1/1/88
1/1/90
1/1/92
1/1/94
1/1/96
1/1/98
1/1/00
1/1/02
1/1/04
1/1/06
1/1/08
1/1/10
Provisional USGS Continuous Water-Level Data*
Approved USGS Continuous Water-Level Data*
SNWA Periodic Water-Level Data
USGS Periodic Water-Level Data
Dry Lake Valley
Carbonate Aquifer
Reference Elevation: 5,456 ft amsl
Well Depth: 2,395 ft bgs
*Approved data have been processed and reviewed by USGS and are approved for publication. Provisional data are subject to revision by USGS.

Table B-6
Pahranagat Valley Well 209M-1, Calendar Year 2009
Water-Level Data, Daily Mean Values

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	---	---	---	1,200.02	1,200.26	1,200.15	---	---	---	1,200.49	1,200.38	1,200.18
2	---	---	---	1,199.97	1,200.19	1,200.20	---	---	---	1,200.23	1,200.44	1,200.18
3	---	---	---	1,199.84	1,200.26	1,200.28	---	---	---	1,199.92	1,200.39	1,200.34
4	---	---	---	1,200.27	1,200.27	1,200.17	---	---	---	1,199.85	1,200.31	1,200.36
5	---	---	---	1,200.49	1,200.22	1,200.06	---	---	---	1,200.24	1,200.28	1,200.02
6	---	---	---	1,200.39	1,200.30	1,200.12	---	---	1,200.27	1,200.32	1,200.20	1,200.04
7	---	---	1,200.20	1,200.13	1,200.27	1,200.18	---	---	1,200.20	1,200.20	1,200.15	---
8	---	---	1,200.11	1,199.95	1,200.26	1,200.15	---	---	1,200.21	1,200.27	1,200.28	---
9	---	---	1,199.98	1,200.04	1,200.23	1,200.16	---	---	1,200.33	1,200.31	1,200.38	---
10	---	---	1,200.30	1,199.98	1,200.28	1,200.15	---	---	1,200.40	1,200.16	1,200.38	---
11	---	---	1,200.23	1,200.17	1,200.17	1,200.18	---	---	1,200.32	1,200.07	1,200.24	---
12	---	---	1,200.24	1,200.44	1,200.13	1,200.20	---	1,200.33	1,200.13	1,200.09	1,200.02	---
13	---	---	1,200.26	1,200.26	1,200.28	1,200.17	---	1,200.34	1,200.11	1,200.14	1,200.09	---
14	---	---	1,200.09	1,199.84	1,200.27	1,200.18	---	1,200.30	1,200.18	1,200.32	1,200.27	---
15	---	---	1,200.14	1,199.97	1,200.31	1,200.19	---	1,200.30	1,200.37	1,200.45	1,200.55	---
16	---	---	1,200.36	1,200.38	1,200.39	1,200.21	---	1,200.37	1,200.39	1,200.43	1,200.47	---
17	---	---	1,200.34	1,200.47	1,200.40	1,200.21	---	1,200.36	1,200.32	1,200.34	1,200.28	---
18	---	---	1,200.27	1,200.46	1,200.28	1,200.20	---	1,200.35	1,200.30	1,200.20	1,200.17	---
19	---	---	1,200.17	1,200.51	1,200.20	1,200.10	---	1,200.32	1,200.28	1,200.01	1,200.34	---
20	---	---	1,200.08	1,200.43	1,200.17	1,200.01	---	1,200.36	1,200.28	1,200.14	1,200.22	---
21	---	---	1,200.02	1,200.31	1,200.19	1,200.09	---	1,200.35	1,200.44	1,200.29	1,200.17	---
22	---	---	1,199.96	1,200.15	1,200.21	1,200.19	---	1,200.37	1,200.45	1,200.30	1,200.24	---
23	---	---	1,200.25	1,200.04	1,200.21	1,200.21	---	1,200.35	1,200.37	1,200.31	1,200.45	---
24	---	---	1,200.31	1,200.02	1,200.21	1,200.30	---	1,200.38	1,200.30	1,200.20	1,200.45	---
25	---	---	1,200.12	1,200.14	1,200.20	1,200.28	---	1,200.42	1,200.32	1,200.34	1,200.40	---
26	---	---	1,200.08	1,200.24	1,200.26	1,200.26	---	1,200.47	1,200.38	1,200.33	1,200.32	---
27	---	---	1,200.28	1,200.21	1,200.28	1,200.34	---	1,200.46	1,200.24	1,199.93	1,200.11	---
28	---	---	1,200.17	1,200.15	1,200.26	1,200.29	---	1,200.43	1,200.13	1,200.00	1,200.03	---
29	---	---	1,199.87	1,200.28	1,200.31	---	---	1,200.33	1,200.04	1,200.29	1,200.33	---
30	---	---	1,200.25	1,200.31	1,200.27	---	---	1,200.25	1,200.28	1,200.43	1,200.37	---
31	---	---	1,200.15	---	1,200.18	---	---	1,200.30	---	1,200.44	---	---
Max	---	---	1,200.36	1,200.51	1,200.40	1,200.34	---	1,200.47	1,200.45	1,200.49	1,200.55	1,200.36
Min	---	---	1,199.87	1,199.84	1,200.13	1,200.01	---	1,200.25	1,200.04	1,199.85	1,200.02	1,200.02

Year 2009 Statistics: Year Max 1,200.55; Year Min 1,199.84
Note: Depth in ft bgs


2009 HYDROGRAPH FOR WELL 209M-1
WATER LEVEL (ft bgs)
1,194
1,195
1,196
1,197
1,198
1,199
1,200
1,201
1,202
1,203
1,204
WATER-LEVEL ELEVATION (ft amsl)
3,903
3,902
3,901
3,900
3,899
3,898
3,897
3,896
3,895
3,894
3,893
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
Sensor Failed
SNWA Continuous Water-Level Data*
SNWA Periodic Water-Level Data
Pahranagat Valley
Carbonate Aquifer
Reference Elevation: 5,097 ft amsl
Well Depth: 1,616 ft bgs
*Data corrected for temperature


HISTORICAL HYDROGRAPH FOR WELL 209M-1
WATER LEVEL (ft bgs)
1,194
1,195
1,196
1,197
1,198
1,199
1,200
1,201
1,202
1,203
1,204
WATER-LEVEL ELEVATION (ft amsl)
3,903
3,902
3,901
3,900
3,899
3,898
3,897
3,896
3,895
3,894
3,893
9/1/06
11/1/06
1/1/07
3/1/07
5/1/07
7/1/07
9/1/07
11/1/07
1/1/08
3/1/08
5/1/08
7/1/08
9/1/08
11/1/08
1/1/09
3/1/09
5/1/09
7/1/09
9/1/09
11/1/09
1/1/10
Sensor Failed
SNWA Continuous Water-Level Data*
SNWA Periodic Water-Level Data
Pahranagat Valley
Carbonate Aquifer
Reference Elevation: 5,097 ft amsl
Well Depth: 1,616 ft bgs
*Data corrected for temperature

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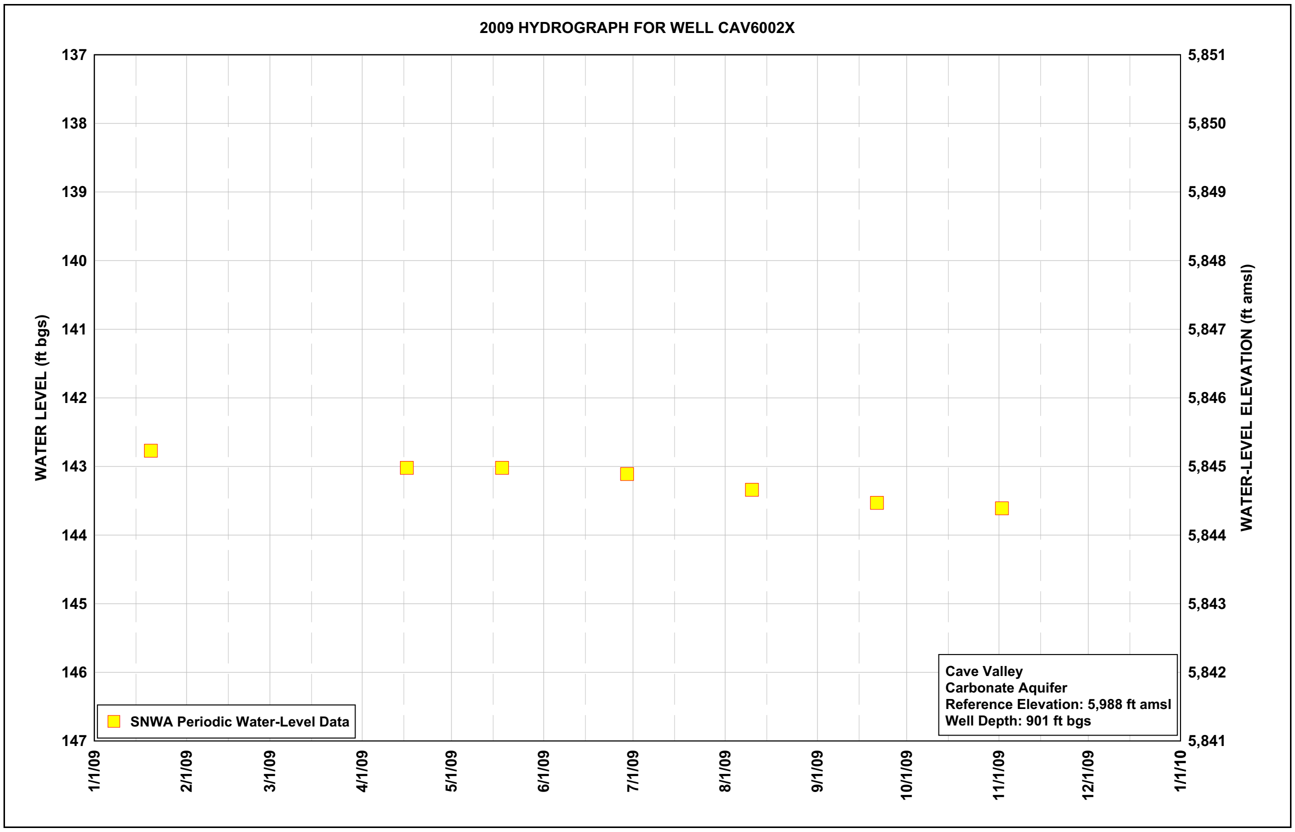
Appendix C

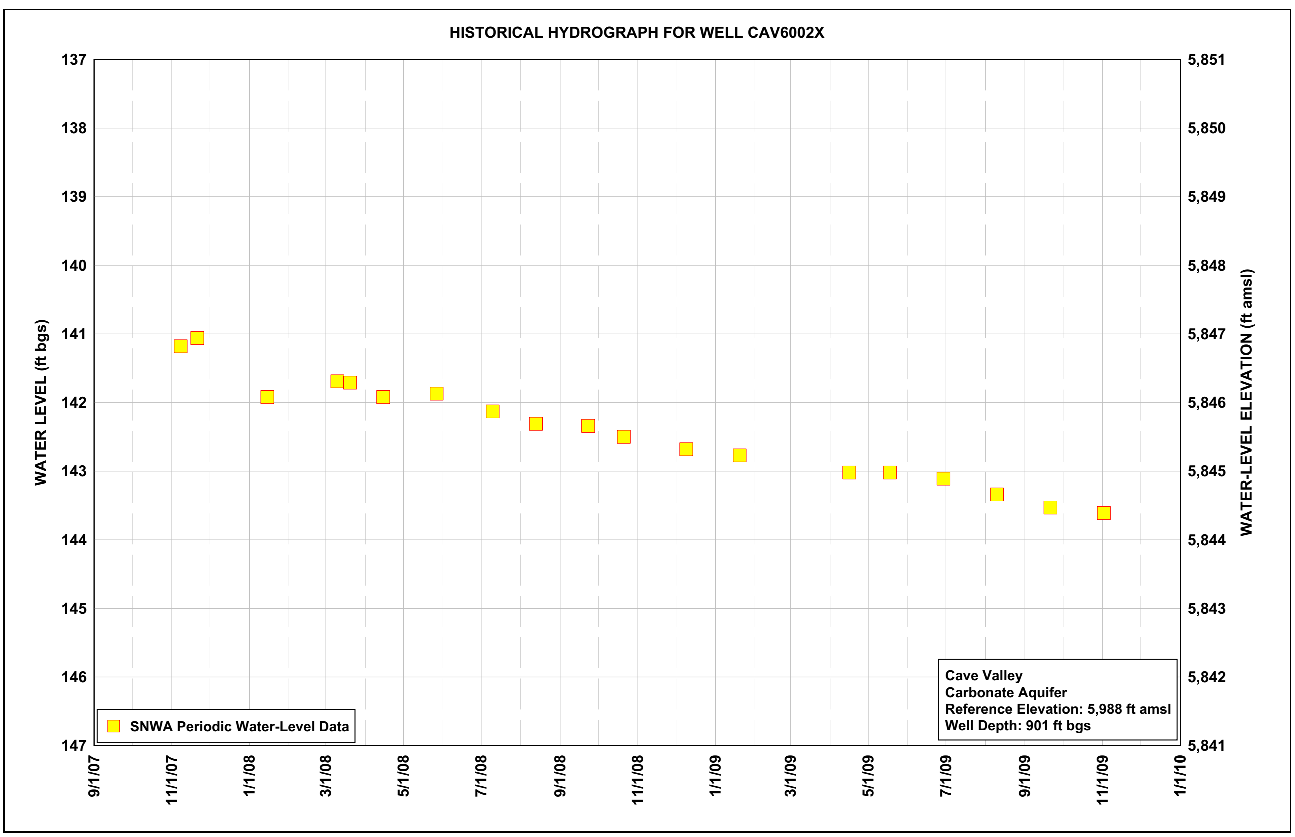
Periodic Water-Level Measurements and Hydrographs for SNWA Exploratory and Test Wells

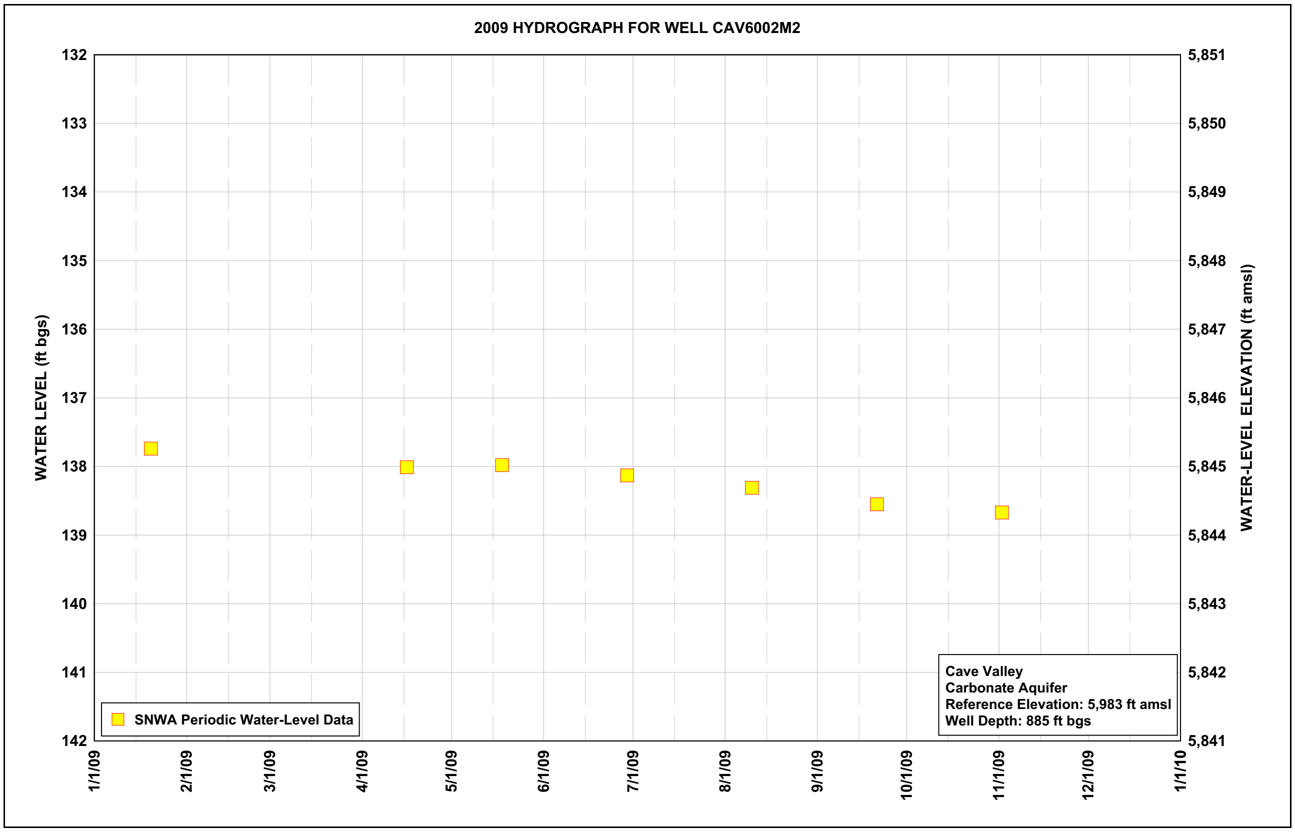
Table C-1
Periodic Water-Level Measurements Collected at SNWA Exploratory and Test Wells

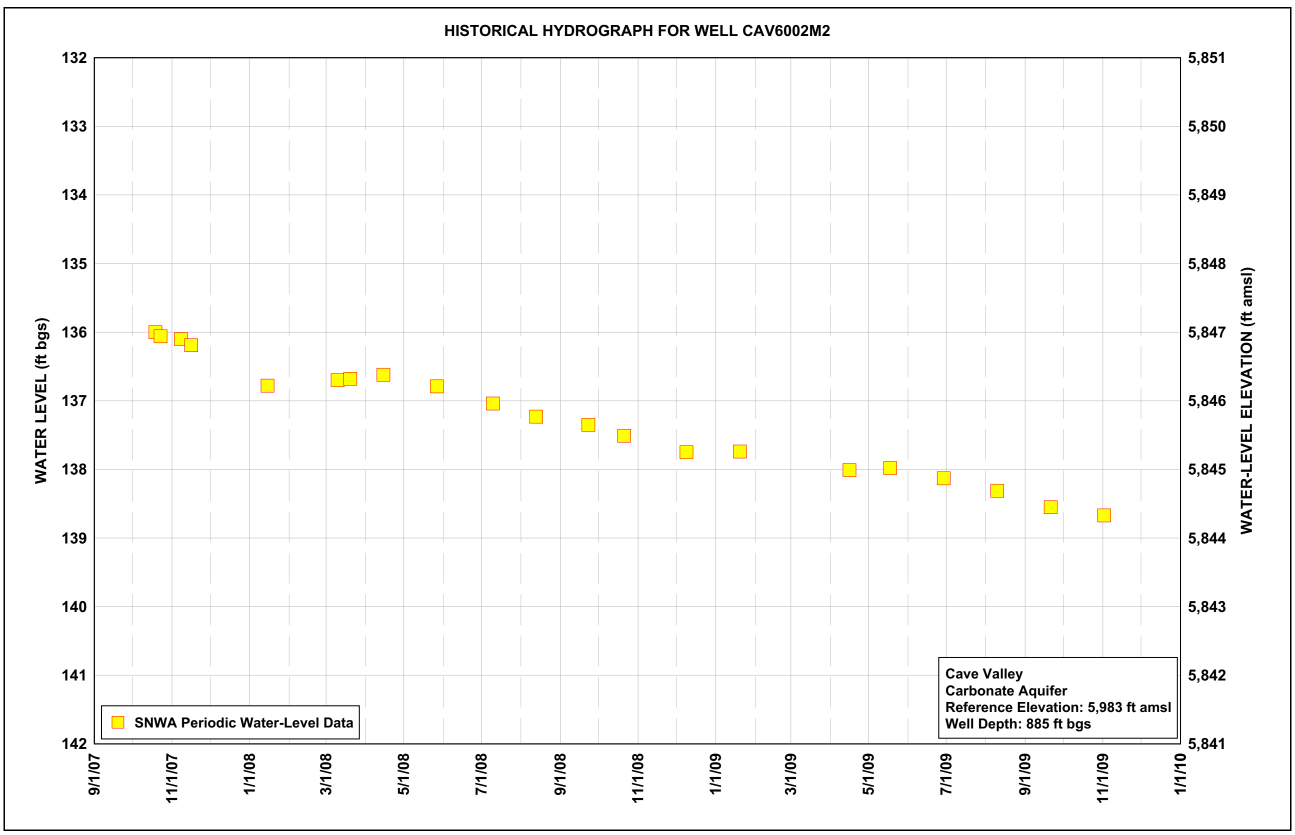
Site Number	Station Local Number	Well Depth (ft bgs)	Surface Elevation (ft amsl)	Water Level			
				Date	Depth to Water (ft bgs)	Well Status[a]	Measurement Method[b]
CAV6002X	CAV6002X	901	5,987.97	1/20/2009	142.77	S	T
				4/16/2009	143.02	S	T
				5/18/2009	143.02	S	T
				6/29/2009	143.11	S	T
				8/10/2009	143.34	S	T
				9/21/2009	143.53	S	T
				11/2/2009	143.61	S	T
CAV6002M2	CAV6002M2	885	5,982.81	1/20/2009	137.74	S	T
				4/16/2009	138.01	S	T
				5/18/2009	137.98	S	T
				6/29/2009	138.13	S	T
				8/10/2009	138.31	S	T
				9/21/2009	138.55	S	T
				11/2/2009	138.67	S	T

[a]S = Static conditions
[b]T = Electric tape measurement


2009 HYDROGRAPH FOR WELL CAV6002X
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
137
138
139
140
141
142
143
144
145
146
147
5,851
5,850
5,849
5,848
5,847
5,846
5,845
5,844
5,843
5,842
5,841
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
SNWA Periodic Water-Level Data
Cave Valley
Carbonate Aquifer
Reference Elevation: 5,988 ft amsl
Well Depth: 901 ft bgs


HISTORICAL HYDROGRAPH FOR WELL CAV6002X
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
137
138
139
140
141
142
143
144
145
146
147
5,851
5,850
5,849
5,848
5,847
5,846
5,845
5,844
5,843
5,842
5,841
9/1/07
11/1/07
1/1/08
3/1/08
5/1/08
7/1/08
9/1/08
11/1/08
1/1/09
3/1/09
5/1/09
7/1/09
9/1/09
11/1/09
1/1/10
SNWA Periodic Water-Level Data
Cave Valley
Carbonate Aquifer
Reference Elevation: 5,988 ft amsl
Well Depth: 901 ft bgs


2009 HYDROGRAPH FOR WELL CAV6002M2
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
132
133
134
135
136
137
138
139
140
141
142
5,851
5,850
5,849
5,848
5,847
5,846
5,845
5,844
5,843
5,842
5,841
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09
11/1/09
12/1/09
1/1/10
SNWA Periodic Water-Level Data
Cave Valley
Carbonate Aquifer
Reference Elevation: 5,983 ft amsl
Well Depth: 885 ft bgs


HISTORICAL HYDROGRAPH FOR WELL CAV6002M2
WATER LEVEL (ft bgs)
WATER-LEVEL ELEVATION (ft amsl)
132
133
134
135
136
137
138
139
140
141
142
5,851
5,850
5,849
5,848
5,847
5,846
5,845
5,844
5,843
5,842
5,841
9/1/07
11/1/07
1/1/08
3/1/08
5/1/08
7/1/08
9/1/08
11/1/08
1/1/09
3/1/09
5/1/09
7/1/09
9/1/09
11/1/09
1/1/10
SNWA Periodic Water-Level Data
Cave Valley
Carbonate Aquifer
Reference Elevation: 5,983 ft amsl
Well Depth: 885 ft bgs

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Appendix D

Spring Discharge Measurements and Hydrographs

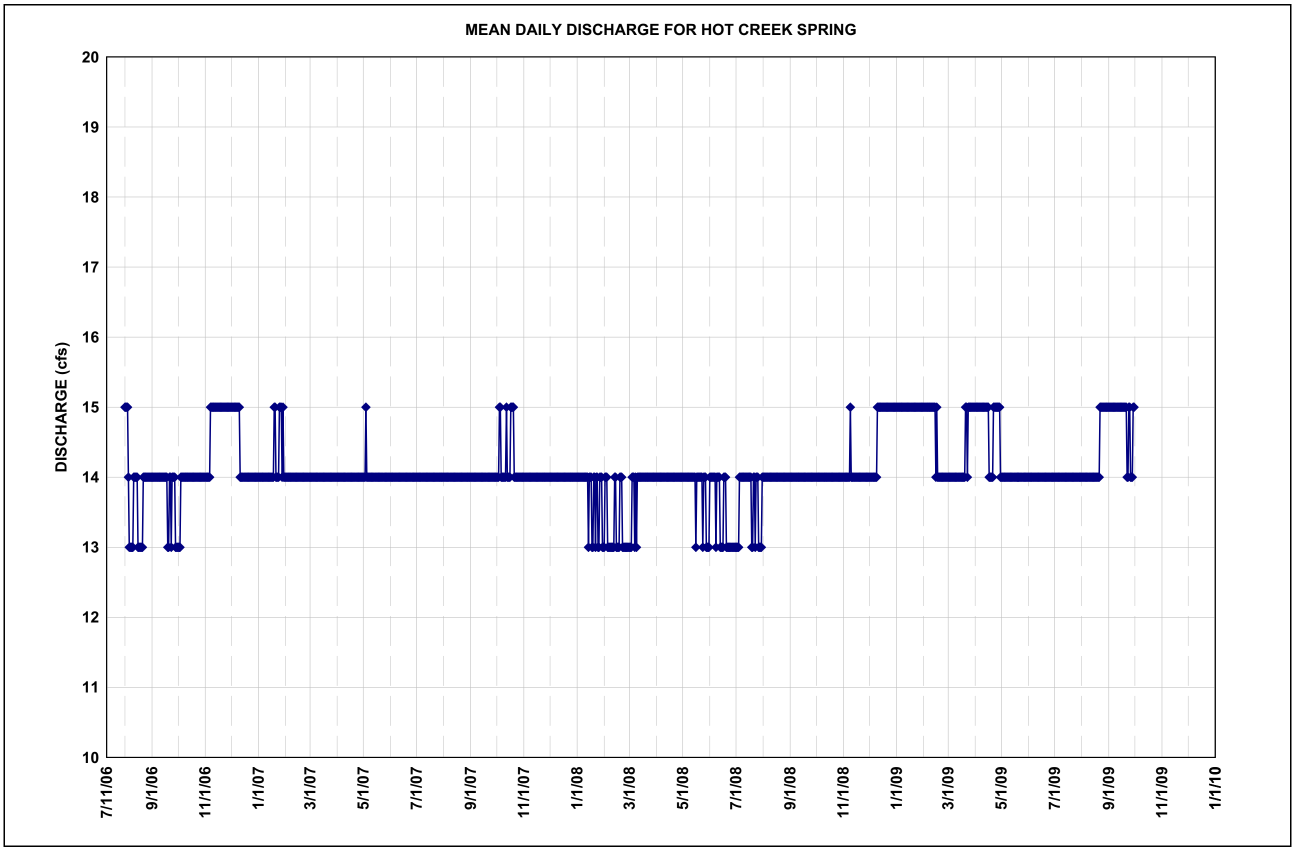
Table D-1
Spring Discharge Measurements
(Page 1 of 2)

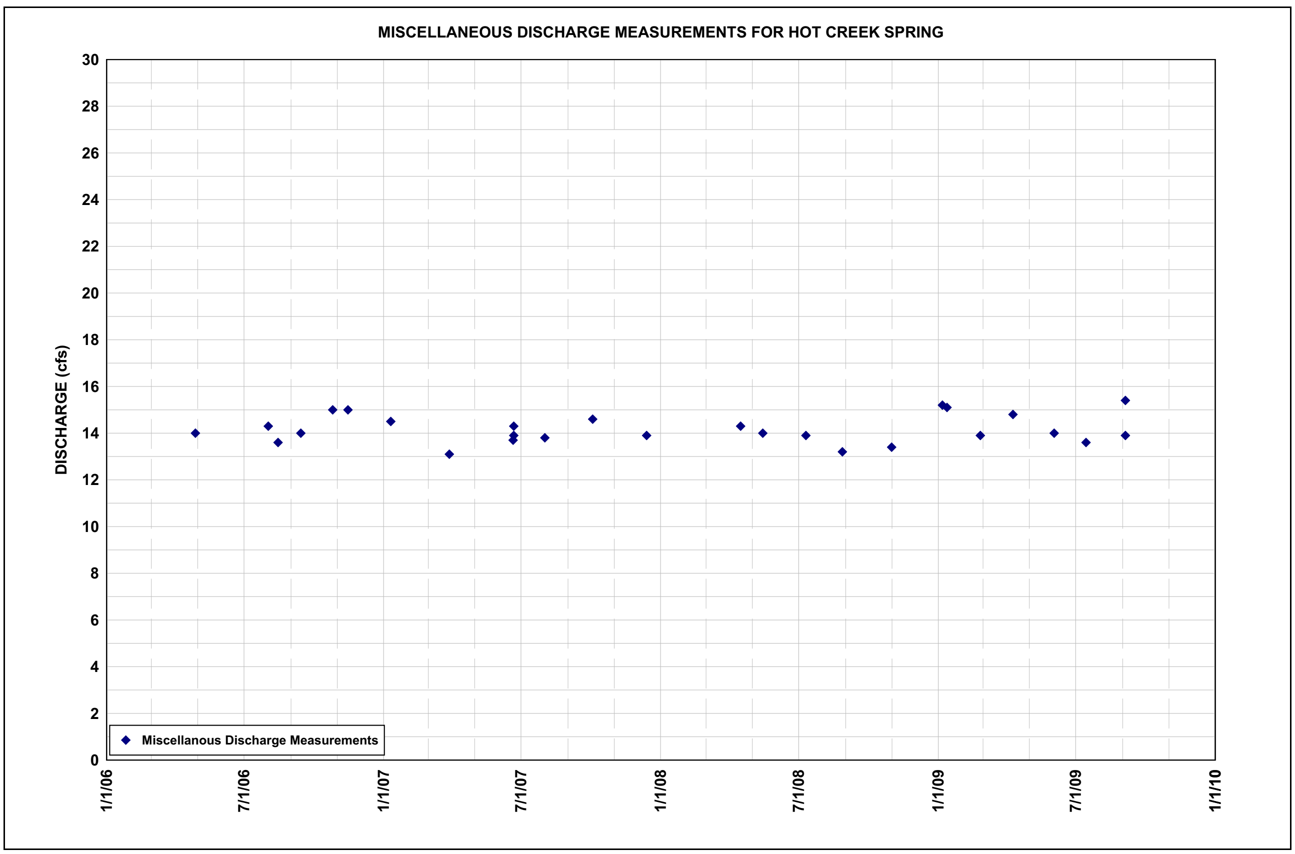
Station Name	Primary Name	Date	Discharge (cfs)	Reported Unit
Hot Creek Spring near Sunnyside, NV	2070501	01/06/2009	15.2	cfs
		01/12/2009	15.1	cfs
		02/25/2009	13.9	cfs
		04/09/2009	14.8	cfs
		06/02/2009	14.0	cfs
		07/14/2009	13.6	cfs
		09/04/2009	15.4	cfs
		09/04/2009	13.9	cfs
		10/09/2009	14.7	cfs
		12/10/2009	15.1	cfs
Moorman Spring	2071101	4/30/2009	0.35	cfs
		4/30/2009	0.34	cfs
		9/24/2009	0.24	cfs
		9/24/2009	0.28	cfs
Flag Spring 3	2071301	4/30/2009	2.36	cfs
		4/30/2009	2.31	cfs
		9/25/2009	2.22	cfs
		9/25/2009	2.26	cfs
Flag Spring 2	2071302	4/30/2009	2.83	cfs
		4/30/2009	2.73	cfs
		9/25/2009	2.70	cfs
		9/25/2009	2.69	cfs
		11/24/2009[a]	2.33	cfs
Flag Spring 1	2071303	4/30/2009	2.40	cfs
		4/30/2009	2.41	cfs
		9/25/2009	2.58	cfs
		9/25/2009	2.55	cfs
Hardy Springs	2071501	8/20/2009[a]	0.34	cfs
Crystal Springs near Hiko, NV	2090401	1/5/2009	12.7	cfs
		3/13/2009	12.6	cfs
		4/6/2009	2.99	cfs
		5/15/2009[a]	13.7	cfs
		6/2/2009	12.4	cfs
		7/14/2009	12.3	cfs
		7/23/2009	2.72	cfs
		9/11/2009	13.1	cfs
		10/9/2009	12.5	cfs
		12/4/2009	13.2	cfs

Table D-1
Spring Discharge Measurements
(Page 2 of 2)

Station Name	Primary Name	Date	Discharge (cfs)	Reported Unit
Crystal Springs Diversion near Hiko, NV	09415589	1/5/2009	0	cfs
		1/12/2009	0	cfs
		3/13/2009	0	cfs
		4/6/2009	8.04	cfs
		5/7/2009	0	cfs
		5/15/2009[a]	0	cfs
		6/2/2009	0	cfs
		7/14/2009	0	cfs
		7/23/2009	8.34	cfs
		9/11/2009	0	cfs
		10/9/2009	0	cfs
		12/4/2009	0	cfs
Ash Springs Creek below Highway 93 at Ash Springs, NV	2090501	1/5/2009	17.8	cfs
		3/13/2009	17.6	cfs
		4/23/2009	14.4	cfs
		6/2/2009	15.7	cfs
		7/14/2009	14.0	cfs
		9/11/2009	18.3	cfs
		10/16/2009	18.7	cfs
		12/11/2009	16.8	cfs
Ash Springs Diversion at Ash Springs, NV	9415639	1/5/2009	3.10	cfs
		3/13/2009	0.94	cfs
		3/13/2009	0.93	cfs
		4/23/2009	3.45	cfs
		6/2/2009	3.01	cfs
		7/14/2009	2.12	cfs
		9/11/2009	1.62	cfs
		10/16/2009	1.47	cfs
		12/11/2009	2.10	cfs
Cave Spring[a]	1800101	5/14/2009	NM[b]	cfs
		9/30/2009	0	cfs
Littlefield Spring[a]	1810301	9/30/2009[a]	0.04	cfs

Note: USGS is the owner agency for the data presented unless otherwise specified.
[a]Data collected by SNWA which is the data owner agency.
[b]No measurement made.


MEAN DAILY DISCHARGE FOR HOT CREEK SPRING
DISCHARGE (cfs)
20
19
18
17
16
15
14
13
12
11
10
7/11/06
9/1/06
11/1/06
1/1/07
3/1/07
5/1/07
7/1/07
9/1/07
11/1/07
1/1/08
3/1/08
5/1/08
7/1/08
9/1/08
11/1/08
1/1/09
3/1/09
5/1/09
7/1/09
9/1/09
11/1/09
1/1/10


MISCELLANEOUS DISCHARGE MEASUREMENTS FOR HOT CREEK SPRING
DISCHARGE (cfs)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
Miscellanous Discharge Measurements
1/1/06
7/1/06
1/1/07
7/1/07
1/1/08
7/1/08
1/1/09
7/1/09
1/1/10

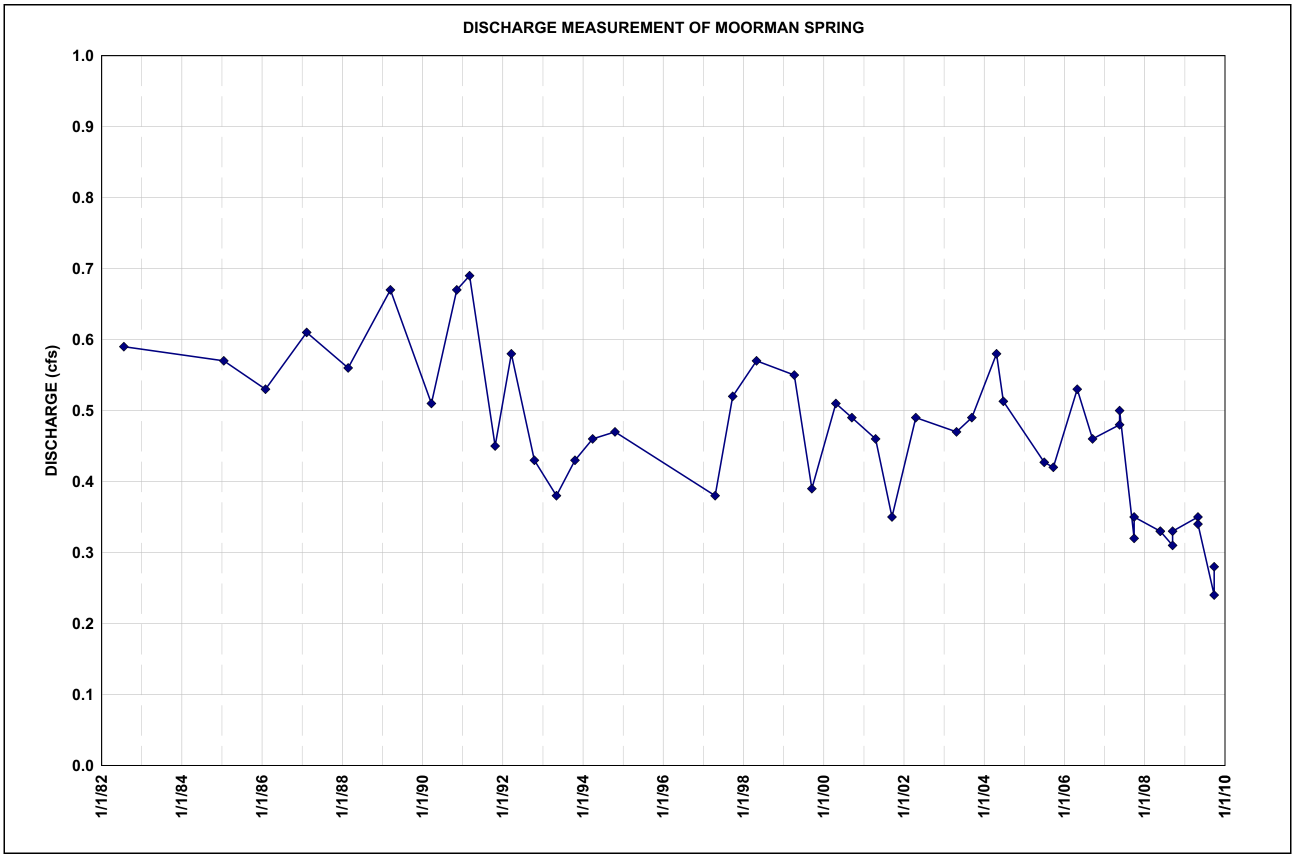

DISCHARGE MEASUREMENT OF MOORMAN SPRING
DISCHARGE (cfs)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1/1/82
1/1/84
1/1/86
1/1/88
1/1/90
1/1/92
1/1/94
1/1/96
1/1/98
1/1/00
1/1/02
1/1/04
1/1/06
1/1/08
1/1/10

Table D-2
Discharge Measurement Summary of Flag Springs Complex

Spring Name	Average Discharge[a] (cfs)	Minimum Discharge[a] (cfs)	Maximum Discharge[a] (cfs)	Standard Deviation[a] (cfs)	April 2009 Discharge[b,c] (cfs)	September 2009 Discharge[b,c] (cfs)	November 2009 Discharge[d] (cfs)
Flag Spring 1 (North)	2.35	1.54	3.50	0.40	2.41	2.56	---
Flag Spring 2 (Middle)	2.91	0.49	3.56	0.44	2.78	2.70	2.33
Flag Spring 3 (South)	2.26	1.20	3.65	0.50	2.34	2.24	---

[a]Period of Record (1982-2009)
[b]2009 Discharge measurements are average of two reported measurements.
[c]Source: USGS (2010)
[d]Source: SNWA data

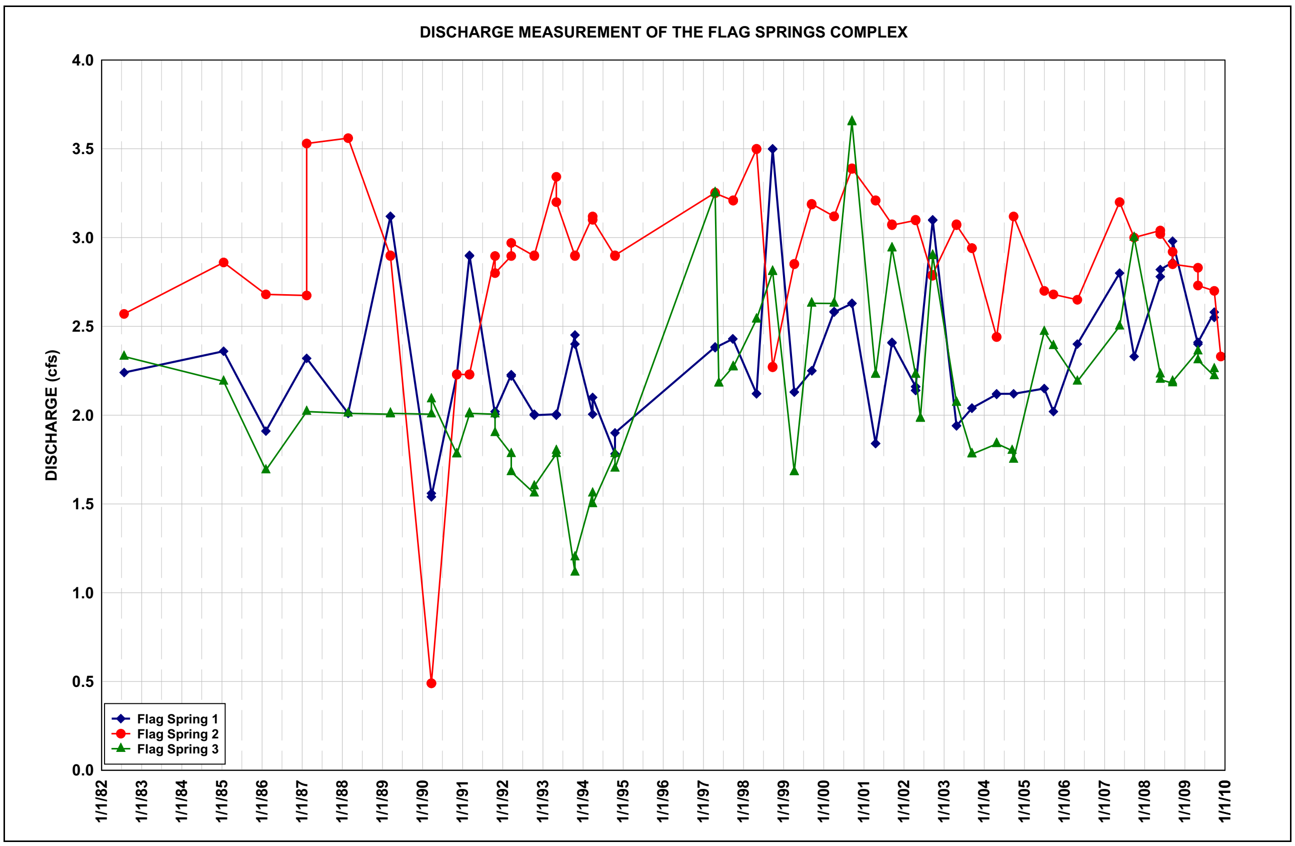


Table D-3
Discharge Measurement Summary of Hardy Springs

Spring Name	Average Discharge[a] (cfs)	Minimum Discharge (cfs)	Maximum Discharge (cfs)	Standard Deviation (cfs)	August 2009 Discharge (cfs)
Hardy Springs	0.39	0.34	0.45	0.07	0.34

[a]Average of two measurements obtained in 2004 and 2009.

Table D-4
Annual Discharges at Crystal Springs

Water Year[a,b]	Crystal Springs (09415590)		Crystal Springs Diversion (09415589)			Total Combined Discharge (afy)
	Annual Discharge (afy)	Average Annual Discharge (cfs)	Annual Discharge (afy)	Average Annual Discharge (cfs)	Days Diverted	
2005	8,110	11.2	1,230	1.70	78	9,340
2006	8,180	11.3	930	1.28	67	9,110
2007	8,250	11.4	1,000	1.38	68	9,250
2008	8,110	11.2	1,010	1.40	80	9,120
2009[c]	8,110	11.2	1,050	1.45	74	9,160
Average for the period of record[d]	8,150	11.3	1,040	1.44	73	9,200

[a]Water years 1990, 1991, 1992, 1993, and 1999 are excluded, as explained in the text.
[b]Data are from USGS Water Resources Data - Nevada water years 2005 through 2009 (USGS, 2010).
[c] Provisional data.
[d]These values are extrapolated form the Crystal Springs gaging station record published by USGS (USGS, 2010).
Source: U.S. Geological Survey, 2010, National water information system (NWIS Web) [Internet], [accessed February 2010], available from http://waterdata.usgs.gov/nwis.

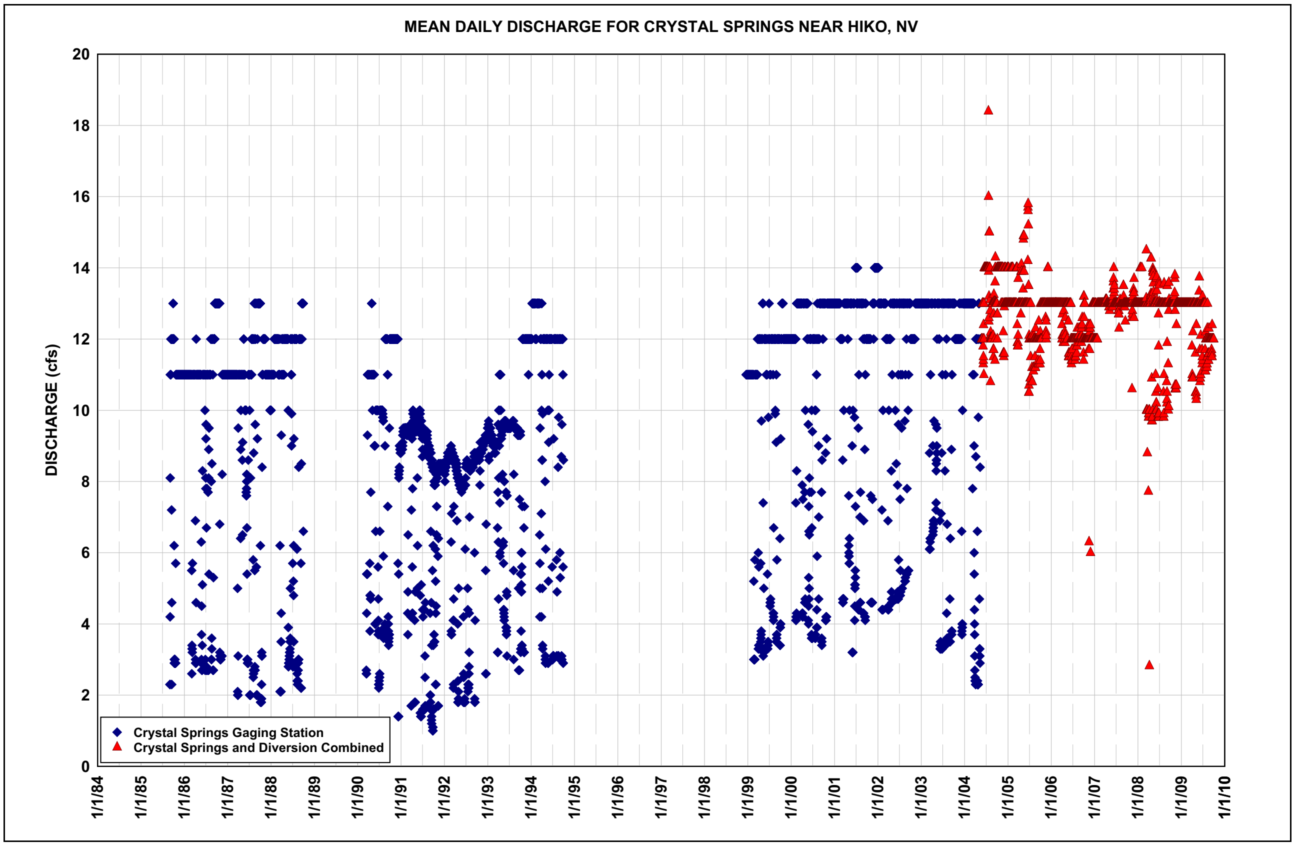
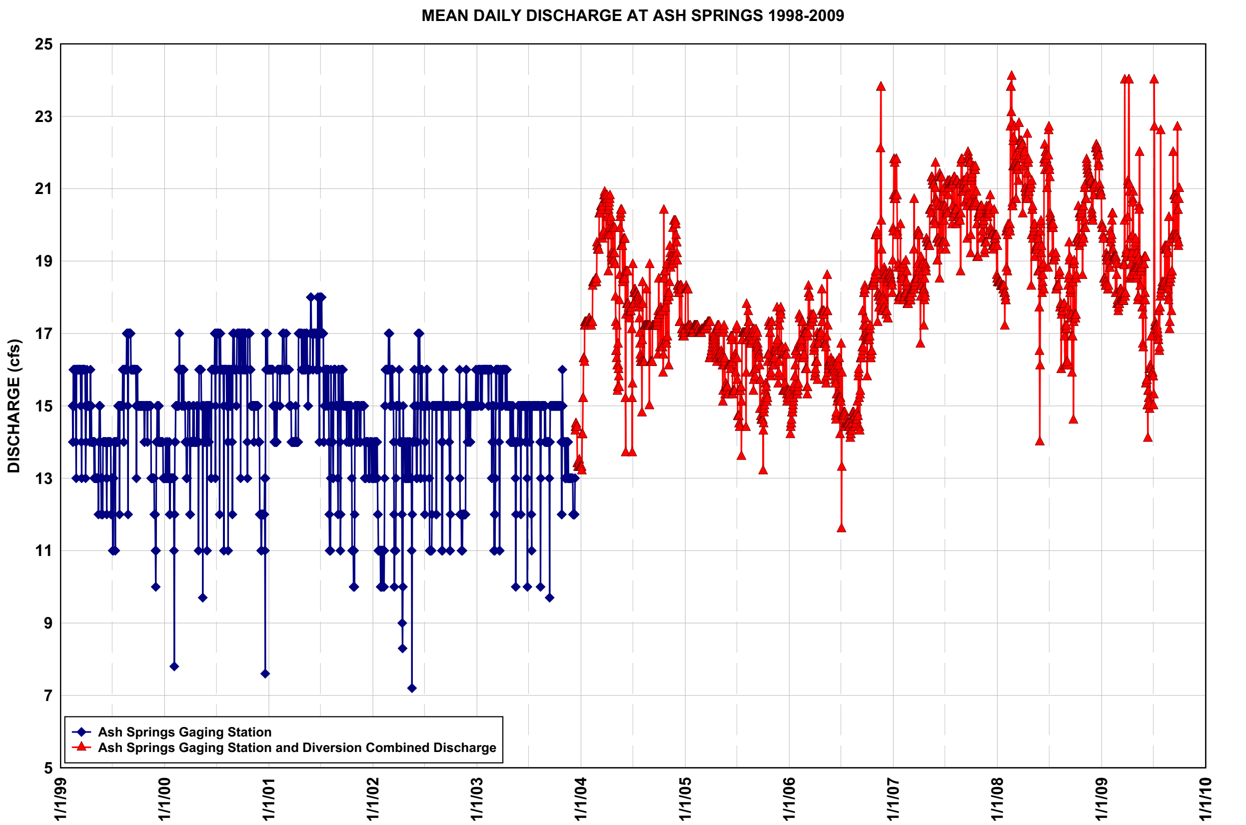
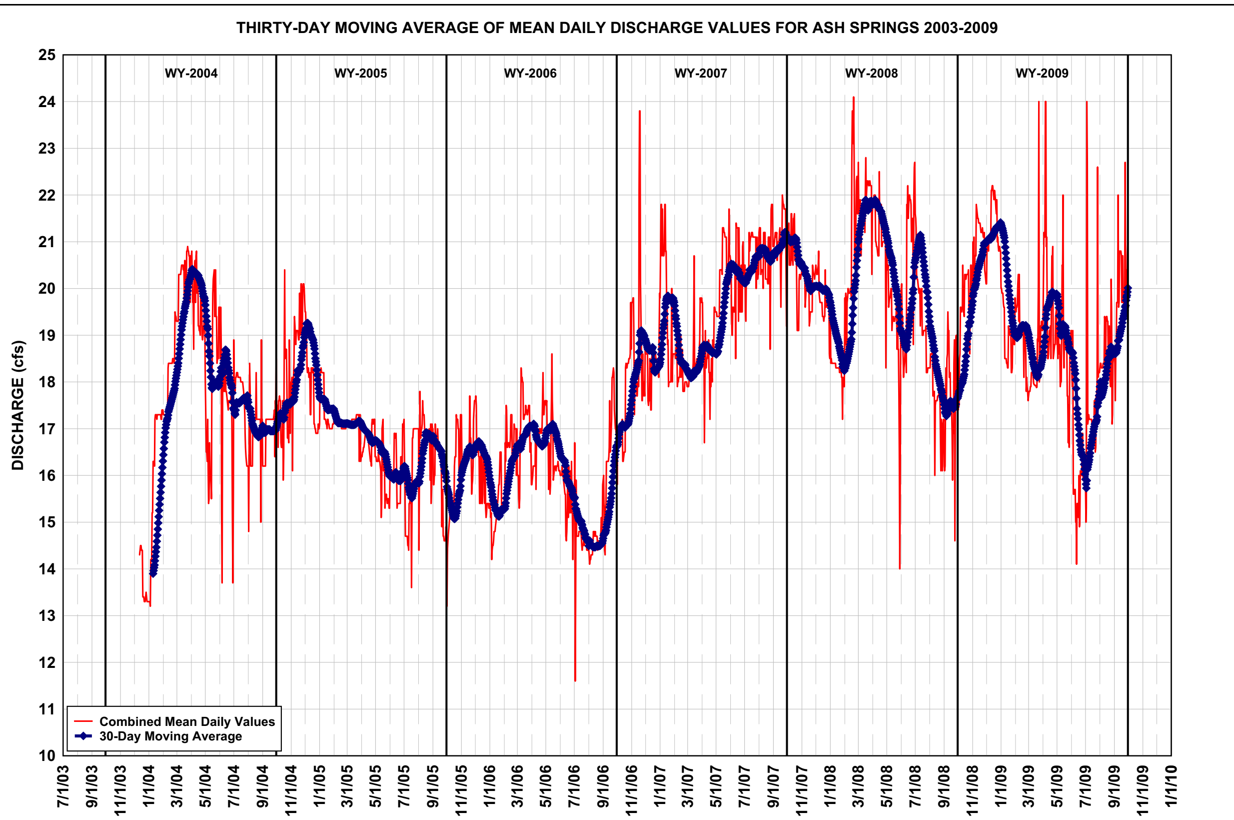


Table D-5
Annual Discharges at Ash Springs

	Ash Springs (09415640)		Ash Springs Diversion (09415639)			
Water Year[a]	**Annual Discharge (afy)**	**Average Annual Discharge (cfs)**	**Annual Discharge (afy)**	**Average Annual Discharge (cfs)**	**Days Diverted**	**Total Combined Discharge (afy)**
2005	10,060	13.9	2,190	3.03	365	12,250
2006	8,760	12.1	2,800	3.87	365	11,560
2007	11,580	16.0	2,490	3.44	365	14,070
2008	11,730	16.2	2,590	3.58	365	14,320
2009[b]	11,950	16.5	1,920	2.65	365	13,870
Average for the period of record	10,820	14.9	2,390	3.31	365	13,210

[a]Data are from USGS Water Resources Data-Nevada water years 2005 through 2009 (USGS, 2010). Period of record for Ash Springs diversion gage is December 12, 2003, to present. The 2004 water year is incomplete.
[b]Provisional data.
Source: U.S. Geological Survey, 2010, National water information system (NWIS Web) [Internet], [accessed February 2010], available from http://waterdata.usgs.gov/nwis.





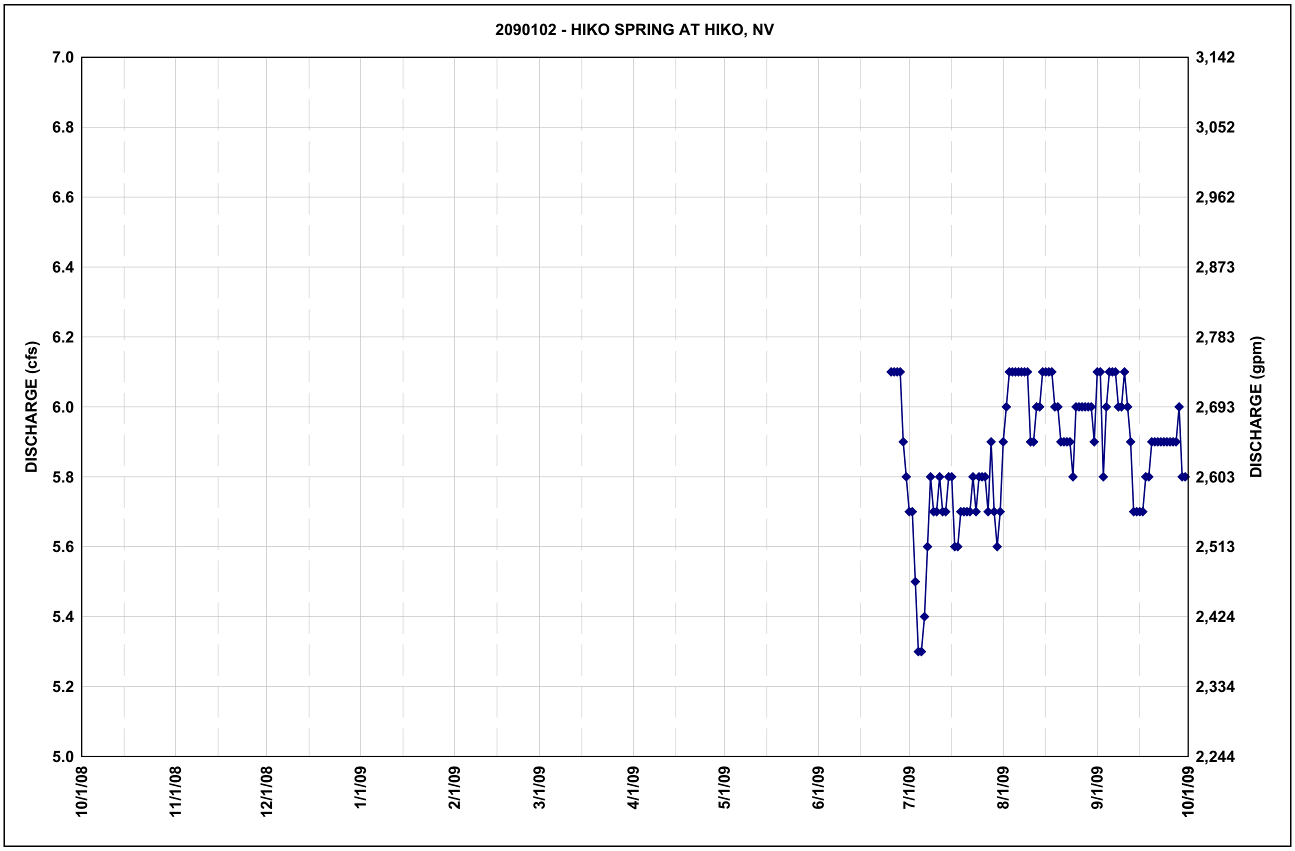
Note: Large variations in flow are diversions above the gage.

Table D-6
2090102 - Hiko Spring at Hiko, NV, Water Year 2009
Mean Daily Discharge Values

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	---	---	---	5.7	5.9e	6.1
2	---	---	---	---	---	---	---	---	---	5.7	6.0e	6.1e
3	---	---	---	---	---	---	---	---	---	5.5	6.1	5.8e
4	---	---	---	---	---	---	---	---	---	5.3	6.1	6.0
5	---	---	---	---	---	---	---	---	---	5.3	6.1	6.1
6	---	---	---	---	---	---	---	---	---	5.4	6.1	6.1
7	---	---	---	---	---	---	---	---	---	5.6	6.1	6.1
8	---	---	---	---	---	---	---	---	---	5.8	6.1	6.0
9	---	---	---	---	---	---	---	---	---	5.7	6.1	6.0
10	---	---	---	---	---	---	---	---	---	5.7	5.9	6.1
11	---	---	---	---	---	---	---	---	---	5.8	5.9	6.0
12	---	---	---	---	---	---	---	---	---	5.7e	6.0	5.9
13	---	---	---	---	---	---	---	---	---	5.7e	6.0	5.7e
14	---	---	---	---	---	---	---	---	---	5.8	6.1	5.7e
15	---	---	---	---	---	---	---	---	---	5.8	6.1	5.7
16	---	---	---	---	---	---	---	---	---	5.6	6.1	5.7
17	---	---	---	---	---	---	---	---	---	5.6	6.1	5.8
18	---	---	---	---	---	---	---	---	---	5.7	6.0	5.8
19	---	---	---	---	---	---	---	---	---	5.7	6.0	5.9
20	---	---	---	---	---	---	---	---	---	5.7	5.9e	5.9
21	---	---	---	---	---	---	---	---	---	5.7	5.9e	5.9
22	---	---	---	---	---	---	---	---	---	5.8	5.9	5.9
23	---	---	---	---	---	---	---	---	---	5.7	5.9	5.9
24	---	---	---	---	---	---	---	---	---	5.8	5.8	5.9
25	---	---	---	---	---	---	---	---	6.1	5.8e	6.0	5.9e
26	---	---	---	---	---	---	---	---	6.1	5.8e	6.0	5.9e
27	---	---	---	---	---	---	---	---	6.1	5.7e	6.0	5.9
28	---	---	---	---	---	---	---	---	6.1	5.9	6.0	6.0e
29	---	---	---	---	---	---	---	---	5.9	5.7	6.0	5.8
30	---	---	---	---	---	---	---	---	5.8	5.6	6.0	5.8
31	---	---	---	---	---	---	---	---	---	5.7e	5.9e	---
Total	---	---	---	---	---	---	---	---	---	141.6	156.5	136.3
Mean	---	---	---	---	---	---	---	---	---	5.7	6.0	5.9
Min	---	---	---	---	---	---	---	---	---	5.3	5.8	5.7
Max	---	---	---	---	---	---	---	---	---	5.9	6.1	6.1
Total (AF)	---	---	---	---	---	---	---	---	---	280.4	309.9	269.9

Note: Values are in cfs unless noted otherwise.
e = Estimated day.

Notes
LOCATION: Latitude 37° 35' 48", longitude 115° 13' 21", in SW1/4 NE1/4 SW1/4 sec. 14, T. 4S., R.60E, Lincoln County, 0.5 mi southwest of the orifice.
DRAINAGE AREA: Indeterminate
PERIOD OF RECORD: June 2009 to current year.
GAGE: Ultra-sonic flow meter. Elevation of the gage is 3,868 ft amsl NAVD88.
REMARKS: Records are fair to good. Estimated days are rated as poor. Discharge records are affected by both upstream and downstream agricultural diversions.


2090102 - HIKO SPRING AT HIKO, NV
DISCHARGE (cfs)
DISCHARGE (gpm)
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
3,142
3,052
2,962
2,873
2,783
2,693
2,603
2,513
2,424
2,334
2,244
10/1/08
11/1/08
12/1/08
1/1/09
2/1/09
3/1/09
4/1/09
5/1/09
6/1/09
7/1/09
8/1/09
9/1/09
10/1/09

References

U.S. Geological Survey, 2010, National water information system (NWIS Web) [Internet], [accessed February 2010], available from http://waterdata.usgs.gov/nwis.

USGS, see U.S. Geological Survey.

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Appendix E

2009 DDC Springs Site Photos

E.1.0 INTRODUCTION

This appendix presents photos of new monitoring structures and instrumentation at Flag Spring 2 (Middle), Hardy, and Hiko springs. Photos taken during the biannual field visits to document DDC spring conditions are also presented. Many of the DDC springs are controlled by collector systems and have been modified from their natural condition. Others, such as Littlefield and Cave Springs, remain in their natural condition.

Figure E-1
Flag Spring 2 Flume and Continuous-Recording Instrumentation, Fall 2009

Figure E-2
Hardy Springs Flume, Fall 2009

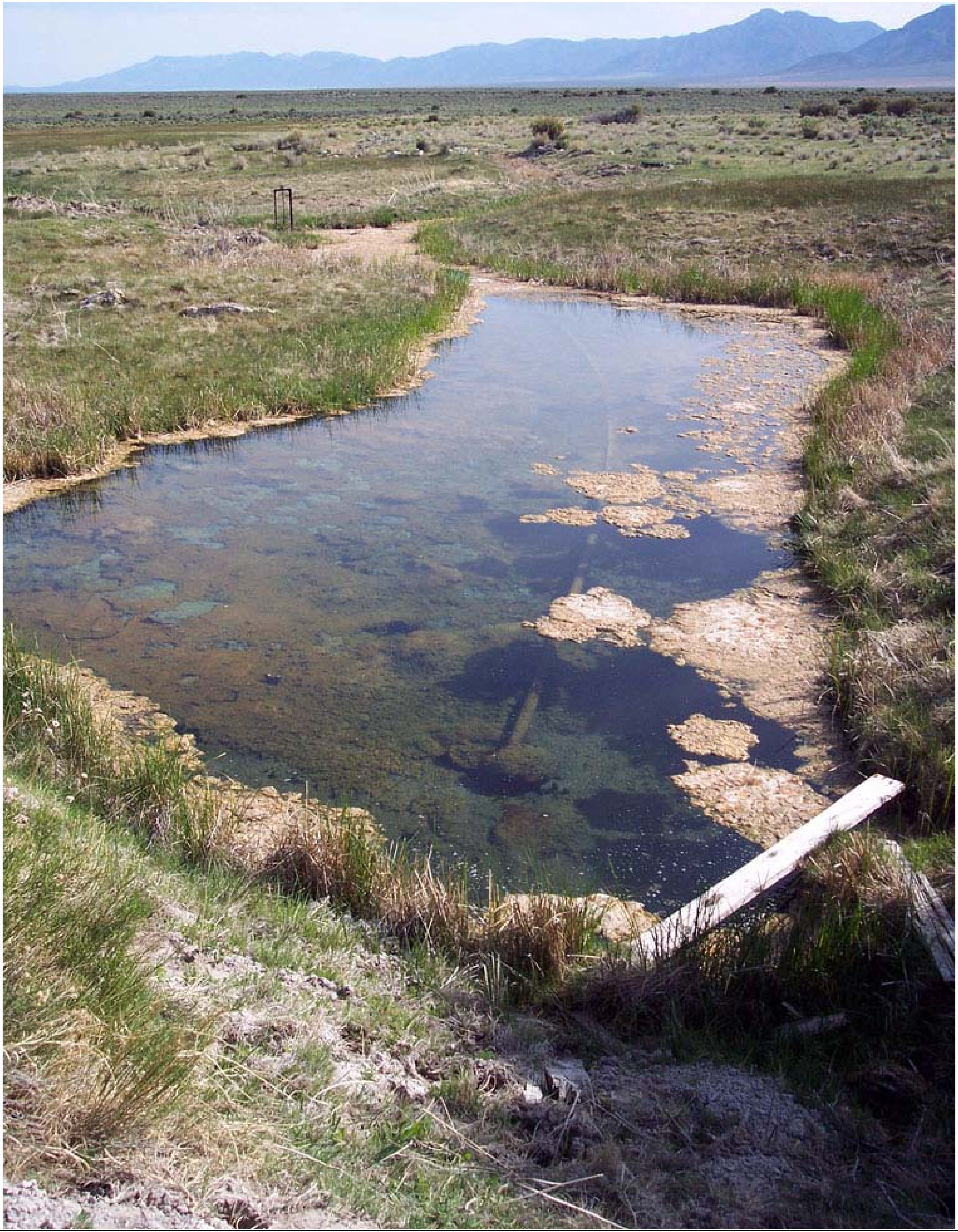

Figure E-3
Moorman Spring, Summer 2009

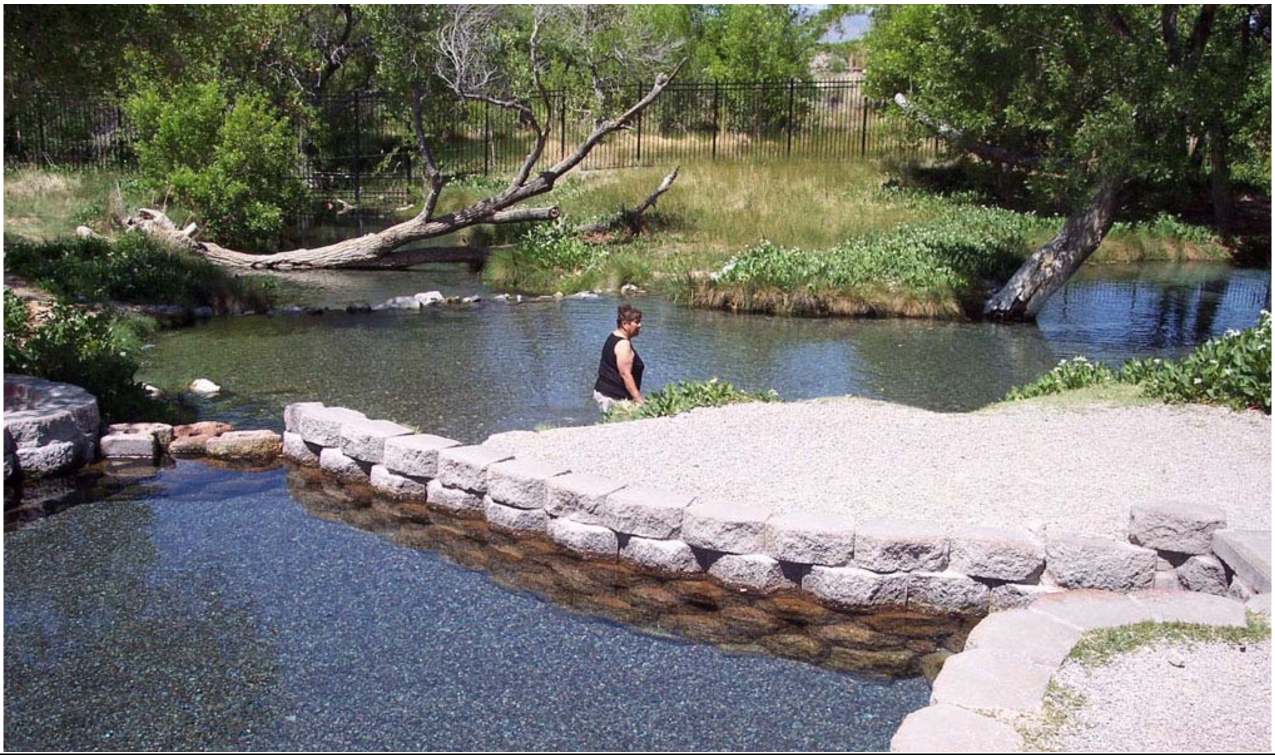

Figure E-4
Ash Springs, Summer 2009

Figure E-5
Crystal Springs, Summer 2009

Figure E-6
Crystal Springs Diversion, Summer 2009

Figure E-7
Hiko Spring, Summer 2009

Figure E-8
Hiko Vault with Continuous Flow Meter on Hiko Discharge Pipeline, Summer 2009

Figure E-9
Hiko Vault and Instrument Housing, Summer 2009

Figure E-10
Cave Spring during High Discharge, May 2009

Figure E-11
Cave Spring with No Discharge, September 2009

Figure E-12
Cave Spring with No Discharge, September 2009

Figure E-13
Parker Station, September 2009

Figure E-14
Lewis Well, September 2009

Figure E-15
Silver King Well Discharge, September 2009

Figure E-16
Silver King Well Discharge, September 2009

Figure E-17
Coyote Spring, September 2009

Figure E-18
Big Mud Springs, September 2009

Figure E-19
Littlefield Spring, June 2009

Figure E-20
Littlefield Spring, September 2009

Figure E-21
Littlefield Spring, September 2009

Figure E-22
Littlefield Spring Discharge Channel, September 2009

Figure E-23
Littlefield Spring Measurement Point, September 2009

Figure E-24
Grassy Spring, September 2009

Figure E-25
Grassy Spring, September 2009

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Appendix F

Regional and High-Altitude Precipitation Data

Table F-1
2009 Regional Precipitation Data
(Page 1 of 3)

Data Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Blue Eagle Ranch Hanks, NV													
2009 Data	0.40	0.99	0.30	1.05	0.13	1.14	0.66	0.55	0.15	0.76	0.12	0.00	6.25
Period of Record Statistics (1978 to Present)													
Mean	0.71	0.71	0.89	0.93	0.94	0.43	0.51	0.73	0.71	0.89	0.68	0.45	8.58
S.D.	0.43	0.44	0.65	0.74	0.94	0.48	0.60	0.82	0.91	0.90	0.62	0.44	3.01
Skew	0.61	1.12	0.61	0.73	1.00	1.00	2.29	2.23	2.08	1.92	1.00	1.20	0.72
Max	1.66	1.97	2.43	2.93	3.43	1.52	2.94	3.92	3.95	4.23	2.53	1.54	15.11
Min	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.41
No. Yrs	30	30	31	31	32	32	32	32	31	32	31	31	26
Caliente, NV													
2009 Data	0.28	1.85	0.01	0.59	0.86	0.40	0.49	0.05	0.08	0.16	0.26	0.79	5.03
Period of Record Statistics (1903 to Present)													
Mean	0.82	0.94	1.01	0.70	0.53	0.33	0.77	0.88	0.62	0.78	0.69	0.66	8.67
S.D.	0.79	0.89	0.98	0.74	0.52	0.44	0.83	0.89	0.74	0.99	0.75	0.64	3.23
Skew	1.27	1.49	1.27	1.73	1.13	1.64	2.37	1.23	1.60	2.26	1.48	1.68	0.34
Max	3.47	3.98	4.59	3.71	2.27	1.95	5.36	4.18	3.14	5.12	3.38	3.76	18.73
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.84
No. Yrs	86	87	84	86	84	84	84	86	87	85	86	86	66
Elgin, NV													
2009 Data	0.31	3.76	0.00	0.64	0.10	0.24	0.25	0.49	0.00z	0.00z	0.00z	0.00z	0.00z
Period of Record Statistics (1951 to Present)													
Mean	1.54	2.08	1.53	1.01	0.43	0.32	0.79	0.89	0.69	0.94	0.90	0.87	12.41
S.D.	1.86	2.00	1.62	0.95	0.45	0.36	1.30	1.09	0.94	1.19	1.13	0.97	5.94
Skew	1.62	1.27	1.38	0.68	1.03	0.94	3.07	2.49	1.52	2.08	1.99	1.12	0.54
Max	6.49	8.01	6.28	3.09	1.54	1.16	6.06	5.07	3.22	5.18	4.63	3.28	24.98
Min	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.72
No. Yrs	22	24	25	25	25	24	23	26	25	24	24	21	18
Ely WBO, NV													
2009 Data	1.49	0.54	0.65	1.18	0.33	1.78	0.92	0.33	0.37	1.45	0.98	0.43	10.02
Period of Record Statistics (1893 to Present)													
Mean	0.77	0.78	1.02	1.02	1.09	0.66	0.62	0.81	0.75	0.81	0.69	0.65	9.54
S.D.	0.56	0.64	0.75	0.82	0.90	0.75	0.55	0.73	0.83	0.66	0.53	0.56	2.88
Skew	0.95	1.77	1.38	2.27	1.03	1.71	1.02	1.09	2.35	1.48	0.92	1.59	0.34
Max	2.50	3.75	4.30	5.52	3.55	3.53	2.30	3.00	4.99	3.67	2.40	3.15	16.16
Min	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.22
No. Yrs	87	87	87	87	87	85	86	88	87	86	85	84	77

Table F-1
2009 Regional Precipitation Data
(Page 2 of 3)

Data Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Great Basin National Park, NV													
2009 Data	1.75	2.90	0.88	1.96	1.31	1.51	1.78	1.43	0.84	1.34	0.03	0.60	13.95
Period of Record Statistics (1948 to Present)													
Mean	1.05	1.15	1.40	1.18	1.24	0.91	0.95	1.20	1.08	1.23	0.96	0.91	13.21
S.D.	0.90	0.83	1.00	0.85	0.98	0.89	0.78	0.91	1.02	0.97	0.85	0.81	3.10
Skew	1.20	0.86	1.17	0.61	1.18	1.40	1.15	1.54	2.20	1.49	0.90	1.45	0.08
Max	3.78	3.59	4.96	3.02	4.74	3.73	3.90	5.10	6.02	5.22	3.40	3.45	21.20
Min	0.03	0.09	0.00	0.03	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00	7.37
No. Yrs	58	58	58	60	60	58	60	60	61	61	60	58	53
Hiko, NV													
2009 Data	0.41	2.47	0.00	0.00	0.00	0.10	0.47	0.10	0.10	0.00	0.10	0.64	3.75
Period of Record Statistics (1989 to Present)													
Mean	0.78	1.16	0.71	0.55	0.40	0.36	0.39	0.47	0.43	0.59	0.45	0.56	7.21
S.D.	0.81	1.15	0.79	0.51	0.44	0.46	0.45	0.56	0.64	0.85	0.51	0.56	3.13
Skew	1.46	1.05	1.54	0.43	1.44	1.52	1.46	2.55	1.87	2.01	1.26	1.09	0.62
Max	2.94	4.13	3.07	1.56	1.69	1.66	1.65	2.52	2.43	3.38	1.91	2.07	13.68
Min	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.45
No. Yrs	19	20	20	20	20	20	20	20	21	20	21	20	17
Lund, NV													
2009 Data	1.46	1.54	0.33	1.02	0.64	1.36	0.71	0.18	0.03	1.50	0.02	0.57	8.79
Period of Record Statistics (1957 to Present)													
Mean	0.79	0.86	1.03	0.98	0.94	0.86	0.66	0.88	0.78	0.89	0.69	0.69	10.08
S.D.	0.64	0.58	0.86	0.77	0.86	1.02	0.70	0.91	0.87	0.80	0.62	0.59	2.98
Skew	0.94	0.36	0.99	0.98	1.38	2.08	1.44	2.02	2.41	1.41	1.29	1.24	0.75
Max	2.78	2.22	3.44	3.44	3.45	5.37	3.05	4.58	5.01	3.66	2.62	2.69	18.83
Min	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.99
No. Yrs	51	51	50	52	52	52	51	51	52	52	53	51	42
McGill, NV													
2009 Data	1.70	0.63	0.93	1.56	0.65	1.98	1.74	0.56	0.68	1.32	0.01	4.70	11.76
Period of Record Statistics (1892 to Present)													
Mean	0.63	0.65	0.75	0.94	1.01	0.77	0.69	0.77	0.67	0.79	0.55	0.56	8.81
S.D.	0.62	0.50	0.54	0.64	0.83	0.88	0.63	0.66	0.78	0.64	0.46	0.49	2.51
Skew	3.09	1.21	1.18	0.81	1.06	1.71	1.16	1.24	2.88	0.97	1.09	1.16	0.53
Max	4.58	2.38	2.54	3.19	3.33	4.30	3.03	3.25	5.57	3.38	1.90	2.10	16.21
Min	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.76
No. Yrs	100	101	102	103	101	102	101	100	100	98	101	101	88

Table F-1
2009 Regional Precipitation Data
(Page 3 of 3)

Data Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Pahranagat Wildlife Refuge, NV													
2009 Data	0.13	1.95	0.02	0.30	0.15	0.18	0.00	0.00	0.00	0.01	0.12	0.00z	2.86
Period of Record Statistics (1964 to Present)													
Mean	0.66	0.76	0.74	0.61	0.38	0.20	0.47	0.60	0.37	0.51	0.49	0.39	6.52
S.D.	0.72	0.94	0.84	0.80	0.38	0.30	0.90	0.74	0.54	0.70	0.54	0.44	2.22
Skew	1.42	1.38	1.32	2.27	1.08	1.64	3.27	1.96	1.79	1.87	1.45	1.41	0.20
Max	3.13	3.22	3.03	4.04	1.59	1.20	4.22	3.60	2.30	3.18	2.48	1.74	11.54
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.23
No. Yrs	39	41	43	42	42	44	44	42	45	44	43	40	28
Ruth, NV													
2009 Data	1.38	1.48	0.69	3.24	1.05	2.75	1.42	0.35	0.44	1.50	0.02	0.41	14.32
Period of Record Statistics (1958 to Present)													
Mean	0.94	1.08	0.95	1.34	1.25	1.16	0.84	0.94	0.83	0.99	0.77	0.91	12.01
S.D.	0.65	1.06	0.81	1.06	1.01	1.12	0.68	0.67	0.81	0.68	0.70	0.74	3.13
Skew	1.04	1.62	1.68	1.03	1.36	1.63	0.85	0.71	1.41	0.23	1.23	0.75	0.24
Max	2.90	4.58	4.00	4.58	4.31	4.94	2.61	2.56	3.35	2.35	3.01	3.02	19.46
Min	0.20	0.00	0.00	0.08	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	6.68
No. Yrs	40	38	40	42	41	42	42	40	41	39	40	39	31
Sunnyside, NV													
2009 Data	0.30	0.01	0.25	0.44	0.06	0.72	0.59	0.00	0.00	0.26	0.00	0.00z	1.93
Period of Record Statistics (1891 to Present)													
Mean	0.68	0.81	1.01	0.80	0.82	0.48	0.76	0.82	0.85	0.92	0.57	0.66	9.41
S.D.	0.53	0.75	0.97	0.79	0.75	0.65	0.87	0.77	0.90	0.92	0.73	0.66	2.98
Skew	1.33	1.76	1.58	1.03	1.10	1.81	1.95	1.65	1.46	1.16	2.91	1.62	0.84
Max	2.64	3.55	4.82	2.81	3.23	2.79	4.37	3.89	3.69	3.76	4.19	2.80	17.11
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.73
No. Yrs	48	48	49	49	48	51	53	50	48	48	47	43	28
Spring Valley State Park, NV													
2009 Data	0.45	2.33	0.39	1.14	0.91	0.60	0.58	0.00	0.16	0.07	0.00	1.25	6.40
Period of Record Statistics (1974 to Present)													
Mean	0.88	1.21	1.36	0.96	1.11	0.44	0.93	1.29	1.29	1.18	0.69	0.63	12.35
S.D.	0.95	1.19	1.17	1.01	1.02	0.59	0.84	1.18	1.83	1.13	0.82	0.62	4.50
Skew	1.68	0.57	0.95	1.33	1.10	1.58	1.52	1.42	3.28	1.38	1.91	0.95	0.77
Max	3.81	3.65	4.30	3.92	3.70	2.14	3.68	5.41	9.72	4.95	3.43	2.37	23.48
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.05
No. Yrs	31	32	33	32	33	34	34	36	33	34	33	31	20

z = 26 or more days missing from record.
Notes: Long-term means based on columns; thus, the monthly row may not sum (or average) to the long-term annual value.
Individual months not used for annual or monthly statistics if more than 5 days were missing.
Individual years not used for annual statistics if any month in that year had more than 5 days missing.

Table F-2
Recent (2005–2008) High-Altitude Precipitation Data
(Page 1 of 2)

Station Name	USGS Site ID	Date	Precipitation (in.)	Comments
Unnamed peak in S. Delamar Mtns	372035114432901	7/6/2005	---	Could not get to gage due to wildfires. Will visit in October.
		10/20/2005	32.5	---
		6/23/2006	7.5	---
		10/13/2006	1.25	Add 1 gal antifreeze.
		6/11/2007	7.25	No antifreeze added.
		10/19/2007	4.25	Added 1 gal of antifreeze.
		6/6/2008	6.5	No antifreeze added.
		10/16/2008	1.5	Drained. Added 2/3 gal mineral oil.
Unnamed peak S. of Chokecherry Peak	373017114433301	10/18/2005	3.5	---
		6/29/2006	5.5	---
		10/30/2006	3.25	Added 1 gal of antifreeze.
		6/5/2007	3	Drained and added 1 gal of antifreeze.
		10/25/2007	5.25	Drained and no antifreeze added.
		6/10/2008	5.25	Baffle needs to be put back on.
		10/2/2008	4	Drained, need 3 people to help replace baffle.
Mt. Irish	373915115232801	7/6/2005	12.5	Added 1 gal antifreeze.
		10/20/2005	3.75	---
		6/23/2006	4.5	---
		10/13/2006	2.5	Shut off valve would not stop leaking/need new o-ring or valve.
		6/11/2007	0	Fixed valve, added 2 gal of antifreeze and 1 gal of water.
		10/19/2007	3.5	---
		6/6/2008	5.5	Added mineral oil.
		10/16/2008	5.75	Drained, added 2/3 gal mineral oil.
Highland Peak	375337114343801	6/21/2005	24	Drained, added 1 gal antifreeze.
		10/18/2005	4	---
		6/29/2006	13	---
		10/30/2006	9.5	---
		6/5/2007	7	Drained and added 1 gal antifreeze.
		10/25/2007	6	Drained and added 1 gal antifreeze.
		6/10/2008	8.5	---
		10/2/2008	4.75	Drained, no antifreeze added.
Quinn Canyon Range	381157115373101	7/6/2005	19.25	Drained, added 1 gal antifreeze.
		10/26/2005	4	---
		6/23/2006	8.5	Collected 2 samples.
		10/13/2006	3.75	Added 1 gal of antifreeze/collected 2 samples.
		6/11/2007	2.5	Gage tipped over at a 45 degrees, uprighted gage and secured it.
		10/19/2007	6.5	Added 1/2 gal of antifreeze.
		6/6/2008	7.75	No antifreeze added, collected 2 samples.
		10/16/2008	4.25	Drained, added 2/3 gal mineral oil, collected 2 samples.
Mt. Wilson	381438114233301	6/21/2005	42.75	Drained. Added 1 gal antifreeze.
		10/18/2005	4.25	Added antifreeze?
		6/19/2006	11.25	---
		10/30/2006	9.75	---
		6/5/2007	5.25	Drained and added 1 gal of antifreeze.
		10/25/2007	3	Drained and added 1 gal of antifreeze.
		6/10/2008	14	Baffle needs to be raised on next visit.
		10/3/2008	4.25	Drained, needs new baffle.

Table F-2
Recent (2005–2008) High-Altitude Precipitation Data
(Page 2 of 2)

Station Name	USGS Site ID	Date	Precipitation (in.)	Comments
Mt. Washington	385409114185401	7/12/2005	46	Took samples from gage and bucket.
		11/2/2005	6	Replaced isotope collection bucket.
		7/5/2006	17.5	---
		7/6/2006	0	Sampled tube - added 2 gal antifreeze to precipitation drained and filled bucket and tube.
		10/19/2006	7	Drained, add 1 gal antifreeze.
		6/5/2007	13.0	Drained, no antifreeze added, will add antifreeze next visit.
		10/24/2007	2.75	Added 1 gal of antifreeze and 3/4 gal oil.
		6/5/2008	12.5	Drained and added one gal antifreeze.
		10/15/2008	4.50	2 samples taken.
Unnamed Peak NW of Mt. Moriah	391913114143101	7/20/2005	22	---
		11/7/2005	6.5	Drained, added 1 gal antifreeze.
		6/23/2006	11.75	---
		10/19/2006	3.5	Drained added antifreeze.
		6/13/2007	10.75	Drained added 1 gal antifreeze.
		10/23/2007	1.25	Did not drain. Added 1gal antifreeze.
		6/5/2008	9.5	Drained. Added 1 gal antifreeze.
		10/14/2008	3.5	Added 1 gal antifreeze.
Cave Mountain	39094611364901	7/20/2005	15.25	---
		11/7/2005	3.25	Drained, added 1 gal antifreeze.
		6/23/2006	18.75	---
		10/19/2006	4.25	Raised wind baffle to just above top of collector, tightened guide wires. Drained - added antifreeze.
		6/13/2007	12	Drained and added 1 gal of antifreeze.
		10/23/2007	3.75	Did not drain. Added 1gal antifreeze.
		6/5/2008	8.5	Drain. Added 1 gal antifreeze.
		10/14/2008	4.25	Added 1 gal antifreeze.

Note: 2009 USGS data not released at the time of the printing of this report.

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Appendix G

Water-Chemistry Data

Table G-1
2009 Water-Chemistry Data
(Page 1 of 2)

Constituent Name	Unit	Analysis Method	MDL	Hiko Spring 7/02/2009 11:38	Hardy Springs 7/02/2009 13:00	Primary MCL	Secondary MCL
Field Measured Water-Quality Parameters							
pH	standard unit	Field	---	7.56	6.50	---	6.5 to 8.5
Specific Conductance	µS/cm	Field	---	515	510	---	---
Temperature	°C	Field	---	25.7	14.1	---	---
Major Constituents							
Alkalinity Bicarbonate	mg/L as HCO_3	SM 2320B	2	280	290	---	---
Alkalinity Carbonate	mg/L as $CaCO_3$	SM 2320B	2	ND	ND	---	---
Alkalinity Total	mg/L as $CaCO_3$	SM 2320B	2	230	240	---	---
Chloride	mg/L	EPA 300.0	0.079	11	3.8	---	250
Sulfate	mg/L	EPA 300.0	0.038	37	15	---	250
Calcium	mg/L	EPA 200.7	0.016	46	56	---	---
Magnesium	mg/L	EPA 200.7	0.012	22	24	---	---
Potassium	mg/L	EPA 200.7	0.081	6.9	1.6	---	---
Sodium	mg/L	EPA 200.7	0.015	25	5.9	---	---
Silica	mg/L	EPA 200.7	0.082	30	14	---	---
Cation/Anion Balance	%	Calculation	---	3.4	2.2	---	---
Trace and Minor Constituents							
Aluminum, total	µg/L	EPA 200.8	0.19	5.2	20	---	50 to 200
Antimony, total	µg/L	EPA 200.8	0.008	0.70	0.18[a]	6	---
Arsenic, total	µg/L	EPA 200.8	0.014	13	1.5	10	---
Barium, total	µg/L	EPA 200.8	0.024	110	85	2,000	---
Beryllium, total	µg/L	EPA 200.8	0.022	ND	ND	4	---
Boron, total	µg/L	EPA 200.7	1	110	26	---	---
Bromide	µg/L	EPA 300.1	4.1	73	37	---	---
Cadmium, total	µg/L	EPA 200.8	0.013	0.11	ND	5	---
Chromium, total	µg/L	EPA 200.8	0.012	0.25	0.22	100	---
Copper, total	µg/L	EPA 200.8	0.022	1.6	0.29[a]	1,300[b]	1,000
Fluoride	mg/L	EPA 300.0	0.013	0.56	0.20	4	2.0
Iron, total	µg/L	EPA 200.7	1.1	1.6[a]	5.2[a]	---	300
Lead, total	µg/L	EPA 200.8	0.017	0.090[a]	0.040[a]	15[b]	---
Lithium, total	µg/L	EPA 200.7	1.4	34	11	---	---

Table G-1
2009 Water-Chemistry Data
(Page 2 of 2)

Constituent Name	Unit	Analysis Method	MDL	Hiko Spring 7/02/2009 11:38	Hardy Springs 7/02/2009 13:00	Primary MCL	Secondary MCL
Trace and Minor Constituents (Continued)							
Manganese, total	µg/L	EPA 200.8	0.019	0.78	2.1	---	50
Mercury, total	µg/L	EPA 245.1	0.0039	0.012[a]	0.0090[a]	2	---
Molybdenum, total	µg/L	EPA 200.8	0.009	5.2	0.69	---	---
Nickel, total	µg/L	EPA 200.8	0.011	0.40[a]	0.17[a]	---	---
Nitrate	mg/L as N	EPA 353.2	0.022	0.52[c]	0.95[c]	10	---
Nitrite	mg/L as N	EPA 353.2	0.033	ND[c]	ND[c]	1	---
Orthophosphate	µg/L as PO_4	EPA 365.3	7.8	ND	ND	---	---
Phosphorus, total	µg/L as P	EPA 365.3	0.83	13	9.6[a]	---	---
Selenium, total	µg/L	EPA 200.8	0.017	0.49	0.71	50	---
Silver, total	µg/L	EPA 200.8	0.008	0.040[a]	0.11[a]	---	100
Strontium, total	µg/L	EPA 200.7	0.17	0.36[a]	190	---	---
Thallium, total	µg/L	EPA 200.8	0.020	0.27	ND	2	---
Uranium, total	µg/L	EPA 200.8	0.008	4.8	1.2	30	---
Vanadium, total	µg/L	EPA 200.8	0.009	1.8	0.63	---	---
Zinc, total	µg/L	EPA 200.8	0.30	5.6	1.3[a]	---	5,000
Stable Isotopes/Environmental Tracers							
Carbon-14 (^{14}C)	pmc	NA[d]	---	-6.2	-10.4	---	---
Carbon-13/12 ($\delta^{13}C$)	per mil (‰)	NA[d]	---	5.7	49.7	---	---
Hydrogen-2/1 (δD)	per mil (‰)	NA[d]	---	-109.4/-109.9	-108.5/-108.2	---	---
Oxygen-18/16 ($\delta^{18}O$)	per mil (‰)	NA[d]	---	-14.33/-14.26	-13.96	---	---
Miscellaneous Parameters							
Hardness	mg/L as $CaCO_3$	EPA 200.7	0.089	210	240	---	---
Total Dissolved Solids	mg/L	SM 2540C	4	320	260	---	500
Total Organic Carbon	mg/L	SM 5310C	0.032	0.47	1.1	---	---
Total Suspended Solids	mg/L	SM 2540D	5	ND	ND	---	---

[a]Measured value is above the method detection limit but below the reporting limit.
[b]Reported value is the action limit
[c]Holding time was exceeded
[d]No EPA method applicable
EPA = Environmental Protection Agency
MCL = Maximum contaminant level
MDL = Method detection limit
ND = Not detected
SM = Standard method (Eaton et al., 2005)

References

Eaton, A.D., Clesceri, L.S., Rice, E.W., Greenberg, A.E., and Franson, M.H., eds., 2005, Standard methods for the examination of water and wastewater. Twenty first edition: Washington, D.C., American Public Health Association.

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