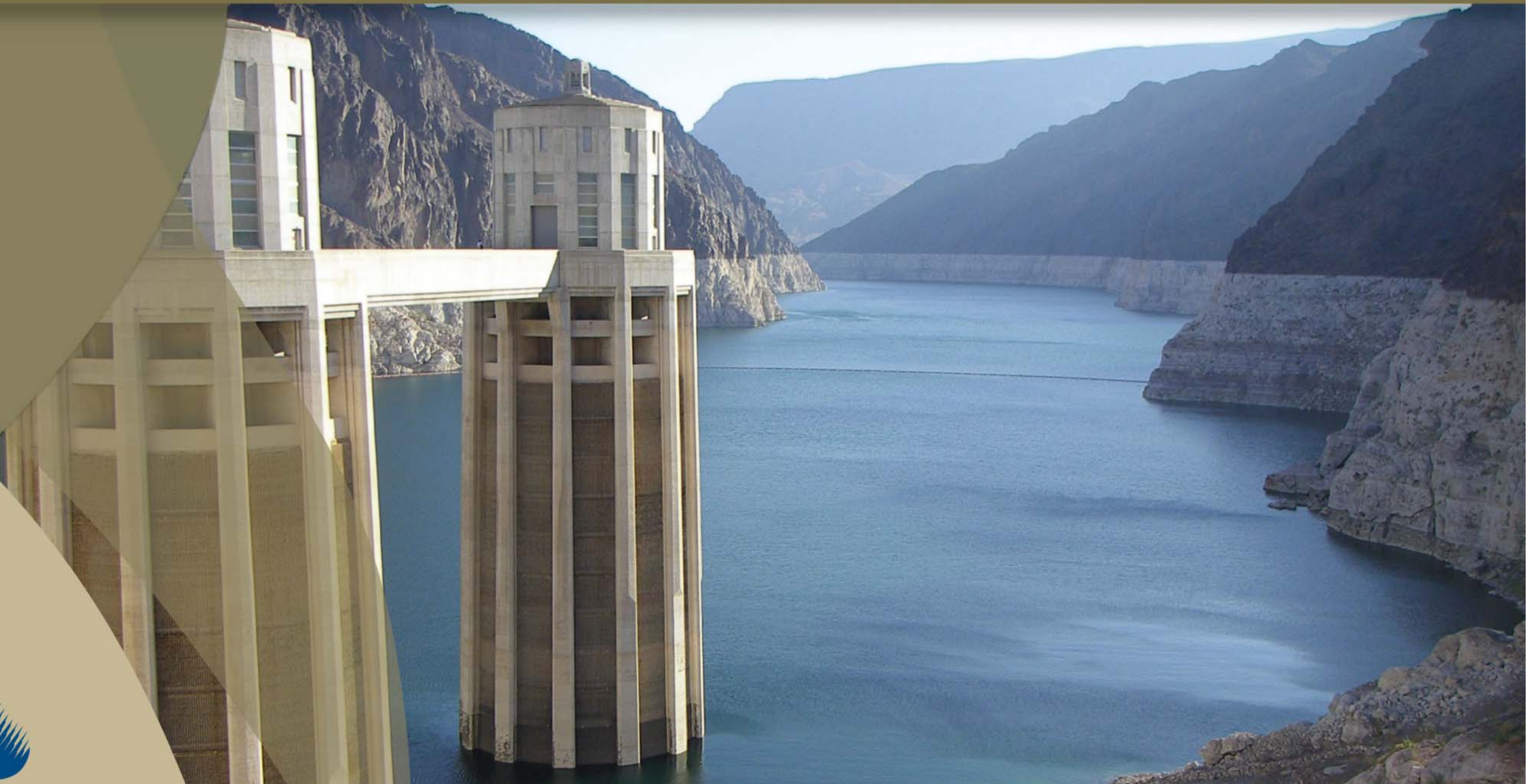
Spring, Cave, Dry Lake and Delamar Valleys



SOUTHERN NEVADA WATER AUTHORITY

Presentation for
Prieur, Marshall and Entsminger Testimony

Professional Resume

James P. Prieur

Senior Hydrologist
Southern Nevada Water Authority
100 City Parkway, Suite 700
Las Vegas, Nevada 89106
james.prieur@snwa.com
(702) 862-7437

Professional Licenses and Affiliations

Professional Geologist license in Wisconsin #294 and Florida #1027
Previously registered as PG or Groundwater Professional in six other states
Nevada Water Resources Association
Association of Groundwater Scientists and Engineers
Served on National Environmental Committee for the Consulting Engineers Council

Professional Experience

Southern Nevada Water Authority, 2006-Present, Las Vegas, NV
Senior Hydrologist, Water Resources Division, Manage Data Acquisition and Reporting Section.

Responsible for hydrologic monitoring, compliance, and reporting for Delamar, Dry Lake, and Cave Valleys and Spring Valley monitoring and mitigation plans. SNWA representative on the Department of Interior/SNWA Stipulation Agreement Hydrologic Technical Review Panel. Responsible for monitoring, permit compliance and reporting for Las Vegas Valley Artificial Recharge Program and groundwater production permits, and Jean, Searchlight, Blue Diamond, and Kyle Canyon water systems. Responsible for well performance and aquifer testing/analysis program. Coordinate USGS/ SNWA joint funding agreements for surface and groundwater monitoring in east-central Nevada and western Utah.

Self-Employed, **1998-2006**
Fulfilled non-compete agreements with Delta, worked as an independent consultant on a variety of water resource and environmental related projects.

Delta Environmental Consultants, Inc., 1986-1998, St. Paul, MN
An original founder, Vice President of Technical Operations and Principal Hydrogeologist

Company grew from 5 employees to over 570 with offices throughout the United States and London.

Responsible for technical quality and troubleshooting and project review for sites located throughout the country in a wide variety of hydrogeologic conditions. Performed domestic and international water resource and environmental project work. Provided extensive technical support for western United States offices in Phoenix, Salt Lake City, Denver, Sacramento, and Seattle.

Duties included water resource and hydrogeologic investigations, client and project management, contaminant hydrogeology, groundwater flow and contaminant transport modeling, site remediation design, environmental chemistry, application of advanced remediation technology, client litigation technical support and expert testimony.

Started an office in Tampa, Florida and managed the southeast region for one year. Professional staff grew from 3 to 60 professionals. Established additional offices in Charlotte and Atlanta.

Founders sold the company to employees through an ESOP program in 1996.

Zane L. Marshall

Southern Nevada Water Authority
Environmental Resources Department
100 City Parkway, Suite 700
Las Vegas, Nevada 89106
Zane.Marshall@SNWA.com
(702) 862-3713
(702) 858-4070

ACADEMIC HISTORY

University of Nevada Las Vegas
4505 S. Maryland Parkway.
Las Vegas, NV 89154-5012
(702) 895-3399

2006 Master of Arts in Science in Biology and Statistics

1996 Bachelor of Arts in Environmental Studies, Minor in Biology

Awards and Scholarships
2006-2007 Outstanding Alumni Award (UNLV, Department of Environmental Studies)
Dean's Honor List
National Dean's List
University President's Scholarship

Scholastic Organizations
UNLV Alumni Association

WORK HISTORY

May 2010-Present Director Environmental Resources Department
Southern Nevada Water Authority

Manage four divisions including Conservation, Environmental Resources, Environmental Monitoring and Management, and Northern Resources with approximately 80 total staff. Facilitate interdepartmental coordination. Lead Strategic Plan implementation and provide strategic guidance to Managers, Supervisors and lead staff. Provide technical guidance for research and monitoring initiatives. Manage a departmental budget exceeding $25 million. Represent SNWA in local and national efforts concerning sustainability and climate change. Oversee the recruitment of management and lead staff positions within the department.

SNWA Hydrologic Management Program for Groundwater Development in Spring, Cave, Dry Lake, and Delamar Valleys, Nevada

Presentation to the Office of the Nevada State Engineer

Prepared by

Southern Nevada Water Authority

June 2011

Doc No. WRD-ED-0011

SOUTHERN NEVADA
WATER AUTHORITY

Water Resources Division

Hydrologic Monitoring and Mitigation Plan for Delamar, Dry Lake, and Cave Valleys

June 2011

Prepared by:
Southern Nevada Water Authority
Water Resources Division
P.O. Box 99956
Las Vegas, Nevada 89193-9956

Submitted for Approval to:
Nevada State Engineer

Doc No. WRD-ED-0012

Water Resources Division

SOUTHERN NEVADA WATER AUTHORITY

Hydrologic Monitoring and Mitigation Plan for Spring Valley (Hydrographic Area 184)

June 2011

Prepared by:
Southern Nevada Water Authority
Water Resources Division
P.O. Box 99956
Las Vegas, Nevada 89193-9956

Submitted for Approval to:
Nevada State Engineer

SNWA Response to Bredehoeft Report and Exhibits

PRESENTATION TO THE OFFICE OF THE NEVADA STATE ENGINEER

Prepared by

SOUTHERN NEVADA
WATER AUTHORITY

August 2011

State 'S EXHIBITS 41
DATE: 9/26/11

STIPULATION FOR WITHDRAWAL OF PROTESTS

This Stipulation is made and entered into between the Southern Nevada Water Authority (SNWA) and the United States Department of the Interior on behalf of the Bureau of Indian Affairs, the Bureau of Land Management, the National Park Service, and the Fish and Wildlife Service (collectively the "DOI Bureaus"). Collectively, SNWA and each of the DOI Bureaus are referred to as the "Parties."

RECITALS

A. In October 1989, the Las Vegas Valley Water District (SNWA's predecessor-in-interest) filed Applications 54003 through 54021, inclusive, (hereinafter referred to as the "SNWA Applications") for a combined 126 cfs of groundwater withdrawals in the Spring Valley Hydrographic Basin ("Spring Valley HB"). SNWA intends to pump up to 91,224 acre-feet of groundwater annually from the Spring Valley HB for municipal purposes with concurrent monitoring, management, and mitigation as specified in Exhibits A and B. In the future, SNWA may seek to change the points of diversion within the Spring Valley HB for any quantities of groundwater permitted pursuant to the SNWA Applications.

B. The DOI Bureaus filed timely protests to the granting of the SNWA Applications pursuant to the DOI Bureaus' responsibilities to protect their state and federal water rights ("Federal Water Rights") and other water-dependent resources ("Federal Resources") of the DOI Bureaus in the Area of Interest (depicted in Figure 1). The DOI Bureaus are required by law to manage, protect, and preserve all Federal Water Rights and Federal Resources that fall under their jurisdiction. A number of these Federal Water Rights and Federal Resources occur within the Area of Interest. As of the date of this Stipulation, those Federal Water Rights that are based upon the application of federal law have not been quantified pursuant to an adjudication that complies with the requirements

SE Exhibit 041
extra copy ex 63

available and the Parties shall collaborate on technical data collection and analysis. The Parties shall use existing data, data collected under this Plan, and an agreed-upon regional groundwater flow system numerical model(s) as tools to evaluate the effects of groundwater development on Federal Water Rights and Federal Resources in the Area of Interest. The Parties agree that a model(s) shall be used to inform the Executive Committee about the potential for effects of groundwater withdrawals to spread through the basin-fill and the regional carbonate-rock aquifers, as well as the effectiveness of the potential mitigation actions.

B. Executive Committee

The Parties shall create and convene an Executive Committee, to include one manager from each of the Parties, within 30 days of a State Engineer Office decision granting any of the SNWA Applications in total or in part. The purpose of the Executive Committee is to: 1) review agreed-upon TRP recommendations for actions to reduce or eliminate an injury to Federal Water Rights and/or unreasonable adverse effects to Federal Resources in the Area of Interest and/or any effect on Federal Resources within the boundaries of Great Basin National Park from groundwater withdrawals by SNWA in the Spring Valley HB and 2) negotiate a resolution in the event that the TRP cannot reach consensus on monitoring requirements/research needs, technical aspects of study design, interpretation of results, and/or appropriate actions to minimize or mitigate unreasonable adverse effects or to avoid any effects on Federal Resources located within the boundaries of Great Basin National Park from groundwater withdrawals by SNWA in the Spring Valley HB.

The Executive Committee shall meet within 21 calendar days of being notified by the TRP of a need for action. The Executive Committee shall strive for consensus in all decisions and work to begin implementation of TRP recommendations or other mutually acceptable course(s) of action as negotiated by the Executive Committee within 60 calendar days of TRP notification. If any Party disagrees on recommended courses of action, then the Executive Committee shall refer the issue to a neutral third party, as described below in Section E.II.

C. Technical Review Panel (TRP)

The Parties shall create and convene a Technical Review Panel within 30 days of a State Engineer Office decision granting any of the SNWA Applications in total or in part, or at such earlier date as mutually agreed-upon by the Parties. The purpose of the TRP is to carry out the functions required of it under this Plan, including reviewing, analyzing, and interpreting information collected under this Plan, evaluating the results of the model(s), and making recommendations to the Executive Committee. Membership shall include one representative from SNWA and one representative from each of the DOI Bureaus. Each Party at its sole discretion may invite such additional staff or consultants to attend, as each deems necessary. To assist the TRP, the Parties mutually agree to invite a representative of the State Engineer's Office to participate in the TRP. Furthermore, the Parties may mutually agree to invite other non-Party entities to assist and participate in the TRP as deemed necessary or appropriate.

The TRP shall meet annually through the first ten years of SNWA production pumping in the Spring Valley HB and then as often as mutually agreed upon by the Parties.

The TRP shall:

available and the Parties shall collaborate on technical data collection and analysis. The Parties shall use existing data, data collected under this Plan, and an agreed-upon regional groundwater flow system numerical model(s) as tools to evaluate the effects of groundwater development on Federal Water Rights and Federal Resources in the Area of Interest. The Parties agree that a model(s) shall be used to inform the Executive Committee about the potential for effects of groundwater withdrawals to spread through the basin-fill and the regional carbonate-rock aquifers, as well as the effectiveness of the potential mitigation actions.

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The Parties shall create and convene an Executive Committee, to include one manager from each of the Parties, within 30 days of a State Engineer Office decision granting any of the SNWA Applications in total or in part. The purpose of the Executive Committee is to: 1) review agreed-upon TRP recommendations for actions to reduce or eliminate an injury to Federal Water Rights and/or unreasonable adverse effects to Federal Resources in the Area of Interest and/or any effect on Federal Resources within the boundaries of Great Basin National Park from groundwater withdrawals by SNWA in the Spring Valley HB and 2) negotiate a resolution in the event that the TRP cannot reach consensus on monitoring requirements/research needs, technical aspects of study design, interpretation of results, and/or appropriate actions to minimize or mitigate unreasonable adverse effects or to avoid any effects on Federal Resources located within the boundaries of Great Basin National Park from groundwater withdrawals by SNWA in the Spring Valley HB.

The Executive Committee shall meet within 21 calendar days of being notified by the TRP of a need for action. The Executive Committee shall strive for consensus in all decisions and work to begin implementation of TRP recommendations or other mutually acceptable course(s) of action as negotiated by the Executive Committee within 60 calendar days of TRP notification. If any Party disagrees on recommended courses of action, then the Executive Committee shall refer the issue to a neutral third party, as described below in Section E.II.

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The TRP shall meet annually through the first ten years of SNWA production pumping in the Spring Valley HB and then as often as mutually agreed upon by the Parties.

The TRP shall:

E. The State Engineer has set an administrative hearing on the protests of the DOI Bureaus and other protestants commencing September 11, 2006.

F. The Parties acknowledge that other entities and individuals have lodged protests to the SNWA Applications, but such additional protestants are not Parties to or in any way bound or prejudiced by this Stipulation. Further, these protestants may enter into stipulations with SNWA concerning the SNWA Applications. Such stipulations shall not require the participation of the DOI Bureaus nor modify in any way the intent or content of this Stipulation, nor shall the DOI Bureaus be bound or prejudiced by such stipulations.

G. The common goals of the Parties are 1) manage the development of groundwater by SNWA in the Spring Valley HB without causing injury to Federal Water Rights and/or unreasonable adverse effects to Federal Resources in the Area of Interest, 2) accurately characterize the groundwater gradient from Spring Valley HB to Snake Valley HB via Hamlin Valley, and 3) to avoid any effect on Federal Resources located within the boundaries of Great Basin National Park from groundwater withdrawal by SNWA in the Spring Valley HB. The Parties agree that the preferred conceptual approach for protecting Federal Water Rights from injury and Federal Resources from unreasonable adverse effects within the Area of Interest and for avoiding any effect on Federal Resources located within the boundaries of Great Basin National Park that may be caused by groundwater withdrawals by SNWA in the Spring Valley HB is through the development of such groundwater in conjunction with the implementation of the monitoring, management, and mitigation plans described in Exhibits A and B. The effects of groundwater withdrawals pursuant to the development of any or all of the SNWA Applications and any future changes in points of diversion and/or rates of withdrawal need to be properly monitored and managed to avoid any injury to Federal Water Rights and unreasonable adverse effects to Federal Resources within the Area of Interest and any effect on Federal Resources located within the boundaries of Great Basin National Park. There is a need to better understand the response of the aquifers and associated discharge points, such as artesian wells, springs, streams, wetlands, and playas, to pumping stresses from development of permitted quantities of groundwater in accordance with the monitoring, management, and mitigation plans set forth in Exhibits A and B to this Stipulation. The Parties have determined that it is in their best interests to cooperate in the collection and analysis of additional hydrologic, hydrogeologic, and water chemistry information. The Parties shall cooperate in the development of a regional groundwater-flow numerical model, for assessing the effects of groundwater withdrawals by SNWA in the Spring Valley HB.

H. The common goals of the Parties are 1) to manage the development of groundwater by SNWA in the Spring Valley HB in order to avoid unreasonable adverse effects to wetlands, wet meadow complexes, springs, streams, and riparian and phreatophytic communities (hereafter referred to as Water-dependent Ecosystems) and maintain the biological integrity and ecological health of the Area of Interest over the long term, and 2) to avoid any effects to Water-dependent Ecosystems within the boundaries of Great Basin National Park. The Parties agree that the preferred conceptual approach is development of groundwater by SNWA in conjunction with the implementation of the monitoring, management, and mitigation plans described in Exhibits A and B to this Stipulation. The Parties further agree that there is a need to better understand: 1) the response of aquifers and associated discharge areas, such as artesian wells, springs, streams, wetlands, playas, and riparian and phreatophytic communities to pumping stresses, and 2) the response of aquatic and terrestrial organisms to changes in water-dependent habitats caused by groundwater withdrawals by SNWA in the Spring Valley HB. The Parties have determined that it is in their best interests to cooperate in data collection and analysis related to groundwater levels and the long-term maintenance of Water-dependent Ecosystems within the Area of Interest.

I. The common goal of the Parties is to manage the development of groundwater by SNWA in the Spring Valley HB to avoid an unreasonable degradation of the scenic values of, and visibility from Great Basin National Park due to a potential increase in airborne particulates and loss of surface vegetation which may result from groundwater withdrawals by SNWA in the Spring Valley HB. The Parties agree that the preferred conceptual approach for protecting existing visibility from unreasonable degradation is through the implementation of appropriate monitoring, management, and mitigation activities in conjunction with SNWA's groundwater development. The purpose of this goal is to support the "significant … scenic values" of Great Basin National Park, as recognized by Congress in establishing the park. 16 U.S.C. § 410mm(a). The NPS has interpreted this mandate in its Great Basin National Park General Management Plan to be "the ability to view broad areas of basin and range topography and distant mountains is central to interpreting the entire Great Basin region." Additionally, a goal of the Parties for SNWA's Clark/Lincoln/White Pine Counties Ground-water Development Project also includes managing the construction and operation activities related to any wells and water delivery pipelines and support structures associated with the use of water under the SNWA Applications to avoid unreasonable degradation of the scenic values of and the visibility from Great Basin National Park. Further, it is in the Parties' best interests to cooperate in the collection and analysis of additional information regarding the

Environmental Evaluation of SNWA Groundwater Development in Spring, Cave, Dry Lake, and Delamar Valleys

PRESENTATION TO THE OFFICE OF THE NEVADA STATE ENGINEER

Prepared by

SOUTHERN NEVADA WATER AUTHORITY

June 2011

SNWA Exhibit 363

Biological Monitoring Plan for the Spring Valley Stipulation


Photo by Kelly Douglas

February 2009

Biological Work Group

Stipulation Parties: Bureau of Indian Affairs
Bureau of Land Management
National Park Service
Southern Nevada Water Authority
U.S. Fish and Wildlife Service

Invited Parties: Nevada Department of Wildlife
Utah Division of Wildlife Resources

BWG and Biological Monitoring Activities under the Spring Valley Stipulation, 2006-2011.

	Activity	Date	Duration	Agency Representation and Participation	Topics
1	BWG/TRP/EC meeting	2006 12/18	n.a.	12 attendees. BWG members & participants: 2 SNWA, 2 FWS, 1 BLM, 2 NPS. TRP member: 1 BLM. EC members: 1 SNWA, 1 NPS, 1 FWS. 1 DOI liaison.	Inviting NDOW and UDWR to participate on BWG; expert advice from outside organizations; determining sites to monitor based on likelihood of impacts and hydrologic and biologic significance; SNWA pump tests; available baseline data; monitoring opportunities on SNWA deeded lands; BWG and TRP collaboration
2	BWG working meeting (call)	2007 02/09	1 hour	n.a.	Letter of invitation to NDOW and UDWR to participate in BWG; topics and agenda for next meeting
3	Monitoring plan development/writing	2007 02/12 - 2009 02/18		14 contributors. BWG members & participants: 2 SNWA, 2 FWS, 2 BLM, 1 NPS, 1 BIA, 3 NDOW, 1 UDWR. Invited: 1 BIO-WEST, 1 KS2. Reviewed by BWG, agency scientists (SNWA, FWS, BLM, NPS, BIA, NDOW, UDWR), and EC.	Collaborative and iterative writing/review/revision process. Introduction/background; goals and objectives; CAP process; selection and description of groundwater-influenced ecosystems, species, sites, key ecological attributes, and indicators to monitor; TRP hydrologic monitoring; determining range of variation and unreasonable adverse effect; criteria for initiating BWG/TRP/EC consultation; adaptive framework and phased approach; sampling objectives, designs and protocols; gathering external data; discussion on ecological modeling; identification of potential research needs; data management, analysis and reporting; monitoring plan implementation and schedule; conceptual models.
4	BWG working meeting	2007 02/23	4 hours	14 attendees. BWG members & participants: 1 SNWA, 2 FWS, 2 BLM, 1 NPS, 1 BIA, 3 NDOW, 1 UDWR. EC member: 1 NPS. 1 BLM EIS liaison. 1 DOI liaison.	Review of Stipulated Agreement; NPS framework for developing inventory and monitoring programs; data and reports shared, ftp site created; monitoring plan writing/revision (outline and introduction/background); available baseline data; monitoring site selection
5	BWG working meeting	2007 03/29	7 hours	14 attendees. BWG members & participants: 1 SNWA, 2 FWS, 2 BLM, 1 NPS, 1 BIA, 3 NDOW, 1 UDWR. EC member: 1 FWS. 1 BLM EIS liaison. 1 DOI liaison.	Identification of experts across various ecological fields; landscape-level monitoring; monitoring plan writing/revision (introduction/background and objectives); identification of monitoring goals, including establishing baseline, determining trends and providing early warning; potential groundwater-influenced ecosystems, attributes and species to monitor; baseline data gathering
6	BWG planning meeting (call)	2007 04/19	1 hour	10 attendees. BWG members & participants: 1 SNWA, 2 FWS, 1 NPS, 1 BIA, 1 NDOW, 1 UDWR. EC: 2 FWS. 1 BLM EIS liaison.	Planning for potential expert workshop
7	BWG working meeting	2007 05/08	6 hours	12 attendees. BWG members & participants: 1 SNWA, 2 FWS, 1 NPS, 1 BIA, 2 BLM, 3 NDOW, 1 UDWR. 1 DOI liaison.	Overview of NSE Ruling on SNWA Spring Valley applications; monitoring plan writing/revision (introduction/background and objectives); sensitive species in IBMA; baseline data gathering; USGS Great Basin Integrated Landscape Monitoring Program
8	EC/BWG core team meeting (call)	2007 05/11	1 hour	n.a.	Updates and feedback; CAP workshop; BWG chairperson rotation; monitoring to meet both Stipulation and NSE requirements
9	BWG working meeting	2007 06/05	8 hours	15 attendees. BWG members & participants: 1 SNWA, 2 FWS, 1 BLM, 1 NPS, 1 BIA, 3 NDOW, 1 UDWR. EC member: 1 FWS. 1 BLM EIS liaison. 1 DOI liaison. Invited: 1 TNC, 1 NSE.	TNC presentation on CAP process; hydrologic and biologic monitoring site selection; biologic rationale and BWG recommendation to TRP re: piezometer sites; coupling spring monitoring with monitoring well network; monitoring plan writing/revision (introduction/background and objectives); BWG and TRP collaboration

Conservation Action Planning

Developing Strategies, Taking Action, and Measuring Success at Any Scale

Overview of Basic Practices

Version: February 2007

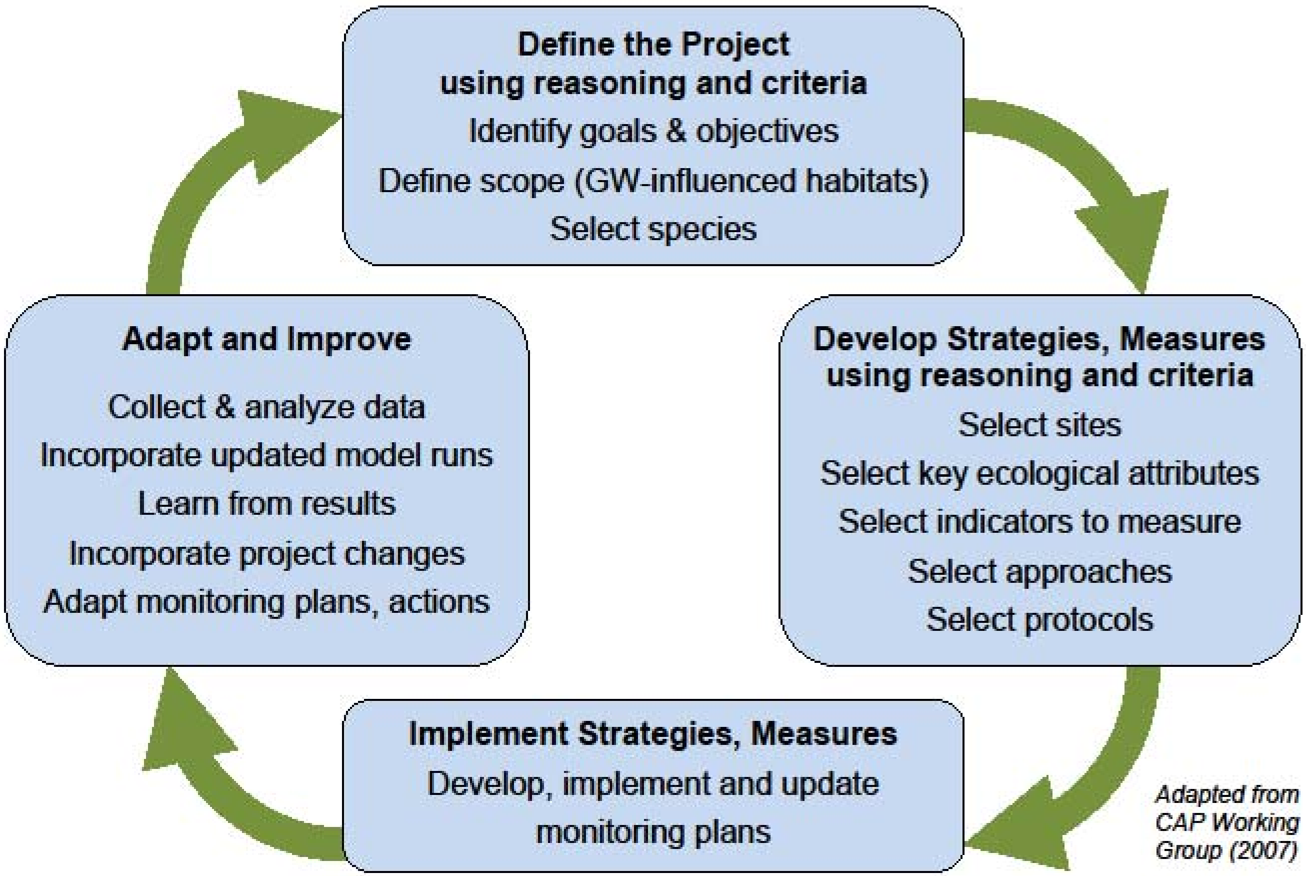


Figure 3-1
BWG and BRT Use of TNC Conservation Action Planning (CAP) Process

JIM GIBBONS
Governor

ALLEN BIAGGI
Director

STATE OF NEVADA

TRACY TAYLOR, P.E.
State Engineer

ROBERT "BOB" COACHE, P.E.
Deputy State Engineer

SOUTHERN NEVADA BRANCH OFFICE
(702) 486-2770

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
SOUTHERN NEVADA BRANCH OFFICE
400 Shadow Lane, Room 201
Las Vegas, Nevada 89106
http://water.nv.gov

January 23, 2009

Kenneth Albright, P. E.
Director, Groundwater Resources
Southern Nevada Water Authority
100 City Pkwy #700
Las Vegas, NV 89106-4615

Re: State Engineer's Approval of Spring Valley Biological Plan

Dear Mr. Albright:

On September 8, 2006, a stipulation for the withdrawal of protest was reached between the Southern Nevada Water Authority (SNWA) and the U.S. Department of the Interior on behalf of Bureau of Indian Affairs (BIA), Bureau of Land Management, (BLM), U.S. Fish and Wildlife Service (FWS), and National Park Service (NPS) (DOI Bureaus).

A condition of this stipulation was the establishment of a Spring Valley Biological Monitoring Plan by representatives of multiple agencies known as the Spring Valley Biological Work Group which this office is not a party. Additionally, as part of Ruling No. 5726 in the matter of SNWA's applications to appropriate ground water in the Spring Valley Hydrographic Basin, the State Engineer also required a Biological Monitoring Plan.

The State Engineer's office has reviewed the "Biological Monitoring Plan for the Spring Valley Stipulation" dated January 2009 developed by the Biological Work Group and offers the following. The State Engineer's office finds the Biological Monitoring Plan for the Spring Valley Stipulation dated January 2009 to be comprehensive and compliant with the State Engineer's requirement for the development of a Biological Monitoring

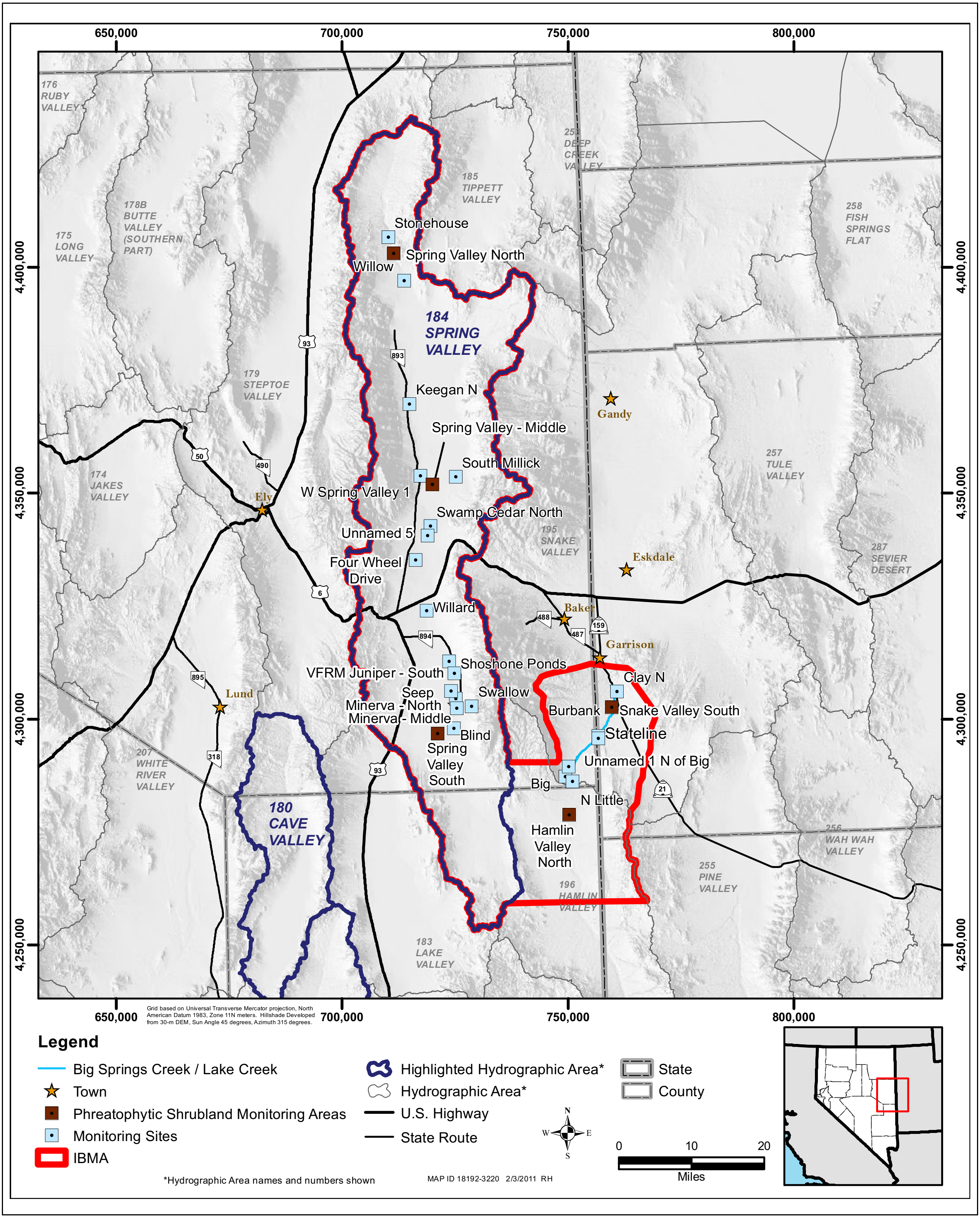


Figure 3-2
Biological Monitoring Sites in the IBMA, Spring Valley Stipulation

SNWA Exhibit 363

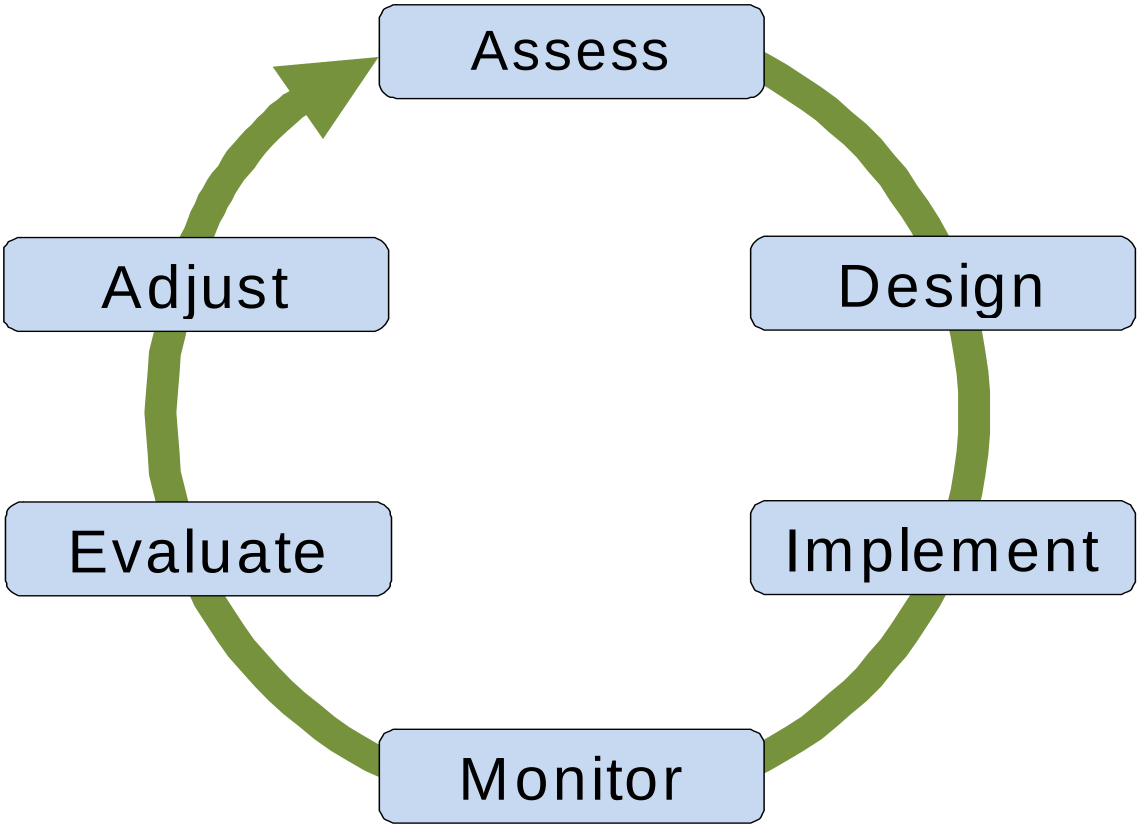


Figure 6-1 Adaptive Management Flow Diagram, Department of Interior Adaptive Management Technical Guide 5 (2007)

Doc No. ERD-ED-000X

Environmental Resources Division

Spring Valley Stipulation
Biological Monitoring Plan
2009 Annual Report

March 2010

Prepared by
Southern Nevada Water Authority
Water Resources Division
P.O. Box 99956
Las Vegas, Nevada 89193-9956

Submitted to
Nevada State Engineer
and the Stipulation
Executive Committee

SNWA Exhibit 368

SOUTHERN NEVADA WATER AUTHORITY

Environmental Resources Division

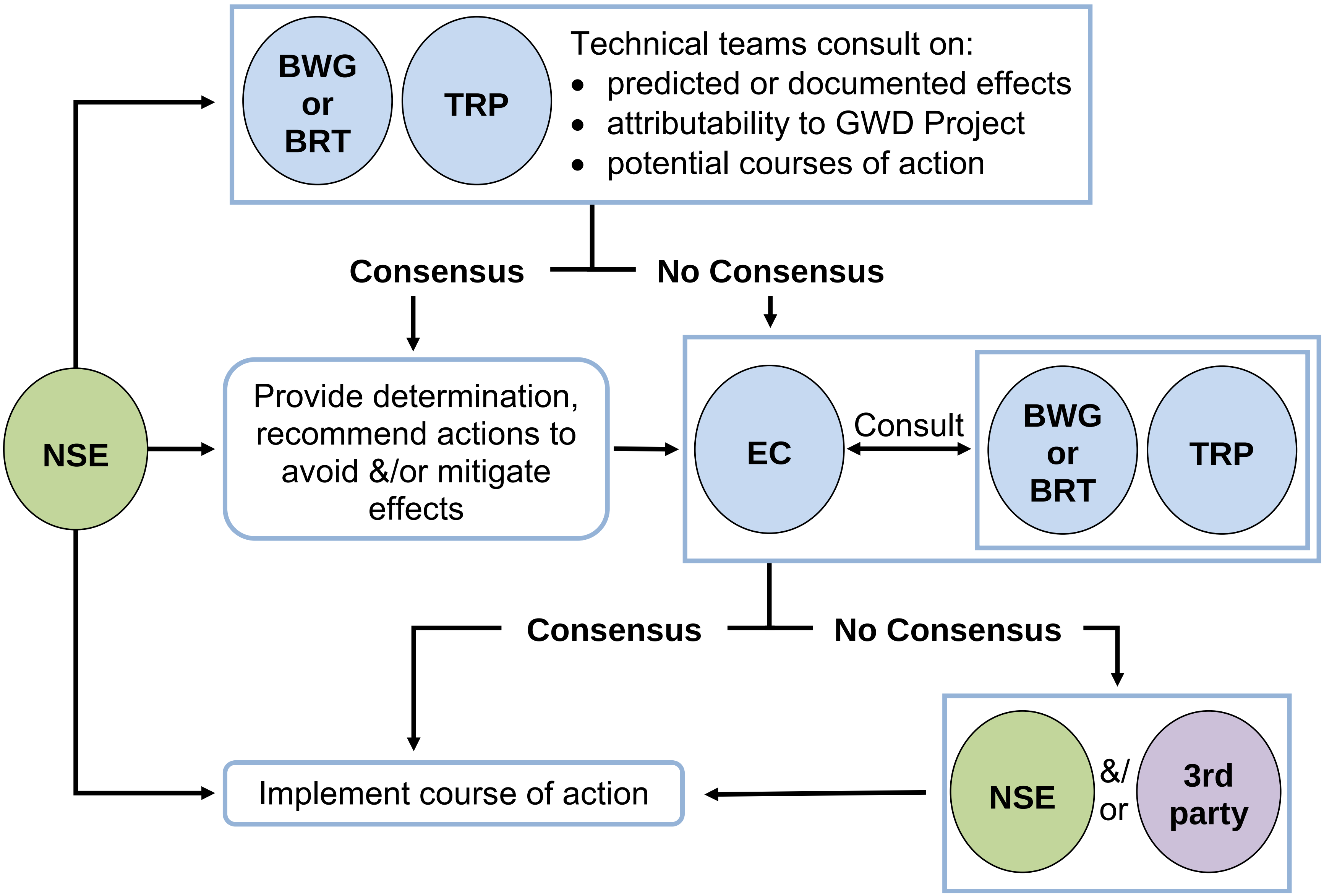
Spring Valley Stipulation Biological Monitoring Plan 2010 Annual Report

March 2011

Prepared by
Southern Nevada Water Authority
Water Resources Division
P.O. Box 99956
Las Vegas, Nevada 89193-9956

Submitted to
Nevada State Engineer
and the Stipulation
Executive Committee

SNWA Exhibit 369



Stipulation Consultation and Decision-Making Process

JIM GIBBONS
Governor

STATE OF NEVADA

ALLEN BIAGGI
Director

TRACY TAYLOR, P.E.
State Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
901 South Stewart Street, Suite 2002
Carson City, Nevada 89701-5250
(775) 684-2800 • Fax (775) 684-2811
(800) 992-0900
(In Nevada Only)
http://water.nv.gov

February 9, 2009

Kenneth A. Albright, P.E.
Director, Groundwater Resources
Southern Nevada Water Authority
P.O. Box 99956
Las Vegas, NV 89143-9956

Re: Ruling 5726 - Spring Valley Hydrologic Monitoring and Mitigation Plan

Dear Mr. Albright,

We have received your February 2009 revised Spring Valley Hydrologic Monitoring and Mitigation Plan (Plan) required pursuant to Ruling 5726 regarding Permits 54003-54015, 54019, and 54020. This Plan includes monitoring and management criteria established in the Stipulated Agreement, Exhibit A, between SNWA and the Federal Agencies, and provides for additional monitoring requirements near Cleve Creek and Turnley Spring. One additional monitoring well will be completed at a site to be determined north of the northernmost production well on the east side of Spring Valley.

The Plan as submitted is hereby accepted with the understanding that monitoring and management are ongoing processes, subject to modifications if unforeseen conditions are encountered, or if significant changes to the ground-water development project are to occur.

Please do not hesitate to call me at (775) 684-2866 if you have any questions concerning this letter or the requirements of the Plan.

Sincerely,

Richard A Felling

Richard A. Felling
Chief, Hydrology Section

Cc: Jason King (email)
Bob Coache (email)
Andrew Burns, SNWA (email)

Doc No. WRD-ED-0003

Southern Nevada Water Authority

Water Resources Division

Spring Valley Hydrologic Monitoring and Mitigation Plan (Hydrographic Area 184)

February 2009

Prepared by
Southern Nevada Water Authority
Water Resources Division
P.O. Box 99956
Las Vegas, Nevada 89193-9956

Approved by the
Nevada State Engineer
to Fulfill Requirements of
Ruling #5726
February 9, 2009

SNWA Exhibit 151

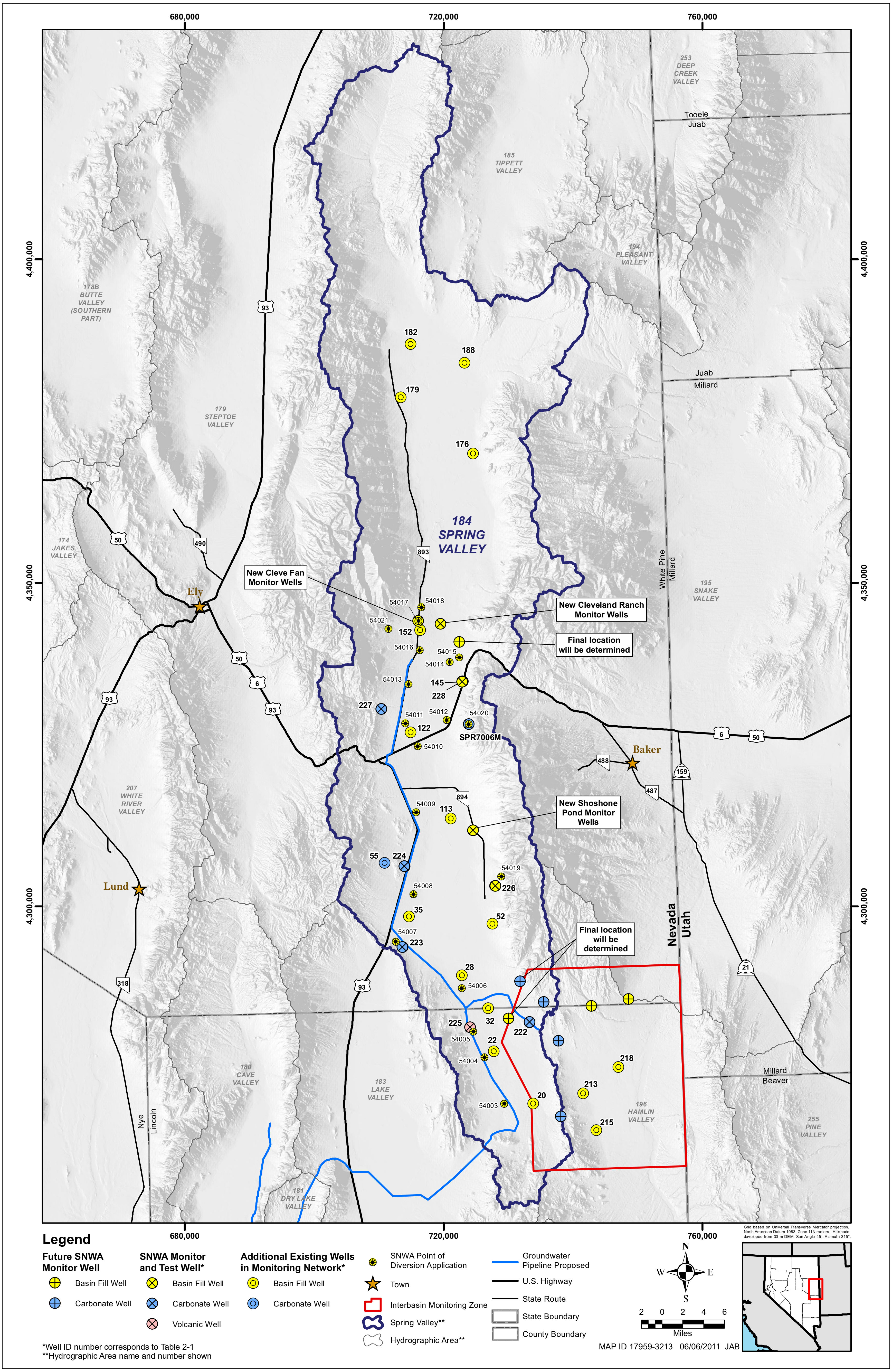


Figure 2-1
Spring Valley Monitoring Plan Well Network

SNWA Exhibit 147

Table 2-1
Spring Valley Existing-Well Monitoring Network

Map ID	Site Number	Station Local Number	Location[a] UTM Northing (m)	UTM Easting (m)	NDWR Log Number	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)	Date of Recent DTW Meas.	Recent DTW Meas. (ft bgs)	Aquifer	Monitor Frequency
22	383704114225001	184 N09 E68 30AAAB 1 USGS-MX (Spring Valley S.)	4,277,594.57	727,759.99	22176	6,002.52	8/7/1980	700	679	11	559 to 679	50 to 700	9/15/2010	224.90	Basin Fill	Continuous
32	384039114232701	184 N10 E68 31CD 1 USGS-MX	4,284,275.68	726,871.51	---	5,896.49	---	---	150	2	---	50 to 150	9/15/2010	118.35	Basin Fill	Continuous
35	384831114314301	184 N11 E66 23AB 1 USGS-MX	4,298,411.13	714,633.01	---	5,842.94	---	102	102	2	---	50 to 102	9/14/2010	47.52	Basin Fill	Continuous
52	384745114224401	184 N11 E68 19DCDC 1 USGS-MX (Spring Valley)	4,297,304.22	727,554.19	---	5,900.18	---	200	200	2	---	50 to 200	9/15/2010	100.11	Basin Fill	Continuous
122	390352114305401	184 N14 E66 24BDDD 1 USGS-MX (Spring Valley N.)	4,326,894.19	714,873.84	---	5,846.04	1980	---	160	2	---	50 to 160	9/15/2010	38.76	Basin Fill	Continuous
145	390803114251001	184 N15 E67 26CA 1 USGS-MX	4,334,740.47	722,963.02	---	5,727.21	---	---	200	2	---	50 to 200	9/15/2010	40.30	Basin Fill	Continuous
179	393211114320701	184 N19 E66 11B 1	4,378,627.03	713,381.69	---	5,698.43	4/22/1960	---	400	---	---	50 to 400	9/15/2010	43.12	Basin Fill	Continuous
215	383023114115302	196 N08 E69 35DC 2 USGS-MX (Hamlin Valley S.)	4,265,403.02	743,597.36	---	5,837.67	8/7/1980	520	435	2	320 to 420	35 to 520	9/15/2010	174.76	Basin Fill	Continuous
222	184W502M	184 N09 E68 11 BD 2	4,282,116.34	733,294.42	102843	6,189.72	1/25/2007	1,828	1,799	8	495 to 1,779	58 to 1,828	9/15/2010	482.33	Carbonate	Continuous
223	184W504M	184 N11 E66 34 DD 2	4,293,712.49	713,647.12	102158	5,900.11	11/17/2006	1,040	1,020	8	309 to 999	61 to 1,040	9/16/2010	100.75	Carbonate	Continuous
224	184W506M	184 N12 E66 26 BA 2	4,306,214.21	713,939.81	102132	6,014.04	10/19/2006	1,160	1,140	8	430 to 1,120	80 to 1,160	9/14/2010	216.05	Carbonate	Continuous
225	184W508M	184 N09 E67 11 DB 1	4,281,308.68	724,070.89	102139	6,056.19	12/15/2006	1,180	1,160	8	376 to 1,140	241 to 1,180	9/15/2010	276.79	Volcanic	Continuous
226	SPR7007M	184 N11 E68 05 BC 2	4,303,146.59	727,976.03	---	6,017.73	8/17/2007	1,040	1,020	8	300 to 1,000	101 to 1,040	9/15/2010	147.20	Basin Fill	Continuous
227	SPR7005M	184 N14 E66 09 AB 2	4,330,471.51	710,372.44	---	6,395.68	7/10/2007	1,412	1,404	8	663 to 1,383	439 to 1,412	9/15/2010	494.24	Carbonate	Continuous
228	SPR7008M	184 N15 E67 26 CD 2	4,334,702.61	722,865.27	---	5,704.86	7/25/2007	960	946	8	226 to 926	54 to 960	9/15/2010	14.47	Basin Fill	Continuous
20	383351114180201	184 N08 E68 14A 1 USBLM	4,269,504.76	733,845.43	---	6,184.22	---	---	495	6	50 to 495	50 to 495	8/4/2010	406.52	Basin Fill	Quarterly
28	384310114261401	184 N10 E67 22AA 1 USGS-MX (Spring V Central)	4,289,331.34	722,826.33	---	5,853.54	---	---	100	2	---	50 to 100	8/3/2010	65.58	Basin Fill	Quarterly
55	184 N12 E66 21CD 1	184 N12 E66 21CD 1	4,306,700.53	710,871.15	10440	6,370.31	9/13/1966	631	631	6	3 to 631	3 to 631	8/3/2010	570.20	Carbonate	Quarterly
113	385636114265501	184 N13 E67 33DDA 1	4,313,590.54	721,086.82	---	5,769.73	---	---	--	36	---	---	5/5/2010 8/4/2010	7.47 Dry	Basin Fill	Quarterly
152[b]	391224114293601	184 N16 E66 36DBAD 1 USBLM - Cleve Creek Well	4,342,683.25	716,362.90	---	5,870.25	---	---	--	---	---	---	8/3/2010	207.74	Basin Fill	Quarterly
176	392703114230501	184 N18 E67 01CCAA 1	4,369,956.56	724,523.82	---	5,587.78	---	---	42	38	---	---	8/3/2010	35.13	Basin Fill	Quarterly
182	184 N20 E66 13AB 1	184 N20 E66 13AB 1	4,386,884.19	714,871.84	9157	5,774.93	6/26/1966	907	296	16	135 to 296	---	8/3/2010	125.91	Basin Fill	Quarterly
188	393442114231801	184 N20 E67 26ABBD 1 USBLM	4,383,955.15	723,240.35	---	5,708.77	---	130	130	6	---	50 to 130	8/3/2010	118.39	Basin Fill	Quarterly
213	383325114134901	196 N08 E69 15B 1	4,271,103.41	741,539.28	---	5,729.98	---	---	110	6	---	50 to 110	8/4/2010	71.41	Basin Fill	Quarterly
218	383533114102901	196 N08 E70 06B 1 USBLM - Monument Well	4,275,166.91	747,014.36	548	5,676.76	7/22/1947	---	164	6	111 to 115/ 152 to 164	---	8/4/2010	89.67	Basin Fill	Quarterly

[a]All coordinates are Universal Transverse Mercator (UTM), North American Datum of 1983 (NAD83), Zone 11.
[b]The Cleve Creek well will be replaced by a new monitor well approximately 1 mi to the north.
Well-construction data are based upon best available information from well logs, MX Project Report, and direct field measurements.

SNWA Exhibit 147

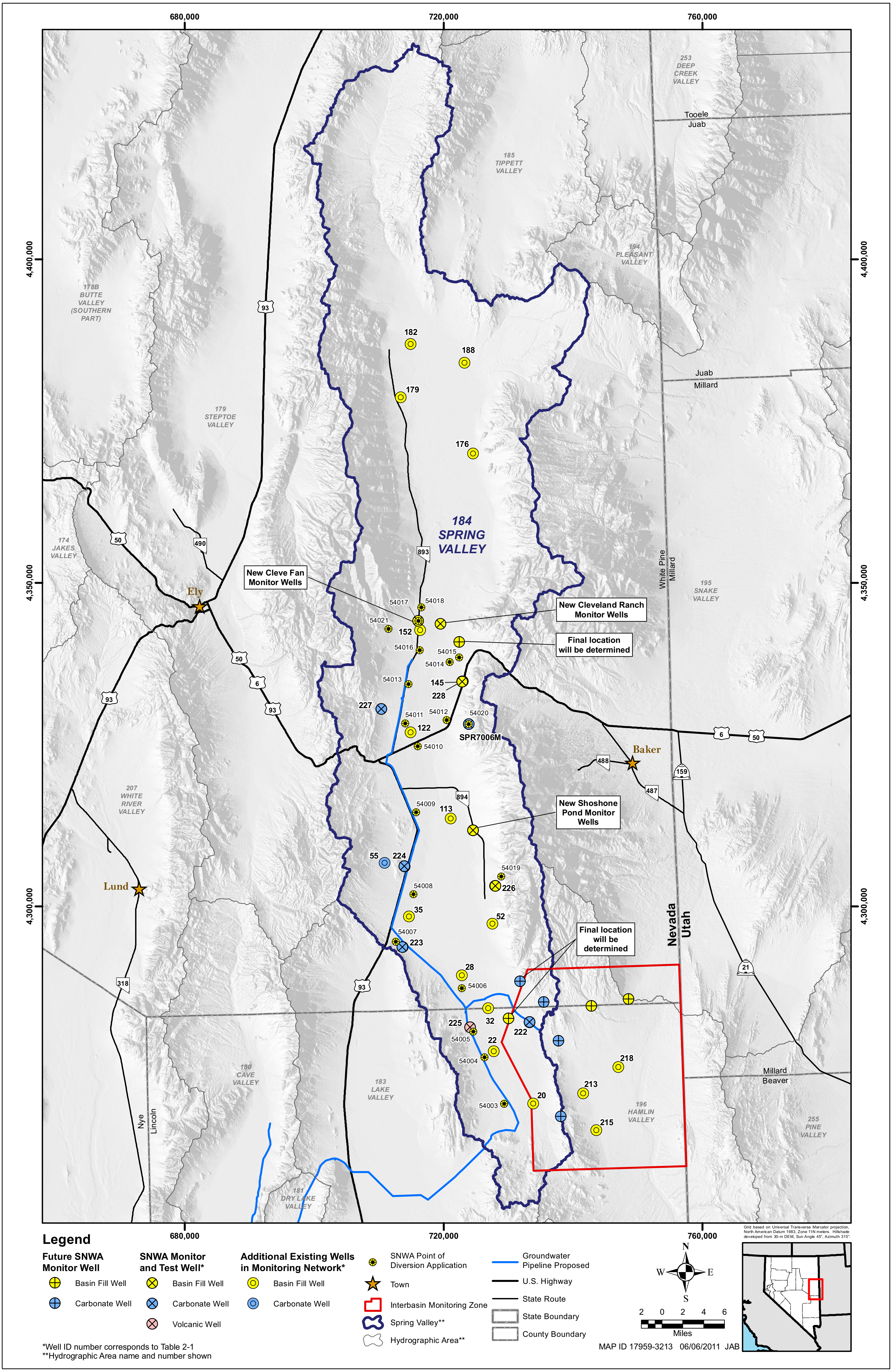


Figure 2-1
Spring Valley Monitoring Plan Well Network

SNWA Exhibit 147

Doc No. RDS-ED-0026

Southern Nevada Water Authority

Well Completion and Geologic Data Analysis Report for Monitor Wells SPR7030M and SPR7030M2 in Spring Valley

June 2011

SNWA Exhibit 179

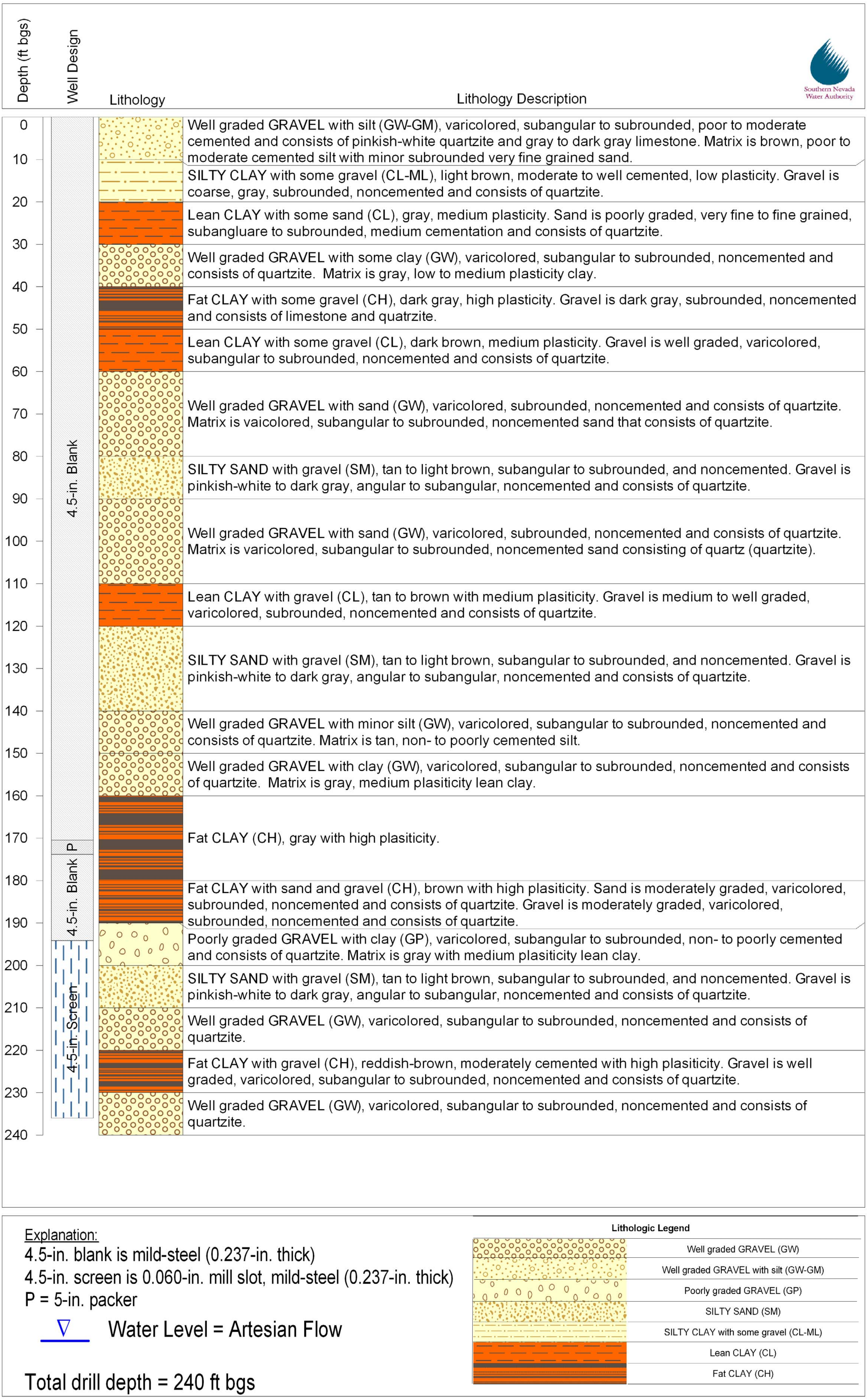


FIGURE 10
MONITOR WELL SPR7030M2 BOREHOLE STRATIGRAPHIC COLUMN

Doc No. RDS-ED-0027

Southern Nevada Water Authority

Well Completion and Geologic Data Analysis Report for Monitor Wells SPR7029M and SPR7029M2 in Spring Valley

June 2011

SNWA Exhibit 180

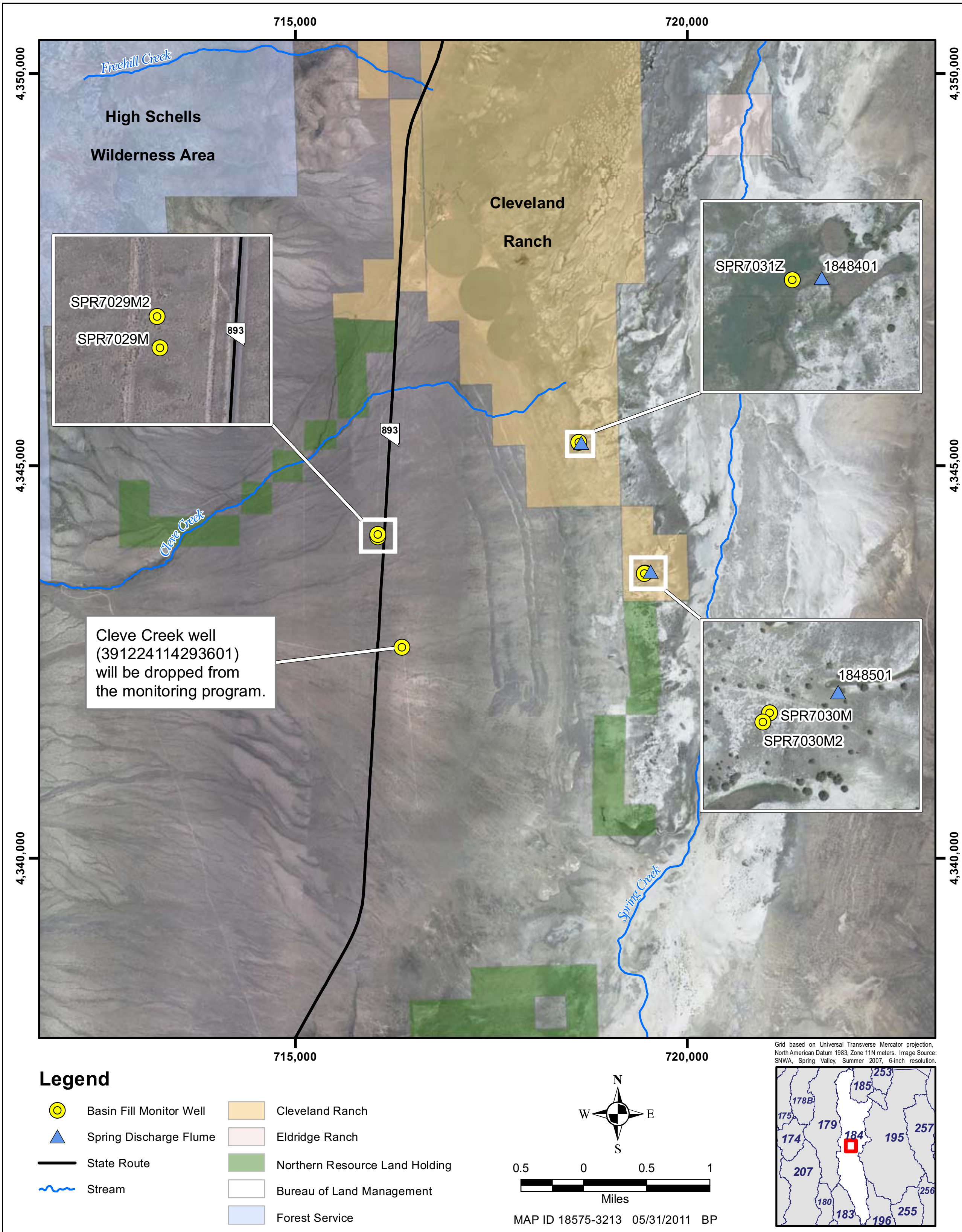


Figure 13
Monitoring Locations Associated with Cleveland Ranch

SNWA Exhibit 149

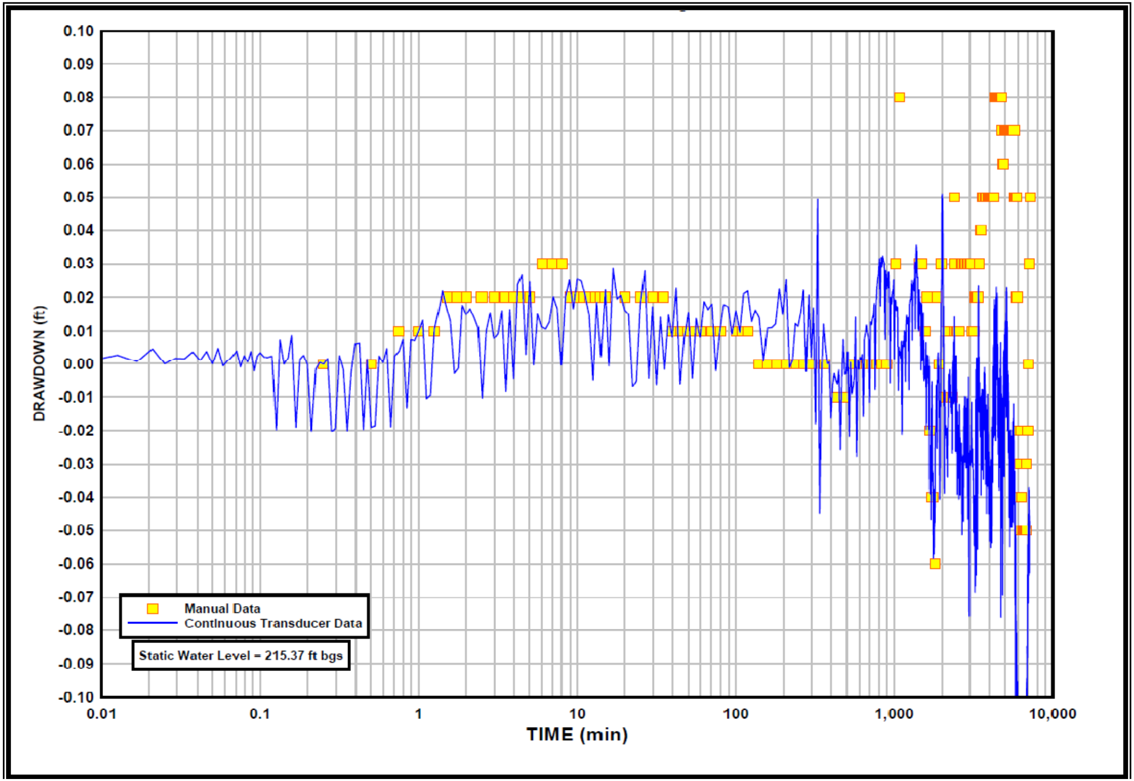


Figure D- 3
SPR7029M Semi-Log Constant-Rate Drawdown

SNWA Exhibit 177

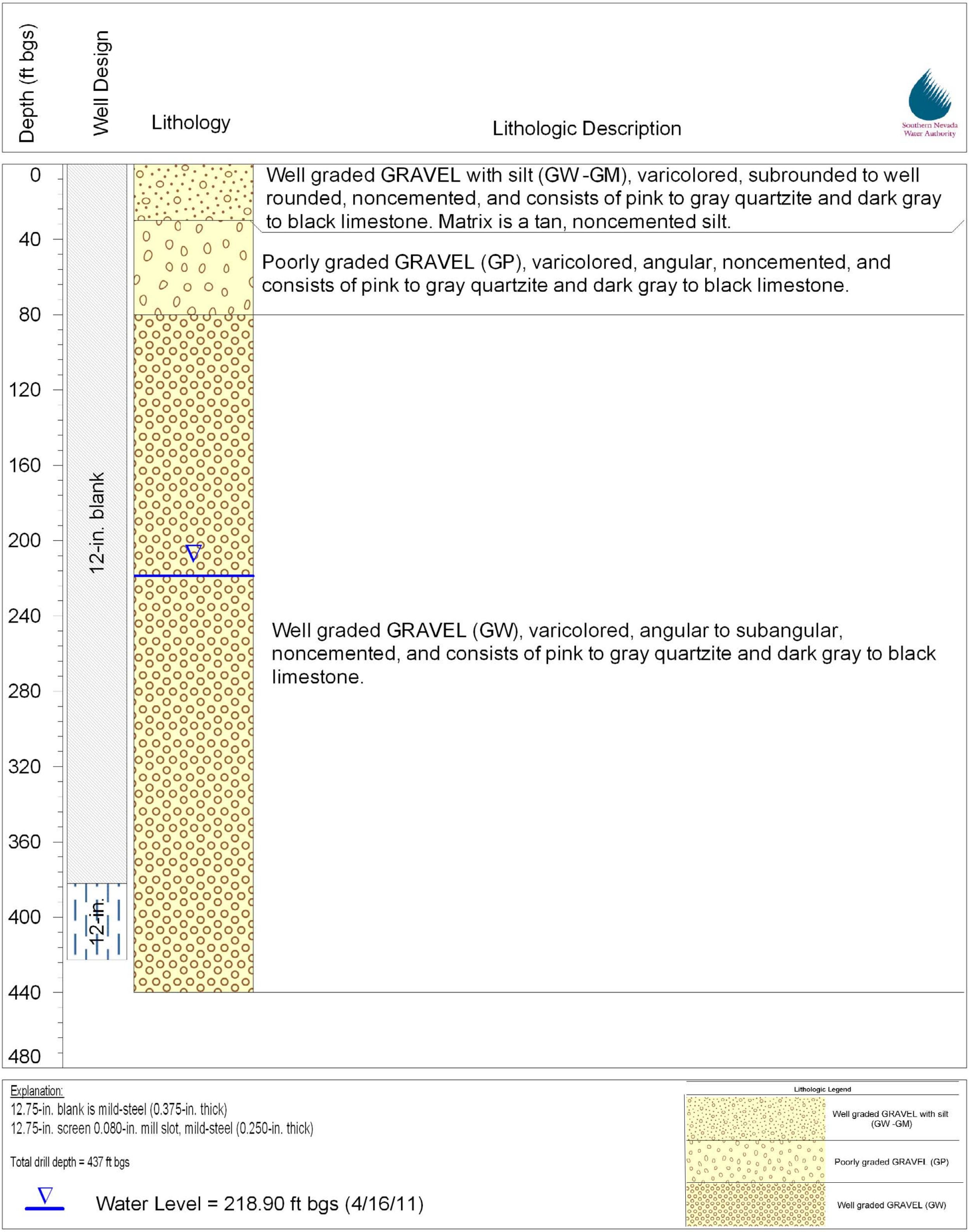


FIGURE 10
MONITOR WELL SPR7029M2 BOREHOLE STRATIGRAPHIC COLUMN

SOUTHERN NEVADA WATER AUTHORITY
100 CITY PARKWAY, SUITE 700
LAS VEGAS, NV 89106

PRELIMINARY DATA MEMO

June 28, 2011

WELL DEVELOPMENT AND AQUIFER TESTING RESULTS TEST WELL SPR7029M2 SPRING VALLEY, NV

Prepared by: James Prieur and Chris Ashinhurst

Introduction

This memorandum presents preliminary data associated with the development and hydraulic testing at monitor well SPR7029M2 located in western Spring Valley, NV. The program was conducted between May 17 and 26, 2011 and consisted of development, a step-drawdown test and a 120-hr constant-rate aquifer test. This memorandum includes well construction, regional background information and test data including discharge rates, water levels, specific capacity, and field water chemistry data. The field data collected is presented in the form of summary tables and graphs in the appendices.

A comprehensive hydrologic analysis report will be prepared for this site, which will present hydrologic and water chemistry data, analysis, and results. Data is provisional and has not been processed through the quality control program review.

Background Information

The following background information is provided to orient the reader to the location, well construction information, and water-level data for those wells measured as a part of the development and testing program. The site location section is specific to the test and observation wells, while the Regional Wells section is specific to the background wells monitored during the testing. The Well Construction section provides an overview of the well construction and completion information for all wells monitored.

Site Location

Monitor well SPR7029M2, which was used as the pumping well during hydraulic testing, is located on the west side of Spring Valley in White Pine County, Nevada, near Cleve Creek (Figure A-1). It is located 12 miles north of the intersection of U.S. Highway 93 and State Route 893 in Section 25, T16N R66E. The approximate surface elevation at the well site is 5,883 feet above mean sea level (ft amsl). One associated observation well, identified as SPR7029M, is located 110 feet to the south of SPR7029M2. Regional and site plan maps depicting the wells and spatial orientation are presented in Figures A-1 and A-2. Coordinate locations and surface

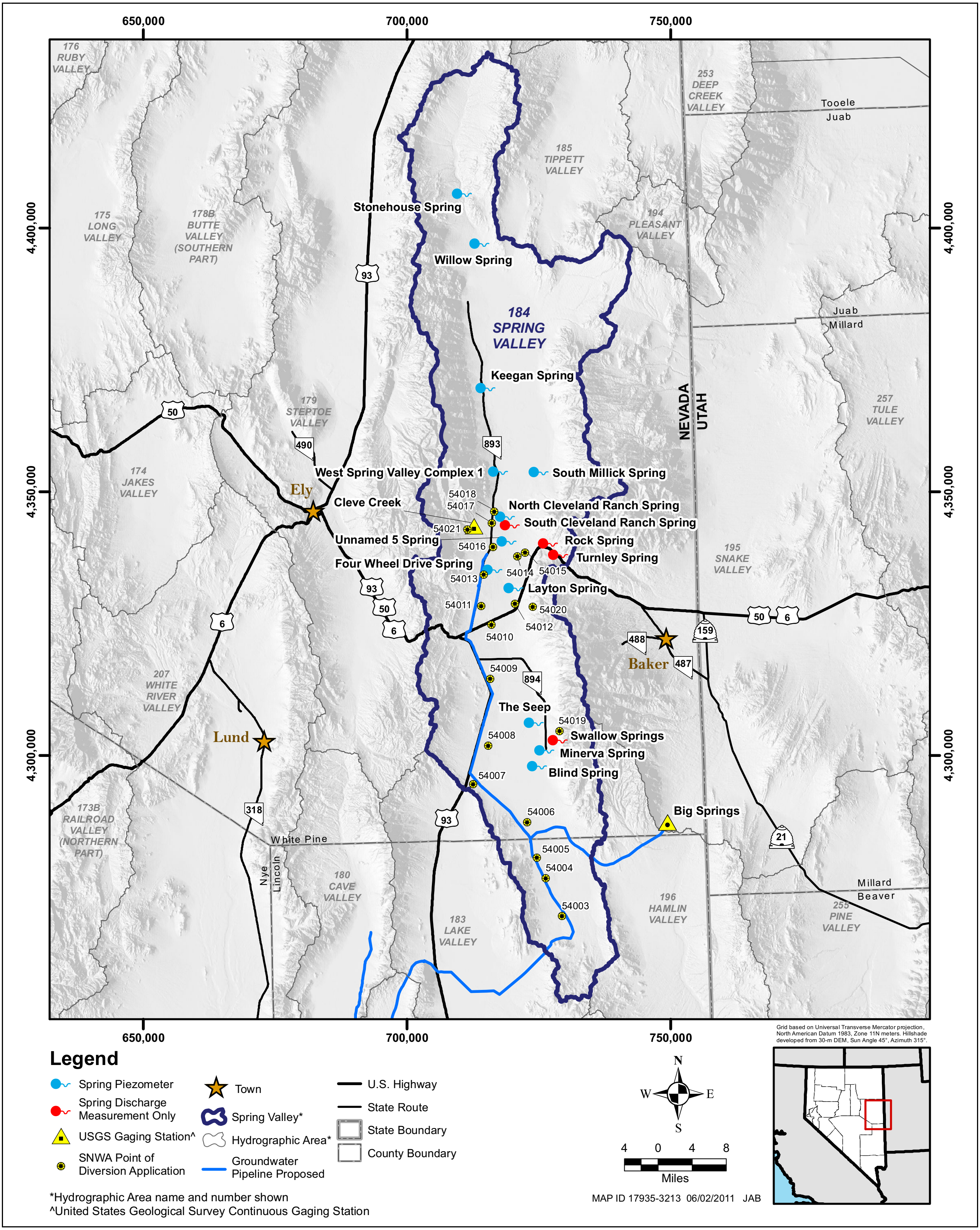


Figure 2-2
Spring Valley Monitoring Plan Spring and Stream Network

SNWA Exhibit 147

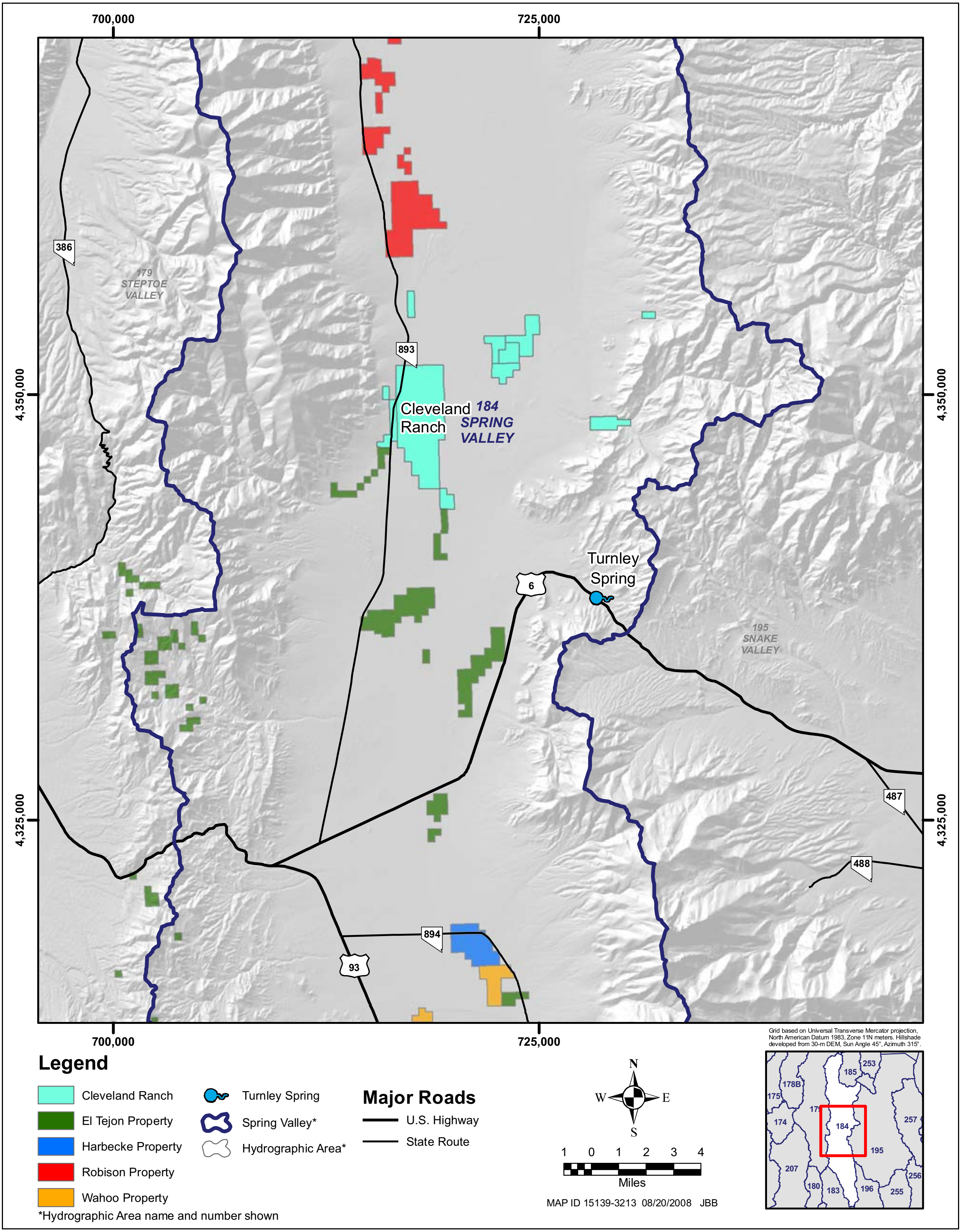


Figure 12
Location of Cleveland Ranch and Turnley Spring

SNWA Exhibit 149

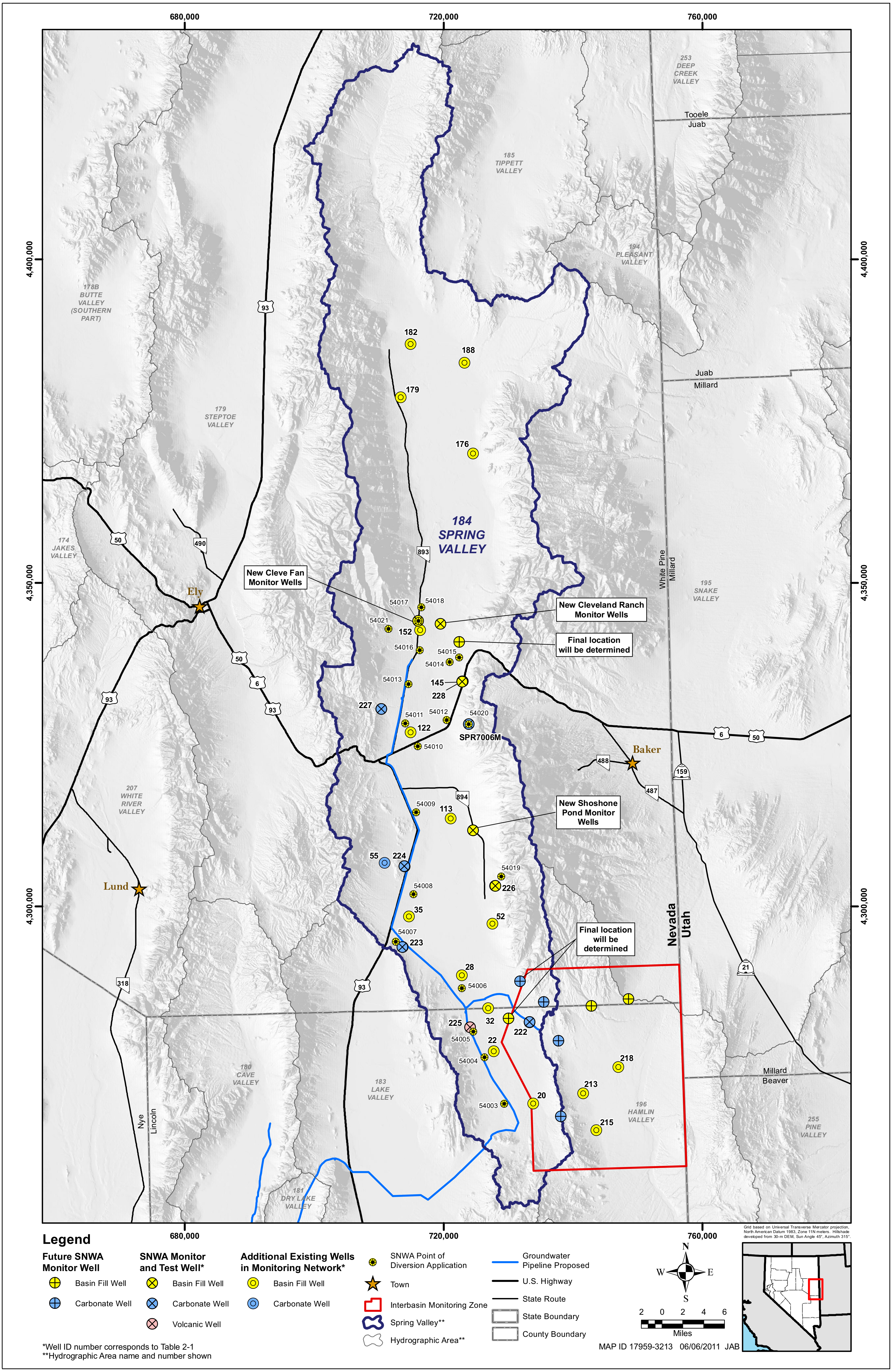


Figure 2-1
Spring Valley Monitoring Plan Well Network

SNWA Exhibit 147

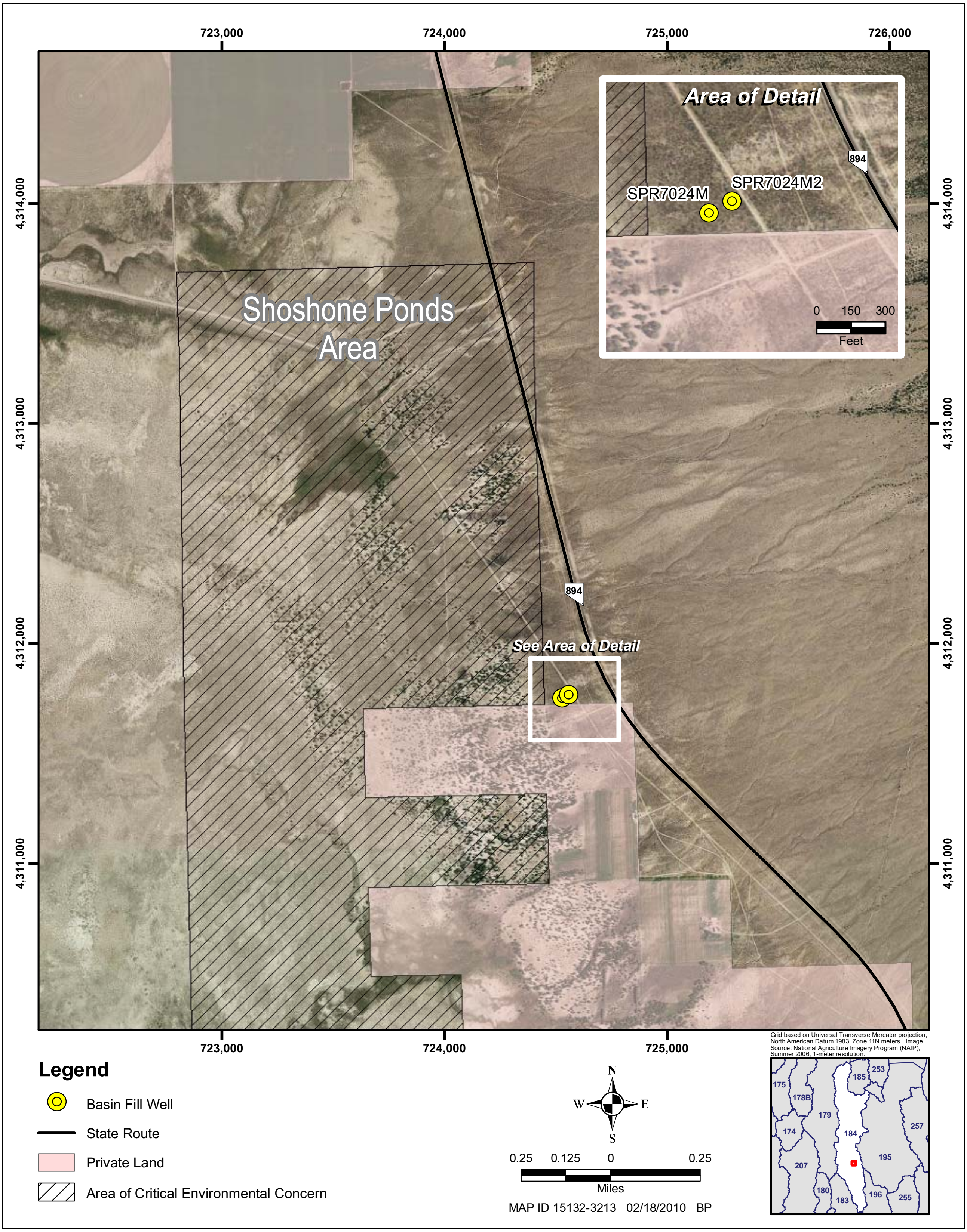


Figure 5
Location of Monitor Wells near Shoshone Ponds

SNWA Exhibit 149

Doc No. RDS-ED-0025

Southern Nevada Water Authority

Well Completion and Geologic Data Analysis Report for Monitor Wells SPR7024M and SPR7024M2 in Spring Valley

June 2011

SNWA Exhibit 178

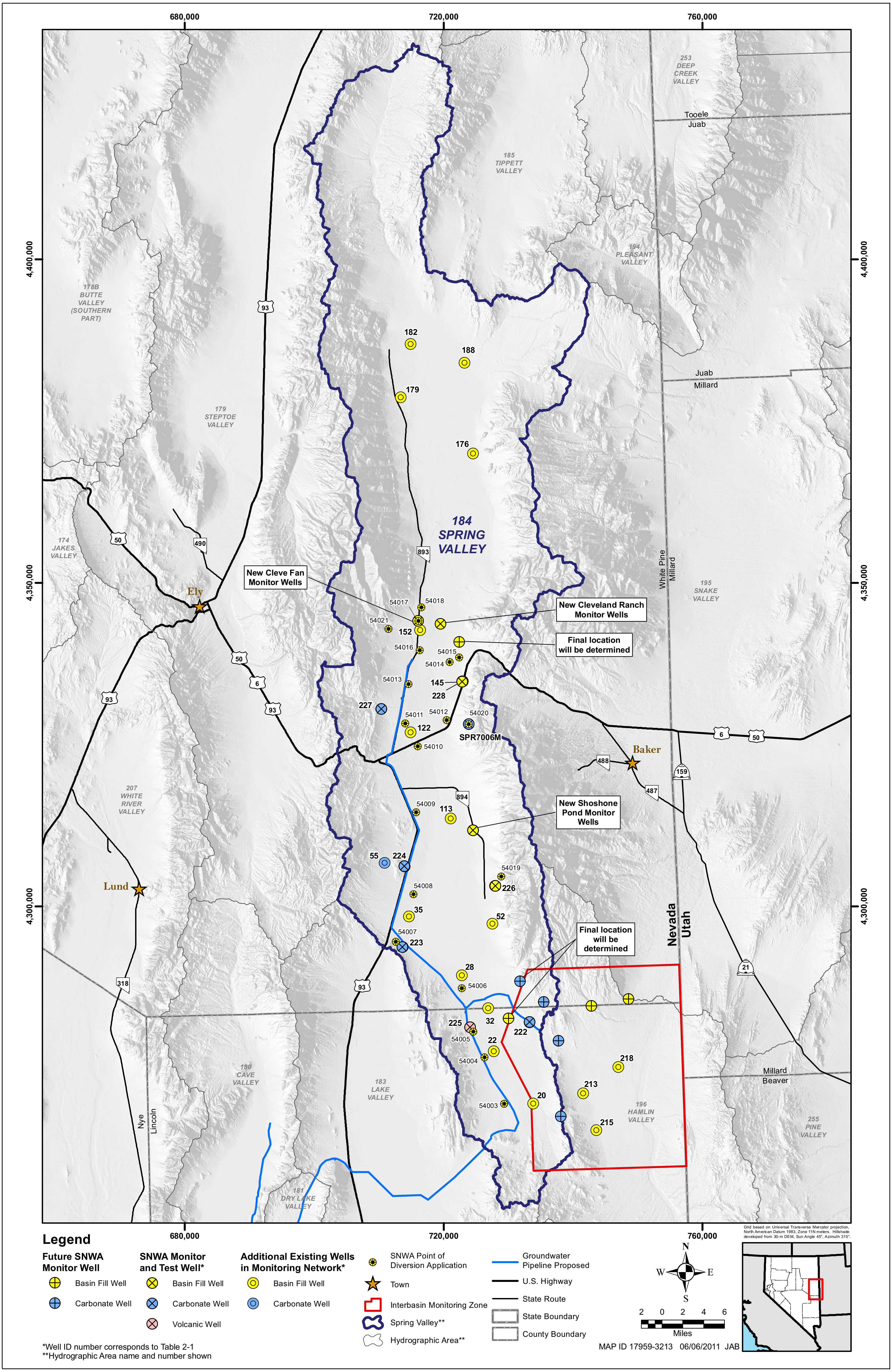


Figure 2-1
Spring Valley Monitoring Plan Well Network

SNWA Exhibit 147

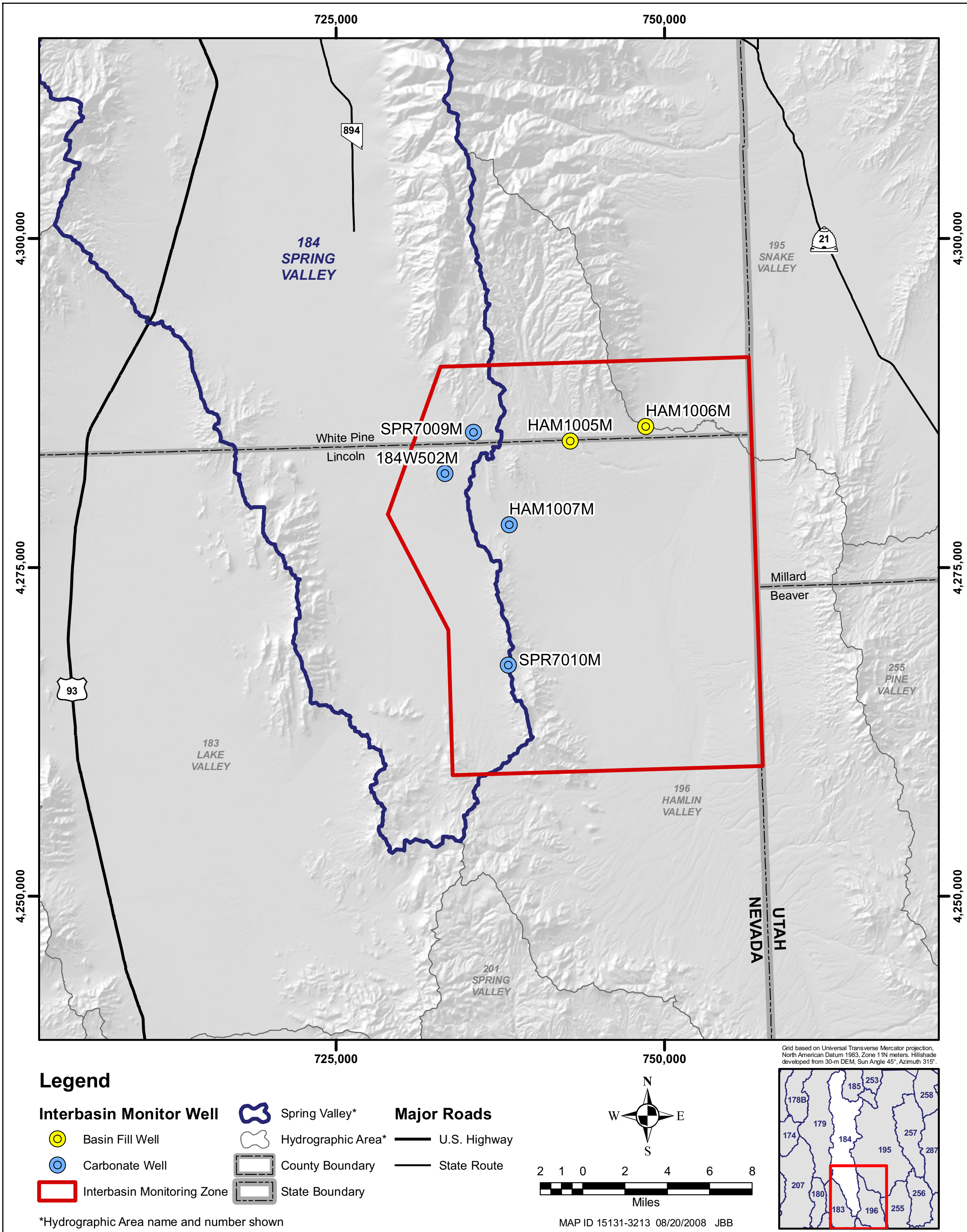


Figure 3
SNWA Interbasin Monitoring Zone Well Locations

SNWA Exhibit 149

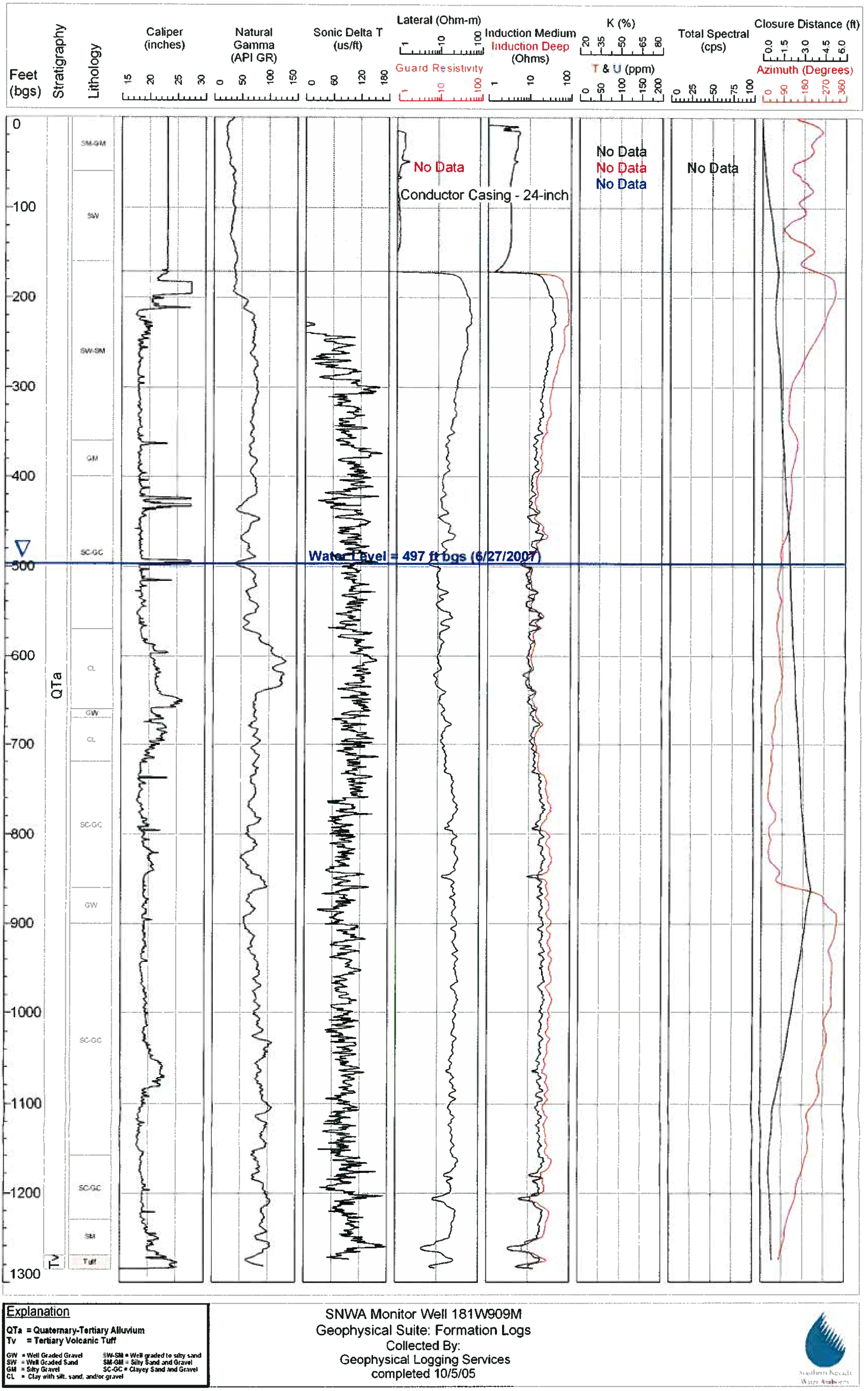
Doc No. DAR-ED-0003

Southern Nevada Water Authority

Hydrologic Data Analysis Report for Test Well 184W101 in Spring Valley Hydrographic Area 184

April 2010

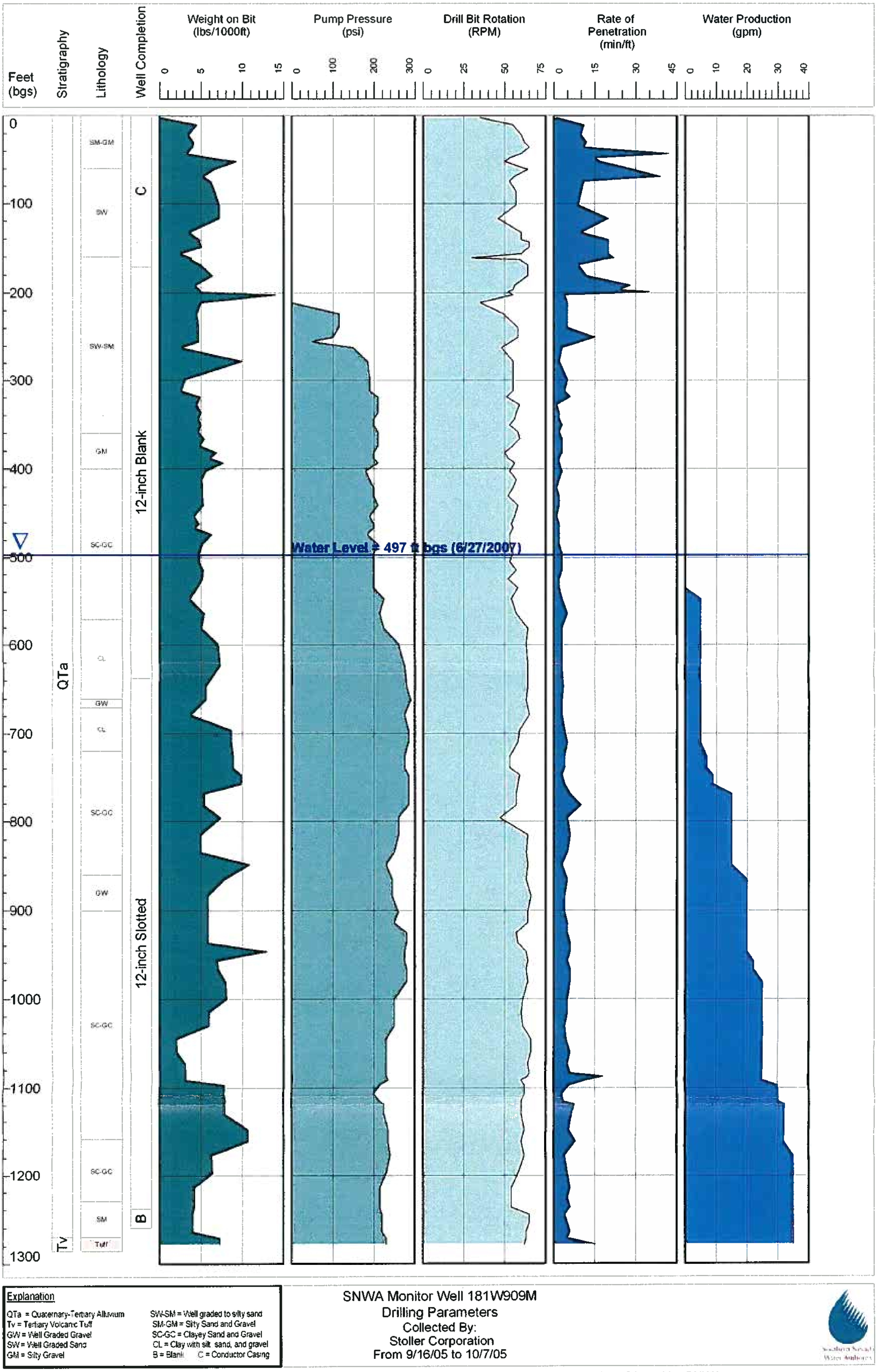
SNWA Exhibit 159



Note: Correlation with regional geologic units (Dixon et al., 2007): The Tertiary volcanic tuff is part of the Tv RGU. Plotted by SNWA.

FIGURE 10
MONITOR WELL 181W909M GEOPHYSICAL FORMATION LOGS

SNWA Exhibit 175



SNWA Monitor Well 181W909M
Drilling Parameters
Collected By:
Stoller Corporation
From 9/16/05 to 10/7/05

Note: Correlation with regional geologic units (Dixon et al., 2007): The Tertiary volcanic tuff is part of the Tv RGU. Plotted by SNWA.

FIGURE 11
MONITOR WELL 181W909M DRILLING PARAMETERS

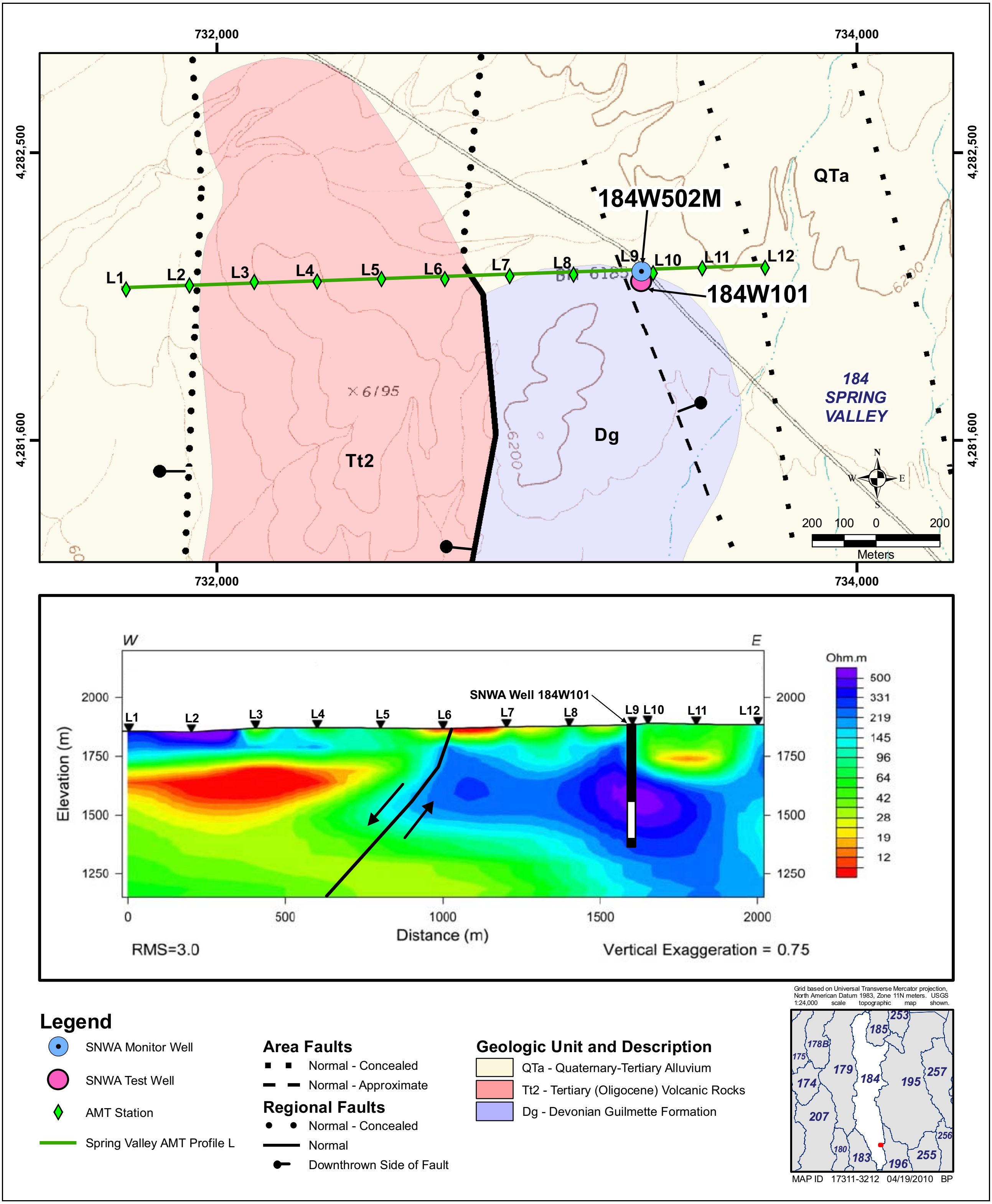


Figure 2-2
Geologic Map and Surface Geophysical Profile at Test Well 184W101

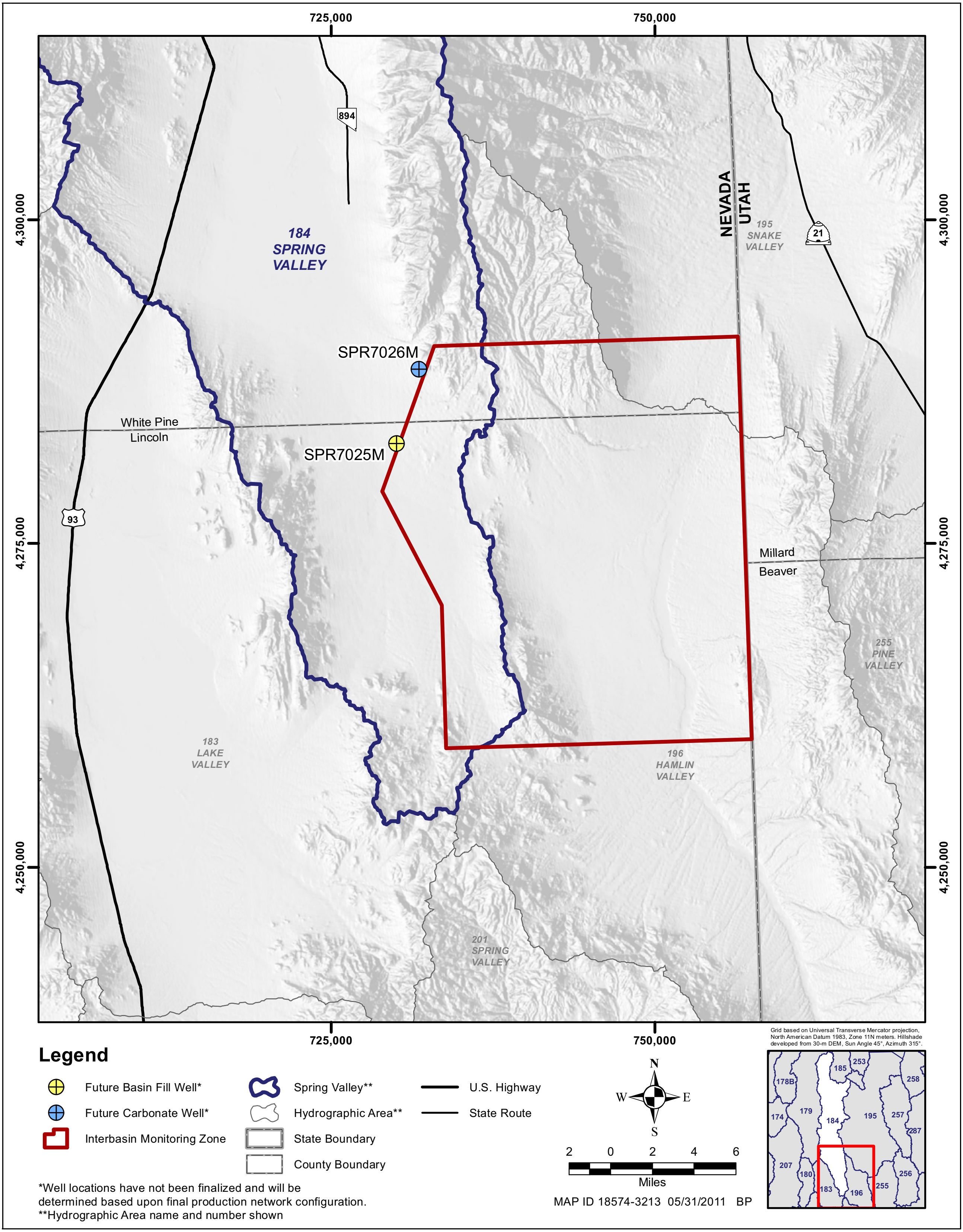


Figure 4

Proposed Near-Zone Monitor Well Locations in Spring Valley

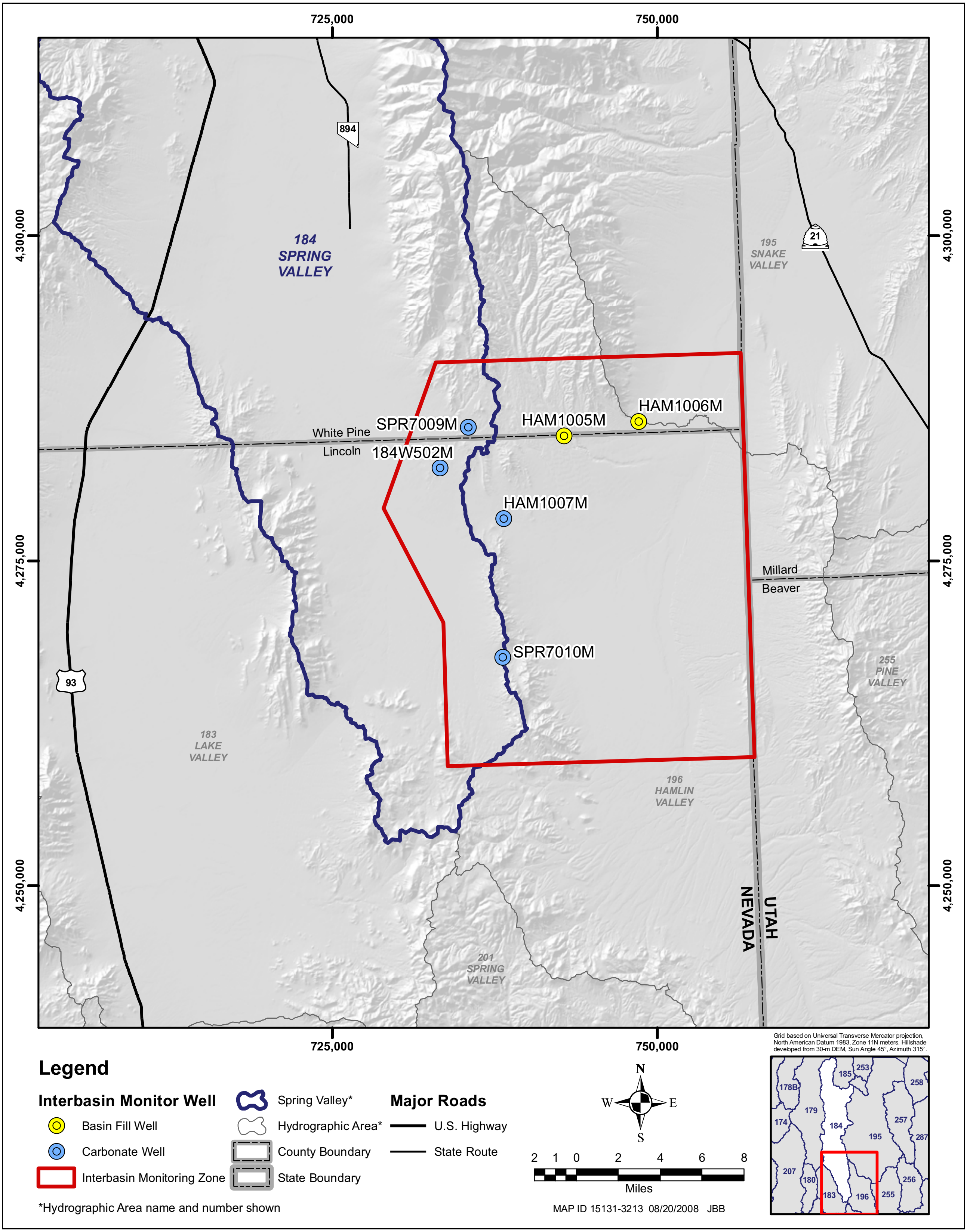


Figure 3
SNWA Interbasin Monitoring Zone Well Locations

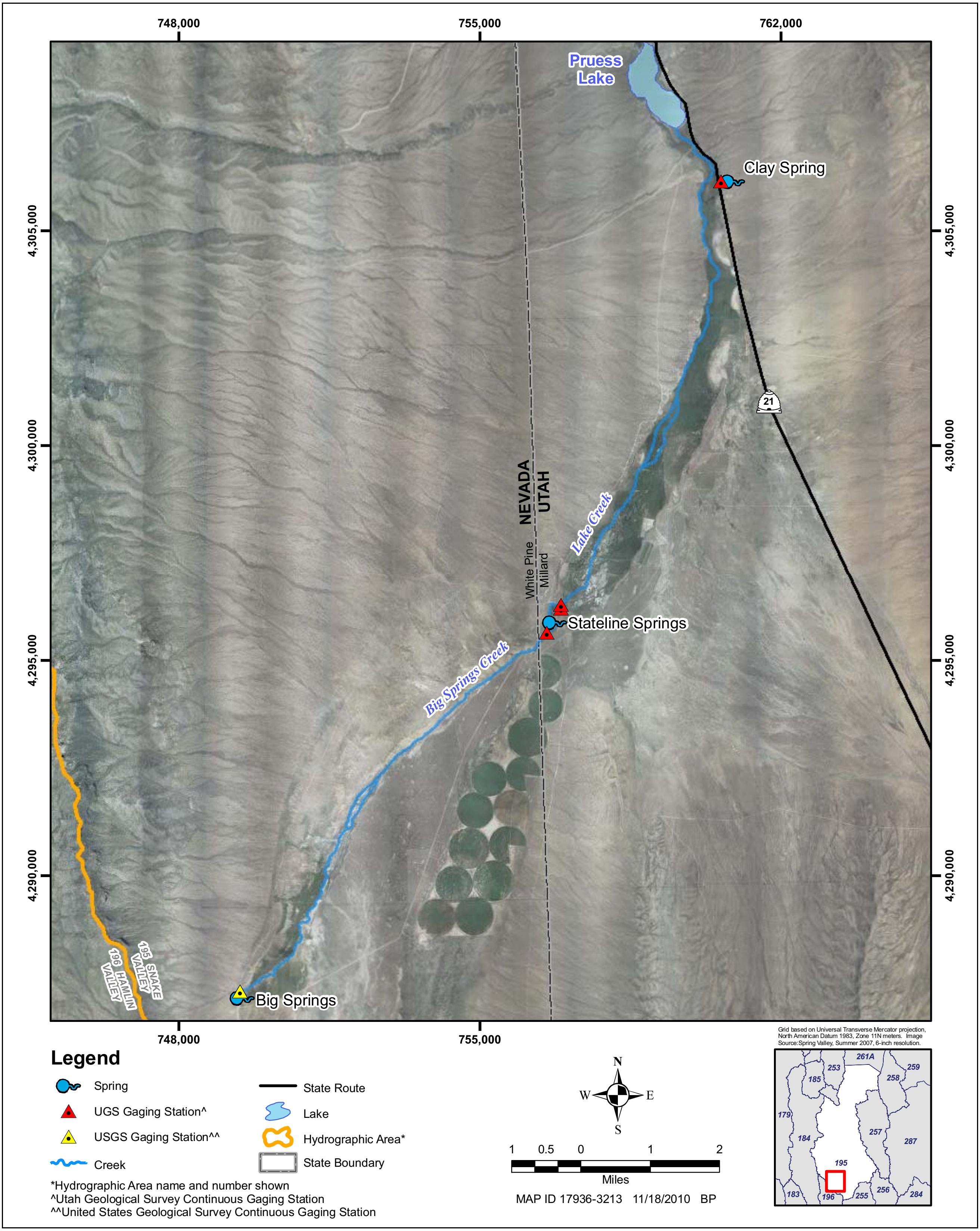


Figure 2-3
Spring Valley Monitoring Plan Big Springs and Lake Creek Complex

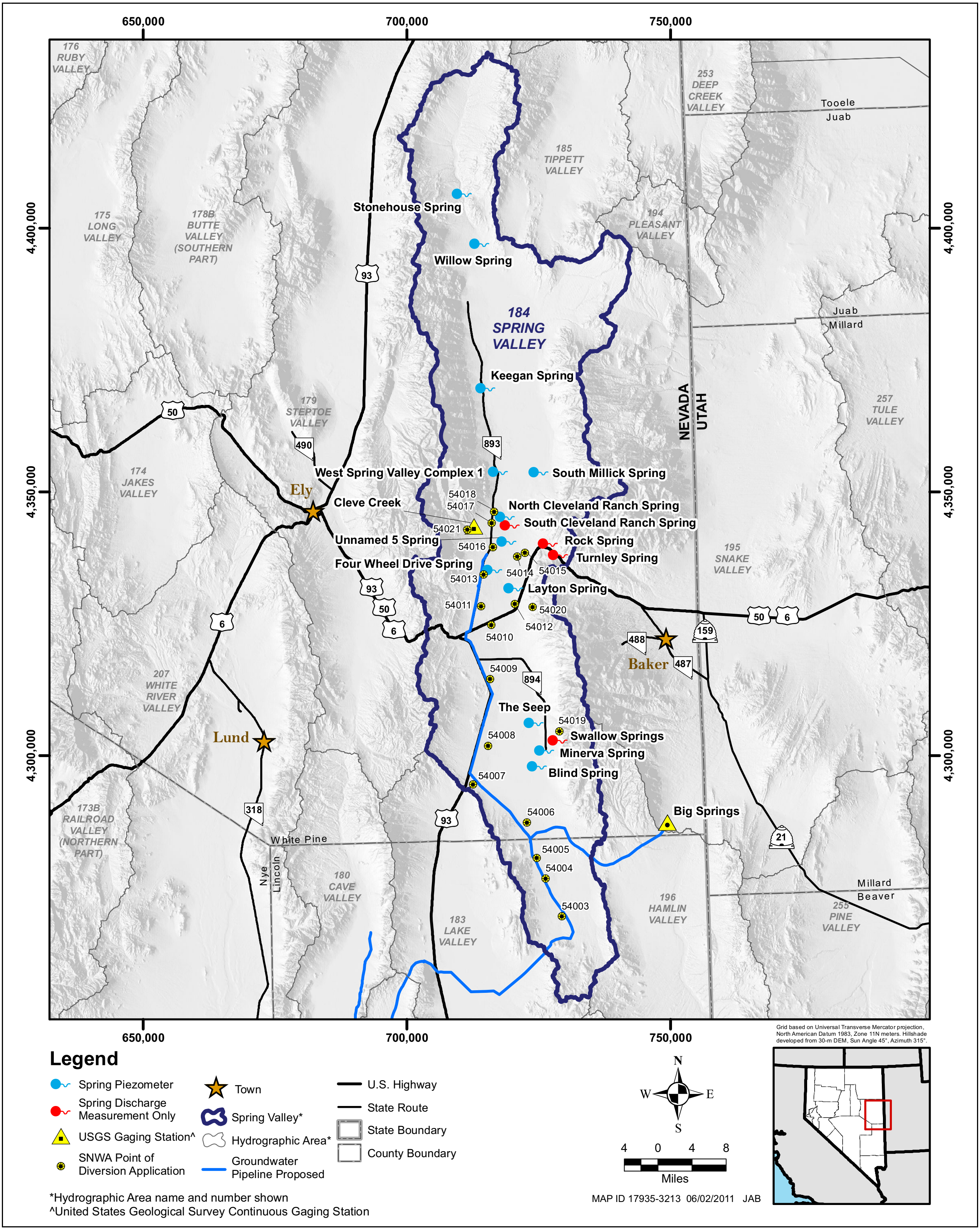


Figure 2-2
Spring Valley Monitoring Plan Spring and Stream Network

SNWA Exhibit 147

Stipulation that this Exhibit A is attached to and incorporated therein, 2) accurately characterize the groundwater gradient from Spring Valley HB to Snake Valley HB via Hamlin Valley, and 3) to avoid any effect on Federal Resources within the boundaries of Great Basin National Park from groundwater withdrawals by SNWA in the Spring Valley HB. The Parties, through the TRP and BWG (as described in Exhibit B that is attached to and incorporated in the Stipulation), shall collaborate on data collection and technical analysis and shall rely on the best scientific information available in making determinations and recommendations required by the Plan.

2. Monitoring Requirements

A. General

The Parties agree to cooperatively implement a monitoring plan sufficient to collect and analyze data to assess the effects, if any, of SNWA's proposed groundwater withdrawals in the Spring Valley HB on Federal Water Rights and Federal Resources. The monitoring network shall be comprised of SNWA exploratory wells, SNWA production wells, existing monitoring wells selected by the TRP, new monitoring wells, the springs selected by the TRP and the BWG listed in Table 1, and certain selected stream discharge sites. Some of the wells within the monitoring network shall be designed and constructed to detect any potential change in the groundwater gradient from Spring Valley HB to Snake Valley HB via Hamlin Valley HB. Other wells in the monitoring network shall be located throughout Spring Valley to provide early warning of the spread of drawdown toward Federal Water Rights and Federal Resources as well as data for future groundwater model calibration. Shallow piezometers and wells shall be used to evaluate the effects of groundwater withdrawals near discharge areas that are within areas the Parties are seeking to protect and preserve.

The cost of the monitoring plan shall be borne primarily by SNWA. The DOI Bureaus shall provide staffing to the TRP and shall seek funding to contribute to monitoring efforts. Except as otherwise provided in this Plan, each DOI Bureau is responsible for monitoring its own Federal Water Rights and Federal Resources, and for sharing this information with the other Parties within 90 days of its collection.

Any requirement of SNWA to continuously monitor wells, piezometers, and surface water sites pursuant to the Plan shall require SNWA to install all equipment necessary to continuously record discharge and/or water levels at all monitoring sites and shall, unless prevented by circumstances beyond its control, ensure that all such discharge and/or water level data is recorded on a continuous basis.

B. Exploratory and Production Well Monitoring

SNWA shall record discharge and water levels in all SNWA production wells on a continuous basis.

SNWA shall record water levels in all SNWA exploratory wells at least quarterly. Following the beginning of the groundwater withdrawals pursuant to any permits issued for the SNWA

Doc No. WRD-ED-0010

SOUTHERN NEVADA WATER AUTHORITY

Water Resources Division

2010 Spring Valley Hydrologic Monitoring and Mitigation Plan Status and Data Report

March 2011

Prepared by
Southern Nevada Water Authority
Water Resources Division
P.O. Box 99956
Las Vegas, Nevada 89193-9956

Submitted to the
Nevada State Engineer and the
Spring Valley Stipulation
Executive Committee

Doc No. WRD-ED-0007

SOUTHERN NEVADA WATER AUTHORITY

Water Resources Division

2009 Spring Valley Hydrologic Monitoring and Mitigation Plan Status and Data Report

March 2010

Prepared by
Southern Nevada Water Authority
Water Resources Division
P.O. Box 99956
Las Vegas, Nevada 89193-9956

Submitted to the
Nevada State Engineer and the
Spring Valley Stipulation
Executive Committee

Doc No. WRD-ED-0004

SOUTHERN NEVADA
WATER AUTHORITY

Water Resources Division

2008 Spring Valley Hydrologic Monitoring and Mitigation Plan Status and Data Report

March 2009

Prepared by
Southern Nevada Water Authority
Water Resources Division
P.O. Box 99956
Las Vegas, Nevada 89193-9956

Submitted to the
Nevada State Engineer and the
Spring Valley Stipulation
Executive Committee

SNWA Exhibit 156

Doc No. WRD-ED-0001

SOUTHERN NEVADA
WATER AUTHORITY

Water Resources Division

Spring Valley Stipulation Agreement Hydrologic Monitoring Plan Status and Data Report

March 2008

Prepared by
Southern Nevada Water Authority
Water Resources Division
P.O. Box 99956
Las Vegas, Nevada 89193-9956

SNWA Exhibit 154

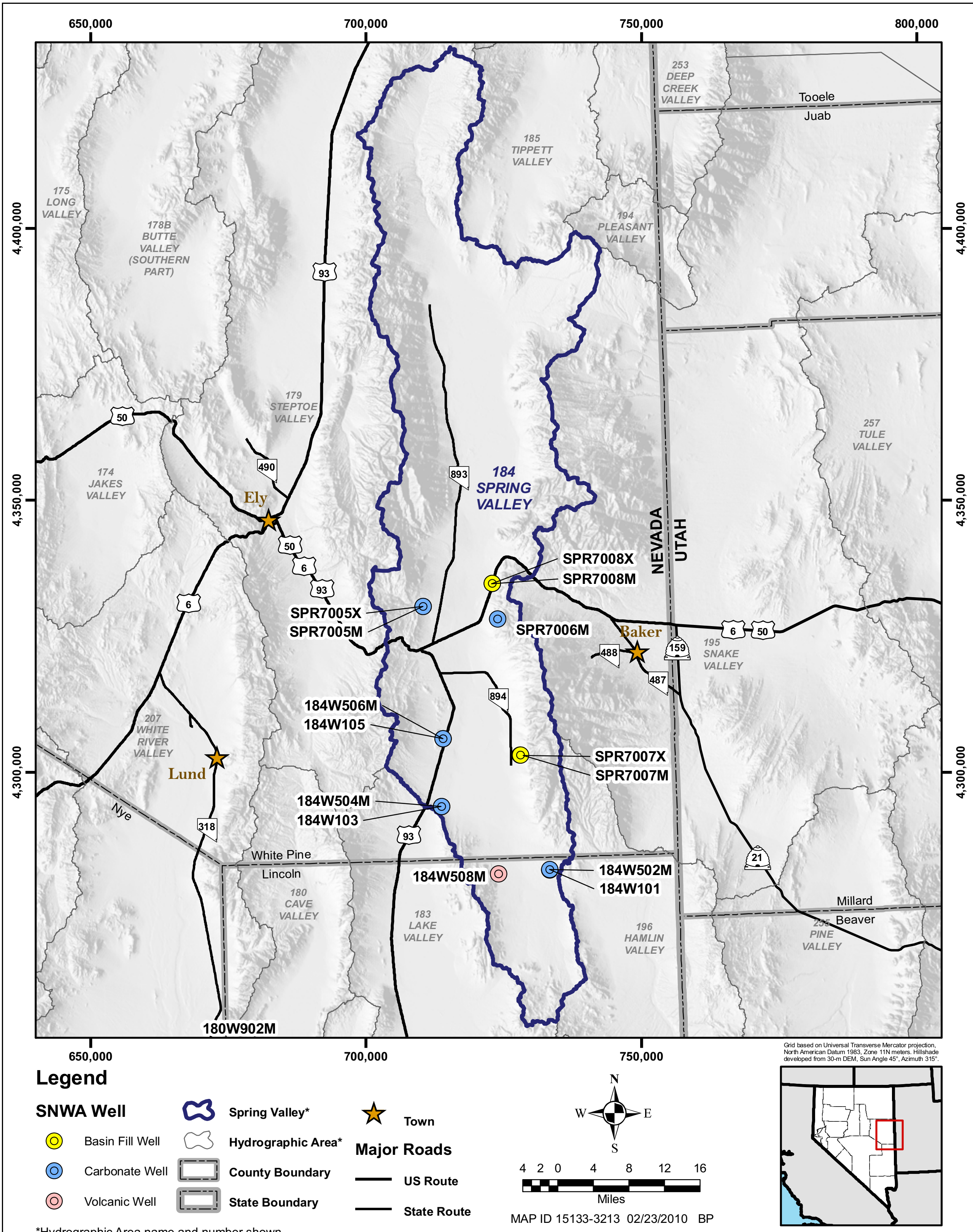


Figure 6
SNWA Exploratory and Test Wells in Spring Valley (as of June 2011)

SNWA Exhibit 149

Doc No. DAR-ED-0002

Southern Nevada Water Authority

Hydrologic Data Analysis Report for Test Well 184W105 in Spring Valley Hydrographic Area 184

August 2009

SNWA Exhibit 158

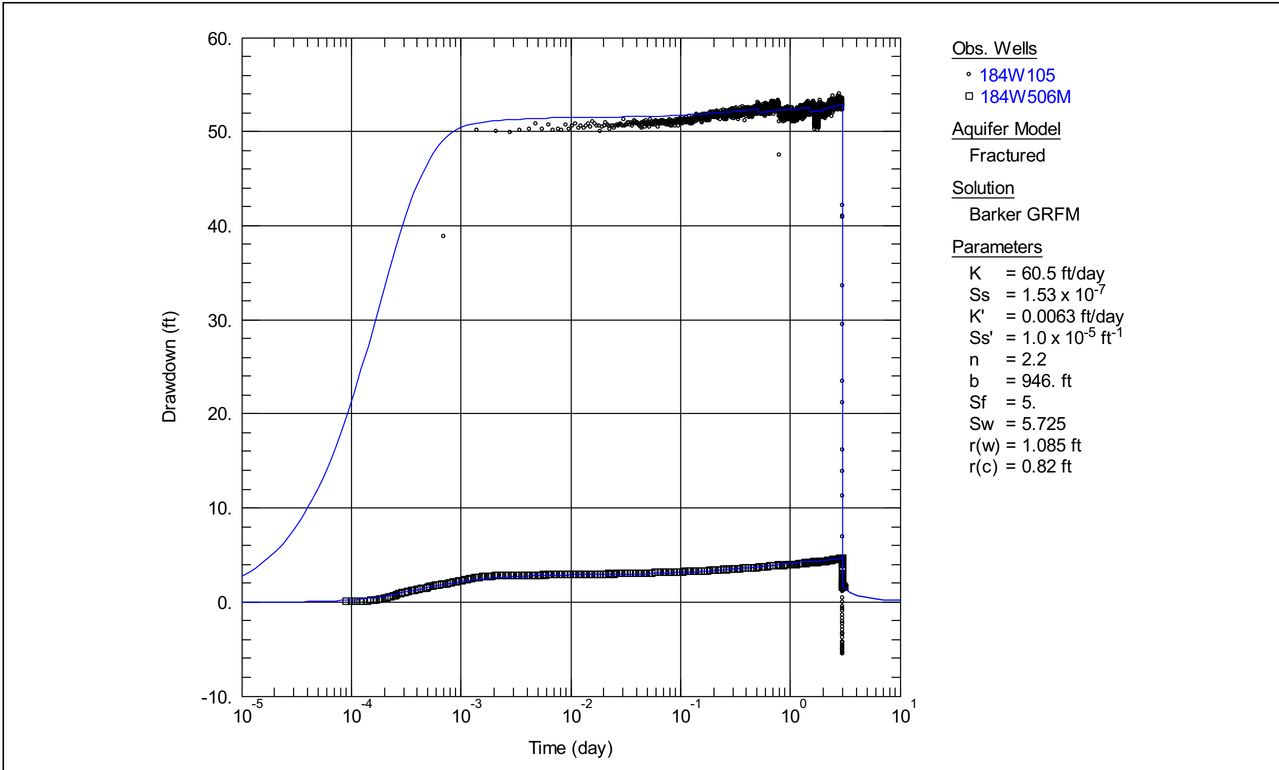


Figure 5-7
Optimal Barker GRFM Solution Pumping Period Semi-Log Plot

Doc No. DAR-ED-0004

Southern Nevada Water Authority

Hydrologic Data Analysis Report for Test Well 184W103 in Spring Valley Hydrographic Area 184

July 2010

Doc No. DAR-ED-0005

Southern Nevada Water Authority

Hydrologic Data Analysis Report for Test Well SPR7007X in Spring Valley Hydrographic Area 184

September 2010

SNWA Exhibit 161

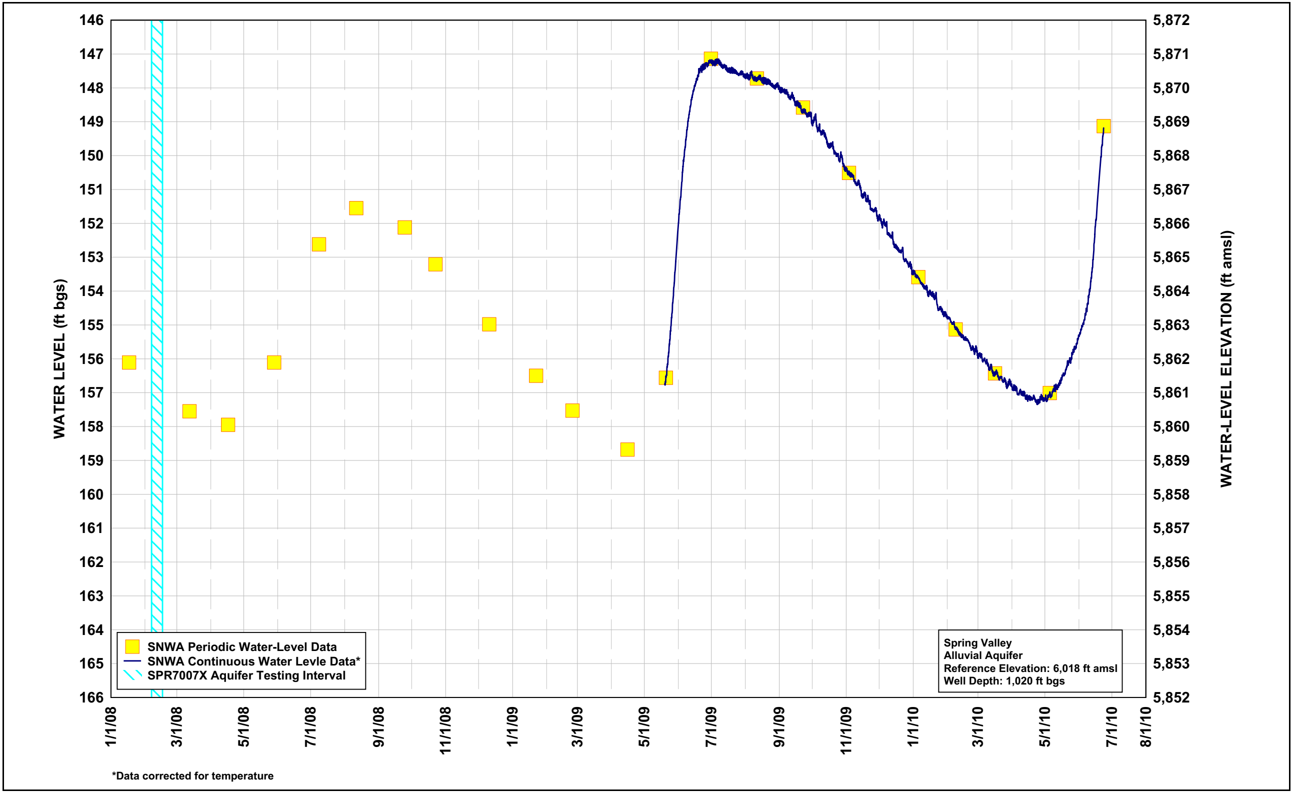


Figure 2-8
Monitor Well SPR7007M Historical Hydrograph

SNWA Exhibit 161

Doc No. DAR-ED-0006

Southern Nevada Water Authority

Hydrologic Data Analysis Report for Test Well SPR7008X in Spring Valley Hydrographic Area 184

June 2011

SNWA Exhibit 162

Doc No. DAR-ED-0007

Southern Nevada Water Authority

Hydrologic Data Analysis Report for Test Well SPR7005X in Spring Valley Hydrographic Area 184

June 2011

SNWA Exhibit 163

STIPULATION FOR WITHDRAWAL OF PROTESTS

This Stipulation is made and entered into on this 7th day of January, 2008 between the Southern Nevada Water Authority ("SNWA") and the United States Department of the Interior on behalf of the Bureau of Indian Affairs, the Bureau of Land Management, the National Park Service, and the Fish and Wildlife Service (collectively the "DOI Bureaus"). Collectively, SNWA and each of the DOI Bureaus are referred to as the "Parties."

RECITALS

A. In October 1989, the Las Vegas Valley Water District (SNWA's predecessor-in-interest) filed Applications 53987 through 53992, inclusive, (hereinafter referred to as the "SNWA Applications") for a combined 48 cubic feet per second ("cfs") of groundwater withdrawals in the Delamar, Dry Lake and Cave Valley Hydrographic Basins ("the Hydrographic Basins"). SNWA intends to pump up to 34,752 acre-feet of groundwater annually from the Hydrographic Basins for municipal purposes with concurrent monitoring, management, and mitigation as specified in Exhibit A to this Stipulation. In the future, SNWA may seek to change the points of diversion within the Hydrographic Basins for any quantities of groundwater permitted pursuant to the SNWA Applications.

B. The DOI Bureaus filed timely protests to the granting of the SNWA Applications pursuant to the DOI Bureaus' responsibilities to protect their state and federal water rights ("Federal Water Rights") and other water-dependent resources ("Federal Resources") of the DOI Bureaus in 1) the Hydrographic Basins; 2) that portion of the Whiter River Valley Hydrographic Basin that is south of Hardy Springs; and 3) the Pahranagat Valley Hydrographic Basin, including the Pahranagat National Wildlife Refuge ("Area of Interest") (depicted in Figure 1). The DOI Bureaus are required by law to manage, protect, and preserve all Federal Water Rights and Federal Resources that fall

Resources, and/or Water Dependent Ecosystems; (2) acquisition of real property and/or water rights dedicated to the protection of Special Status Species; and (3) measures designed and calculated to rehabilitate, repair or replace any and all Federal Water Rights, Federal Resources and Water Dependent Ecosystems if necessary to achieve the Common Goals set forth in Paragraph 1.A. of this Exhibit A.

For purposes of this Exhibit A, "Area of Interest" shall consist of 1) the Hydrographic Basins, 2) that portion of the White River Valley Hydrographic Basin that is south of Hardy Springs, and 3) the Pahranagat Valley Hydrographic Basin, including the Pahranagat National Wildlife Refuge. The term "Special Status Species" is defined in Paragraph V.F. of this Exhibit A. The terms "Federal Water Rights" and "Federal Resources" as used in this Exhibit A shall have the same definition as in the Stipulation to which this Exhibit A is attached. The term "Water Dependent Ecosystem" is defined in Paragraph V.F. of this Exhibit A.

A. *Common Goals*

The Common Goals of the Parties are to manage the development of any water rights permitted to SNWA by the Nevada State Engineer in the Hydrographic Basins without causing: 1) any injury to the Federal Water Rights; and 2) any unreasonable adverse effects to Federal Resources and Special Status Species within the Area of Interest as a result of groundwater withdrawals by SNWA in the Hydrographic Basins ("Common Goals"). These Common Goals include taking actions that protect and recover those Special Status Species that are currently listed pursuant to the Endangered Species Act and avoid listing of currently non-listed Special Status Species. To accomplish these goals, the Parties will strive to improve existing Water Dependent Ecosystems within the Area of Interest for habitat areas that are within the current and historic habitat range of each of the Special Status Species. Such actions should be focused on habitat within the hydrographic basin(s) that is most likely to be affected by hydrologic changes that may result from SNWA groundwater withdrawals in the Hydrographic Basins.

To accomplish the Common Goals, the Parties agree that once the TRP has determined that an agreed-upon transient regional groundwater flow model has been adequately calibrated and validated by actual field measurements, it will be used as one tool to give an early warning of possible injury to Federal Water Rights or unreasonable adverse effects to Federal Resources and Special Status Species within the Area of Interest as a result of groundwater withdrawals by SNWA in the Hydrographic Basins. It is the intent of the Parties to take actions as provided for in this Exhibit A to the extent possible to prevent injury to Federal Water Rights or unreasonable adverse effects to Federal Resources and Special Status Species within the Area of Interest as a result of groundwater withdrawals by SNWA in the Hydrographic Basins.

Actions that SNWA may take in order to offset any unreasonable adverse effect to Federal Resources and/or Special Status Species within the Area of Interest or any injury to Federal Water Rights include, but are not necessarily limited to:

1. Reduction or cessation of groundwater withdrawals within the Hydrographic Basins;

2. Geographic redistribution of pumping within the Hydrographic Basins;

Biological Monitoring Plan for the Delamar, Dry Lake and Cave Valley Stipulation

January 2011
Biologic Resources Team

Stipulation Parties:	Bureau of Indian Affairs Bureau of Land Management National Park Service Southern Nevada Water Authority U.S. Fish and Wildlife Service
Invited Party:	Nevada Department of Wildlife

SNWA Exhibit 366

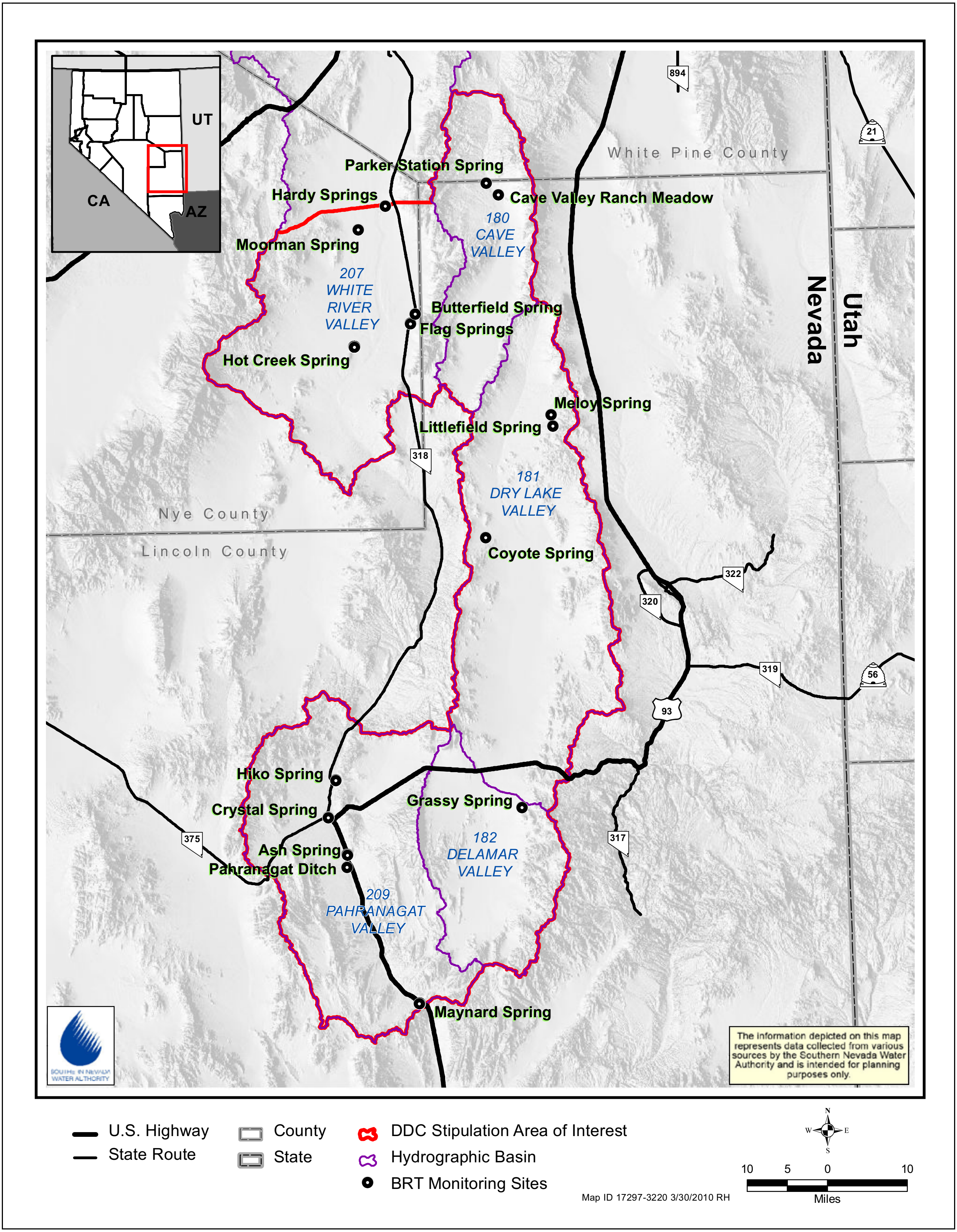


Figure 3-4
Biological Monitoring Sites in the Area of Interest, DDC Stipulation

SNWA Exhibit 363

JIM GIBBONS
Governor

STATE OF NEVADA

ALLEN BIAGGI
Director

TRACY TAYLOR, P.E.
State Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
901 S. Stewart Street, Suite 2002
Carson City, Nevada 89701
(775) 684-2800 • Fax (775) 684-2811
http://water.nv.gov

DEC 2009
RECEIVED
SNWA RESOURCES

December 22, 2009

Kenneth A. Albright, P.E.
Director, Groundwater Resources
Southern Nevada Water Authority
P.O. Box 99956
Las Vegas, NV 89143-9956

Re: Ruling 5875 - Delamar, Dry Lake and Cave Valleys Hydrologic Monitoring and Mitigation Plan

Dear Mr. Albright,

We have received your December 2009 Hydrologic Monitoring and Mitigation Plan (Plan) for Delamar, Dry Lake and Cave Valleys required pursuant to Ruling 5875 regarding Permits 53987 through 53992. This Plan fulfills the requirements of Ruling 5875 regarding the hydrologic component of the Plan, and it is understood that the biologic component of the Plan is under development and will be submitted in the near future.

The Plan as submitted is hereby accepted with the understanding that monitoring and management are ongoing processes, subject to modifications if unforeseen conditions are encountered, or if significant changes to the ground-water development project are to occur.

Please do not hesitate to call me at (775) 684-2866 if you have any questions concerning this letter or the requirements of the Plan.

Sincerely,

Richard A Felling

Richard A. Felling
Chief, Hydrology Section

Cc: Tracy Taylor (email)
Jason King (email)
Bob Coache (email)
Andrew Burns, SNWA (email)

SNWA Exhibit 152

Doc No. WRD-ED-0006

SOUTHERN NEVADA WATER AUTHORITY

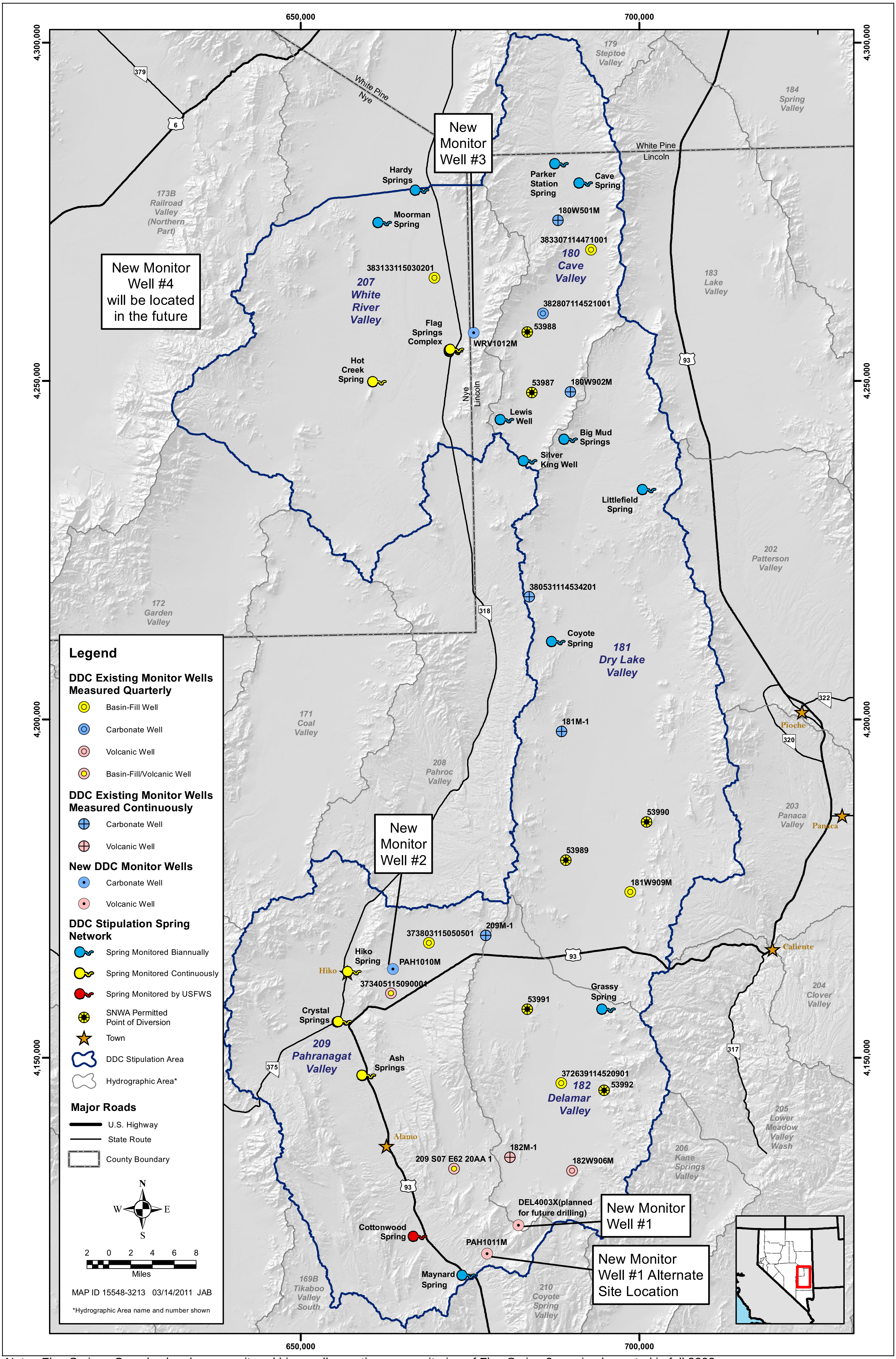
Water Resources Division

Hydrologic Monitoring and Mitigation Plan for Delamar, Dry Lake, and Cave Valleys

December 2009

Prepared by
Southern Nevada Water Authority
Water Resources Division
P.O. Box 99956
Las Vegas, Nevada 89193-9956

Approved by the
Nevada State Engineer
to fulfill Requirements of Ruling #5875
December 22, 2009



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

Figure 3-1
DDC Monitoring Plan Well and Spring Network

SNWA Exhibit 147

SNWA Exhibit 172

Doc No. RDS-ED-0004

Southern Nevada Water Authority

Geologic Data Analysis Report for Monitor Well 180W501M in Cave Valley

October 2007

Five of the six wells that represent native groundwater in Dry Lake Valley apparently reflect groundwater from further up the flow system – interbasin flow. Little of the groundwater in Dry Lake Valley actually results from recharge within the valley. This supports the rebuttal arguments elsewhere and the direct evidence in Myers (2011a) suggesting that recharge in Dry Lake Valley is much less than determined by Burns and Drici (2011). If the groundwater within the Valley does not reflect recharge within the valley, the only conclusion is that the groundwater is from interbasin flow.

The data for Delamar Valley reflects the more negative deuterium values rather than any mixture of interbasin flow with recharge. SNWA acknowledges that the mixture reflects more interbasin flow than local recharge, which again indicates the recharge estimate for Delamar Valley may be significantly too high (Thomas and Mihevc, 2011, p. 23). Claiming their data is wrong because the development water has not been completely removed from the aquifer is just an excuse for the fact that the data does not support their recharge arguments. Or, it demonstrates sloppiness on behalf of SNWA and their well drillers.

SNWA's suggestion that inaccurate data is the result of failure to remove well-development water, if supportable, is additional evidence that there is very little water available in the aquifers in Dry Lake and Delamar Valleys, at least where SNWA drilled these wells. At least in three places regarding Dry Lake and Delamar Valleys, the authors argue that water from the wells may not reflect the native water because of all the water brought in from elsewhere to develop the wells (Thomas and Mihevc, 2011, ps. 22 and 23). If sampling the well involved purging up to three well volumes from the well and only the most recent sample was reported, and still SNWA cannot get a representative sample from these wells, the wells must have been constructed in a poor aquifer with a low groundwater flux, implying little recharge or interbasin inflow.

Further south in the WRFS, the isotope report notes that Cave Valley water supports springs in Pahranagat Valley and even further south. "Thus, the isotopic data indicate that some of the groundwater flowing out of southwestern Cave Valley likely contributes to Pahranagat Valley warm spring discharge. Some groundwater originating in Cave Valley likely flows south past the Pahranagat Valley warms springs as part of the mixture of regional groundwater flow in the WRFS" (Thomas and Mihevc, 2011, p. 25).

It should be noted that nothing on Plate 2 (Thomas and Mihevc, 2011) precludes interbasin flow from Steptoe or Lake Valley to Spring Valley. The plate shows a few data – certainly it was not intended to present all of the data in those valleys – that demonstrate that groundwater in Lake and Spring have very similar δD values and that they closely resemble the recharge within the basin (and on the south Schell Creek and Egan Range).

The groundwater discharging from the warm springs in the WRFS reflects current climatic conditions because the isotopic values reflect current isotope readings in upgradient basins (Thomas and Mihevc, 2011, p. 26 and discussions above in this rebuttal regarding isotopes). "This is supported by the fact that if warm springs in the WRFS were discharging a significant amount of groundwater recharged under a

SNWA Exhibit 174

Doc No. RDS-ED-0006

Southern Nevada Water Authority

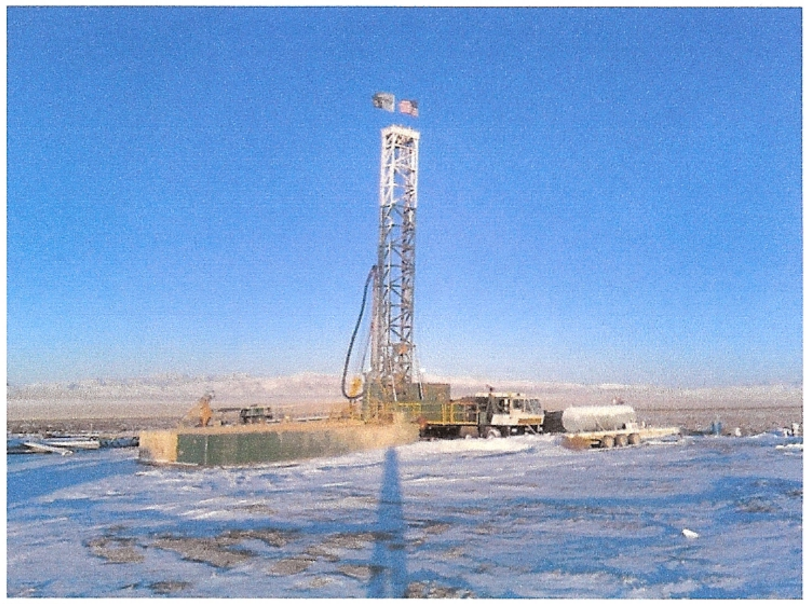
Geologic Data Analysis Report for Monitor Well 209M-1 in Pahranagat Valley

October 2007

Report

Well PW-1 Completion and Testing

Dry Lake Valley, Lincoln County, Nevada



Prepared for:

Lincoln County Water District
Lincoln, County, NV
Vidler Water Company
Carson City, NV

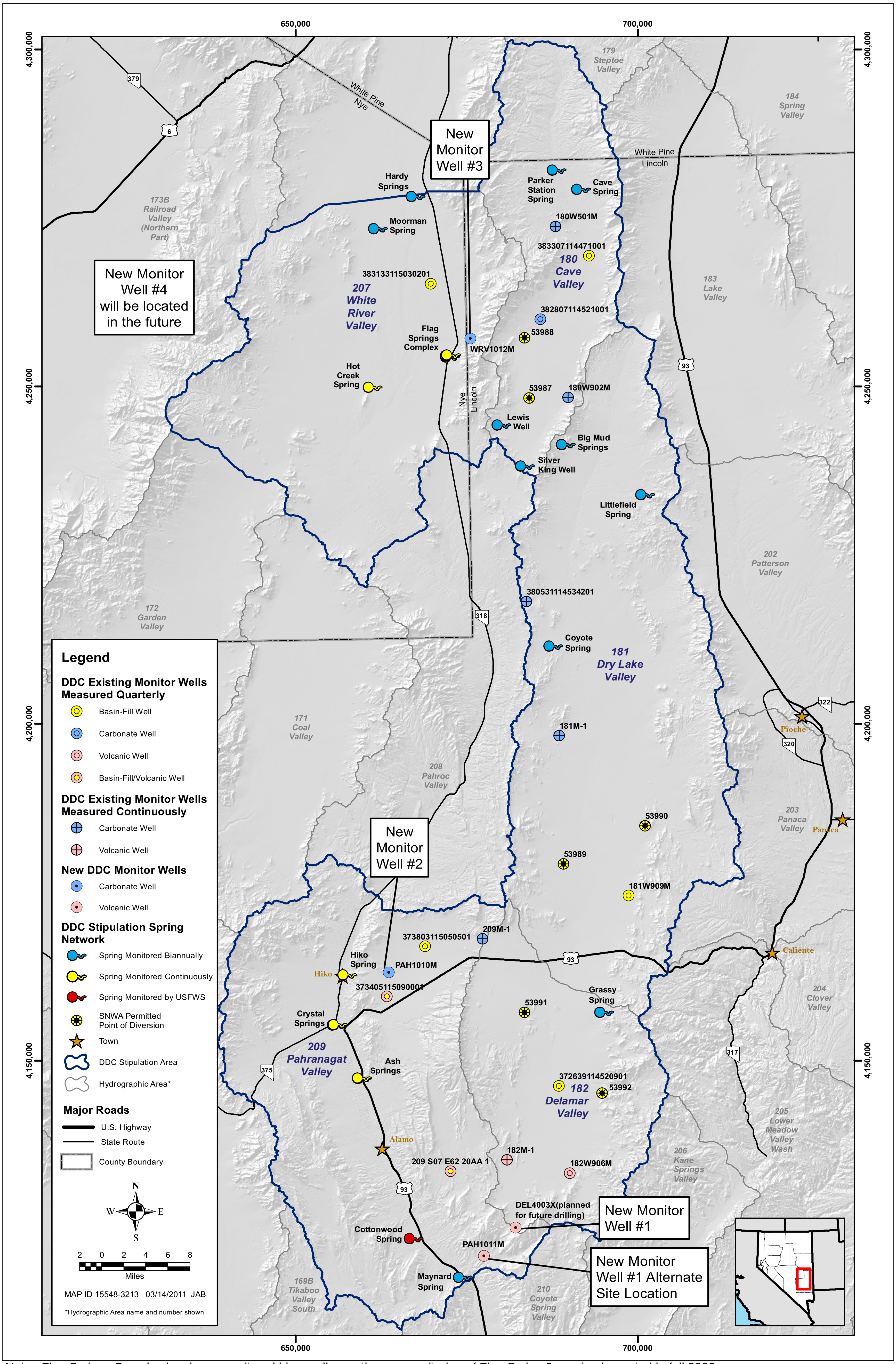
Prepared by:

Feast Geosciences, LLC
Boise, ID
September 2010
(revised June 3, 2011)

REGISTERED PROFESSIONAL GEOLOGIST
CHARLES F. FEAST
588
STATE OF IDAHO

Charles F. Feast
6/3/11

SNWA Exhibit 181



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

Figure 2
DDC Monitoring Network

SNWA Exhibit 148

Doc No. WRD-ED-0002

SOUTHERN NEVADA
WATER AUTHORITY

Water Resources Division

Delamar, Dry Lake, and Cave Valley Stipulation Agreement Hydrologic Monitoring Plan Status and Data Report

July 2008

Prepared by
Southern Nevada Water Authority
Water Resources Division
P.O. Box 99956
Las Vegas, Nevada 89193-9956

Doc No. WRD-ED-0005

SOUTHERN NEVADA
WATER AUTHORITY

Water Resources Division

Delamar, Dry Lake, and Cave Valleys Stipulation Agreement Hydrologic Monitoring Plan Status and Historical Data Report

September 2009

Prepared by
Southern Nevada Water Authority
Water Resources Division
P.O. Box 99956
Las Vegas, Nevada 89193-9956

Submitted to
Nevada State Engineer
and the DDC Stipulation
Executive Committee

SNWA Exhibit 166

Doc No. WRD-ED-0008

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

Prepared by
Southern Nevada Water Authority
Water Resources Division
P.O. Box 99956
Las Vegas, Nevada 89193-9956

Submitted to
Nevada State Engineer
and the DDC Stipulation
Executive Committee

Doc No. WRD-ED-0009

SOUTHERN NEVADA
WATER AUTHORITY

Water Resources Division

2010 Delamar, Dry Lake, and Cave Valleys Hydrologic Monitoring and Mitigation Plan Status and Data Report

March 2011

Prepared by
Southern Nevada Water Authority
Water Resources Division
P.O. Box 99956
Las Vegas, Nevada 89193-9956

Submitted to
Nevada State Engineer
and the DDC Stipulation
Executive Committee

Doc No. DAR-ED-0008

Southern Nevada Water Authority

Hydrologic Data Analysis Report for Test Well CAV6002X in Cave Valley Hydrographic Area 180

June 2011

SNWA Exhibit 164

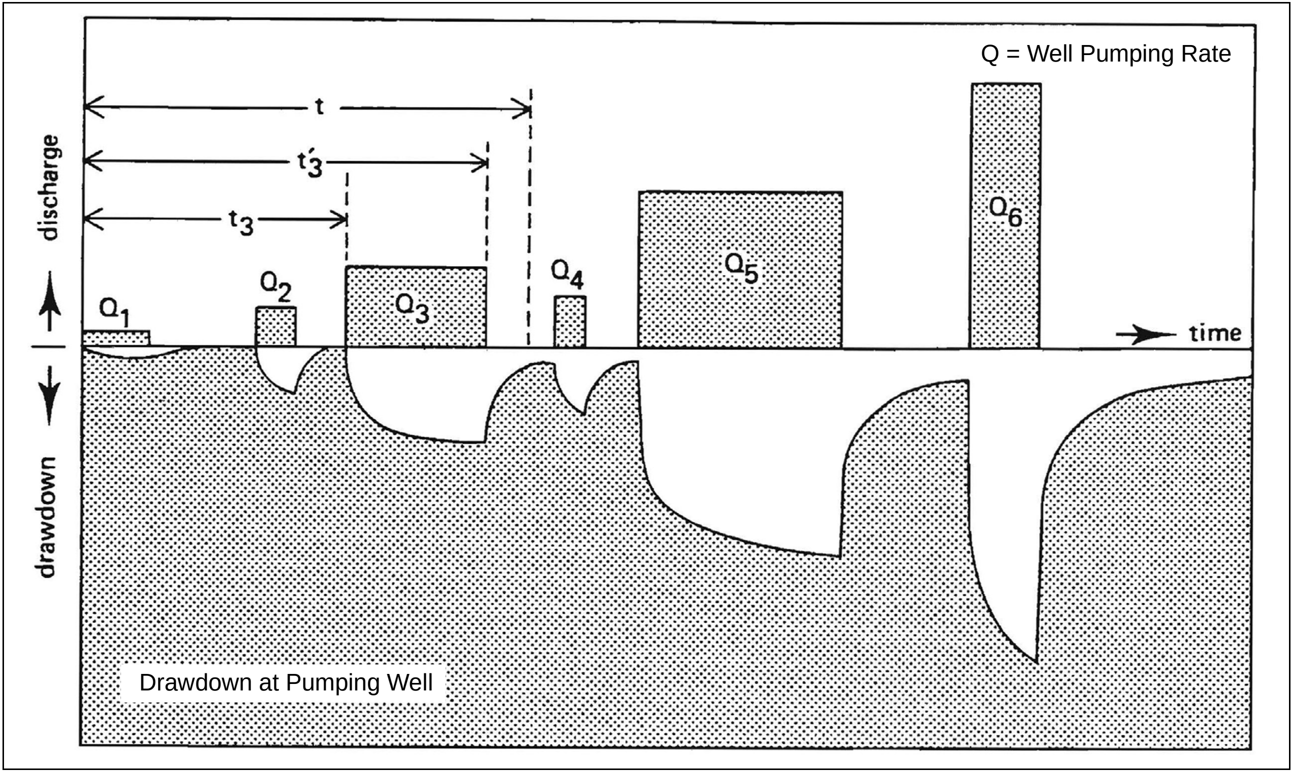
1.0 Report on the Hydrogeology of Proposed Southern Nevada Water Authority Groundwater Development (Bredehoeft, 2011a)

This section presents a rebuttal to the *Report on the Hydrogeolgy [sic] of Proposed Southern Nevada Water Authority Groundwater Development* (Bredehoeft, 2011a) (GBWN Exhibit 009). The Bredehoeft report presents unsubstantiated and invalid general conclusions. The reasons supporting this statement include the following:

- Oversimplification and inadequate examination of project operation and management, resulting in mischaracterization of potential impacts;
- Oversimplification and inadequate examination of local hydrogeologic conditions, and aquifer response dynamics, resulting in mischaracterization of potential impacts;
- Mischaracterization of availability of groundwater data;
- Mischaracterization and flawed evaluation of the effectiveness of monitoring programs as applied to this project;
- Substantial misrepresentation of the results and conclusions of models prepared to date, as described further in Watrus and Drici (2011);
- Overexaggeration and misrepresentation of projected significant harmful impacts resulting from the project operation;
- Failure to adequately consider adaptive management practices when evaluating potential impacts;
- Inadequate identification and examination of mitigation alternatives and remedies, resulting in inappropriate conclusions.

1.1 Bredehoeft (2011a) Invalid Conclusions

Bredehoeft incorrectly concludes that there will be significant harmful impacts associated with SNWA's proposed development. The conclusion is unsubstantiated and invalid based upon the broad over simplification of the project and misrepresentation of potential impacts. Bredehoeft inadequately examines and inaccurately evaluates local hydrogeologic conditions, projected model impacts, project operations, monitoring program effectiveness and adaptive management practices in



Source: Kruseman and De Ridder (2000)

Figure 8
General Drawdown and Recovery Behavior from Intermittent Pumping with Varying Discharge Rates

1.3 *Oversimplification and Inadequate Examination of Local Hydrogeologic Conditions, and Aquifer Response Dynamics Resulting in Mischaracterization of Potential Impacts*

1.3.1 *Consideration of Local Hydrogeologic Conditions*

Bredehoeft (2011a) assumes oversimplified hydrogeologic conditions which are not consistent with the project area. Bredehoeft (2011a) indicates widespread significant harmful impacts without adequately considering the role of specific hydrogeologic conditions of the project area including the degree of hydraulic interconnection between the pumping areas and areas of interest.

Understanding of local hydrogeologic conditions and response to pumping is important in developing and operating the production well network. The specifics of production-well selection, including local hydrogeologic conditions, location of areas of interest, and evaluation of relative hydraulic interconnectivity of those locations, are important in the evaluation of operational constraints and potential impacts. Monitoring with wells strategically located to assess aquifer dynamics and response with varying pumping regimes provide data to refine higher resolution predictive tools and provide information to optimize production well field operations. As more data become available, the certainty of the behavior of each well field improves, as well as the prediction and management of aquifer response.

Bredehoeft admits the importance of understanding hydrogeologic conditions and location of pumping in the aquifer system in other references. *"The dynamic response of the aquifer system is all-important to determining the impacts of development"* (Bredehoeft, 2002). *"Impacts can be quite different depending upon where the pumping is located in the system"* (Bredehoeft, 2011b). Yet in Bredehoeft (2011a), he ignores these factors in reaching his conclusions.

Specific pumping locations will be analyzed and scrutinized considering local hydrogeologic conditions, seasonal fluctuations of groundwater levels, and proximity to areas of interest. The interrelationship of hydraulic connection to local flow systems or perched systems at areas of interest to the production wells would be considered in: well design, including well depth, screened interval and length of gravel pack; system operation; monitor well placement and design; and data evaluation. Contrary to Bredehoeft's assumption, pumping wells will not be located randomly within the system and operated without considering local conditions and potential impacts.

Bredehoeft (2011a) does not mention or adequately consider the difference in hydrogeologic conditions between Spring Valley and DDC. Delamar and Dry Lake valleys have deeper groundwater levels where phreatophytes are not present or of concern. In Cave Valley, phreatophytes located near Parker Station in the northwestern portion of the valley and are supplied by groundwater recharge originating locally in the Eagan Ranges. In DDC, due to the depth of groundwater, springs are not hydrologically connected to aquifers where pumping is proposed. Springs present in DDC are generally mountain block springs not influenced by pumping. Examples include Grassy, Coyote, and Littlefield springs which are described in more detail in Prieur (2011) and SNWA (2009). A steep hydraulic gradient is present between southern Delamar Valley and central Coyote Spring Valley (Burns and Drici, 2011) which suggests the Pahranagat Shear-Zone and associated features control

1.4 Availability of Groundwater Data

Bredehoeft (2011a) page 5, states "*Only a handful of wells with continuous well hydrographs exists in the region.*" While this statement does not appear to directly relate to the conclusions derived by Bredehoeft, it is a mischaracterization of current groundwater, stream and spring monitoring data associated with Spring Valley and DDC.

At this time, there are 54 monitor wells in place specific to the monitoring plans in Spring Valley and DDC with continuous recording instrumentation at 23 locations. Thirty-three (33) springs are currently being monitored with continuous discharge or piezometer instrumentation in place at 19 locations. Installation of 12 additional wells with continuous instrumentation is planned in the future prior to project initiation. These wells and springs, coupled with numerous stream discharge continuous gages, provide an expansive baseline hydrologic monitoring program. Data from the Spring Valley and DDC programs are submitted quarterly to NSE and USGS for publication on their respective publicly accessible databases. Continuous and historic hydrographs for monitoring locations in Spring Valley and DDC are included in annual reports submitted to the NSE.

Additional regional data in the vicinity of the project area is collected in Nevada through joint funding agreements with SNWA, USGS, and NSE. Regional data is also collected in western Utah through a joint funding agreement with SNWA and the Utah office of USGS. Other data collection efforts are ongoing in the project area by USGS and the Utah Geological Survey. An example of hydrologic studies in the region include the SNPLMA hydrologic study led by Dr. David Prudic of UNR, which studies surface and groundwater interaction in and near Great Basin National Park. The study included evaluation of hydrogeologic conditions of in the vicinity of Big Springs. The preliminary study results were summarized at a public meeting in Ely on August 16, 2011 (Prudic, 2011).

1.5 Identification and Examination of Mitigation Alternatives

Bredehoeft (2011a), p.8 again mischaracterizes model results as he states the "Given that the models all project similar results, some or all of these measures will need to be considered." As discussed in Watrus and Drici (2011), widespread impacts are not the consensus from all models. Bredehoeft dismisses any form of mitigation, does not consider adaptive management practices, or remedies for specific impacts which are available. Examples include modification and optimization of well field operations, artificial recharge of excess peak streamflow or rejected recharge, and use of SNWA non-project surface and groundwater water rights for mitigation. He does not consider the lowering of pumps and deepening or replacement of wells which may be impacted. He also does not consider alternative mitigation measures available for springs such as discharge flow augmentation or other measures such as habitat restoration, improved and/or modified grazing and irrigation practices to benefit target species and habitats as explained in Marshall and Luptowitz (2011).

Rejected recharge and excess flood streamflow in Spring Valley are discussed in Rush and Kazmi, 1965. Substantial volumes of runoff have been documented reaching Yelland Dry Lake and to a lesser degree Baking Soda Flats. A photo of Yelland Dry Lake taken in July 2011 is presented in Figure 10. SNWA has performed volumetric estimates of water volume present on Yelland Dry Lake over several decades using satellite imagery. The estimated volume in just Yelland Dry Lake in July

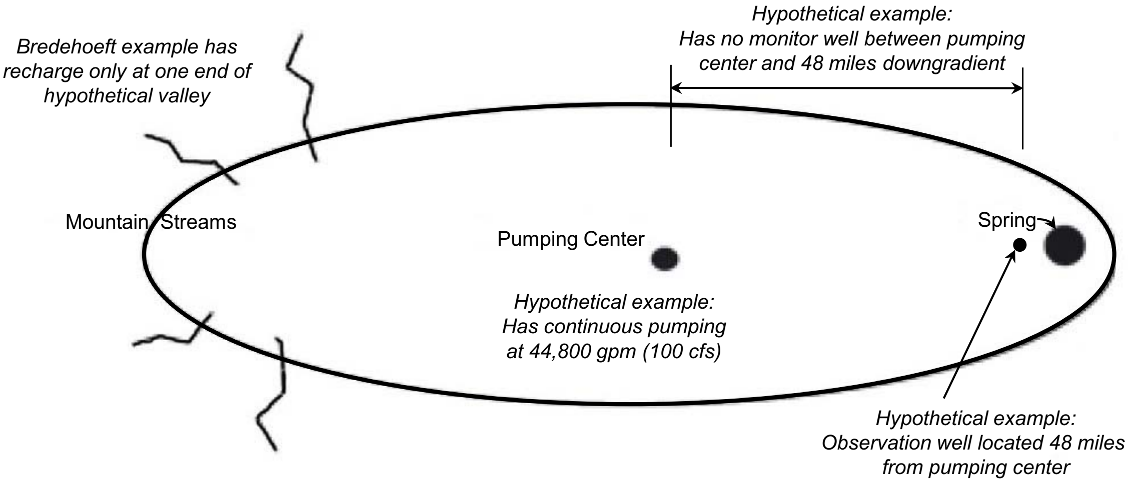
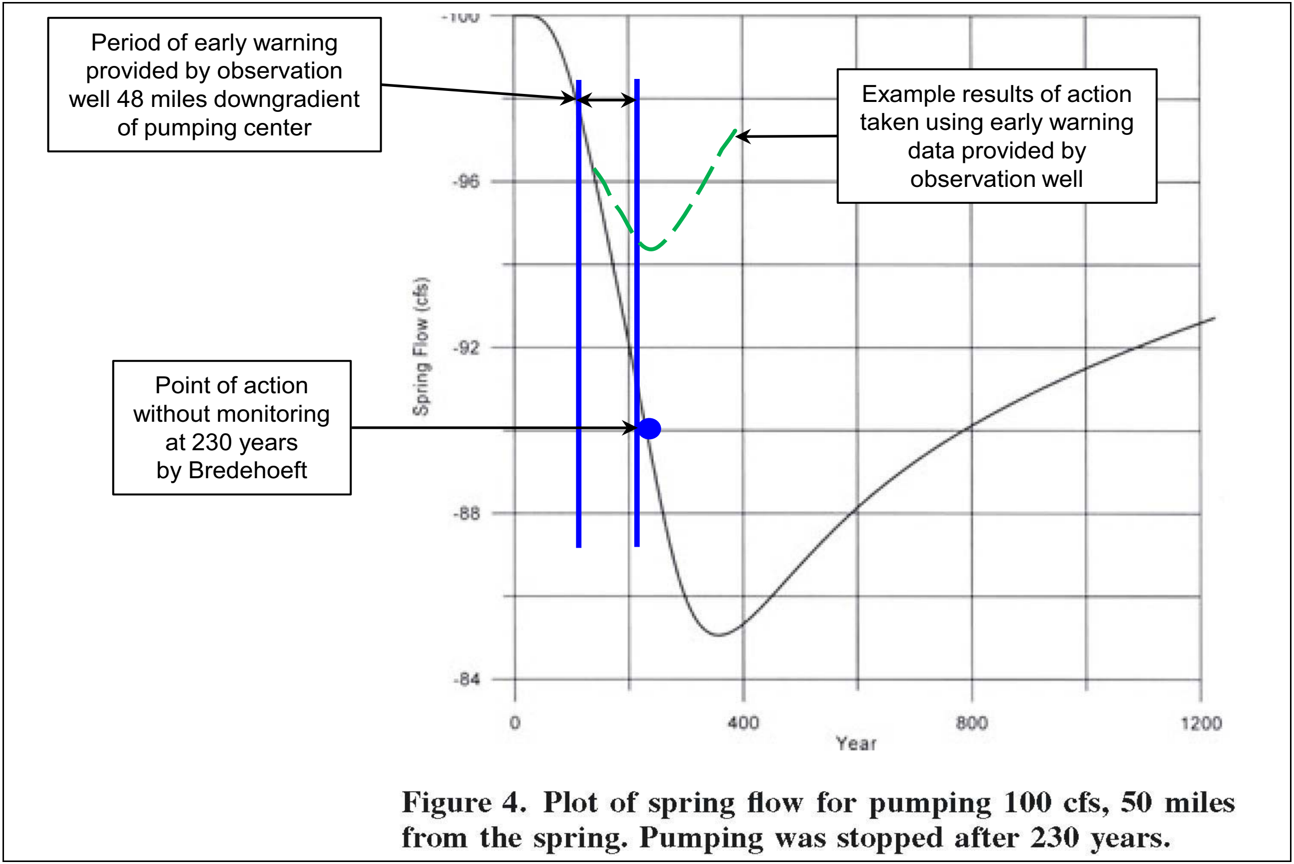


Figure 1. Schematic plan of the hypothetical valley. The pumping center is 50 miles from the spring.

Source: Modified from Bredehoeft (2011b), Note: Italics and observation well added to original figure.

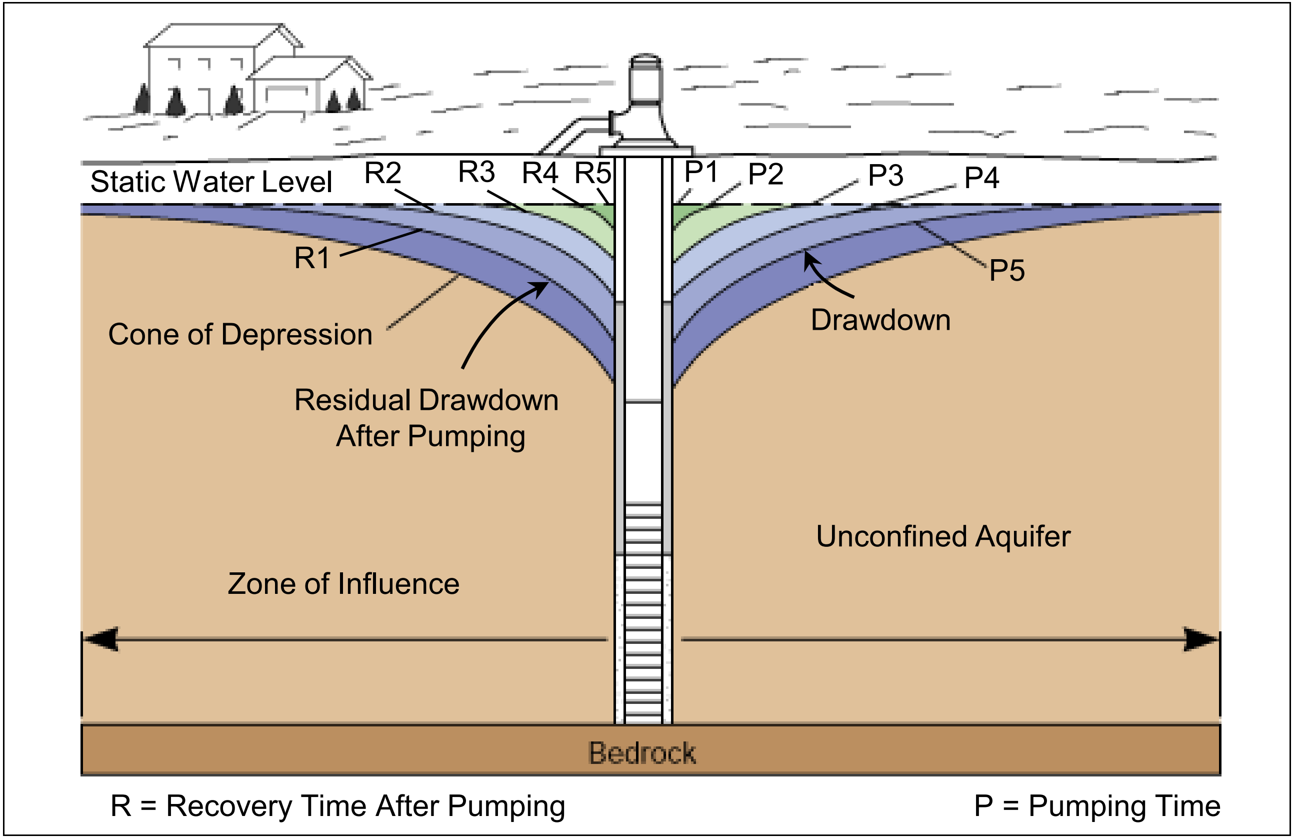
Figure 13

Hypothetical Spring Impact Example Provided by Bredehoeft (2011b)



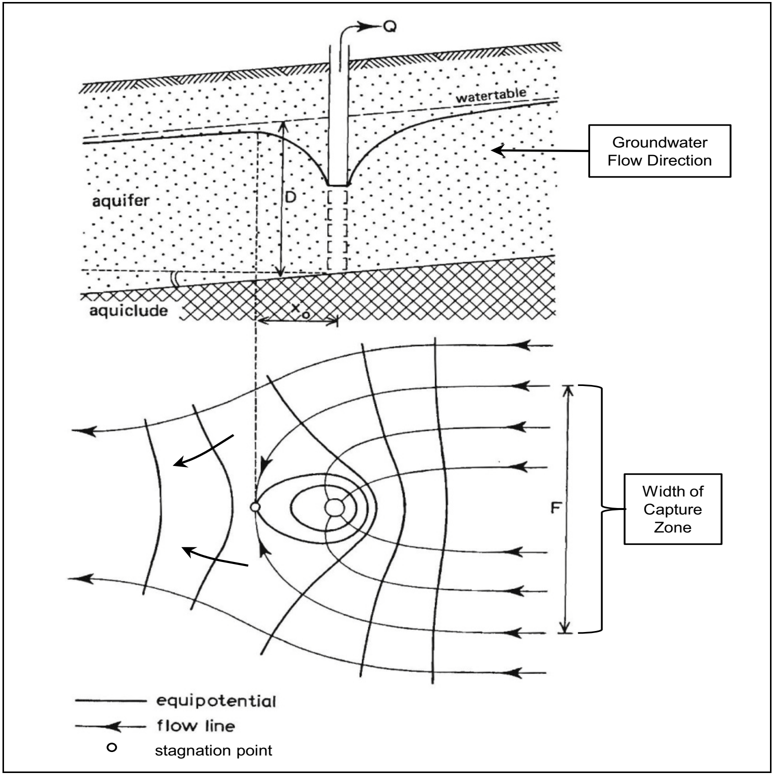
Source: Modified from Bredehoeft (2011b), Note: Text boxes and blue ranges added to original figure.

Figure 14
Effectiveness of Early Warning Monitor Well



Source: Modified from Buddemeier (2000)

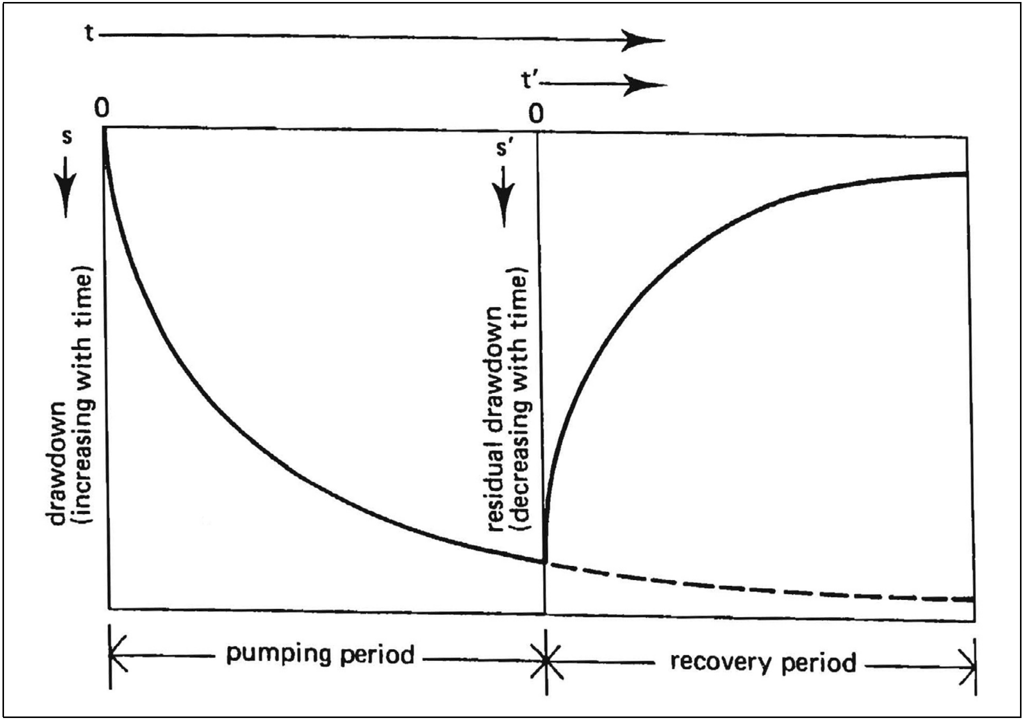
Figure 2
Simplified Water-Table Drawdown and Recovery after Pumping at Different Times



Source: Modified from Kruseman and De Ridder (2000)

Figure 4

Cross Section and Plan View of a Pumped Unconfined Aquifer



Source: Kruseman and De Ridder (2000)

Note: t = Time; t' = Time After Pumping Stops; s = Drawdown; s' = Residual Drawdown

Figure 5

Drawdown During Pumping Period and Residual Drawdown During Recovery (Pumping Stops at Time = t')

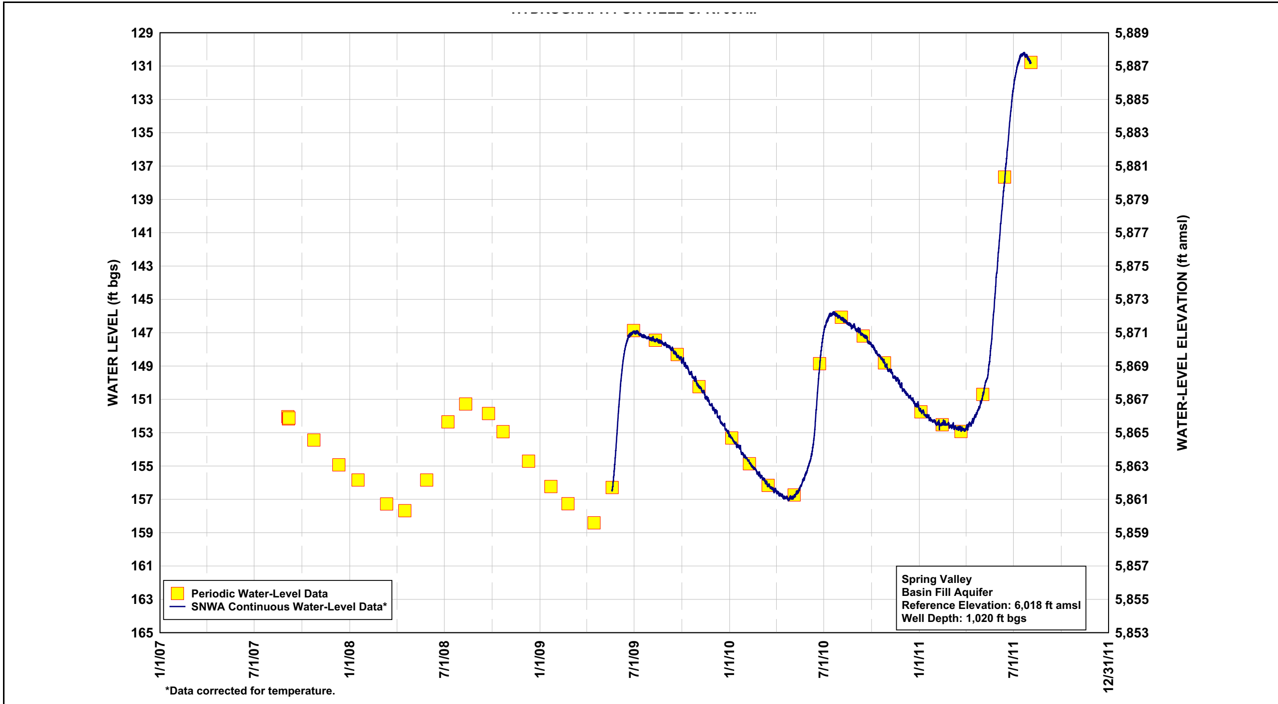


Figure 9
Hydrograph for Well SPR7007M

SNWA Exhibit 428

the hydraulic gradient, and would significantly attenuate or effectively prohibit drawdown propagation into Coyote Spring Valley.

Bredehoeft (2011a), page 8 states that the "*current model suggests that there will be no impact on the Muddy River Springs from the pumping within the simulated 200-year planning horizon. However, we know from first principles that sooner or later the springs will be impacted by the pumping—the pumping will ultimately capture the spring flow.*"(Bredehoeft, 2011a). Bredehoeft specifically mentions potential future impact at Muddy River Springs from pumping in DDC. However, this is inconsistent in that Bredehoeft does not explain or quantify what "sooner or later" is or what degree of potential impact would ever be seen at Muddy River Springs.

He assumes continuous pumping and does not account for the hydrogeologic conditions in southern Delamar and northern Coyote Spring Valley which would limit changes in flux. He does not consider the steep hydraulic gradient from southern Delamar to north central Coyote Spring Valley. The change in hydraulic gradient across this low hydraulic conductivity zone, even if there were significant drawdown present in southern Delamar Valley, would be small. This would result in a minimal change in flux across the zone. So not only is there no response at Muddy River Springs predicted with the model, the hydrogeologic conditions would also act to retard significant impacts beyond 200 years.

Throughout the Dry Lake and Delamar valleys, numerous monitoring wells are in place. Additional monitor wells are present in northern and central Coyote Spring Valley. These locations would act as early warning and identify a propagation of significant drawdown. The monitoring network in Delamar Valley would be effective in detecting significant drawdown, which would need to be present in order to possibly have a future influence on Muddy River Springs. The effectiveness of monitoring at distances greater than 20 miles is described in Section 2.0 of this report. There is no other significant planned pumping other than SNWA's that would be occurring in Delamar Valley to influence the baseline data collected by the monitoring network.

Spring Valley is predominantly a closed basin with limited discharge from southern Spring Valley into Hamlin Valley (Burns and Drici, 2011). Groundwater flows from recharge areas within the mountain block and on the alluvial fan to the groundwater discharge areas on the valley floor. Examples of various local hydrogeologic conditions observed in Spring Valley are presented in Figure 1. Each of these conditions would respond differently to pumping, yet Bredehoeft (2011a) never considers this. SNWA would consider variations in local hydrogeologic conditions in production well location, design and operation, as well as monitor well placement and design.

Varying hydrogeologic conditions present in different parts of the project area must be considered when evaluating the operation of the project and its potential effects. Results from monitoring programs will define the conditions in a more detailed manner than what is represented in the current regional groundwater flow model and be used to refine predictive tools.

Muddy River Springs. Delamar Valley is 50 miles, or so, north of the Muddy River Springs, while Dry Lake is 100 miles to the north. The current SNWA model suggests that there will be no impact on the Muddy River Springs from the pumping within the simulated 200-year planning horizon. However, we know from first principles that sooner or later the springs will be impacted by the pumping—the pumping will ultimately capture the spring flow.

However, it is infeasible to monitor the Muddy River Springs and discriminate a pumping signal created by the pumping in these valleys (Bredehoeft, 2011). The drawdown caused by the SNWA pumping will be superimposed on drawdown from other pumping that impacts the springs, as well as long-term variation in recharge to the system, including the impacts of climate change. It is a virtually impossible signal discrimination problem. It can only lead to arguments among the various interest groups of ***"what/who caused each observed decline in spring flow".***

The monitoring can also be full of surprises. For example: as suggested above, the current conceptual model has the recharge from Delamar Valley providing outflow to the Muddy River springs. However, the Pahranagat shear zone is an east-west geologic feature that cuts across the south end of the Delamar Valley. Eakin's (1966) concept was that the springs in the Pahranagat Valley were fed by the outflow from Delamar Valley.

The plumbing system within the Carbonate Aquifer is not well understood. We know that there are wells drilled into the Carbonate Aquifer that produce large amounts of water with very little drawdown in the short term; so there must be very permeable conduits within the aquifer at least locally. One can also imagine that the conduits extend great distances in the aquifer—perhaps the plumbing system in the Carbonate Aquifer is dominated by a network of highly permeable conduits. One can only speculate given the available data; nevertheless, one can anticipate the monitoring to provide surprises.

MITIGATION

The Draft EIS lists five adaptive management measures that might be implemented to mitigate undesirable impacts:

1. Geographic redistribution of groundwater withdrawals
2. Augmentation of water supply for Federal and existing water rights and Federal resources using surface and groundwater sources
3. Conduct recharge projects to offset local groundwater withdrawals
4. Implement cloud seeding programs to enhance groundwater recharge
5. Reduction or cessation in groundwater withdrawals

Given that the models all project similar impacts, some or all of these measures will need to be considered. Let's assume that the SNWA project is fully implemented, and groundwater is being pumped from each of the valleys at the State Engineer's specified perennial yield. Given this assumption we can examine the implications of the adaptive management measures:

1. **Relocate Pumping:** The drawdown created by pumping will spread outward in an attempt to capture the discharge—for example, spring flow, or phreatophyte plant groundwater

discharge. We can move the pumping to a new location further away from say a spring in an effort to minimize its impact. However, if the spring is within the zone of ultimate groundwater drawdown eventually it will be impacted. In the end, moving the pumping is simply a method of delaying the ultimate response—in the vernacular it is a means of ***kicking the can down the road.***

2. **Augmentation:** If we assume that the pumping is already at the perennial yield, then augmenting a local user means diverting water that would normally be put into the pipeline for local use. Presumably this would entail some small fraction of the total quantity pumped. This measure does not seem to be intended to keep widespread areas of vegetation that are impacted by declines in spring discharge, or phreatophyte use, alive.
3. **Recharge:** Currently in the valleys under consideration all of the available water for recharge to the groundwater system is being recharged naturally. It is hard to imagine how one might increase the recharge over what is already occurring—all the water available to the system is currently utilized naturally. It is implausible to presume that once Las Vegas has invested billions to export water from these valleys that water would in turn be imported into the impacted valleys to artificially create additional recharge.
4. **Cloud Seeding:** This always seems to be mentioned as an additional source of water for the system. Perhaps it is—most discussions I have heard suggest that one might get, at best, an increase in precipitation of 10%, or so.
5. **Reducing or Ceasing to Pump:** While feasible, this seems the most unrealistic management alternative of all those suggested. Let's presume that SNWA, a public agency, builds a multibillion dollar project to pump and deliver groundwater to Las Vegas, a city of now two million people. I cannot imagine that any future State or Federal Agency will have the political will to stop pumping in order to save the vegetation or protect the livelihoods of the people in these rural valleys. If the projected impacts, as portrayed in the Draft EIS, are insufficient to prevent the project from going forward now, I cannot imagine that in the future those impacts would be perceived as so much more dire as to lead to the curtailment of pumping once so many billions of dollars have been invested in the project and so many Clark County residents have been encouraged to grow dependent on the groundwater from years of pumping.

Geographic Redistribution of Pumping Between Valleys

There is another suggestion talked about of pumping in a particular valley until an adverse impact occurred, and then stopping pumping, resting the valley until it can recover. Once the valley had recovered one would pump again. I addressed this problem (Bredehoeft, 2011) and showed that the time for the valley to fully recover from a period of pumping is very long.

One can illustrate the recovery problem like this: I simulated a rather large valley with a thick alluvial fill aquifer where the recharge averaged 100 cfs, and prior to development a spring at the lower end of the valley discharged at 100 cfs—the system was in balance. I then imposed pumping of 100 cfs on the system some 50 miles up the valley away from the spring, midway in the valley. After 70 years the pumping caused the spring flow to decline by 10% to 90 cfs, at which point I stopped the pumping. It is instructive to examine the water budget for the system in the 70^{th} year of pumping, and in the 71^{st} year just after pumping stopped.

Table 2. Water budgets 70^{th} year (pumping), and 71^{st} year (stopped pumping)

discharge. We can move the pumping to a new location further away from say a spring in an effort to minimize its impact. However, if the spring is within the zone of ultimate groundwater drawdown eventually it will be impacted. In the end, moving the pumping is simply a method of delaying the ultimate response—in the vernacular it is a means of ***kicking the can down the road.***

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3. **Recharge:** Currently in the valleys under consideration all of the available water for recharge to the groundwater system is being recharged naturally. It is hard to imagine how one might increase the recharge over what is already occurring—all the water available to the system is currently utilized naturally. It is implausible to presume that once Las Vegas has invested billions to export water from these valleys that water would in turn be imported into the impacted valleys to artificially create additional recharge.
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5. **Reducing or Ceasing to Pump:** While feasible, this seems the most unrealistic management alternative of all those suggested. Let’s presume that SNWA, a public agency, builds a multibillion dollar project to pump and deliver groundwater to Las Vegas, a city of now two million people. I cannot imagine that any future State or Federal Agency will have the political will to stop pumping in order to save the vegetation or protect the livelihoods of the people in these rural valleys. If the projected impacts, as portrayed in the Draft EIS, are insufficient to prevent the project from going forward now, I cannot imagine that in the future those impacts would be perceived as so much more dire as to lead to the curtailment of pumping once so many billions of dollars have been invested in the project and so many Clark County residents have been encouraged to grow dependent on the groundwater from years of pumping.

Geographic Redistribution of Pumping Between Valleys

There is another suggestion talked about of pumping in a particular valley until an adverse impact occurred, and then stopping pumping, resting the valley until it can recover. Once the valley had recovered one would pump again. I addressed this problem (Bredehoeft, 2011) and showed that the time for the valley to fully recover from a period of pumping is very long.

One can illustrate the recovery problem like this: I simulated a rather large valley with a thick alluvial fill aquifer where the recharge averaged 100 cfs, and prior to development a spring at the lower end of the valley discharged at 100 cfs—the system was in balance. I then imposed pumping of 100 cfs on the system some 50 miles up the valley away from the spring, midway in the valley. After 70 years the pumping caused the spring flow to decline by 10% to 90 cfs, at which point I stopped the pumping. It is instructive to examine the water budget for the system in the 70th year of pumping, and in the 71st year just after pumping stopped.

Table 2. Water budgets 70th year (pumping), and 71st year (stopped pumping)

Figure 10
Yelland Dry Lake Photo from Taft Creek (July, 2011)

discharge. We can move the pumping to a new location further away from say a spring in an effort to minimize its impact. However, if the spring is within the zone of ultimate groundwater drawdown eventually it will be impacted. In the end, moving the pumping is simply a method of delaying the ultimate response—in the vernacular it is a means of ***kicking the can down the road.***

2. **Augmentation:** If we assume that the pumping is already at the perennial yield, then augmenting a local user means diverting water that would normally be put into the pipeline for local use. Presumably this would entail some small fraction of the total quantity pumped. This measure does not seem to be intended to keep widespread areas of vegetation that are impacted by declines in spring discharge, or phreatophyte use, alive.
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Figure 1 Hydrograph locations.

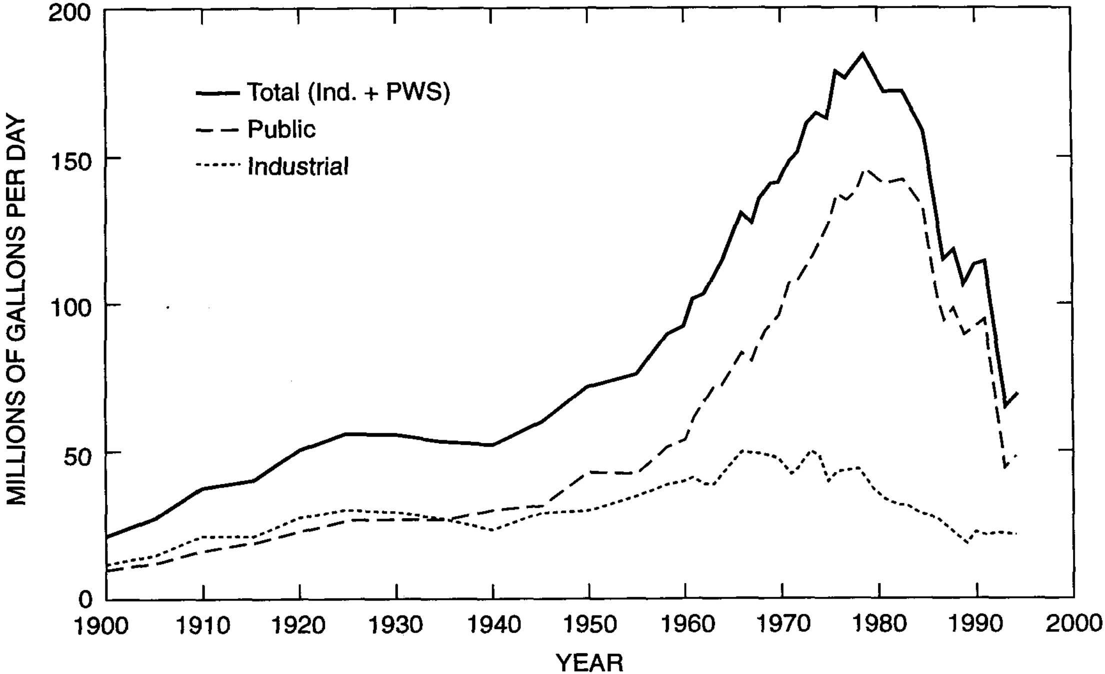


Figure 3. 1900-1994 production from the deep bedrock aquifers in the eight-county Chicago region, subdivided by use

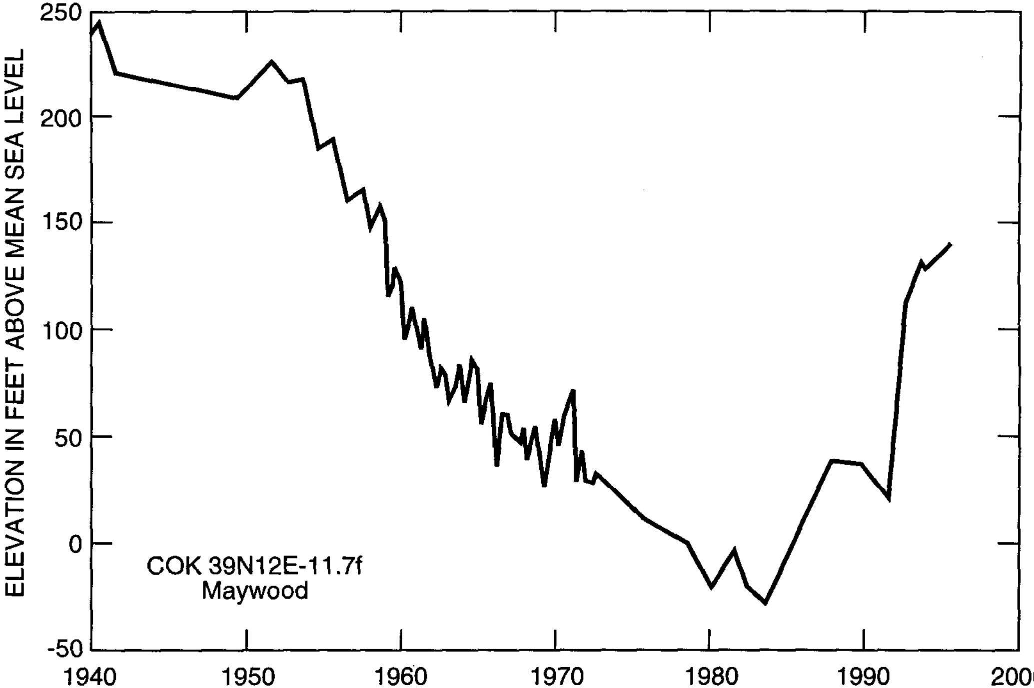


Figure 6. Representative trend of deep well water levels in Cook County since 1940

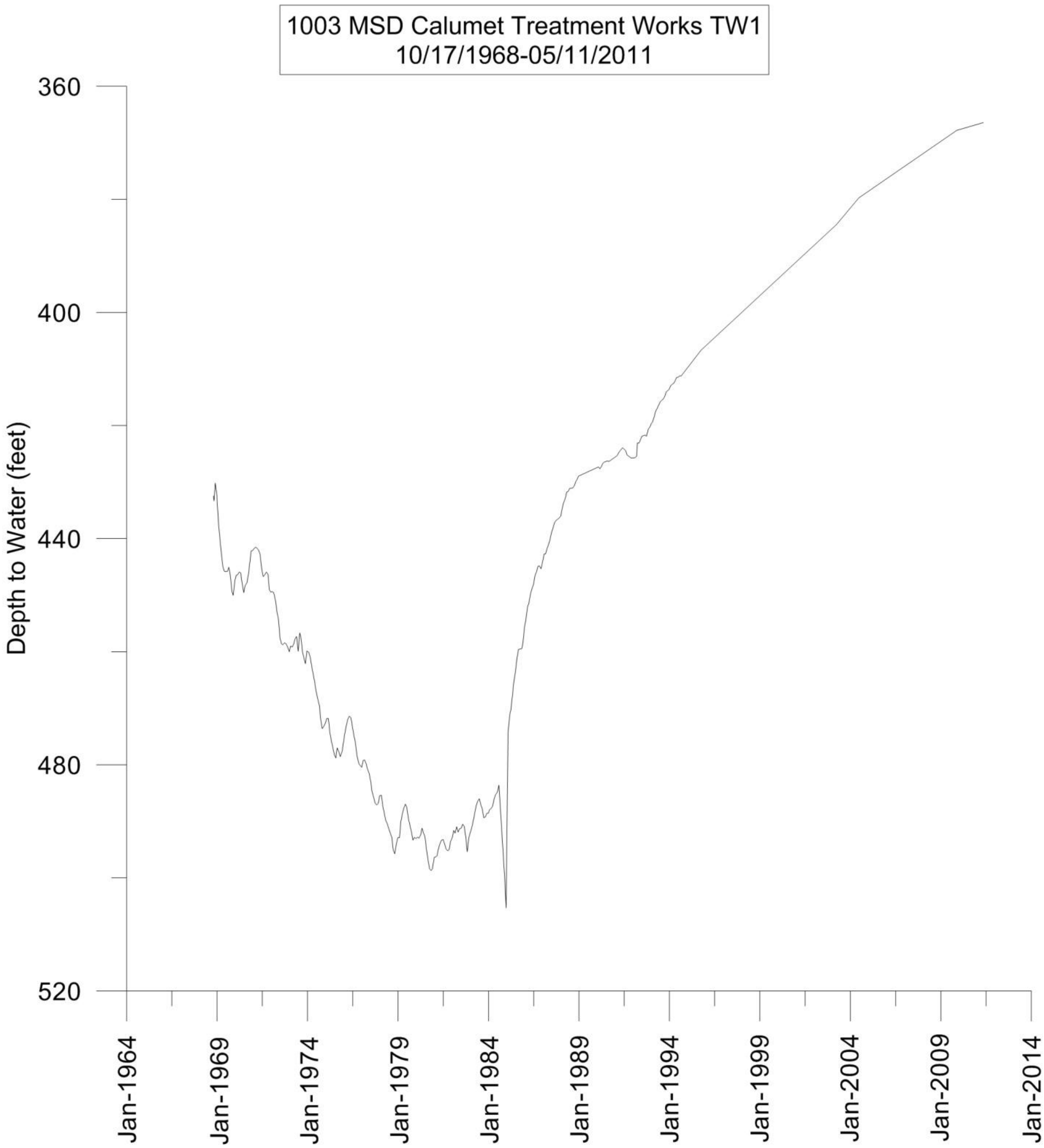


Figure 3. Depth to water in observation well 1003 (MSD Calumet Treatment Works TW1).

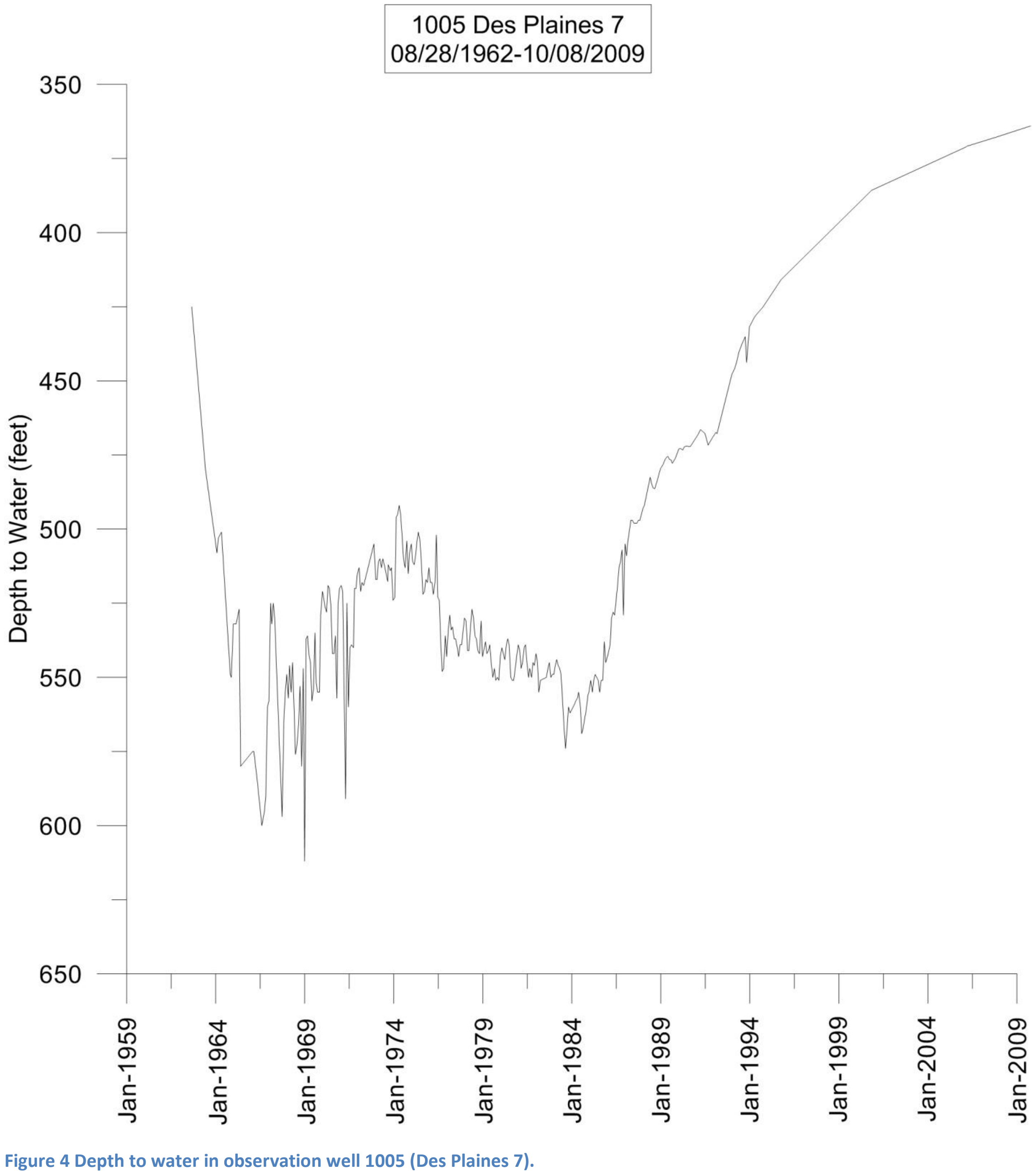


Figure 4 Depth to water in observation well 1005 (Des Plaines 7).

The next stages of the project include aquifer configuration of the production network, followed by initiation of operations and collection of response data. The adaptive management process allows the hydrologic monitoring plans to be reevaluated as additional information becomes available to effectively meet project objectives. The NSE has the authority to require modifications to the monitoring program in the future.

Throughout my professional career since 1979, I have prepared, implemented, or reviewed hundreds of hydrologic monitoring plans and performed hydrologic or remedial investigations at locations throughout the United States and internationally. The plans I was involved with were developed or implemented primarily for private industry, utilities, state environmental agencies, and Federal government Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (commonly known as SUPERFUND) sites. The project sites and facilities were located in a wide variety of hydrogeologic conditions and program scales ranging from local to regional in scope.

I am currently responsible for supervising the monitoring programs in the Las Vegas Valley associated with the LVVWD artificial recharge program and production wells and SNWA regional and shallow monitoring networks. I supervise the groundwater monitoring for water systems in Searchlight, Jean, Kyle Canyon, and Blue Diamond, Nevada. I also supervise and am responsible for DDC and Spring Valley hydrologic monitoring plans and aquifer testing and analysis. I oversee the SNWA joint funding agreements with Nevada Division of Water Resources and USGS Nevada office for hydrologic monitoring in east-central and southern Nevada and the SNWA-USGS Salt Lake City office for hydrologic data collection in western Utah.

I have recently reviewed numerous water resource management plans and regional groundwater monitoring programs developed by other organizations for locations in Nevada, across the United States, and internationally for comparability with the approach and technical content to the Spring Valley and DDC Management Programs.

The comparison of elements of the various regional management and monitoring programs, demonstrate that the SNWA Hydrologic Management Program is comparable with other plans at this stage of implementation and is appropriate and effective for the conditions encountered and monitoring objectives. The key elements of the Program include the following:

- Clear monitoring objectives which have been identified and used as the foundation for monitoring plan development;

- Understanding of the regional and basin geologic framework and hydrologic system. This was defined through the collection and evaluation of time independent data using methods such as geophysical surveys, geologic mapping, test drilling, aquifer testing, and previous report and log reviews;

- Establishment of a regional monitoring network to document baseline conditions through collection of representative time dependent data such as water levels, spring discharge, streamflow, and precipitation data over varying climatological periods, including wet and dry periods. The groundwater network includes existing and new monitor wells which have been professionally surveyed and have known construction attributes and integrity;

- Identification of specific monitoring locations of interest including existing water rights holders, groundwater influenced ecosystems, aquatic species of interest and other areas of interest. Locations were identified through water resource and biological resource inventories and selected by consensus with the TRP;

- Effective data collection and management system to insure that all monitoring points are constructed or selected to provide representative data and station integrity is maintained throughout the Program's life. Data is collected in a consistent manner which follows approved field procedures and QA/QC protocols. Data is processed and stored in an approved and secure manner;

- The Program has flexibility through adaptive management practices to utilize monitoring data to refine the Program in an iterative process. The monitoring plans data is used to refine predictive tools such as numerical flow modeling. The predictive tools, in turn, are used to evaluate monitoring network effectiveness, identify data gaps or modifications to the network or monitoring frequency to improve Program performance;

- The management and data review process has input from stakeholders, including NSE and TRP, to refine or modify the plans based upon scientifically sound data and current conditions.

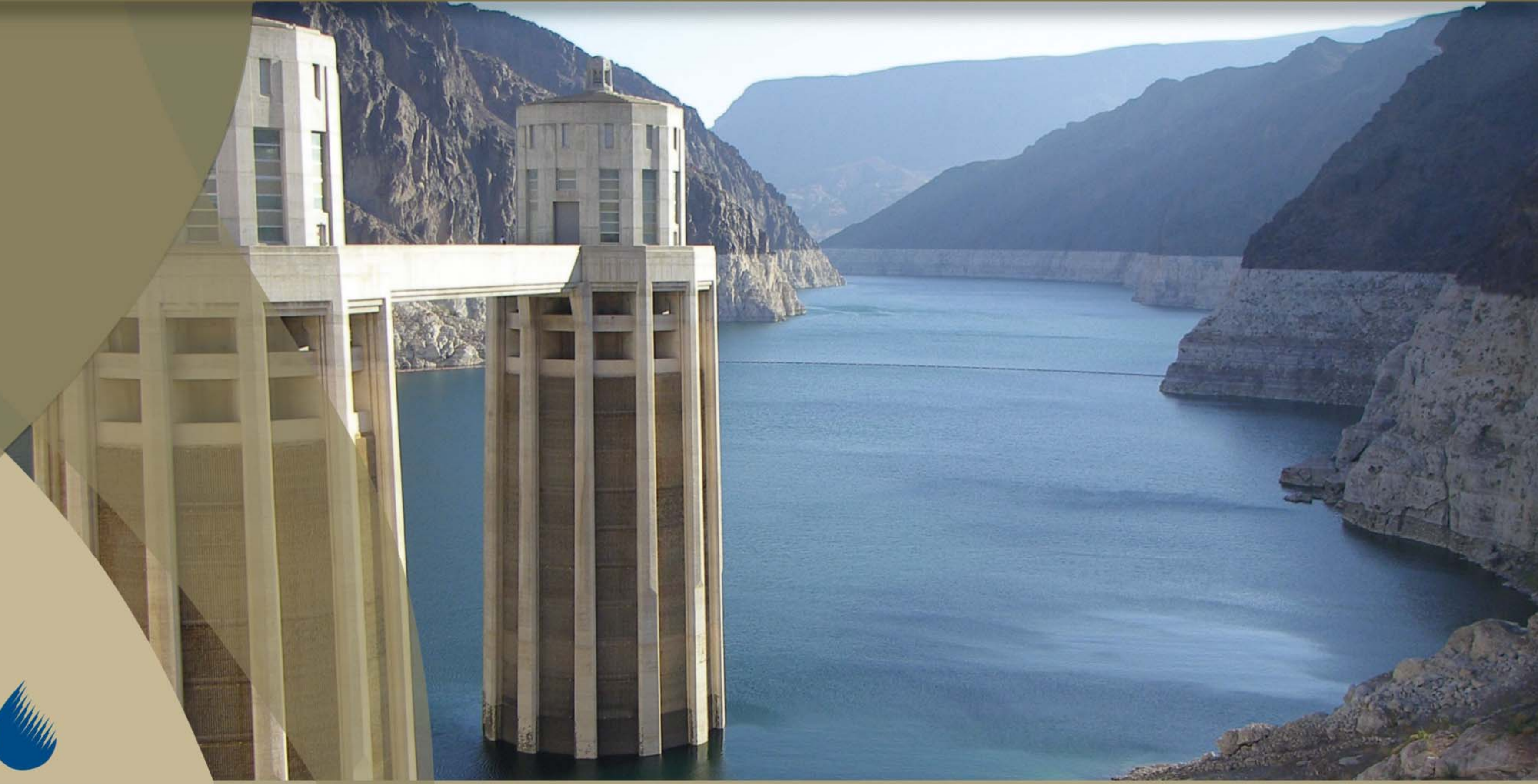
- The monitoring plan results, predictive tools, and water development operations plan are integrated to provide for optimal operations while minimizing and managing potential impacts.

- The specific technical content is site specific and tailored to the local hydrologic and hydrogeologic conditions, areas of interest, scale, and monitoring objectives. The site specifics such as monitoring density, frequency of measurements, and location are determined in consensus with local technical experts such as the NSE, TRP, and SNWA representatives who developed the technical specifics of the Program to meet project monitoring objectives.

Programs recently reviewed include those with comparable or more complex technical and management issues. Groundwater monitoring and management plans throughout the nation address a variety of issues on a regional and local scale. They involve municipal and agricultural water development and usage, mining dewatering, coal bed methane producer impacts, and regional water resource management plans. These include identification and evaluation of the influence of water development and pumping on regional aquifers. Issues of concern include management of sole-source aquifers, production well interference, control and movement of contaminant plumes, salt water intrusion, and long term sustainability of water resources and groundwater influenced ecosystems. Plans also include wellfield development projects and regional pipeline distribution systems located in various parts of the country.

A few examples include successful water management programs administered by the Florida Water Management Districts which consider large urban water supplies, regional population growth, agricultural usage, sensitive ecological systems (including the Everglades) and regional carbonate springs, surface water usage and recreation, and coastal saltwater intrusion issues.

Spring, Cave, Dry Lake and Delamar Valleys



SOUTHERN NEVADA
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