

Appendix B

Draft Monitoring, Mitigation and Monitoring Plan for Snake Valley, Utah-Nevada

SNWA, working in conjunction with the BLM, other Department of Interior agencies, and with input from the States of Nevada and Utah, will develop and implement a long-term monitoring, management, and mitigation plan for Snake Valley (3M Plan) as outlined below. When the 3M Plan is fully developed, it will be comparable to the monitoring plans developed (or to be developed) under the existing stipulation agreements for other basins addressed in this EIS. The 3M Plan will reflect a staged approach to implementing monitoring, management, and mitigation activities because of the time period that may elapse between this Environmental Impact Statement (EIS) and construction and operation of groundwater infrastructure in Snake Valley. Building and implementing the various stages of the 3M Plan will be dependent upon triggers as SNWA moves closer to implementing groundwater development in Snake Valley.

The purpose of the 3M Plan is to insure that: 1) implementation of the Record of Decision protects water dependent resources and water-related resources on public lands, 2) protects federal water rights managed by federal agencies, and 3) provides a process for mitigating impacts. To accomplish this purpose, the 3M Plan will establish a network of groundwater and surface water monitoring sites to collect baseline data, monitor the effects of groundwater development on water resources, biological resources, and air resources. The intent of the 3M Plan is to provide early warning of potential adverse impacts to water rights and water-dependent sensitive resources, and provide time and flexibility to implement management measures and gage their effectiveness. Following this intent, the highest priority actions in the Snake Valley 3M Plan will be tied to predicted impacts from groundwater development, as identified in this EIS.

The 3M Plan would be required to be implemented and updated as long as SNWA maintains long-term plans to develop groundwater and remove it from Snake Valley. If SNWA terminates plans to develop groundwater from Snake Valley, and the 3M Plan adopted for Spring Valley shows no interbasin effects from pumping in Spring Valley, then the Bureau of Land Management (BLM) may terminate the requirement for a Snake Valley 3M Plan.

Key Concepts of Proposed Snake Valley 3M Plan

Hydrologic, Biological, and Air Quality Provisions – The Snake Valley 3M Plan will include sections to address hydrologic, biological, and air quality issues, and would be similar to the plans developed with the BLM and other Department of Interior agencies for the other groundwater development basins analyzed in this EIS. The 3M Plan will include:

- Development and implementation of baseline monitoring plans.
- Establishment of new monitoring sites and use of existing monitoring sites, including monitoring wells, piezometers, stream flow gages, and precipitation or meteorological stations.
- Collection of data on groundwater elevations, spring and stream flow rates, water quality, aquifer testing, vegetation communities, special status and water-dependent species and their habitats.
- Updates or revisions to groundwater flow numerical modeling.
- Upwind and downwind air quality monitoring.

Appendix B-1 in this document, entitled “Guidance to Technical Working Group for Development of Snake Valley Monitoring, Mitigation and Management Plan” provides additional direction for development of the 3M Plan.

Management and Mitigation Actions – The initial 3M Plan will generally identify available management options and mitigation actions to address any adverse effects of SNWA pumping. These actions may include:

- Geographic redistribution of groundwater withdrawals.
- Reduction or cessation of groundwater withdrawals.
- If water supplies used for consumptive purposes, such as irrigation, domestic and livestock watering use were limited by the project, then SNWA will provide alternate supplies of water.
- Acquisition of real property and/or water rights dedicated to management of special status species.
- Augmentation of water supply and/or acquisition of existing water rights.

The initial 3M Plan will include triggers that will prompt SNWA and the Technical Working Group (described below) to develop more detailed management response actions and specify conditions when those management actions will be implemented.

Staged Approach with Triggers for 3M Plan Activities – SNWA and the technical working group will develop an initial 3M Plan within one year of the Record of Decision for this EIS. The initial 3M Plan will focus on:

- identification of existing monitoring sites that would be useful in establishing baseline conditions,
- identification of additional monitoring sites that will be needed to build full sets of baseline data,
- processes for sharing monitoring data with interested parties,
- describe other monitoring, management, and mitigation activities that will begin at later stages of project development, and
- include triggers, such as decisions by the Nevada State Engineer regarding water rights for Snake Valley or completion of the interstate agreement between Nevada and Utah regarding Snake Valley, that will initiate additional activities under the 3M Plan.

When these triggers occur, sections of the initial 3M Plan that were only generally described will be more fully developed to meet the objective of early detection of potential project impacts. Resources that must be committed by SNWA to build and implement the 3M Plan are expected to gradually increase over time, commensurate with SNWA implementation of groundwater development in Snake Valley.

Management Committee and Technical Working Group – As part of the 3M Plan, a management committee and a technical working group will be formed to implement the various aspects of the 3M Plan to achieve its purpose. SNWA, in conjunction with the BLM, will develop appropriate guidelines for the management committee and technical group. The BLM Nevada State Director, or his designee, will chair the management committee. Members of the management committee and technical working group may include representatives from SNWA, federal agencies, and the States of Nevada and Utah (including but not limited to the Utah Division of Air Quality). Final approval of the Snake Valley 3M Plan (or any interim plans) rests with the BLM.

SNWA Management and Reporting Responsibilities – SNWA would be responsible for the development and implementation of management actions associated with the 3M Plan including all monitoring activities during the life of the project. In the initial phase of the 3M Plan, SNWA will provide results of monitoring on a quarterly basis and provide a detailed analysis of monitoring in an annual report provided to the BLM. The report would include maps indicating drawdown extent and magnitude, and hydrographs indicating water levels and spring discharge measurements over time. When subsequent phases of the 3M Plan implement additional activities, such as research, groundwater modeling, and groundwater testing, reporting requirements would be similar as specified in the Spring Valley Monitoring and Mitigation Plan. These reports would be made available to the public on BLM's website.

Monitoring Area – The monitoring areas associated with the 3M Plan are to be located within the Great Salt Lake Desert Flow System. Subject to input from the management committee and the technical working group it is anticipated that the highest intensity area for monitoring effort will occur between Miller Springs at the northern end of Snake Valley and the southern boundary of the Snake Valley hydrographic area. Lower intensity monitoring efforts will occur in adjacent hydrographic basins, including Fish Springs Flat, Tule Valley, Pine Valley, and Wah Wah Valley. The technical working group will be tasked with coordinating operation of the Snake Valley and Spring Valley Plans.

Management of Monitoring Data – The technical working group will be responsible for establishing data collection methodology and quality control procedures. The technical working group will also be responsible for integrating and interpreting monitoring results from a variety of sources, including the U.S. Geological Survey (USGS), Utah Geological Society (UGS), and the SNWA-operated monitoring well locations. SNWA will be responsible for constructing and maintaining a database to house the collected data and make it publicly available.

Effectiveness – It is anticipated that the 3M Plan would provide early warning of potentially undesirable impacts to water-dependent resources and provide time and flexibility to implement management measures to mitigate their effects. However, since groundwater development presumes some level of vegetation change and significant reduction in groundwater levels in some parts of Snake Valley, not all impacts would be avoided by this mitigation measure. The Snake Valley 3M Plan may include mitigation measures offered by SNWA, in coordination with the State of Utah, to mitigate impacts that occur to lands, water rights, and water-dependent resources owned by private parties, local governments, and state governments. However, the BLM cannot enforce mitigation measures on lands owned by other parties, and cannot insure that the funding and land access necessary to implement these measures will be made available.

Appendix B Supplement 1
**Guidance to Technical Working Group for Development of Snake Valley Monitoring,
Mitigation and Management Plan**

The SNWA, working in conjunction with the BLM, other Department of Interior agencies, and with input from the States of Nevada and Utah, will incrementally develop a comprehensive 3M Plan as the SNWA accomplishes various milestones toward groundwater development in Snake Valley. The sections below provide direction to the Technical Working Group that will be charged with building the Snake Valley 3M Plan as to provisions that should be given serious consideration for inclusion in the 3M Plan. This guidance is based on concepts found in plans for other groundwater development basins and concepts found in the draft interstate agreement between the States of Utah and Nevada for Snake Valley. There is a potentially long period that may elapse between the Record of Decision for this EIS and construction of groundwater development facilities in Snake Valley. Issues and circumstances driving the Snake Valley 3M Plan may change significantly during that period. Accordingly, BLM recognizes that the Technical Working Group will require some latitude in selecting final elements and procedures for the 3M Plan. The recommended elements of the 3M Plan are as follows:

Hydrologic Monitoring Provisions – The 3M Plan will include the following provisions for hydrologic monitoring. The technical working group will be tasked with prioritization and sequencing of monitoring tasks, so that increased monitoring obligations will be linked to accomplishment of significant milestones toward groundwater development. Accordingly, all of the monitoring tasks listed below may not be implemented immediately, and the recommended timing of each task below will be addressed in the initial 3M Plan.

- **Monitoring Wells** – The 3M Plan will rely upon existing groundwater monitoring networks established by the USGS and by the UGS. The SNWA, will construct and operate additional monitoring well sites at locations where the greatest impacts of groundwater diversions are expected to occur and in sites where geologic and aquifer properties are not well known. The well monitoring network will collect both groundwater level data and water quality data, with the objective of establishing baseline conditions.
- **Spring Monitoring** – The 3M Plan will also include a program for monitoring spring discharge and groundwater levels associated with springs. Monitoring efforts will be focused on identification of early warning of groundwater declines that could impact springs. SNWA, working with the technical working group, will initially identify the springs to be monitored and this will be updated as the information indicates needs for additional or changed monitoring locations. The initial list of springs to be considered for monitored will be derived from springs that may experience flow rate reductions according to the groundwater modeling analysis for this EIS. Initially, the spring monitoring would be accomplished using continuous water level monitoring in piezometers located near each spring and biannual monitoring of flow at the spring.
- **Stream Monitoring** – The SNWA may be required to construct and operate stream gages on creeks within Snake Valley or adjacent valleys that are not currently monitored by USGS gages or by the State of Utah or State of Nevada. Emphasis will be placed on monitoring stream reaches that could be directly affected by the SNWA groundwater diversions and streams that make significant contributions to the Snake Valley groundwater budget.
- **Meteorological (Climate) Stations** – The SNWA will be required to construct and operate meteorological monitoring stations to provide information for geographic areas not covered by current stations operated by USGS, BLM, National Oceanographic and Atmospheric Administration (NOAA), State of Utah, or State of Nevada. Emphasis will be placed on locations that require better groundwater recharge estimates for use in groundwater modeling procedures. Data collected would include at a minimum precipitation, temperature, wind, soil moisture and temperature, relative humidity (although not all stations may require all parameters). As per the Air Quality Provisions below, an Air and Climate monitoring plan will be created and implemented as part of this project.

Hydrologic Analysis Provisions – Hydrologic analysis activities that will be included in the 3M Plan are set forth below. These activities are not expected to be fully implemented until later stages of the 3M Plan, with timing based upon triggers established by the technical working group.

- **Aquifer Characterization** – The regional groundwater model used to support the National Environmental Policy Act (NEPA) process identified areas of uncertainty with regard to geologic and hydraulic characteristics of Snake and adjacent valleys. The technical working group will determine whether the SNWA should conduct additional studies to determine lithology and structure (such as faulting) of geologic units and aquifers in Snake Valley. One area of research focus will be to better characterize inter-basin flow zones with valleys adjacent to Snake Valley. Results from these additional studies will be used to enhance groundwater modeling efforts.
- **Numerical Modeling of Snake Valley Groundwater Flow** – The SNWA will develop a groundwater flow system numerical model that is specific to Snake Valley, in cooperation with the technical working group. The technical working group will determine the characteristics of the Snake Valley flow model, such as grid size and representation of existing groundwater depletions. The SNWA will develop the flow model well in advance of any proposals from the SNWA for specific production well locations, so that model results can be used to identify areas of uncertainty that could be reduced by investigations that could be implemented by the technical working group.

Biology Provisions – The 3M Plan will include the following provisions for biologic monitoring and analysis. The SNWA working with the technical working group, will be tasked with identifying the appropriate timing to commence biology activities in the 3M Plan, with regard to the time periods needed to establish baseline conditions before groundwater development commences.

- **Biological Monitoring Plan Objectives** – A detailed biological monitoring plan will be developed by the SNWA, in conjunction with the BLM and the technical working group to establish a monitoring program that will further the understanding of groundwater-influenced ecosystem dynamics and track biotic community responses to the SNWA's groundwater withdrawal from the Snake Valley Hydrographic Basin. This monitoring will provide an early-warning indication as to whether, in combination with the hydrologic monitoring component, SNWA groundwater development in Snake Valley is, or causing, or may cause, adverse effects to groundwater-influenced ecosystems. It will also track ecosystem response as management response actions are implemented.
- **Biological Monitoring Plan Methodology** – The biological monitoring plan utilizing the Nature Conservancy's Conservation Action Planning (CAP) process, or some other similar process. This process adopted should allow the technical working group to systematically organize, incorporate, and analyze biological information for vegetation, special status species, other priority species, and their habitats for the development of the Snake Valley Biological Monitoring Plan. Specifically, the CAP, or similar, process will assist in: 1) identification of ecosystems and species that will be the targets for conservation efforts; 2) identification of key ecological attributes (KEAs) essential to the long-term viability of those targets; 3) identification of indicators to assess each KEA, including those that may be used to predict potential adverse effects and/or show early warning of effects from SNWA's groundwater development; and 4) integration of existing monitoring into this plan. Other components of the CAP process include an assessment of the current status and determination of an acceptable range of variation for attributes and indicators.
- **Biological Monitoring Plan Indicators and Parameters** – Biological monitoring will require population level monitoring of sensitive species, or their surrogates, at representative locations. Monitoring of selected KEAs will coincide with the population level monitoring to track habitat condition relative to SNWA groundwater development. KEAs will be identified based on the following criteria: 1) strongly related to the status of the groundwater-influenced ecosystem and possibly essential to its viability; 2) good indicator of ecosystem health, including those that may provide early warning of adverse impacts due to SNWA groundwater withdrawal; and 3) reasonably feasible and efficient to measure. The technical working group, through the CAP process, will determine if there will be any biological monitoring needed in Utah basins adjacent to Snake Valley to fully assess impacts to certain species.

Air Quality Provisions -- The 3M Plan will include the following provisions for air quality monitoring and analysis. The technical working group will be tasked with identifying the appropriate timing to commence air quality activities in the 3M Plan, with regard to the time periods needed to establish baseline conditions before the groundwater development commences.

- **Air Quality and Climate Monitoring Plan** – SNWA shall develop an Air and Meteorological (climate) Monitoring Plan in conjunction with BLM and the technical working group. Parameters that will be monitored include PM₁₀ (particulate matter less than 10 microns in size), wind direction and speed, precipitation, temperature, relative humidity, soil moisture and temperature, and solar radiation. The Plan will include appropriate locations of stations, timing of measurements; identification of operation, data collection, and maintenance procedures; and responsibilities for data collection, data compilation, and quality assurance/quality control of data.
- This Plan will identify necessary coordination with other state and agency partners, and regulatory entities involved in air quality and climate monitoring. This Plan will also include early indicators of air quality pollutants, such as wind erosion and dust monitoring and will include both upwind and downwind information. Climate monitoring needs are discussed under the Hydrology Provisions, but are also a key component in addressing air quality and biological monitoring. This data will be used to address groundwater recharge, aid in modeling efforts, and assist in interpretation of air quality and other data. The climate monitoring data will also analyzing whether changes in vegetation and soils due are due to climate variation or reductions in groundwater levels.
- **Commencement of Air-Quality Monitoring** – As part of the Air Quality Monitoring Plan, the SNWA, in conjunction with the BLM and the Technical Working Group, shall locate, construct and instrument at least one monitoring station for air quality (specifically PM₁₀) and associated meteorological data. This station shall be located in Utah at a site representative of the Snake Valley air shed. The site will be operated continuously for at least 5 years prior to and for the duration of the SNWA groundwater withdrawal in Snake Valley. The cost of equipment, installation, maintenance, data collections and reporting, shall be the responsibility of the SNWA.

Appendix B Supplement 2 Additional Meteorological and Air Quality Monitoring Recommendations

The 3M Plan was developed for inclusion in the Proposed Clark, Lincoln, and White Pine Counties Groundwater Development Project EIS to describe planned monitoring and mitigation measures for Snake Valley in Nevada and Utah. To supplement the air quality provisions of the current 3M Plan to meet the inferred monitoring goals, the following additional meteorological and air quality monitoring recommendations are proposed.

The SNWA would authorize and fund the creation of an Air Quality Technical Working Group (AQTWG), which would include representatives from the National Park Service (NPS), Utah Department of Environmental Quality (UDEQ), and Nevada Department of Environmental Quality (NDEP). The AQTWG would be responsible for the development of an air monitoring plan; oversight of the plan implementation; adjustment of the plan to respond appropriately to changes in the National Ambient Air Quality Standards (NAAQS); and selection of air quality thresholds that would trigger additional mitigation measures.

Key Plan Objectives

1. The air monitoring plan will be approved by both Nevada and Utah BLM state offices.
2. The AQTWG will detail the siting and operation plan for a minimum of three PM₁₀ air monitoring stations, one of which will be upwind of the project area. PM_{2.5} monitoring is strongly recommended and the AQTWG will consider its addition at the time the detailed plan is written.
3. In addition, data from existing air quality monitors will be used to the extent possible. Existing monitors at Great Basin National Park (GBNP) and along Utah's Wasatch Front could be useful for establishing long-term trends in regional air quality. The monitored values during the baseline period can be compared to regional normal values to determine if the baseline period is representative of area. For example, if a 20 year history of data from GBNP shows that the baseline period is abnormally dry, it is likely that the monitored particulate matter during the baseline period are higher than normal.
4. The monitoring plan will comply with USEPA monitoring guidance¹ when selecting the site locations and instrumentation, developing the data management plan, and establishing quality assurance criteria. The selected instrumentation must have the ability to monitor pollutant concentrations at a frequency that corresponds with the form of applicable National and State AAQS (e.g., a selected PM_{2.5} monitor must have the ability to monitor concentrations over a 24-hour period, at a minimum).
5. This air quality monitoring plan may include mitigation measures offered by SNWA, in coordination with the National Park Service, UDEQ, and/or NDEP, to mitigate impacts that occur to air quality and visibility conditions at GBNP.
6. Baseline air measurements will be initiated at least 1 year prior to project construction activities to establish a baseline against which increased particulate values could be measured.
7. Once baseline air quality levels are established, monitoring would continue for the duration of groundwater pumping activities.

¹ USEPA 2006. Quality Assurance Handbook for Air Pollution Measurement Systems. EPA-454/D-06-001. October 2006.

8. Other meteorological measurements are recommended to provide a complete analysis of the air quality situation in the area of interest. The established monitoring goals would influence required monitoring parameters. At this time, the recommended measurements include:
 - a. Multiple soil depth moisture and temperature measurements;
 - b. Air temperature measurements at two levels to represent vertical temperature differences;
 - c. Total solar radiation;
 - d. Calculated standard deviation of horizontal and vertical wind direction (called sigma theta and sigma w, respectively);
 - e. The contribution of air quality impacts related to drawdown in other valleys would be considered and defined as either a project-related impact or an upwind, non-Snake Valley impact. The desire to include impacts from other valleys would be considered when siting an upwind monitor; and
 - f. Ozone monitoring may be requested but at this time, the project is not anticipated to have a long-term contribution to ozone.

This air quality monitoring plan may include mitigation measures offered by SNWA, in coordination with the NPS, UDEQ, and/or NDEP, to mitigate impacts that occur to air quality and visibility conditions at GBNP. However, the BLM cannot enforce mitigation measures on lands owned by other parties, and cannot ensure that the funding and land access necessary to implement these measures will be made available.

After groundwater pumping commences, then information gained from air quality trends measured in the project area combined with air quality trends from existing and upwind monitors may result in: 1) geographic redistribution of groundwater withdrawals, 2) reduction or cessation of groundwater withdrawals, and 3) augmentation of water supply and/or acquisition of existing water rights.

Appendix B2

Ongoing Studies in Southern Snake Valley and Vicinity and the Kinds of Questions That They Will Address

As of April 2011, several studies of various facets of the hydrogeology of Snake Valley, NV, and vicinity are ongoing. In 2008, a proposal submitted by the National Park Service, Bureau of Land Management, U.S. Fish & Wildlife Service, and U.S. Forest Service was awarded funding through the Southern Nevada Public Lands Management Act (SNPLMA) Conservation Initiatives Program. This SNPLMA funding has been applied to a hydrogeologic investigation that is currently being done by the U.S. Geological Survey (USGS) and the University of Nevada, Reno (UNR) entitled: “*A Study of the Connection Among Basin-Fill Aquifers, Carbonate-Rock Aquifers, and Surface-Water Resources in Southern Snake Valley, Nevada*”. This investigation began in July 2008 and a final USGS Scientific Investigations Report (SIR) will be completed later this year and likely will be available to the public by the end of calendar year 2011. The SNPLMA project consists of four principal study elements, which will be accomplished “...through data collection and analysis that are concentrated in two distinct areas on the eastern and southern flanks of the Snake Range” (USGS Fact Sheet 2008-3071). The four principal elements are: (1) a characterization of geologic and hydraulic properties of basin-fill sediments; (2) a quantitative assessment of groundwater – surface water interactions along Lehman, Baker, and Snake creeks; (3) delineation of the sources of water to Rowland Spring and Big Springs; and (4) a refinement of estimates of inter-basin groundwater flow from southern Spring Valley to Snake Valley. The final report from this investigation will address questions regarding the interaction of groundwater and surface water in the Lehman, Baker, and Snake Creek watersheds within and adjacent to Great Basin National Park; and the source and hydrogeologic dynamics of Rowland Spring and Big Springs. This information could be used to further the understanding of the conceptualization of the flow system in these areas, especially with regard to the lateral connectivity of flow systems, and the connectivity among surface waters, basin-fill aquifers, and the carbonate-rock aquifer. It also will likely be useful to numerical models, and could likely help further constrain model results and thus improve model predictive estimates. The results for Baker Creek likely will include a discussion of the hydrogeology of the Baker Creek Cave System and the extent of its interaction with Baker Creek and with the aquifer system in this area, based on geologic, geophysical, hydrologic, hydraulic, and hydrogeochemical evidence.

Additional ongoing studies include the following: (1) a regional potentiometric-surface map of Snake Valley and adjacent basins being prepared cooperatively by the USGS Nevada and Utah Water Science Centers; (2) a USGS study of the water quality of caves, springs, and streams in the Baker Creek drainage; (3) a dye-tracing study in the Baker Creek drainage; and (4) development by the USGS of approximately three hydrogeologic cross-sectional diagrams in the vicinity of Lehman, Baker, and Snake Creek drainages from within Great Basin National Park out onto the valley floor of Snake Valley. All of these studies are likely to be completed by the end of calendar year 2011. The first study will address questions about the extent and likely direction of groundwater flow in the regional aquifer in and adjacent to Snake Valley. The second and third studies will address questions regarding the hydrogeology of the Baker Creek drainage, including the Baker Creek Cave System, and the extent of its connection with Baker Creek and with the aquifer system along the mountain front and out into the adjacent valley. The fourth study will address questions about the extent of connection of the hydrogeologic system within Great Basin National Park with the aquifer system beneath the adjacent valley floor.

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