SOUTHERN NEVADA WATER AUTHORITY

Environmental Resources Division

Spring Valley Biological Monitoring Plan 2013 Status and Data Report

March 2014

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1.0 INTRODUCTION

This report was prepared by the Southern Nevada Water Authority (SNWA) in satisfaction of monitoring and reporting requirements set forth in the *Biological Monitoring Plan for the Spring Valley Stipulation* (Plan) (BWG, 2009). This report satisfies the biological data reporting requirements of Nevada State Engineer (NSE) Ruling 6164, which granted SNWA groundwater rights in the Spring Valley Hydrographic Area 184 (Spring Valley) (NSE, 2012). The location of Spring Valley is presented in Figure 1-1.

This report also satisfies the biological data reporting requirements of the 2006 Stipulated Agreement between SNWA and the U.S. Department of the Interior (DOI) regarding associated SNWA groundwater applications in Spring Valley (Stipulation, 2006).

This report provides the NSE with a summary of biological data collected in 2013, and the current status of each major element of the Plan. The biological data contained in this report are available to the NSE and DOI Stipulation Party representatives in electronic format on the SNWA data-exchange website.

This is the fourth status and data report in a series of reports associated with the Spring Valley biological monitoring, management and mitigation program. The reports document historic biological conditions and plan status since 2009 (SNWA, 2010, 2011a, and 2013a).

1.1 Background

On September 8, 2006, prior to the initial NSE hearing for SNWA groundwater applications 54003-54021 in Spring Valley, a Stipulation for Withdrawal of Protests (Stipulation, 2006) was established between SNWA and DOI on behalf of the Bureau of Indian Affairs (BIA), the Bureau of Land Management (BLM), the National Park Service (NPS), and the U.S. Fish and Wildlife Service (USFWS) (collectively known as the DOI Bureaus) regarding SNWA groundwater applications 54003-54021 in Spring Valley. Exhibits A and B of the Stipulation require the development of hydrologic and biological monitoring plans. As part of the Stipulation, an Executive Committee (EC) was established to oversee the implementation of the agreement. The Biological Work Group (BWG), composed of technical expert representatives of Parties to the Stipulation, was established to develop and oversee implementation of the biological monitoring, management and mitigation program, review program data, and modify the monitoring plan, if necessary. A hydrologic Technical Review Panel (TRP) was also established to oversee the development and implementation of the hydrologic monitoring, management and mitigation program.

On April 16, 2007, the NSE issued Ruling 5726 granting SNWA groundwater rights in Spring Valley for municipal and domestic purposes under permits 54003-54015, 54019, and 54020. As part of

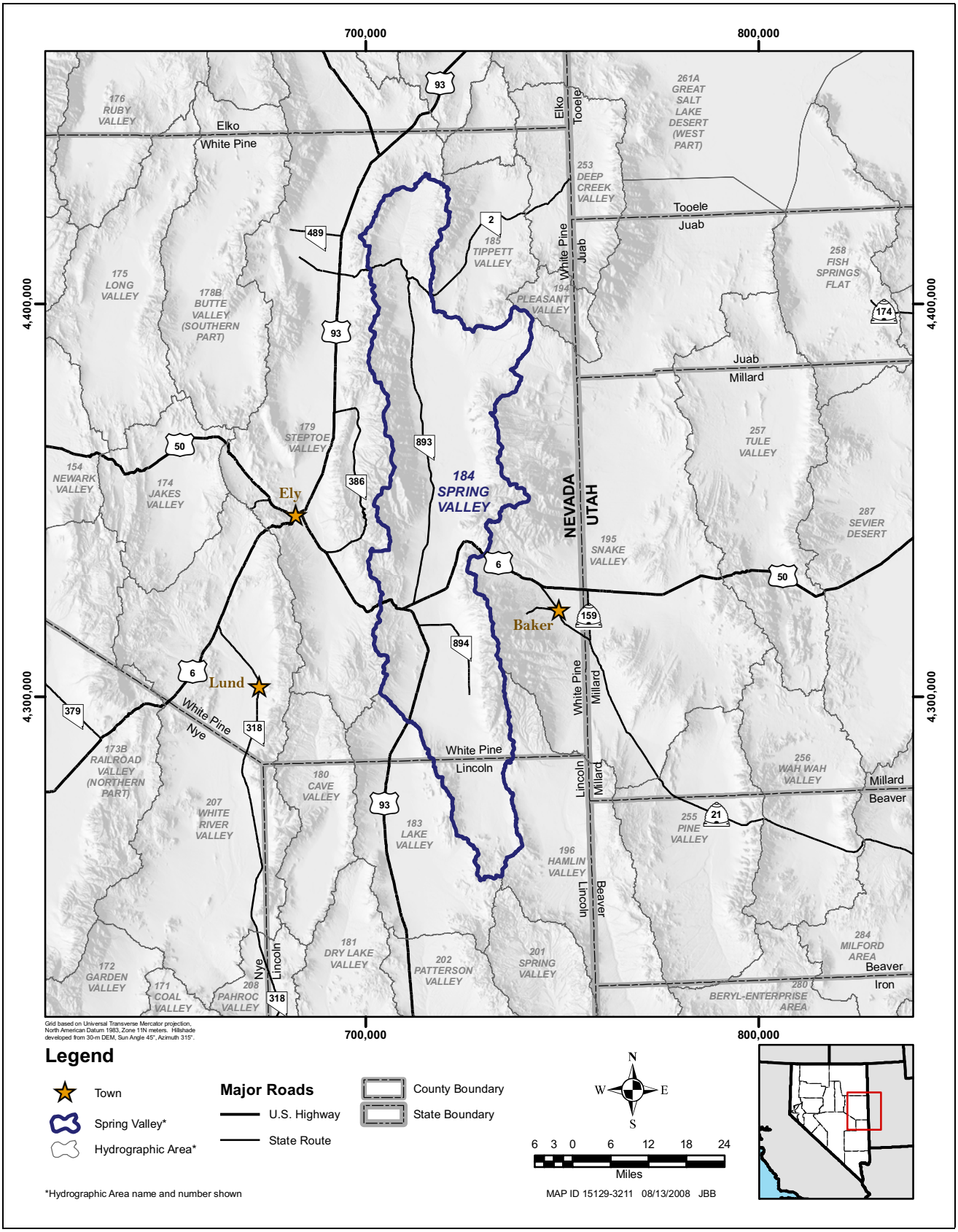

Figure 1-1
Spring Valley Hydrographic Area 184

Ruling 5726, the NSE conditioned SNWA's groundwater rights upon biological and hydrologic monitoring and mitigation programs approved by the NSE (NSE, 2007 at page 56). Ruling 5726 required annual reports be submitted to the NSE detailing the findings of the approved monitoring and mitigation plans (NSE, 2007 at page 56). The Plan (BWG, 2009) and the *Spring Valley Hydrologic Monitoring and Mitigation Plan (Hydrographic Area 184)* (SNWA, 2009) were approved by the NSE on January 23, 2009 and February 9, 2009 (respectively). The hydrologic monitoring plan was implemented by SNWA in 2008, and the Plan was implemented by SNWA in 2009.

Following the issuance of Ruling 5726, an opinion by the Nevada Supreme Court concluded that the NSE must re-notice SNWA's original groundwater applications and reopen the protest period (Great Basin Water Network, et. al. v. NSE, et. al., June 17, 2010) (Nevada Supreme Court, 2010). Ruling 5726 was vacated, and a second hearing on the water right applications was held by the NSE from September-November, 2011.

On September 15, 2011, prior to the second NSE hearing for SNWA groundwater applications 54003-54021 in Spring Valley, a separate Stipulation for Withdrawal of Protests (Stipulation, 2011) was established between SNWA and the U.S. Forest Service (USFS) regarding groundwater applications 54003-54021 in Spring Valley. The SNWA-USFS Stipulation requires establishment of additional hydrologic and biological monitoring sites, with biological monitoring to be conducted according to the principles contained in the Plan (BWG, 2009). The USFS also participates in the EC, BWG and TRP established by the [SNWA-DOI] Stipulation.

On March 22, 2012, the NSE issued Ruling 6164 granting SNWA groundwater rights in Spring Valley for municipal and domestic purposes under permits 54003-54015, 54019, and 54020. As part of Ruling 6164, the NSE reviewed and approved the Plan (BWG, 2009) and the updated *Hydrologic Monitoring and Mitigation Plan for Spring Valley* (SNWA, 2011b), and conditioned SNWA's groundwater rights upon compliance with the plans and any amendments to the plans that the NSE requires at a later date pursuant to his authority under Nevada water law (NSE, 2012 at page 217). Ruling 6164 requires that prior to SNWA exporting any groundwater resources from Spring Valley, a minimum of two years of biological and hydrologic baseline data shall be collected by SNWA in accordance with the approved monitoring plans. Ruling 6164 also required annual reports be submitted to the NSE detailing the findings of the approved monitoring plans (NSE, 2012 at page 217).

1.2 Biological Monitoring, Management and Mitigation Program Status

The Plan requires that seven years of baseline biological data be collected prior to SNWA groundwater withdrawal from Spring Valley. Two years of baseline biological data collection were completed in 2009 and 2010 (SNWA, 2010 and 2011a). To meet Plan requirements, full monitoring is planned to resume five years prior to SNWA groundwater withdrawal from Spring Valley. The BWG and EC identified the time until five years prior to groundwater withdrawal from Spring Valley as an "interim period", which if feasible can be used to examine data, test field protocols, make Plan adjustments, and conduct targeted monitoring and studies in support of the Plan and Stipulation goals. As such, in 2013 SNWA conducted additional surveys, studies and data analyses associated with the Plan.

In Ruling 6164, the NSE found that the adaptive approach incorporated in the Plan is an accepted scientific approach that is appropriate and advisable for managing a long-term project, and that adaptive management is a critical component in ensuring water development occurs in a manner that is environmentally sound (NSE, 2012 at page 182). As part of this adaptive approach, the BWG plans to routinely evaluate biological and hydrologic data and groundwater flow modeling results, as well as consider any future NSE decisions, changes in permitted points of diversion, and specific production well locations, to inform biological monitoring, management, and mitigation needs. Currently in accordance with the Plan, the BWG is evaluating the first two years of data collection (2009-2010) and additional data collected in 2011-2013, and conducting scientific evaluations of the Plan with the goal of revising components, methods and approaches as needed to continue to meet the needs of the Stipulation. The NSE would review and determine approval of any proposed Plan modifications submitted by SNWA under Ruling 6164, and may require additional amendments pursuant to his authority under Nevada water law (NSE, 2012 at page 217).

1.3 Major Activities Performed in 2013

Major activities associated with the Plan performed in 2013 were as follows:

- Conducted northern leopard frog (*Rana pipiens*) and Shoshone Ponds water quality surveys, and assisted NDOW with Shoshone Ponds Pahrump poolfish (*Empetrichthys latos*) and relict dace (*Relictus solitarius*) surveys.

- Conducted data analyses to evaluate sampling designs and methods, explore species distributions within monitoring sites, and better clarify relationships between species and habitat indicators. Such efforts were conducted for the following surveys: relict dace, Big Springs / Lake Creek native fishes, Pahrump poolfish, springsnails, macroinvertebrates, vegetation, physical habitat mapping, and water quality.

- Finalized three reports on the following Spring and Snake Valley data collection efforts: 2011-2012 relict dace surveys (SNWA, 2013b); 2011 Big Springs / Lake Creek native fish survey (SNWA, 2013c); and 2013 Shoshone Ponds water quality sampling (SNWA, 2013d).

- Developed ArcGIS geodatabases for viewing 2009-2013 data.

- Maintained the SNWA data-exchange web site accessible by the NSE, EC, BWG, and TRP. The web site contains monitoring plans, data and reports.

- As requested by the NSE Office, submitted a document and geodatabase detailing the vegetation monitoring transects. As also requested by the NSE Office, evaluated options for enhancing biological and hydrologic monitoring of phreatophytic shrublands in the drier groundwater discharge areas of lower-central and south Spring Valley.

- Applied for a USFS Special Use Permit to enable biological monitoring on one spring site on USFS-managed land (Chokecherry Spring, Spring Valley, Nevada) to fulfill requirements of the 2011 SNWA-USFS Stipulation.

- The BWG and TRP collaborated and shared expert opinions to inform biological and hydrologic monitoring efforts under the Stipulation.

- The BWG continued the Plan evaluation, focusing on the following monitoring efforts: relict dace, Pahrump poolfish, Big Springs/Lake Creek native fish, springsnails, and macroinvertebrates. Associated habitat monitoring (water quality, physical habitat, and hydrologic data collection) were included in the evaluation of each monitoring effort.

    - BWG evaluation of fish monitoring efforts involved members of all Stipulation Parties (SNWA, BIA, BLM, NPS, and USFWS) and invited participants (Nevada Department of Wildlife [NDOW], Utah Division of Wildlife Resources [UDWR], and U.S. Forest Service [USFS]). The BWG consulted with the TRP regarding hydrologic data and monitoring relevant to BWG fish monitoring efforts. The BWG submitted a draft report evaluating the fish monitoring efforts to the EC in December 2013 (BWG, 2013), and a BWG-consensus report was completed in 2014.

    - BWG preliminary evaluation of springsnail and macroinvertebrate monitoring efforts involved a BWG subgroup consisting of members of two Stipulation Parties (SNWA and USFWS) and an invited participant (UDWR). The BWG developed a plan to conduct a full evaluation in 2014, including members of all Stipulation Parties and invited participants, with TRP input and EC review.

    - The following consultant efforts were undertaken to support the Plan evaluation: USFWS contracted with a consultant to evaluate springsnail and macroinvertebrate sampling at springsnail monitoring sites; SNWA contracted with a consultant to evaluate the vegetation transects established under the Plan; and SNWA contracted with a consultant to evaluate physical habitat data collection in relation to fish and springsnail monitoring at select sites.

1.4 Report Scope

This report provides the NSE with a summary of biological data collected in 2013, and the current status of each major element of the Plan. The monitoring sites identified in the Plan are located within the Stipulation Initial Biological Monitoring Area (IBMA), which encompasses Spring Valley, northern Hamlin Valley (Hydrographic Area 196), and the Big Springs/Lake Creek sub-watershed in southern Snake Valley (Hydrographic Area 195) (Stipulation, 2006). The IBMA is depicted in Section 2.0.

Section 2.0 presents the status and data collected for each major element of the Plan. Section 3.0 discusses the planned activities for 2013. Section 4.0 provides a list of references. Appendix A presents a table and graphs of the various data discussed in the report.

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2.0 BIOLOGICAL MONITORING PLAN STATUS AND DATA

The current status of each major element of the Plan, and biological data collected in 2013 are presented in this section. Data collection on private property is contingent upon property access.

2.1 Physical Habitat Mapping

The Plan (BWG, 2009) identifies that physical habitat mapping be conducted at: 16 springs within Spring and Snake Valleys during the spring and fall seasons; and Big Springs/Lake Creek (Snake Valley) reaches monitored for fish during the late summer or early fall season (Section 2.9). Small springs are mapped in their entirety, and long springs and large spring complexes are mapped within designated sample areas. Physical habitat mapping sites are presented in Figure 2-1.

In 2013, the BWG conducted an evaluation of the physical habitat mapping effort at fish sampling sites (Keegan Spring Complex, Stonehouse Spring Complex, Big Springs/Lake Creek, and Shoshone Ponds). The evaluation involved members of all Stipulation Parties (SNWA, BIA, BLM, NPS, and USFWS) and invited participants (NDOW, UDWR, and USFS). Included in this effort were data analyses to evaluate sampling designs and methods and explore relationships between species and habitat indicators. As part of this process, SNWA contracted with BIO-WEST to evaluate physical habitat mapping at Keegan Spring Complex, and the BWG reviewed and provided comments on a BIO-WEST technical memorandum. The draft BWG fish evaluation report (BWG, 2013) and BIO-WEST technical memorandum (BIO-WEST, 2013) were prepared in 2013 and completed in 2014.

2.2 Site Assessment

The Plan (BWG, 2009) identifies that qualitative site assessments be conducted at: 16 springs within Spring and Snake Valleys, and Shoshone Ponds (Spring Valley), during the spring and fall seasons; and Big Springs/Lake Creek (Snake Valley) reaches monitored for fish during the late summer or early fall season (Section 2.9). Small springs are assessed in their entirety, and long springs and large spring complexes are assessed within designated sample areas established in 2009. Site assessment monitoring sites are presented in Figure 2-2.

No work was conducted regarding site assessments in 2013.

2.3 Water Quality

The Plan (BWG, 2009) identifies that: standard water quality (temperature, conductivity, pH, dissolved oxygen, turbidity, and velocity) and nutrient (nitrogen and phosphorus) data be collected at 16 springs within Spring and Snake Valleys during the spring and fall seasons; continuous

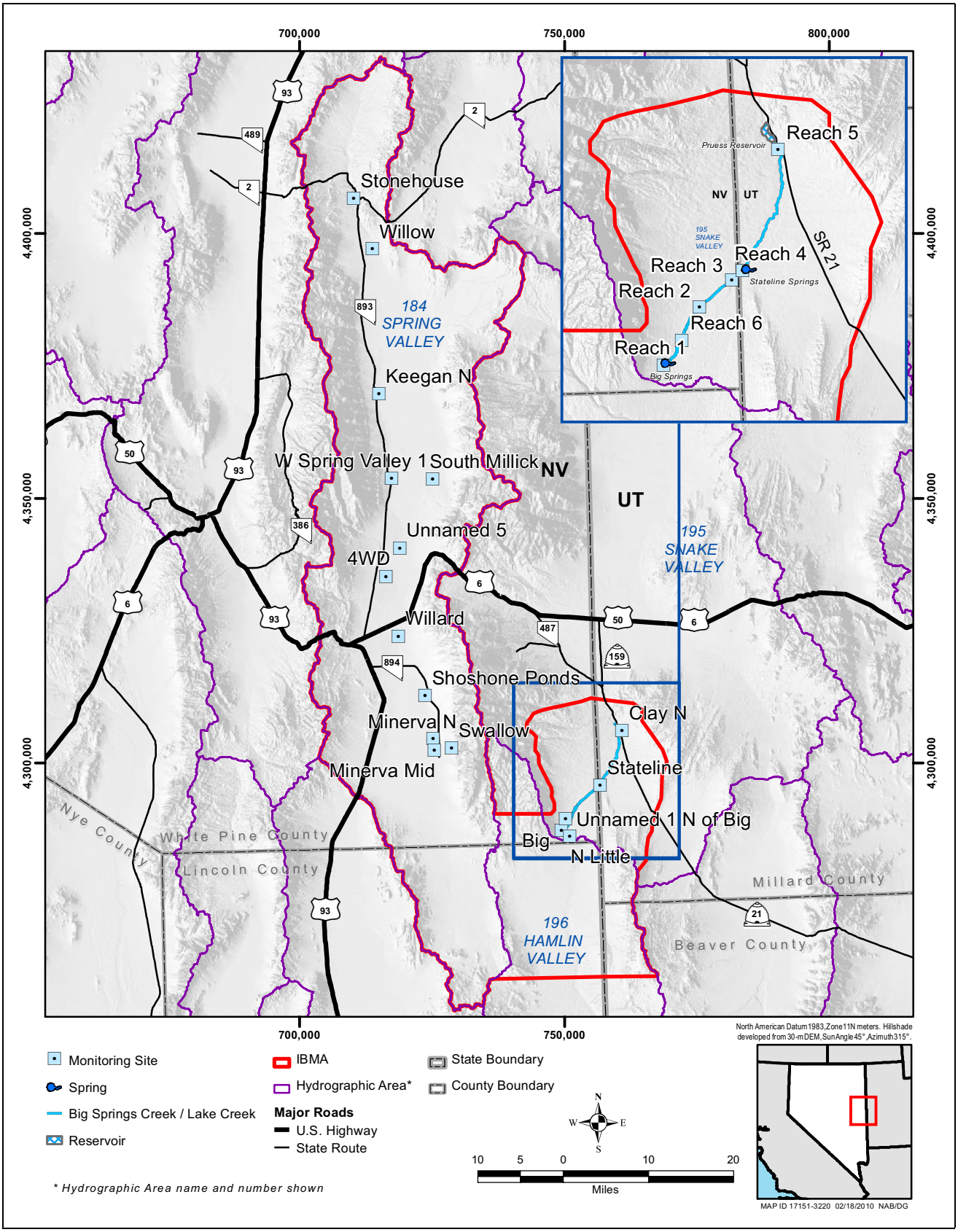

Figure 2-1
Physical Habitat Mapping Monitoring Sites within the IBMA

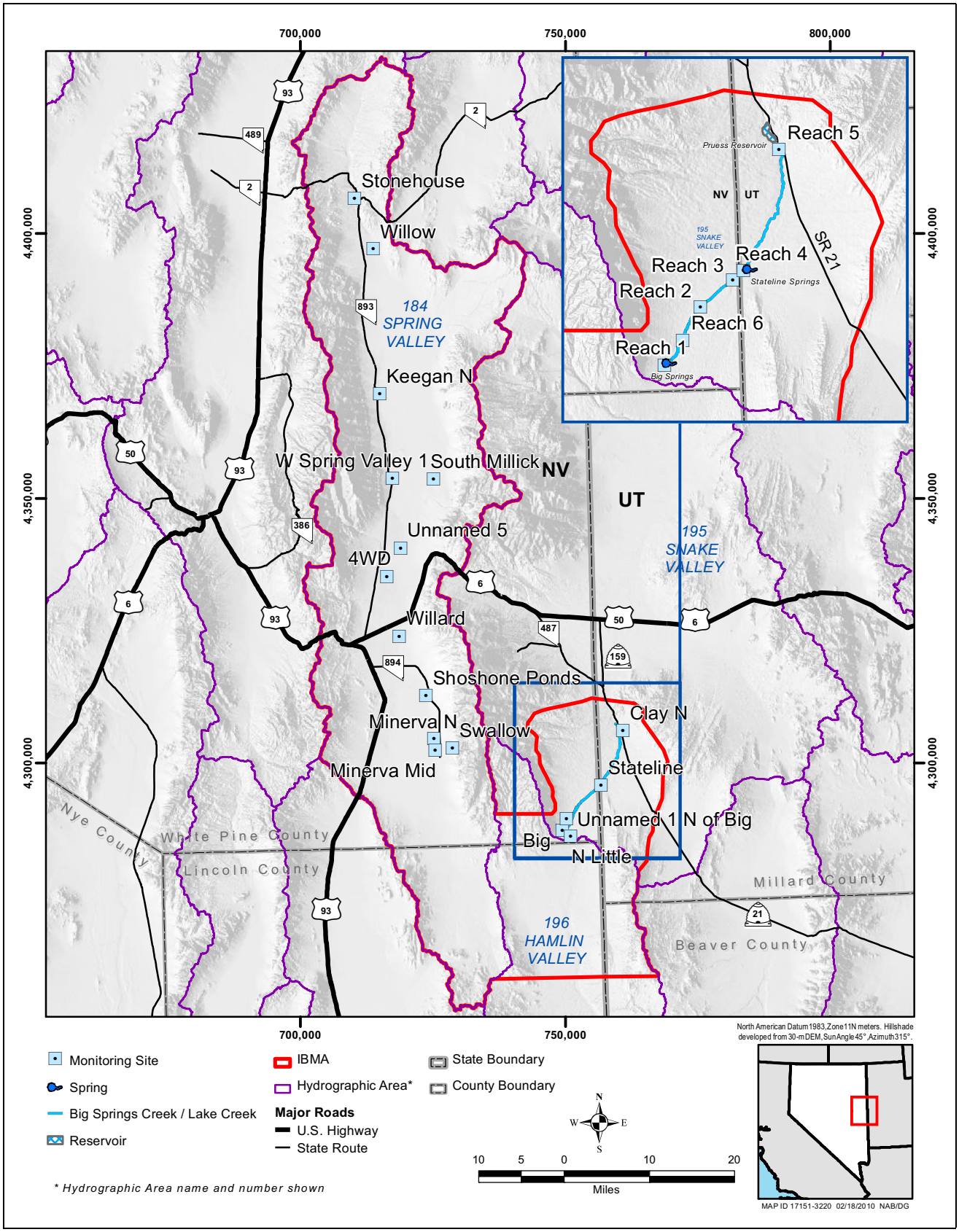

Figure 2-2
Site Assessment Monitoring Sites within the IBMA

temperature data be collected at the same 16 springs; and standard water quality data be collected at Big Springs/Lake Creek (Snake Valley) reaches monitored for fish during the late summer or early fall season (Section 2.9). Small springs are surveyed in their entirety, and long springs and large spring complexes are surveyed within designated sample areas. The Plan also integrates standard water quality data collected by NDOW during their annual Shoshone Ponds summer fish survey (Section 2.7 and Section 2.8). Water quality monitoring sites are presented in Figure 2-3.

Supplemental water quality sampling was conducted at Shoshone Ponds in 2013 to support Plan activities and Pahrump Poolfish Recovery Implementation Team (RIT) efforts. The following data were collected in spring 2013 (April 28-May 1, and May 14-16): 24-hour water quality sampling was conducted in the surface waters of the Middle refuge ponds, the Stock Pond, and the Well #2 outflow where Pahrump poolfish currently occur; water velocity data were collected in the Well #2 outflow; and vertical water quality profiling was conducted in the North refuge pond where Pahrump poolfish occurred prior to 2011. Detailed results and discussion of the water quality sampling are available in the field report: *Shoshone Ponds Water Quality Field Report: 2013* (SNWA, 2013d).

NDOW collected standard water quality data in 2013 as part of their annual Shoshone Ponds fish survey (Section 2.7 and Section 2.8). To support Plan activities, and as a participant of the Pahrump Poolfish RIT, SNWA assisted with this survey effort. Data were collected in August 2013 at the North, Middle and South refuge ponds, the Stock Pond, and the Well #2 outflow. NDOW's forthcoming 2013 field trip report will be available through NDOW.

Continuous 24-hour water quality sampling conducted in 2011 were presented in two final reports in 2013 regarding: relict dace surveys (Section 2.7; SNWA, 2013b), and a Big Springs/Lake Creek native fish survey (Section 2.9; SNWA, 2013c). The reports included detailed results and discussion pertaining to continuous 24-hour water quality data collection (temperature, conductivity, pH, and dissolved oxygen). Water quality data collected in 2011-2012 as part of a springsnail study (Section 2.4) were also analyzed, and detailed results and discussion will be available in a forthcoming springsnail study report. These data collection efforts were discussed in SNWA's last status and data report to the NSE (SNWA, 2013a).

In 2013, the BWG conducted an evaluation of water quality monitoring associated with springsnail, macroinvertebrate, relict dace, Big Springs/Lake Creek native fish, and Pahrump poolfish monitoring efforts. Included in these efforts were data analyses to evaluate sampling designs and methods and explore relationships between species and habitat indicators. Additional information on these evaluation efforts is presented in Sections 2.4-2.5 and Sections 2.7-2.9.

2.4 Springsnails

The Plan (BWG, 2009) identifies that springsnail abundance, distribution, and habitat data be collected at ten springs within Spring and Snake Valleys during the spring and fall seasons. Springsnail monitoring sites are presented in Figure 2-4.

Springsnail data collected in 2011-2012 as part of a springsnail study were analyzed in 2013. Detailed results and discussion will be available in a forthcoming springsnail study report. The data collection effort was discussed in SNWA's last status and data report to the NSE (SNWA, 2013a).

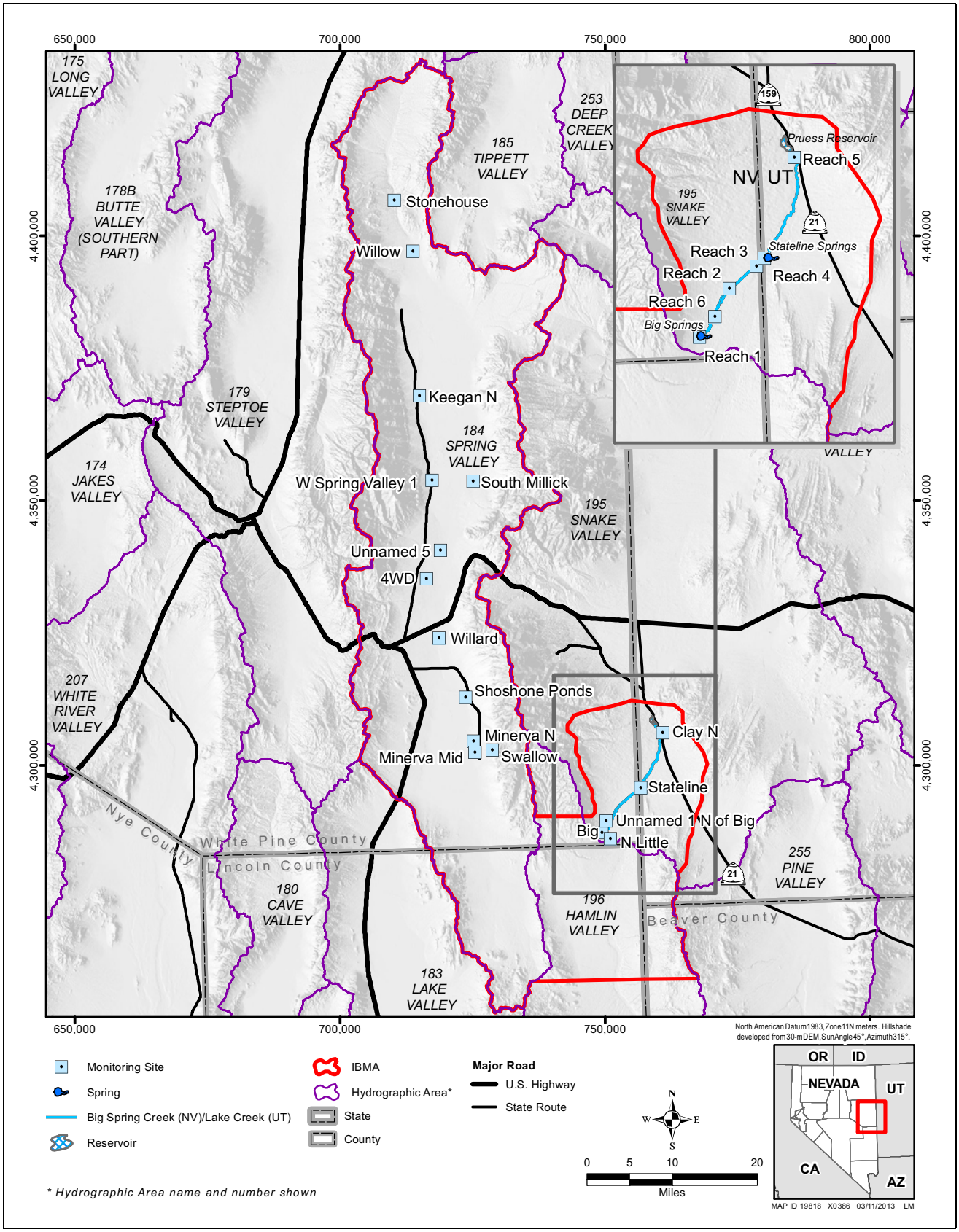

Figure 2-3
Water Quality Monitoring Sites within the IBMA

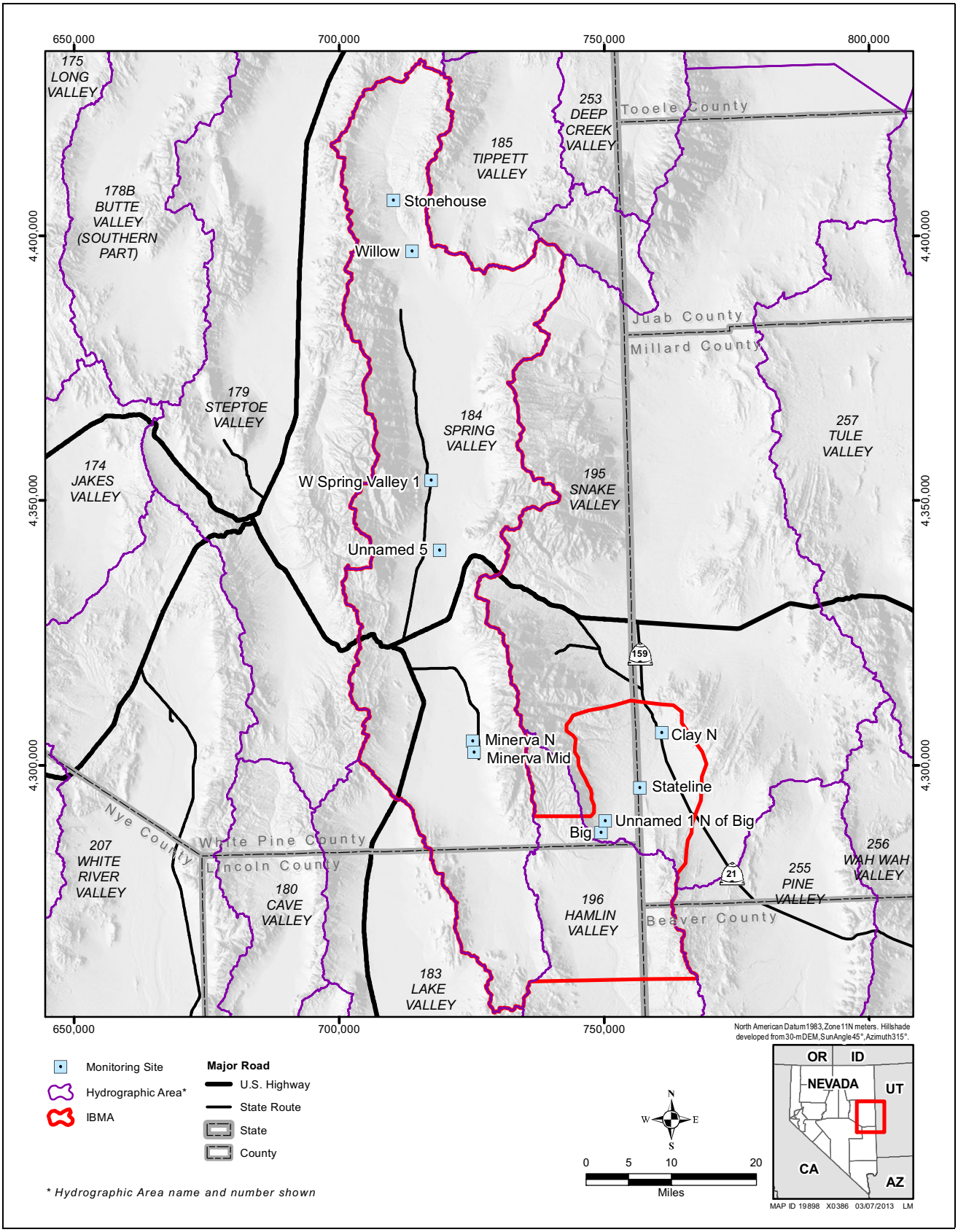

Figure 2-4
Springsnail Monitoring Sites within the IBMA

In 2013, the BWG conducted a preliminary evaluation of the springsnail monitoring effort. The preliminary evaluation involved a BWG subgroup consisting of members of two Stipulation Parties (SNWA and USFWS) and an invited participant (UDWR). As part of this process, USFWS contracted with Dr. Don Sada (Desert Research Institute) to evaluate springsnail monitoring, and the BWG subgroup reviewed and provided comments on Dr. Sada's draft report (Sada, 2013; finalized in 2014). The BWG developed a plan to conduct a full evaluation of the springsnail monitoring effort in 2014, including members of all Stipulation Parties and invited participants, with TRP input and EC review.

2.5 Macroinvertebrates

The Plan (BWG, 2009) identifies that macroinvertebrate sampling be conducted at 13 springs within Spring and Snake Valleys during the spring and fall seasons. Small springs are surveyed in their entirety, and long springs and large spring complexes are surveyed within designated sample areas established in 2009. Macroinvertebrate monitoring sites are presented in Figure 2-5.

Macroinvertebrate data collected in 2011-2012 as part of a springsnail study (Section 2.4) were analyzed in 2013. Detailed results and discussion will be available in a forthcoming springsnail study report. The data collection effort was discussed in SNWA's last status and data report to the NSE (SNWA, 2013a).

In 2013, the BWG conducted a preliminary evaluation of the macroinvertebrate monitoring effort. The preliminary evaluation involved a BWG subgroup consisting of members of two Stipulation Parties (SNWA and USFWS) and an invited participant (UDWR). As part of this process, USFWS contracted with Dr. Don Sada (Desert Research Institute) to evaluate macroinvertebrate monitoring, and the BWG subgroup reviewed and provided comments on Dr. Sada's draft report (Sada, 2013; finalized in 2014). The BWG developed a plan to conduct a full evaluation of the macroinvertebrate monitoring effort in 2014, including members of all Stipulation Parties and invited participants, with TRP input and EC review.

2.6 Northern Leopard Frogs

The Plan (BWG, 2009) identifies that northern leopard frog egg mass and breeding habitat data be collected during the spring season at any spring monitoring sites identified in the Plan (Spring and Snake Valleys) where the species is documented. Northern leopard frog presence surveys were conducted in the first two years of data collection (2009-2010) at: 16 springs and wetlands throughout Spring and Snake Valleys; Shoshone Ponds (Spring Valley); and Big Springs/Lake Creek (Snake Valley). In accordance with the Plan, sites with no historic records of species presence and no signs of northern leopard frogs after two consecutive survey seasons were dropped from the survey protocol; if northern leopard frogs are incidentally documented at one of these sites in the future, the surveys at that site will be re-initiated (SNWA, 2011a). For the egg mass surveys, small springs are surveyed in their entirety, and long springs and large spring complexes are surveyed within designated sample areas established in 2009. Northern leopard frog previous presence and current egg mass monitoring sites are presented in Figure 2-6.

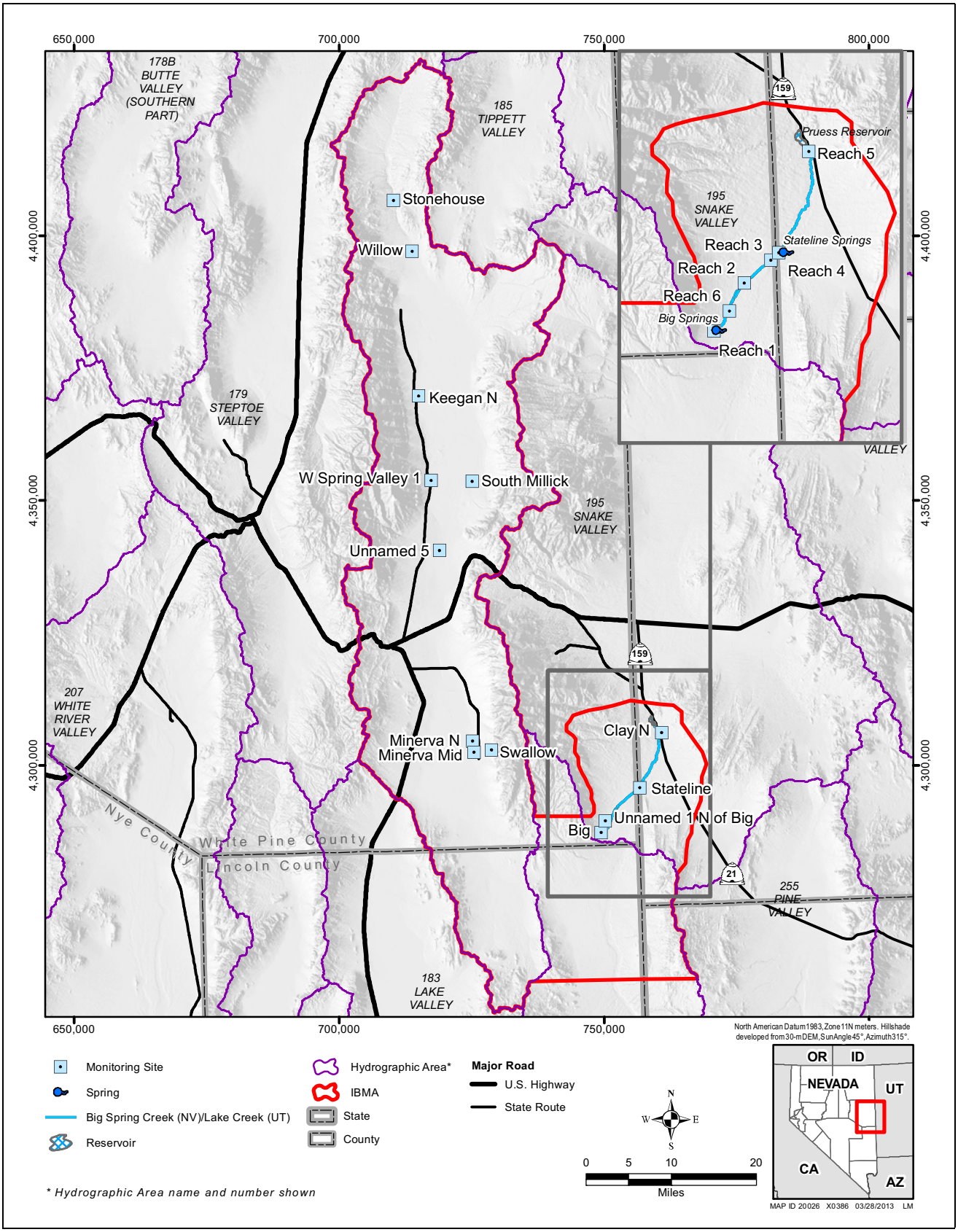

Figure 2-5
Macroinvertebrate Monitoring Sites within the IBMA

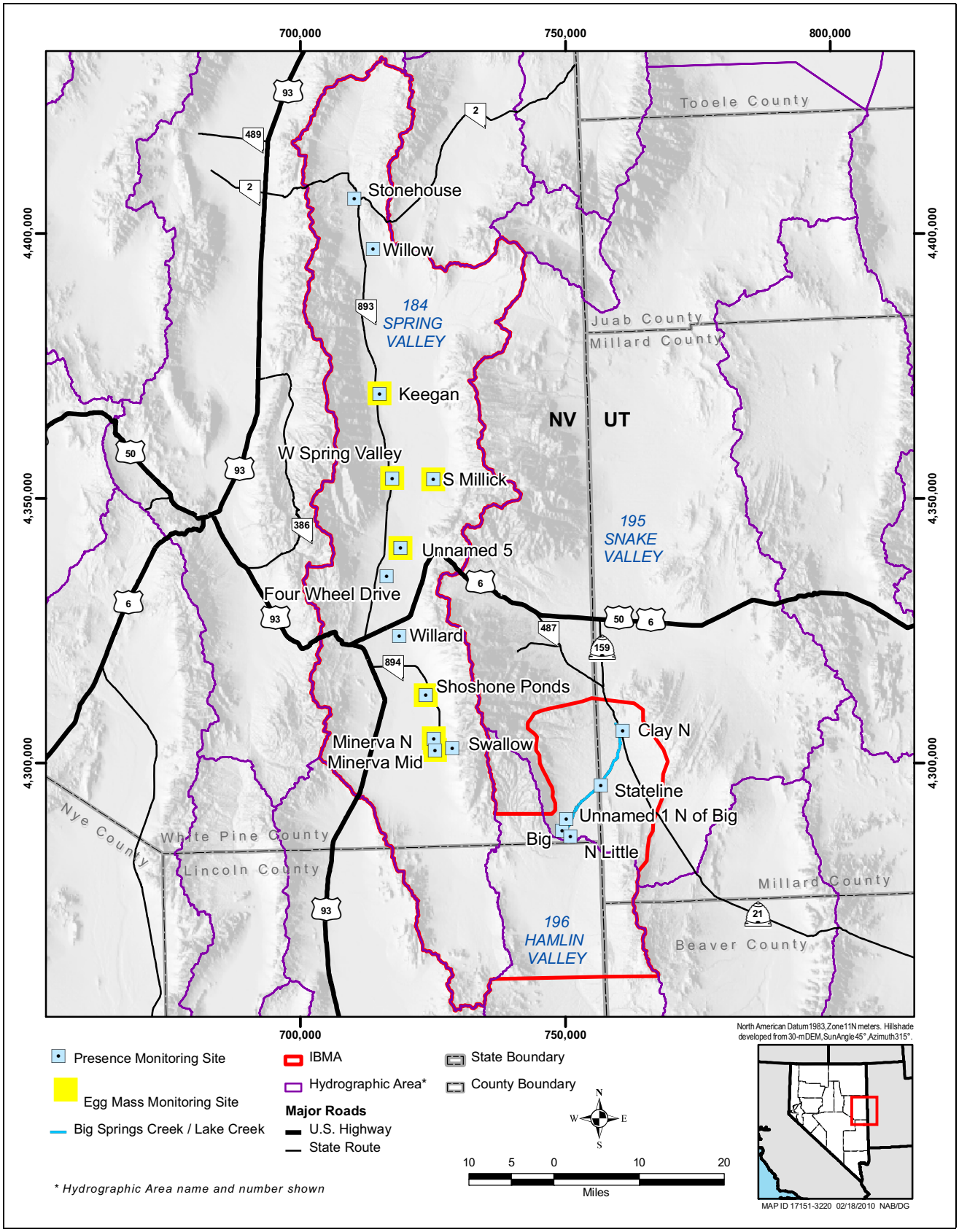

Figure 2-6
Northern Leopard Frog Monitoring Sites within the IBMA

Northern leopard frog egg mass and breeding habitat data were collected at 7 sites in 2013. Data were collected in spring 2013 (March 6-May 15) at Keegan Spring Complex North, Minerva Spring Complex Middle, Minerva Spring Complex North, Shoshone Ponds, South Millick Spring, Unnamed 5 Spring, and West Spring Valley Complex 1. The sites were chosen because egg masses were documented at these sites between 2009-2012 (SNWA, 2011a and 2013a). Data were collected according to the methods outlined in the Plan (BWG, 2009), changes agreed upon by the BWG (SNWA, 2010 at page 4-1), and methods described in the 2010 annual report (SNWA, 2011a). Data in 2013 were also collected according to a goal in the Plan (BWG, 2009 at page 5-16) to shift to Columbia spotted frog breeding survey protocols currently implemented by Utah Division of Wildlife Resources (UDWR, 2004); i.e., to collect habitat data not at individual egg masses (as in 2009-2011), but around egg mass clusters. Detailed results and discussion on 2011-2013 northern leopard frog surveys will be provided in a forthcoming survey report.

2.7 Relict Dace

The Plan (BWG, 2009) identifies that relict dace age class and distribution data be collected at 2 springs within Spring Valley during the spring and fall seasons. These large spring complexes are surveyed within designated sample areas established in 2009. The Plan also integrates relict dace population estimates and age class structure data collected by NDOW during their annual Shoshone Ponds summer fish survey. Relict dace monitoring sites are presented in Figure 2-7.

Relict dace surveys conducted in 2011-2012 were presented in a final report in 2013: *Relict Dace 2011-2012 Survey Report* (SNWA, 2013b). The report included detailed results and discussion pertaining to the following: relict dace sampling in Keegan Spring Complex North and Stonehouse Spring Complex designated sampling areas; trapping efforts extended beyond the designated sample areas to determine relict dace distributions within the spring complexes; supplemental continuous 24-hour water quality data collection within sampling areas (temperature, conductivity, pH, and dissolved oxygen); and supplemental habitat data collection at fish traps (hydromorphological unit [pool, channel], standing water depth, and percent vegetation cover). Relative abundance, age class structure, recruitment, spatial distribution, and habitat characterization data were presented.

NDOW conducted their annual Shoshone Ponds fish survey in 2013. To support Plan activities, SNWA assisted with the survey effort. Relict dace data were collected in August 2013 at the South refuge pond. The forthcoming 2013 field trip report will be available through NDOW.

In 2013, the BWG conducted an evaluation of the relict dace monitoring effort at Keegan and Stonehouse spring complexes. The evaluation involved members of all Stipulation Parties (SNWA, BIA, BLM, NPS, and USFWS) and invited participants (NDOW, UDWR, and USFS). The evaluation focused on monitoring indicators, sample designs, and methods used to survey fish populations; as well as, associated water quality, water quantity, and habitat variables. To conduct the evaluation, the BWG reviewed and analyzed relict dace and associated habitat data collected in 2009-2012 (SNWA 2010, 2011a, 2013a, and 2013b). As part of this process, SNWA contracted with BIO-WEST to evaluate physical habitat monitoring in relation relict dace monitoring. The BWG reviewed and provided comments on BIO-WEST's draft report, which informed BWG's evaluation (BIO-WEST, 2013; finalized in 2014). The BWG also consulted with the TRP regarding hydrologic data and monitoring relevant to BWG relict dace monitoring efforts. The BWG submitted a draft

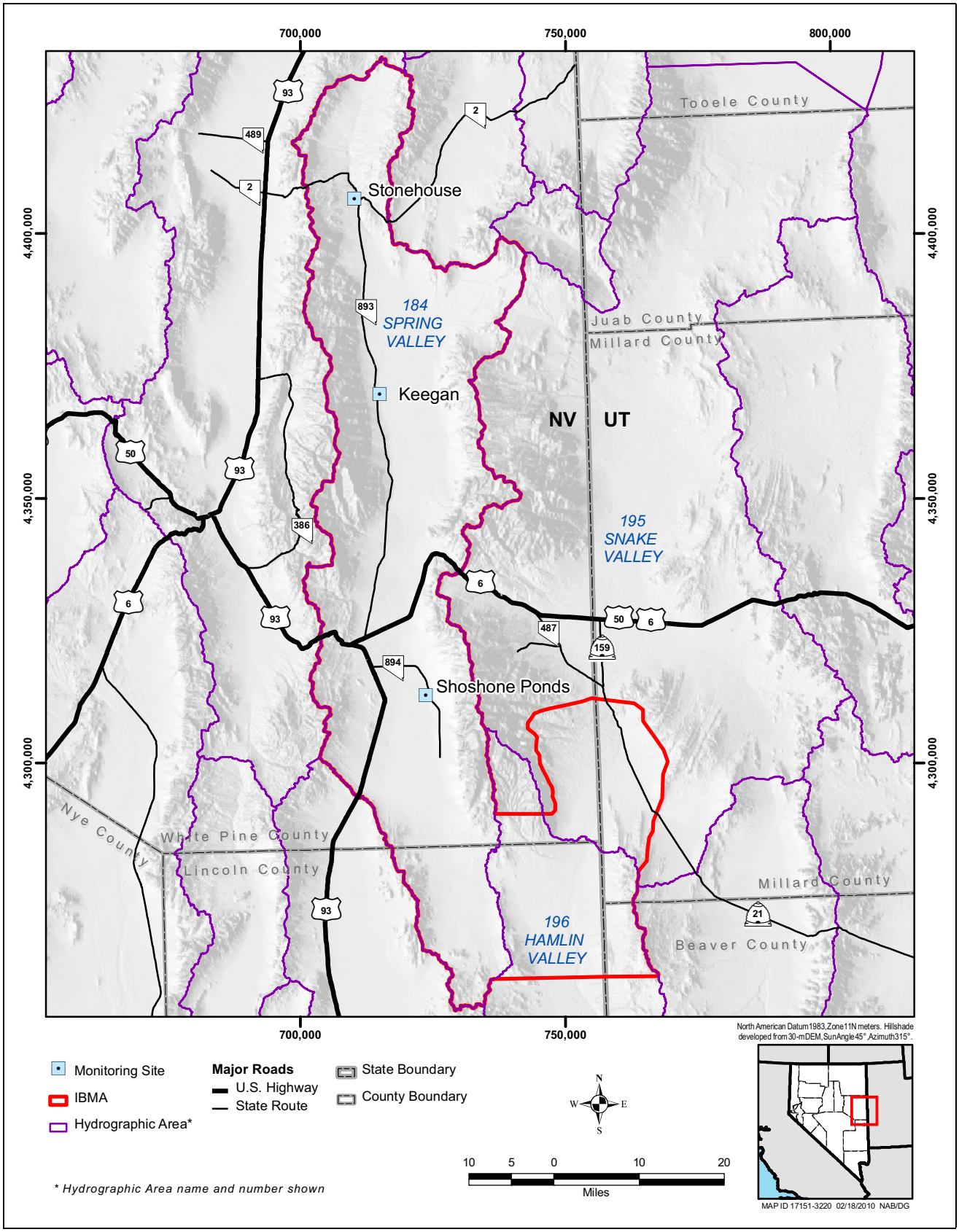

Figure 2-7
Relict Dace Monitoring Sites within the IBMA

report evaluating fish monitoring efforts to the EC in December 2013 (BWG, 2013), and a BWG-consensus report was completed in 2014.

2.8 Pahrump Poolfish

The Plan (BWG, 2009) integrates Pahrump poolfish population estimates and age class structure data collected by NDOW during their annual Shoshone Ponds summer fish surveys. The Parhump poolfish monitoring site is presented in Figure 2-8.

NDOW conducted their annual Shoshone Ponds fish survey in 2013. To support Plan activities, and as a participant of the Pahrump Poolfish RIT, SNWA assisted with the survey effort. Pahrump poolfish data were collected in August 2013 at the North and Middle refuge ponds, the Stock Pond, and the Well #2 outflow. Standard water quality data were collected as part of their fish survey. SNWA also conducted a 2013 Shoshone Ponds water quality study (24-hour water quality sampling, velocity data collection, and vertical water quality profiling) in the North and Middle refuge ponds, the Stock Pond, and the Well #2 outflow in April-May 2013 (Section 2.3). Detailed results and discussion of the SNWA water quality sampling, which is discussed in Section 2.3, are available in the SNWA field report (SNWA, 2013d). The forthcoming NDOW 2013 field trip report will be available through NDOW.

In 2013, the BWG conducted an evaluation of the Pahrump poolfish monitoring effort at Shoshone Ponds. The evaluation involved members of all Stipulation Parties (SNWA, BIA, BLM, NPS, and USFWS) and invited participants (NDOW, UDWR, and USFS). The evaluation focused on monitoring indicators, sample designs, and methods used to survey fish populations; as well as, associated water quality, water quantity, and habitat variables. To conduct the evaluation, the BWG reviewed and analyzed Pahrump poolfish and associated habitat data collected in 1997-2013 (NDOW 2013; NDOW field reports in SNWA 2010, 2011a, and 2013a; SNWA 2012, 2013d). As part of this process, the BWG discussed data collection efforts with the Pahrump poolfish RIT, The BWG also consulted with the TRP regarding hydrologic data and monitoring relevant to BWG Pahrump poolfish monitoring efforts. The BWG submitted a draft report evaluating fish monitoring efforts to the EC in December 2013 (BWG, 2013), and a BWG-consensus report was completed in 2014.

2.9 Big Springs/Lake Creek Native Fish Community

The Plan (BWG, 2009) identifies that native fish species composition, relative abundance, age class structure, and distribution data be collected within Big Springs/Lake Creek (Snake Valley) reaches during the late summer or early fall season. In accordance with the Plan, five representative reaches 100 meters long were selected across the system in 2009. In accordance with changes agreed upon by the BWG (SNWA, 2010 at page 4-2), a sixth reach was added in 2010 in an effort determine the best placement of reaches between Big Springs and Stateline Springs. Reach 1-6 start and end locations were recorded in Zone 11 North, North American Datum 1983 (Zone 11N NAD 83) using a Trimble GeoXH GPS Unit, and a geodatabase of Reach start and end locations was created in ArcGIS Software version 10.0 (ESRI). Native fish monitoring reaches are presented in Figure 2-9.

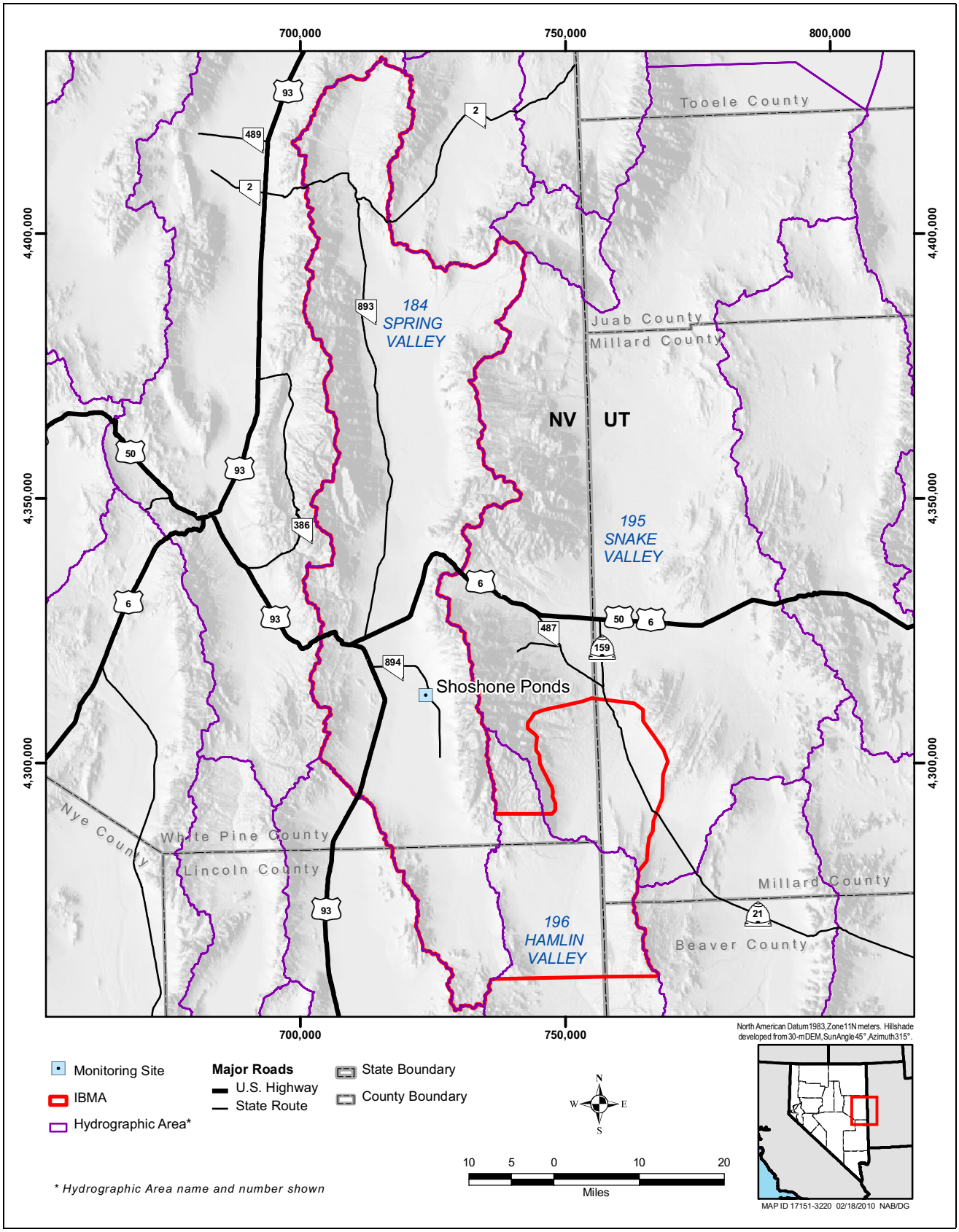

Figure 2-8
Pahrump Poolfish Monitoring Sites within the IBMA

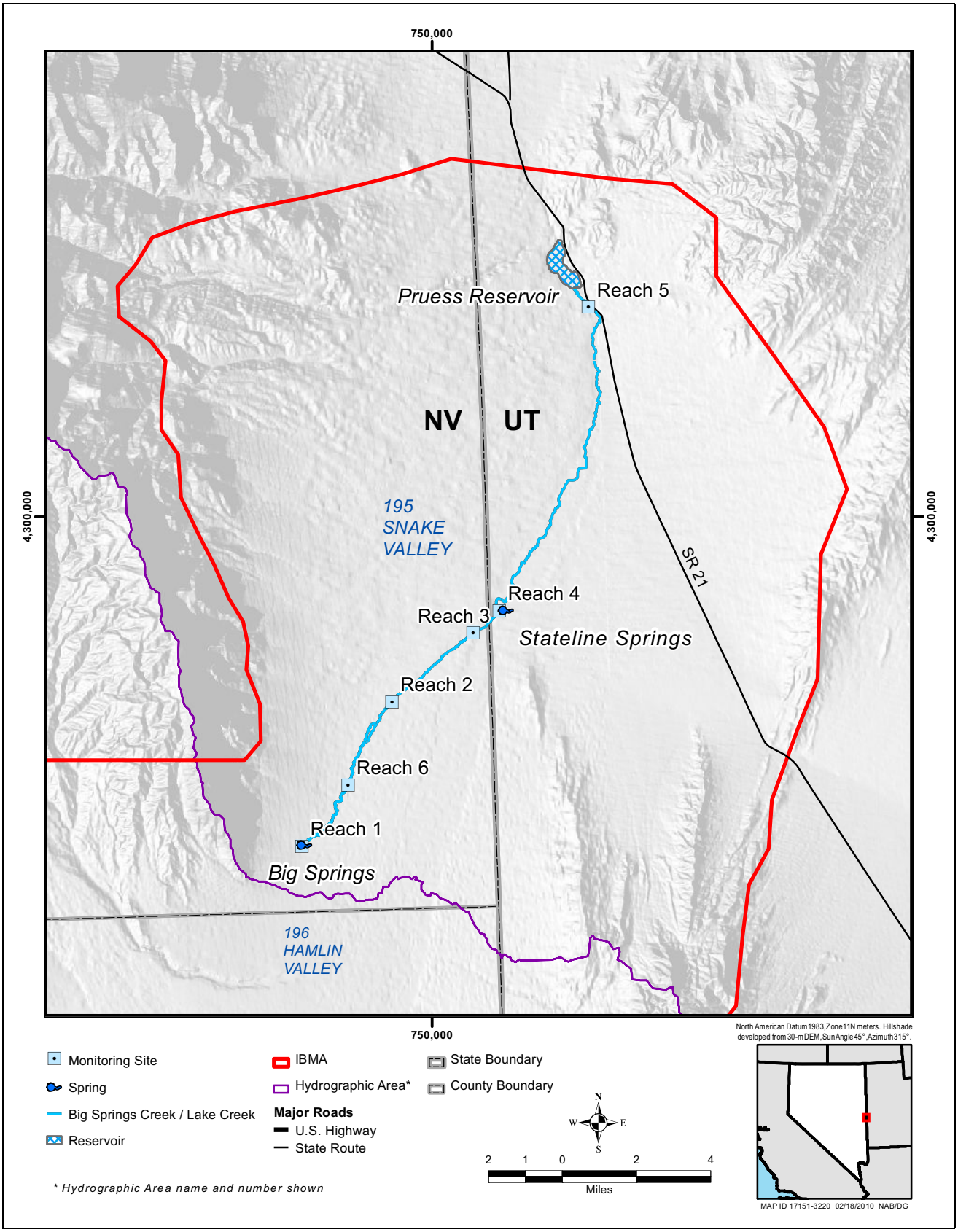

Figure 2-9
Big Springs/Lake Creek Fish Monitoring Reaches within the IBMA

Native fish surveys conducted in 2011 were presented in a final report in 2013: *Big Springs/Lake Creek Native Fish Community 2011 Survey Report* (SNWA, 2013c). The report included detailed results and discussion pertaining to the following: native fish sampling in designated sampling reaches; supplemental continuous 24-hour water quality data collection within the sampling reaches (temperature, conductivity, pH, and dissolved oxygen); and supplemental habitat data collection along transects within the reaches (substrate type, maximum water depth, maximum water velocity, percent emergent vegetation, and percent submergent vegetation). Relative abundance, age class structure, recruitment, spatial distribution, and habitat characterization data were presented.

In 2013, the BWG conducted an evaluation of the native fish monitoring effort at Big Springs/Lake Creek. The evaluation involved members of all Stipulation Parties (SNWA, BIA, BLM, NPS, and USFWS) and invited participants (NDOW, UDWR, and USFS). The evaluation focused on monitoring indicators, sample designs, and methods used to survey fish populations; as well as, associated water quality, water quantity, and habitat variables. To conduct the evaluation, the BWG reviewed and analyzed Big Springs/Lake Creek fish and associated habitat data collected in 2009-2011 (SNWA 2010, 2011a, 2013a, and 2013c). The BWG also consulted with the TRP regarding hydrologic data and monitoring relevant to BWG creek fish monitoring efforts. The BWG submitted a draft report evaluating fish monitoring efforts to the EC in December 2013 (BWG, 2013), and a BWG-consensus report was completed in 2014.

2.10 Vegetation

The Plan (BWG, 2009) identifies that vegetation cover and composition data be collected during the summer at transects within: 19 spring and wetland/meadow sites within Spring and Snake Valleys; phreatophytic shrublands within Spring, Hamlin and Snake Valleys; and two lower elevation Rocky Mountain juniper woodland populations in Spring Valley. Vegetation monitoring sites are presented in Figure 2-10.

In accordance with the Plan, 179 vegetation transects were established in 2009. The transects include: 122 line transects in spring, wetland and meadow habitats at biological monitoring sites within Spring and Snake Valleys; 25 line transects in greasewood (*Sarcobatus verminculatus*)-dominated phreatophytic shrubland habitats distributed across five IBMA regions (Spring Valley North, Spring Valley Middle, Spring Valley South, Hamlin Valley North, and Snake Valley South); and 32 belt transects (each composed of three 20-m line transects) in the two lower elevation Rocky Mountain juniper woodland populations within Spring Valley (SNWA, 2013e). Transect endpoints were marked with capped rebar monuments, and transect endpoint and landmark locations were recorded and post-processed using professional survey-grade GPS equipment (SNWA, 2013e). A geodatabase of transect endpoint and landmark locations and digitally-generated transect lines was completed in 2012.

As requested, in January 2013 SNWA submitted a vegetation transect geodatabase and the document *Southern Nevada Water Authority Vegetation Transects: Spring Valley (Hydrographic Area #184)* (SNWA, 2013e) to the NSE Office. The document provides detailed information on the vegetation monitoring transects, including methods for transect design and establishment, their spatial distribution, the types of habitats that they traverse, and their locations in relation to hydrological monitoring network components. Also in 2013, SNWA evaluated options for enhancing biological

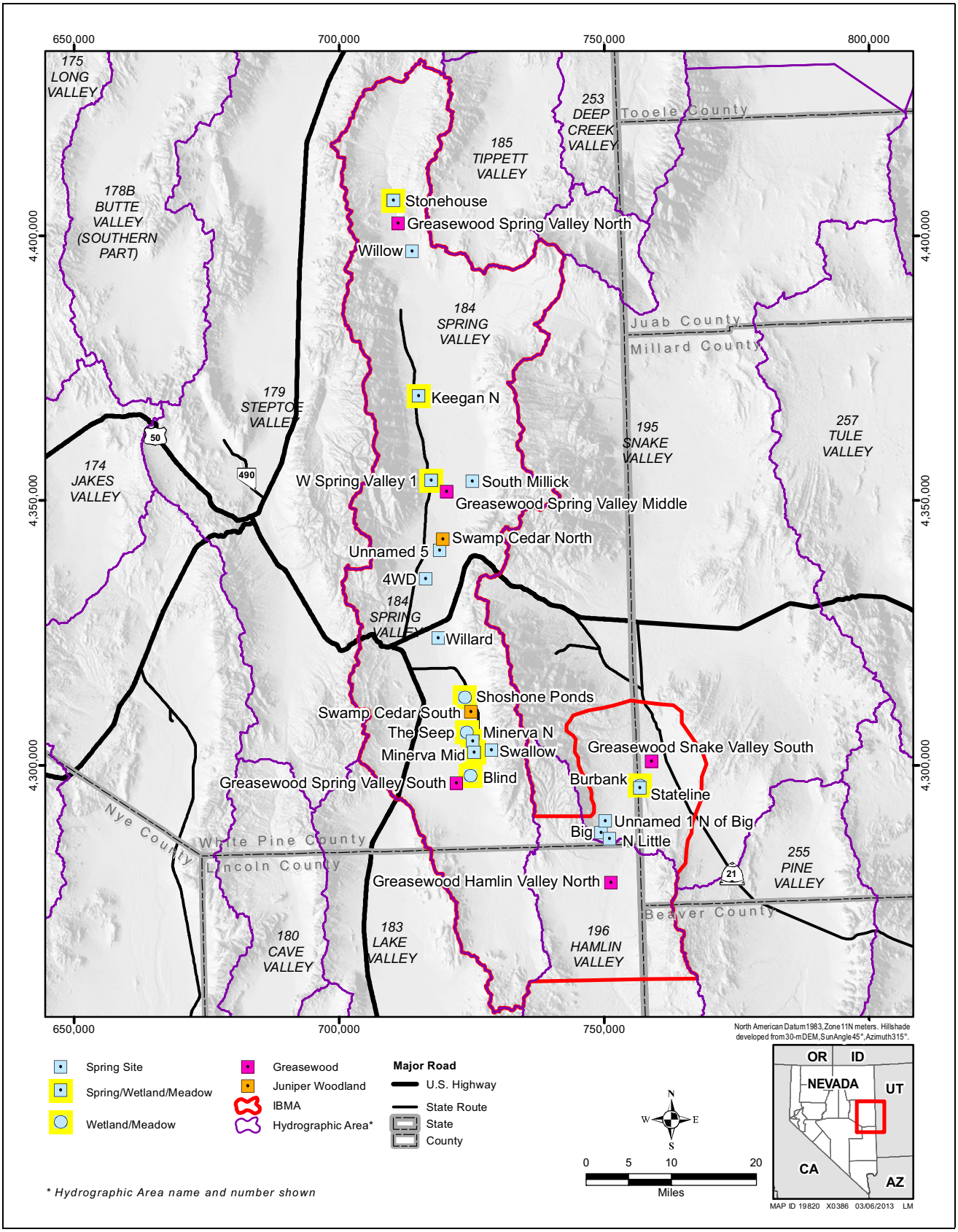

Figure 2-10
Vegetation Monitoring Sites within the IBMA

and hydrologic monitoring of phreatophytic shrublands in the drier groundwater discharge areas of lower-central and south Spring Valley, as requested by the NSE Office.

In 2012-2013, SNWA conducted an evaluation of the vegetation survey effort. SNWA contracted with KS2 Ecological Field Services to evaluate vegetation transect efficacy and efficiency, and to test sampling protocols. As discussed in SNWA's last status and data report to the NSE (SNWA, 2013a), vegetation cover and composition data were collected for this effort at various transects and habitat types in 2012. The 2012 data and the 2009-2010 data collected under the Plan were extensively analyzed to evaluate sampling designs and methods. KS2 Ecological Field Services submitted a draft report to SNWA in 2013 (KS2 Ecological Field Services, 2013), which will be distributed to the BWG for review.

2.11 Rocky Mountain Junipers

The Plan (BWG, 2009) identifies that stem elongation, tree height, tree circumference and tree count data be collected at transects within two lower elevation Rocky Mountain juniper (*Juniperus scopulorum*; a.k.a. swamp cedar) woodland populations in Spring Valley during the summer season. The Rocky Mountain juniper monitoring sites are presented in Figure 2-11.

In accordance with the Plan, 32 belt transects were established in 2009. The transects were distributed across the two lower elevation Rocky Mountain juniper woodland populations within Spring Valley (16 transects per population) (SNWA, 2013e). Within each population, based on topography and understory vegetation composition inferring typical moisture conditions, the transects were distributed across Dry Sites and Wet Sites. The belt transects are 20-m long by 5-m wide, with three 20-m line transects located along the middle and long edges of the belts (Rocky Mountain juniper data are collected within the belt transects, and vegetation cover and composition data [Section 2.10] are collected along the line transects). Transect endpoints were marked with capped rebar monuments, and transect endpoint and landmark locations were recorded and post-processed using professional survey-grade GPS equipment (SNWA, 2013e).

In 2013, SNWA submitted a vegetation transect geodatabase and the document *Southern Nevada Water Authority Vegetation Transects: Spring Valley (Hydrographic Area #184)* (SNWA, 2013e) upon request to the NSE Office. An evaluation of vegetation transect efficacy and efficiency, which included Rocky Mountain juniper transects, was also conducted in 2013. For more information on these efforts, please see Section 2.10.

2.12 Fixed Station Photography

The Plan (BWG, 2009) identifies that fixed station photography be conducted at: 16 springs within Spring and Snake Valleys, and Shoshone Ponds (Spring Valley), during the spring and fall seasons; transects monitored for vegetation (Spring, Hamlin and Snake Valleys) during the summer season (Section 2.10); and Big Springs/Lake Creek (Snake Valley) reaches monitored for fish during the late summer or early fall season (Section 2.9). The fixed station photography monitoring sites are presented in Figure 2-12.

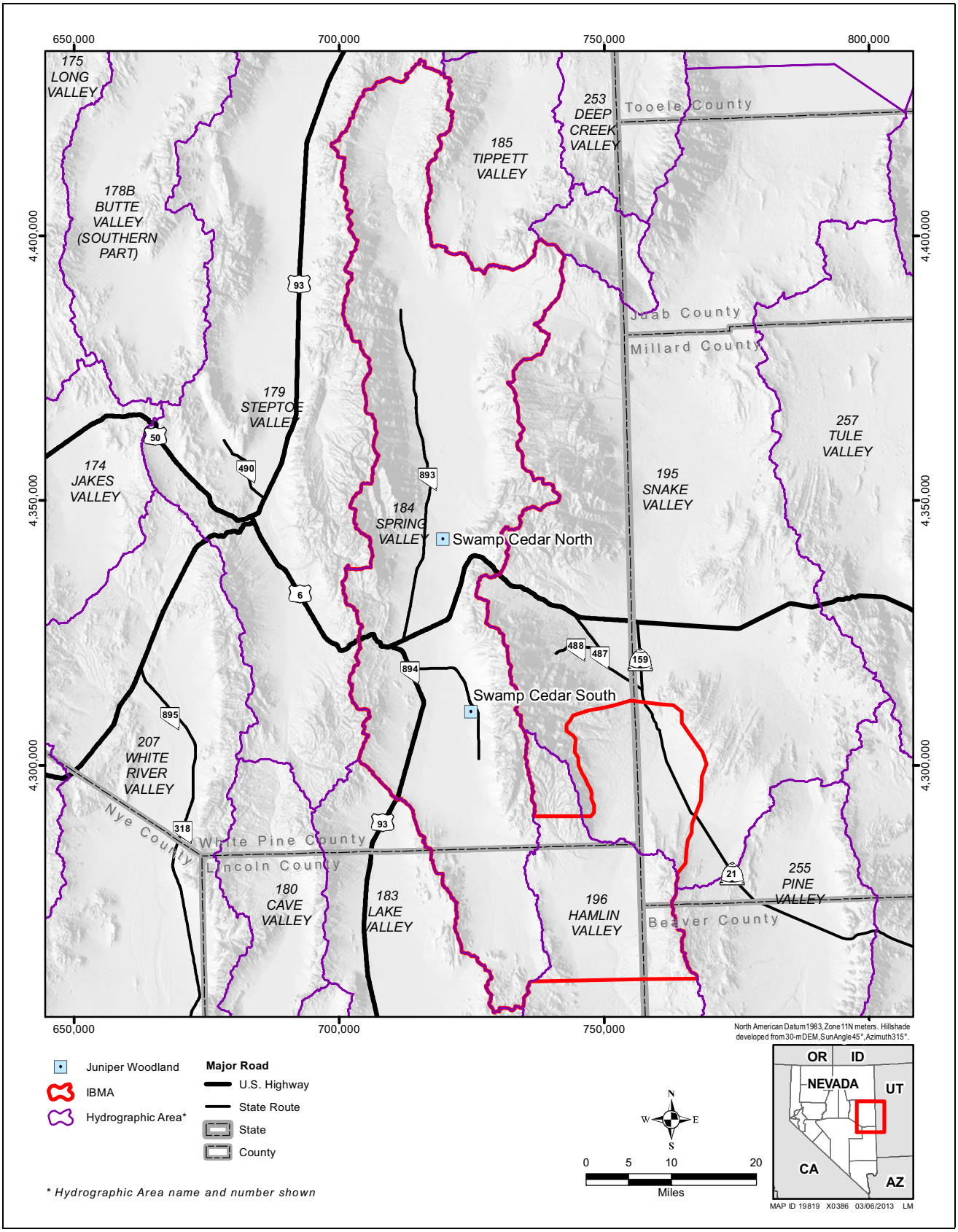

Figure 2-11
Rocky Mountain Juniper Monitoring Sites within the IBMA

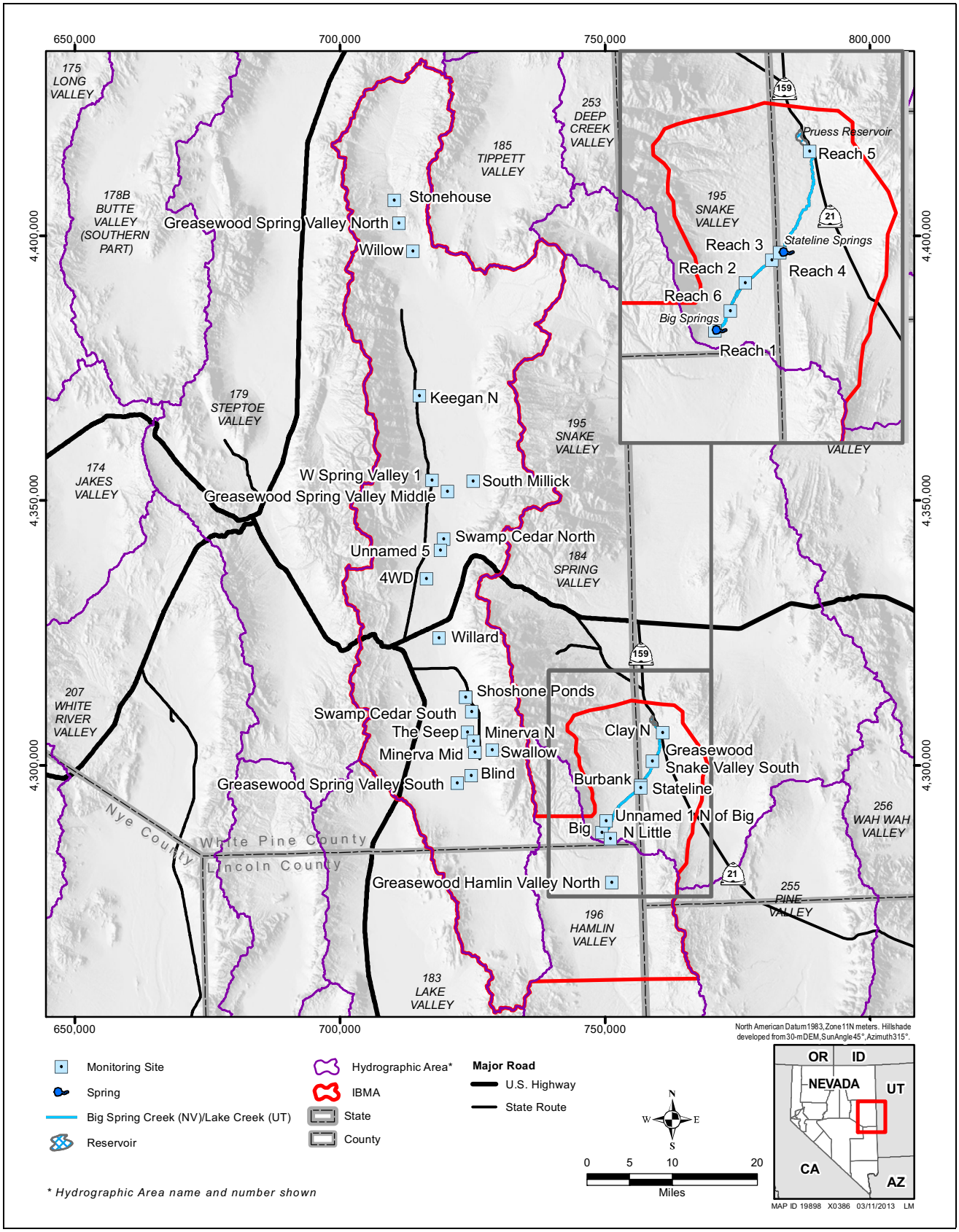

Figure 2-12
Fixed Station Photography Monitoring Sites within the IBMA

In accordance with the Plan, photography stations were established in 2009. In accordance with changes agreed upon by the BWG (SNWA, 2010 at page 4-1), the number of stations to monitor and the number of photographs to be taken at each station was reduced in 2010 in an effort to increase efficiency. The photography stations currently include: 53 stations at spring monitoring sites (located to capture representative aquatic areas where biological surveys are conducted); 6 stations at Big Springs/Lake Creek fish monitoring reaches (one location at each reach); and 179 stations at vegetation transects (one endpoint at each of the 179 transects [Section 2.10]). Photography stations at springs were marked with capped rebar monuments, and the station and landmark locations were recorded and post-processed using professional survey-grade GPS equipment. A geodatabase of photography station and landmark locations was completed in 2012.

No work was conducted regarding fixed station photography in 2013.

2.13 Data Management and Reporting

A data management system was developed in 2009 to manage data required under the Spring Valley Stipulation (Stipulation, 2006) and NSE Ruling 6164 (NSE, 2012). The data management workflow process includes archival storage of original data, standardized data sheets and geographic information system (GIS) files, rigorous multistep Quality Assurance/Quality Control (QA/QC) of digital data, storage of final data in a secure network location, and file back-ups on a regularly scheduled basis. Data required under the Stipulation and Ruling 6164 are also uploaded into a secure Relational Database Management System. Final data are provided to the NSE, EC, BWG, and TRP via a data-exchange web site, and are available to the public.

A data-exchange web site accessible by the NSE, EC, BWG, and TRP members was implemented in 2008. This secure web site is used to distribute monitoring data to the NSE and BWG within 90 days of required data collection. SNWA is also using the data-exchange web site to distribute additional biological data and reports associated with the Plan.

3.0 ANTICIPATED 2014 BIOLOGICAL MONITORING PLAN ACTIVITIES

Anticipated Plan activities in 2014 are summarized below.

- SNWA plans to finish developing ArcGIS geodatabases for viewing 2009-2013 data.
- BWG plans to continue the Plan evaluation.
- SNWA awaits a USFS response to the Special Use Permit application for biological monitoring at Chokecherry Spring.

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Appendix A

Northern Leopard Frog Data

Table A-1 Northern Leopard Frog Egg Mass Counts by Site, Spring 2013

Site	Survey Period (mm/dd)	Total Egg Mass Total
Keegan Spring Complex North[1]	4/03-5/15	59
Minerva Spring Complex Middle	4/02-5/14	0
Minerva Spring Complex North[1]	4/02-5/14	23
Shoshone Ponds (refuge ponds, stock pond)	3/21-5/14	3
South Millick Spring	3/06-5/14	0
Unnamed 5 Spring	4/02-5/15	69
West Spring Valley Complex 1[1]	4/03-5/15	119
Overall	3/06-5/15	273

[1] Northern leopard frogs have been documented and are expected to breed in the spring complex at large (outside of sampling area)

Figure A-1 Northern Leopard Frog Time Series Graphs: Egg Mass Counts

Time Series by year (09 = 2009) and season (SP = Spring)