5-YEAR REVIEW
Railroad Valley springfish (*Crenichthys nevadae*)

GENERAL INFORMATION:

Species: Railroad Valley springfish (*Crenichthys nevadae*)
Date listed: March 31, 1986
Critical Habitat: Designated, March 31, 1986
FR citation(s): USFWS. [U.S. Fish and Wildlife Service] 1986 (51 FR 10857–10865); Endangered and Threatened Wildlife and Plants; Determination of Threatened Status and Critical Habitat for the Railroad Valley Springfish; March 31, 1986.
Classification: Threatened

BACKGROUND:

Most recent status review: U.S. Fish and Wildlife Service (Service). 2009. Railroad Valley Springfish (*Crenichythys nevadae*); 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Nevada Fish and Wildlife Office, Reno, Nevada. August 18, 2009. 36 pp.

FR Notice citation announcing this status review: USFWS 2020 (85 FR 4692); Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 66 Species in California and Nevada; January 27, 2020.

ASSESSMENT:

Information acquired since the last status review:

The Reno Fish and Wildlife Office (RFWO) conducted this 5-year review of the status of Railroad Valley springfish ((*Crenichythys nevadae*; RVS). Data for the review was solicited from interested parties through a Federal Register notice announcement on January 27, 2020. The RFWO also contacted the Nevada Department of Wildlife (NDOW), and the Duckwater Shoshone Tribe (Duckwater) to request any data or information to be consider in our review. Additionally, we conducted a literature search and a review of information in our files.

New information since the last 5-year review consists primarily of annual monitoring conducted by the NDOW and associated monitoring reports. The RFWO received these reports from NDOW and collated the information.

Distribution and abundance:

Railroad Valley springfish are extant at all six historically occupied thermal springs, which compose their entire designated critical habitat (Figures 1–2). Four of the six springs are located at Lockes Wildlife Management Area (LWMA) and two at Duckwater. Annual population surveys are conducted by NDOW at the four historically occupied thermal springs at LWMA (Big, North, Reynolds, and Hay Corral Spring), and conducts infrequent presence-absence surveys at the two refugia populations (Terrace Hot Spring and Hot Creek Canyon). Only two

surveys have been conducted at the occupied springs at Duckwater (Big Warm and Little Warm Spring) since the last 5-year review in 2009. The need for a standardized survey protocol for the Big Warm and Little Warm springs is discussed in the *Recommendations for Future Actions* described below.

Populations have been estimated using annual mark-recapture surveys at the four thermal springs located within LWMA have varied since 2005 (Figures 3–6; NDOW 2003–2020). The methodology for the calculation of population estimates is described below under Methodology. The two refugia populations (Terrace Hot Spring and Hot Creek Canyon), based on presence-absence surveys, were described as abundant when last surveyed in 2017 and 2019, respectively.

Population estimate methodology

Using two sizes of Gee minnow traps (0.64 cm [0.25 inch] and 0.32 cm [1/8 inch]), NDOW trapped RVS for the marking phase and only the larger, 0.64 cm trap for the recapturing phase of the survey. All fish captured were measured and counted, and fish greater than or equal to 30 mm (1.2 inch) were marked with a caudal fin clip and then released. Recaptured fish were examined for caudal fin clips, enumerated, and then released.

Population estimates were calculated using Peterson's estimator: M*C/R (where M = the number of fish marked during the marking session, C = the number of fish captured during the recapture session, and R = the number of fish recaptured during the recapture session). Confidence intervals (95 percent) were calculated by the method recommended in Ricker (1975; as cited in NDOW 2020) using the Poisson distribution.

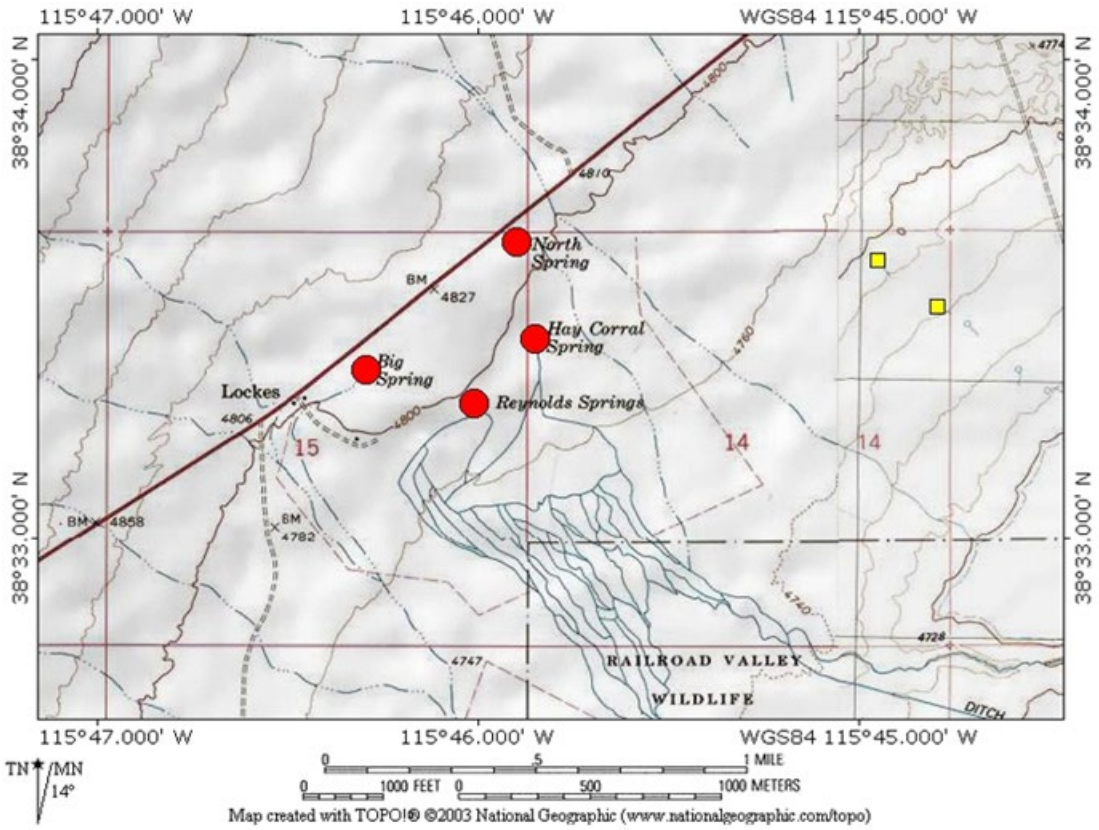

Figure 1. Big Spring, Reynolds Spring, Hay Corral Spring, and North Spring at the LWMA. Red circles indicate extent of designated critical habitat (Service 2009)

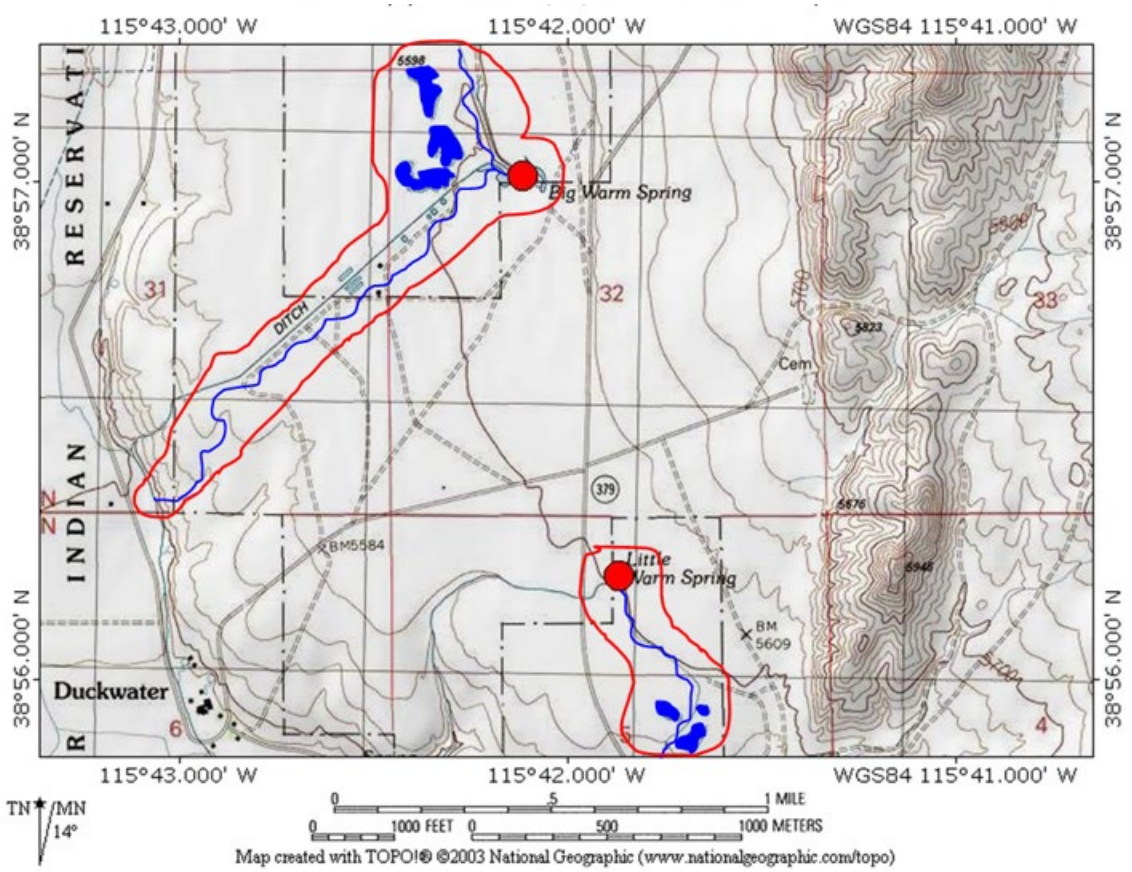

Figure 2. Critical habitat map of historically occupied Big Warm and Little Warm springs at Duckwater, critical habitat outlined in red (Service 2009)

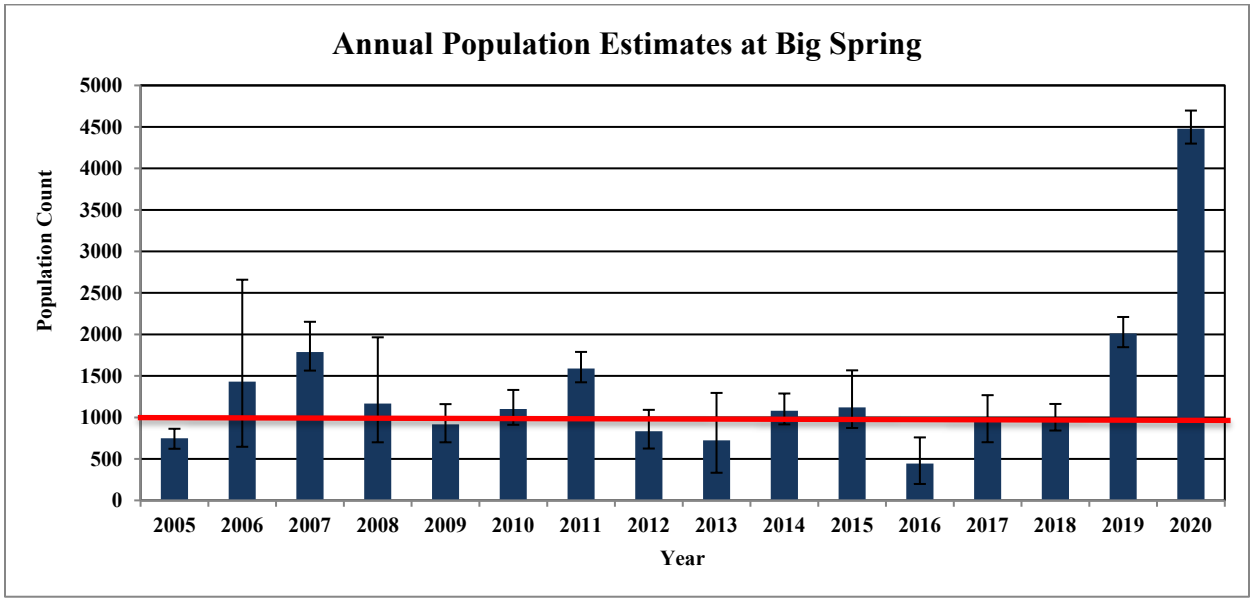

Figure 3. Annual population estimates at Big Spring (NDOW 2005–2020)

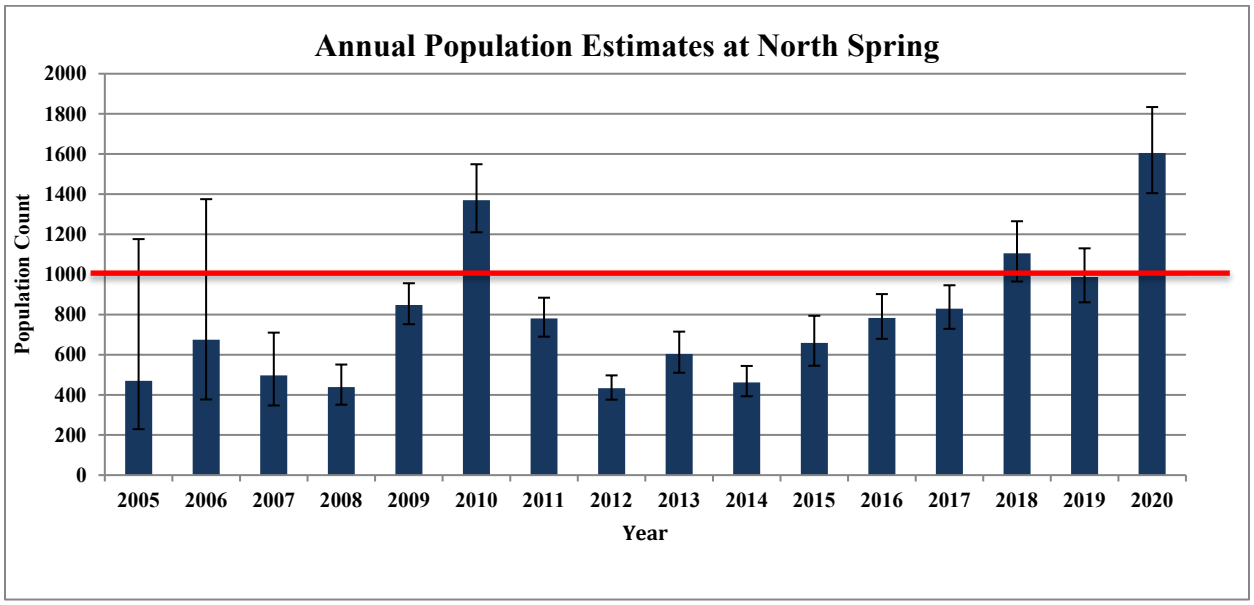

Figure 4. Annual population estimates at North Spring (NDOW 2005–2020)

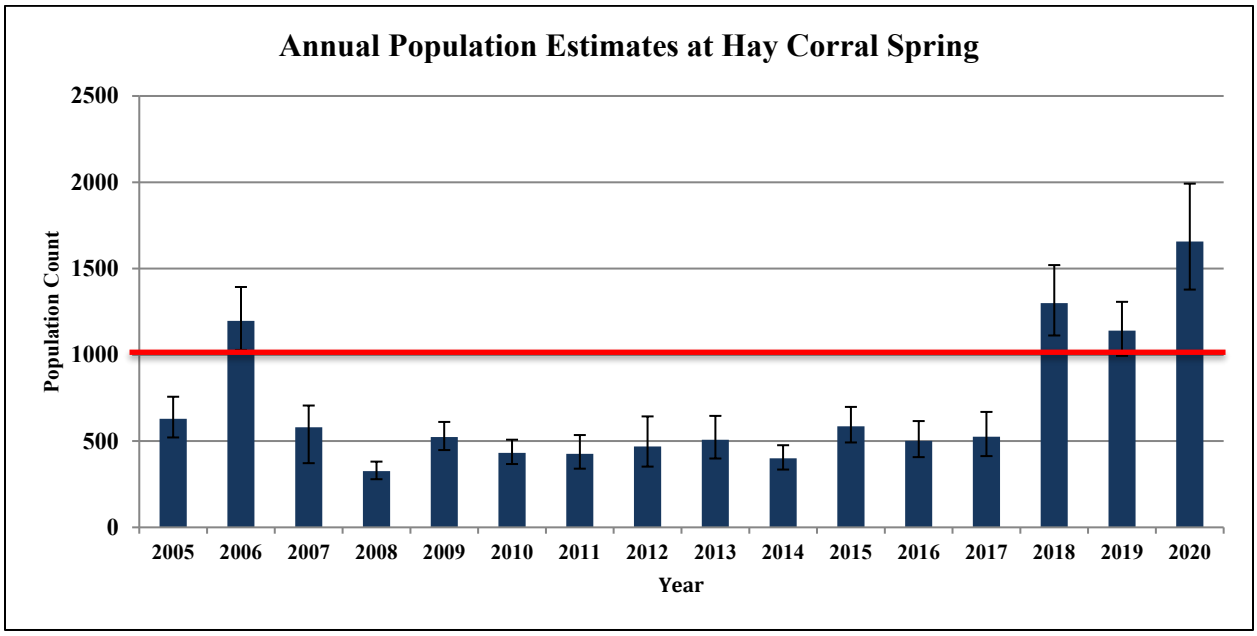

Figure 5. Annual population estimates at Hay Corral Spring (NDOW 2005–2020)

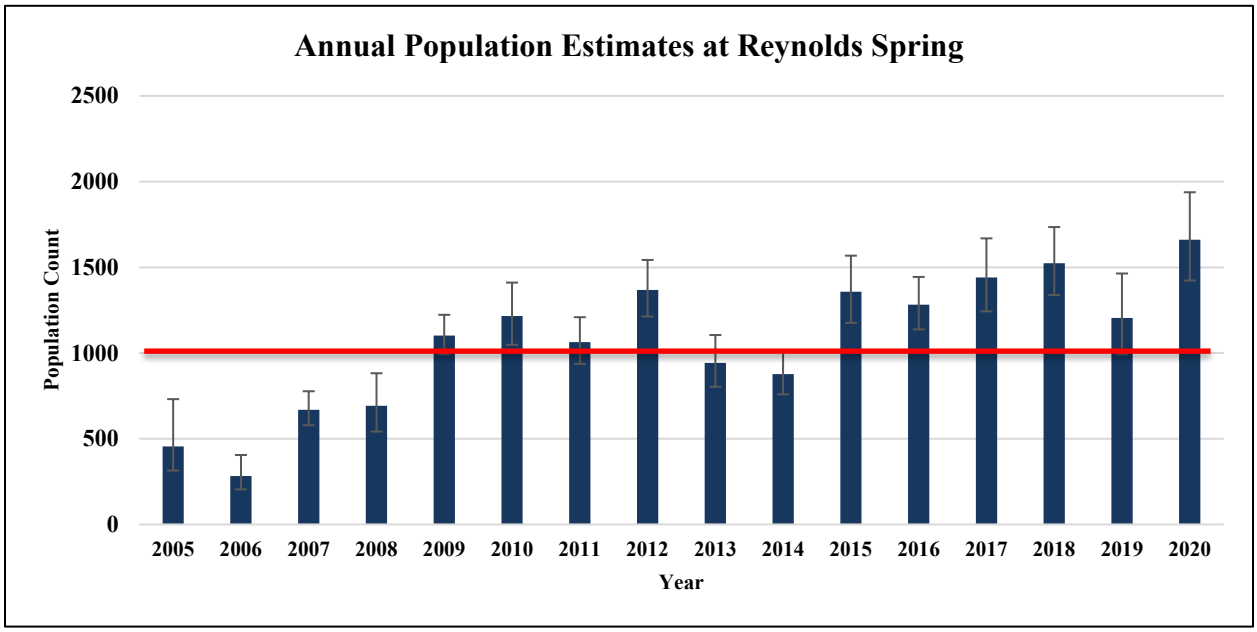

Figure 6. Annual population estimates at Hay Corral Spring (NDOW 2005–2020)

Recovery Criteria:

The Service believes Railroad Valley springfish have a high potential for recovery. However, the recovery criteria outlined in the Railroad Valley springfish Recovery Plan (Service 1996) should be re-evaluated based on the most recent, best available science. In 1996, when the Recovery Plan for this species was written, accurate population estimates for each spring were lacking. The Recovery Plan (Service 1996) states that:

"The status information available for each [RVS] population varies from general narrative descriptions of abundance based on visual inspections to numerical population estimates based on intensive censusing efforts. The available data provide general baseline information on the [RVS] populations. However, due to differences in personnel collecting the information, sampling techniques used, actual locations sampled, and time of year sampling was conducted, these data are not strictly comparable and should not be used to indicate actual population status and trends. A standardized methodology is needed to monitor future population status and trends."

Due to a lack of accurate scientific data to determine population estimates for each spring, the existing recovery criteria provided population benchmarks developed with inconsistent scientific data, the Service believes the 1996 Recovery Plan should be re-assessed with input from all interested parties to develop new recovery criteria. New recovery benchmarks should be based on current threats to the species and the three conservation biology principles of resiliency, redundancy, and representation (collectively known as the three R's, [Smith *et. al* 2018]). The table below outlines the recovery criteria outlined in the 1996 Recovery Plan, whether they were achieved by the 2009 5-year review, and the status as of this writing.

Table 1. Recovery criteria, 2009 status, and 2021 status

Delisting Criteria	Criteria still valid?	2009 Status	2021 Status
1. All six historical spring habitats are permanently protected from adverse modifications through conservation agreements, easements, or fee title acquisitions.	Yes	Partially achieved	The status of the species remains as described in Service (2009). Historical spring populations have protections through free-title acquisitions and Safe Harbor Agreements but groundwater development in the valley and adjacent valleys could decrease or eliminate groundwater on which these spring systems depend.
2. At least 21,000 adult Railroad Valley springfish are present among the six springs, with each population containing at least 1,000 adults and documented annual reproduction and recruitment for 5 consecutive years.	No	Not achieved	The Service believes this criterion may not be achievable or appropriate because 1,000 individuals may exceed the carrying capacity of some springs. At this time, Reynolds Springs is the only population considered to have the potential for supporting this number of RVS for 5 consecutive years (Figure 1, NDOW 2009–2020). The two Duckwater populations lack sufficient population data to determine if this criterion is being met, is achievable or appropriate. Further discussion regarding the development of a standardized monitoring protocol is needed. While there is no direct mention of recruitment in NDOW's field reports, it is assumed to occur due to RVS lifespan of three to five years (Service 1996).
3. (*Optional Criteria*) Existing introduced populations should be maintained as refugia.	Yes	Achieved	Based on recent surveys, NDOW has described the refugia populations at Terrace Hot Spring (2017) and Hot Creek (2019) as abundant.

Translocation Efforts:

The translocation of RVS from Little Warm Spring to Big Warm Spring has been ongoing since 2013. The RVS Recovery Implementation Team intends to work with the Duckwater-Shoshone Tribe to conduct additional translocations to augment RVS within the Big Warm Spring system.

Habitat Improvement Projects:

Elaeagnus angustifolia (Russian olive) removal and other vegetation management actions have been ongoing at LWMA. These actions have benefitted the springs and outflows, and overall quantity of habitat available for RVS, as Russian olive can choke out native plants and affect the natural hydrology of riparian systems. The continuation of Russian olive removal projects will help improve spring and lacustrine habitat for RVS.

Threats:

Invasive aquatic species removal:

The Duckwater Shoshone tribe has an annual program to remove non-native shortfin mollies (*Poecilia mexicana)*. The trapping and removal of mollies reduces resource competition and may lead to RVS population increases. Additionally, the reduction in mollies will reduce the need for future RVS translocations from Little Warm Spring to Big Warm Spring.

Groundwater withdrawal:

On August 9, 2021, RFWO, Bureau of Land Management (BLM), and NDOW filed protests on 40 water rights applications associated with a proposed project to extract lithium brine from a groundwater aquifer in Railroad Valley. Initial investigations suggest the targeted water source is connected to thermal springs and habitat for RVS. Terrace Hot Spring and the four thermal springs within LWMA, are managed by BLM and NDOW, respectively. The RFWO's primary basis for the protests are concerns that the proposed lithium brine mining and reinjection may negatively impact water quality and water quantity, key primary biological features required for RVS persistence (Service 2021; Appendix A). As the Department of Interior prioritizes the development of renewable energy resources, threats to RVS related to groundwater use will persist.

Oil and gas extraction:

The BLM's Tonopah Resource Management Plan (RMP; BLM 1994) and RFWO's associated Programmatic Biological Opinion (BO; Service 1994) addresses land management in and adjacent to Railroad Valley. Both documents rely on certain assumptions, including designation of the Railroad Valley Area of Critical Environmental Concern and project-specific ESA consultations to ensure protections of resources from oil and gas production activities. However, the RMP and BO are outdated and do not account for impacts from recent expansion of oil and gas leasing activity near RVS habitat. In addition, these documents do not analyze potential impacts on water quality and quantity from modern drilling techniques such as directional drilling and hydraulic fracturing. From July 1, 2011 to January 1, 2021, the BLM Tonopah field office has authorized approximately 40,650 acres in oil and gas leases (CBD 2021).

Conclusion:

After reviewing the best available scientific information, the RFWO concludes that the listing status for RVS as a threatened species remains valid and supported. The evaluation of threats affecting the species under the factors in section 4(a)(1) of the Endangered Species Act and analysis of the status of the species in our Railroad Valley springfish (*Crenichythys nevadae*) 5-Year Review: Summary and Evaluation (Service 2009), remain an accurate reflection of the species' current status.

RECOMMENDATIONS FOR FUTURE ACTIONS:

Reassess Recovery Criteria:

The RFWO and recovery partners are considering the need to re-evaluate the recovery criteria outlined in the Recovery Plan (Service 1996) based on updated available science. These spring systems are not identical in morphology, therefore the carrying capacity will vary and population benchmarks required for recovery should represent each individual population. Developing benchmarks based on current threats to the species, the three R's (resiliency, redundancy, and representation), and the best available science will accurately represent the recovery potential for RVS.

Develop Standardized Monitoring Protocols:

Since the last five-year review (2009), there have only been two population surveys on the two springs at Duckwater (Big Warm Spring and Little Warm Spring), both occurring at Little Warm Spring (NDOW 2009–2020). The development and implementation of a standardized monitoring protocol at Big Warm and Little Warm Spring would provide the valuable population data required for meeting current recovery criteria.

Continue RVS Translocation and Mollie Removal:

The translocation of RVS from Little Warm Spring to Big Warm Spring has been ongoing since 2013. This should continue as an effort to extirpate the population of non-native shortfin mollies that also occupy Big Warm Spring. If these transfers continue, RVS may eventually outcompete and extirpate the mollie population. Additionally, the Duckwater-Shoshone tribe has an annual mollie removal program. The trapping and removal of mollies reduces resource competition and may contribute to RVS population increases.

Implement Habitat Improvement Projects:

Continue Russian olive management:

Control projects to manage Russian olive trees in RVS habitat should continue. Exploring and implementing additional opportunities to manage invasive vegetation at occupied may also improve habitat for RVS.

Access road development:

The existing access road into LWMA bisects habitat for RVS. Abandoning and reclaiming this access road would decrease disturbance to the open-water habitat area of Big Spring. The Service and NDOW should collaborate to fund and implement this project.

Big Spring outflow management:

The population in Big Spring at LWMA has benefited from the development of the large, shallow open-water habitat in the lower outflow channel. This is currently the largest Railroad Valley springfish population and may continue to be so in the future. Stabilizing the outflow channel and water delivery efficiency will improve long-term stability of this population.

Lead Field Supervisor, Fish and Wildlife Service

Approve MARC JACKSON Digitally signed by MARC JACKSON Date: 2021.09.24 13:30:23 -07'00' Date _____

Literature Cited

Bureau of Land Management (BLM). 1994. Tonopah Resource Management Plan and Final Environmental Impact Statement. Bureau of Land Management, Battle Mountain District, Tonopah Resource Area, Tonopah, NV. October 21, 1994. 498 pp.

Center for Biological Diversity (CBD). 2021. Sixty-day Notice of Intent to Sue for Violations of Section 7 of the Endangered Species Act Relating to the Bureau of Land Management's Failure to Properly Consult with the U.S. Fish and Wildlife Service Regarding Impacts to Listed Species From Oil and Gas Development in Railroad Valley, Nevada. Center for Biological Diversity, Reno, Nevada. January 12, 2021. 11 pp.

Nevada Department of Wildlife (NDOW). 2005. Field Trip Report: Lockes Ranch and Duckwater Shoshone Reservation in Railroad Valley, Nye County, NV. 28-30 April; 30 June; 8, 20-22 and 27-29 July 2009. 12 pp.

Nevada Department of Wildlife (NDOW). 2006. Field Trip Report: Lockes Ranch and Duckwater Shoshone Reservation in Railroad Valley, Nye County, NV. 25-26 July 2006, 1-3 August 2006. 12 pp.

Nevada Department of Wildlife (NDOW). 2007. Field Trip Report: Lockes Ranch and Duckwater Shoshone Reservation in Railroad Valley, Nye County, NV. 23-25 July 2007, 30 July-1 August 2007. 14 pp.

Nevada Department of Wildlife (NDOW). 2008. Field Trip Report: Lockes Ranch and Duckwater Shoshone Reservation in Railroad Valley, Nye County, NV. 15-16, 22-23, and 28-30 July, 5-6 August, 15-16 September, 6-7 and 27 October, 3 December 2008. 21 pp.

Nevada Department of Wildlife (NDOW). 2009. Field Trip Report: Lockes Ranch and Duckwater Shoshone Reservation in Railroad Valley, Nye County, NV. 28-30 April; 30 June; 8, 20-22 and 27-29 July 2009.

Nevada Department of Wildlife (NDOW). 2010. Field Trip Report: Lockes Ranch and Duckwater Shoshone Reservation in Railroad Valley, Nye County, NV. 2, 9 August 2010. 14 pp.

Nevada Department of Wildlife (NDOW). 2011. Field Trip Report: Lockes Ranch in Railroad Valley, Nye County, NV. 15, 22 August 2011. 9 pp.

Nevada Department of Wildlife (NDOW). 2012. Field Trip Report: Lockes Ranch and Duckwater Shoshone Reservation in Railroad Valley, Nye County, NV. 6, 13 August 2012. 11 pp.

Nevada Department of Wildlife (NDOW). 2013. Field Trip Report: Lockes Ranch and Duckwater Shoshone Reservation in Railroad Valley, Nye County, NV. 12, 19 August 2013. 9 pp.

Nevada Department of Wildlife (NDOW). 2014. Field Trip Report: Lockes Ranch and Duckwater Shoshone Reservation in Railroad Valley, Nye County, NV. 11, 18 August 2014. 10 pp.

Nevada Department of Wildlife (NDOW). 2015. Field Trip Report: Lockes Ranch and Duckwater Shoshone Reservation in Railroad Valley, Nye County, NV. 21, 27 July 2015. 10 pp.

Nevada Department of Wildlife (NDOW). 2016. Field Trip Report: Lockes Ranch and Duckwater Shoshone Reservation in Railroad Valley, Nye County, NV. 16, 23 August 2016. 10 pp.

Nevada Department of Wildlife (NDOW). 2017. Field Trip Report: Lockes Ranch in Railroad Valley, Nye County, NV. August 8 and 15, 2017. 10 pp.

Nevada Department of Wildlife (NDOW). 2018. Field Trip Report: Lockes Ranch in Railroad Valley, Nye County, NV. August 21 and 28, 2018. 10 pp.

Nevada Department of Wildlife (NDOW). 2019. Field Trip Report: Lockes Ranch in Railroad Valley, Nye County, NV. August 13 and 20, 2019. 11 pp.

Nevada Department of Wildlife (NDOW). 2020. Field Trip Report: Lockes Ranch in Railroad Valley, Nye County, NV. August 11 and 18, 2020. 11 pp.

Ricker, W.E. 1975. Computation and Interpretation of Biological Statistics of Fish Populations. Bulletin of the Fisheries Research Board of Canada 191. 1975. 400 pp.

Smith, David R. N.L. Allan, C.P. McGowan, J. A. Szymanski, S.R. Oetker, H. M. Bell. Development of a Species Status Assessment Process for Decisions under the U.S. Endangered Species Act. *Journal of Fish and Wildlife Management* June 1, 2018; 9 (1): 302–320. doi: https://doi.org/10.3996/052017-JFWM-041. 18 pp.

U.S. Fish and Wildlife Service (Service). 1994. Biological on Implementation of the Proposed Tonopah Resource Management Plan. U.S. Fish and Wildlife Service, Nevada Fish and Wildlife Office, Reno, Nevada. August 12, 1994. 16 pp.

U.S. Fish and Wildlife Service (Service). 1996. Railroad Valley springfish (*Crenichythys nevadae*) Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon. 2006. 56 pp.

U.S. Fish and Wildlife Service (Service). 2009. Railroad Valley springfish (*Crenichythys nevadae*); 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Nevada Fish and Wildlife Office, Reno, Nevada. August 18, 2009. 36 pp.

U.S. Fish and Wildlife Service (Service). 2021. Protests of Application Nos. 90712 – 90751, Proposed New Water Right Applications by 3PL Operating, Inc. in Railroad Valley-Northern Part, Nevada (Hydrographic Basin 173B). U.S. Fish and Wildlife Service, Nevada Fish and Wildlife Office, Reno, Nevada. August 18, 2009. 7 pp.

Appendix A

United States Department of the Interior

FISH AND WILDLIFE SERVICE

2800 Cottage Way, Ste 2606
Sacramento, CA 95825

In Reply Refer To:
FWS/LR8/IR10/RFWO-2021-CPA-0015

August 5, 2021

Adam Sullivan, State Engineer
Nevada Department of Conservation
and Natural Resources
Division of Water Resources
901 South Stewart Street, Suite 2002
Carson City, Nevada 89701

Subject: Protests of Application Nos. 90712 – 90751, Proposed New Water Right Applications by 3PL Operating, Inc. in Railroad Valley-Northern Part, Nevada (Hydrographic Basin 173B)

Dear Adam Sullivan:

The U.S. Fish and Wildlife Service (Service) has reviewed water right application numbers 90712 through 90751 by 3PL Operating, Inc. for 40 new underground water rights and points of diversion (PODs) for the purpose of mining lithium brine over an approximate 56 square mile area beneath and southwest of the playa of northern Railroad Valley.

We are concerned that the proposed points of diversion would impair the protection of eight thermal springs at Lockes Wildlife Management Area and Terrace Hot Springs, located west of the playa in northern Railroad Valley, which provide habitat for Railroad Valley springfish (*Crenichthys nevadae*). The thermal springs in the Lockes Area are one of only two areas globally where Railroad Valley springfish are native (the other location being Duckwater Reservation in northern Railroad Valley). Terrace Hot Springs is an established refugium for the springfish (NDOW 2020) located about six miles south of the Lockes Area springs in the northern part of the basin. Railroad Valley springfish is federally-listed as threatened under the Endangered Species Act of 1973, as amended (ESA; 16 U.S. C. 1531 *et seq*). Railroad Valley is rich with endemic wildlife species that are dependent on the rare aquatic resources of the area. However, the Service is particularly concerned about the potential impacts of water right applications 90712 through 90751 on Railroad Valley springfish and their habitat at the Lockes Area thermal springs and Terrace Hot Springs due to the proximity of these two collections of

springs to the proposed PODs.

The bases for the Service's protests of water right applications 90712 through 90751 are as follows:

(1) Terrace Hot Springs and the Lockes Area thermal springs, which provide important habitat for the federally-listed threatened Railroad Valley springfish, are about 4 and 7 (or more) miles, respectively, from the sections in which the proposed groundwater (brine) extraction / injection wells would be located; the latter are shown and listed as PODs in the map filed with application 90712 and referenced in applications 90712 through 90751. However, per Exhibit B of the applications, the 40 applications collectively are anticipated to result in a net rate of extraction (rate of pumping, less rate of injection), on an annual basis, of about 18,500 acre-feet per year (afy) or 11,500 gallons per minute (gpm). *To the extent that a hydraulic connection exists between the springs and proposed PODs (see point 3 and 4 below) in combination with* the magnitude of this projected net rate of extraction (i.e., pumping), the habitat supporting the Railroad Valley springfish in these two sets of springs may become adversely impacted from declines in spring discharge and degradation of water quality.

(2) The maximum possible net rate of extraction within the overall wellfield *at any particular point in time* may be significantly greater than the anticipated annual average of 18,500 afy (or 11,500 gpm); the upper limit being 156 cubic feet per second based on the applied for diversion rates (3.9 cubic feet per second per application x 40 proposed points of diversion) or roughly 70,000 gpm. Beyond the latter, the maximum possible net extraction rate *at any particular point in time* appears to be unspecified in the applications.

(3) A cursory examination of the hydrogeology of the area suggests that the Lockes Area thermal springs and Terrace Hot Springs may discharge from the lower (regional) carbonate-rock aquifer (Figure 1). Available water quality data reported in the U.S Geological Survey (USGS) NWIS database (based on spring water samples collected from the late 1960's to early 1980's) shows that water discharging from these two collections of springs originates largely from the underlying (likely regional) carbonate-rock aquifer. The same data also shows that mixing likely occurs with more surficial groundwater before discharge to the surface at the spring pools (see Figure 2)[1].

Based on data reported in USGS (2021), concentrations of lithium in spring discharges at Lockes Wildlife Management Area and Terrace Hot Springs is 240 milligrams per liter

[1] For example, there are two thermal springs in the Lockes Area for which USGS water quality data are available: spring site nos. 383321115461501 and 383318115461701. While the relative "bicarbonate + carbonate anion" composition of the two Lockes Area springs are similar (see springs in the "RR V West of Playa Lockes" group shown in the Piper diagram of Figure 2), their relative "sodium + potassium cation" and "calcium + magnesium cation" compositions indicate different chemistries; despite the being only separated by about 350 feet.

(see locations in Figure 1) suggesting that bicarbonate type groundwater (largely originating in the carbonate-rock aquifer per the available water quality data and Piper diagram of Figure 2) is mixing with groundwater that is in contact with a source of lithium, likely volcanic materials[2], before discharge at the springs; demonstrating that *a hydraulic connection exists between these two collections of thermal springs and the lithium-containing geologic unit.*

Further, lithologic data ("tops") noted in oil/gas well logs online with the Nevada Bureau of Mines and Geology (NBMG 2021) indicate that volcanic materials are encountered at a depth of about 800 to 1,000 feet (ft) below ground surface (bgs) in the vicinity of the Lockes Area thermal springs and Terrace Hot Springs, and that the volcanic materials overlie the regional carbonate-rock aquifer (Mississippian to Ordovician in age) at a depth of about 1,300 to 1,500 ft bgs in the area. This information suggests the regional carbonate-rock aquifer is relatively shallow at the locations of these two collections of thermal springs; which, in turn, is overlain by even more shallow volcanic materials that are the likely source of lithium discharging from the springs – a line of *evidence that a hydraulic connection exists between the thermal springs and lithium-containing volcanic materials which underlie the springs at a relatively shallow depth (and ultimately the playa at greater depths).*

(4) Those same volcanic materials (again based on lithologic data noted in oil/gas well logs available online from NBMG 2021) are seen to extend eastward beneath the playa, but at depths ranging from 4,400 to 6,500 ft bgs in the vicinity of the PODs (i.e., project area). At the same time, the total depth of the proposed project wells is approximately 2,500 feet (according to each of the 40 applications). Therefore, the target brine pool likely overlies the bulk of the volcanics that exist beneath the playa, which appear to be the source of lithium in the brine pool. *This provides another line of evidence of the existence of a hydraulic connection between the target brine pool (the proposed PODs) and volcanic materials underlying the playa; which, in turn, extend physically west beneath the Lockes Area thermal springs and Terrace Hot springs.*

Considering the above (items 3 and 4), we conclude that there is a high likelihood for brine extraction from the proposed PODs to adversely impact the discharge of the thermal springs at Lockes Wildlife Management Area and Terrace Hot Springs which in turn would negatively alter aquatic habitat for the Railroad Valley springfish. Furthermore, the planned reinjection of post-processed brine using some subset of the proposed PODs may also result in changes in water quality at the springs that would also potentially create impacts on threatened Railroad Valley springfish within these important spring habitats.

(5) Furthermore, due to a lack of onsite hydraulic field testing, reliable site-specific aquifer parameter estimates for subsurface materials at the depth of the proposed extraction / injection wells, as well as the underlying volcanics, reliable predictions of drawdown and

[2] For context, volcanic materials are a common source of lithium worldwide and the concentration of lithium in brines of Clayton Valley, Nevada, is reportedly 300 milligrams per liter (Wikipedia 2021).

reductions in spring flows at Lockes Wildlife Management Area and Terrace Hot Springs as a result of the proposed (net) extractions, are not possible based on the material submitted with these applications.

(6) Lastly, in view of the potentially substantial "time to full capture" issues associated with the proposed extraction, as well as any recovery thereof (Bredehoeft and Durbin 2009)[3], monitoring of changes in discharge and water quality is unlikely to provide sufficient "early warning" to avert adverse effects to the Lockes Area thermal springs or Terrace Hot Spring, or the springfish which depend upon them. That is, monitoring alone, no matter how robust, would not be an effective remedy for the potential adverse impacts to Railroad Valley springfish posed by water right applications 90712 through 90751 on these two collections of thermal springs due to likely "time to full capture" issues (described by Bredehoeft and Durbin 2009), or the subsequent impacts on threatened Railroad Valley springfish at the springs; nor would it sufficiently offset the associated hydrologic uncertainties.

In summary, the Service believes that approval of water right applications 90712 through 90751 could be substantially harmful to Railroad Valley springfish by impairing the habitat provided by the thermal springs in the Lockes Area and Terrace Hot Springs. We therefore request that these applications be denied.

Thank you for the opportunity to formally express our concerns related to these permit applications. If you have any questions, please contact the Reno Fish and Wildlife Office Assistant Field Supervisor, Shawna Theisen, at 775-861-6378 (mobile 775-313-1910) or Hydrologist Sue Braumiller, at 775-846-2301.

Sincerely,

Damian K. Higgins
Acting Assistant Regional Director
Ecological Services

Enclosure

cc:
Nevada Department of Wildlife, Director, Reno, Nevada

[3] "Time to full capture, for example, being the time for pumping-induced drawdown (or impacts to spring flows) to propagate some distance to a particular point of impact from pumped well(s); or alternatively, for the recovery of pumping-induced drawdown in groundwater levels (or spring flows) to "arrive" at a distant location / resource after a reduction in or cessation of pumping at the well causing the original impact.

Duckwater Shoshone Tribe of the Duckwater Reservations, Chairman, Duckwater, Nevada

Bureau of Land Management, State Director, Nevada State Office, Reno, Nevada

Bureau of Land Management, District Manager, Battle Mountain District Office, Battle Mountain, Nevada

Bureau of Indian Affairs, Superintendent, Western Nevada Agency, Carson City, Nevada

Nevada Department of Conservation and Natural Resources, Nevada Division of Environmental Protection, Administrator, Carson City, Nevada

REFERENCES

Bredehoeft, J.D., and T.J. Durbin. 2009. Ground water development – the time to full capture problem. Ground Water 47: 506-514.

Crafford, A.E.J. 2007. Geologic Map of Nevada: G.S. Geological Survey Data Series 249. 1 CD-ROM, 46 p., 1 pl.

Nevada Bureau of Mines and Geology (NBMG). 2021. Oil and gas well information for Nevada –2011 Update. Online: http://www.nbmg.unr.edu/oil&gas/NVWellInfo.html. Accessed most recently July 2021.

Nevada Department of Wildlife. 2020. Field Trip Report: Lockes Ranch and Duckwater Shoshone Reservation in Railroad Valley, Nye County, NV. August 11, 18, 2010.

U.S. Geological Survey (USGS). 2021. USGS Water data for Nevada. Online: http://waterdata.usgs.gov/nv/nwis. Accessed most recently July 2021.

Wikipedia. 2021. Brine mining. Online: https://en.wikipedia.org/wiki/Brine_mining. Accessed most recently July 2021.

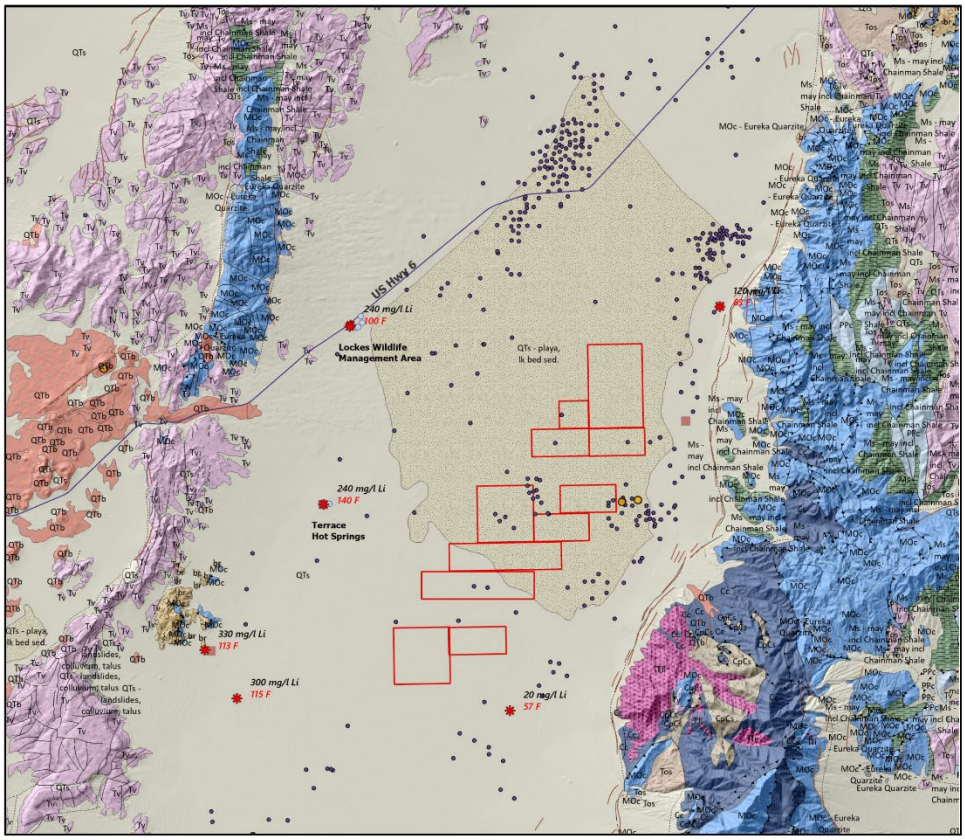

Figure 1. Locations of the thermal springs in the Lockes Area and Terrace Hot Springs, providing important habitat for federally-listed threatened Railroad Valley springfish, relative to sections in which the proposed points of diversion would be located (red rectangles); water temperature and lithium concentration data reported in the U.S. Geological Survey NWIS database (USGS 2021) for springs in the vicinity of the playa of northern Railroad Valley annotated in red and black. Hydrogeologic base map interpreted by S. Braumiller from the geologic map of Crafford 2007 (unpublished to date).

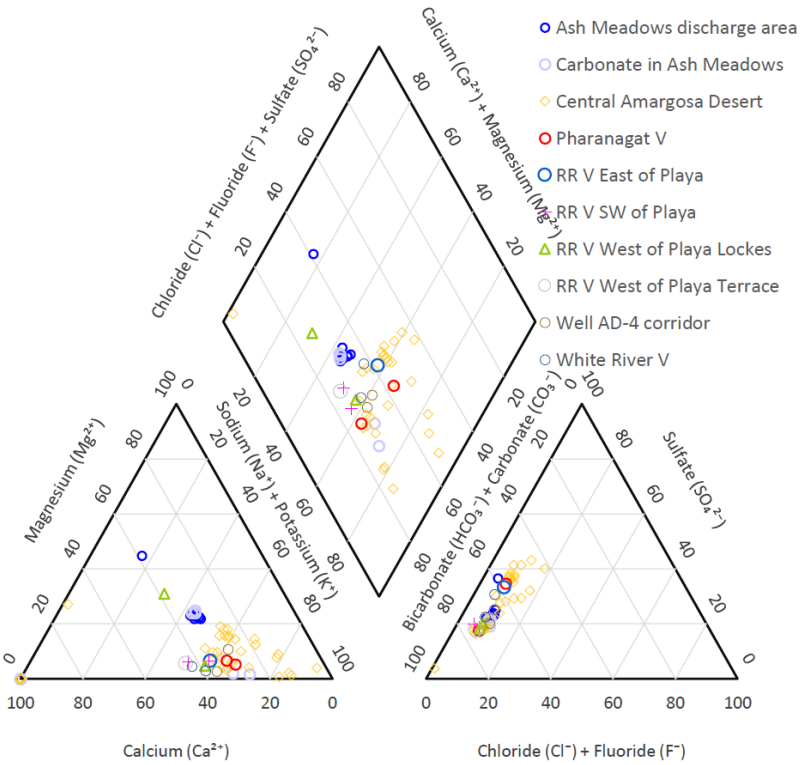

Figure 2. Piper diagram of water chemistry characteristics for springs in northern Railroad Valley and other known "carbonate springs" as points of reference, as compiled from U.S. Geological Survey data in the NWIS database (USGS 2021). Note: The data shown in the Piper diagram is based on water quality samples collected from the late 1960's to early 1980's (water quality and Piper diagram available upon request).