F I N A L

Appendix A to I

Volume 3, Book 1

JULY 2008

C O Y O T E S P R I N G S
I N V E S T M E N T

PLANNED DEVELOPMENT PROJECT

Coyote Springs Investment Planned Development Project

Appendix A to I

July 2008

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Appendix A to I

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APPENDIX D

Muddy River Memorandum of Agreement Biological Opinion

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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January 30,2006
File No. 1-5-05-FW-536

Memorandum

To: Manager, CalifornialNevada Operations, Fish and Wildlife Service, Sacramento, California

From: Field Supervisor, Nevada Fish and Wildlife Office, Fish and Wildlife Service, Reno, Nevada

Subject: Intra-Service Programmatic Biological Opinion for the Proposed Muddy River Memorandum of Agreement Regarding the Groundwater Withdrawal of 16,100 Acre-Feet per Year from the Regional Carbonate Aquifer in Coyote Spring Valley and California Wash Basins, and Establish Conservation Measures for the Moapa Dace, Clark County, Nevada

This document transmits the Fish and Wildlife Service's (Service) programmatic biological opinion for the proposed Memorandum of Agreement (MOA) among the Southern Nevada Water Authority (SNWA), Moapa Valley Water District (MVWD), Coyote Springs Investment, LLC (CSI), Moapa Band of Paiutes (Tribe), and the Service. The Service has determined that the proposed action is likely to adversely affect the endangered Moapa dace *(Moapa coriacea).* No critical habitat has been designated for the Moapa dace; therefore, none will be affected and thus no further analysis is required. This biological opinion is being submitted in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 *et seq.).* We have assigned 1-5-05-FW-536 to this programmatic consultation; please reference this number in future correspondence. Future actions pursuant to the MOA that may adversely affect Moapa dace will be tiered to this programmatic biological opinion.

This biological opinion evaluates, as the proposed action, the executionofthe MOA by the Service. None of the activities included in the MOA will be implemented absent project or activity specific consultations. Since the MOA contemplates future groundwater development up to 16,100 acrc-feet per year (afy), this total withdrawal and the potential effects to the Moapa dace are evaluated in this biological opinion. As part of the proposed action, the following biological opinion will evaluate the effects of the cumulative groundwater withdrawal of 16,100 afy from two basins within the regional carbonate aquifer to the federally listed as endangered Moapa dace at a programmatic level in light of the conservation measures proposed in the MOA. The groundwater is proposed to be withdrawn from the White River Groundwater

Flow System at the MX-5, RW-2 wells, CSI Well #1, and CSI Well #2 (SNWA 9,000 afy), and CSI Well #1 (Permit 70430) and CSI Well #2 (Permit 70429), and other wells (CSI 4,600 afy) in the Coyote Spring Valley (Basin 210), and from a well-field located in the southwestern third of the Moapa Reservation (2,500 afy) in the California Wash (Basin 218). Species not evaluated in this biological opinion but may be evaluated in the future as proposed actions are submitted in accordance with section 7 of the Act include, but are not limited to the following endangered species: (1) the Mojave population of desert tortoise *(Gopherus agassizii)* and its designated critical habitat; (2) southwestern willow flycatcher *(Empidonax trail/ii extimus);* and (3) the Yuma clapper rail *(Rallus longirostris yumanensis);* as well as, (4) the western U.S. distinct population segment of the Federal candidate yellow-billed cuckoo *(Coccyzus americanus)* (67 FR 40666).

This biological opinion is based on the following information: (1) the January 27,2006, proposed MOA (Attachment A) and attached Exhibit (Attachment B); (2) the proposed final Water Supply Agreement among the Tribe, SNWA, MVWD, Las Vegas Valley Water District (LVVWD), and Muddy Valley Irrigation Company (MVIC) received on January 26,2006, (Attachment C); (3) Bureau of Land Management's (BLM) July 8,2003, Biological Assessment of the Coyote Spring Valley area (BLM 2003); (4) numerous meetings and discussions among MOA signatories; (5) discussions with species experts familiar with the ecology of the species; and (6) other sources of available information available in our files and cited herein. The Service has prepared this biological opinion in the absence of site-specific and spatially explicit information on future site-specific actions that would be tiered to this programmatic biological opinion. In the absence of this information, this biological opinion reflects the ecologically and hydrogeologically most conservative estimate of effects for the Moapa dace and its habitat. A complete administrative record for this consultation is on file at the Service's Southern Nevada Field Office.

PROGRAMMATIC CONSULTATION

This biological opinion was prepared in accordance with the July 16, 2003, guidance for programmatic-level consultations (Service 2003). Such consultations can provide the benefit of streamlining the consultation process while leading to a more landscape-based approach to consultations that can minimize the potential "piecemeal" effects that can occur when evaluating individual projects out of the context of a complete agency program. Some of the benefits of programmatic consultations include: (l) better and more cost effective integration of ecosystem/recovery planning activities with agency activities; (2) streamlined consultation processes; (3) added predictability for all signatories of the MOA; (4) minimization of the potential "piecemeal" effects that can occur when evaluating individual projects out of the context of a complete agency program; and (5) the opportunity to better and more efficiently integrate the action agency's 7(a)(l) responsibilities at the program level.

Due to the number of impending actions by different entities included in the proposed action, a tiered-programmatic approach has been taken by the Service in an attempt to analyze the effects of the proposed action. This approach does not cover future site-specific actions resulting from implementation of the proposed action, nor does it authorize any incidental take for programmatic impacts associated with the activities included in the MOA. The tiered approach

is a two-stage consultation process with the two stages fulfilling the same purposes. The first stage biological opinion or concurrence, as appropriate, evaluates the landscape-level effects. The second stage results in the completion of project-specific documentation that addresses the specific effects of each individual project. Under the tiered approach, two complete biological opinions are completed for each proposed action, with the second-stage documents "tiering" to the first-stage document by incorporating portions of it by reference. Thus each action has its own individual consultation document that is supported by the programmatic document.

Project-level Consultation under the Tiered Programmatic Consultation Approach

As individual projects are proposed under the tiered programmatic consultation approach, project-specific information will be provided that: (l) describes each proposed action and the specific areas to be affected; (2) identifies the species and critical habitat that may be affected; (3) describes the manner in which the proposed action may affect listed species; (4) describes the anticipated effects; (5) specifies the *anticipated effects/rom the proposed project are consistent with those analyzed in the programmatic biological opinion;* (6) describes proposed measures to minimize potential effects of the action; and (7) describes any additional effects, if any, not considered in the programmatic consultation. The Service reviews this information and then completes a tiered biological opinion with a project-specific incidental take statement. This document, while meeting the basic requirements of biological opinions as specified at 50 CFR 402. 14(h), generally requires less effort to complete because it references back, or tiers, to the program-level biological opinion.

The following assumptions regarding future consultation (second stage) are incorporated into this programmatic biological opinion:

1. Analysis for site-specific actions proposed under the "umbrella" of this proposed MOA will be submitted to the Service pursuant to section 7 or section 10 of the Act, as appropriate.

2. Specific actions that the Federal permitting agency or the Service determines may affect listed species will undergo consultation according to section 7(a) (2). These actions will be assessed on their own merits and be evaluated relative to the jeopardy and adverse modification criteria of the Act, as appropriate.

3. Specific actions that do not have a Federal nexus but may result in take of a listed species will require a section 10 incidental take permit. These actions will be assessed on their own merits and be evaluated relative to the jeopardy and adverse modification criteria and section 10 issuance criteria of the Act, as appropriate.

4. The Service will provide guidance on future site-specific actions in order to ensure that the project description is consistent with our biological opinion, such that our determination remains valid.

The effects of actions resulting from the proposed action will require future programmatic and/or site-specific section 7 consultations for the listed species covered in this biological opinion. This

biological opinion does not issue exemption for any incidental take resulting from any action undertaken by Federal agencies or applicants.

Consultation History

On July 30, 2004, a meeting was held among SNWA, MVWD, and the Service to discuss conservation measures that would be identified and incorporated into an ongoing consultation for a proposed pipeline that would be necessary to comply with Nevada State Engineer Order 1169. It was determined that a Memorandum of Agreement was the appropriate mechanism to effectuate these commitments. The MOA would then become part of the project proposal and thus incorporated into the Description of the Proposed Action in the biological opinion.

On August 6, 2004, a meeting was held among SNWA, MVWD, and the Service to discuss, clarify, and continue development on the MOA.

On August 30, 2004, a meeting was held among SNWA, MVWD, and the Service to discuss, clarify, and continue development on the MOA.

On September 20, 2004, a meeting was held among SNWA, MVWD and the Service to negotiate average flow levels that would be necessary to protect in-stream flows that may be affected by the proposed project. These flow levels would then be incorporated into the MOA.

On October 5, 2004, the Office of the Solicitor sent a letter to the Tribe outlining technical and legal concerns with a Proposed Water Settlement Agreement that the Tribe had negotiated with other entities regarding water issues in the California Wash Basin.

On October 7,2004, the MOA was revised to include CSI due to the potential effects to the Moapa dace from pumping their existing permitted water rights in Coyote Spring Valley for their proposed development in Clark County.

November 19,2004, the National Park Service (NPS) and the Service met with the Tribe to discuss the technical concerns identified in the October 5, 2004, letter.

On December 15, 2004, the Service sent the Tribe a letter outlining technical concerns and suggesting that the Tribe participate in a Recovery Implementation Program to address species related groundwater issues consistent with that was developed in the MOA with SNWA, MVWD, and CSI.

On January 25,2005, a meeting was held among the Tribe, NPS, and the Service to discuss the concerns identified in the December 15, 2005 letter. In addition, the Service discussed the MOA that was negotiated with SNWA, MVWD, and CSI and explained that this MOA did not bind or affect the Tribe or their resources in any way, but rather that the MOA may prove beneficial to the Tribe.

On March 7,2005, a memorandum from the Office of the Solicitor was sent to the Acting Assistant Secretary for Water and Science recommending that bureau coordination of the two

actions [(1) Tribal Water Settlement Agreement and (2) MOA] and to develop a recommendation on future water development in southern Nevada.

On March 17,2005, a letter from SNWA was sent to the Office of the Solicitor requesting resolution of both actions before April 22, 2005, or they would pursue other options for development of their water rights.

On March 23,2005, the Nevada BLM State Director (designated Liaison between DOl and SNWA) conducted a meeting with DOE Regional Managers and a separate meeting on the same day with SNWA to initiate discussions in an effort to resolve the two groundwater issues [(1) Tribal Water Settlement Agreement and (2) MOA].

On April 6, 2005, a meeting was held among the Tribe, SNWA, NPS, BLM, Bureau of Reclamation, Bureau of Indian Affairs, the Deputy Assistant Secretary for Fish, Wildlife, and Parks, and the Service to discuss including the Tribe into the MOA. Following this meeting, the Service made a decision to include the Tribe and formally conduct section 7 consultation on the MOA.

On June 6, 2005, a meeting was held among the Tribe, SNWA, and the Service to discuss, clarify, and continue inclusion of the Tribe into the MOA.

On June 27, 2005, a meeting was held among the Tribe, SNWA, and the Service to discuss, clarify, and continue inclusion of the Tribe into the MOA.

On July 14, 2005, a MOA was agreed to by the Tribe, SNWA, MVWD, CSI, and the Service to ensure that conservation actions were in place prior to potential impacts associated with the project's groundwater pumping. Also agreed to by MVWD and the Service was the Jones Spring Agreement which is an Exhibit to the MOA.

On July 14, 2005, a Water Supply Agreement was agreed to by the Tribe, SNWA, MVWD, LVVWD, and MVIC. Among other features under this Water Supply Agreement, the Tribe will receive the State groundwater permit and State groundwater applications which are to be provided to the Tribe by LVVWD under the Water Supply Agreement, and a lease of Muddy River water rights which in certain respects will be functionally similar to the federally-reserved Muddy River rights to be secured to the Tribe under the Water Supply Agreement.

On July 19,2005, the Service determined that given the complexity of various entities, withdrawing groundwater from the regional carbonate aquifer system, a tiered programmatic approach for those actions included in the MOA would be the most effective approach to evaluate those effects, including proposed conservation measures to minimize the effects to the endangered Moapa dace. Other species may potentially be affected as a result of actions associated with the use of the groundwater withdrawals; however those proposed actions will be evaluated in subsequent biological opinions (tiered) as appropriate.

On October 5, 2005, the Service requested review of the draft Intra-Service Programmatic Biological Opinion for the Proposed Muddy River Memorandum of Agreement Regarding the

Groundwater Withdrawal of 16,100 afy from the Regional Carbonate Aquifer in Coyote Spring Valley and California Wash Basins, and Establish Conservation Measures for the Moapa Dace, Clark County, Nevada (File No. 1-5-05-FW-536) by the Parties of the MOA.

On October 18, 2005, a meeting was held among the Parties of the MOA, including the Service to discuss comments on the draft programmatic biological opinion (File No. 1-5-05-FW-536). It was determined at the meeting that the Parties of the MOA would provide a set of substantial written comments to the Service by November 10, 2005.

On October 27,2005, the Service received preliminary written comments on the October 5, 2005, draft programmatic biological opinion (File No. 1-5-05-FW-536) from CSI.

On November 15,2005, the Service received written comments on the October 5, 2005, draft programmatic biological opinion (File No. 1-5-05-FW-536) from SNWA, MVWD, and CSI, collectively.

On November 22, 2005, the Service received written comments on the October 5, 2005, draft programmatic biological opinion (File No. 1-5-05-FW-536) from the Tribe via their consultants Ziontz, Chestnut, Varnell, Berley & Slonim.

On November 29, 2005, the Service received written comments on the October 5, 2005, draft programmatic biological opinion (File No. 1-5-05-FW-536) from the Tribe via their consultants Mifflin & Associates, Inc.

On December 12, 2005, a meeting was held among the Parties of the MOA to discuss the Parties comments relative to the Service's representation of available information.

On January 11, 2006, the final draft programmatic biological opinion (File No. 1-5-05-FW-536) was emailed to the Parties of the MOA.

On January 27, 2006, the final MOA was agreed to by the Tribe, SNWA, MVWD, CSI, and the Service to ensure that conservation actions were in place prior to potential impacts associated with the project's groundwater pumping.

BIOLOGICAL OPINION

Description of the Proposed Action

The proposed action involves the cumulative withdrawal of 16,100 afy of groundwater by the SNWA (9,000 afy), MVWD, CSI (4,600 afy), and Tribe (2,500 afy) from two separate basins (Coyote Spring Valley and California Wash basins) within the White River Groundwater Flow System (Figure 1), which is part of a larger carbonate aquifer system. The White River Groundwater Flow System encompasses many smaller basins throughout several counties within the State of Nevada. These basins include Long Valley (175), Jakes Valley (174), White River Valley (207), Cave Valley (180), Garden Valley (172), Coal Valley (171), Pahroc Valley (208), Pahranagat Valley (209), Delamar Valley (182), Kane Springs Valley (206), Coyote Spring

Valley (210), Muddy River Springs Area (219), Hidden Valley (217), Lower Moapa Valley (220), California Wash (218), Gamet Valley (216), and Black Mountains Area (215).

The breakdown of proposed groundwater withdrawals associated with this action and evaluated in this programmatic biological opinion include: 1) SNWA's withdrawal of 9,000 afy from Coyote Spring Valley at the MX-5, RW-2, CSI Wells #1 and #2; 2) CSI's withdrawal of 4,600 afy from Coyote Spring Valley at CSI Well #1 (Permit 70430) and CSI Well #2 (Permit 70429) and other wells in Coyote Spring Valley; and 3) the Tribe's withdrawal of2,500 afy from California Wash from a well-field located in the southwestern third of the Moapa Reservation. These proposed projects would require actions by other Federal agencies; however, their actions are only administrative in nature and would not change the scope of the projects or the effects analyzed in this biological opinion. Therefore, as long as the Federal action does not change the effects analysis, then future section 7 consultations for each Federal action could be tiered to this biological opinion as described above. Moapa Valley Water District is responsible for supplying the municipal water needs of Upper and Lower Moapa Valley in Clark County, Nevada, and owns several water rights including surface rights to spring flows in the Warm Springs Area and groundwater rights. Signatories to the MOA have proposed various minimization/conservation actions to offset effects to the Moapa dace.

State Engineer Rulings and Existing Groundwater Permits in Coyote Spring Valley (210), Muddy River Springs Area (219), and California Wash (218) Basins

There are three primary Nevada State Engineer rulings that affect the withdrawal of groundwater associated with the proposed action. In these ruling the Nevada State Engineer has employed a "staged development" approach that outlines an incremental approach for phasing in development of the carbonate aquifer with adequate monitoring in cooperation with other parties in order to assist in assessing affects. This approach was adopted by the Nevada State Engineer"…in order to predict, through the use of a calibrated model, the effects of continued or increased development with a higher degree of confidence." Two of these rulings (Order 1169 and Ruling 5115) held rights and applications in abeyance while allowing small projects to go forward"…that are possibly augmented gradually if conditions and confidence warrant. This approach allows the effects of development to be observed and analyzed continually, so that the benefits and adverse effects of development can be judged, and the effects reversed or mitigated if they prove to be detrimental to existing rights and the environment." These rulings are summarized below along with the existing permitted groundwater rights in the three hydrographic basins associated with the proposed action, as well as in Table 1.

Coyote Spring Valley (210)

In Order 1169 the Nevada State Engineer held in abeyance applications for new groundwater rights in certain groundwater basins (Table 1), and mandated that all water right holders (SNWA, LVVWD, MVWD, CSI and Nevada Power Company) conduct a regional groundwater study including the pumping of at least 50 percent of the permitted water rights within the Coyote Spring Valley hydrographic basin for a period of at least two consecutive years. Order 1169 is designed to evaluate how groundwater pumping activities in Coyote Spring Valley will impact water rights and the environment within the Warm Springs Area,including the Muddy River

ecosystem. In an effort to meet the requirements of Order 1169, the SNWA is proposing to remove the 9,000 afy of groundwater rights they currently own from the Coyote Spring Valley basin at the MX-5 and RW-2 wells. However, SNWA may propose to redistribute development of their existing groundwater rights from other wells within the Coyote Spring Valley. Data obtained from the study will be used to evaluate groundwater development activities within the regional carbonate groundwater system. SNWA is cooperating with MVWD, which will accommodate the 9,000 afy of Coyote Spring Valley groundwater pump test for the Order 1169 study through a new SNWA pipeline and existing MVWD pipelines and facilities, terminating at the Bowman Reservoir. Flows in excess of the capacity of the Bowman Reservoir would ultimately enter the lower Muddy River.

As of 2002, the Nevada State Engineer had granted 16,300 afy of groundwater right permits in Coyote Spring Valley (Table 1). To date, there has been almost no pumping of the permitted rights in the basin.

Muddy River Springs Area (219) *(Warm Springs Area)*

In Ruling 4243 the Nevada State Engineer granted permits to MVWD for 5,800 afy, but with pumping phased in over a ten-year period while monitoring surface water flows and groundwater levels in order to assess potential effects to wells and springs. Annual volume pumped is limited to annual demand, up to the maximum permitted. Annual pumping has consistently been less than the amount allowed in the ruling.

As of 2002, the Nevada State Engineer had granted a total of approximately 14,800 afy of groundwater permits for the alluvial aquifer or the carbonate aquifer in the Muddy River Springs Area Basin or Warm Springs Area (Table 1). Included in these are the MVWD permits for the Arrow Canyon Well totaling 10 cubic feet per second (cfs) or 7,240 afy (1,440 afy prior to Ruling 4243 plus 5,800 afy from Ruling 4243). To date, the actual pumping from the Arrow Canyon Well (carbonate aquifer pumping) has been far less than the permitted volume. Approximately 2,400 afy has been pumped on average from 1998 to 2003. Nevada Power Company holds groundwater rights in the Warm Springs Area as well, but their groundwater pumping has been historically limited to the alluvial aquifer only.

California Wash (218)

In Ruling 5115 the Nevada State Engineer granted Application Number 54075, filed by the LVVWD on October 17, 1989, for a total duty of 2,500 afy with a diversion rate of 5.0 cfs within the California Wash hydrographic basin (Permit Number 54075). By separate agreement, the LVVWD will transfer ownership of Permit Number 54075 to the Tribe (Attachment C). The Tribe plans to divert and utilize groundwater under Permit Number 54075.

As of 2002, the Nevada State Engineer had granted 3,067 afy of permitted groundwater rights in California Wash Basin (Table 1). It is not known how much of the permitted groundwater rights are being pumped.

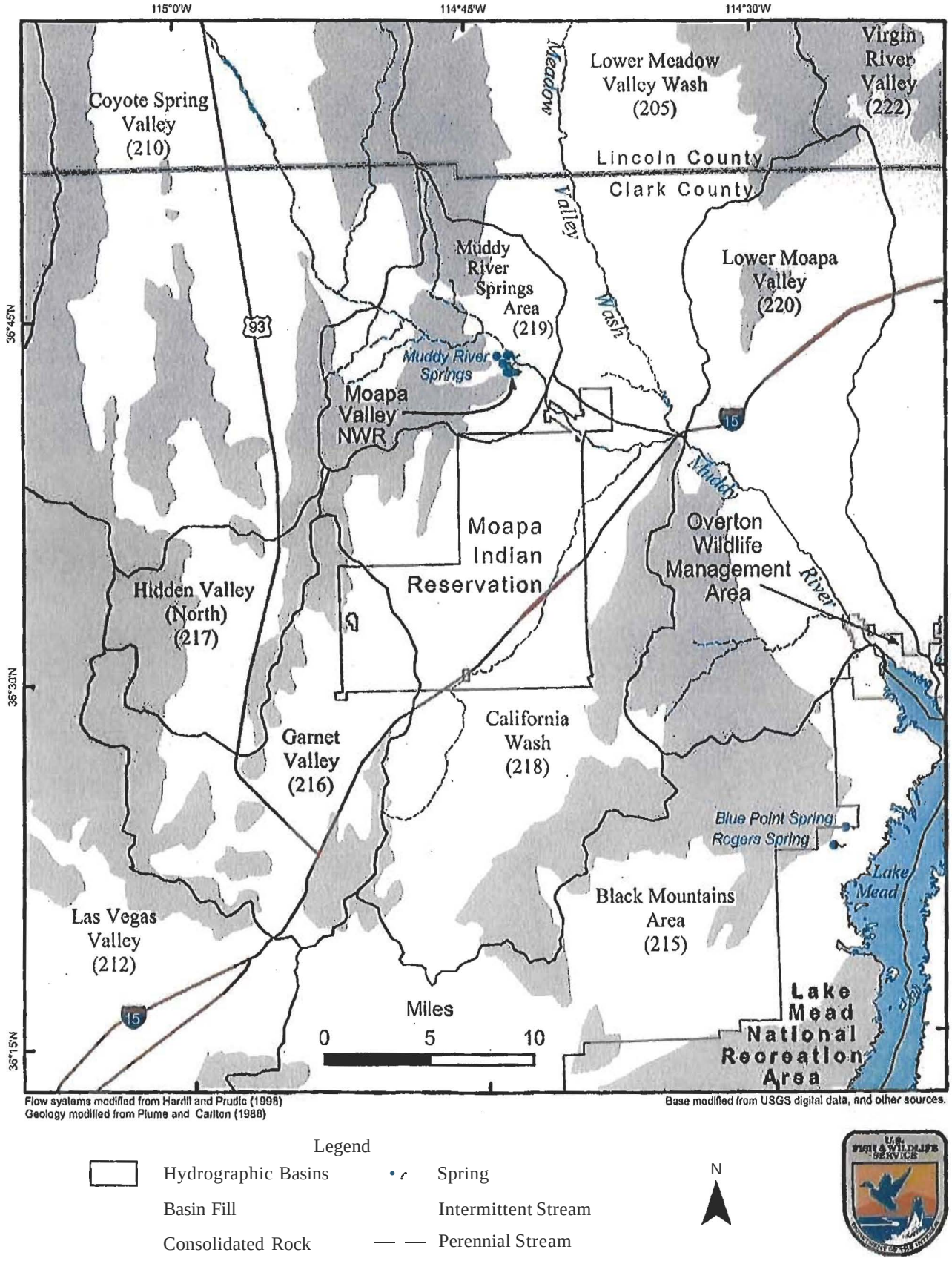


Figure I.--Location of the Moapa Valley National Wildlife Refuge (NWR) and vicinity.

Table I. Primary Nevada State Engineer's Rulings In lhe While River Groundwaler Flow System 1995102005

STATE ENGINEER'S DECISION	DATE OF DECISION	IIYDROGRAPIIIC AREA	APPLICANT	IUGIITS PERMITTED BY DECISION (afy)	RIGIITS HELD IN ABEYANCE BY DECISION (afj')	TOTAL GROUNDWATER RJGIITS PERMITTED IN BASIN AND MAJOR PERMIT "OLDERS (afy)	TOTAL GROUNDWATER RIGHTS PENDING IN BASIN AND MAJOR APPLICATION 1I0LDERS (afy)*
Ruling 4243	Oct 1995	Muddy River Springs Area	MVWO	5,800	●	~14,800 (MVWD and NPC)	22.000 (MVWD. Silver State Wal,rCo)
Significant Points Of Ruling 4243:	I) State Engineer granted permits to MVWD but with pumping phased In incrementally over a ten-year period while monitoring to assess effects to wells and springs. A "staged development" approach. The ruling requires monitoring for impacts to resources or other water rights. The consequences of impaelO are handled somewhat vaguely in the ruling. 2) Annua1 volume i. limited 10 annual demand, up to the maximum permitted. Annual pumping has consistently been less than what is allowed in the ruling. 3) Monitoring to be conducted by applicant In cooperation with other parties (NPS, FWS, NPC, US Geological Survey (USGS). SNWA)						
Order 1169	March 2002	Coyote Spring Valley	LVVWO and <.:sl	●	27,SOO (LVVWD) I08,600{CSI)	16.300 (LVVWD/SNWA, CSJ. NPC)	>200.000 (LVVWDISNWA, CSI. Dry Lake Water Co.)
Significant Points of Order 1169:	I) State Engineer ordered that at least half of the existing permits be pumped for two consecutive years during a minimum five-year study period, continuing the "staged development" approach. A report on pumping-related impacts to groundwater and surface water resources is due to the State Engineer following the study. 2) Pending and any new water right applications in Coyote Spring Valley, Black Min' Area, Garnet Valley, Hidden Valley, Upper Moapa Valley, and Lower Moapa Valley are held in abeyance until the pump test Is completed. 3) Monitoring is to be conducted by applicants ill cooperation with other parti. . (MVWD, NPC, fWS, NPS)						
Ruling 5115	April 2002	C.lifornia Wllh	LVVWD and Moapa Paiutes	2,500	7,200	~3,000 (LVVWD/Moapa Paiutes)	29,000 (LVVWD/Moapa Paiutes, Dry Lake Water Co., NPC. Oxford Power
Significant Points nfRulingSIJS:	I) State Engineer continued the "staged development" approach by granting a portion of one application and holding the other in abeyance until the development occurs and effects can be assessed 2) Granted only the volume of water needed for an air-cooled power plant, stating !h" it was not prudent "..10 use substantial quantiti. . of newly appropriated groundwater for water-cooled power plants in one of the dri. .l places In the nation, particularly with the uncertainty as to what quantity of water i. available..... 3) State Engineer noted in the Ruling that SNWA intends to transfer the permits to the Moapa Band of Paiutes.						

*Estimates of pending groundwater rights should be viewed as approximate and subject to change.

Acronyms: CSI (Coyote Springs Investment), FWS (U.S. Fish and Wildlife Serviee), IVVWD (Las Vegas Valley Water Oistrict), SNWA (Southern Nevada Water Authority), MVWD (Moapa Valley Water District), NrC (Nevada Power Company), NPS (National Park Service), USGS

Proposed Groundwater Withdrawals Associated with the MOA

On July 14, 2005, an MOA was agreed to by the signatories to outline specific conservation actions that each party would complete in order to minimize potential impacts to the Moapa dace should water levels decline in the Muddy River system as a result of the cumulative withdrawal of 16,100 afy of groundwater from two basins within the regional carbonate aquifer system. The following descriptions summarize the signatories intended water withdrawals and conservation actions that would be implemented in order to offset potential impacts to the Moapa dace. Each of these proposed groundwater withdrawals will be the subject of a future tiered biological opinion prior to any such withdrawal occurring.

Southern Nevada Water Authority and Moapa Valley Water District

As part of Nevada State Engineer Order 1169, a minimum of half the existing permitted groundwater rights in Coyote Spring Valley are to be pumped consecutively for two years as part of a five-year study to monitor the effects of the pumping. The SNWA and LVVWD have existing water right permits for approximately 9,000 afy of groundwater in Coyote Spring Valley. SNWA has indicated that they will pump 9,000 afy to meet the minimum pumping requirement in Order 1169. MVWD shall have the right during the pump test to use the Arrow Canyon Well only in the event and to the extent SNWA is unable to supply MVWD with "all necessary municipal and domestic water supplies." In conjunction with the MVWD, SNWA will pump this water from Coyote Spring Valley to water users in Moapa Valley via a pipeline, which would be analyzed in a future project-specific tiered biological opinion. Any excess water that is not utilized by SNWA and MVWD will be sent to the Bowman Reservoir. If the capacity of the 'reservoir is reached, then the water will be discharged into the lower Muddy River. It is anticipated that construction of the pipeline would take two years upon issuance of a right-of-way permit, thus pumping of this 9,000 afy would not occur until construction of the pipeline was completed. SNWA and the LVVWD have begun implementing the study in cooperation with other water right holders and Federal agencies (Service, NPS, and BLM) by expanding existing monitoring efforts, and drilling eight additional monitoring wells in Coyote Spring Valley and the Warm Springs Area. Following the study period, it is assumed that the transmission system will continue to be utilized by SNWA and/or MVWD to convey the 9,000 afy of permitted water rights. It is anticipated that the permitted water right will ultimately be used as a resource option for MVWD and/or SNWA.

Coyote Springs Investment, LLC

CSI has initiated development of a residential community in the Coyote Spring Valley basin in Clark County. In order to meet the water demands of that community, CSI proposes to withdraw their State appropriated groundwater right of 4,600 afy from the basin at CSI Well #1 (Permit 70430) and CSI Well #2 (Permit 70429) well locations or other well locations approved by the Nevada State Engineer as production locations for CSI's water right in Coyote Spring Valley. However, CSI has anticipated a phased in approach over five years, for the production of the full water rights as follows: 1) first year, 600 afy, 2) second year, 1,600 afy, 3) third year, 3,600 afy, 4) fourth year, 3,600 afy, and 5) fifth year, 4,600 afy. Incidental take has been exempted for desert tortoise in Clark County under section 10(a)(1)(B) of the Act pursuant to the approved

Clark County Multiple Species Habitat Conservation Plan (MSHCP); however the Moapa dace is not included in the MSHCP, nor the associated incidental take statement. Utilization of the CSI water right and its affect to Moapa dace would be analyzed in a future project-specific tiered biological opinion.

Moapa Band of Paiutes

Through a Water Supply Agreement with LVVWD (Attachment C), the LVVWD will transfer to the Tribe, 2,500 afy groundwater water rights in the California Wash Basin. Although no proposal has been submitted for any specific action regarding groundwater withdrawals, the Tribe has indicated the potential use of 500 afy of that 2,500 afy right for commercial development within the next two years. Utilization of the Tribe's water right and its affect to Moapa dace would be analyzed in a future project-specific tiered biological opinion, as will any other future projects up to the maximum 2,500 afy right analyzed in this programmatic opinion.

Proposed Conservation Measures

In order to minimize effects to the Moapa dace, conservation actions have been identified by the signatories of the MOA that propose to withdraw groundwater from the regional carbonate groundwater system. In order to be considered a benefit to the species, it is assumed that the proposed conservation measures will be initiated or fully implemented prior to the proposed groundwater withdrawal of 16,100 afy associated with the proposed action. Since development of the 16,100 afy requires the construction of facilities, as identified above, there would be a two to five year timeframe in which to implement many of these actions prior to the pumping of the full amount of water analyzed in this biological opinion. However, as indicated above, CSI would utilize a small portion of their water right in Coyote Spring Valley prior to full implementation of all of the conservation measures. While the contribution of funding is crucial to any conservation action, the completed, on-the-ground activity that results from the funding is the action that will be the evaluated benefit to the species. The true benefit to the species will occur with the implementation of the intended conservation action. Each of these actions, either separately or in combination, will be the subject of a future tiered biological opinion prior to their implementation. The action items are identified in the MOA (Attachment A); the following is a summary of those actions:

1. Implement restoration of Moapa dace habitat on the Service's Apcar Unit of the Moapa Valley National Wildlife Refuge (MVNWR);

2. Develop a Recovery Implementation Program (Recovery Program), which will be used to effectuate the goals of the MOA by implementing measures necessary to accomplish the protection and promote the recovery of the Moapa dace, as well as, outline the development of regional water facilities and include additional parties as appropriate. The Recovery Program will be developed for the purposes of continuing to identify the key conservation actions that, when implemented, would continue to contribute to offset any pumping impacts that may result from groundwater pumping;

3. Assist in developing an ecological study designed specifically to determine effects of groundwater pumping on the Moapa dace and other aquatic dependent species in the Muddy River system;

4. Construct fish barriers in order to prevent additional non-native fishes from migrating into Moapa dace habitat;

5. Eradicate non-native fish, such as tilapia from the historic range of Moapa dace;

6. Restore Moapa dace habitat outside the boundary of the MVNWR;

7. Provide the use of the Tribal greenhouse to cultivate native plants for restoration actions in the Muddy River area;

8. Provide access to Tribal lands for the construction and maintenance of at least one fish barrier;

9. Dedication of an existing 1.0 cfs Jones Spring water right (MVWD) towards establishing and maintaining in-stream flows in the Apcar tributary system that empties into the Muddy River as outlined in Attachment B; and

10. Dedication of 460 afy of water rights (portion of CSI appropriated water rights) to the survival and recovery of the Moapa dace, in perpetuity.

In addition, minimum in-stream flow levels were also established in the MOA that trigger various conservation actions should those predetermined levels be reached. The flow levels will be measured at the Warm Springs West Flume located on MVNWR. These automatic actions are identified in the MOA (Attachment A) and are summarized below:

1. Should the water flows reach 3.2 cfs, the signatories will meet to discuss the issue and compare/evaluate hydrology data;

2. Should the water flows reach 3.0 cfs, during the pendency of the pump test, the Arrow Canyon well will shut down and SNWA will provide the MVWD with the sufficient water quantity necessary to meet their municipal demands. In addition, SNWA and CST will take necessary actions to geographically redistribute groundwater pumping in Coyote Springs Valley if flows levels continue to decline;

3. Should the water flows reach 3.0 cfs or less but greater than 2.9 cfs, SNWA and CST will restrict groundwater pumping from MX-5 and RW-2 wells, and CSI Well #1 (Permit 70430) and CST Well #2 (Permit 70429) and CST's pumping from other wells in Coyote Spring Valley, in combination, to 8,050 afy;

4. Should the water flows reach 2.9 cfs or less but greater than 2.8 cfs, SNWA and CSI will restrict groundwater pumping from MX-5 and RW-2 wells, and CSI Well #1 (Permit 70430) and CSI Well #2 (Permit 70429) and CST's pumping from other wells in Coyote

Spring Valley, in combination, to 6,000 afy, and the Tribe will restrict their pumping (under permit number 54075) in the California Wash basin to 2,000 afy;

5. Should the water flows reach 2.8 cfs or less but greater than 2.7 cfs, SNWA and CSI will restrict groundwater pumping from MX-5 and RW-2 wells, and CSI Well #1 (Permit 70430) and CSI Well #2 (Permit 70429) and CSI's pumping from other wells in Coyote Spring Valley, in combination, to 4,000 afy, and the Tribe will restrict their pumping (under permit number 54075) in the California Wash basin to 1,700 afy;

6. Should the water flows reach 2.7 cfs or less, SNWA and CSI will restrict groundwater pumping from MX-5 and RW-2 wells, and CSI Well #1 (Permit 70430) and CSI Well #2 (Permit 70429) and CSI's pumping from other wells in Coyote Spring Valley, in combination, to 724 afy, and the Tribe will restrict their pumping (under permit number 54075) in the California Wash basin to 1,250 afy.

Action Area

The Action Area is defined as the hydrogeomorphic basins which have hydrologic connectivity to the Muddy River ecosystem. Although the entire White River Groundwater Flow System is hydrogeologically connected, only the basins that include the area of the proposed groundwater development and location of the Moapa dace and its habitat are included in the action area. These basins include the Coyote Spring Valley (Basin 210), Muddy River Springs Area (Basin 219) and California Wash (Basin 218).

Status of the Species

Moapa Dace

The Moapa dace was federally-listed as endangered under the Endangered Species Preservation Act of 1966 on March 11, 1967 (32 FR 4001), and has been protected under the Act since its inception in 1973. Critical habitat has not been designated for the Moapa dace. The Service assigned the Moapa dace the highest recovery priority because: (1) it is the only species within the genus *Moapa;* (2) the high degree of threat to its continued existence; and (3) the high potential for its recovery (Service 1996). A final recovery plan was approved by the Service in 1996 (Service 1996).

The Moapa dace was first collected in 1938 and was described by Hubbs and Miller (1948). Key identification characteristics are a black spot at the base of the tail and small, embedded scales, which create a smooth leathery appearance. Coloration is olive-yellow above with indistinct blotches on the sides, with a white belly. A diffuse, golden-brown stripe may also be present. Maximum size is approximately 4.7 inches fork length. The oldest known specimen on record is over four-years old (Scoppettone et al. 1992).

The Moapa dace is a member of the North American minnow family, *Cyprinidae.* The genus *Moapa* is regarded as being most closely related to the dace genera *Rhinichthys* (speckled dace) and *Agosia* (longfin dace) (Coburn and Cavender 1992). These three dace genera, along with the

genera *Gila* (chub), *Lepidorneda* (spinedace), *Meda* (spikedace), and *Plagopterus* (woundfin), developed from a single ancestral type (monophletic) and are only associated with the Colorado River Basin (Service 1996).

The Moapa dace is thermophilic and endemic to the headwaters of the Warm Springs Area, typically occurring in waters ranging from 78.8 to 89.6° F (Hubbs and Miller 1948); however, one individual was collected in water temperatures of 67.1 OF (Ono et al. 1983). Although, Rinne and Minckley (1991) rarely found the species below 86° F. Deacon and Bradley (1972) indicated that the species reaches its greatest abundance at warmer temperatures between 82.4 and 86.0° F. Reproduction occurs year-round and is confined to the upper, spring-fed tributaries (Scoppettone et al. 1992) where the water temperatures vary from 84.2 to 89.9° F and dissolved oxygen concentrations vary between 4.1 and 6.2 parts per million (Scoppettone et al. 1993). Juveniles are found almost exclusively in the spring-fed tributaries, whereas adults are also found in the mainstem of the Muddy River (Scoppettone et al. 1992). Adults show the greatest tolerance to cooler water temperatures, which appears to be 78.8° F (Scoppettone et al 1993). Given the species temperature tolerances and cooling pattern of the river (in a downstream direction), its range appears to be restricted to the warmer waters of the upper springs and tributaries of the Warm Springs Area (Deacon and Bradley 1972, Cross 1976, Scoppettone et al. 1992, Scoppettone et al. 1993).

In 1983, the Service prepared a recovery plan for Moapa dace which was updated in 1996, and identified various tasks to guide Recovery (Service 1996). The plan also addresses the CUlTent status, threats, and recovery needs of seven other endemic aquatic species. These include three fishes: the Virgin River chub *(Gila seminuda)* [this species is currently listed as endangered in the Virgin River and is under review for listing in the Muddy River], Moapa speckled dace *(Rhinichthys osculus moapae),* and the Moapa White River springfish *(Crenichthys baileyi rnoapae);* two snails: the Moapa pebblesnail *(Fluminicola avernalis),* and the grated tyronia *(Tryonia clathrata);* and two invertebrates: the Moapa Warm Springs riffle beetle *(Stenelmis moapa)* and the Amargosa naucorid *(Pelocoris shoshone shoshone)* that co-exist with the Moapa dace in the Muddy River ecosystem.

Threats to Moapa dace habitat include introductions of non-native fishes (e.g. tilapia and mollies), and parasites; habitat loss from water diversions and impoundments; increased threat of fire due to encroachment of non-native plant species such as palm trees, and reductions to surface spring-flows resulting from groundwater development which reduces spawning, and nursery habitats and the food base for the species. The Moapa dace is more vulnerable to catastrophic events due to their limited distribution in conjunction with these threats.

Hydrogeologic Setting

To understand the factors influencing the distribution and abundance of the Moapa dace, it is important to understand the unique hydrogeologic setting of Moapa dace habitat in the Warm Springs Area. The following description is based on past reports, monitoring information, and discussions with hydrology experts from the SNWA, NPS, USGS, Service, other agencies and organizations. We acknowledge that there are other interpretations of the hydrogeology and existing hydrologic data and the effects of CUlTent groundwater pumping that have been

expressed by Parties of the MOA (refer to the Journal of Nevada Water Resources Association, Volume 1, pg. 14 and pg [40], Johnson and Mifflin, 2003 and 2005). While these interpretations are plausible and differ from ours, the goal of the pump test as identified in Order 1169 is to gain a better understanding of the effects of groundwater pumping on existing rights and the environment, which will further our understanding of the hydrogeology of the area.

The Warm Springs Area is a groundwater discharge area consisting of about 20 regional springs, with numerous seeps and wetlands (Figure 2). This area is part of the White River Groundwater Flow System, a regional groundwater flow system located in Southern Nevada (Eakin 1966, Harrill et al. 1988, Prudic et al. 1993). As originally defined by Eakin (1966), the flow system encompasses 13 topographic basins, extending over 400 km and terminating at the Warm Springs Area. The flow system consists of numerous local basin fill aquifers underlain by a large regional carbonate aquifer that transmits groundwater from basin to basin, beneath topographic divides. This regional carbonate aquifer varies considerably in thickness, saturated zones ranging from 4,000 to 17,000 feet thick (Dettinger et al. 1995). The identification of the regional groundwater flow system was based on: (1) the hydrologic properties of the rocks in the area; (2) the movement of groundwater inferred from hydraulic gradients; (3) the relative distribution and quantities of estimated recharge and discharge in the system; (4) the relative uniformity of the discharge of the principal springs; and (5) the chemical composition and warm temperature of the discharge from the principal springs (Eakin 1966).

Groundwater inflow or recharge to the regional carbonate aquifer is primarily through precipitation. Nevada is the most arid State in the United States, and precipitation is strongly dependent on elevation. Most precipitation recharging the flow system occurs as snow in the higher elevation areas of the northern part of the flow system. The regional groundwater flow is inter-basin and is generally south and southeast through the system. Outflow or discharge from the system occurs primarily through spring discharge in three areas: (1) the White River Valley; (2) Pahranagat Valley and; (3) the Warm Springs Area.

The terminal discharge of the regional flow system is most likely to be the Warm Springs Area in the Upper Moapa Valley. However, there has been some speculation that a portion of the regional flow reaches the Colorado River. Eakin (1966) estimated that approximately 37,000 afy or 51 cfs of discharge occurs here annually from about 20 springs, as well as subsurface seepage, although the river discharge at the Moapa gage has decreased significantly since that time (LVVWD 2001). The springs are warm (thermal), discharging at a nearly constant temperature of 89.6° F (Scoppettone et al. 1992), and occur within a 2-km radius and form the headwaters of the Muddy River. Historically, this river was a major tributary to the Virgin River, which then joined the Colorado River; however, after the construction of the Hoover Dam, it now flows into Lake Mead at the Overton Arm.

The source water supporting spring discharge in the Warm Springs Area is primarily groundwater flowing beneath Coyote Spring Valley, with a small contribution possibly from Lower Meadow Valley Wash to the northeast (Eakin 1966, Prudic et al. 1993, Thomas et al. 1996, Bassett 2003). The average age of spring discharge water is approximately 6,100 years, based on carbon-14 dating (Thomas et al. 1996). Coyote Spring Valley is also the location of the groundwater pumping described in the proposed action. The two wells, MX-5 and RW-2, in

Coyote Spring Valley that have been identified as the withdrawal points for Order 1169 are located about 10 to 12 miles northwest of the Warm Springs Area.

Groundwater flow from Coyote Spring Valley to the Warm Springs Area appears to be through a zone of high permeability. Estimates of groundwater transmissivity, based on measurements from MX-5 in Coyote Spring Valley and the Arrow Canyon Well in the Warm Springs Area, range from 230,000 to 360,000 ft2/day (Van Liew et al. 2004). Such high permeability zones are commonly observed upgradient of areas of regional spring discharge. Dettinger et al. (1995) analyzed 39 well tests in southern Nevada and determined that the aquifer transmissivity measured at wells located within 10 miles upgradient from regional springs is about 10-20 times more transmissive, on average, than that portion of the aquifer located further away. However, other measurements indicate the zone of high transmissivity may be spotty and localized. The transmissivity of Arrow Canyon Well No.2, adjacent to the Arrow Canyon well, is 92,000 ft2/day. Downgradient of the Warm Springs Area, a normal fault juxtaposes low permeability rock of the Muddy Spring Formation against the carbonate aquifer, forming a barrier of sorts to regional subsurface flow. This low permeability barrier is responsible for the location of the springs.

Carbonate potentiometric heads at MX-4 and MX-5 in Coyote Spring Valley are about 4 feet (ft) greater than carbonate potentiometric heads at EH-4 and EH-5B wells, which are located in the Warm Springs Area about 12 miles to the southeast (Figure 2) (SNWA 2003). The resulting hydraulic gradient of 6.3×10^{-5} is very low. The high transmissivities and low hydraulic gradients suggest the presence of a zone of well-developed hydraulic continuity and high flow rates extending from Coyote Spring Valley to the Warm Springs Area (Figure 1). Pumping stresses imposed at any point in this zone are expected to be readily propagated to all areas in the high transmissivity zone. Johnson and Mifflin (2003) essentially came to the same conclusion. They state that "Extractions from the "northern" flow field, which extends northwestward from the Muddy River springs and includes Coyote Spring Valley, will impact Muddy River flows on essentially a one-to-one basis."

The other area of potential groundwater development included in the MOA is the California Wash hydrographic basin (Basin 218). This basin is located to the south of the Warm Springs Area and includes the Moapa Indian Reservation. There is less information on the hydrologic properties of the carbonate aquifer underlying the basin. Some areas within the California Wash basin appear to be highly transmissive and the potentiometric surface is generally quite flat, with a small east-southeast gradient (Johnson et al. 2001). The hydraulic connectivity of the California Wash basin to the Warm Springs Area is unknown although there are some indications that the area is connected with the Warm Springs Area based on monitoring well data that was shared with the Service in July 2004. However, Johnson and Mifflin (2003, 2005) suggest that there is a hydraulic barrier that will prevent pumping in the southern part of California Wash from impacting the Warm Springs Area.

Moapa Valley National Wildlife Refuge

The MVNWR is a 106-acre area of springs and wetlands located in the Warm Springs Area of the Upper Moapa Valley (Figure 3). The MVNWR was established in 1979 for the protection of

the endangered Moapa dace. The thermal headwaters of the springs on the MVNWR are some of the most productive spawning habitat in the area. The MVNWR consists of three units encompassing the major spring groups: the Pedersen Unit, Plummer Unit, and Apcar Unit (upper Apcar). The MVNWR also provides protection for the Moapa White River springfish and other aquatic fauna including endemic snails and other aquatic invertebrates native to the Warm Springs Area.

Pedersen Unit

The Pedersen Unit was the first parcel acquired for the MVNWR and is one of the important strongholds for the Moapa dace reproduction. The Pedersen Unit contains five major springs or spring groups: Pedersen Spring; the East Pedersen Spring group; the Spring 13 group; the Spring 12 group; and Spring 11. Pedersen Spring, at an elevation of 1,810 ft (Mayer 2004), is the highest elevation spring in the Warm Springs Area. The other major spring groups range in elevation from 1,792 to 1,807 ft (Mayer 2004). As discussed later, spring elevation is significant if and when groundwater levels in the regional carbonate aquifer decline due to groundwater development. Therefore, higher elevations springs will be impacted first and with a relative reduction in flow than lower elevation springs.

The Service holds a State-appropriative water right for spring discharge on the Pedersen Unit with a priority date of 1991. The water right is for 3.5 cfs as measured at the Warm Springs West gage, which is located near the downstream boundary of the MVNWR and discharges into the Refuge Stream.

The USGS monitors the total spring discharge from the Pedersen Unit of the MVNWR through a one-ft Parshall flume at the Warm Springs West Gaging Station (USGS Station Number 09415920). The site has been monitored continuously since 1985, except for a data gap from October 1994 through May 1996, due to a lack of funding. Until January 1998, there was an un-metered irrigation diversion upstream of the Warm Springs West flume. The diversion was set up such that water in excess of the irrigation needs could be returned to the stream channel, but downstream of the flume. Water was probably not diverted continuously; however, there is no record of when the diversion was open or closed or how much water was diverted. The flow that was diverted for irrigation was not accounted for in the flume measurements, resulting in an underestimate of the total spring discharge from the MVNWR. For this reason, the period of record prior to January 1998 does not adequately represent the total volume of water emanating from the springs on the Pedersen Unit. The diversion was metered by MVWD beginning in February 1998. The farmer ceased irrigating through this diversion after May 1999, and no water has been diverted since that time. The February 2001, seepage run reported a flow of 3.82 cfs at this site (USGS 2001) although flows have decreased since then (Mayer 2004).

Figure 2

,Warm Springs Area

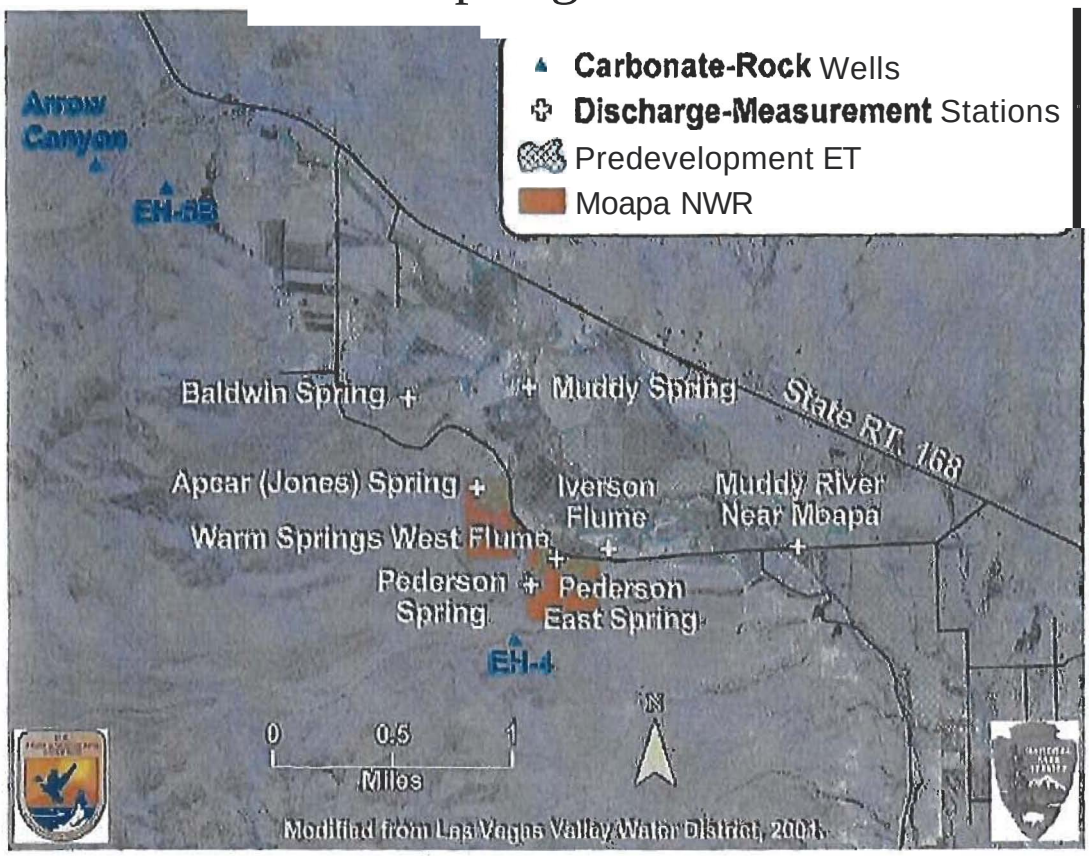
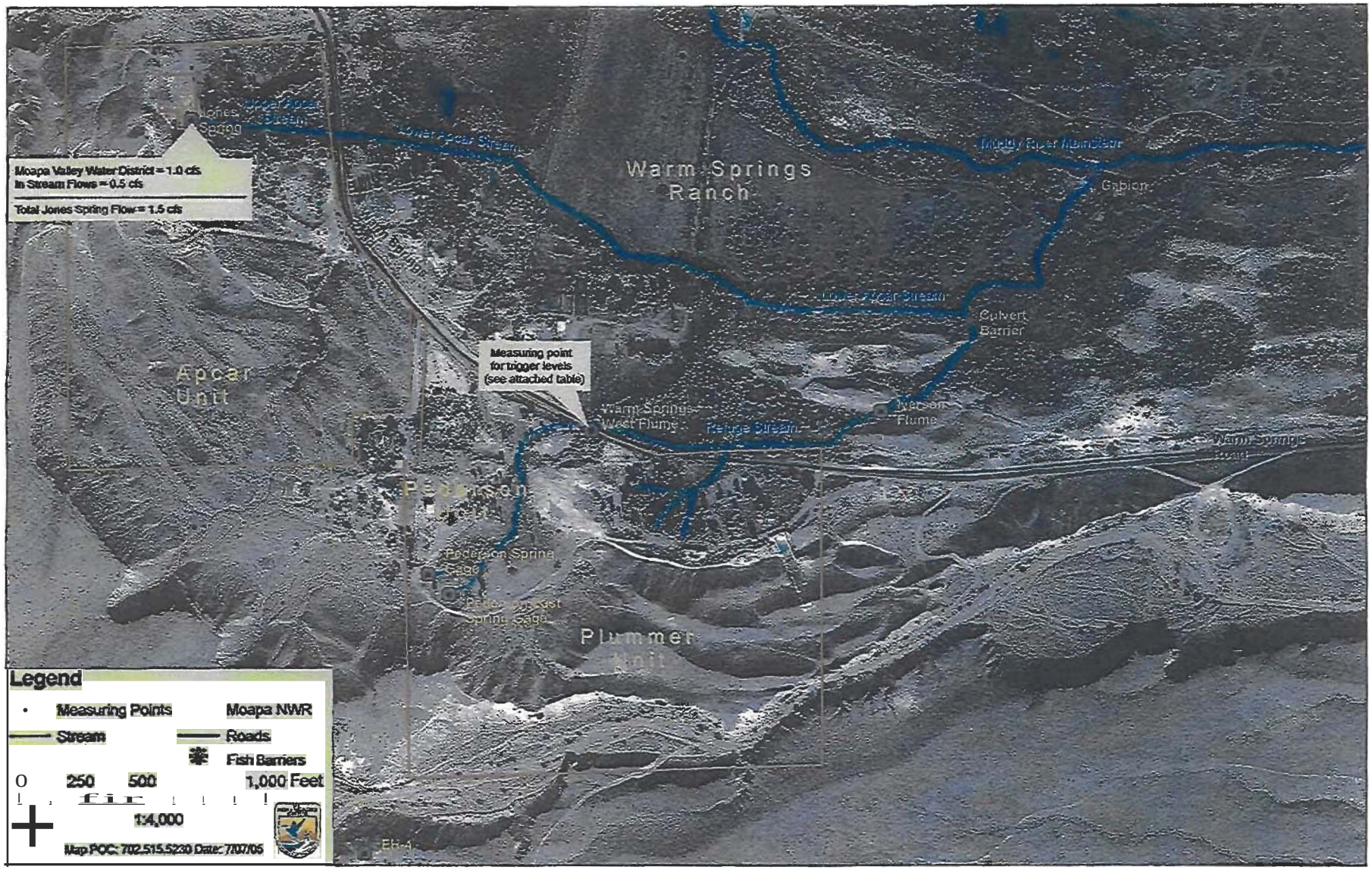


Figure 3
Moapa Valley National Wildlife Refuge



Plummer Unit

The Plummer Unit is the second parcel acquired for the MVNWR and is located just east of the Pedersen Unit. It contains three major springs or spring groups: Plummer West; Plummer Central; and Plummer East. The elevations of all three of the spring groups are about 1,755 to 1,760 ft, which is lower than the springs on the Pedersen Unit. The total spring discharge from the Plummer Unit, as measured at Plummer Main, averages about 2.5 cfs, based on periodic measurements by the Service and the USGS. The February 2001, seepage run reported a flow of 2.39 cfs at Plummer Main (USGS 2001).

The discharge from the Plummer and Pedersen units combines to become the Refuge Stream, downstream of the MVNWR boundary. The Iverson flume (USGS Station Number 9415927) on the Refuge Stream measures the flow leaving the MVNWR, plus any additional losses or gains between the MVNWR boundary and the gaging station. The February 2001, seepage run reported a flow of 8.00 cfs at the flume with an additional 1.13 cfs being diverted upstream of the flume, for a combined total of 9.13 cfs (USGS 2001). The combined total at the Iverson Flume was about 150 percent of the sum of the two flows measured upstream on the same day at Warm Springs West gage and Plummer Stream (USGS 2001). The additional flow measured at the downstream site is assumed to result from subsurface seepage gain into the channel along this reach.

Apcar Unit

The Apcar Unit is the third and most recent parcel acquired for the MVNWR. There is just one spring emanating in this area, the Apcar or Jones Spring. The elevation of the spring orifice is reported to be 1,788 ft although the orifice is buried and the elevation may be difficult to determine accurately. Flows from Apcar Spring are reported by MVWD and have averaged about 1.5 to 1.6 cfs since January 2001. MVWD currently diverts 1.0 cfs of the total flow from Apcar Springs continuously for municipal use (Water Right Certificate Number 10060). The undiverted portion of the spring discharge flows east into Apcar Stream. The February 2001, seepage run reported a flow of 2.54 cfs downstream of Apcar Stream at the Pipeline Jones flume and 3.86 cfs just above the confluence with the Refuge Stream. MVWD reported an average daily flow of 1.55 cfs during February 2001, (flow measurements for specific days were not available, only an average daily flow based on a monthly total). Presumably, 1.0 cfs of this 1.55 cfs was being diverted by MVWD, leaving 0.55 cfs in the channel. The additional flow measured during the seepage run at the two measurement sites downstream of the Apcar Unit is assumed to result from un-metered springs on private property and subsurface seepage gain into the channel along the entire stream.

Historic Distribution and Abundance of the Moapa dace

Between 1933 and 1950, Moapa dace was abundant in the Muddy River and was estimated to inhabit as many as 25 individual springs and up to 10 miles of stream habitat (Ono et al. 1983). La Rivers (1962) considered the species "common" until at least 1950. However, by 1983, the species only occurred in springs and 2 miles of spring outflows (Ono et aI.1983). The species

appears to have declined since 1938, when Hubbs and Miller considered the species "rather common" in all warm water habitats in the headwaters of the Moapa River (Muddy River), including spring pools, small creeks and the mainstem.

During 1984-87, the Service's Seattle National Fisheries Research Center, now part of the USGS-Biological Resources Division (BRD), extensively surveyed Moapa dace habitats and estimated the adult Moapa dace population to be between 2,600 and 2,800 individuals (Scoppettone et al. 1992). These areas were re-surveyed by USGS-BRD in August 1994, when approximately 3,841 Moapa dace were recorded (Scoppettone et al. 1996). There was a substantial reduction in the number of individuals counted in 1997, with less than 1,600 adult Moapa dace observed, which was believed to be a result of the introduction of tilapia (Scoppettone et al. 1998). In January 2001, a total of 934 Moapa dace were recorded by a consortium of agencies, including the Nevada Department of Wildlife, USGS-BRD, SNWA, and the Service. In February 2002 and 2003, annual surveys enumerated approximately 1,085 and 907 individuals, respectively (Table 2).

Table 2. Moapa dace survey results "

Stream Survey Segment	1994	1997	Feb 1999	Feb 2000	Jan 2001	Feb 2002	Feb 2003	Feb 2005
Muddy River Mainstem	2,088·	260'						
- NP to REF	NIA	NIA	X	X	X	8	0	X due 10 turbidity
- REF to NIS forks	NIA	NIA	X	X	34	49	19	49
Apcar (off MVNWRj	407·	528·						
- Lower			X	43	85	55	30	"7
South Fork	355	28	IJ	9	18	24	14	'0
North Fork	'26	'06	77	13	46	37	33	9
Muddy Spring	236	28	14	X	5	2	0	0
Apcar-Upper (MVNWRj			5	X	87	86	'O	6
Plummer (MVNWR)	0	20	113	X	11	53	60	177
Pedersen (MVNWRj			185	163	18'	172	204	174
Refuge Stream	313·	595·						
- Wann Springs Road to AIR	NIA	NIA	566	643	416	599	507	652
- AIR 10 Gabion Structure	NIA	NIA	X	X	X	X	X	62
TOTALS	3841	1565	973	931	934	1085	907	1,296

"2004 surveys not completed throughout the species entire range "lid not used for comparison

AIR - just above confluence of Refuge and Apcar Streams; NJS · confluence of North and South Forks; NP - Nevada Power diversion; MVNWR · spring heads to Wann Springs Road; REF = confluence of Refuge Stream and Muddy River; X- stream reach not surveyed.

* entire reach surveyed, not broken into segments. 2005 population surveys were broken illlo distinct reach segments and did include juveniles in the Refuge Stream and Plummer Unit on the MVNWR

Current Distribution and Abundance a/the Moapa Dace

The Moapa dace currently occupies a variety of habitats in the Warm Springs Area, including spring pools, tributaries (spring outflows), and the upper 2.48 miles of the 24.8 mile-long mainstem Muddy River (post-Hoover Dam). Habitat use varies among larval, juvenile, and adult life stages. Larval dace are observed only in the upper-warmest reaches of tributaries and occur most frequently in slack water, suggesting that spawning only occurs near the spring heads in the extreme upper end of the Muddy River headwaters. Juveniles occur throughout tributaries and occupy habitats with increasing flow velocities as they grow (Service 1996). Adults inhabit both tributaries and the mainstem of the Muddy River, but are most often seen in the mainstem except during spawning when they are in the upper end of the thermal tributaries (Scoppettone et al. 1987, 1992). Larger adults are typically associated with higher velocity flows of 2.6 to 3.0 ft per second (fps) (Cross 1976), with the largest occurring in the Muddy River (Scoppettone et al. 1987). In the Warm Springs Area, water emerges at 89.6° F, cools and increases in turbidity as it travels downstream (Scoppettone et al. 1992). Cooler water temperatures in the lower Muddy River likely form a natural barrier to downstream movement of the Moapa dace (La Rivers 1962).

Moapa dace surveys continue to be conducted annually on both public and private lands throughout the upper Muddy River system. The 2005, survey data indicate that there are approximately 1,300 fish in the population that occur throughout 5.6 miles of habitat in the upper Muddy River system. Approximately 95 percent of the total population occurs within one major tributary that includes 1.78 miles of spring complexes that emanate from the Pedersen, Plummer, and Apcar (a.k.a. Jones) spring complexes on the MVNWR and their tributaries(upstream of the gabion barrio Figure 4). Approximately 28 percent of the population was located on the MVNWR and 55 percent occupied the Refuge Stream supplied by the spring complexes emanating from the MVNWR (Table 3 and Figure 4). This Refuge Stream reach accounts for the highest density of Moapa dace, with the 2lld and 3rd highest densities occurring on the MVNWR's Plummer and Pedersen units, respectively (Table 3 and Figure 4).

Although the stream segment downstream from the convergence of the Refuge Stream and the mainstem Muddy River to the USGS Gaging station (Survey Reach Number 11) (Figure 4) was not surveyed in 2005, due to lack of visibility, available information indicate that no Moapa dace have been present in this portion of the Muddy River since 2002, when only eight dace were reported (Table 2). This loss is likely the result of competition with and predation by non-native tilapia. Since the Moapa dace is a thermally restricted species, water temperatures that drop below the preference range would not provide sufficient habitat for spawning, foraging, or shelter. The species shows varying water temperature tolerances for different life stages; however, the adult stage shows a lower tolerance of approximately 79° F (Scoppettone et al. 1993); therefore, any temperature cooler than 79° F would not provide long-term habitat for the species, thereby creating a thermal barrier for species. While the species has always had a natural thermal barrier due to the warm spring water cooling as it travels downstream, the tail of the temperature threshold can fluctuate due to reduced flows in the system (as explained later in the thermal loads section). Thermal losses can occur as a result of decreasing flows from warm

Figure 4

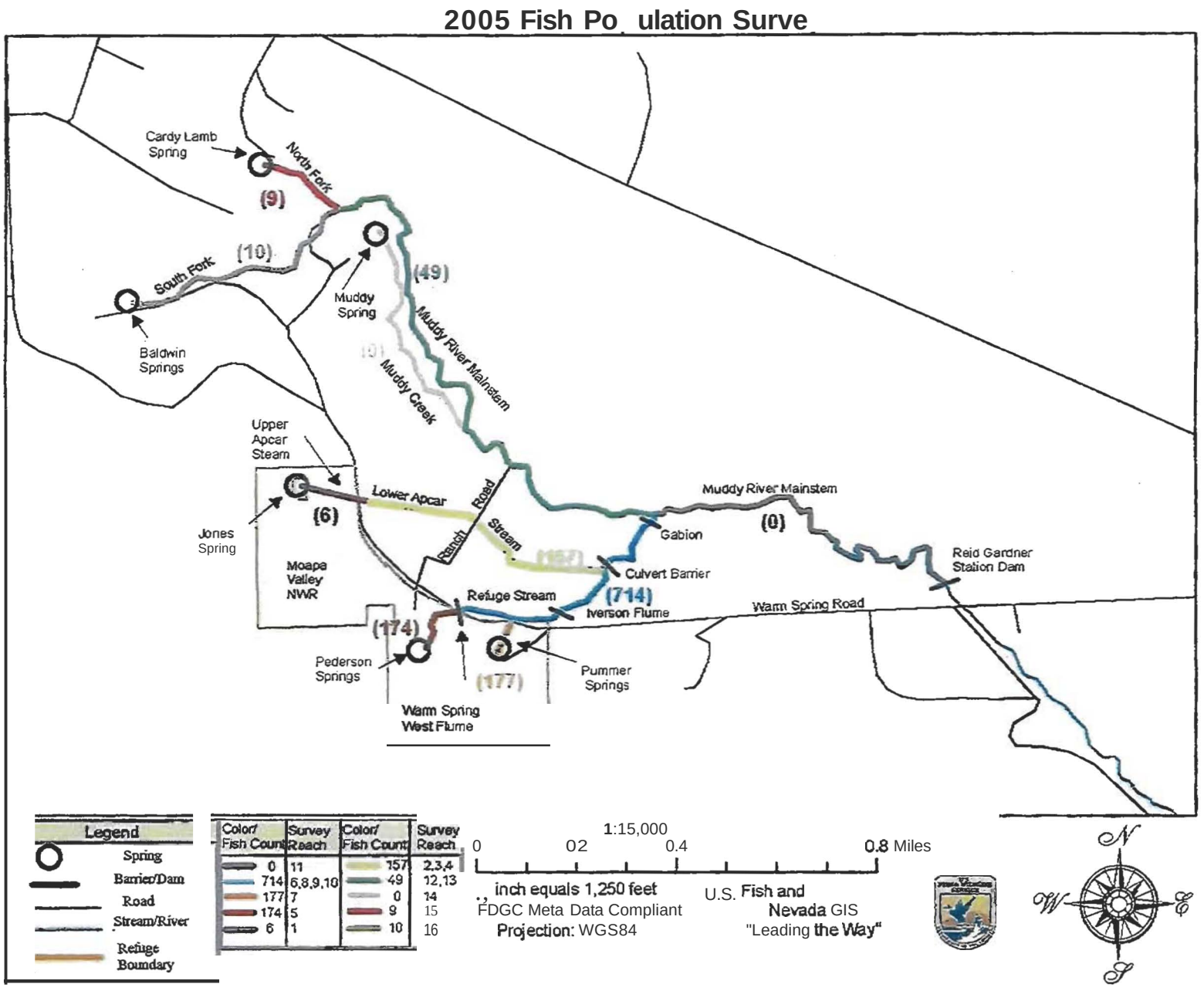

2005 Fish Po_ ulation Surve
Cardy Lamb Spring
North Fork
(9)
South Fork
(10)
Baldwin Springs
Muddy Spring
(49)
Muddy River Mainstem
Muddy Creek
Upper Apcar Steam
Lower Apcar
(6)
Jones Spring
Moapa Valley NWR
Ranch Road
Stream
(157)
Culvert Barrier
Gabion
Muddy River Mainstem
(0)
Reid Gardner Station Dam
Refuge Stream
(714)
Iverson Flume
Warm Spring Road
(174)
Pederson Springs
(177)
Pummer Springs
Warm Spring West Flume
Legend
Spring
Barrier/Dam
Road
Stream/River
Refuge Boundary
Color/ Fish Count
Survey Reach
0 11
714 6,8,9,10
177 7
174 5
6 1
157 2,3,4
49 12,13
0 14
9 15
10 16
1:15,000
0 0.2 0.4 0.8 Miles
inch equals 1,250 feet
FDGC Meta Data Compliant
Projection: WGS84
U.S. Fish and
Nevada GIS
"Leading the Way"
N
W
E
S

Table 3. Moapa dace density and population estimates for 2005

Stream Segment	Available Habitat *	Fish Density (# fish! 10 Ft)	Fish Density	Total Number ofFish (2005 Survey)
Muddy River Mainstem (N/S forks convergence to WSR Bridge)	11,743 ft or 2.22 mi	0.04	1 fish!239 ft	49
Apcar - Lower (off MVNWR)	3,145 ft or 0.60 mi	0.50	I fish!20 ft	157
South Fork	3,085 ft or 0.58 mi	0.03	I fish!309 ft	10
North Fork	2,640 ft or 0.50 mi	0.03	I fish!293 ft	9
Muddy Spring	2,743 ft or 0.52 mi	0	0	0
Apcar -Upper (MVNWR)	733 ft or 0.14 mi	0.08	1 fish! 122 ft	6
Plummer (MVNWR)	860 ft or 0.16 mi	2.06	I fish/5 ft	177
Pedersen (MVNWR, includes all springs and tributaries)	1,839 ft or 0.35 mi	0.95	1 fish/II ft	174
Refuge Stream (off Pedersen Unit of MVNWR-Warm Springs Road to confluence with the mainstem of the Muddy River)	2,849 ft or 0.53 mi	2.51	I fish!4 ft	714
Totals	29,637 ft or 5.6 mi	--	--	1,296

* Stream segment lengths are approximations derived from digitized aerial photos (USGS In Draft see Lit. Cited).
Note: shaded areas indicate the 3 stream segments with the highest Moapa dace densities.

water springs, water diversion structures, and/or surface sheet flow (water that flows freely out of stream banks across the land) and result in an overall reduction in the species' distribution potential. With the potential loss of these warmer waters contributing to the overall decrease in thermal load in the system, the Muddy River cools more rapidly, thus decreasing the distribution potential for the species.

Reproduction

Moapa dace larvae have been observed year-round, indicating year-round reproduction; however, peak spawning activity likely occurs in the spring, with lesser activity in autumn, probably linked to food availability (Scoppettone et al. 1992). Sexual maturity occurs at one year of age, at approximately 1.6 to 1.8 inches fork length (Hubbs and Miller 1948, Scoppettone et al. 1987, 1992). Fecundity is related to fish size; egg counts range from 60 eggs in a 1.77-inch fork length dace to 772 eggs in a 3.5-inch fork length dace (Scoppettone et al. 1992).

Reproduction of Moapa dace is believed to occur within a very narrow temperature range of 86° to 89.6 OF (Scoppettone et al. 1992) and is likely isolated with the warmer springs (headwaters) of the Muddy River. Although Moapa dace have never been observed spawning, Scoppettone et al. (1992) observed recently emerged larvae within 492 ft of the warm water spring discharge, over sandy silt bottoms in temperatures ranging from 86° to 89.6 OF, and dissolved oxygen levels of 3.8 to 7.3 ppm. Sexually mature Moapa dace must migrate upstream from the Muddy River into thermal tributaries to spawn successfully (Scoppettone et al. 1987). Several depressions in the sand were similar to "redds" described by Minckley and Willard (1971) for longfin dace *(Agosia chrysogaster)*. Depth and velocity at the suspected redds were representative of the outflow channel and similar to other suspected spawning areas in the Warm Springs (Scoppettone et al. 1992). Redds were in sandy-silt substrate at depths of 5.9 to 7.5 inches, water velocities near the nesting redds ranged from 0.12 to 0.24 fps, and mean water column velocities from 0.5 to 0.6 fps (Scoppettone et al. 1992).

The duration of egg incubation is unknown, but is likely relatively short due to the high water temperatures (Service 1996). Emigration of young-of-the-year Moapa dace from the Refuge Stream is believed to peak in May (Scoppettone et al. 1987), and dispersal is likely similar in other tributaries with comparable water temperatures. Mortality rates for Moapa dace have been estimated to be 68 percent for the first year (juveniles) and 65 percent in the second year (adults) (Scoppettone et al. 1987).

Visual observations of Moapa dace have revealed that they are omnivores, feeding primarily on drift items, but adults forage from the substrate as well. Larval dace feed on plankton in the upper water column, in areas with little or no current, and juveniles feed at mid-water (Service 1996). Schools of 30 or more Moapa dace have been observed congregating at drift stations to feed (Scoppettone et al. 1987). They often use sites where cover is provided by overhanging vegetation (Service 1996). Drift stations are also located in reaches of low to moderate water velocity adjacent to depressions in the substrate. These depressions may be located downstream of a pebble riffle, thus creating turbulent flows. Moapa dace actively feed 24 hours a day, but peak feeding occurs around dawn and dusk (Scoppettone et al. 1987).

Threats

Moapa dace are thermophilic and endemic to the headwaters of the Muddy River (Figure 5). The Muddy River originates from spring discharges in the Warm Springs Area. When it was described by Eakin (1964), the Muddy River at the Moapa gage had an average annual discharge of 46.5 cfs and temperatures ranging from 87.8 to 89.6°F at its sources. Flows have declined over the last 40 years to about 35 cfs due to a combination of surface water diversions and groundwater pumping (LVVWD 2001). The Muddy River is a unique system due to the fact that its headwaters emanate from warm water springs. Given the warm sources, the water does not get warmer as it travels downstream like most riverine systems but rather cools as it travels downstream. Although the flow in the headwaters is nearly constant seasonally, flow in the mainstem of the Muddy River varies with precipitation events, seasonal water diversions, groundwater recharge, vegetation transpiration, evaporation, and irrigation return flows. Before reaching Lake Mead, nearly 75 percent of the annual inflow is lost to diversions, evaporation, and transpiration (Soil Conservation Service 1993).

Physical alteration of Moapa dace habitats in the Warm Springs Area, initially for irrigation purposes, began even before the species was discovered in 1938 (Scrugham 1920). These habitats have since been developed for recreational, industrial, and municipal uses. Spring orifices and outflow streams have been dug out, lined with concrete and/or gravel, mechanically and/or chemically treated to eliminate aquatic vegetation, and chlorinated to create private and public swimming pools. Several springs are capped and piped directly from the orifices for municipal use, desiccating associated outflow streams. Chlorination and agricultural activities in the Warm Springs have decreased in recent years, but some spring outflow streams continue to flow through culvelis and/or dili and cement irrigation ditches. Historically, irrigation return flows and runoff from pasture land and alfalfa fields carried significant quantities of sediment into the upper Muddy River. Encroachment of non-native vegetation [i.e., palm trees *(Washingtoniafilifera),* and tamarisk *(Tamarix ramosissima)]* within and along stream channels has also modified habitat. The root system of palm trees has modified stream morphology by obstructing the stream channel and/or lining the channel bed.

The upper Muddy River has also been subjected to various physical perturbations. In 1944, the Bureau of Reclamation constructed a lO-ft-high Cipoletti weir gaging station at the Warm Springs Road Bridge. The USGS took ownership of the gage in 1948, and continues to measure flows at this gaging station. This concrete dam impounds approximately 150 ft of riverine habitat. Although the structure serves as a barrier to fish migration upstream during normal flows, it also hinders movement of Moapa dace from accessing the upstream spawning tributaries or escaping turbid river conditions. The structure also cools the river water as it cascades over the structure to a temperature below that preferred by Moapa dace (Deacon and Bradley 1972).

It is believed that the first non-native, mosquito fish *(Gambusia a!finis)* became established in the Muddy River by 1938 (Hubs and Miller 1948). A decline in the abundance of Moapa dace was first noted in the 1960s, shortly after the introduction of non-native shortfin mollies *(Poecilia mexicana)* (Deacon and Bradley 1972, Cross 1976). The concurrent decline in the

abundance of Moapa dace was likely related in part to interactions between these two species. Habitat use by mollies is similar to that of larval and juvenile Moapa dace (Deacon and Bradley 1972, Scoppettone et al. 1987), and laboratory experiments have demonstrated that shortfin mollies are predators of fish larvae (Scoppettone 1993). Together, these species have introduced fish parasites into the ecosystem, including tapeworms *(Bothriocephalus acheilognathi),* nematodes *(Contracaecum* spp.), and anchor worms *(Lernaea* spp.), which have negatively impacted native fishes of the Muddy River, including Moapa dace (Wilson et al. 1966, Heckman 1988).

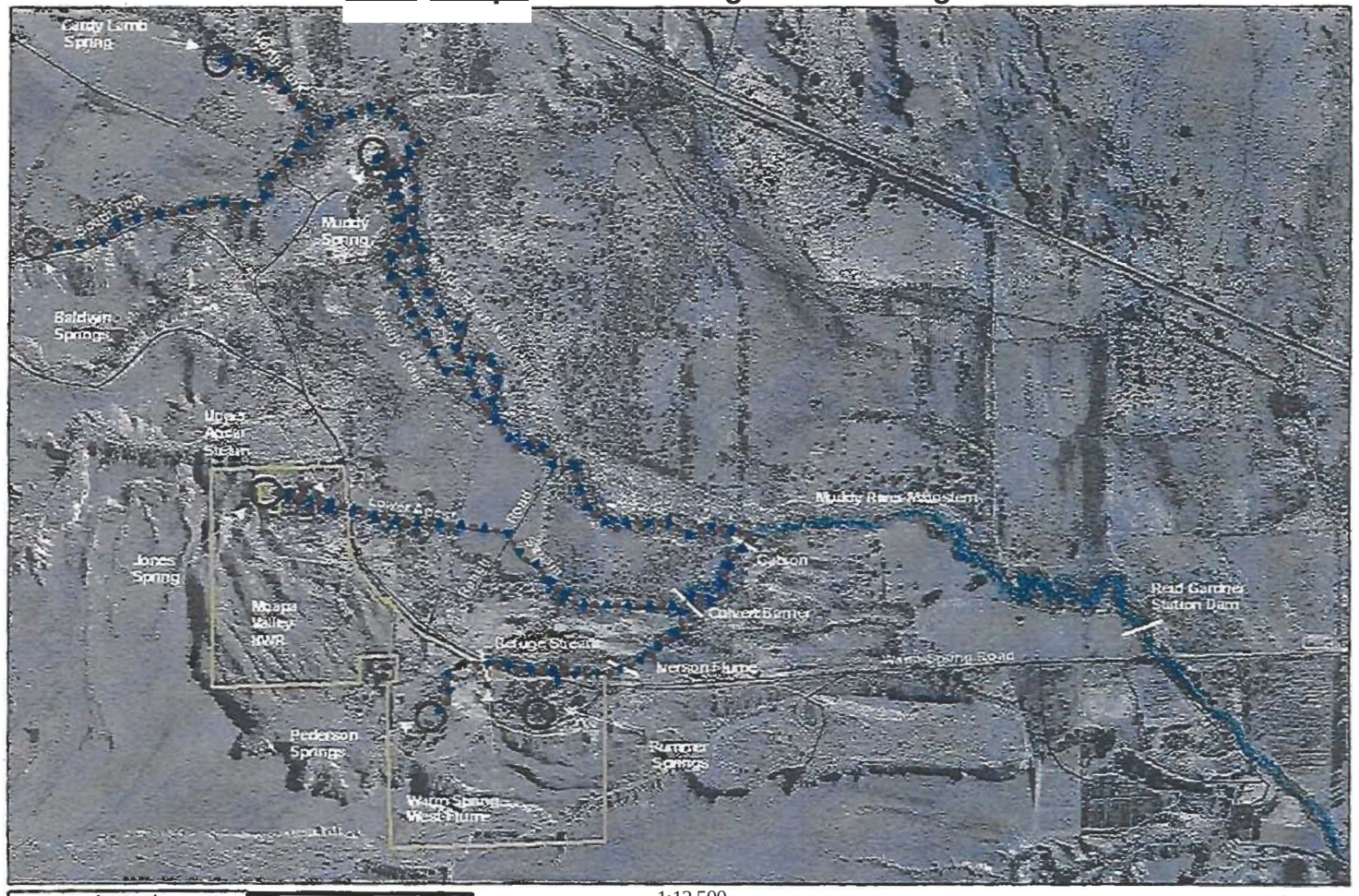
The blue tilapia *(Oreochromis aurea)* is the only non-native fish to become established in the Warm Springs Area since the introduction of the shortfin molly (Scoppettone et al. 1998). With the exception of waters on the MVNWR, Apcar and Refuge streams, tilapia occur in the Warm Springs' tributaries and have had devastating effects on Moapa dace and other native fish populations. The Moapa dace population has declined dramatically since the invasion of tilapia. The tilapia is detrimental to native fish species in a number of ways. Shortly after the invasion of tilapia into the Warm Springs Area, most of the aquatic vegetation disappeared. This vegetation provided habitat for invertebrates that Moapa dace rely upon as a food resource. Analysis of tilapia stomach contents revealed the presence of Moapa dace and Moapa White River springfish, indicating that tilapia further degrade native fish populations through predation (Scoppettone et al. 1998). Additionally, tilapia significantly altered the stream bed through the creation of nesting areas.

The introduction and establishment of tilapia in 1997 and other non-native fishes have been a major factor in the deterioration of the Muddy River as habitat for native fishes (Deacon and Bradley 1972). Currently, the springs and streams on the MVNWR, and Apcar and Refuge streams are the only Muddy River tributaries free of tilapia; therefore, making them more vulnerable to catastrophic events. The OCCUlTence of tilapia is likely the primary cause for reductions in Moapa dace populations in the South Fork, North Fork, and Muddy River tributaries (Scoppettone et al. 1998). Deacon and Bradley (1972) stated, "The marked decrease in abundance of native fishes that follows establishment of a non-native species could conceivably can'y a native species to the point of extinction."

A threat in recent years to the Moapa dace is the increased occurrence of fire, primarily due to the encroachment of non-native vegetation. In June of 1994, a flash fire swept through the upper Refuge Stream that either killed or displaced individual Moapa dace that were occupying affected stream reaches. Surveys conducted post-fire in 1994, indicated that only 34 Moapa dace survived on the MVNWR (Scoppettone et al. 1998), and subsequent surveys indicated an overall decline in the total population of Moapa dace (Table 2). Given the restricted range of the species, and the associated mortality from the fire, it is apparent that the species is vulnerable to stochastic and catastrophic events.

Figure 5

2005 Moapa Dace Existing/Historic Range



Legend

- Spring
- Barrier/Dam
- Road
- Refuge Boundary
- Stream/River Historic
- SlreamIRiver Existing

1:12,500

O 0.15 0.3 0.6 Miles

1 inch equals , ,041 .666667 feet
FDGC Meta Data Compliant
Projection: WGS84

U,S, Fish and Wildlife Service
Nevada GIS
'Leading the Way"

Environmental Baseline

Groundwater Elevation/Spring Discharge Relationships

It is well established that the spring discharge in the Warm Springs Area emanates from the regional carbonate aquifer (Eakin 1966, Pmdic et al. 1993, Thomas et al. 1996). The regional carbonate aquifer underlying the area is confined and the potentiometric surface of the carbonate aquifer is greater than the land surface elevation of the springs. This hydraulic head differential causes groundwater in the carbonate aquifer to rise to the land surface through cracks and fissures, manifesting itself as spring discharge. Darcy's Law states that flow through a porous medium is proportional to the hydraulic head differential or hydraulic gradient (Fetter 1994). The law is valid for groundwater flow in any direction. **In** the case of spring discharge, the greater the hydraulic head differential between the elevation of the spring orifice and the hydraulic head of the aquifer, the greater the spring discharge, all other things being equal.

Groundwater development activities in the Coyote Spring Valley or Warm Springs Area will lead to the development of a drawdown cone around the pumping center. We assume that if the drawdown cone extends to the area underlying the springs, then the hydraulic head differential at the springs will be reduced. Darcy's Law states that a reduction in the hydraulic head differential will result in a proportional decrease in flow. For example, if the head differential at a spring is initially 10 ft but groundwater pumping lowers the potentiometric surface of the aquifer by 2 ft, then the head differential will only be 8 ft, a 20 percent decrease. The proportionality relationship in Darcy's Law implies that the spring discharge will also be decreased by a similar amount, or 20 percent.

The elevations of spring pool orifices in the Warm Springs vary by more than 60 ft (SNWA 2003). Considering the head/discharge relationship described above, it becomes evident that for a given decline in the potentiometric surface of the aquifer, the springs in a system with the smallest head differential, the highest elevation springs, will be the most susceptible to groundwater pumping impacts. Figures 6 and 7 illustrate this concept with two hypothetical springs of different elevations. Following a decrease of 5 ft in the groundwater elevations, the hydraulic head at the higher elevation spring is reduced by 50 percent. The discharge at the spring is expected to be reduced proportionately (Figures 6 and 7). By contrast, the same 5 ft decrease in groundwater elevations only reduces the hydraulic head at the lower elevation spring by 25 percent. The spring discharge would be reduced by a much smaller percentage (25 percent) compared to the higher elevation spring. The underlying assumption in this example is that the drawdown is uniform at both springs, a reasonable assumption in a highly transmissive system with a shallow, extensive drawdown cone. **In** such a system, the springs that will be most susceptible will be the highest elevation springs and not necessarily the springs that are closest to the pumping center.

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Figure 6

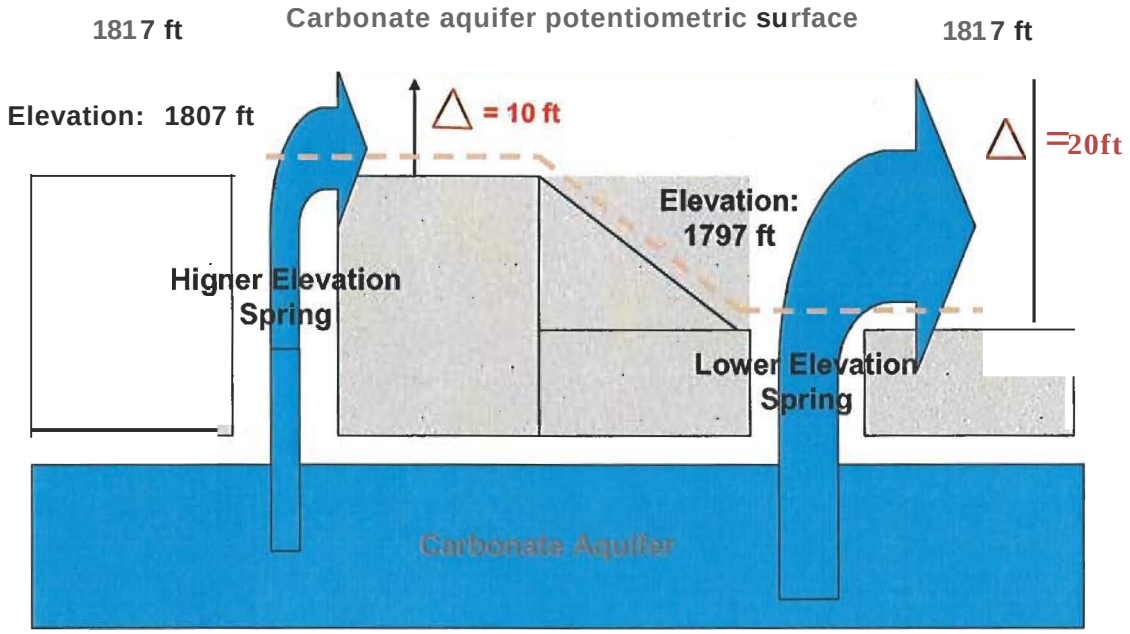
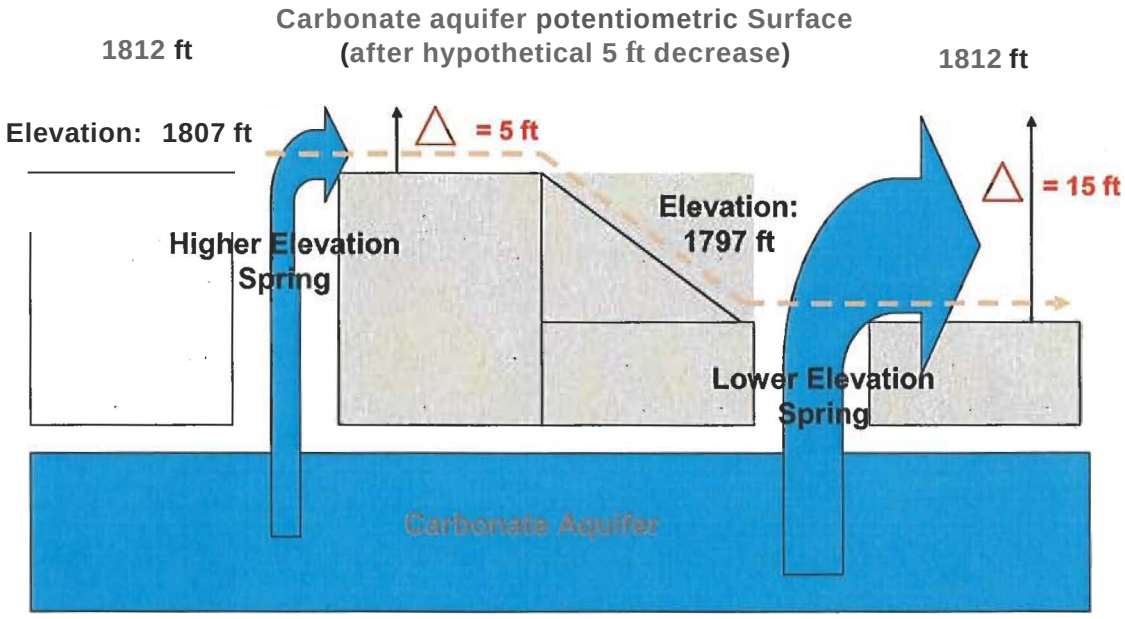


Figure 7



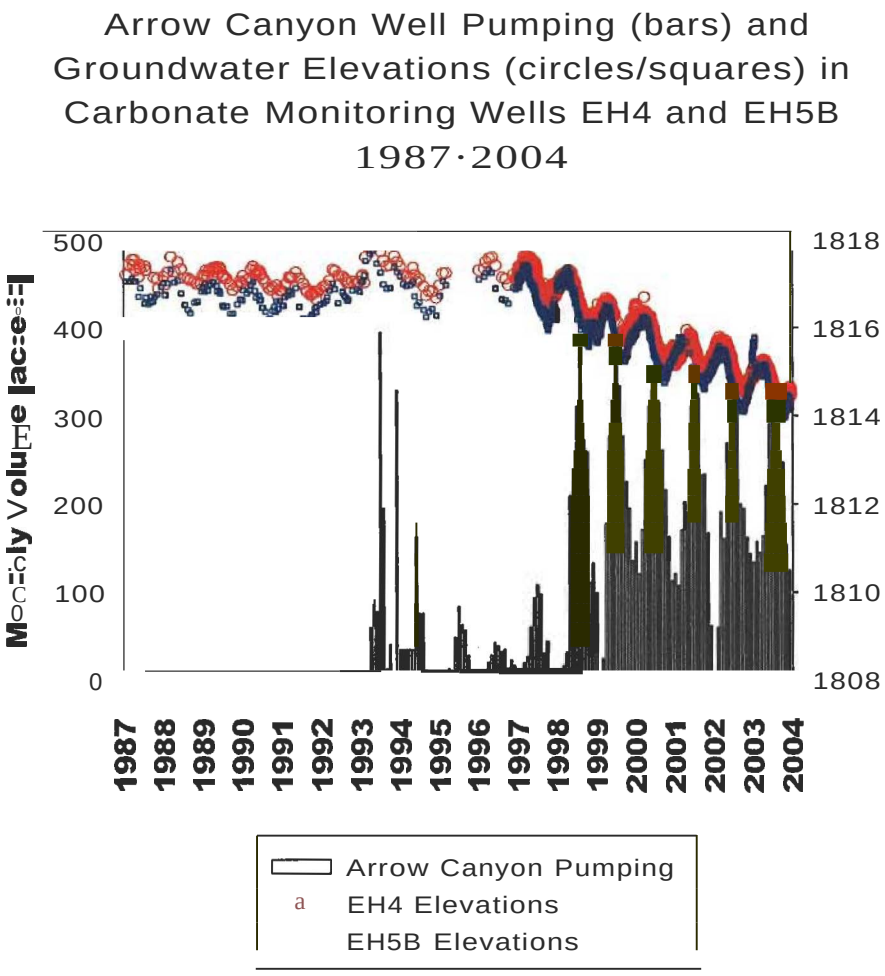
Current groundwater pumping at the Arrow Canyon Well and impacts

In the following discussion, the groundwater/spring discharge relationships described above have been used to base our current analysis of impacts from CUlTent pumping and to project the impacts of future groundwater development on the springs. It is anticipated that upon completion of the pump test required in Order 1169, that additional hydrogeologic information will be available to assist in a better understanding of this relationship. In the interim, the Service recognizes that there are different interpretations and opinions regarding the timing and causes of recent groundwater level declines in the flow system than that discussed in this programmatic biological opinion (Buqo 2004, Johnson and Mifflin 2003 and 2005).

In 1990 and 1992, MVWD applied for water rights of an additional 3.0 and 5.0 cfs, respectively, of groundwater for municipal purposes from the carbonate aquifer in the Warm Springs Area. The point of diversion is the Arrow Canyon Well, located about 2.3 miles west of the MVNWR. The MVWD had existing water rights in the area, including a right for 2.0 cfs from the Arrow Canyon Well. MVWD forecasts of growth in the Moapa area indicated the need for additional water. The water right applications were formally protested by the Service, NPS, and Nevada Power Company, primarily due to concerns about Moapa dace and injury to senior water rights, including the Service's water right for the Pedersen Unit of the MVNWR. In 1995, the Nevada State Engineer overruled the protests but ordered (in Ruling 4243) that pumping be phased in incrementally from 1996 through 2004, with monitoring to evaluate any impacts to springs or groundwater levels (Nevada State Engineer 1995).

Growth in demand was less than forecasted by the MVWD and groundwater pumping from the Arrow Canyon Well has lagged behind the incremental pumping rate ordered by the State Engineer in Ruling 4243. Pumping was stepped up to 2.7 cfs in 1998, in part at the request of the Federal agencies to allow collection of data related to the effects of groundwater production from the carbonate aquifer, and has averaged 3.3 cfs or 2,400 acre-ft annually since that year (Mayer 2004). ConCUlTent with the increased pumping, groundwater levels and spring discharge in the Warm Springs Area have been consistently decreasing since 1998. Water levels in the two carbonate monitoring wells, EH-4 and EH-5B, have decreased by 0.38 ft/yr or a little more than 2 ft over the six-year period (Figures 2 and 8). Over the same period, the total spring discharge from the Pedersen Unit, as measured at Warm Springs West, has decreased from 4.00 cfs to 3.55 cfs. The rate of decrease is about 0.08 cfs/year, representing an 11 percent decrease over the period (Figure 9). The discussion in Mayer (2004) shows that the observed decreases in spring discharge are consistent with expected decreases based on the two-foot decline in groundwater levels observed in the carbonate monitoring wells in the Warm Springs Area. The relationship between groundwater levels and spring discharge at Warm Springs West was used to predict a 13 percent decrease in spring flows over the period from 1998 to 2003, in response to the 2-ft drawdown that has occurred (Table 4). The actual measured decrease of 11 percent is in close agreement with the predicted value.

Figure 8


Arrow Canyon Well Pumping (bars) and
Groundwater Elevations (circles/squares) in
Carbonate Monitoring Wells EH4 and EH5B
1987·2004
500
400
300
200
100
0
1818
1816
1814
1812
1810
1808
1987
1988
1989
1990
1991
1992
1993
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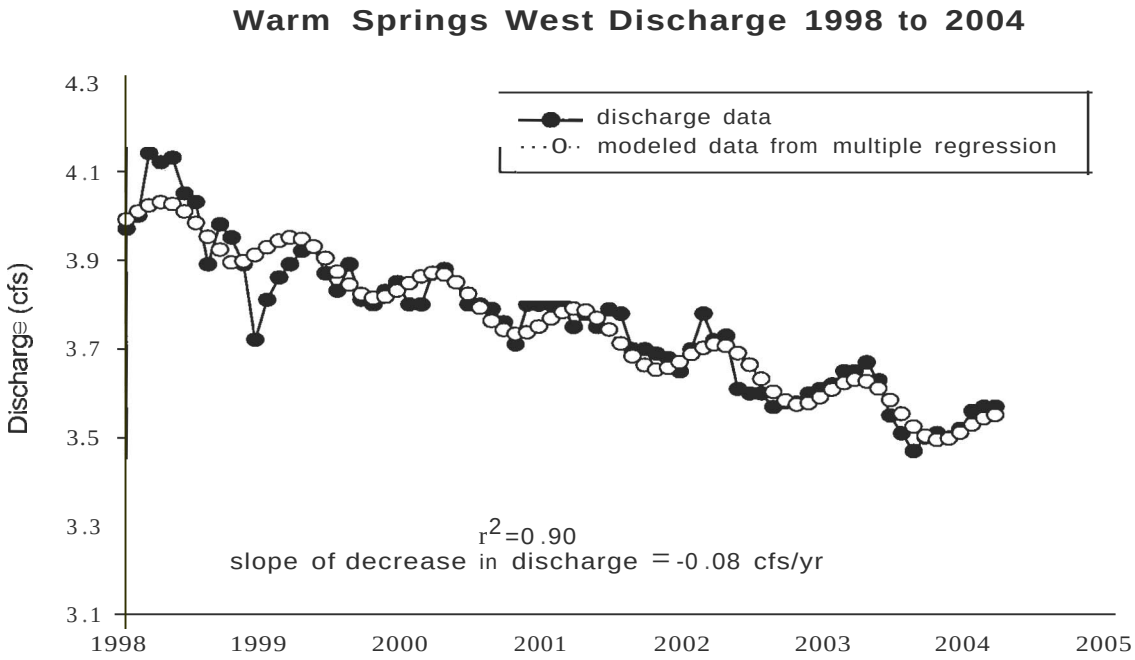
2002
2003
2004
Arrow Canyon Pumping
EH4 Elevations
EH5B Elevations

Figure 9



The exact timing of the groundwater level decline is important because if the actual decline precedes in time any action or event suspected of causing the decline (such as increased pumping or drought), then this is strong evidence that there are other factors causing the decline. We have attempted to analyze the timing of the decline here.

Figure lOis a plot of the periodic water level readings in EH-5B. Also shown is a lowess smooth of the data. Lowess (locally weighted scatterplot smoothing) is a smoothing technique used to emphasize trends in xy data (ex. water levels with time). The lowess says nothing about the statistics of a trend, it is simply a method of ascertaining any trend. The lowess of the EH-58 data shows that while there was variability prior to 1998 (possibly due to climatic impacts, seismic activity, barometric changes, earth tides, existing pumping), the slope of the decline clearly became more negative starting in this year. In other words, the rate of decline increased from 1998 through 2004. Looking at similar data from EH-4, Mayer (2004) showed through multiple regression analysis that the slope of the decline changed from -0.06 ft/yr in the period 1989 to 1993, to -0.38 ft/yr in the period 1998 to 2003, and that this change in slope was statistically significant. The magnitude and extent of the decline is unlike anything observed in the earlier record. This rate and magnitude of the 1998 to 2004 decrease is what is of concern to the Service. The start of the decline coincides with MVWD's increased pumping from the carbonate aquifer (see Figure 8). It also coincides with a very wet year (see Figure 11), which has implications for likelihood of drought or climatic impacts causing this decline, as discussed below.

Figure 10

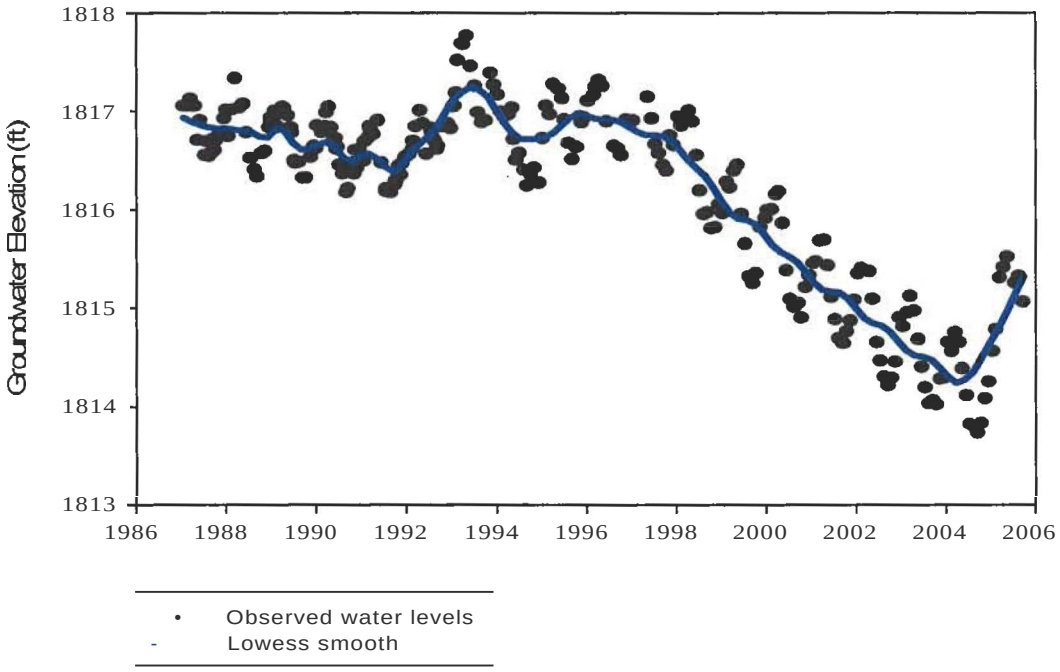


Figure 10. Periodic Measurements of Water Level Elevations in EH-5B for the period 1987 to 2005. Lowess smooth added as discussed in text.

In order to address the possibility that drought caused the groundwater level declines, we compiled precipitation records from a number of stations in the southeastern Nevada area. Four of these stations (Desert Game Range, Las Vegas Weather Service Office (WSO) airport, Valley of Fire, St George Utah) have precipitation records of 30 years or more. A fifth station (Red Rock Canyon) has a 27-year period of record. We averaged the precipitation from these five stations for a measure of local precipitation (Figure 11). In addition, we compiled the Palmer Drought Severity Index (PDSI) and the Palmer Hydrological Drought Index (PHDI) for a 30-year period of record for both Region 4 (southeastern Nevada) and Region 3 (Central Nevada). Our analysis shows that the decline from 1998 to 2004 was not likely to be drought-related for the following reasons.

Figure 11

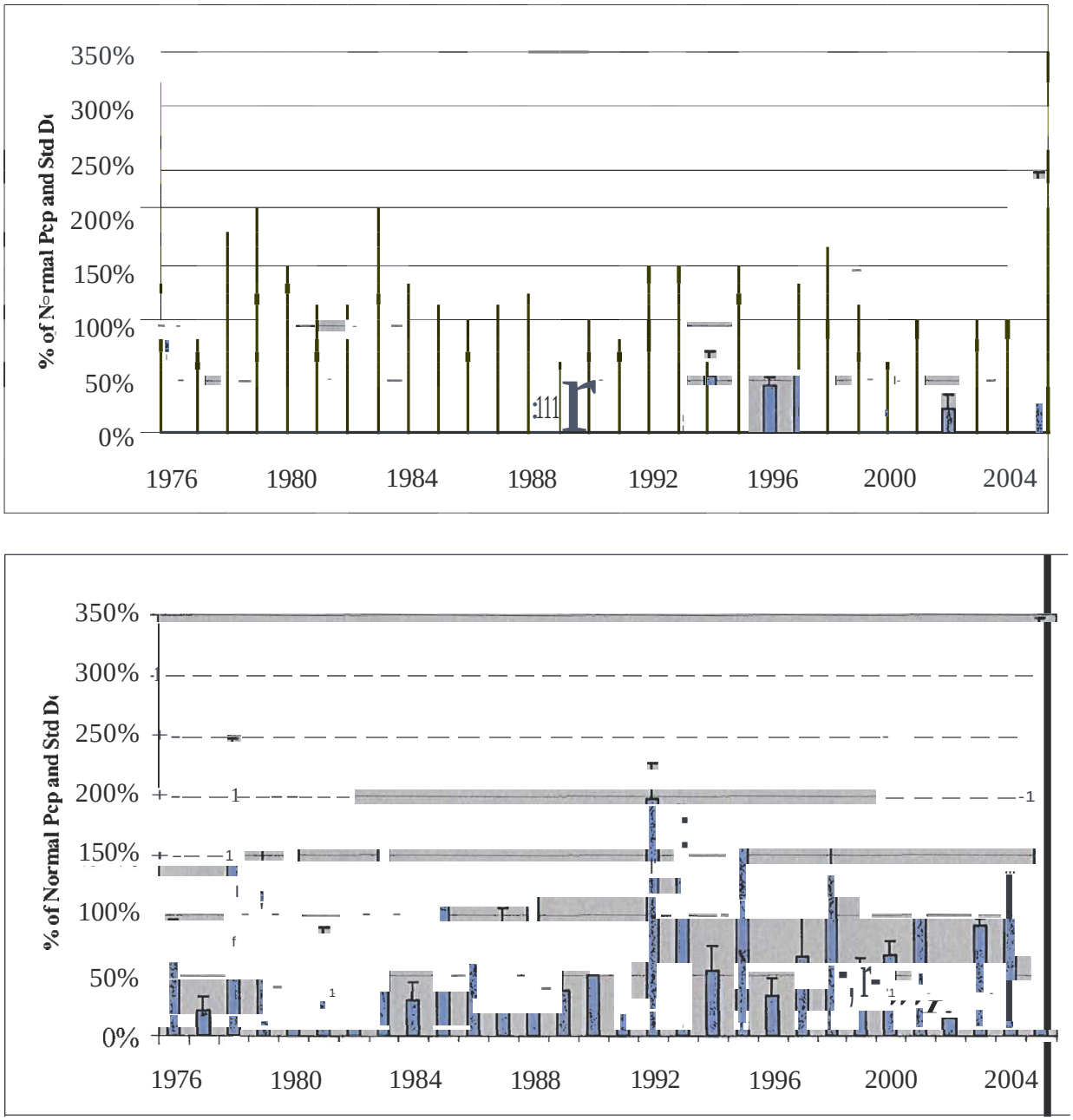


Figure 11. Percent of normal precipitation for the water year (top) and Nov-Apr period (bottom) averaged at five precipitation stations in or near southeastern Nevada. Station locations are discussed in the text.

Figure 1I shows the percent of normal precipitation from the five precipitation stations for the winter and water year. 2002 was an exceptionally dry year (24 percent of normal water year) but the other years were not unexpectedly dry and were not much different from earlier periods in the preceding decade (Figure 11). 1998 was a fairly wet year (156 percent of normal for the water year and 134 percent of normal for the winter), yet the groundwater level decline started in 1998. 1999 and 2000 were dry years (75 percent and 59 percent, respectively of the normal water year), but 2001 was close to average (95 percent of normal for the water year and 106 percent of normal for the winter), yet the groundwater level decline continued through this year.

The PHDI for southeastern Nevada indicates similar trends, a period of mild drought from 1999 through 2000, a recovery in 2001, followed by a period of severe or extreme drought from 2002 to 2003 (Fig 12). There were periods of severe drought observed from 1989 to 1991 and 1996 to 1997 without groundwater level declines of similar magnitude. Furthennore, the average precipitation for the four year period from 1998 to 2001 was 96 percent. There were two other periods in the 1990s that were significantly drier than this. From 1989 to 1991, the average precipitation was 67 percent of normal. From 1996 and 1997, the average precipitation was 76 percent ofnonnal. There is a slight decline in water levels corresponding to the 1989 to 1991 dry period, but it is nothing of the magnitude of the decline from 1998 to 2004. Finally, overlaying the plots of EH-5B water levels and PHDI on the same time series suggests that while climate likely has some effect on groundwater levels in the area, the decline from 1998 to 2004 does not seem to be related to a change in the PHDI. (Figure 13)

With respect to the increase in water levels in 2005, it should be noted that both the local precipitation stations and the PHDI and PDSI show this to be an extraordinarily wet year. The average water year precipitation for the five local stations was 200 percent of normal. Thus, this increase in precipitation has resulted in groundwater level increases. However, the long-tenn effect of the extremely wet year is unknown and not likely to influence the downward trend in groundwater levels. Understanding the factors responsible for influencing trends and variability in the groundwater level record will become more apparent as more data and information is collected.

The declines observed since 1998, have occurred not only locally in the Warm Springs Area, but have also occurred in monitoring wells 12 miles upgradient in Coyote Spring Valley and 15 miles south to monitoring wells in California Wash, based on USGS monitoring well data and monitoring well data shared with the Service in July 2004, respectively. Both of these locations are areas of potential groundwater development under the terms of the MOA.

The flow from the Pedersen Unit of the MVNWR, as measured at the Warm Springs West gage, has declined at an annual rate of 0.08 cfs/yr since 1998. If the current decline continues unabated, the flow will reach a monthly minimum of2.7 cfs by 2014. It is not certain that the current rate of decrease will continue as it has for the past six years. While the system could begin to equilibrate and the rate of decrease could slow, there is no evidence to suggest that this could occur. On the other hand, if the rate of groundwater pumping increases then the rate of decline could increase.

Figure 12

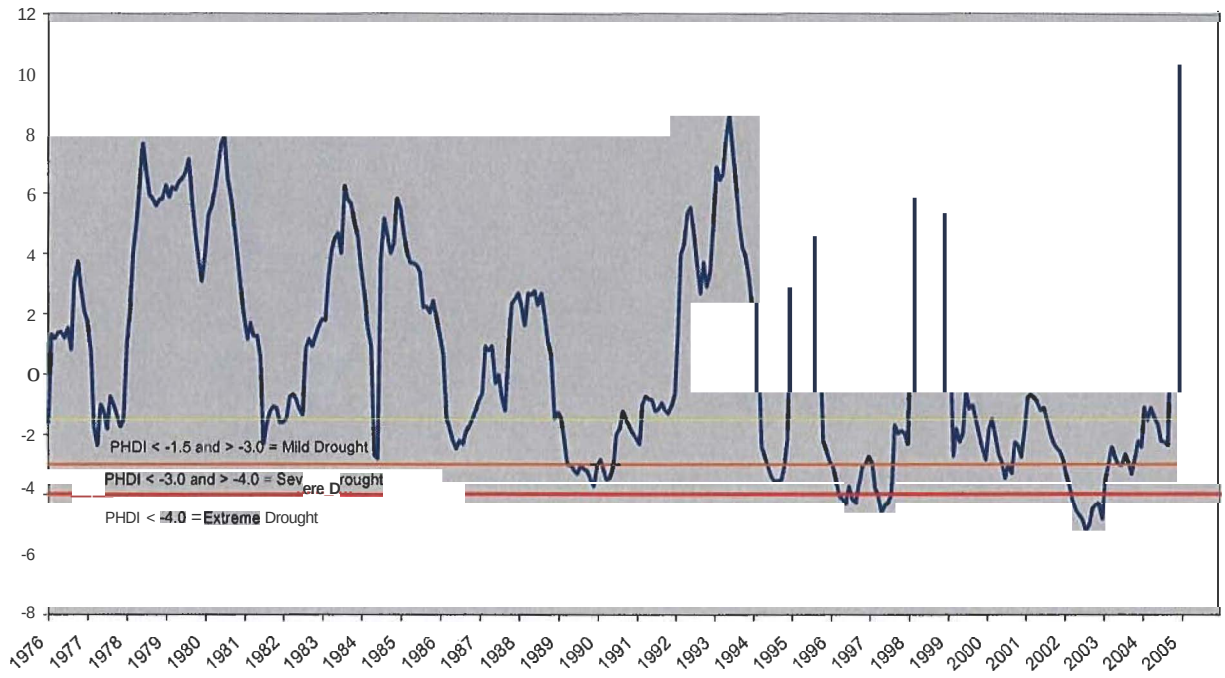


Figure 12. Palmer Hydrological Drought Index for U.S. Climate Division, Nevada Region 4, southeastern Nevada (positive values indicated wetter years, negative values indicate drier years)

Figure 13

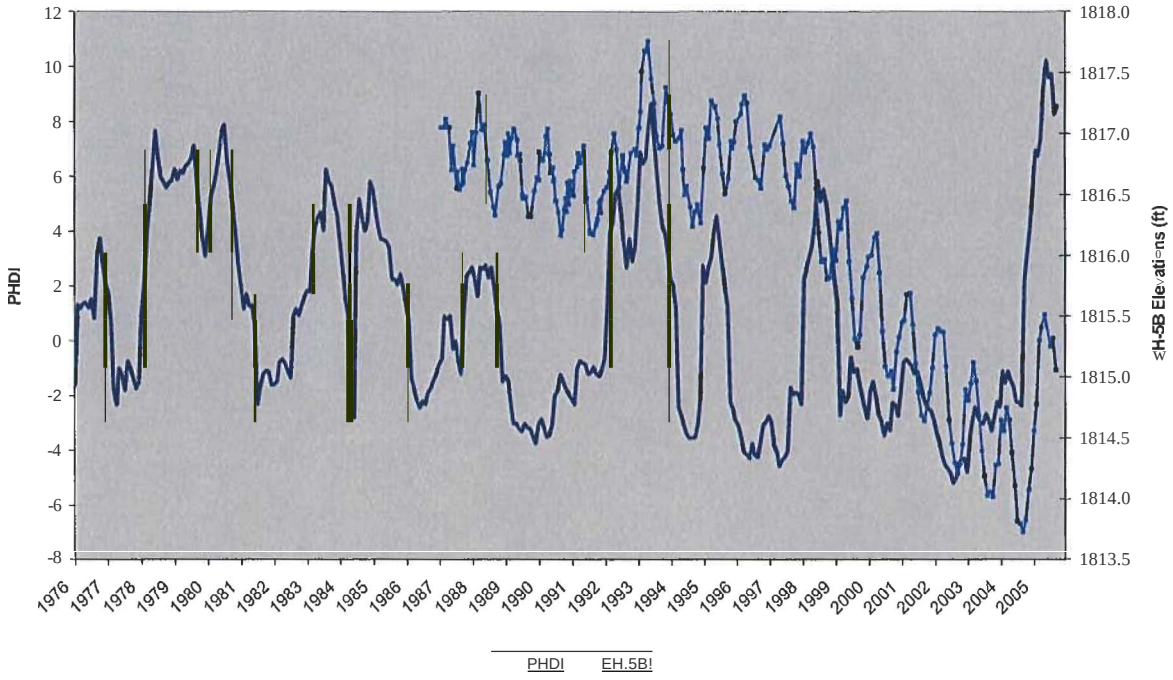


Figure 13. Relationship of Palmer Hydrological Drought Index (NV Region 4) and EH-5B Water Level Elevations

The current pumping rate and volume and associated groundwater declines are not affecting all springs in the Warm Springs Area to the same degree as those on the Pedersen Unit, despite the fact that the water level decline in the carbonate aquifer is believed to be uniformly distributed throughout the area. As discussed above, those springs at lower elevation are less susceptible to the current groundwater declines. The springs on the Plummer Unit of the MVNWR range in elevation from 1,755 to 1,760 ft, much lower than the springs on the Pedersen Unit. These springs have shown very little change in flow in the last six years although the measurements from Plummer Unit are less frequent and the period of record is not as long as Warm Springs West. The lack of decline in flow at these springs is consistent with the estimated change in the hydraulic head differential at the springs over the last six years.

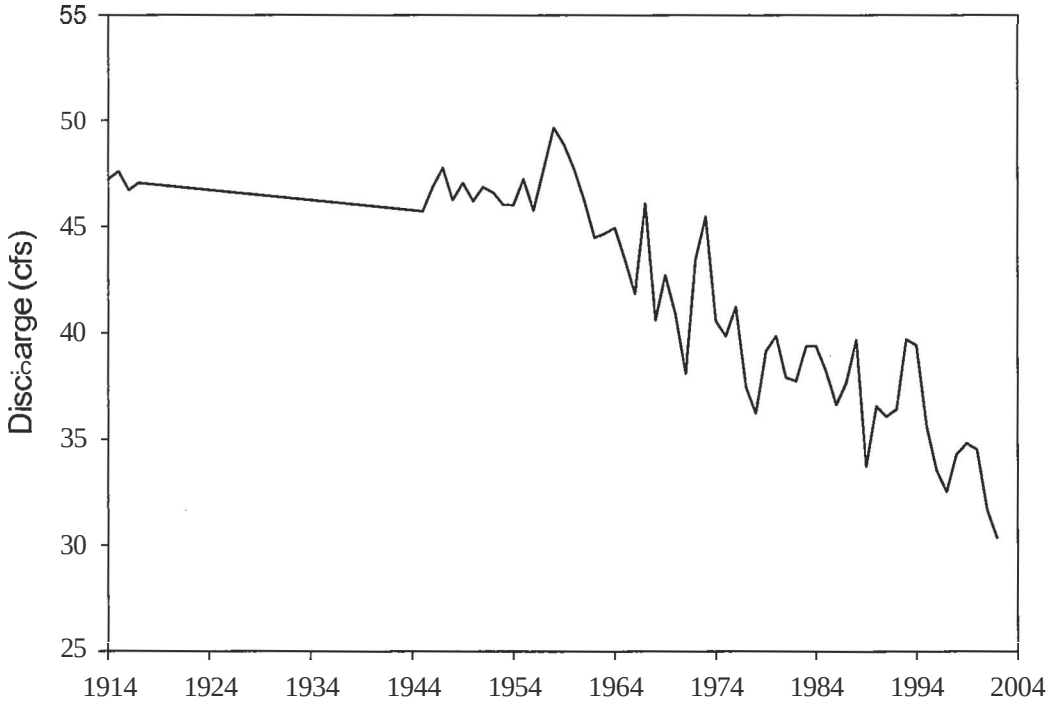
The Apcar Spring, at 1,788 ft, is intermediate between the spring elevations on the Pedersen Unit and the Plummer Unit. According to the annual reports from MVWD, the flow at Apcar has decreased in the last six years from about 2 cfs to 1.5 cfs. A large decrease in flow occurred during 2000 (from an average of 1.9 cfs in 1999 to 1.6 cfs in 2001). The cause of this decline is not known.

The USGS has a continuous record of flow on the Muddy River at Moapa (USGS Station Number 9416000) from 1945 to the present, with discontinuous or periodic measurements as far

back as 1913 (Figure 14). This is one of the longest periods of records for any measuring site in the area. The flow at this location in the river is much greater than the sum of all the spring discharge measurements (Eakin 1964, USGS 2001). About half of the flow measured at the gage is unaccounted for at the springs, and is believed to come from subsurface seepage gains into the river channel and its tributaries. The annual flow in the river changed little between 1913 and about 1960. The average flow during this period was 47 cfs. There is a steady significant decline in flow starting in the 1960s and continuing until the present. The decline is believed to be due to groundwater pumping from both the alluvial and carbonate aquifers, which has decreased subsurface seepage into the river, and to a lesser extent, from surface water diversions. The mean annual flow from 1960 to 1969 was 44 cfs. From 2000 to 2004, the flow has averaged 32 cfs. This equates to a decrease of approximately 0.4 cfs/yr or 28 percent over the 40-year period. At the present rate of decline, the mean annual flow in the river will decline to 28 cfs in another 10 years and 22 cfs in 25 years.

Figure **14**

Mean Annual Flow in the Muddy River near Moapa
USGS Site No. 09416000 1914 - 2002



Completed or Ongoing Conservation Actions

- A piscicide called rotenone was used to successfully remove tilapia from waters on the MVNWR, Refuge Stream and the Apcar Stream to the gabion structure (just upstream of the Refuge Stream and Mainstem convergence);
- Various fish barriers (gabion and culvert) have been constructed in the Refuge Stream to prevent further encroachment of non-natives;
- The Pedersen and Pedersen East (a.k.a. Playboy pool) spring heads have been restored to make use of all available surface water and to maintain good flow records;
- Old concrete channels in portions of the Pedersen Unit have been removed to facilitate a more natural flow and recruitment of invertebrates (one food source for the dace);
- The development stage of restoring habitat on the Plummer Unit has been completed to provide more suitable habitat for and public viewing of the Moapa dace;
- Prevention of wild fire threats has continued through the removal of potential fire sources such as palm trees;
- Hydraulic geometry, water temperature, and groundwater flow models were developed to predict both existing and future conditions that may modify water quality and quantity that supply the warm water supply necessary for the Moapa dace and other aquatic species in the Warm Springs Area; and
- Multi-agency, annual Moapa dace surveys continue to be conducted throughout the range of the species (depending on access to private lands).

Conservation Needs of the Moapa Dace

- Placement of additional fish barriers in the lower reaches of the historic range of the Moapa dace in order to facilitate reestablishment in these areas;
- Eradication/control of remaining non-native invasive species including, but not limited to, fishes, bullfrogs, spiny softshell turtles, and non-native plant species such as palm trees, *Vallisneria*, Russian olive and salt cedar throughout the range of the dace;
- Continued fire maintenance activities to reduce the threat of wild fires;
- Minimization/elimination of surface water sheet flows that decrease the natural thermal load of water within dace habitat;
- Prevention of illegal water diversions that reduce or modify water quality and quantity in the Muddy River and its tributaries;
- Securing adequate water flows for Moapa dace recovery at the MVNWR and other spring sources, to provide long-term habitat for reproduction, nursery, forage, shelter, etc;

- Enhancement of existing occupied habitat [i.e. restoring stream dynamics, eradication of non-native fish and vegetation, removal of barriers to native fish migration in upper Muddy River and tributaries];
- Expansion of research efforts to gain additional knowledge about the biological needs/requirements of the species;
- Establishment of easements or acquisition of private lands within the range of the Moapa dace to address the threat of habitat loss as a result of residential/commercial development; and
- Continuation of the multi-agency, annual Moapa dace surveys throughout its range.

Major Activities Authorized Under Sections 7 and lO(a)(l)(A) of the Act in the Action Area

File No. 1-5-98-FW-177. On November 2,1998, the Service issued a non-jeopardy biological opinion to the Nevada Fish and Wildlife Office for the implementation of eradication of non-native fish activities and installation of fish barriers in the Apcar Stream in the Warm Springs Area of the Muddy River. The Service concluded that the project was not likely to jeopardize the continued existence of the Moapa dace. Incidental take was authorized and Reasonable and Prudent Measures were identified to minimize take to the species.

File No. 1-5-01-F-463. On December 26,2001, the Service issued a non-jeopardy biological opinion to the Bureau of Indian Affairs for approval of the Tribe's lease for reservation lands on the Reservation for construction and operation of the Moapa Paiute Energy Center. Calpine Corporation would lease the lands from the Tribe for the project. The proposed project would disturb 222 acres of desert tortoise habitat, and could result in take of 6 desert tortoises by death or injury, and 70 desert tortoises by harassment; and up to 7 percent of the total available spawning habitat for the Moapa dace. As of the date of this biological opinion, the proposed project has not moved forward and the Service is not aware of any plans in the near future to construct the project. Should a decision be made to implement the project, re-initiation of consultation would be required based on new information.

File No. 1-5-02-FW-463. On March 13, 2002, the Service issued a non-jeopardy biological opinion to the Desert National Wildlife Refuge Complex, Las Vegas, Nevada for the implementation of riparian and aquatic habitat restoration activities in the Pedersen Unit of the MVNWR. The Service concluded that the incidental take of less than 10 percent of the 180-200 individuals (18-20 individuals) that may be present in the project area would not likely jeopardize the continued existence of the Moapa dace. Reasonable and Prudent Measures were identified and implemented to minimize take of the species.

Effects of the Action

Moapa Dace

The Moapa dace will be directly affected by the proposed groundwater withdrawals since those actions are likely to affect the spring flows upon which the dace depends. The signatories of the MOA are proposing to cumulatively pump 16,100 afy of groundwater from the White River Groundwater Flow System at the MX-5, RW-2, Coyote Springs Wells #1 and #2, and other wells in the Coyote Spring Valley Basin (Basin 210) and from a well-field located in the southwestern third of the Moapa Reservation in the California Wash Basin (Basin 218). The purposes of these water withdrawals are: I) part of a Nevada State Engineer Order (Order 1169) to test the carbonate systems response to groundwater withdrawals and continued use for residential and commercial purposes (9,000 afy); 2) municipal uses for a residential community in Coyote Spring Valley (4,600 afy); and 3) Tribal commercial developments (2,500 afy). For the purposes of this programmatic biological opinion, this consultation will only evaluate the effects of the MOA (cumulative groundwater withdrawal of 16,100 afy and their minimization measures) to the endangered Moapa dace. The specific actions associated with the uses of the groundwater will be evaluated in subsequent tiered biological opinions as applicants apply for Federal permits in the area.

The pump test to be undertaken pursuant to the MOA is expected to generate additional data to better understand and predict the effects of development of the carbonate-rock aquifer and to reduce or mitigate the effects of its development on the environment. In the interim, the Service recognizes that there are different interpretations regarding the causes of recent groundwater level declines in the flow system than that discussed in this programmatic biological opinion (Buqo 2004, Johnson and Mifflin 2003 and 2005). However, for the purposes of this programmatic biological opinion, the Service is utilizing the information and data presented above and analysis below. Groundwater extracted through a well, typically results in a decline in groundwater levels around the well. The technical term for this zone of lowered water levels is the "cone of depression" or the "drawdown cone." For a given aquifer, the drawdown cone increases in depth and extent with increasing time of pumping. Drawdown at any point and time is directly proportional to the pumping rate and inversely proportional to the transmissivity and storativity of the aquifer (Freeze and Cherry 1979). Aquifers of high transmissivity develop shallow drawdown cones of wide extent. As discussed earlier, the regional carbonate aquifer between Coyote Spring Valley and the Warm Springs Area is a zone of high transmissivity; the drawdown cone in this area is expected to be shallow and wide. This high transmissivity zone is one reason that the pumping at the Arrow Canyon Well is assumed to have caused the drawdown in well levels 12 miles upgradient in Coyote Spring Valley (Van Liew et al. 2004).

The hydraulic connectivity of the California Wash basin to the Warm Springs Area is uncertain although there are some indications that the area is connected with the Warm Springs Area based on monitoring well data that were shared with the Service in July 2004. These data from California Wash show a downward trend in groundwater levels. While there are various

opinions as to cause of the decline, based on the very limited available data, the Service assumes that groundwater pumping in California Wash is likely to cause a decline in spring flow in the Warm Springs Area.

The proposed groundwater development in Coyote Spring Valley and California Wash is likely to cause further declines in groundwater levels in the carbonate aquifer within the area of the proposed pumping, and the Warm Springs Area. Our analysis predicts that a reduction in head at springs in the Warm Springs Area and decreases in spring discharge and groundwater seepage into streams is likely to occur, although the magnitude and timing of impacts from pumping in Coyote Spring Valley and California Wash are uncertain. Differences in boundary conditions relating to the areal extent of the aquifer, location of the pumping, transmissivity, and permeability, all influence the magnitude and timing of pumping impacts. Also, if the proposed pumping lowers carbonate water levels in the Warm Springs Area further, not all springs will be affected equally. The decrease in spring discharge will be proportional to the decrease in head elevation at each spring. Higher elevation springs have a lower head difference initially and are therefore more susceptible to decreases in groundwater levels. Therefore, the higher elevation springs will be affected proportionately more for a given decline in groundwater levels. This relationship has been observed in the Warm Springs Area as a result of a 2-ft drawdown in" groundwater levels that has occurred since 1998 (Mayer 2004). The highest elevation springs, which are the most susceptible to impacts from groundwater pumping, occur on the Pedersen Unit of MVNWR, an area which also comprises some of the most important spawning habitat for dace in the system.

As discussed above, existing data indicates a decline in the regional carbonate aquifer levels locally and in the Coyote Spring Valley, and a decrease in spring discharge in the warm Springs Area from the current groundwater pumping of the Arrow Canyon Well (Mayer 2004). In addition, existing data has suggested that the same pumping has led to a decrease in carbonate aquifer levels in the California Wash Area as well. The average pumping rate at the Arrow Canyon Well for the last five years has been 3.3 cfs or 2,400 afy. The proposed action includes pumping of an additional 22.2 cfs or 16,100 afy from the same regional carbonate aquifer, which is almost seven times the existing withdrawal rate. Much of the pumping (13,600 afy) will be located along the same flow path that supplies the Warm Springs Area and is within the low-gradient, high-transmissivity zone that connects the Coyote Spring Valley and Warm Springs Area. The remainder of the pumping (2,500 afy) will be located downgradient in California Wash which has uncertain hydrologic connection to Warm Springs Area.

Under the terms of the MOA, if flows reach 2.7 cfs at the Warm Springs West gage, the pumping from Coyote Spring Valley will be reduced to 724 afy and the pumping from California Wash will be reduced to 1,250 afy. This 724 afy will replace the flows (I cfs) that MVWD once used from the Jones Spring (on the MVNWR's Apcar Unit) to meet their water demands, which would be utilized for the Moapa dace on the MVNWR per the MOA. The 1,250 afy will be available for use by the Tribe. The following assumptions are used relative to groundwater pumping if the 2.7 cfs "Average Flow Level" as identified in the MOA is reached:

- The Arrow Canyon Well will be turned back on and will resume pumping at the current rate of 2,400 afy to meet MVWD's existing municipal water demands;
- 724 afy will be pumped from MX-5 and RW-2 wells in the Coyote Spring Valley by SNWA to replace MVWD's municipal commitment from the Jones Spring;
- No additional pumping in Coyote Spring Valley will occur; and
- Pumping in the California Wash is assumed to be limited to 1,250 afy of the existing pennitted water rights held by the Tribe.

The exact magnitude and timing of the impacts from pumping groundwater from the carbonate aquifer in Coyote Spring Valley and California Wash are unknown at this time, as are the effects of reduced or cessation of groundwater pumping or whether there will be some equilibration of the aquifer to the proposed pumping. Two approaches were used to bracket the range of potential impacts to groundwater levels and spring discharge at the Warm Springs West gage: (1) an extrapolation of the current groundwater impacts and trends; and (2) numerical groundwater modeling.

Extrapolation of Current Groundwater Impacts and Trends

Using this approach, the groundwater system is assumed to respond proportionally to increased pumping; that is, increasing the pumping rate by some factor will increase the rate of decline in groundwater levels by a similar factor. The assumption is that because of the high transmissivity of the carbonate aqUifer in this area, the decline in groundwater levels will be relatively small, but widespread. The location of pumping within these three basins doesn't matter under these assumptions. Thus, the decline in groundwater levels would be similar in magnitude and timing to the decline in the Warm Springs Area for pumping at the Arrow Canyon Well; at MX-5, RW-2, or other wells in Coyote Spring Valley; or for wells in California Wash. This assumption is simplified and may tend to overestimate the effects because of different boundary conditions in Coyote Spring Valley and California Wash, and because the pumping in Coyote Spring Valley and California Wash is further from the Warm Springs Area than the Arrow Canyon well. Therefore, this represents a worst-case scenario that can be used to bracket the lower end of the possible range of effects.

Under the above assumption, increasing the total pumping from the system sevenfold, from 2,400 afy to 16,100 afy, will increase the rate of water level decline in carbonate levels approximately sevenfold, from the current rate of 0.38 ft/yr to 2.55 ft/yr. The rate of decline of the spring discharge from the Pedersen Unit of the MVNWR, as measured at the Warm Springs West gage, would increase proportionately as well, from 0.08 to approximately 0.6 cfs/yr, using the groundwater spring discharge relationships described in Mayer (2004). Initial projections based on these extrapolated rates suggest that the flow at Warm Springs West gage will decline during the two-year pump test. A decrease of 1.2 cfs (two years multiplied by 0.6 cfs/yr) is predicted. However, under the tenns of the MOA, as flows are reduced below 3.0 cfs at Warm Springs West, the pumping at Arrow Canyon Well will be stopped and the pumping from Coyote Spring Valley and California Wash will be reduced. While the response of the aquifer to a reduction or cessation of pumping is not known and has not been tested, it is assumed that

reducing and ceasing the pumping will slow the decline in water levels. Furthermore, it is not likely that the entire 16,100 afy of groundwater will be withdrawn during the two-year pump test. CSI has proposed a five year incremental approach to utilizing their full water right of 4,600 afy and the Tribe has not identified a use for all of its 2,500 afy of potential groundwater pumping in California Wash. For the purposes of identifying the lower bound of the range of impacts, this analysis will assume that the total volume of water will be pumped and that the Warm Springs West gage will reach 2.7 cfs upon or before completion of the two-year pump test. Using the head/spring discharge relationships described in Mayer (2004), the groundwater levels are estimated to be about 5 ft below 1998 levels at a flow of 2.7 cfs. At this point, pumping would be adjusted to the levels stipulated in the MOA.

Under the terms of the MOA, if the 2.7 cfs average flow level is reached at the Warm Springs West gage, then the pump test is ended even if this occurs before two years. Following the pump test, if the average flow level at Warm Springs West gage remains below 2.7cfs, the total volume of groundwater that could be pumped from the regional carbonate aquifer in Coyote Spring Valley, California Wash, and the Warm Springs Area is 2,400 afy from Arrow Canyon Well, 724 afy from the MX-5 well or other CSI wells or wells, and 1,250 afy from California Wash, or a total of 4,374 afy. However, it is not certain that this amount would be pumped. The 4,374 afy total volume represents about an 80 percent increase above the current pumping volume from the Arrow Canyon Well. Assuming a proportional response in groundwater levels and spring discharge (e.g., an increase of the pumping rate results in a proportional increase in the rate of decline), then groundwater levels are predicted to decline about 1.8 times the present rate, or 0.7 ft/yr. Likewise, the spring discharge at the Warm Springs West gage would decline by about 1.8 times the present rate, or 0.14 cfs/yr. Using this approach, groundwater levels are projected to be about 8.5 ft lower than 1998 groundwater levels five years after the completion of the pump test. Total spring discharge from the Pedersen Unit, as measured at the Warm Springs West gage, would be about 2.0. cfs five years after completion of the pump test, (approximately 50 percent of 1998 flows). This likely represents the worst-case or lower bound of the range of possible impacts. The system may not respond as predicted, the pumping may be less than assumed, or the system may equilibrate, resulting in less severe impacts to groundwater levels and spring discharge.

Numerical Groundwater Model

The Service, in cooperation with other Federal agencies, has developed a numerical groundwater model for the southern half of the White River Groundwater Flow System (GeoTrans 2001). Several elements of the model were recently modified, including updated pumping and water-level information and updated spring elevation and discharge data (GeoTrans 2003). The model was recalibrated based on the modifications. Predicted water levels in the Warm Springs Area are still approximately 10 ft too low, but drawdown matches to carbonate wells EH4 and EH-5B were improved for the period 1998 to 2001 (GeoTrans 2003). However, when the model output from January 2002 to January 2004, was compared against measured water levels in EH-4 and EH-5B for the same period, the model was under-predicting drawdown considerably. The observed decreases in groundwater levels from January 2002 to January 2004, in both of these carbonate monitoring wells are greater than the model predicted. The model appears to be

predicting some kind of equilibration of the system that has not yet been observed in the field data. For this reason, the model output is believed to be an underestimate of the impact of pumping on groundwater levels and spring discharge in the Warm Springs Area. The model results should be viewed as a likely best-case or upper bound of the range of possible impacts.

The model was used to evaluate several pumping scenarios including a fivefold increase in total pumping in the system, to 12,400 afy (2,400 afy from Arrow Canyon Well and 10,000 afy from Coyote Spring Valley). This modeling was completed prior to the current MOA draft and does not include either the 4,600 afy of pumping by CSI or the 2,500 afy of pumping by the Tribe. The model predicted about 1 ft of drawdown in monitoring well EH4 and 1.5 ft of drawdown in monitoring well EH5-B after two years of pumping 10,000 afy in Coyote Spring Valley and 2,400 afy from Arrow Canyon Well pumping.

It is difficult to use the modeled drawdown to estimate spring discharge. A head loss of 1.0 to 1.5 ft is estimated to equate to a reduction of about 0.25 to 0.37 cfs in flow at the Warm Springs West gage (Mayer 2004). But the groundwater levels and spring discharge at the beginning of the pump test are not known. Pumping-related declines are expected to continue with the Arrow Canyon Well pumping until the pipeline is constructed and the pump test begins. However, groundwater levels have generally increased recently, likely in response to the extremely wet winter experienced by the region in 2005. This is expected to be a transient response but the timing and level of a return to equilibrium conditions is not known for certain. The pumping reductions identified in the MOA in response to decreases in the flow at Warm Springs West were not modeled either. So the validity and the applicability of the model results are difficult to ascertain. What can be noted is that the model predicts that there will be declines in groundwater levels with increased pumping, as opposed to no declines. This will affect spring discharge.

The potential effects on spring discharge at the Warm Springs West gage discussed above are applied below to predict potential effects to Moapa dace habitat.

Moapa Dace Habitat Loss Within the Pedersen Unit of the MVNWR

Hydraulic Geometry Modeling

The Hydraulic Geometry Modeling was only conducted for the Pedersen Unit because of the susceptibility of the higher elevation springs in this area to reductions in groundwater levels. The lower-elevation springs are not as susceptible to the decreases in groundwater level; therefore, these springs will not be as affected as those on the Pedersen Unit. The hydraulic model HEC-RAS was used to model the effect of reduced spring discharge on Moapa dace habitat on the MVNWR (Otis Bay 2003). The variation in width, depth, and velocity as a function of discharge is known as hydraulic geometry. Channel topographical survey data were collected at cross sections of the Pedersen Unit in order to estimate the changes in channel hydraulic geometry associated with declining spring discharge.

Representative cross-sections for pool and riffle habitats at two different locations on the Pedersen Unit were analyzed. The first pair of riffle/pool cross-sections was located just below

the confluence of the outflows from the Pedersen and Pedersen East Spring complexes. The second pair of riffle/pool cross-sections was located below the outflows from the five major spring complexes on the Pedersen Unit. The latter site represents approximately the total spring discharge as measured at the Warm Springs West gage. The relationship between groundwater levels and spring discharge on the Pedersen Unit was used to estimate the reduced flow at both pairs of cross-sections given an incremental decline in groundwater levels (Mayer 2004). The HEC-RAS modeling results were then used to estimate the change in hydraulic geometry and dace habitat at each cross-section based on the flow reductions (Otis Bay 2003). It is important to understand that higher elevation springs will show a greater percent flow reduction for a given head loss. Therefore, an equal percentage reduction cannot be applied to both pairs of cross-sections; the upstream pair will have a higher percentage loss of flow for a given decline in groundwater levels. Table 4 presents the estimated head differential, estimated flows, percent flow reduction, and percent habitat reduction as a function of groundwater levels for the upstream site (Pedersen and Pedersen East Spring groups) and the downstream site (Warm Springs West) for 1998.

The results indicate that both spring discharge and dace habitat are reduced with declines in groundwater levels. Flows and habitat loss at both upstream and downstream sites are projected as a function of incremental declines in groundwater levels in Table 4. As described in the section entitled Extrapolation of Current Groundwater Impacts and Trends, if flows decrease to 2.7 cfs by the end of the pump test, then groundwater levels are predicted to be about 5 ft below 1998 levels. Using the results in Table 4, flow at the upstream site is projected to be roughly 40 percent less than 1998 conditions at this groundwater level. Habitat is projected to be about 43 percent less for riffle habitat and 25 percent less for pool habitat relative to 1998 conditions. Flow at the downstream site is projected to be 30 percent less than 1998 conditions. Habitat at the downstream site is projected to be about 22 percent less for riffle habitat and 16 percent less for pool habitat relative to 1998 conditions. These results likely represent a worst-case or lower bound of impacts as discussed above.

Five years after the pump test is completed, groundwater levels are predicted to be approximately 8.5 ft below 1998 levels, under the worst-case scenario. Flows are projected to be about 65 and 53 percent of 1998 levels at the upstream and downstream sites, respectively. At the upstream site, riffle and pool habitat are projected to be 60 percent and 40 percent less, respectively, relative to 1998 conditions. At the downstream site, riffle and pool habitat are projected to be about 40 percent and 30 percent less, respectively, relative to 1998 conditions. Again, these results likely represent a worst-case or lower bound of impacts as discussed above.

The primary effect to the Moapa dace of diminished flows within the spring channels will be a decrease in the hydraulic conditions that create the diversity of habitat. A decrease in velocity and depth within riffles would result in a decrease of invertebrate and phytoplankton (food) production. Drift stations in pools are maintained by the scouring effect of turbulent flow. Scour will decrease in pools as water velocity and depth at the upstream end of the pool decreases. Perhaps the most prominent impact that would occur, as a result of decreased discharge and subsequent depth, is the reduction of overall volume of water that will be available to the species within the channel. Scoppettone et al. (1992) demonstrated that Moapa dace size is scaled to

water volume. Thus, larger water volumes provide the habitat necessary for increased food production and subsequently larger fish, therefore greater fecundity. Hence, more numerous, larger eggs provide a better opportunity for the long-term survival of the species.

As previously stated, decreasing flows in the headwater spring channels of the upper Muddy River were modeled and resulted in a decrease in the hydraulic parameters of width, depth, and velocity, for a loss of habitat available to the species. Additional factors that would influence channel and hydraulic characteristics within the stream channels following a decline in spring discharge include, but are not limited to, changes in sediment transportation rates, and the alteration of riffle and pool maintenance that is accomplished at the present rate of discharge in each spring channel. Additionally, vegetative encroachment and subsequent channel obstruction may also occur as the wetted cross sectional area of the channel decreases, and new surfaces become exposed for vegetation growth. Decreases in these parameters will likely have an adverse impact on the overall diversity and quantity of hydraulic habitat.

Table 4. Estimated Habitat Loss

Pedersen Unit - Upstream Site (Combined flow of Pedersen Spring and Pedersen East Spring Groups)				
Groundwater Level Reduction Since 1998 (ft)	Estimated Flow (cfs)	Estimated Percent Flow Reduction from 1998 Conditions	Estimated Percent Habitat Reduction in Riffles from 1998 Conditions	Estimated Percent Habitat Reduction in Pools from 1998 Conditions
0	1.47*			
2	1.23	16 percent	23 percent	9 percent
3	1.11	24 percent	33 percent	14 percent
4	0.99	33 percent	37 percent	20 percent
				ercent
6	0.75	49 percent	50 percent	31 percent
7	0.63	57 percent	55 percent	46 percent
8	0.57	62 percent	58 percent	39 percent
9	0.48	68 percent	63 percent	43 percent

Pedersen Unit - Downstream Site (Combined flow of the 5 major spring groups/upstream of Warm Springs West gage)				
Groundwater Level Reduction Since 1998 (ft)	Estimated Flow (cfs)	Estimated Percent Flow Reduction from 1998 Conditions	Estimated Percent Habitat Reduction in Riffles from 1998 Conditions	Estimated Percent Habitat Reduction in Pools from 1998 Conditions
1	4.03*			
2	3.51	13 percent		6 percent
3	3.26	19 percent		10 percent
4	3.02	25 percent		13 percent
		ercent	22 percent	16 percent
6	2.50	38 percent	27 percent	20 percent
7	2.26	44 percent	32 percent	23 percent
8	2.03	51 percent	37 percent	27 percent
9	1.82	54 percent	42 percent	31 percent

*based on a back-calculated estimate of flows at this site, as described in text

Note: Highlighted row indicates the level at which groundwater pumping would be reduced to levels stipulated in theMOA.

Thermal Load Modeling

A Stream Segment Temperature Model (SSTEMP) was used to predict impacts of decreasing spring flows to the natural thermal load of the system (Brock 2004). A study area downstream of all the spring complexes was selected on the Pedersen Unit of the MNVWR that was approximately 220 meters (722 ft) long and appeared to have a minimal net accrual or loss of stream flows. The model was calibrated to the 220-meter-long segment and was based on inputs of meteorology, stream geometry, riparian shading, and hydrology. SSTEMP simulates downstream water temperature in a discrete homogenous segment of a flowing stream channel over a 24-hour day.

In all 16 scenarios the simulated result of the reductions in spring discharges was reduced water temperatures (Brock 2004); however, only 4 scenarios are presented herein (Table 5). The greatest impact of flow reduction to thermal load occurred during the winter (December) when air temperature is the coldest, relative to the temperature of the thermal spring channel. Since Moapa dace have a reproductive temperature threshold of 30° C (86° F) (Scoppettone et al. 1992) any area with cooler temperatures is not considered reproductive habitat. In the winter, a reduction in flow (3.6 cfs) by 10 percent (3.25 cfs), 20 percent (2.90 cfs), and 30 percent (2.50 cfs) brought about a respective decrease of 0.06° C, 0.14° C, and 0.25° C in the temperature of the spring channel at the end of the study segment (Brock 2004). These reductions of 10,20, and 30 percent in spring flows would result in an upstream shift of the base thermal tail temperature by approximately 66 (20 meters), 131 (40 meters), and 197-ft (60 meters), respectively. Although under these scenarios the temperatures at the downstream reach of the study segment would remain above 30° C (86° F) and therefore within the reproductive temperature threshold, the model illustrates that reduced flows result in decreases in temperature and an upstream shift in the base thermal tail. Therefore, assuming that there is a minimal net accrual or loss of stream flows, the shift in base thermal tail in the downstream reach of the Pedersen Unit tributary (Refuge Stream off of MVNWR) would result in the loss of spawning habitat based on temperature.

Reductions in some of the headwater sources within the system will have downgradient repercussions to the Moapa dace. Since the springs on the MVNWR's Pedersen Unit are the highest in elevation of all the headwater sources, these springs would be the first to be affected by groundwater pumping. Reductions in the spring flows on the Pedersen Unit would cause the stream to cool more rapidly as it travels downstream resulting in a loss of thermal load, thereby decreasing the available downstream spawning habitat in the Refuge Stream.

Table 5. Estimated Thermal Loss with 4-Water Flow Scenarios on the Pedersen Unit of the MVNWR

Flow Scenario (cfs) (Warm Springs West gage)	3.60	3.25	2.90	2.50
Percent reduction	0.00	10.00	20.00	30.00
Distance from head of segment (meters)	Water Temperature (degrees C)			
0	31.20	31.20	31.20	31.20
10	31.17	31.16	31.16	31.16
20	31.14	31.13	31.12	31.12
30	31.11	31.10	31.09	31.07
40	31 .08	31.06	31.05	31.03
50	31.05	31.03	31.01	30.99
60	31.02	30.99	30.98	30.95
70	30.99	30.96	30.94	30.91
80	30.95	30.93	30.90	30.86
90	30.92	30.89	30.87	30.82
100	30.89	30.86	30.83	30.78
110	30.86	30.82	30.79	30.74
120	30.83	30.79	30.75	30.70
130	30.80	30.76	30.72	30.65
140	30.77	30.72	30.68	30.61
150	30.74	30.69	30.64	30.57
160	30.71	30.65	30.61	30.53
170	30.68	30.62	30.57	30.49
180	30.64	30.59	30.53	30.44
190	30.61	30.55	30.50	30.40
200	30.58	30.52	30.46	30.36
210	30.55	30.48	30.42	30.32
220		30.45	30.38	30.28

Shading shows the loss of stream survey length with various scenarios of reduced spring flows.

Summary of Adverse Effects Caused by the Proposed Groundwater Pumping

As discussed in the Status of the Species section, there are 5.6 miles of available habitat for all life stages of Moapa dace (Figure 4, Table 3) within the Muddy Springs Area. Of the total amount, approximately 1.78 miles of stream are located above the gabion barrier that protects the stream reaches on the MVNWR and the Refuge Stream on private property from tilapia predation (Figure 4). The remaining 3.82 miles of habitat continues to be threatened by the presence of tilapia and has been relatively uninhabitable. The 2005 dace survey data reflect that 95 percent of the dace population is relegated to the 1.78 miles (32 percent) of habitat above the gabion (Table 3) due to the presence of predatory non-native tilapia. However, dace still exist, albeit in low numbers, in the upper Muddy River mainstem and north and south forks of the Muddy River.

The 5.6 miles of the springs, tributaries, and mainstem of the Muddy River are not utilized proportionately by all life stages of the species due to the different hydrologic conditions of the various stream segments and the specific life history needs of adult, juvenile, and larval fish. The appropriate hydrologic conditions including velocity, depth, and temperature are necessary to provide for adequate spawning conditions. These various habitat types have not been quantified throughout the entire 5.6 miles of occupied or potential habitat. However, for the purposes of our analysis we have focused on the MVNWR streams and stream reaches above the gabion and attempted to quantify the availability of spawning, rearing and adult habitat. It is generally known that most of the habitat on the mainstem Muddy River is adult and juvenile habitat, with some limited spawning occurring in the north and south forks, and historically in the Muddy Spring. We have estimated that of the 1.78 miles of available occupied habitat above the gabion, 1.15 miles or approximately 66 percent of the habitat is essential spawning and rearing habitats. This habitat includes the 0.35 miles on the Pedersen Unit, 0.16 miles on the Plummer Unit, 0.14 miles on the Apcar Unit, 0.30 miles in the lower Apcar Stream, and 0.20 miles in the Refuge Stream upstream of the Iverson Flume.

The Pedersen Unit of the MVNWR is one of the six spring complexes that the Moapa dace depends on for successful reproduction and is devoid of tilapia. It is also the highest spring in elevation, and therefore, most susceptible to groundwater level declines. The analysis presented above likely represents the worst-case scenario or lower bound of impacts and it is uncertain whether it is likely to occur. The analysis estimates that at 2.7 cfs there is a loss of 31 percent in flow on the Pedersen Unit from 1998 conditions. This loss in flow is estimated to reduce available riffle habitat by 22 percent and pool habitat by 16 percent within the Pedersen Unit only. In addition to the loss of habitat, decreased flows would also result in a loss of temperature that would extend downstream, thereby reducing the thermal load in the system and thus the amount of available habitat at the appropriate spawning temperature. This loss in flow and habitat could further impact Moapa dace by restricting its reproductive potential and make it more vulnerable to catastrophic events such as wildfire.

The seepage run study conducted in 2001 by USGS reported the cumulative flows of the Refuge Stream at its confluence with the Muddy River to be approximately 12.99 cfs. The Pedersen Unit contributed approximately 3.5 cfs or 27 percent of that flow (see Hydrologic setting

discussion). Assuming a loss of .8 cfs (from 3.5 cfs to 2.7 cfs at the Warm Springs West gage) from the Pedersen Unit due to groundwater pumping proposed under the MOA, flows at the confluence would be reduced to 12.19 cfs for an overall reduction in flow by 6 percent. This reduction in flow assumes that flows in the lower elevation springs and subsurface seepage gains are not likely affected by the groundwater pumping. The Hydraulic Geometry Model indicated that habitat further upstream in the system would be affected greater than habitat lower in the system; however, given the existing information the extent of the affects of the groundwater pumping in these lower elevation springs and stream reaches is unknown at this time. Therefore, based on the seepage run (USGS 2001), we are assuming that spring discharge from the Plummer and Apcar units and the subsurface flows will continue to flow at a rate that would provide approximately 12 cfs above the gabion, thus providing spawning, juvenile, and adult habitat in those reaches.

Although the overall reduction in flow by 6 percent to the system above the gabion is relatively minor; it does not adequately reflect the importance of the Pedersen Unit to Moapa dace reproduction and recruitment throughout the system. The various units of the MVNWR and the tributaries downstream of the MVNWR are currently the primary areas that provide suitable spawning habitat due to the absence of predatory tilapia. Collectively, these reaches are extremely important to the survival and recovery of the species. Our analysis indicates that there would be a loss of 31 percent of the available spawning habitat currently on the Pedersen Unit due to the proposed groundwater pump test. However, it is also recognized that much of the available spawning habitat on the Plummer and Apcar Units, and the Refuge Stream would not be as affected by groundwater pumping since they are lower in elevation and would continue to provide adequate spawning habitat. The conservation measures described in the next section were identified as actions that would be implemented by the signatories to minimize the effects to the Moapa dace, including the loss of habitat on the Pedersen Unit and other reaches of the Refuge Stream. Such measures include the removal of non-native fishes, enhancing, and restoring habitat and restoring instream flows (Apcar Unit) to increase the amount of habitat available for use by all life stages of the species.

Conservation Measures Identified to Minimize Effects of the Proposed Action

The major threats to the continued existence of the Moapa dace are: (1) loss of suitable habitat caused by reduced spring discharge/water flows; (2) loss of suitable habitat and direct predation resulting from the presence of non-natives species such as tilapia; (3) degradation and loss of suitable habitat resulting from habitat modification and increased occurrence of fire facilitated by non-native vegetation invasion; and (4) a restricted distribution, which increases the species vulnerability to catastrophic and stochastic events. The signatories to the MOA are proposing conservation measures (Attachment A) to minimize these threats to the Moapa dace and its habitat. These conservation measures are generally grouped in two categories and will result in the following: (1) reduction in pumping and dedication of water (surface and ground); and (2) implementation of habitat restoration activities including removal of non-native fishes. Reduction of groundwater pumping, dedication of water, and implementation of restoration actions would result in providing improved long-term habitat for the Moapa dace, and would

promote an increase in its population size and distribution. The overall expected outcome of these measures is an increase in the species distribution and abundance throughout the range of the species.

While some of the restoration activities are currently in the planning phase, the funding that is being provided pursuant to the MOA will ensure a more timely completion of those activities. It is anticipated that most of these conservation measures will be implemented before or during the construction phase of the infrastructure required to develop and transport the water identified in the MOA. It is also anticipated that the Moapa dace population will respond positively, increasing in its distribution and abundance above current conditions Therefore, the conservation benefit to the species would be realized prior to and would off-set the effect of groundwater development. The following is a description of each action and its benefit to the Moapa dace.

Guaranteed Groundwater Pumping Reductions (Threshold levels)

The groundwater pumping will be reduced to 724 afy in the Coyote Spring Valley and 1,250 in California Wash, should stream flows reach 2.7 cfs at the Warm Springs West gage. This conservation measure will result in a reduction in the rate of decline of water levels and spring discharge. The reduction in the rate of decline will depend on the effect of remaining groundwater pumping in the Coyote Spring Valley, California Wash, and the Warm Springs Area (2,400 afy at Arrow Canyon by MVWD). This conservation measure provides certainty that if our analysis is correct and groundwater pumping in fact lowers the groundwater level thereby decreasing spring flows, then pumping will be substantially reduced.

Dedication of the MVWD Jones Spring Water Right of 1.0 cft

As stated earlier, the Jones (a.k.a. Apcar) Spring is lower in elevation than the Pederson Unit and is not anticipated to be affected by groundwater pumping to the magnitude that higher elevation springs would be. The Jones Spring Agreement (Attachment B) guarantees an additional 1.0 cfs of flow entering the Muddy River flow system via the Jones Spring system located on the Apcar Unit of the MVNWR (this is in addition to the .5 cfs that is currently flowing in this reach as long as 1.0 cfs is provided to MVWD by other sources). This increase in flow guaranteed under the Agreement will provide additional water to support important spawning habitat in the system that is not currently available to the Moapa dace for reproduction, nursery, forage or long-term survival. The additional flows would increase the habitat available to Moapa dace both on the Apcar Unit and the tributary downstream. It is anticipated that the dace will respond positively and there will be an increase in the population. The addition of the 1.0 cfs of warm water from the Jones Spring to the system would also provide additional spawning habitat downstream by increasing the thermal load in the system. The additional water flow will contribute a greater quantity of warm water to the system, thus lengthening the thermal tail and thereby extending the species spawning habitat (temperatures at and above 30° C). This could contribute to an increase in the population by increasing its reproduction and distribution potential within the Apcar system, both on and off the MVNWR. **In** the past, population numbers have reached

200 individuals on the Apcar Unit of the MVNWR (personal communication *200S,* G. Scoppettone), whereas in *200S,* only 6 individuals were enumerated. It is anticipated that with an increase in flows and implementation of habitat restoration, as described below, the Moapa dace population would respond positively. An expanded species distribution would provide a more secure population since the species would not be as vulnerable to catastrophic events.

Dedication of Portion of CSI Water Rights

As agreed to in the MOA, a conservation easement would be recorded dedicating 460 afy (an amount equal to 10 percent of CSI's water right in Coyote Spring Valley, which may be a portion of CSI's water rights in Coyote Spring Valley or water rights from an alternative source in lieu of water from Coyote Spring Valley), to the survival of the Moapa dace and its habitat. In addition, CSI agrees that it will dedicate water rights in an amount equal to S percent of the water rights above 4,600 afy that CSI may be authorized by the Nevada State Engineer to appropriate from the Coyote Spring Valley, or import into the Basin for use at its project. The actual water rights so dedicated to the survival and recovery of the Moapa dace might be from sources other than Coyote Spring Valley Basin. The specific method of these water rights contributions to the Muddy River system from CSI is unknown at this time. However, through the Recovery Implementation Program, described below, a determination will be made of the most effective method for utilizing such water rights for the benefit of the Moapa dace.

The transfer of certificated water rights by CSI from Coyote Spring Valley for the use in the recovery of Moapa dace and its habitat is a long term benefit to the species. The dedication of future water rights from basins outside of Coyote Spring Valley would be analyzed in a future tiered section 7 consultation and the resulting benefit to the species determined at that time.

Improve/Restore Moapa Dace Habitat on the Apcar Unit of the MVNWR

SNWA will provide *$7S0,000* to implement this action. This area currently is not optimum habitat for Moapa dace reproduction, nursery, food forage, and shelter. The Apcar Unit is currently overgrown with non-native vegetation and requires stream restoration throughout the entire unit. Historically, this unit supported hundreds of Moapa dace, which now supports only six individuals (Table 3). The habitat on this parcel was neglected and became less than optimum prior to purchase by the Service. Given, the history, this Unit has the potential to support a much larger number of individuals. The proposed funding, in addition to the Service's funds, will be used to restore habitat conditions to an optimum level for the Moapa dace. With the improved habitat and additional flow guarantees discussed above, the Moapa dace will likely increase its distribution and population to levels prior to the invasion of tilapia.

Restore Moapa Dace Habitat Outside of the MVNWR Boundary

CSI has agreed to provide *$S0,000* annually for four years to be used for habitat restoration outside of the MVNWR boundary to promote recovery of the Moapa dace. This funding will be applied towards various on-going or proposed activities that would improve and secure habitat that is currently not being utilized due to degraded conditions (i.e. illegal diversions or non-

native species presence). The funding will provide a mechanism to restore habitat to a level that would provide a higher quality habitat for the species. These habitat improvements would contribute to the long term survival of the species by increasing the food production potential, providing additional habitat types that would be available for the various life stages and providing an environment that is void of predatory non-native fishes. Implementation of these actions would occur on private property and is dependent upon landowner permission.

Eradicate Non-native Fishes in the Warm Springs Area

SNWA will provide $25,000 towards this effort. As discussed in the Status of the Species section of this biological opinion, the invasion of tilapia has had a devastating effect on the Moapa dace. Only the Refuge and lower Apcar streams and those springs and outflows located on the MVNWR are devoid of the non-native tilapia. Tilapia currently occur throughout the remaining 3.82 miles of Moapa dace habitat which is on privately-owned lands. Due to the presence of tilapia, only 5 percent (68 individuals, Figure 3) of the population occur in these reaches where tilapia are present. Currently, the property that includes the majority of habitat with tilapia is privately held; however, SNWA has an access agreement with the property owner. Removal of tilapia from the 3.82 miles of the upper Muddy River will result in a substantial increase in the Moapa dace population, and the potential for a return to previous population levels when there was over a thousand Moapa dace in this reach.

Construct Fish Barriers in the Muddy River

Funding has been secured through the Southern Nevada Public Lands Management Act by BLM and the Service to construct a set of fish barriers on the Muddy River to prevent the further migration of non-native fishes, especially tilapia. SNWA would provide an additional $50,000 to be used towards the construction of a smaller structure upstream in the Muddy River tributaries; although the land is privately owned, SNWA maintains an access agreement with the private landowner. Fish barriers are essential to the overall effort to remove the invasive tilapia from the system and result in successful eradication efforts in order to benefit the Moapa dace.

In addition, the Tribe will allow access for the construction of at least one fish barrier. The location of a fish barrier on Tribal lands would be beneficial in order to reduce the opportunity for upstream movement into Moapa dace habitat by non-native fishes.

Development of a Recovery Implementation Program (Recovery Program)

In order to effectuate the goals of the MOA, a Recovery Program will be established whereby recovery measures are identified, prioritized and funded in order to accomplish the protection and recovery of the Moapa dace, the operation and development of regional water facilities and the inclusion of necessary and interested third parties are outlined and implemented. The cooperation of other entities within the region that have an interest in the development and management of water and biological resources in the Muddy River system will be sought. This Recovery Program will become instrumental in future site-specific actions tiered to this biological opinion by allowing the Service to evaluate the development of regional water

resources while providing for the protection and conservation of the Moapa dace. SNWA will provide $300,000 towards the development of this Recovery Program.

Development of an Ecological Model for the Moapa dace

The Muddy River Recovery Implementation Team has identified the need to obtain additional biological/ecological information to better understand the needs of the Moapa dace. A study to assess the species physiological and biological response to the changing environmental conditions will be conducted concurrently with groundwater pumping. This model may assist in making critical management decisions that could result in minimizing or avoiding long-term adverse affects to the Moapa dace. SNWA and the Service will each provide $125,000 for the development of this ecological model for the Moapa dace. While this conservation/minimization measure will not provide short-term protection for the Moapa dace, the information obtained from this model would assist in the long-term management and recovery efforts of the species.

Hydrologic Review Team

The signatories to the MOA have agreed to establish a Hydrologic Review Team (HRT) for the purpose of developing a coordinated regional monitoring effort of the groundwater pumping proposed under the MOA and to satisfy the State Engineer requirement for monitoring under the various orders. The objectives of the HRT are to establish technically sound analyses of impacts on Muddy River Springs and Muddy River flows resulting from regional groundwater pumping, and ensure accuracy and efficiency in data collection as required under the Regional Monitoring Plans. Another objective of the HRT is to collect sufficient information and to adjust, through consensus, pumping restrictions of the signatories to better reflect the extent to which the individual pumping action may be causing impacts to the Muddy River Springs and Muddy River flows. The monitoring of the springs and stream reaches within the Muddy Springs Area and River is a critical component of the MOA that would provide early detection of effects from the proposed groundwater pumping. The commitment of the signatories to develop a regional monitoring plan would assure that all pumping effects within the basins (Coyote Spring Valley, Muddy River Springs Area, and California Wash) are being monitored such that if the average flow threshold levels are reached as stipulated in the MOA, actions could be implemented to protect the Moapa dace.

Overall Summary of Effects of the Proposed Action with the Conservation Measures

As previously described, the proposed conservation measures would provide additional flows (1.0 cfs) from the Jones Spring on the Apcar Unit that would increase thermal habitat and the reproductive potential of the species in the Apcar (upper and lower) and Refuge streams. In addition to the increased flows, the proposed restoration activities would reduce the potential for fire and restore the overall spawning and rearing habitat sufficient to sustain several hundred Moapa dace on the Apcar Unit of the MVNWR.

The proposed action also provides funding for conservation actions outside the boundary of the MVNWR, which include the restoration of habitat in one or more tributaries including the Apcar

Stream, North and South Forks and Muddy Springs streams; the construction of fish barriers; and removal of non-native fishes (e.g., tilapia) throughout the species range. These conservation measures would provide more secure habitat should water flows decline from groundwater development activities in the future. The implementation of the conservation actions assured by the funding committed in the MOA will improve habitat throughout the range of the species and will reduce the species vulnerability to catastrophic events. The expansion of the species within its range and increase in its current population size will minimize or off-set the effects of decreased flows within the Pedersen Unit that are anticipated to occur from the proposed groundwater development.

It is assumed that the conservation actions identified above would be initiated upon signature of the MOA with most of them completed prior to the actual groundwater development pump test. During the construction of facilities (18-24 months), and the subsequent pump test, critical conservation measures, including barrier construction, non-native species removal, and habitat restoration will all be initiated, if not completed, during the construction period and before the pump test. In addition, the Recovery Program will also be developed during the construction period and in advance of the pump test. It is anticipated that with the commencement of the pump test, the Recovery Program would have identified and funded additional conservation measures above and beyond those described herein to further the conservation of the species. The signatories to the MOA and the participants in the Recovery Program will be identifying and funding future conservation actions such as land acquisition and monitoring of groundwater pumping which are key to the success of the Recovery Program.

The conservation measures identified in this programmatic biological opinion and future actions developed as part of the Recovery Program would be implemented within the range of the Moapa dace in an effort to increase the population and expand its range from current levels and distribution in order to assure the continued existence of the species.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Future demand for groundwater will continue to threaten spring flows and surface water important for aquatic species such as the Moapa dace. In the Muddy Springs Area, MVWD's existing permit would allow more groundwater to be pumped from the Arrow Canyon Well in the future. The maximum permitted pumping rate at the Arrow Canyon Well is 7,200 afy or 10.0 cfs, as compared with the annual average of 2,400 afy or 3.3 cfs pumped currently. Depending on the outcome of the five-year study mandated in the State Engineer Order 1169 and subsequent ruling by the State Engineer, additional groundwater could potentially be pumped in Coyote Spring Valley. While the MOA includes the removal of 13,600 afy in Coyote Spring Valley, the total volume of permitted water rights in Coyote Spring Valley is 16,100 afy. Any of

the remaining permitted water rights (2,500 afy) could be developed. The maximum volume that could be removed from the Coyote SpringlWarm Springs Area under existing permits is 23,300 afy. This represents almost a tenfold increase from current withdrawals in the system.

In addition to the existing permitted water rights, there are pending applications for a far greater volume of groundwater above and beyond the permitted amount in the Coyote Spring/Warm Springs Area as well as in Kane Springs Valley, both areas that are part of the White River Flow System, and where pumping could potentially affect groundwater levels and spring discharge in the Warm Springs Area. The State Engineer, through Order 1169, held all of these pending applications in abeyance until the completion of the two-year pump test and evaluated results. Given the possible impacts already associated with the current pumping at Arrow Canyon and the proposed pumping in Coyote Spring Valley and California Wash, further groundwater development in the area would have very serious impacts on the water resources and biota in the Warm Springs Area. However, if these applications are granted, it is uncertain which would require a future Federal action in order to develop the rights upon approval.

Any future groundwater pumping by private parties above that analyzed in this biological opinion that is determined to affect or take Moapa dace could only legally occur under the authorization of a Habitat Conservation Plan section 10(a)(1)(B) and its associated incidental take permit issued by the Service. The Service's action of issuing such a permit would involve an internal consultation to affirm that section 7(a)(2) of the Act would not be violated.

Conclusion

After reviewing the current status of and environmental baseline for the Moapa dace, the effects of the proposed MOA, and the cumulative effects, it is the Service's biological opinion that the Service becoming a signatory to the MOA, as proposed and analyzed, is not likely to jeopardize the continued existence of the endangered Moapa dace. Our finding is based on implementation of the MOA and its associated conservation actions that would be implemented within the range of the Moapa dace prior to the initiation of groundwater pumping, in an effort to increase the population and expand its range from current levels and distribution in order to assure the continued existence of the species, and that the groundwater pumping proposed in the MOA and the associated effects of such pumping occur as analyzed in this biological opinion.

The Service's signing of the MOA does not waive any of the statutory duties or authorities of the Service or the United States, nor relieve the participants of the MOA from complying with any Federal laws, including but not limited to, National Environmental Policy Act, Endangered Species Act, National Wildlife Refuge System Improvement Act of 1997, and Federal Land Policy and Management Act of 1976, and any and all rules and regulations thereunder. In addition, future site-specific actions for pumping groundwater identified in the MOA would require additional section 7 consultation that would be tiered to this programmatic biological OpInIOn.

Incidental Take Statement

No exemption from Section 9 of the Act is issued through this biological opinion. The cumulative withdrawal of 16,100 afy from Coyote Spring Valley and California Wash is likely to adversely affect listed species. However, the proposed action of signing the MOA, in and of itself, does not result in the pumping of any groundwater, and is one of many steps in the planning process for proposed groundwater withdrawal projects identified in the MOA and in the action area. Therefore, the Service has taken a tiered-programmatic approach in an attempt to analyzing the effects of the action. This programmatic biological opinion does not authorize any incidental take for programmatic impacts associated with the activities included in the MOA. The likelihood of incidental take, and the identification of reasonable and prudent measures and terms and conditions to minimize such take, is anticipated to be addressed in future project-specific consultations (second stage). These tiered-consultations would incorporate conservation measures outlined in the MOA at the specific project level. Any incidental take and measures to reduce such take cannot be effectively identified at the programmatic level of the proposed action because of the number of impending actions by different entities and its regional scope. Incidental take and reasonable and prudent measures may be identified adequately through subsequent actions subject to section 7 consultation, and tiered to this programmatic biological opinion. Future site-specific projects that are in the Description of the Proposed Action section and identified in the MOA would require additional section 7 consultation (second stage) that would be tiered to this programmatic biological opinion.

Reporting Requirements

Upon locating a dead or injured endangered or threatened species, initial notification must be made to the Service's Division of Law Enforcement in Las Vegas, Nevada, at (702) 388-6380. Care should be taken in handling sick or injured fauna in order to ensure effective treatment and care. **In** addition, care should be given in the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death. **In** conjunction with the care of sick or injured species or preservation of biological materials from a dead animal or fish, the finder has the responsibility to carry out instructions provided by the Service's Division of Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed. All deaths, injuries, and illnesses of Moapa dace, whether associated with project activities or not must be reported to the Service.

The following actions should be taken for injured or dead dace if directed by the Service's Division of Law Enforcement:

Dead Moapa dace suitable for preparation as museum specimens shall be frozen immediately and provided to the Southern Nevada Field Office in Las Vegas, Nevada.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act, by carrying out conservation programs for the benefit of endangered and threatened

species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. In any future consultation related to this programmatic biological opinion, the following conservation recommendations should be considered.

1. Acquire Moapa dace habitat and/or water rights that are currently privately owned and secure the management of these rights for the long-tenn benefit of the Moapa dace in perpetuity;
2. Restore and enhance additional Moapa dace habitat. This includes funding restoration actions at Baldwin Spring, Cardy Lamb, and/or Muddy Spring or other areas identified by the Muddy River Recovery Implementation Team;
3. Provide funding for pre- and post-construction monitoring of water quality and quantity throughout the range of the species;
4. Establish an access agreement with Wann Springs Ranch private property owners for the continued implementation of recovery actions; and
5. Develop and implement a Moapa dace habitat restoration plan.

Reinitiation Notice

This concludes fonnal consultation on the actions outlined in your request. As required by 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over an action has been retained (or is authorized by law) and if: (1) The amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species that was not considered in this opinion; (4) a new species is listed or critical habitat designated that may be affected by the action; or (5) there is failure to meet any of the measures or stipulations in the MOA. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If we can be of any further assistance, please contact me at (775) 861-6300 or Cynthia Martinez in the Southern Nevada Field Office at (702) 515-5230.

Robert D. Williams

Attachments

cc:
President, Coyote Springs Investment, LLC, Sparks, Nevada
Deputy General Manager, Engineering Operations, Southern Nevada Water Authority, Las Vegas, Nevada
General Manager, Moapa Valley Water District, Moapa, Nevada
Chairman, Moapa Band of Paiutes, Moapa, Nevada
Chief, Planning Division, Department of Army, Los Angeles District Corps of Engineers Office, Los Angeles, California
Project Leader, Desert National Wildlife Refuge Complex, Las Vegas, Nevada
Refuge Manager, Moapa Valley National Wildlife Refuge, Moapa Valley, Nevada
Assistant Regional Director, Ecological Services, Fish & Wildlife Service, Portland, Oregon (electronic copy only)

Literature Cited

Bassett, R. L. 2003. Evaluation of spring and aquifer isotopic data associated with the Muddy River Springs Geographic Area, Southeastern Nevada. Report prepared for the U.S. Fish and Wildlife Service by Geochemical Technologies Corp., Wheat Ridge, CO.

Buqo, T. S. 2004. Allometric responses in coupled groundwater-surface water-reservoir systems. Journal of Nevada Water Resources Association, Volume 1, pg. 40

Bureau of Land Management. 2003. Coyote spring Well and Moapa Transmission System Project Biological Assessment. Prepared by Wildland International for Bureau of Land Management, Las Vegas District on behalf of and in cooperation with the Southern Nevada Water Authority. 78 pages.

Clark County Department of Comprehensive Planning and U.S. Fish and Wildlife Service. 2000. Clark County Multiple Species Habitat Conservation Plan and Environmental Impact Statement. Report prepared by RECON, San Diego, California. June 2000.

Coburn, M.M. and T.M. Cavendar. 1992. Interrelationships of North American cyprinid. Pages *328-273 in* Systematics, Historical Ecology, and North American Freshwater Fishes. R.L. Mayden (ed.). Stanford University Press, Stanford, California.

Cross, J. N. 1976. Status of the native fish fauna of the Moapa River (Clark County, Nevada). Transactions of the American Fisheries Society 105(4):503-508.

Deacon, J. E. and W. C. Bradley. 1972. Ecological distribution of the fishes of the Moapa (Muddy) River in Clark County, Nevada. Transactions of the American Fish Society 101(3): 408-419.

Brock, James T. 2004. Preliminary analysis of effects of reduced discharge on thermal habitat of Pedersen Warm Springs channel on the Moapa Valley National Wildlife Refuge, Clark County, Nevada. Desert Research Institute. 22 pages.

Dettinger, M. D., J. R. Harrill, and D. L. Schmidt. 1995. Distribution of carbonate-rock aquifers and the potential for their development, Southern Nevada and adjacent parts of California, Arizona, and Utah. U. S. Geological Survey Water Resources Investigations Report 91-4146.

Eakin, T. E. 1964. Groundwater appraisal of Coyote Spring and Kane Spring Valley and Muddy River springs area, Lincoln and Clark Counties, Nevada. Nevada Department of Conservation and Natural Resources. Groundwater Resources-Reconnaissance Series. Report 25.

Eakin, T. E. 1966. A regional interbasin groundwater system in the White River Area, Southeastern Nevada. Water Resources Research 2(2):251-271.

Fenlen, J.M. and M.T. Moreo. 2002. Trend analysis of groundwater levels and spring discharge in the Yucca Mountain Region, Nevada and California. U.S. Geological Survey Water Resources Investigations Report 02-4178.

Freeze, R. A. and J. A. Cherry. 1979. Groundwater. Prentice hall, Inc., Englewood Cliffs, New Jersey.

GeoTrans, Inc. 2001. Groundwater modeling of the Muddy River Area and surrounding basins with an emphasis on evaluating pending groundwater applications in Coyote Spring Valley. A Report prepared by GeoTrans, Inc. for the U. S. Fish and Wildlife Service, Portland ,OR.

GeoTrans, Inc. · 2003. Addendum to groundwater modeling of the Muddy River Area and surrounding basins with an emphasis on evaluating pending groundwater applications in Coyote Spring Valley. A Report prepared by GeoTrans, Inc. for the U. S. Fish and Wildlife Service, Portland, OR.

Heckman, R. A. 1988. Presence of the Asian fish tapeworm, *(Bothriocephalus acheilognathi)*, in the Moapa-Muddy River area, Nevada. Brigham Young University, Provo, Utah. 6 pages.

Hubbs, C. L. and R. R. Miller. 1948. Two new, relict genera of cyprinid fishes from Nevada. University of Michigan Museum of Zoology Occasional Paper 507:1-30.

Johnson, C., Mifflin, M., Johnson, R.I., Haitjema, H., 2001. Hydrogeologic and Groundwater Modeling Analyses for the Moapa Paiute Energy Center, a Calpine Company Project in cooperation with the Moapa Band of Paiute Indians, Moapa Indian Reservation, Clark County, Nevada: 218p. (Appendix to Moapa Paiute Energy Center DEIS (2001) and Supplemental DEIS (2002)).

Johnson., C., Mifflin, M., 2003. Evidence for a Sub-Regional Hydraulic Barrier in Southeastern Nevada (abstract). Geological Society of America 115th annual meeting, Seattle, WA.

Johnson, C., Mifflin, M., 2005. The AEM and regional carbonate aquifer modeling. Groundwater (in press).

La Rivers, 1. 1962. Fishes and fisheries of Nevada. Nevada Fish and Game Commission; Reno, Nevada. 782 pages.

Las Vegas Valley Water District. 2001. Water resources and groundwater modeling in the White River and Meadow Valley Flow Systems, Clark, Lincoln, Nye, and White Pine counties, Nevada. A report prepared by the Las Vegas Valley Water District, Las Vegas, Nevada.

Mayer, T. 2003. Presentation at the Nevada Water Resource Association's 2003 annual meeting held on February 26,2003.

Mayer, T. 2004. Possible impacts of groundwater pumping on spring discharge and dace habitat at Moapa Valley National Wildlife Refuge. Fish and Wildlife Service; Region One, Portland, Oregon. 16 pages.

Minckley, W. L. and W. E. Willard. 1971. Some aspects of biology of the longfin dace, a cyprinid fish characteristic of streams in the Sonoran Desert. Southwest Naturalist 15: 459-464.

Nevada State Engineer. 1995. Ruling Number 4243. The Office of the State Engineer of the State of Nevada; Carson City, Nevada.

Nevada State Engineer. 2002. State Engineer Order 1169. State Engineer of the State of Nevada; Carson City, Nevada.

Ono, R. D., J. D. Williams, and A. Wagner. 1983. Vanishing fishes of North America. Stone Wall Press, Washington, D.C. 257 pages.

Otis Bay Environmental Consultants. 2003. Hydraulic geometry of the Pedersen and Plummer streams. Report submitted to the Fish and Wildlife Service.

Prudic, D. E., 1. R. Harrill, and T. J. Burby. 1993. Conceptual evaluation of regional ground-water flow in the carbonate-rock province of the Great Basin, Nevada, Utah, and adjacent states. U.S. Geological Survey Open-File Report 93-170.

Rinne, John N. and W.L. Minckley. 1991. Native fishes of arid lands: a dwindling resource of the desert southwest. General Technical Report RM-206. Fort Collins, Colorado; U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 45 pages.

Scoppettone, G. G, H. L. Burge, P. L. Tuttle, and N. K. Parker. 1987. Life history and status of the Moapa dace *(Moapa coriacea).* U.S. Fish and Wildlife Service, National Fisheries Research Center. Seattle, Washington. 77 pages.

Scoppettone, G. G, H. L. Burge, and P. L. Tuttle. 1992. Life history, abundance, and distribution of Moapa Dace *(Moapa coriacea).* Great Basin Naturalist 52 (3):216-225.

Scoppettone, G. G. 1993. Interactions between Native and Non-native Fishes of the Upper Muddy River, Nevada. Transactions of the American Fisheries Society 122:599-608.

Scoppettone, G. G., P. H. Rissler, M. B. Nielsen, and J. E. Harvey. 1996. Abundance of Moapa dace *(Moapa coriacea)* and Virgin River chub *(Gila seminuda)* in the Muddy River, with information on fish distribution. Unpublished Report: National Biological Service, California Science Center, Reno Filed Station, Reno, Nevada. 29 pages.

Scrugham, J. G. 1920. Order of determination of relative rights to the Muddy River and its tributaries. Judgment and decree, Case No. 377. State Engineer, Carson City, Nevada. 23 pages plus exhibits.

Soil Conservation Service. 1993. Salinity control plan and final environmental impact statement. Moapa Valley Unit, Nevada. Colorado River Salinity Control Program. Nevada State Office, Reno. 105 pages plus appendices.

Southern Nevada Water Authority [SNWA]. 2003. Survey of wells and stream gages in the Black Mountain Area, California Wash Basin, Coyote Spring Valley, Gamet Valley, Hidden Valley, and the Muddy River Springs Area, Nevada. Las Vegas, Nevada.

Southern Nevada Water Authority [SNWA]. 2004. Addendum No.1 to Southern Nevada Water Authority's 2003 Annual Monitoring Report for Coyote Spring Valley, Gamet Valley, Hidden Valley, and California Wash Basin-Permit Numbers 49414,49660-49662,49987-49987, and 54073-54075. Submitted to Hugh Ricci, State Engineer on February 11, 2004. 18 pages.

Thomas, J. M., A. H. Welch, and M. D. Dettinger. 1996. Geochemistry and isotope hydrology of representative aquifers in the Great Basiri region of Nevada, Utah, and adjacent states. U.S. Geological Survey Professional Paper 1409-C.

U. S. Fish and Wildlife Service [Service]. 1996. Recovery plan for the rare aquatic species of the Muddy River ecosystem. Service; Portland, Oregon. 60 pages.

U.S. Fish and Wildlife Service [Service]. 2003. Draft Programmatic Consultation Guidance. 31 pages.

U.S. Geological Survey. In Draft. Discharge, Water-Property and Water-Chemistry measurement for Muddy River Springs, Muddy River, Nevada, February 7,2001. Scientific Investigation Report.

Van Liew, W. P. 2003. The effects of increase groundwater pumping in the Muddy River Springs area on water levels in nearby wells. Presented at the Nevada Water Users Association Annual Conference, February 2003, Reno, Nevada.

Van Liew, W. P., RE. Gillies, and M.A. Aldhamari. 2004. The effects of increased groundwater pumping in the Muddy River Springs area on water levels in nearby carbonate-rock wells. July 12, 2004. National Park Service, Water Resources Division; Fort Collins, Colorado.

Wilson, B. L., J. E. Deacon, and W. G. Bradley. 1966. Parasitism in the fishes of the Moapa River, Clark County, Nevada. Transactions of the California-Nevada Section of the Wildlife Society 1966:12-23.

Final 1127/06

MEMORANDUM OF AGREEMENT

This Memorandum of Agreement ("MOA") is entered into this _____ day of _____, 2006, (the "Effective Date") by and between the Southern Nevada Water Authority ("SNWA"), a political subdivision of the State of Nevada, the United States Fish and Wildlife Service ("FWS"), Coyote Springs Investment LLC, a Nevada limited liability company ("CSI"), the Moapa Band of Paiutes ("Tribe") and the Moapa Valley Water District ("MVWD"), a political subdivision of the State of Nevada. For convenience, SNWA, FWS, CSI, the Tribe and MVWD are at times herein referred to individually as "Party" and collectively as "Parties."

RECITALS

A. In Order No. 1169 the Nevada State Engineer held in abeyance applications for new groundwater rights in certain groundwater basins, and mandated that SNWA, MVWD and other parties conduct a regional groundwater study including the pumping of at least 50 percent of the permitted water rights within the Coyote Spring Valley hydrographic basin for a period of at least two consecutive years ("Pump Test,,).1 SNWA currently owns 9,000 afy of water rights with points of diversion within the Coyote Spring Valley hydrographic basin under Permit Nos. 49414,49660 through 49662 and 49978 through 49987 ("SNWA Water Rights").

B. To facilitate the Pump Test and delivery of SNWA Water Rights, SNWA applied to the Bureau of Land Management ("BLM") for a right-of-way across Federal land for the

1 Currently there are 16,100 acre-feet per year ("afy") of pennitted groundwater rights in the Coyote Spring Valley hydrologic basin, including the SNWA Water Rights and CSI Water Rights, defined in Recitals A and D herein, and Order No. 1169 requires the continuous diversion of 8,050 acre-teet per year during the Pump Test.

construction and operation of a pipeline to deliver groundwater from the Coyote Spring hydrographic basin to either the Muddy River System or to MVWD's service system.

C. In Ruling No. 5115 the Nevada State Engineer granted Application No. 54075, filed by the Las Vegas Valley Water District ("District") on October 17, 1989, for a total duty of 2,500 afy with a diversion rate of 5.0 cubic feet per second ("cfs") within the California Wash hydrographic basin ("Permit No. 54075"). By separate agreement, the District has transferred ownership of Permit No. 54075 to the Tribe. The Tribe plans to divert and utilize groundwater under Permit No. 54075.

D. CSI is a private landowner in the Coyote Spring Valley hydrographic basin and owns 4,600 afy of water rights with points of diversion within the basin under Permit Nos. 70429 and 70430 ("CSI Water Rights").

E. MVWD is responsible for supplying the municipal water needs of Upper and Lower Moapa Valley located in Clark County, Nevada. MVWD owns several water rights within Upper Moapa Valley including surface rights to spring flows in the Muddy Springs area and groundwater rights (Permit Nos. 52520, 55450 and 58269) with points of diversion at the Arrow Canyon well and a right to 1.0 cfs of spring flow from the Jones Spring (Certificate No. 10060) ("Jones Water Right").

F. FWS is a Federal agency within the Department of the Interior. FWS' responsibilities include implementation of the Endangered Species Act and administration of the National Wildlife Refuge System. FWS holds a Nevada State water right certificate for a flow rate of not less than 3.5 cfs as measured at the Warm Springs West flume (Permit No. 56668; Certificate No. 15097 issued subject to the tenns of Permit No. 56668) for the maintenance of habitat of the Moapa dace and other wildlife purposes ("FWS Water Right").

G. The Moapa dace *(Moapa coriacea)* is an endemic fish that inhabits the upper Muddy River and tributary thermal spring systems within the Warm Springs area in Clark County, Nevada. The Moapa dace was federally listed as endangered on March 11, 1967 (32 FR 4001). FWS manages the Moapa Valley National Wildlife Refuge established in 1979 as part of the National Wildlife Refuge System.

H. Based upon its evaluation of available data, FWS postulates that current groundwater pumping by MVWD at the Arrow Canyon well is causing a decline in spring flows in the Warm Springs area and that future withdrawals of groundwater by SNWA and/or CSI in the Coyote Spring Valley hydrographic basin and/or by the Tribe in the California Wash hydrographic basin may cause spring flows to decline. SNWA, CSI, and MVWD do not believe the available hydrologic data supports these conclusions.

1. The Tribe believes that regional groundwater monitoring and scientifically valid, but conservative, regional computer modeling have demonstrated and will continue to demonstrate that on-Reservation groundwater pumping authorized under Permit No. 54075 will not cause appreciable declines in spring flows in the Warm Springs area.

J. Prior to the issuance of Order No. 1169, a stipulation was executed on July 19, 2001, between Federal agencies and SNWA regarding protests filed by Federal agencies against SNWA applications for new groundwater rights in the Coyote Spring Valley hydrographic basin. The Federal agencies and SNWA agreed to implement a monitoring study that was clarified in a Monitoring, Management, and Mitigation Plan for Existing and Future Permitted Groundwater Development in Coyote Spring Valley ("3M Plan") attached to and incorporated in that stipulation.

K. As part of the approval of the MVWD water rights at the Arrow Canyon well, the Nevada State Engineer required a monitoring plan. A monitoring plan has been developed and agreed upon jointly by MVWD, Nevada Power Company, FWS and National Park Service, with the most recent amendments to that plan being submitted to the State Engineer in September 2002 ("MVWD Monitoring Plan").

L. State Engineer Ruling No. 5115 requires that "[a] monitoring program approved by the State Engineer prior to the diversion of any water [under Permit No. 54075] be prepared in conjunction with the [Pump Test] ordered in State Engineer's Order No. 1169.„2 The Tribe will develop, in coordination with the other Parties, a monitoring plan approved by the Nevada State Engineer prior to applying any groundwater to beneficial use under Permit No. 54075 ("Tribal Monitoring Plan").

M. On March 11, 2005, the Nevada State Engineer approved a document entitled "Southern Nevada Water Authority's Monitoring Plan for Groundwater Applications and Permits in Coyote Spring Valley, Hidden and Gamet Valleys, and California Wash Hydrographic Basin, Clark and Lincoln Counties March, 2005" ("SNWA Monitoring Plan"). The State Engineer directed that the SNWA Monitoring Plan serve as the monitoring plan required by the State Engineer for the SNWA Water Rights and the CSI Water Rights.

N. The Parties share a common interest in the conservation and recovery of the Moapa dace and its habitat. Each Party also has an interest in the protection, use and enjoyment of its water rights and entitlements. To serve these interests, the Parties have identified certain conservation measures with the objective of making measurable progress toward the conservation and recovery of the Moapa dace, and have agreed to coordinate the monitoring, management and mitigation measures included and to be included in the 3M Plan, MVWD

Monitoring Plan, SNWA Monitoring Plan, and Tribal Monitoring Plan (collectively the "Regional Monitoring Plans").

O. The Parties desire that FWS engage in consultation and prepare a formal biological opinion under the provisions of Section 7 of the Endangered Species Act and its implementing regulations prior to execution of this MOA. The consultation shall consider the effects on the Moapa dace from the pumping of 9,000 afy under the SNWA Water Rights, 4,600 afy under the CSI Water Rights, and 2,500 afy by the Tribe under Permit No. 54075, together with the implementation of the monitoring, management and conservation measures identified herein.

NOW, THEREFORE, in consideration of the mutual promises and covenants contained herein, the Parties do agree as follows:

I. Conservation Measures. The Parties agree that in order to make measurable progress toward protection and recovery of the Moapa dace and its habitat concurrent with the operation and development of water projects for human use, it is beneficial to the public interest to establish the following conservation measures:

1. Establishment of Recovery Implementation Program. To effectuate the goals of this MOA the Parties agree to establish a Recovery Implementation Program ("RIP") whereby measures necessary to accomplish the protection and recovery of the Moapa dace, the operation and development of regional water facilities, and the inclusion of necessary and interested third parties are outlined and implemented. To facilitate establishment of the RIP:

a. The Parties agree to cooperate in the selection of qualified personnel and/or contractors to oversee the development of the RIP.

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2 Ruling No. 5115 at 40.

b. SNWA agrees to provide funding in the amount of $300,000.00 to develop the RIP. SNWA agrees to execute such documents as may be necessary to ensure that these funds are available to meet the needs of those persons designated by the Parties with the task of establishing the RIP.

c. The Parties agree to seek the cooperation of other parties within the region that have an interest in the development and management of water and biological resources. To achieve the goals of the RIP, the Parties agree to employ principles of adaptive management to further the current understanding of the habitat and aquatic needs of the Moapa dace. The Parties will jointly negotiate the participation of any other party in the RIP.

2. Dedication of the Jones Water Right. The Parties agree that the recovery of the Moapa dace will be enhanced by the guarantee of additional in-stream flows in areas of historical Moapa dace habitat. One such area is the Apcar Stream down gradient of the Jones Spring. The Parties concur that the dedication of the Jones Water Right to the purpose of providing in-stream flows will be beneficial to the Moapa dace population in this area and further the recovery of the species. To effectuate the dedication of the Jones Water Right to the provision of in-stream flows in the Apcar Stream, the Parties agree as follows:

a. MVWD agrees to record an agreement between MVWD and FWS ("Jones Springs Agreement") on the Jones Water Right with both the Nevada State Engineer and the Clark County, Nevada, Recorder's Office that requires the entire 1.0 cfs flow right under the Jones Water Right to be dedicated to the purpose of maintaining in-stream flows in the Apcar Stream subject to the provisions of paragraph 7 of the Jones Springs Agreement. MVWD shall retain ownership of the Jones Water Right. The Jones Springs Agreement shall be executed and recorded promptly upon execution of this MOA. A draft of the Jones Springs Agreement is

attached hereto as "Exhibit A." The Jones Springs Agreement ultimately recorded pursuant to this paragraph shall be in substantially the same form as Exhibit A.

b. SNWA agrees to transfer to MVWD, at no cost, a portion of Permit No. 49414 equal to 724 afy. This transferred portion of Permit No. 49414 shall remain of equal priority date with that portion of Permit No. 49414 retained by SNWA.

c. MVWD agrees to transfer to SNWA, at no cost, the first 724 afy, or any portion thereof if less than 724 afy is permitted, of any permit(s) issued by the Nevada State Engineer pursuant to Application Nos. 54055 through 54059, inclusive.

d. The Parties agree to cooperate with MVWD in the filing and processing of any change applications, including applications to change the manner or place of use that are filed by MVWD with the Nevada State Engineer in order to effectuate the Jones Springs Agreement referenced in paragraph I(2)(a) above.

e. Subject to paragraph 2 of the Jones Springs Agreement, the Parties agree to cooperatively determine the best methods to ensure that the Jones Water Right accomplishes the purpose stated in paragraph I(2)(a) above, as related to the recovery of the Moapa dace and other endemic species, including the possibility of restoration of the springhead at Jones Spring.

3. Dedication of Portion of CSI Water Rights.

a. CSI agrees to record a conservation easement with both the Nevada State Engineer and the Clark County, Nevada, Recorders Office dedicating 460 afy of the CSI Water Rights to the survival and recovery of the Moapa dace and its habitat. The use of this water would be at the discretion of the FWS in consultation with the CSI and the Parties.

b. In addition, CSI agrees to dedicate 5 percent of all water rights above 4,600 afy that CSI may in the future be entitled to withdraw from Coyote Spring Valley

hydrographic basin or any water rights that CSI imports into and uses in the basin. The Parties, consistent with the RIP, will determine the most effective method for utilizing such water rights. CSI shall execute and record such documentation, including conservation easements, deeds, change applications and reports of conveyance, as may be necessary to effectuate the dedication of that portion of such water rights that is subject to the terms and conditions contained herein.

4. Habitat Restoration and Recovery Measures. To restore the habitat necessary for the Moapa dace and take other steps to protect and recover the species, the Parties agree as follows:

a. SNWA agrees to provide funding in the amount of $750,000.00 for the restoration of Moapa dace habitat under the direction of FWS on the Apcar Unit of the Moapa National Wildlife Refuge or otherwise. All tasks funded under this paragraph I(4)(a) shall be agreed to in advance by SNWA and FWS in consultation with the other Parties. SNWA agrees to execute such documents as may be necessary in order to ensure that these funds are available for such habitat restoration.

b. FWS agrees to provide funding in the amount of $125,000.00 and SNWA agrees to provide funding in the amount of $125,000.00 to develop an ecological model designed to investigate the effects of habitat change on the ecology of the Moapa dace. FWS and SNWA shall, in consultation with the other Parties, agree upon the selection of a contractor to prepare the model.

c. SNWA agrees to provide funding in the amount of $50,000.00 to construct fish barriers to help eliminate the predacious Tilapia from areas of Moapa dace habitat. FWS and SNWA shall, in consultation with the other Parties, agree upon the selection of a contractor to perform such work.

d. SNWA agrees to provide funding in the amount of $25,000.00 to implement programs related to the eradication of non-native fish species, including predacious Tilapia, in the Warm Springs area. FWS and SNWA shall, in consultation with the other Parties, agree upon the selection of a contractor to perform such work.

e. CSI agrees to provide FWS with funding on an annual basis in the amount of $50,000.00 for a period of four years following the execution of this MOA for the restoration of Moapa dace habitat outside the boundaries of the Moapa National Wildlife Refuge along the Apcar Stream, or at such other locations as CSI and FWS, in consultation with the other Parties, agree.

f. The Tribe agrees to use a reasonable portion of the existing on-Reservation greenhouse facility for a reasonable period of years, for the purpose of cultivating native vegetation for use in RIP-approved habitat restoration. The Parties understand that the greenhouse is in a state of major disrepair and that such use of the greenhouse will require repairs and a water supply. FWS will work with the Tribe to obtain the funding necessary to provide for such repairs and to identify and secure a water supply adequate for such use. The Tribe reserves the right to pursue, and if feasible implement, separate arrangements for the improvement and commercial operation of the remainder of the greenhouse.

g. The Tribe agrees to provide access to the Tribe's Reservation for the construction and subsequent maintenance of at least one fish barrier, at a mutually agreeable location, to help eliminate the predacious Tilapia from Moapa dace habitat. FWS will work with the Tribe to obtain the funding necessary for construction, maintenance and repair of such barrier(s).

h. The Tribe agrees to provide the services of the Tribe's Environmental Director for in-kind staff services and participation in the RIP.

5. Protection of In-Stream Flows. The Parties recognize that maintenance of minimum in-stream flows in the Warm Springs area is essential for the protection and recovery of the Moapa dace. Although those flows are unknown at this time, the Parties agree as follows:

a. For purposes of this paragraph 1(5), all "Average Flow Levels" specified herein shall be determined by flow measurements at the Warm Springs West flume. Average Flow Levels will be determined to have reached a particular level within a range specified in paragraphs I(5)(b) through (g) ("Trigger Range"): (1) if the daily average flow for each of 45 consecutive days decreases to an amount within the Trigger Range, or if the 90 day average flow over any 90 consecutive day period decreases to an amount within the Trigger Range; or (2) if the daily average flow for each of 90 consecutive days increases to an amount within the Trigger Range, or if the 135 day average flow over any 135 consecutive day period increases to an amount within the Trigger Range. If determined to be necessary by the Parties, the Parties will cooperate in removing phreatophytes, repairing or replacing the flume or taking any other steps to ensure the accuracy of flume measurements. Any adjustment in the rating curve for the Warm Springs West flume shall result in a pro-rata adjustment of the Trigger Ranges. The remaining provisions of this paragraph 1(5) apply both during and after the Pump Test, except for paragraphs I(5)(c)(i) and (ii) which apply only during the Pump Test.

b. If the Average Flow Level decreases to an amount within the Trigger Range of 3.2 cfs or less, the Parties agree to meet as soon as practicably possible to discuss and interpret all available data and plan for mitigation measures in the event flows continue to decline.

c. If the Average Flow Level decreases to an amount within the Trigger Range of 3.0 cfs or less, the following Parties agree to take the following further actions:

1. During the pendency of the Pump Test, MVWD agrees to immediately cease pumping from the Arrow Canyon well; and

ii. While the Arrow Canyon Well is shut down pursuant to paragraph I(5)(c)(i) above, SNWA agrees to supply MVWD with all necessary municipal and domestic water supplies from the MX-5 and RW-2 wells or other sources available to the SNWA. Except for the express provision contained in paragraph I(2)(b) of this MOA, nothing in this MOA will obligate SNWA to supply MVWD with any water from SNWA's existing permits in the Coyote Spring Valley following the completion of the Pump Test; and

111. SNWA and CSI agree to take necessary actions to prepare to geographically redistribute their groundwater pumping in the Coyote Spring Valley should flow levels continue to decline; and

d. If the Average Flow Level is within the Trigger Range of 3.0 cfs or less but greater than 2.9 cfs, the pumping of SNWA from the MX-5, RW-2, CS-l and CS-2 wells in combination with the pumping of CSI from the MX-5, RW-2, CS-l and CS-2 and CSI's pumping from other wells within the Coyote Springs Valley ("CSV") shall be restricted to 8,050 afy.

e. If the Average Flow Level is within the Trigger Range of 2.9 cfs or less but greater than 2.8 cfs, the pumping of SNWA from the MX-5, RW-2, CS-l and CS-2 wells in combination with the pumping of CSI from the MX-5, RW-2, CS-l and CS-2 and CSI's

pumping from other wells in CSV shall be restricted to 6,000 afy, and the pumping of the Tribe under Permit No. 54075 shall be restricted to 2,000 afy.

f. If the Average Flow Level is within the Trigger Range of 2.8 cfs or less but greater than 2.7 cfs, the pumping ofSNWA from the MX-5, RW-2, CS-I and CS-2 wells in combination with the pumping of CSI from the MX-5, RW-2, CS-l and CS-2 and CSI's pumping from other wells in CSV shall be restricted to 4,000 afy, and the pumping of the Tribe under Permit No. 54075 shall be restricted to 1,700 afy.

g. If the Average Flow Level is within the Trigger Range of 2.7 cfs or less, the pumping of SNWA from the MX-5, RW-2, CS-l and CS-2 wells in combination with the pumping of CSI from the MX-5, RW-2, CS-I and CS-2 and CSI's pumping from other wells in CSV shall be restricted to 724 afy, and the pumping of the Tribe under Permit No. 54075 shall be restricted to 1,250 afy.

h. The Parties agree that any pumping of the 460 afy of CSI Water Rights dedicated to the survival and recovery of the Moapa dace pursuant to paragraph 3.a. of this MOA shall be at the discretion of FWS and not counted against the pumping restrictions set forth in paragraphs 5(d) through 5(g) of this MOA.

6. Hydrologic Review Team. Upon execution of this MOA, the Parties shall establish a Hydrologic Review Team ("HRT") which shall be constituted and function as follows:

a. Membership. Each Party shall appoint two representatives ("HRT Representatives"), including at least one with substantial formal training and experience in hydrogeology ("Technical Representative"). Except as otherwise provided herein, the two HRT Representatives shall together have one vote on HRT matters. By consensus, the HRT

Representatives may offer voting or non-voting HRT membership to others who provide regional monitoring records and analyses to the HRT.

b. Objectives. The objectives of the HRT shall be: (1) to identify opportunities and make recommendations for the purpose of coordinating and ensuring accuracy, consistency and efficiency in monitoring, other data collection, and analytical activities performed under the Regional Monitoring Plans; (2) to establish technically sound analyses of impacts on Muddy River Springs and Muddy River flows resulting from regional groundwater pumping; (3) to assess based thereon whether the pumping restrictions, but not the Trigger Ranges, under paragraphs I(5)(c) through (g) above (or any successors thereto) should be adjusted to better reflect the extent to which regional groundwater pumping by the respective Parties causes, or is likely to cause, impacts on Muddy River Springs and Muddy River flows; and (4) to adopt by consensus appropriate adjustments to such restrictions, if warranted.

c. Regional Baseline Pumping Analysis. Within one year following the execution of this MOA, the Technical Representatives shall prepare a written analysis of regional groundwater pumping data and impacts ("Regional Baseline Pumping Analysis"). In preparing such baseline analysis, the HRT shall consider all relevant and available data and analytical materials. The Regional Baseline Pumping Analysis shall set forth all shared and dissenting analyses, interpretations and recommendations of the participating Technical Representatives. All modeling analyses contained therein shall be based on modeling codes in the public domain and data files that are available for comprehensive review by all Technical Representatives.

d. Annual Determination. Based on the Regional Baseline Pumping Analysis, and no later than one year after preparation of that analysis and annually thereafter, the HRT shall endeavor to determine by consensus ("Annual Determination") whether the

groundwater pumping restrictions, but not the Trigger Ranges, under paragraphs I(5)(c) through (g) above (or any successors thereto) should remain in place, or whether and how any of such restrictions should be adjusted ("Pumping Restriction Adjustments") to better reflect the extent to which regional groundwater pumping by the respective Parties causes, or is likely to cause, impacts on Muddy River Springs and Muddy River flows. However, no Pumping Restriction Adjustments will be made within the first five years following the Effective Date of this MOA. All Annual Determinations (including any Pumping Restriction Adjustments adopted by HRT consensus) shall be final and binding on all Parties, except that by consensus the HRT may at any time modify or vacate any Annual Determination.

e. Annual Determination Reports. Each Annual Determination shall be set forth and explained in a written Annual Determination Report which includes as appendices the Regional Baseline Pumping Analysis, all previously submitted Annual Technical Representative's Reports, and any other data or analytical materials considered by the HRT. If the Annual Determination is not made due to lack of consensus or any other reason, the positions thereon of the HRT Representatives shall be set forth and explained in the Annual Determination Report. Furthermore, if the HRT fails to adopt Pumping Restriction Adjustments recommended in a timely submitted Annual Technical Representative's Report, the Annual Determination Report shall briefly explain why such recommendation was not adopted.

f. Annual Technical Representative's Reports. Within six months after the close of the year of this MOA and annually thereafter, based on the best available scientific data and information, any Technical Representative may submit to all other HRT Representatives a written report ("Annual Technical Representative's Report") containing both: (1) a well-

documented professional analysis of monitored regional pumping and pumping impacts; and (2) recommendations, if any, for Pumping Restriction Adjustments.

g. Provision for Peer Review. If the HRT Representatives are unable to reach consensus on an Annual Determination, the Parties shall refer the matter to a qualified panel of third party reviewers ("Panel") consisting of three scientists unaffiliated with any Party and having substantial formal training and experience in hydrogeology. If the Parties cannot agree by consensus on the make-up of the Panel, one member of the Panel shall be designated by each of the following from its own ranks: U.S. Geologic Survey, Desert Research Institute and a private firm with the requisite expertise designated by a majority of the Parties ("Appointing Entities"), provided that the Parties by consensus may designate different similarly qualified Appointing Entities. If any Appointing Entity for any reason is unable or refuses to designate a member of the Panel, the Parties by majority vote shall designate a qualified replacement Appointing Entity. The purpose of the referral to the Panel will be to obtain peer review of the then-current Annual Determination Report, the data upon which it is based, all previously submitted Annual Technical Representative's Reports, and any other relevant and available data and analytical materials. The Panel will be asked to make its recommendation based on the foregoing information concerning the appropriate content of the Annual Determination. All Parties shall have a fair and reasonable opportunity to present factual and analytical submissions in person and/or in writing to the Panel. The Parties contemplate that a determination of the Panel on the Annual Determination will constitute the best available scientific information concerning the impacts on Muddy River Springs and Muddy River flows resulting from regional groundwater pumping, and the appropriateness of any proposed Pumping Restriction Adjustments. The cost of the Panel shall be borne equally by the Parties.

7. Acquisition of Additional Land and Water Rights. As a potential conservation measure, the Parties agree to work cooperatively to identify both land and water rights that, if acquired and dedicated to the recovery of the Moapa dace, will assist in making measurable progress towards the recovery of the Moapa dace. SNWA agrees to make a good faith effort to acquire land and water rights identified by the Parties. The Parties expressly agree that the reasonableness of any terms and conditions for any acquisition of land or water rights by SNWA shall be determined by SNWA at SNWA's sole discretion, and that SNWA shall have no obligation to acquire any land or water rights upon terms and conditions that SNWA finds unreasonable. When such land or water rights are acquired by SNWA, SNWA will cooperate with FWS in establishing restrictions upon the use of such lands and water rights consistent with existing laws so as to effectuate the conservation of these resources and the recovery of the Moapa dace.

8. Operational Coordination Among FWS, SNWA, CSI and MVWD. Consistent with the terms of this MOA and to accomplish the goals of protecting and recovering the Moapa dace, and accommodating the operation of municipal water supply infrastructure, FWS, SNWA, CSI and MVWD agree to examine all reasonable water operational scenarios and agree to implement feasible scenarios that will minimize impacts to the Moapa dace and its habitat, including, but not limited to the provision of water to MVWD from the Coyote Spring Valley hydrographic basin during the Pump Test or other water supplies available to SNWA and MVWD. MVWD shall have the right during the Pump Test to use the Arrow Canyon Well only in the event and to the extent SNWA is unable to supply MVWD with "all necessary municipal and domestic water supplies" pursuant to the provisions of paragraph I(5)(c)(ii) of this MOA. Except for the express provision contained in paragraph I(2)(b) of this MOA, nothing in this

MOA will obligate SNWA to supply MVWD with any water from SNWA's existing permits in the Coyote Spring Valley hydrographic basin following the completion of the Pump Test.

SNWA and CSI agree, following the execution of this MOA, and in coordination with FWS, to cooperate in locating and drilling one or more production wells in the northern part of the Coyote Spring Valley hydrographic basin. The details of this cooperative effort shall be contained in a separate agreement between CSI and SNWA.

9. Adaptive Management Measures. The Parties agree to carry out additional conservation measures that will need to be taken to protect and recover the Moapa dace following the initiation of the **RIP** and as more data becomes available both as to the biology of the Moapa dace and regional hydrology. Thus, the Parties agree to cooperate in carrying out the following measures as may be appropriate:

a. Funding, preparation and implementation of biological and hydrological studies and activities supporting the recovery of the Moapa Dace; and

b. Establish a regional monitoring and management plan that will include science-based management and mitigation measures for **RIP** participants; and

c. Assessing the feasibility of augmenting and/or restoring in-stream flows and establishing those flows as deemed feasible.

d. Continue to re-evaluate necessary measures to protect and recover the Moapa dace.

II. Current Access Agreement. SNWA currently has an access agreement with the owners of the Warm Springs Ranch, which contains Moapa dace habitat, in order to conduct biological surveys of the Moapa dace. SNWA agrees to use its best efforts to seek to amend this access

agreement so that each of the Parties to this MOA will have similar rights of access to the Warm Springs Ranch.

III. Modification of MVWD Monitoring Plan. Pursuant to the MVWD Monitoring Plan, submitted to the Nevada State Engineer in September 2002, FWS and MVWD agreed to a monitoring plan for development of MVWD's water rights at the Arrow Canyon well that contained certain management and mitigation measures that would be taken if flows at the Warm Springs West flume reached 3.17 cfs and 2.94 cfs respectively. This monitoring plan was recognized by the Nevada State Engineer in Ruling No. 5161. The Parties agree that, in order to effectuate a uniform regional monitoring and management plan, that the flow level restrictions and mitigation measures contained in this MOA shall replace the flow and water level restrictions and mitigation measures contained in the MVWD Monitoring Plan.

IV. No Assertion ofFWS State Water Right. Provided that the other Parties to this MOA are in full compliance with the terms of this MOA, FWS expressly agrees not to assert a claim of injury to the FWS Water Right against either MVWD for pumping at the Arrow Canyon Well, against the Tribe for pumping within the California Wash hydrographic basin or against SNWA or CSI for any pumping in the Coyote Spring Valley for any diminution in flows at the Warm Springs West flume above 2.7 cfs. This provision shall in no way prejudice the FWS' ability and/or right to assert any and all rights inherent to the FWS Water Right for any diminution in flows at the Warm Springs West flume below 2.7 cfs.

V. No Waiver of Statutory Duties or Legal Rights. This MOA does not waive any of the authorities or duties of the FWS or the United States, nor does it relieve SNWA, CSI, the Tribe and MVWD from complying with any Federal laws, including but not limited to, the National Environmental Policy Act, Endangered Species Act, National Wildlife Refuge System

Improvement Act of 1997, and Federal Land Policy and Management Act of 1976, and any and all rules and regulations thereunder. Except as provided in paragraph IV of this MOA, it is the expressed intention of the Parties that FWS and the United States are not waiving any legal rights or obligations of any kind, including obligations to consult or re-consult under the Endangered Species Act, by entering into this MOA. Further, this agreement is entered as a good faith resolution of certain issues and is not intended to waive any party's rights in a subsequent legal proceeding regarding those issues. In addition, except for the restrictions set forth in paragraphs I(5)(e) through (g) above, this MOA does not in any respect waive, limit, or diminish any rights or claims of the Tribe to any federally-reserved or State surface or groundwater rights.

VI. No Modification of Previous Agreements. The Parties recognize that CSI, SNWA and MVWD have previously entered into multiple agreements concerning the sale, purchase and settlement of water rights within the Coyote Spring Basin including a certain *Agreement For Settlement Of All Claims To Groundwater In The Coyote Spring Basin* entered into between MVWD, CSI, SNWA and the District on March 7, 2002, and a certain *Agreement For Option, Purchase and Sale of Water Rights, Real Property and Easements* entered into between SNWA and CSI on April 16, 1998. Nothing contained herein is intended to abrogate or modify in any manner any of the provisions contained in any of those agreements except as expressly provided in paragraphs I(2)(b) and I(2)(c) of this MOA.

VII. Miscellaneous Provisions.

1. Notices. If notice is required to be sent by the Parties, the addresses are as follows:

If to FWS:

Supervisor
Nevada Fish and Wildlife Office
Fish and Wildlife Service
1340 Financial Blvd., #234
Reno, Nevada 89502

If to SNWA:

General Manager
Southern Nevada Water Authority
1001 South Valley View Boulevard
Las Vegas, Nevada 89153

If to MVWD:

General Manager
Moapa Valley Water District
Post Office Box 257
Logandale, Nevada 89021

If to CSI:

Carl Savely, General Counsel
Wingfield Nevada Group
6600 North Wingfield Parkway
Sparks, Nevada 89436

If to the Tribe:

Chairperson, Moapa Band of Paiute Indians
Post Office Box 340
Moapa, Nevada 89025
Fax: 702-865-2875

With copies to:

Steven H. Chestnut
Richard M. Berely
Ziontz, Chestnut, Varnell, Berely & Slonim
2101 Fourth Avenue, Suite 1230
Seattle, Washington 98121
Fax: 206-448-0962

2. Choice of Law. This MOA shall be governed in accordance with applicable Federal laws, and the laws of the State of Nevada to the extent not inconsistent with Federal law.

3. Funding. Any commitment of funding by FWS, MVWD or SNWA under this MOA is subject to appropriations by the respective governing bodies of those entities.

4. Amendment. This MOA may be amended in writing by mutual agreement of the Parties.

5. Integration. This MOA sets forth the entire agreement of the Parties and supercedes all prior discussions, negotiations, understandings or agreements with respect to the subject matter hereof. No alteration or variation of this MOA shall be valid or binding unless contained in an amendment in accordance with paragraph VI(4) of this MOA.

6. Binding Effect, Withdrawal From MOA. The terms and conditions of this MOA shall be binding upon and inure to the benefit of the Parties hereto and their respective personal representatives, successors, transferees and assigns. However, the Parties expressly agree that should the execution of this MOA, or any consultation held or biological opinion issued under Section 7 of the Endangered Species Act which is premised thereon, be challenged in a court of competent jurisdiction and be found in violation of the Endangered Species Act or any other law, any of the Parties may withdraw from the MOA upon thirty days written notice to the other Parties. Upon such withdrawal, the withdrawing Party shall have no further obligation to perform any commitment contained in this MOA.

7. Effective Date, Counterparts. This MOA will become effective as between the Parties upon all Parties signing this MOA. The Parties may execute this MOA in two or more counterparts, which shall, in the aggregate, be signed by all Parties; each counterpart shall be deemed an original as against any party who has signed it.

8. Additional Parties. Other entities may become Parties to this MOA by mutual written assent of the Parties.

9. Headings. The underlined paragraph headings used in this MOA are for the convemence of the Parties only, and shall not be deemed to be of substantive force in interpreting the MOA.

10. No Third Party Beneficiaries. This MOA does not create any right or benefit, substantive or procedural, enforceable by any third parties against the Parties or against any other person or entity. The terms of this MOA are not enforceable by any person or entity other than a Party.

IN WITNESS WHEREOF, the Parties have executed this Memorandum of Agreement on the day of , 2006.

MOAPA VALLEY WATER DISTRICT

_____

By: Ivan Cooper
Title: Chairman

FISH AND WILDLIFE SERVICE

_____

By: Steve Thompson
Title: Manager, CalifomialNevada Operations Office

SOUTHERN NEVADA WATER AUTHORITY

_____

By: Amanda M. Cyphers
Title: Chair

COYOTE SPRINGS INVESTMENT, LLC

_____

By: Robert R. Derek
Title: General Manager

MOAPA BAND OF PAIUTES:

_____

By: Dalton Tom,
Title: Chairman

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ATTACHMENT B

When Recorded Mail To:

_____

_____

_____

Jones Springs Agreement

This Jones Springs Agreement ("Agreement") is entered into for the purposes described herein this ___ day of , 2004 by between Moapa Valley Water District ("MVWD") and the U.s. Fish and Wildlife Service ("FWS").

RECITALS

1. MVWD was created in 1983 by an act of the Nevada Legislature and is the municipal water purveyor in upper and lower Moapa Valleys and serves the communities of Moapa, Glendale, Logandale and Overton, and the surrounding areas, located in Clark County, Nevada.

2. One ofMVWD's water sources is a spring known locally as Pipeline Jones Spring ("Jones Spring"). MVWD holds Certificate No.10060 issued by the Nevada State Engineer to divert 1 c.f.s. of flow of water from Jones Spring for municipal purposes. The waters oOolies Spring and Certificate No.10060 constitute a portion of the Muddy River Decreed water rights.

3. Water from Jones Spring, as well as numerous other springs, form small streams which make up the Muddy River ("Tributary Streams").

4. There lives in the upper reaches of the Muddy River and in the Tributary Streams, a small minnow known as the Moapa Dace ("Dace"). The Dace was listed as endangered in 1967 under the Endangered Species Preservation Act of 1966 and contillues to be so listed and protected under the Endangered Species Act of 1973 as amended.

5. MVWD needs the quantity of water represented by Certificate No.1 0060 to serve its municipal customers.

6. As an inducement to MVWD to grantthis Agreement, the Southern Nevada Water Authority ("SNWA") has agreed to furnish to MVWD a quantity of water equal to MVWD's rights under Certificate No.1 0060 from SNWA's wens and water rights in Coyote Spring Valley ("Coyote Spring Water"). The terms and conditions of SNWA's obligations ate set forth ina separate agreement.

7. MVWD desires to help in the recovery and preservation of the Dace.

NOW THEREFORE, for the purpose of aiding in the recovery and preservation of the Dace, MVWD and FWS hereby agree as follows:

ATTACHMENT B

1. Effective on MVWD receiving Coyote Spring Water from Southern Nevada Water Authority, the water from Jones Spring shall not be diverted for municipal purposes pursuant to Certificate No. 10060, but shall be allowed to flow down the Tributary Streams to the Muddy River.

2. MVWD may, as soon as Coyote Spring Water is available and being furnished to MVWD for municipal purposes disconnect their existing pumping facilities from the Jones Spring diversion pipe and or otherwise affix appurtenances that will allow the entire flow of water from Jones Spring to flow down to the Muddy River, thus increasing the flow of water in one or more Tributary Streams.

3. MVWD shall file any necessary change applications with the State Engineer as may be required by Nevada Law as a result of this Agreement.

4. The Agreement herein granted shall be for a non-consumptive use of water, with no warranty as to quality or quantity of flow.

5. MVWD reserves the right, in the future when it can use surface water, to change the point of diversion for its consumptive use right to the water from Jones Spring to a point on the Muddy River, below the Gleridale gauging station. Any such change shall not affect the flow of water at Jones Spring for in-stream purposes.

6. This Agreement will be recorded with the Clark County Recorder and filed with the Nevada State Engineer.

7. So long as MVWD is in full compliance with the terms and conditions applicable to MVWD in the Memorandum of Agreement dated November ___, 2004 and attached hereto as Attachment 1, then, if for any reason, whether natural, man-made or otherwise, any portion of the Coyote Spring Water becomes unavailable or unusable to meet MVWD's municipal needs previously supplied by Certificate 10060 (Jones Spring), then MVWD shall have the right to utilize a like portion of water from Jones Spring to replace such portion of the Coyote Spring Water that remains unavailable to MVWD for so long as the Coyote Spring Water remains unavailable.

MOAPA VALLEY WATER DISTRICT

By: _____
Ivan Coopei, Chairman of the Board

U.S. FISH AND WILDLIFE SERVICE

By: _____
Steve Thompson, Manager
California/Nevada Operations Office

Attachment C

WATER SUPPLY AGREEMENT

WATER SUPPLY AGREEMENT ("Agreement") effective _____ 2006, among the Moapa Band of Paiutes (liTribe"), Las Vegas Valley Water District ("LVVWD"), Southern Nevada Water Authority C'SNWA"), Muddy Valley Irrigation Company (f1MVIC") and Moapa Valley Water District ("MVWD'I) referred to herein individually as a IIPartyli and collectively as the IIParties.[1]

Recitals

A. The Tribe, LVVWD, SNWA, MVIC, MVWD and the State of Nevada ("State") have negotiated a proposed written Water Settlement Agreement and remain committed to consummating the Water Settlement Agreement substantially in its current form (the IIWSA"). The proposed WSA Is attached hereto as Exhibit A. The United States must approve and join In the WSA,

B. SNWA, Coyote Springs Investment LLC, MVWD and the United States Fish and Wildlife SeNice ("FWS") have negotiated a proposed Memorandum of Agreement (the liMON') regarding certain planned groundwater pumping in the Coyote Spring Hydrographic Basin and measures to- mitigate potential impacts

of such pumping on the endangered Moapa dace, The proposed MOA is attached hereto as Exhibit B, This Agreement has been negotiated by the Parties to obtain and facilitate the Tribe's joinder in the MOA.

C. The Tribe will execute the MOA upon execution of this Agreement by all Parties and the satisfaction of certain conditions precedent which are explicitly set forth below, Among other features, subject to conditions set forth below, under this Agreement the Tribe will receive the state groundwater permit and state groundwater applications which are to be provided to the Tribe by LVVWD under the WSA, and a lease of Muddy River water rights which in certain respects will be functionally similar to the federally-reserved Muddy River rights to be secured to the Tribe under the WSA.

Terms and Conditions

The Parties hereto agree as follows:

1. Commitment to W5A. The Tribe, LVVWD, SNWA, MVIC and MVWD:

a, shall make best efforts to secure Federal approval and execution of the WSA substantially in its current form;

b. on the securing of such Federal approval, shall execute the WSA; and

c. shall make best efforts to secure mutually satisfactory written confirmation from the state that it continues to support consummation of the WSA.

2. Commitment by Tribe to Execute the MOA. The Tribe shall execute the MOA upon satisfaction of the following conditions precedent:

a. **Condition Precedent No.1.** Provision by the state of Nevada of the written confirmation described in ¶ 1.c above.

b. **Conditions Precedent Nos. 2 - 5.** The conditions precedent set forth in ¶¶ 3.e and 4.c below,

3. Provision of Groundwater Rights.

a. **2500 acre-feet per year (afy) Permit and Related LVVWD Groundwater Applications.** In 1989, LVVWD filed two State applications to appropriate groundwater from the California Wash Hydrographic Basin (Applications 54075 and 54076) totaling

20 cubic feet per second (cfs) and 14,480 afy, On April 18, 2002, the Nevada State Engineer issued Ruling 5115, which granted LVVWD a permit to withdraw 2,500 afy of groundwater under Application 54075 (112500 afy Permit"), denied the balance of Application 54075, and held Application 54076 in abeyance pending completion of the groundwater study ordered in State Engineer's Order 1169,

b. **Tribal Appeal.** The Tribe has appealed RUling 5115 to the Eighth Judicial District Court of Clark County, Nevada (the IIAppeal"), and LVVWD has intervened as a defendant in the Appeal (which remains pending). Through the Appeal, the Tribe is seeking an increase in the quantity of groundwater currently permitted to be withdrawn under Application 54075 and restoration of the balance of Application 54075 pending further action by the State Engineer. This Agreement does not resolve the Tribe's claims in the Appeal. Application 54076 and any balance of Application 54075 which may be restored as a result of the Appeal are referred to herein as the ilLVVWD Groundwater Applications" and individually as an IILVVWD Groundwater Application,1I

c. **Pending LVVWD Change Applications.** In July 2003, in contemplation of the consummation of the WSA, LVVWD in

consultation with the Tribe filed three applications (ilLVVWD Change Appllcations") with the state Engineer to change the point of diversion under the 2500 afy Permit to locations on the Moapa Indian Reservation C'Reservation"). The LVVWD Change Applications were not protested and are pending for approval before the State Engineer. LVVWD shall make best efforts to secure the promptest possible State Engineer approval of the LVVWD Change Applications.

d. **Transfer of 2500 afy Permit and LVVWD Groundwater Applications to Tribe.** Contemporaneous with the Tribe's execution of the MOA, LVVWD shall transfer to the Tribe, at no charge and free and clear of liens and encumbrances, full ownership of the 2500 afy Permit and the LVVWD Groundwater Applications, subject to reversion under ¶ 7 below. If the Tribe subsequently establishes a federally-reserved right to grqundwater appurtenant to any portion of the Reservation, an equal quantity of State groundwater rights acquired by the Tribe under the 2500 afy Permit and/or LVVWD Groundwater Applications shall be deemed relinquished by the Tribe.

e. **Conditions Precedent Nos. 2 and 3.** The following are two additional conditions precedent that must be satisfied to trigger the Tribe's obligation to execute the MOA:

i. approval of the LVVWD Change Applications by the State Engineer on no conditions unacceptable to the Tribe; and

ii. transfer of the 2500 afy Permit and LVVWD Groundwater Applications to the Tribe as provided in ¶ 3.d above.

f. **LVVWD Disclaimers.** LVVWD makes no representation or warranty to the Tribe as to the quantity or quality of water that: (i) will ultimately be permitted by the State Engineer in response to the LVVWD Groundwater Applications; or (ii) can ultimately be developed under the 2500 afy Permit.

g. **Issuance of Further Rights to Tribe under LVVWD Groundwater Applications.** All Parties hereto shall withdraw their pending protests, if any, against the LVVWD Groundwater Applications. No Party shall oppose (or assist others to oppose), in any administrative or judicial proceeding or otherwise, any issuance to the Tribe by the State Engineer of additional groundwater rights under an LVVWD

Groundwater Application in the form of a permit or certificate ("Further Permit or Certificate"), except that LVVWD may contend in the Appeal or any remand therefrom that, as provided in state Engineer Ruling 5115, the 2500 afy Permit should be for 2500 afy with a maximum diversion of 5 cfs and that Application 54076 should be held in abeyance pending completion of the groundwater study ordered in State Engineer Order 1169. No Party hereto may oppose (or assist others to oppose) in any administrative or judicial proceeding or otherwise, any Tribal application to have an LVVWD Groundwater Application acted on by the State Engineer on a piecemeal basis over time, by dividing the LVVWD Groundwater Application into increments or by comparable means.[1]

h. **Change Applications.** No Party hereto may oppose (or assist others to oppose) in any administrative or judicial proceeding or otherwise, the granting by the State Engineer of the LVVWD Change Applications, or any Tribal application under a LVVWD Groundwater Application, the 2500 afy Permit, or a Further Permit or Certificate: (i) to change any point of groundwater diversion thereunder to any location on or off the Reservation within the

[1] The Tribe acknowledges that the State has previously advised that the State Engineer does not decide groundwater applications on a piecemeal basis.

California Wash Hydrographic Basin, which lies at least one mile (in the case of a carbonate aquifer well) and two miles (in the case of an alluvial well) from Muddy Springs and the Muddy River; or (ii) to change any use or place of use of groundwater thereunder to facilitate the beneficial use thereof on or off the Reservation.

i. **Tribal Acquisition of Additional Groundwater Rights.** Subject to the protest rights of any other Party hereto (except for those relinquished under ¶¶ 3.g and h above), nothing in this Agreement shall prejudice the Tribe's right to apply under State law to the State Engineer either (i) for further groundwater rights appurtenant to the Reservation, or (ii) for transfer to the Reservation of State law-based groundwater rights having points of diversion or places of use located off the Reservation.

4. Provision of Surface Water Rights.

a. **Muddy River.** The Muddy River flows through the Reservation and the Tribe claims an unadjudicated 1873 federally-reserved water right in the river. MVIC holds legal title to certain State surface water rights in the Muddy River ("MVIC Surface Water Rights")

awarded in a Judgment and Decree dated March 12, 1920, (IiMuddy River Decree"), in *Muddy Valley Irrigation Co., et 01.* v. *Moapa and Salt Lake Produce Co., et 01.,* in Nevada's Tenth Judicial District Court (now Nevada's Eighth Judicial District Court). The Muddy River Decree also purported to award the Tribe surface water rights in the Muddy River appurtenant to the ReseNation of 1.242 cfs (Apr. - Sept.) and 0.87 cfs (Oct. - MaL). However it is the position of the Tribe that the Court did not have jurisdiction to adjudicate the Tribe's water rights, and the Tribe shall not claim or use the awarded right while the Surface Water Lease provided under ¶ 4.b below is in force. Each shareholder in MVIC holds, pursuant to its shares, a beneficial interest in MVIC Surface Water Rights, and collectively all MVIC shareholders hold all beneficial interests in all MVIC Surface Water Rights.

b. **Lease of MVIC Surface Water Rights.** Contemporaneous with the Tribe's execution of the MOA, MVIC and the Tribe shall enter into the lease attached hereto as Exhibit C (liSurface Water Lease"). The Surface Water Lease provides a rent-free 99-year lease of a portion of MVIC Surface Water Rights to the Tribe, sufficient to provide the Tribe with the right to divert at the existing Muddy River diversion

points on the Reservation and beneficially use on the Reservation 11.5 cfs (Apr. - Sept.) and 10.5 cfs (Oct. - Mar.), subject to a maximum consumptive use limit of 3700 afy. The Surface Water Lease further provides that if the Tribe wishes, at any time during the term thereof, to change the manner of use or place of beneficial use within the Reservation of MVIC Surface Water Rights covered by the Surface Water Lease, MVIC shall fully cooperate with the Tribe in the preparation, filing and pursuit of State Engineer approval of a change application necessary to effect such change. No other Party hereto shall oppose (or assist others to oppose) the granting of such change application. The Surface Water Lease further provides that the Tribe's right to divert and use water pursuant to the Surface Water Lease is, as a matter of contract, functionally senior to the rights of all shareholders in MVIC to divert and use water pursuant to the MVIC Surface Water Rights. The Surface Water Lease is renewable on the same terms and conditions at the end of the 99-year term for an additional 99 years at the Tribe's option, provided that the Surface Water Lease is terminable as provided in ¶ 8 below. In exercising its rights under the Surface Water Lease, the Tribe shall otherwise have all rights and privileges, and be bound by all substantive and procedural laws, principles and rules, applicable

to owners of MVIC Surface Water Rights, including without limitation with respect to beneficial use and changes in the point of diversion, place of use and manner of use. The foregoing notwithstanding, the Surface Water Lease does not expressly or impliedly have the effect in law or in equity, of making the Tribe a shareholder in MVIC for any purpose,

c, **Conditions Precedent Nos. 4 and 5.** The following are two additional conditions precedent that must be satisfied to trigger the Tribe's obligation to execute the MOA:

i. execution and delivery to the Tribe of the Surface Water Lease; and

ii. State Engineer approval of the two filed change applications authorizing the Tribe to divert at the existing points of diversion for the Reservation and beneficially use on the Reservation the MVIC Surface Water Rights covered by the Surface Water Lease.

5. Provision of Mitigation Surface Water Rights.

a. **Pumping Limits.** As reflected in paragraph 1(5)(e) - (g) of the attached MOA, the Tribe is prepared to agree therein that on-Reservation pumping under the 2500 afy Permit shall be reduced to specified amounts ("Pumping Limits") if flow levels at the Warm Springs West flume decline to specified levels, The Tribe believes, however, that monitoring data and sound hydrogeologic analysis show and will continue to show that on-Reservation pumping under the 2500 afy Permit will not appreciably impact flows as measured at the Warm Springs West flume. Nevertheless, the Tribe Is prepared to agree to the Pumping Limits principally because:

i. as provided in paragraph 1(6) of the MOA, the validity of the Pumping Limits will be regularly reconsidered by the Hydrologic Review Team on the basis of monitoring data and hydrogeologic analysis, and, as appropriate, adjusted; and

ii. MVWD has agreed to mitigate the effects of the Pumping Limits as provided in ¶ 5.b below,

b. **Mitigation Surface Water Rights.** To mitigate the effects of the Pumping Limits, the surface water rights described in subparagraph i. below (the IIMitigation Surface Water Rights") shall be available for use by the Tribe:

i. Subject to the approval of any necessary change application(s) as provided in subparagraph ii(3) below, upon the Tribe's execution of the MOA, the Tribe shall have the right, at no charge and free and clear of liens and encumbrances, to divert water from the Muddy River, at the existing Muddy River diversion points on the ReseNation, at a maximum rate of 1 cfs, subject to a maximum diversion and consumptive use limit of 520 afy, from MVWD's IIJones Water Right" (Certificate No. 10060) dedicated to in-stream flows in accordance with paragraph 1(2)(a) of the MOA. Such Mitigation Surface Water Rights shall be useable by the Tribe only during times, and only to the extent, that a Pumping Limit of less than 2500 afy is being implemented. At all times, and in all other respects, MVWD's Jones Water Right shall remain under the ownership and control of MVWD. The Tribe's use of the Mitigation Surface Water Rights will be monitored in accordance with ¶ 10 below.

ii. **Characteristics of Mitigation Surface Water Rights.** The Mitigation Surface Water Rights shall have the following characteristics:

(1) they shall be subject to reversion under ¶ 7 below;

(2) they shall provide to the Tribe a right to divert and use such water from the Muddy River;

(3) they shall be available for municipal use anywhere on the Reservation and, to facilitate such diversion and use, MVWD in consultation with the Tribe shall timely develop, file and secure issuance by the State Engineer of all legally required approvals of any necessary change applications. Any costs associated with the securing necessary approvals of any such change applications shall be born equally by the Tribe and MVWD;

(4) they sholl be additive to the Tribe's rights under the Surface Water Lease to be provided under ¶ 4.b above; and

(5) in exercising the Mitigation Surface Water Rights, the Tribe shall have all rights and privileges, and be bound by all substantive and procedural laws, principles and rules, applicable to other owners of surface water rights in the Muddy River, including without limitation with respect to beneficial use and changes in the point of diversion, place of use and manner of use.

(6) MVWD agrees to keep the Jones Water Right or successor rights in good standing for so long as MVWD's obligation under this paragraph 5 is in existence. A copy of this Agreement shall be filed with the Office of the Nevada State Engineer and any successor to or assignee of MVWD shall be bound this paragraph 5.

6. State Law. The 2500 afy Permit LVVWD Groundwater Applications and any Further Permit or Certificate acquired by the Tribe under ¶ 3 above, the Surface Water Lease acquired by the Tribe under ¶ 4.b above, and the Tribe's right to use the Mitigation Surface Water Rights under ¶ 5.b above, and any Tribal change application with respect to any of the foregoing, shall be held, sought made and utilized by the Tribe in accordance with State law, both substantive and procedural. Without limitation, no such water right may be

transferred by the Tribe for use at an off-ReseNation location without compliance with state law. In addition, the provisions of ¶¶ 7 and 8 below shall be interpreted and enforced in accordance with state law. All of the foregoing shall be enforceable in administrative and jUdicial forums specified in State law for injunctive or declaratory enforcement of such water rights matters, and the Tribe hereby waives its sovereign immunity for the exclusive purpose of such enforcement in such forums, and as to any appeals therefrom in any appellate courts with jurisdiction over such appeals under state law. The Tribe hereby waives and foregoes any right to claim that exhaustion of Federal or Tribal court remedies is a prerequisite to any action by any Party to enforce the provisions of this ¶ 6 in the specified state administrative or judicial forums. However, no Party shall ever contend that any water right acquired by the Tribe under ¶¶ 3, 4.b or 5.b above has been abandoned or forfeited.

7. **Reversion of 2500 afy Permit, LVVWD Groundwater Applications, Further Permit or Certificate, and Mitigation Surface Water Rights.** Ownership of the 2500 afy Permit, LVVWD Groundwater Applications and any Further Permit or Certificate acquired by the Tribe under ¶ 3 above and the Tribe's entitlement to the Mitigation Surface Water Rights under ¶ 5.b above (collectively "Rights Subject to Reversion") shall revert to LVVWD or MVWD, as the case may be, as follows:

a. **Reversion.** The Rights Subject to Reversion shall revert if, prior to consummation of the WSA, the Tribe (or the United States on behalf of the Tribe)1 in any administrative or judicial proceeding, seeks federally-reserved groundwater rights appurtenant to the Reservation in excess of 14,480 afy ("Groundwater Reversion Trigger") or seeks federally-reserved surface water rights in the Muddy River appurtenant to the Reservation having diversion rates in excess of **11.5** cfs (Apr. - Sept.) and 10.5 cfs (Oct. - *MaL)1* a consumptive use limit in excess of 3700 *afYI* or a priority date earlier than March *121* 1873 ("Surface Water Reversion Trigger").

b. **Notice.** To exercise the above right of reversion, LVVWD or MVWD, as the case may *bel* must give the Tribe written notice of its intention to do so and the grounds therefor, and 120 days to reverse or terminate the Groundwater Reversion Trigger or Surface Water Reversion Trigger, as the case may be.

8. Termination of Surface Water Lease. The Surface Water Lease provided to the Tribe under ¶ 4.b above will instantly terminate upon the first occurrence of any of the following:

a. **Surface Water Reversion Trigger.** Occurrence of the Surface Water Reversion Trigger as defined in ¶ 7,a above, the giving of notice thereof by MVIC in the same manner provided in ¶ 7,b above, and the failure of the Tribe to reverse or terminate the Surface Water Reversion Trigger within the 120-day period specified in the notice,

b, **WSA.** "Judicial Confirmation" of the Tribe's federally-reserved water rights in the Muddy River as contemplated by the WSA.

c, **Adjudication.** Failing consummation of the WSA, adjudication in a court of competent jurisdiction of the Tribe's federally-reserved rights in the Muddy River appurtenant to the Reservation,

9. Change Applications in Case of Reversion or Termination. In the event of a reversion of Rights to Subject to Reversion under ¶ 7 above, or termination of the Surface Water Lease under ¶ 8 above, the Tribe shall cooperate with and not oppose the granting of any change applications reasonably necessary to restore the involved water rights to their original place of diversion, place of use and manner of use,

10. Monitoring Plan. The Parties shall in good faith diligently and cooperatively establish, agree on, and as necessary adjust over time a written plan for monitoring their respective uses of Muddy River water and groundwater from the California Wash Hydrographic Basin and adjacent hydrographic basins, and the water-related impacts therof, if any, Existing on-Reservation monitoring wells shall be incorporated in the monitoring plan and the plan shall be integrated with the Regional Monitoring Plans referred to in recital N of the MOA.

a, **Elements of Monitoring Plan.** Without limitation, such plan shall provide for: installation of appropriate metering devices by all Parties including parshall flumes (if not already installed) to meter the Parties' respective Muddy River diversions, provided that SNWA shall pay all costs of acquiring and installing (if not already installed) parshall flumes at the Muddy River diversion points on the Reservation (which shall be installed within 120 days of the effective date of this Agreement) ; the right of each Party to inspect diversion facilities, measuring devices (including any well meters) and pumping and diversion data of all other Parties; and appropriate methods for determining the Muddy River diversion rates, annual diversion amounts, and annual consumptive use amounts of each

Party, and the groundwater pumping rates and annual groundwater withdrawals of each Party.

b. **Interim Monitoring.** Pending finalization of such monitoring plan, each Party, on written notice, shall be accorded the right to reasonably monitor all ground and surface water diversions of any other Party from the Muddy River, the California Wash Hydrographic Basin and the hydrographic basins adjacent thereto, including reasonable access to and inspection of diversion facilities, measuring devices (including well meters) and pumping and diversion data.

11. Notices. All notices and communications given hereunder shall be in writing and shall be delivered by fax and first class, certified or registered mail, postage prepaid, to the fax numbers and addresses shown below, or to such other fax number or addressee as the Party entitled to notice may designate from time to time. Any notice given hereunder shall be deemed to be effective upon receipt.

If to Tribe: Chairperson, Moapa Band of Paiute Indians
Post Office Box 340
Moapa, Nevada 89025
Fax: 702-865-2875

with copies to: Steven H. Chestnut
Richard M. Berley
Ziontz, Chestnut, Varnell, Berley & Sionim
2101 Fourth Avenue, Suite 1230
Seattle, Washington 98121
Fax: 206-448-0962

If to LVVWD: General Counsel
Las Vegas Valley Water District
1001 South Valley View Boulevard
Las Vegas, Nevada 89153
Fax: 702-258-3268

If to SNWA: General Counsel
Southern Nevada Water Authority
1001 South Valley View Boulevard
Las Vegas, Nevada 89153
Fax: 702-258-3268

If to MVIC: General Manager
Muddy Valley Irrigation Company
Box 665
Overton, Nevada 89040
Fax: 702-397-6013

If to MVWD: General Manager
Moapa Valley Water District
Post Office Box 257
Logandale, Nevada 89021
Fax: 702-397-6894

12. No Waiver. No failure by a Party to insist upon the strict performance of any term or condition of this Agreement, or to exercise any right or remedy consequent upon noncompliance therewith, shall constitute a waiver of any such term or condition, it being understood that any such waiver shall require the written agreement of such Party.

13. Amendment. All amendments or modifications of this Agreement shall be effective only when reduced to writing and signed by all Parties.

14. Further Documents and Action. The Parties shall execute all further documents and do all further things as may reasonably be necessary to give full force and effect to the provisions of this Agreement.

15. Interpretation. This Agreement shall be construed as a whole and in accordance with its fair meaning. Captions are used for convenience and shall not be used in construing meaning.

16. Successors. Every obligation, term and condition of this Agreement shall extend to and be binding upon, and every right and benefit hereunder shall inure to, the assignees, transferees or other successors of the respective Parties by operation of law or otherwise.

17. Representations and Warranties of Authority. Each Party represents and warrants as follows: (a) that it and the individual executing the Agreement on its behalf is fully empowered and authorized to execute and deliver this Agreement; (b) that it is fully empowered and authorized to approve and perform this Agreement; (c) that this Agreement is binding on its interest at the

moment of execution and for so long as this Agreement is in effect; (d) that its governing body has authorized and approved the foregoing representations and warranties by duly adopted written resolution, a copy of which will be provided to the other Party on execution of this Agreement; and (e) that it has obtained all approvals necessary to enter into and perform this Agreement, including without limitation the Tribe's taking of all actions necessary to accomplish the Tribe's waivers of sovereign immunity set forth herein and delivery by MVIC to the Tribe of a shareholder resolution approving this Agreement and the Surface Water Lease.

18. Counterparts. This Agreement may be executed and approved in multiple counterparts, each of which shall be deemed an original.

19. Dispute Resolution. In ¶ 6 above, the Tribe has expressly granted a waiver of sovereign immunity with respect to the enforcement of certain matters set forth in ¶ 6. Further, if a dispute should arise among the Tribe and any other Party or Parties with respect to the meaning or enforcement of any provision of this Agreement, any Party to the dispute may seek to resolve it only through a suit among such Parties brought in the Eighth Judicial District Court, Clark County, Nevada. The Tribe hereby waives its sovereign immunity as to such suits in such Court with respect to declaratory or injunctive relief only, and as to any

appeals therefrom in appellate courts with jurisdiction over such appeals under state law. The Tribe hereby waives and foregoes any right to claim that exhaustion of Federal or Tribal court remedies is a prerequisite to any action brought in state court under this ¶ 19.

20. Entire Agreement. This Agreement constitutes the entire agreement among the Parties with respect to the matters covered hereby, and subsumes and incorporates all prior written and oral statements and understandings.

MOAPA BAND OF PAIUTE INDIANS

By _ Date: _
Chairman

LAS VEGAS VALLEY WATER DISTRICT

By _ Date: _
President

SOUTHERN NEVADA WATER AUTHORITY

By _ Date: _
Chair

MUDDY VALLEY IRRIGATION COMPANY

By _ Date: ___
Chairman of the Board

MOAPA VALLEY WATER DISTRICT

By _ Date: _
Chairman of the Board