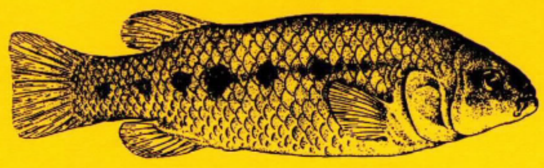

RAILROAD VALLEY SPRINGFISH RECOVERY PLAN

U.S. Department of the Interior
Fish and Wildlife Service

RAILROAD VALLEY SPRINGFISH
Crenichthys nevadae

RECOVERY PLAN

U.S. Fish and Wildlife Service
Region 1
Portland, Oregon

Approved: ______________________
Regional Director

Date: 3/17/97

DISCLAIMER

Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect Federally listed threatened and endangered species. Plans are published by the U.S. Fish and Wildlife Service (Service), sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Recovery teams serve as independent advisors to the Service. Plans are reviewed by the public and submitted to additional peer review before being adopted by the Service. The objectives of the recovery plan will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not obligate other parties to undertake specific tasks, and may not represent the views, official positions, or approval of any individual or agency involved in the plan formulation, other than the Service. They represent the official position of the Service *only* after they have been signed by the Director or appropriate Regional Director as *approved.* Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and completion of recovery tasks.

By approving this document, the Service certifies that the data used in its development represent the best scientific and commercial data available at the time it was written. Copies of all documents reviewed in the development of this plan are available in the administrative record, which is maintained at the Service's Nevada State Office in Reno, Nevada.

Literature Citation should read as follows:

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5340 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814
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The fee for this recovery plan will be based on the number of pages it contains.

ACKNOWLEDGMENTS

This recovery plan was prepared by Donna Withers of the Service's Nevada State Office, Reno, Nevada. The Nevada State Office of the U.S. Fish and Wildlife Service appreciates the efforts of those individuals and agencies who reviewed and commented on the draft version of this document, as identified in Appendix A. Comments have been incorporated into this final document as appropriate, and are summarized in Appendix B.

EXECUTIVE SUMMARY OF THE RAILROAD VALLEY SPRINGFISH RECOVERY PLAN

Current Status: Railroad Valley springfish (*Crenichthys nevadae*) are endemic to six thermal spring systems in Railroad Valley, Nye County, Nevada, and have been introduced into four other springs in Nevada. Railroad Valley springfish are extant in all historical habitats and three of the introduced habitats, with populations varying from fewer than one hundred to several thousand individuals. The species was listed as threatened in 1986 because suitable habitat had decreased since the species was discovered in the 1930's. Portions of all six historical habitats have been designated critical habitat.

Habitat Requirements and Limiting Factors: Railroad Valley springfish require thermal spring habitats with water temperatures ranging from 29° to 36° Celsius (84° to 97° Fahrenheit) and adequate supplies of aquatic vegetation and invertebrates. Primary factors limiting this species include habitat alteration, water diversion, nonnative aquatic species introductions, and ground water depletion.

Recovery Objective: Delist

Recovery Criteria: Railroad Valley springfish may be considered for delisting when (1) all six historical spring habitats are protected from adverse modifications through conservation agreements, easements, or fee title acquisitions; and (2) at least 21,000 adult Railroad Valley springfish are present among the 6 springs, with each population containing at least 1,000 adults and documented annual reproduction and recruitment, for 5 consecutive years. Existing introduced populations should be maintained as refugia, but are not required for recovery.

Actions Needed:
1. Protect Railroad Valley springfish habitats from adverse modifications.
2. Improve and manage Railroad Valley springfish habitats and populations.
3. Monitor Railroad Valley springfish populations and habitats.
4. Establish a public information program.

Total Estimated Cost of Recovery: $570,000

Date of Recovery: Delisting of the Railroad Valley springfish could be initiated in 2004, if tasks are implemented as recommended and recovery criteria are met.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Railroad Valley Springfish
(Crenichthys nevadae)
Recovery Plan

Part I. INTRODUCTION

A. Brief Overview

The Railroad Valley springfish (*Crenichthys nevadae*) is the only fish species native to the thermal spring systems of Railroad Valley, Nye County, Nevada. Railroad Valley springfish currently occupy all six known historical habitats, as well as three additional habitats outside the species' historical range (Figure 1). The Railroad Valley springfish was listed as a threatened species with critical habitat pursuant to the Endangered Species Act of 1973, as amended (ESA), on March 31, 1986, because available habitat at each spring had decreased since the species' description in 1932 (51 Federal Register 10857). The historical populations have been impacted to various degrees by habitat loss and modification resulting from water diversion, nonnative fish introductions, and ground water depletion.

The Fish and Wildlife Service assigned the Railroad Valley springfish a recovery priority of 2C, indicating that this species has a high degree of threat and existing conflicts to recovery, but a high recovery potential. Recovery of Railroad Valley springfish will require landowner cooperation to prevent further adverse habitat modification and allow for habitat restoration.

B. Species Taxonomy and Description

The springfish genus *Crenichthys* includes Railroad Valley springfish and five subspecies of White River springfish (*C. baileyi*). The genus and the Railroad Valley springfish species were described from specimens collected in 1930 from Big Warm Spring, Duckwater, Nye County, Nevada (Hubbs 1932). The genus *Crenichthys* is related to the killifish genus *Empetrichthys*, but differs in coloration, placement of the dorsal and anal fins, and several morphological features related to feeding habits (Hubbs 1932). In 1980, the common name of the genus *Crenichthys* was changed from "killifish" to "springfish" in deference to selection of the genus name based on the species' occupation of spring

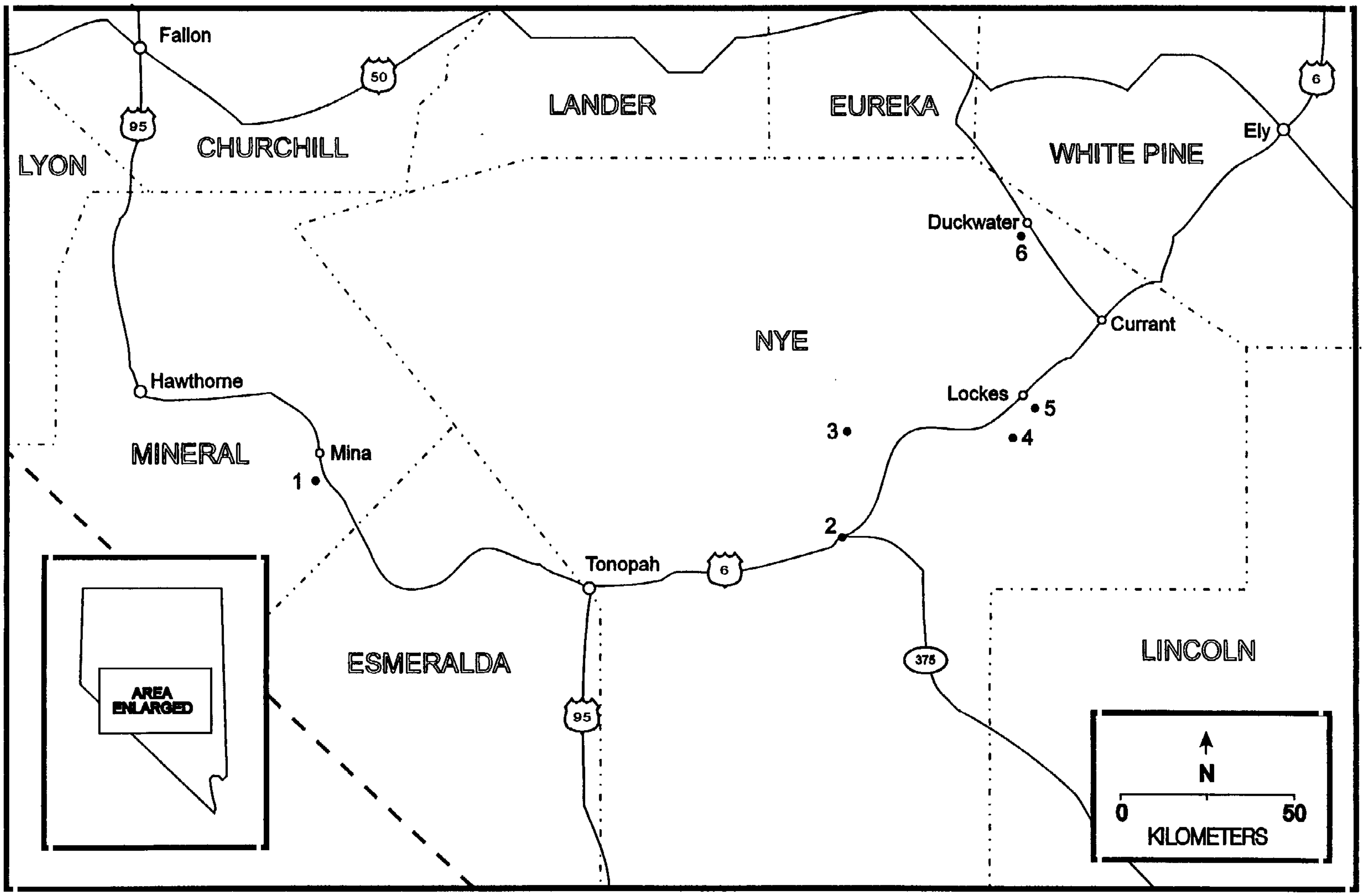

Figure 1. Distribution of Railroad Valley springfish populations: 1) Sodaville (introduced); 2) Warm Spring (introduced); 3) Dugan Ranch (introduced); 4) Chimney Spring (introduced); 5) North Spring, Hay Corral Spring, Reynolds Springs, and Big Spring; and 6) Big Warm Spring and Little Warm Spring.

habitats (Hubbs 1932; Bailey, et al. 1970; Robins, et al. 1980; Williams and Wilde 1981).

Railroad Valley springfish and White River springfish occupy adjacent drainage systems that have no current hydrologic connections. The two species can be identified by differences in coloration. Both species vary from yellow to olive to gray on the top half of the body with a dark stripe extending along the dorsal surface from snout to tail, and are silver on the bottom half (La Rivers 1962). Railroad Valley springfish, however, possess a single row of lateral dark spots down the length of their sides, whereas White River springfish have two rows of lateral spots (Hubbs and Miller 1941).

The Railroad Valley springfish has a chunky body that is two-thirds as wide as deep and a very large head. This fish lacks pelvic fins, while its dorsal and anal fins are set far back, and pectoral fins are set low but with a vertical base. Jaw teeth occur in a single row and are bicuspid (Hubbs 1932). The average total length of Railroad Valley springfish varies between 23 and 39 millimeters (0.9 and 1.5 inches), depending on the spring it occupies, although individuals may attain a total length exceeding 70 millimeters (2.7 inches). Railroad Valley springfish from Big Warm Spring and Little Warm Spring are generally larger than those from Big Spring and Chimney Spring. Big Warm Spring fish are the largest overall with an average total length of 34.5 millimeters (range 13 millimeters to 72 millimeters) (1.4 inches; range 0.5 to 2.8 inches). Fish in the Big Spring population averaged 24.2 millimeters total length (range 10 millimeters to 48 millimeters) (1 inch; range 0.4 to 1.9 inches) (Williams 1986).

C. Associated Proposed Species and Species-of-Concern

In May 1992, the Fish and Wildlife Service proposed to list *Astragalus lentiginosus* var. *sesquimetralis* (Sodaville milk-vetch) as a threatened species with no critical habitat (57 Federal Register 19844). This plant occurs near Sodaville, Mineral County, Nevada, where it is restricted to powdery, clay, saline soils adjacent to the springs occupied by an introduced population of Railroad Valley springfish. This plant species was proposed for listing because it is threatened by habitat alteration and destruction associated with off-road vehicle activity and commercial development, and by extinction associated with randomly occurring natural events due to its small population size. Efforts to secure the

Railroad Valley springfish habitat at Sodaville should consider and include protection of *Astragalus lentiginosus* var. *sesquimetralis* habitat.

Several other species occur in Railroad Valley that are of concern to the Fish and Wildlife Service. However, they are neither proposed nor candidates for listing as threatened or endangered. None of these species-of-concern, however, occur in or immediately adjacent to springs occupied by Railroad Valley springfish. Although actions recommended by this recovery plan may not directly benefit these species-of-concern, several actions may prevent or minimize future habitat disturbances that may adversely affect them. Consideration of these species-of-concern during Railroad Valley springfish recovery activities could promote their conservation and contribute to alleviating the need to list them as threatened or endangered in the future.

Railroad Valley springfish are the only fish native to the thermal springs of Railroad Valley. Railroad Valley tui chub (*Gila bicolor* ssp.), the only other fish native to the valley, occupy cold-water springs and are not found in association with Railroad Valley springfish (Deacon and Williams 1984; Williams and Williams 1981). Efforts to protect the ground water system(s) that support the thermal springs occupied by Railroad Valley springfish could be expanded to also include those systems that support the cold-water springs in Railroad Valley.

Astragalus uncialis (Currant milk-vetch) and *Sphaeralcea caespitosa* (Jones globemallow) are plants that occur in mixed desert shrub communities on gravelly limestone or sometimes sandy soil. The two known populations of *Astragalus uncialis* occur on dry knolls and slopes near Current, Nevada, approximately 30 kilometers (18.6 miles) east of Lockes, Nevada (Mozingo and Williams 1980). *Sphaeralcea caespitosa* has been found in several locations at or near Lockes (Janik, Nevada Department of Transportation, in litt., June 1989). *Asclepias eastwoodiana* (Eastwood milkweed) occurs in low alkaline clay hills or shallow gravelly drainages, usually growing apart from other plants (Mozingo and Williams 1980). This species occurs northwest of Lockes (Janik, in litt., 1989). These three species are upland plants, so it is not likely that Railroad Valley springfish recovery activities directed at aquatic and riparian habitats will directly affect their status. However, if these plants occur within the general vicinity of areas managed for Railroad Valley springfish, they may indirectly benefit from efforts to protect these areas from future habitat disturbance.

The Railroad Valley skipper (*Hesperia uncas* spp.) is restricted to the alkaline saltgrass flats near Lockes. Very little specific information is available for this butterfly, but it was considered relatively common in 1990 (Austin, Nevada State Museum, in litt., 1990). This butterfly lays its eggs on or near grasses that serve as its host plant (Scott 1986). If Railroad Valley skipper host plants occur within the general vicinity of Railroad Valley springfish habitats, the butterfly may benefit from efforts to protect these areas from future habitat disturbance.

D. Distribution and Population Status

Pluvial (ancient) Lake Railroad encompassed as many as six present-day valleys, including Railroad, Reveille, Hot Creek, Little Fish Lake, and Sand Springs Valleys, and an unnamed valley containing pluvial Lake Snyder (Snyder, et al. 1964; Mifflin and Wheat, 1979; Hubbs, et al. 1974). Desiccation of Lake Railroad isolated Railroad Valley springfish into six thermal springs distributed in two areas of Railroad Valley. Big Warm Spring and Little Warm Spring (Figure 2) are on the Duckwater Shoshone Indian Reservation at Duckwater, Nevada. Portions of each outflow cross public lands administered by the Bureau of Land Management. The outflow streams from these springs flow into Duckwater Creek, which also historically supported Railroad Valley springfish (Hubbs, et al. 1974). Big Spring, Reynolds Springs, Hay Corral Spring, and North Spring are approximately 43 kilometers (26.7 miles) south of Duckwater at Lockes, Nevada (Figure 3). Big Spring and Hay Corral Spring originate on private property, but the outflow streams cross public land. North Spring and Reynolds Springs are on public land, although portions of each outflow cross private land. The Reynolds Springs complex consists of two springs, approximately 10 meters (33 feet) apart, whose outflows combine almost immediately. This complex is considered one spring for the purposes of this document.

The status information available for each Railroad Valley springfish population varies from general narrative descriptions of abundance based on visual inspections to numerical population estimates based on intensive censusing efforts. The available data provide general baseline information on the Railroad Valley springfish populations. However, due to differences in personnel

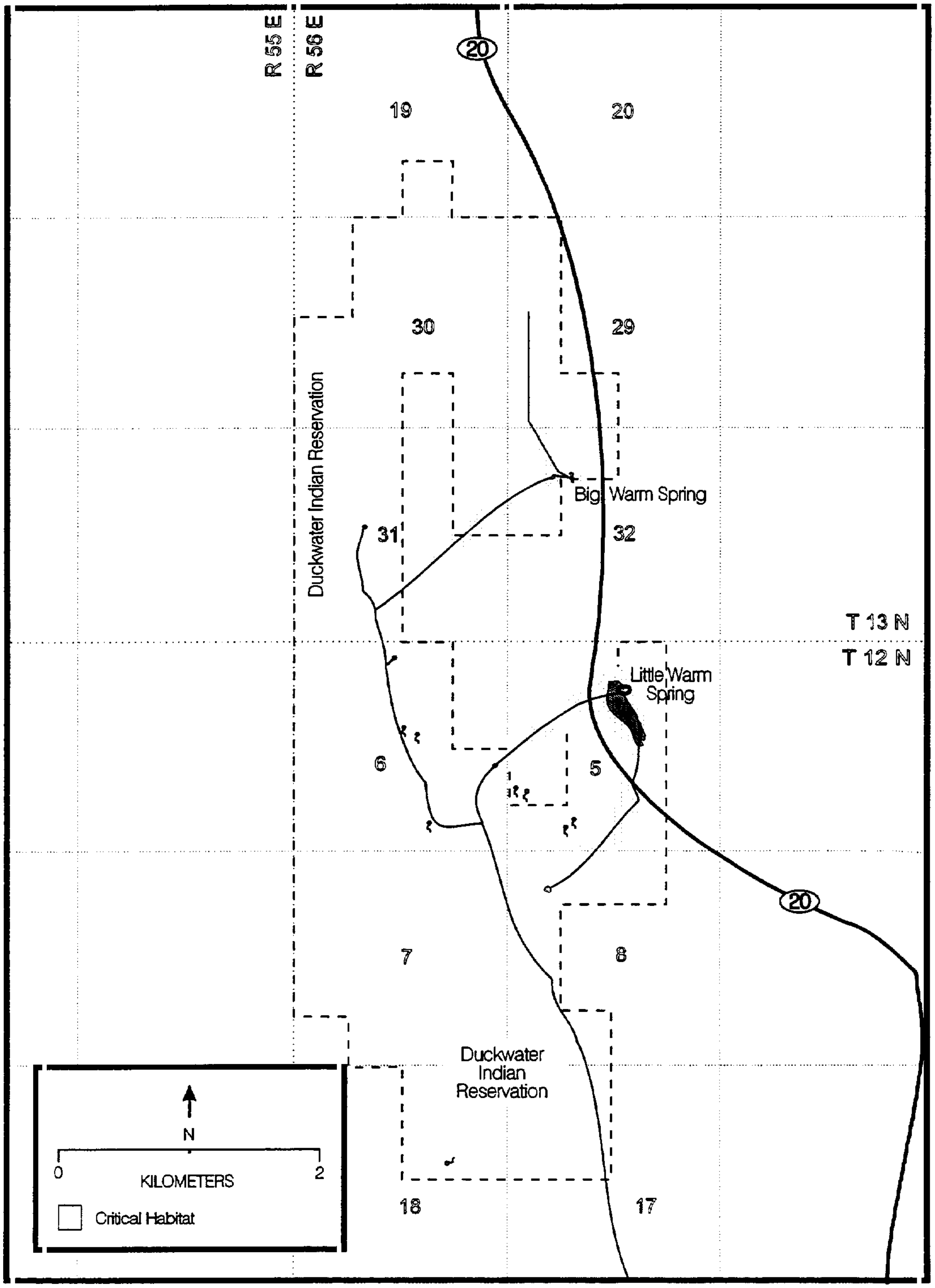

Figure 2. Critical habitat for Railroad Valley springfish at Duckwater, Nevada (Big Warm Spring and Little Warm Spring) (51 Federal Register 10857).

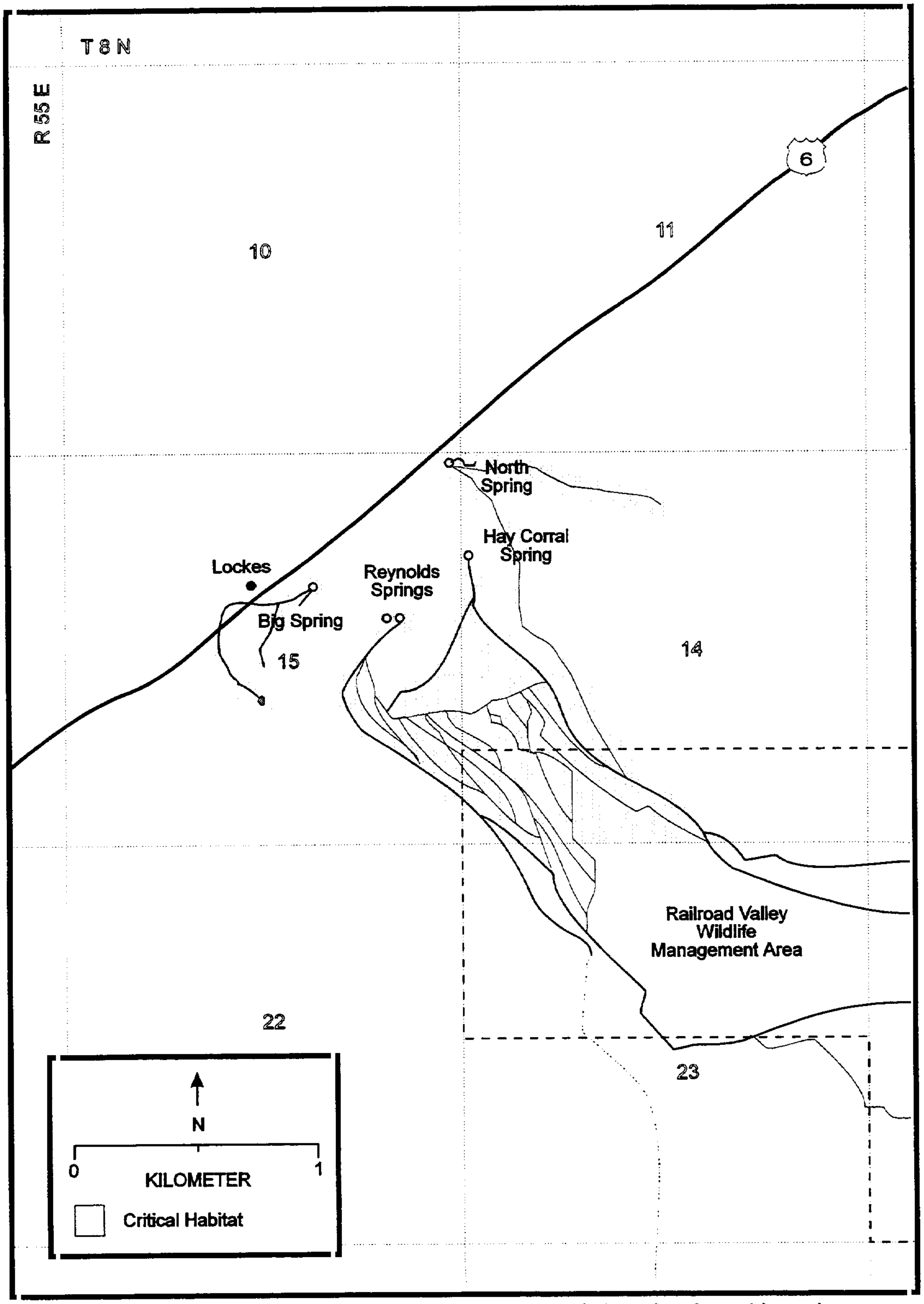

Figure 3. Critical habitat for Railroad Valley springfish at Lockes, Nevada (North Spring, Hay Corral Spring, Reynolds Springs, and Big Spring) (51 Federal Register 10857).

collecting the information, sampling techniques used, actual locations sampled, and time of year sampling was conducted, these data are not strictly comparable and should not be used to indicate actual population status and trends. A standardized methodology is needed to monitor future population status and trends.

Very little population status information is available for the Railroad Valley springfish populations that occur on the Duckwater Indian Reservation. No numerical estimates of population size have been made. The Big Warm Spring population was described as "teeming" and "abundant" during the 1930's, but declined to "exceedingly rare" between 1981 and 1982, following introduction of nonnative fishes and installation of a catfish rearing facility (Table 1). The species persisted in Big Warm Spring in extremely limited numbers for over 10 years. The population rebounded to "abundant" between 1994 and 1996, while the catfish facility was inoperative. Visual observations made during April and sampling conducted during July 1996 suggest that Railroad Valley springfish are the most abundant fish in the system during the late winter and spring, but by mid-summer nonnative fishes are the most abundant (D. Withers, Fish and Wildlife Service, pers. obser, February and May 1996; Stein 1996). Further study is needed to determine the dynamics of this population shift.

A "teeming" population of Railroad Valley springfish occupied Little Warm Spring during 1934, and the springfish remain "common" despite the draining of an associated marsh and diversion of the spring outflow into two ditches (Table 2). In 1986, Railroad Valley springfish occupied the spring pool and both ditches, although densities were greatest in the west ditch. In June 1989, very few Railroad Valley springfish were observed at Little Warm Spring, but the population rebounded and was again "common" by 1992. Data collected during August 1994 and August 1996 suggest the Railroad Valley springfish population fluctuated between these years, but remain abundant to common at Little Warm Spring.

More population status information has been collected for the Railroad Valley springfish populations at Lockes, as compared to those at Duckwater. The Railroad Valley springfish population estimates for Big Spring suggest a downward trend, from approximately 13,000 fish in July 1980, 4,200 fish in

Table 1: Railroad Valley springfish population information and certain water quality parameters for **Big Warm Spring**, Duckwater, Nevada.

Date	Population Size (relative description)	Fish Captured	Fish Captured per Trap Hour	Ave.Total Length (mm)	Total Length Range (mm)	Sample Size	Water Temp (°C)	Dissolved Oxygen (mg/l)	Source
1912							32.5		1
Jul 1930	"abundant"								2
Aug 1938	"teeming"	778			10-55	778			2
Apr 1963							33		1
Jun 1964							32.3	0.5	3
1981				34.5	13-72	1350	30-32		4
Apr 1981				39.1	19-72	139	30		4
Sep 1981				28.7	16-39	121	30		4
Jan 1982		9							4
May 1982	"exceedingly rare"								4
Sep 1986		10	0.2				32.5	3.5	5
Aug 1989	"uncommon"								6
Aug 1992	"rare"								7

Table 2: Railroad Valley springfish population information and certain water quality parameters for **Little Warm Spring**, Duckwater, Nevada.

Date	Population Size (relative description)	Fish Captured	Fish Captured per Trap Hour	Total Length Range (mm)	Sample Size	Water Temp (°C)	Dissolved Oxygen (mg/l)	Source
Sep 1934	"teeming"	1,677		13-71	1,677			1
Nov 1966						32.5		2
Sep 1986		669	7.6			33	1.3-1.9	3
Aug 1989	"uncommon"	47	0.8					4
Aug 1992	"common"							5
Apr 1993	"present"							6
Aug 1994		432	19.0					7
July 1996		265	9					8

Source References

1. Hubbs, et al. 1974
2. Garside and Schilling 1979
3. Withers 1986a
4. Sjoberg 1990
5. Heinrich 1992
6. Heinrich 1994
7. Heinrich, pers. comm. 1995
8. Stein 1996

Table 3: Railroad Valley springfish population information and certain water quality parameters for **Big Spring**, Lockes, Nevada.

Date	Population Size (no. of fish or relative description)	Fish Captured	Fish Captured per Trap Hour	Ave.Total Length (mm)	Total Length Range (mm)	Sample Size	Water Temp (°C)	Dissolved Oxygen (mg/l)	Source
Feb 1934							32.5		1
Sep 1934	"teeming"	1,158			10-55	1,158			2
Jun 1957							39		1
Jun 1964							37	0.9	3
Nov 1966							38		1
Jun 1980	11,393						37	1.6	4
Jul 1980	12,788						38	2.2	4
Aug 1980	7,309						39	1.8-2.4	4
Sep 1980	7,792						38	1.6-2.1	4
1981				24.2	10-48	1,350	35-38		5
Mar 1981				28	13-48	151	35		5
Jul 1981				22.6	13-33	158	37		5
May 1985		165	37.3	39	30-62	165	37	4.5-9.2	6
Sep 1986	"abundant"								7

Table 3: Railroad Valley springfish population information and certain water quality parameters for **Big Spring**, Lockes, Nevada.

Date	Population Size (no. of fish or relative description)	Fish Captured	Fish Captured per Trap Hour	Ave.Total Length (mm)	Total Length Range (mm)	Sample Size	Water Temp (°C)	Dissolved Oxygen (mg/l)	Source
Jun 1988		147	4.5	35	22-60	88	37		8
Aug 1989	4,207		18.6						9
Aug 1991		261	10.2						10
Aug 1992		134	18.1				35		11
Apr 1993	2,657		10.9						12
Jul 1994		121	5.4						12
Jul 1996		60							13

Source References

1. Garside and Schilling 1979
2. Hubbs, et al. 1974
3. Hubbs and Hettler 1964
4. Deacon, et al. 1980
5. Williams 1986
6. Predretti, et al. 1985
7. Withers 1986b
8. Withers 1988b
9. Sjoberg 1990
10. Heinrich 1991
11. Henrich 1992
12. Heinrich, pers. comm. 1994
13. Stein 1996

August 1989, and 2,700 fish in April 1993, to fewer than 100 in 1996 (Table 3). The North Spring population has fluctuated from an estimated 3,300 Railroad Valley springfish in August 1989 to 860 in April 1993, and 3,500 in July 1994 to 930 in July 1996 (Table 4). The Hay Corral population estimate for August 1989 was 2,700 fish, expanded to 5,100 in April 1993, but dropped to 3,200 in August 1996 (Table 5). The Reynolds Springs population of Railroad Valley springfish was estimated to contain 2,600 individuals in August 1989, and 4,500 in April 1993 (Table 6).

Four additional Railroad Valley springfish populations have been established in Nevada outside of the species' historical range (Figure 1). In 1947, Nevada State Fish and Game Commission (now called Nevada Division of Wildlife) personnel released Railroad Valley springfish into ponds on private property at Sodaville, Mineral County, Nevada. The transplant was motivated due to the possibility that largemouth bass (*Salmoides micropterus*) would be released in historical Railroad Valley springfish habitats (La Rivers 1962). Railroad Valley springfish occupy the southernmost of the two spring groups at Sodaville. In 1991, this population was estimated to contain 250 fish, based on visual observations (Sevon 1991). Mark-and-recapture trapping efforts conducted in July 1994, June 1995, and June 1996 resulted in population estimates of 125, 81, and 27 individuals, respectively (Elliott 1994, 1995; Crawforth and Drake 1996). This population is declining as open water habitat becomes overgrown with emergent aquatic vegetation.

In 1977, a population of Railroad Valley springfish was discovered in an unnamed warm spring on private property at the Dugan Ranch in Hot Creek Canyon, Nye County, Nevada, presumably the result of an unauthorized transplant (Allan 1983). In 1984, 1,775 Railroad Valley springfish were captured from the Dugan Ranch spring complex at a rate of 27 fish per trap hour (Deacon 1984). The fish averaged 42.5 millimeters (1.7 inches) total length and ranged from 32 to 76 millimeters (1.3 to 3.0 inches), based on a sample of 100 individuals. Railroad Valley springfish were abundant in the Dugan Ranch spring during the summers of 1990 and 1992 (Sjoberg 1990; Heinrich 1992).

In 1978, Bureau of Land Management and Nevada Division of Wildlife personnel released Railroad Valley springfish from Big Spring into three ponds created at Chimney Spring, 10 kilometers (6.2 miles) south of Lockes (Williams 1986).

Table 4: Railroad Valley springfish population information and certain water quality parameters for **North Spring**, Lockes, Nevada.

Date	Population Size (no. of fish)	Fish Captured	Fish Captured per Trap Hour	Ave. Total Length (mm)	Total Length Range (mm)	Sample Size	Water Temp(°C)	Dissolved Oxygen (mg/l)	Source
Feb 1934							35		1
1981							24-34		2
Sep 1985		24	1	39	30-55	24	35	2.1	3
Sep 1986		271	13.6	31	22-48	112	35	1.8	4
Apr 1987		483	26.8						5
Jun 1988		210	8.4	35	22-38	31	35		6
Aug 1989	3,268		3.0				36		7
Aug 1991		139	1.5						8
Aug 1992		60	8.9				34		9
Apr 1993	856		2.3						10
Jul 1994	3,536	240	6.8						10
Jul 1996	933	209	28						11

Source References
1. Garside and Schilling 1979
2. Williams 1986
3. Pedretti, et al. 1985
4. Withers 1986b
5. Withers 1987
6. Withers 1988b
7. Sjoberg 1990
8. Heinrich 1991
9. Heinrich 1992
10. Heinrich, pers. comm., 1994
11. Stein 1996

Table 5: Railroad Valley springfish population information and certain water quality parameters for **Hay Corral Spring**, Lockes, Nevada.

Date	Population Size (no. of fish or relative description)	Fish Captured	Fish Captured per Trap Hour	Ave.Total Length (mm)	Total Length Range (mm)	Sample Size	Water Temp(°C)	Dissolved Oxygen (mg/l)	Source
Feb 1934							34		1
1981							29-35		2
Aug 1985		805	20.6	42	30-60	100	34	4.8	3
Sep 1985		332	20.8	38	28-60	100	32	7.5	3
Sep 1986	"abundant"						32	5.0	4
Jun 1988		397	16	39	30-66	60	34		5
Aug 1989	2,705		2.7						6
Aug 1991		438	58.4						7
Aug 1992		460	68.1						8
Apr 1993	5,055		11.6						9
Jul 1994		592	32.9						9
Jul 1996	3,200	740							10

Source References
1. Garside and Schilling 1979
2. Williams 1986
3. Pedretti, et al. 1985
4. Withers 1986b
5. Withers 1988b
6. Sjoberg 1990
7. Heinrich 1991
8. Heinrich 1992
9. Heinrich, pers. comm. 1994
10. Stein 1996

Table 6: Railroad Valley springfish population information and certain water quality parameters for **Reynolds Springs**, Lockes, Nevada.

Date	Population Size (no. of fish)	Fish Captured	Fish Captured per Trap Hour	Ave.Total Length (mm)	Total Length Range (mm)	Sample Size	Water Temp(°C)	Dissolved Oxygen (mg/l)	Source
Nov 1966							37		1
Jan 1981							35		2
Sep 1985		140	7	37	28-54	140	36	1.7-2.2	3
Sep 1986		367	13.6	29	23-49	75	37	1.9-2.0	4
Apr 1987		386	24.1						5
Jun 1988		757	25.2	27	20-42	27	37		6
Aug 1989	2,645								7
Aug 1991		126	15.3						8
Aug 1992		201	27.5						9
Apr 1993	4,514		10.5						10
Jul 1994		462	22.0						10

Source References

1. Garside and Schilling 1979
2. Williams 1986
3. Pedretti, et al. 1985
4. Withers 1986b
5. Withers 1987
6. Withers 1988b
7. Sjoberg 1990
8. Heinrich 1991
9. Heinrich 1992
10. Heinrich, pers. comm., 1994

Table 7: Railroad Valley springfish population information and certain water quality parameters for **Chimney Spring**, Railroad Valley, Nevada.

Date	Population Size (no. of fish or relative description)	Fish Captured	Fish Captured per Trap Hour	Ave.Total Length (mm)	Total Length Range (mm)	Sample Size	Water Temp (°C)	Dissolved Oxygen (mg/l)	Source
Nov 1965							66		1
Nov 1978	100								2
Jan 1981	"abundant"						66		3
Aug 1981	0								3
May 1982	50								3
May 1985	1,881			41	29-65	267	66	2.1	2
Sep 1985		382	42.4	38	30-65	50	66	2.1	4
Sep 1986	"abundant"						66		5
Jun 1988	0						65		3, 6
Jun 1989	836						63		3
Aug 1991		831	27				66		7
Aug 1992		382	26						8
Apr 1993			14.0						9

Table 7: Railroad Valley springfish population information and certain water quality parameters for **Chimney Spring**, Railroad Valley, Nevada.

Date	Population Size (no. of fish or relative description)	Fish Captured	Fish Captured per Trap Hour	Ave.Total Length (mm)	Total Length Range (mm)	Sample Size	Water Temp (°C)	Dissolved Oxygen (mg/l)	Source
Aug 1994	5,838	732	55.3						9

Source References
1. Garside and Schilling 1979
2. Williams 1986
3. Williams and Williams 1989
4. Pedretti, et al. 1985
5. Withers 1986b
6. Withers 1988a
7. Heinrich 1991
8. Heinrich 1992
9. Heinrich, pers. comm. 1994

The Chimney Spring population has had two major setbacks since being established (Table 7). The fish were abundant in all three ponds during January 1981. During June 1981, however, spring discharge decreased to the extent that all fish were extirpated from the Chimney Spring system by early August 1981. Spring discharge increased in late August 1981 and spring flow and water temperature regimes in each pond had been restored by November 1981 (Williams 1986). Railroad Valley springfish from Big Spring were again released into Chimney Spring in May 1982, and the population was estimated to contain 1,900 fish in May 1985.

In May 1988, cattle entered the Chimney Spring livestock exclosure and severely trampled the berms creating the three ponds. By June 1988, no fish remained in the ponds, but a few were observed downstream (Williams and Williams 1989). Following repair of the ponds, these remaining fish recolonized the ponds during 1989, and the resultant population was estimated to contain 5,800 individuals in 1994.

In 1992, The Nevada Division of Wildlife reported a fourth introduced population of Railroad Valley springfish on private property at Warm Spring near the junction of U.S. Highway 6 and Nevada Highway 375, Nye County, Nevada (Figure 1) (Heinrich, Nevada Division of Wildlife, pers. comm., 1992). However, no Railroad Valley springfish were found at this site during a visual survey conducted in the autumn of 1994 (Heinrich, pers. comm., 1994).

E. Habitat Description

Big Warm Spring is the largest spring in Railroad Valley with a discharge that varied from 23.8 cubic meters per minute (6,300 gallons per minute) in 1912 to 22.1 cubic meters per minute (5,828 gallons per minute) in 1963 (Garside and Schilling 1979). Its main spring pool is approximately 24 meters (80 feet) in diameter (Williams 1986). Water temperature at the spring pool has varied between 30° and 33° Celsius (C) (86° and 91° Fahrenheit (F)) (Table 2). The outflow from Big Warm Spring is immediately divided into two channels by a concrete diversion structure. The south outflow extends approximately 1,300 meters (0.8 mile) before cascading over a bluff and joining Duckwater Creek. The north outflow extends approximately 350 meters (0.2 mile) before entering an underground pipe.

Little Warm Spring, located approximately 1.6 kilometers (1 mile) south of Big Warm Spring, discharged 1.1 cubic meters per minute (300 gallons per minute) in 1966 (Garside and Schilling 1979). Water temperatures at the source are relatively constant at 33° C (91° F) (Table 3). The outflow from Little Warm Spring historically was highly vegetated with undercut banks, and flowed into a 7.5-hectare (18.5-acre) marsh. In 1984, a ditch was dug along the eastern side of the marsh to drain it in preparation for agriculture (Williams 1986). This ditch is still in use, although no agricultural development has occurred at the marsh. A second, smaller ditch carries water to the west where it flows over a small bluff approximately 800 meters (0.5 mile) from its source.

The four springs at Lockes are associated with a low hill of calcareous tufa that forms a bluff to the east and south. Their combined outflows produce approximately 6 cubic meters per minute (1,500 gallons per minute) of water (Garside and Schilling 1979). Big Spring, the largest in the Lockes spring complex, issues from the top of the tufa hill. Its discharge was measured at 3.4 cubic meters per minute (900 gallons per minute) in 1934, but between 1957 and 1967, the average discharge was 2.0 cubic meters per minute (528 gallons per minute) (Garside and Schilling 1979). Water temperature at the spring source was 32.5° C (90 .5° F) in 1934, but it has since increased to a range of 35° to 39° C (95° to 102° F) (Table 4). In 1980, the spring pool was 10 meters (33 feet) in diameter, 1.5 meters (5 feet) deep, and flowed into a narrow outflow with water depth decreasing downstream from 0.7 to 0.15 meter (2.3 to 0.5 foot) (Deacon, et al. 1980). The outflow substrate was very soft mud with some sand and carbonate crusting. Current was negligible in the spring pool, but it increased down-gradient from 0.03 to 0.27 meter per second (0.1 to 0.9 foot per second). The outflow from Big Spring is diverted into two channels approximately 100 meters (330 feet) from the source. The northern outflow crosses under U.S. Highway 6, runs parallel to the highway, crosses back under the highway, and then empties into a small livestock water pond. Both outflow channels are generally narrow with an average width of 1 meter (3 feet), although the northern outflow is much broader due to continual trampling by cattle.

Big Spring has been described as providing "borderline natural stressful conditions" for fish life (Deacon, et al. 1980). The spring water is hard and alkaline, generally low in salt, very low in nitrates, and contains some sulfates.

Dissolved oxygen is generally below 50 percent saturation. In 1980, the invertebrate community in Big Spring was low in species diversity, with generally only one representative from any of the eleven major groups present. Invertebrate abundance, however, was quite high, especially in algal mats. Sixty species of algae, belonging to five algal divisions, were identified. Blue green algae (*Cyanophyta* sp.) represented the highest number of species and comprised the majority of the algal biomass in Big Spring. Diatoms (*Chrysophyta* sp.) were the most diverse algal group. Filamentous blue green algae was the main structural component of the aquatic vegetation community of Big Spring. All other algae grew within the masses of blue green algae. Six of the blue green algae species identified may be able to fix atmospheric nitrogen. If so, their presence is uniquely fundamental to the entire trophic structure of Big Spring (Deacon, et al. 1980).

North Spring discharges out of the northeastern side of the tufa hill without forming a pool at a rate that varied from 0.8 cubic meter per minute (200 gallons per minute) in 1934 to 0.6 cubic meter per minute (158 gallons per minute) in 1967 (Garside and Schilling 1979). The spring's outflow stream is diverted into two channels and eventually flows into a marsh. Water temperature at the source fluctuates between 34° and 36° C (93° and 97° F) (Table 5).

Hay Corral Spring is located at the base of the tufa hill on the southeastern side. The spring's main outflow stream is blocked by an earthen dam that creates a pool approximately 30 meters (100 feet) in diameter. The spring's discharge was measured at 2.3 cubic meters per minute (600 gallons per minute) in 1934 but dropped to 1.6 cubic meters per minute (425 gallons per minute) in 1966 (Garside and Schilling 1979). Recorded water temperature of the main spring has recently varied between 32° and 34° C (90° and 93° F) (Table 6). A smaller spring emerges below the dam and its outflow joins that of the main spring to flow into a marsh.

The Reynolds Springs complex issues out of the southern base of the tufa hill. The two springs are approximately 10 meters (30 feet) apart, but their outflow streams combine almost immediately and eventually flow into a marsh. The combined discharge from the Reynolds Springs has varied from 1.1 cubic meters per minute (300 gallons per minute) in 1934, 1.0 cubic meter per minute (275 gallons per minute) in 1967, and 1.3 (330 gallons per minute) in 1971 (Garside and Schilling 1979). Water temperature has fluctuated between 35° and 37° C (95° and 99° F) (Table 7).

Chimney Spring, approximately 10 kilometers (6 miles) southwest of Lockes, issues from the top of a travertine hill approximately 800 meters (0.5 mile) in diameter and 10 meters (30 feet) high. The spring discharge rate was 0.4 cubic meter per minute (100 gallons per minute) in 1934 and 1965 (Garside and Schilling 1979). In 1981, however, the spring discharge decreased significantly in June and did not fully recover until November (Williams 1986). The water from this spring is the hottest in Railroad Valley, ranging from 63° to 66° C (145° to 151° F) (Table 8). The outflow has been channelized and flows into a succession of three ponds before continuing down the side of the hill and seeping into the ground.

Railroad Valley springfish occupy the southernmost of two spring groups at Sodaville. The total discharge from the southern group of springs was measured at 0.2 cubic meter per minute (50 gallons per minute) in 1986, at a temperature of 30° C (86° F) (Garside and Schilling 1979). The thermal spring at the Dugan Ranch had a measured discharge of 1.4 cubic meter per minute (360 gallons per minute) at 34° C (92° F) in 1965 and 1.8 cubic meters per minute (495 gallons per minute) at 36° C (97° F) in 1967 (Garside and Schilling 1979). Warm Spring, also referred to as Nanny Goat Spring, discharged 2.6 cubic meters per minute (675 gallons per minute) of water in October 1965, and it has varied between 60° and 63° C (140° and 145° F) (Garside and Schilling 1979).

F. Critical Habitats

Critical habitat, as defined by section 3 of the ESA, includes 1) The specific areas, within the geographical area occupied by a species at the time of its listing under the ESA, that contain those physical or biological features essential to the conservation of the species and that may require special management considerations or protection; and 2) specific areas, outside the geographical area occupied by the species at the time it is listed, determined to be essential for the conservation of the species.

Railroad Valley springfish critical habitat includes the six springs historically occupied by Railroad Valley springfish along with their pools, portions of the outflow streams and marshes, and a 15-meter (50-foot) riparian zone around all such areas within the following geographical areas (Figures 2, 3): (1) Big Warm Spring - T. 13 N., R. 56 E., NE¼ Sec. 31, SE¼ Sec. 31, and NW¼ Sec. 32; (2) Little Warm Spring - T. 12 N., R. 56 E., Sec. 5; and (3) North Spring, Hay Corral Spring, Big Spring, and Reynolds Springs - T. 8 N., R. 55 E., SW¼ Sec. 11, NW¼ Sec. 14, SW¼ Sec. 14, SE¼ Sec. 15, NE¼ Sec. 15, and SW¼ Sec. 15 (51 Federal Register 10857). Constituent elements for all Railroad Valley springfish critical habitats include clear, unpolluted thermal spring waters ranging in temperature from 29° to 36° C (84° to 97° F) in pools, flowing channels, and marshy areas with aquatic plants, insects, and mollusks.

The areas designated as critical habitat do not include all habitats historically or currently occupied by Railroad Valley springfish. The species historically occurred in Big Warm Spring's outflow stream downstream from designated critical habitat and in Duckwater Creek, which is formed by the combined outflow streams of Big Warm Spring and Little Warm Spring (Hubbs, et al. 1974). That portion of the outflow stream from Big Spring on the north side of U.S. Highway 6 is not designated as critical habitat. No critical habitat is designated for the introduced populations at Sodaville, the Dugan Ranch, and Chimney Springs.

G. Life History and Habitat Requirements

Fish species that evolved as solitary occupants of any given habitat are usually feeding generalists because they have not needed to specialize to compete for limited resources (Deacon and Minckley 1974). True to this pattern, Railroad Valley springfish are indiscriminate and opportunistic feeders, ingesting a wide variety of foods (Williams 1986). An analysis of the stomach contents of Railroad Valley springfish collected from Big Spring indicated that this species is predominately herbivorous during the spring, consuming primarily filamentous algae. Their diet shifts to carnivory by summer, when animal foods comprise 74 percent of the diet, with seed shrimp (ostracods) most important (Williams 1986). Railroad Valley springfish have been observed diving into algal mats, as if for specific food items, and also drift feeding (Deacon et al. 1980).

In general, small fish need to consume a large percentage of their body weight in food every day to meet metabolic demands, which vary directly with water temperature of the occupied habitat (Bond 1979). Research has shown that one White River springfish subspecies that inhabits warm-water springs (36° to 37° C; 96° to 99° F) has a respiratory rate four or more times greater than another subspecies that inhabits cool-water springs (21° C; 70° F). Additionally, White River springfish from a warm spring could survive in a cool spring, but the converse was not true (Sumner and Sargent 1940). The longevity of Railroad Valley springfish has not been determined, but is assumed to average 3 to 5 years based on information available for other fishes that occupy warm water springs (Scoppettone, National Biological Service, pers. comm. May 1996).

Railroad Valley springfish are uniquely adapted to survive in an environment of high water temperature (30° to 38° C (86° to 100° F) at the spring source) and low dissolved-oxygen content (1.5 to 6.0 parts per million) (milligrams per milliliter) (Tables 2-7). This combination of metabolic stresses is well beyond the tolerance levels of most other fish species (Hubbs and Hettler 1964). Thermal tolerances for Railroad Valley springfish from Big Warm Spring have been determined under laboratory conditions (Williams 1986). At 22° C (72° F), the fish were inactive, often resting under rocks except to feed, but when water temperature was increased to 28° C (82°F), fish activity increased substantially. Reproductive behavior was noted when water temperatures were between 28° and 35° C (82° and 95° F), with maximum spawning activity at 30° C (86° F). When water temperature reached 39° C (102° F), the fish began to loose equilibrium, were obviously stressed, and eventually died. In their natural environment, Railroad Valley springfish will occupy habitats with water temperatures at the extremes of their tolerance limits (e.g., 14° C or 40° C; 57° or 104° F) for limited amounts of time. They adjust their body temperatures by moving in and out of areas where the water temperature would be lethal under extended exposure (Williams 1986).

Railroad Valley springfish spawning has never been observed, but may be similar to White River springfish. Kopec (1949) reported that female White River springfish spawning in aquaria deposited one egg at a time. The egg was fertilized by a male as it was deposited and then fell on to the nearest vegetation and adhered tightly. Spawning females would deposit 10 to 17 eggs (1.9

millimeters (0.07 inch) in diameter) with each spawning. After a 5- to 7-day incubation period, the larval springfish would hatch at an average total length of 5.3 millimeters (0.2 inch). After 15 days, the juvenile fish would average 7.8 millimeters (0.3 inch).

Examination of the reproductive organs of Railroad Valley springfish collected from Big Warm Spring and Big Spring revealed differences in developmental timing (Williams 1986). Females from Big Warm Spring had well-developed ovaries from spring through autumn, with the best development during the summer. Ovaries contained an average of 237 eggs during the spring, summer, and autumn, but only 54 during the winter. The number of eggs per female varied among individuals of the same size and month of collection. A moderately positive correlation (r=0.56) existed between total fish length and total number of eggs in the ovary, and a fairly high correlation (r=0.69) between total fish length and number of mature eggs in the ovary. Most females contained several classes of eggs simultaneously, with mature eggs present during the spring, summer and autumn, but absent during the winter.

Spawning at Big Warm Spring, although never actually observed, probably occurs from March through November. Juveniles (fewer than 25 millimeters (1 inch) total length) comprised 16 to 27 percent of the Big Warm Spring population between June and October 1981. Average seasonal adult sex ratios observed between March and November was 1 male per 1.2 females, but varied from 1 males per .9 female in the spring to 1 male per 1.7 females in the autumn (Williams 1986).

Railroad Valley springfish collected from near the terminus of the Big Spring outflow exhibited greatest ovarian development in the spring, with well-developed ovaries in the autumn and winter, but poor development in the summer (Williams 1986). Considerable variation was observed during any given season. The number of eggs per female averaged 185 in spring, 99 in summer, 134 in autumn, and 139 in winter. A moderately positive correlation (r=0.50) existed between total fish length and total number of eggs in the ovary, and a low correlation (r=0.45) between total fish length and the number of mature eggs in the ovary.

Most females in Big Spring contained several classes of eggs during all seasons, although mature eggs were very uncommon during the summer. Spawning in the outflow of Big Spring, although never observed, presumably occurs during the autumn, winter, and spring months (Williams 1986). Deacon, et al. (1980) reported Railroad Valley springfish reproduction and recruitment at Big Spring throughout their June through September study period, although actual spawning was not observed. Railroad Valley springfish eggs were observed on bladderworts along the edges of stands of bulrush. Juveniles comprised 33 to 75 percent of the population from March through November 1981 (Williams 1986). Seasonal adult sex ratio from March through November 1981 averaged 1 male per 1.5 females, but varied from 1 male per 1 female in the spring to 1 male per 1.9 females in the autumn (Williams 1986).

Railroad Valley springfish collected from the outflow within 100 meters (300 feet) of the source of Big Spring had poorly developed ovaries throughout the year (Williams 1986). Presumably, the water temperature in this reach of the outflow exceeds the tolerance limits for Railroad Valley springfish reproduction. Larval fish were not observed in this area.

In 1995, an evaluation of the genetic status of species and subspecies within the *Crenichthys* genus was initiated. Preliminary results suggest that the Railroad Valley springfish at Duckwater are distinct enough from those at Lockes to warrant consideration of the populations in these areas as separate conservation units (Perkins, National Biological Service, pers. comm., May 1996). Should this occur, establishment of a refugial population of Railroad Valley springfish from Duckwater should be considered, but no modification of the recovery objectives for this species is anticipated.

H. Reasons for Listing and Current Limiting Factors

The Railroad Valley springfish was listed as a threatened species because its populations had declined due to the combined or isolated effects of habitat alteration, nonnative aquatic species introductions, and ground water depletion (51 Federal Register 10857). All historical habitats have been modified to various degrees by human activities, reducing suitable habitat for Railroad Valley springfish. The outflow streams from Big Warm Spring, Little Warm Spring, Big Spring, and North Spring are diverted and/or channelized. The spring pools at Big

Warm Spring and Hay Corral Spring are impounded by a concrete diversion structure and an earthen dam, respectively. Aquatic and riparian habitats around North Spring have been trampled and heavily grazed by cattle. The Big Warm Spring population of Railroad Valley springfish had been adversely affected by the introduction of nonnative fish into the spring system. The Chimney Springs population had been extirpated due to loss of spring flow, although it was subsequently reestablished.

The Big Warm Spring population of Railroad Valley springfish has been more severely affected by various physical and biological alterations than the other populations. A concrete diversion structure impounds and divides the spring outflow stream into two channels. The north channel flows into an underground pipe approximately 350 meters (0.8 mile) from the diversion, but the south channel follows the original outflow stream course. Guppies (*Poecilia reticulata*) were introduced into Big Warm Spring in 1979, and rapidly established a reproducing population (Williams, et al. 1985). The Railroad Valley springfish population in Big Warm Spring's main spring pool declined dramatically following the introduction of guppies (Williams 1986). Subsequent undocumented introductions of mollies (*Poecilia* sp.) and mosquitofish (*Gambusia affinis*) have resulted in established populations of these nonnative fishes. In 1996, the dominant fish species in the Big Warm Spring outflow shifted from Railroad Valley springfish in February and May to mollies and mosquitofish in July (Withers, pers. observ., 1996; Stein 1996).

During 1982, channel catfish (*Ictalurus punctatus*) rearing pens were constructed within the south channel at Big Warm Spring. This section of the stream had previously supported the greatest concentration of Railroad Valley springfish in Big Warm Spring (Williams 1986). Observations made shortly after construction revealed no springfish in the vicinity of the catfish pens and predation by the channel catfish was presumed to be responsible (51 Federal Register 10857). A significant shift in species dominance occurred throughout Big Warm Spring following construction of the catfish facility (Williams 1986). Prior to 1982, even though guppies had excluded them from the main spring pool, Railroad Valley springfish were abundant in the outflow streams and accounted for 95 percent of the total fish biomass in Big Warm Spring. During construction of the catfish facility, the outflow stream was widened, and the resultant shallow water habitat allowed the guppy population to expand, so that they soon comprised 95 percent of the total fish biomass.

The catfish pens were removed from the stream channel following the construction of cement rearing ponds adjacent to the stream channel. Water from the stream is diverted into the rearing ponds. Channel catfish, however, escaped out of the rearing ponds and persist in the stream (Heinrich 1992; Stein 1996). The catfish facility was closed for several years, but reopened in June 1996. The facility, which is operated under lease to a private individual, provides income for the Duckwater Shoshone Indian Tribe. The new catfish facility lessee has agreed to install barrier devices and implement necessary management practices to minimize or prevent the escape of catfish and protect the Railroad Valley springfish that have recolonized the stream channel (Sjoberg, Nevada Division of Wildlife, pers. comm., June 1996). The Duckwater Shoshone Indian Tribe has expressed an interest in developing a cooperative management agreement with the Fish and Wildlife Service to address the needs of Railroad Valley springfish, the catfish facility, and other current and future activities on the reservation which will rely on water from Big Warm Spring and Little Warm Spring (Millett, Duckwater Shoshone Indian Tribe Manager, pers. comm., July 1996). The factors that may be currently limiting the Big Warm Spring Railroad Valley springfish population include competition with guppies, mollies, and mosquitofish; predation by channel catfish; and modification of the spring and outflow streams' physical habitat characteristics to those that favor nonnative fishes. Nutrient loading of the outflow stream below the catfish facility may also be a limiting factor but has not been evaluated.

The outflow stream from Little Warm Spring was diverted into two channels and its associated marsh drained in 1984 to improve water delivery to downstream agricultural lands and allow farming of the marsh (Williams 1986). The channels are periodically cleaned with hand tools or heavy equipment to remove aquatic vegetation. Railroad Valley springfish densities decrease after the channels are cleaned, but then rebound (Williams, Bureau of Land Management, in litt., July 1994). Factors currently limiting the Little Warm Spring population include previous habitat modifications and periodic channel maintenance.

The water from the springs in the Lockes area has been used for irrigation and domestic purposes since the 1880's. A bathhouse was constructed over the Big Spring outflow stream in the early 1900's. In 1982, the outflow stream from Big Spring was partially diverted from its channel into an earthen pond, resulting in the desiccation of a major Railroad Valley springfish nursery area (Williams 1986). Undisturbed habitat above the diversion was not suitable Railroad Valley springfish spawning habitat because of its high water temperature. The newly created channel did not provide suitable Railroad Valley springfish habitat because it was narrow and steeply sloped (51 Federal Register 10857). The stream flow was later returned to its previous course. During the summer of 1994, the outflow stream from Big Spring was completely diverted into the western channel, desiccating the northern channel. Water flow was restored to the northern channel, but Railroad Valley springfish did not immediately recolonize the habitat (Withers, Fish and Wildlife Service, pers. obser., October 1994). In July 1996, fish were present in the outflow in low numbers (Stein 1996).

In 1982, a pond was excavated adjacent to the Big Spring outflow near U.S. Highway 6 to provide water for a highway improvement project. The pond was quickly colonized by Railroad Valley springfish and soon supported a large percentage of the Big Spring population. Following discussions with the Bureau of Land Management and Nevada Division of Wildlife, the Nevada Department of Transportation agreed to screen the intake hoses to prevent fish from being drawn through the pump into the water truck. Following completion of the highway project, the pond was left intact because it contained Railroad Valley springfish. In July 1996, the pond was shallow with dense emergent aquatic vegetation and supported only a few Railroad Valley springfish (Withers, pers. observ., 1996). Factors currently limiting the population at Big Spring, as well as North Spring, include habitat modifications resulting from previous water diversions and encroaching emergent aquatic vegetation.

Habitat conditions have remained stable at Hay Corral and Reynolds Springs, with no new human-caused modifications noted (Withers, pers. obser., June 1996). The Railroad Valley springfish habitat provided at Chimney Spring is subject to natural modification resulting from deposition of minerals contained in the spring water. The mineral deposits divert the water flow away from the ponds and make the ponds smaller and shallower

In 1991, an area adjacent to the springs at Sodaville was graded in preparation for construction of a commercial aquaculture facility (Sevon 1991). The combined threat of habitat destruction and nonnative species introductions prompted the Nevada Division of Wildlife to initiate a conservation agreement with the landowner prior to construction of the facility. Before the agreement could be finalized, a dispute, unrelated to the conservation agreement, over water rights erupted and the landowner defaulted ownership to the previous owner. The Sodaville Railroad Valley springfish population has declined as emergent aquatic vegetation encroached on the pond boundaries and stream outflows, limiting the amount of available habitat.

Any event, natural or human induced, that alters the hydrology of the Railroad Valley ground water basin may affect the springs in the valley and their Railroad Valley springfish populations. Chimney Spring experienced decreased water flows during the summer of 1981. Although flows returned to previous levels by winter, the Chimney Spring population of Railroad Valley springfish was extirpated (Williams 1986). The cause for this loss of flow has not been determined. Several artesian wells have been established in the valley over the years, and new ones may be created as a result of oil and gas exploration. Oil and gas exploration includes detonating subsurface explosive charges in the valley to characterize geologic strata. Development of located oil and gas deposits includes reinjection of ground water extracted along with the oil and gas. The potential effects of reinjection on the chemical and physical characteristics of the groundwater is unknown. In 1989, the Las Vegas Valley Water District applied to the Nevada State Water Engineer for the right to pump approximately 260 cubic meters per minute (69,000 gallons per minute) of ground water per year from the Railroad Valley hydrologic basin and transport it to the Las Vegas Valley, approximately 270 kilometers (168 miles) south (Nevada Division of Water Resources 1989). The effects of these various ongoing and proposed activities on spring discharge rates and/or water quality are unknown.

I. Conservation Efforts

Numerous conservation efforts have been undertaken for the benefit of the Railroad Valley springfish, several of which have been previously mentioned. Prior to its listing as a federally threatened species, Railroad Valley springfish populations were established at Sodaville and Chimney Spring expressly for the conservation of the species.

Railroad Valley springfish are protected by the provisions of the ESA, although a special rule allows take of the species for certain purposes in accordance with Nevada State laws and regulations (51 Federal Register 10857). The Nevada Board of Wildlife Commissioners recognizes the Railroad Valley springfish as a protected species (Nevada Revised Statutes 503.065). Nevada State laws and regulations prohibit taking of protected species without a valid State collecting permit. The Nevada Division of Wildlife has received grant-in-aid funding from the Service through section 6 of the ESA to monitor the status of the Railroad Valley springfish populations.

In 1979, the Bureau of Land Management revised its Railroad Valley Habitat Management Plan (HMP) to include objectives for management of Railroad Valley springfish habitats at North Spring, Reynolds Springs, and Chimney Spring. A second revision of the Railroad Valley HMP was completed in 1990, following listing of the Railroad Valley springfish and a change in management direction for the valley. The Railroad Valley HMP's primary management objective is to protect the Railroad Valley springfish and its habitats on public land. Planned actions include excluding livestock from each spring, continuing photographic documentation of Railroad Valley springfish habitats, and improving the Chimney Spring ponds (Bureau of Land Management 1990).

The Bureau of Land Management constructed livestock exclosures around North and Reynolds Springs along public land boundaries in 1987, to protect the habitats from trampling and grazing by cattle. A dramatic increase in emergent vegetation at North Spring occurred almost immediately following removal of grazing. The effect of this lush growth on the Railroad Valley springfish population has not been evaluated. After cattle trampled the ponds at Chimney Spring, the Bureau of Land Management strengthened the exclosure fence, removed the gate, and developed a livestock water trough outside of the exclosure.

In 1991, the Bureau of Land Management recognized the Railroad Valley springfish as a special status fish and included it in its program to maintain, protect, and enhance special status species and their habitats on public lands

(Bureau of Land Management 1991). The strategy plan and program guidance identified in the Bureau of Land Management's *Fish and Wildlife 2000 National Strategy Plan for Special Status Fishes Habitat Management* enumerates actions the Bureau of Land Management will undertake between 1991 and 2000 to conserve special status species and the ecosystems upon which they depend. The elements contained in the Bureau of Land Management's document are parallel to and consistent with the specific actions recommended in this recovery plan for Railroad Valley springfish.

The Bureau of Land Management's 1994 Tonopah Resource Management Plan identifies management objectives for the Railroad Valley springfish habitats on public lands at North Spring, Reynolds Springs, and Chimney Spring (Bureau of Land Management 1994). The Bureau of Land Management will protect the Railroad Valley springfish and its habitats at these three springs by (1) maintaining the Railroad Valley HMP, (2) excluding livestock, (3) establishing no-surface occupancy restrictions for oil and gas leasing, (4) designating 6,265 hectares (15,470 acres) as the Railroad Valley Area of Critical Environmental Concern, (5) acquiring nonconsumptive water rights, (6) acquiring private lands from willing landowners, and (7) limiting vehicle use.

In 1994, the Bureau of Land Management conducted an evaluation of the Duckwater livestock grazing allotment, which includes portions of the outflow streams from Big Warm Spring and Little Warm Spring. To prevent degradation of Railroad Valley springfish habitat that may be associated with livestock grazing, the Bureau of Land Management has proposed to reduce the number of livestock in the Duckwater Hills Use Area and require livestock watering sites be established away from Railroad Valley springfish habitat (Drais, Bureau of Land Management, in litt., April 1995)

J. Recovery Strategy

The strategy for recovery of the Railroad Valley springfish, as detailed in the following narrative outline, begins with the protection and management of the habitats historically and presently occupied by this threatened species. The cooperation of the Duckwater Shoshone Indian Tribe, private landowners, and the Bureau of Land Management is essential to ensure that the Railroad Valley springfish habitats on their respective properties are restored as necessary and appropriate, and protected from future adverse physical and biological modifications, so that Railroad Valley springfish persist in perpetuity.

Comprehensive status inventories of each Railroad Valley springfish habitat and its population are proposed to serve as baseline data, guide recovery efforts, and monitor the success of recovery efforts. Management plans will be cooperatively developed to outline habitat restoration needs and short- and long-term management actions that meet the needs of both the Railroad Valley springfish and landowner. Public information programs will be implemented to ensure that all parties potentially affected by Railroad Valley springfish recovery efforts are kept involved and informed.

Part II. RECOVERY

A. Objective and Criteria

The objective of the Railroad Valley Springfish Recovery Plan is to recommend measures needed to improve and secure the species' status so that it may be removed from the Federal list of endangered and threatened species. Railroad Valley springfish may be considered for delisting when the following criteria are met:

1) All six historical spring habitats are protected from adverse modifications through conservation agreements, easements, or fee title acquisitions; and

2) at least 21,000 adult Railroad Valley springfish are present among the 6 springs, with each population containing at least 1,000 adults and documented annual reproduction and recruitment, for 5 consecutive years.

These recovery criteria are preliminary and may be modified pending completion of tasks recommended in this recovery plan or receipt of other new information. The criteria of a total of at least 21,000 Railroad Valley springfish and 1,000 fish per population were selected based on a review of the population information available (Tables 1-6). The following numerical values (data from the year indicated rounded to the nearest 100) were used to approximate the size of each population prior to or near the time of listing: Big Warm Spring (1938) - 800; Little Warm Spring (1934) - 1,700; Big Spring (average of four population estimates in 1980) - 9,800; North Spring (1989) - 3,300; Hay Corral Spring (1989) - 2,700; Reynolds Spring (1989) - 2,600.

Five years was selected as an initial criterion because Railroad Valley springfish should colonize enhanced and restored habitats and establish populations containing several age classes within this time period. If after 5 years, surveys indicate that the populations do not meet the numerical criteria and/or are not stable or increasing, delisting should not be considered.

Although not essential to the recovery of the Railroad Valley springfish, the three extant refugia populations of this species should be managed and maintained into the future. These populations have persisted over many years and may prevent the extinction of the Railroad Valley springfish should unforeseen catastrophic events severely impact or eliminate the historical populations. For this reason, this recovery plan includes tasks to protect, manage, and monitor these refugia populations and their habitats, although the tasks are given a lower priority for completion than similar tasks for the historical populations. Additional refugia populations of Railroad Valley springfish from Duckwater may be necessary to adequately protect the entire Railroad Valley springfish gene pool.

Prior to implementation of any task recommended in this recovery plan, the lead agency must comply with all applicable provisions of the National Environmental Policy Act and Endangered Species Act of 1973, as amended. All necessary Federal, State, and local permits or authorizations must be obtained. Landowner permission must be granted if the activity will occur on private land.

B. Narrative Outline of Recovery Actions

1. Protect Railroad Valley springfish habitats from adverse physical and biological modifications

The Railroad Valley springfish was listed as a threatened species because various modifications to its habitats resulted in decreased populations. Recovery of the Railroad Valley springfish will depend in part on preventing further adverse habitat modification and ensuring adequate supply of sufficient quality and quantity water in the future.

1.1. Obtain landowner cooperation

Railroad Valley springfish habitats on public lands are considered essentially secure from adverse modification because of requirements contained in section 7 of the ESA. Section 7(a)(1) directs all Federal agencies, in consultation with and with the assistance of the Fish and Wildlife Service, to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for listed species. Section 7(a)(2) of the ESA further requires every Federal agency, in consultation with and with the assistance of the Fish and Wildlife Service, to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat.

Protection of the remaining Railroad Valley springfish habitats will require obtaining the cooperation of the Duckwater Shoshone Indian Tribe and private landowners. The Tribe and the private landowners must be assured that this recovery effort will strive to provide for their current and planned uses of the habitats or the water on their properties as well as the needs of the Railroad Valley springfish. The landowners should be encouraged to enter into formal agreements with the Fish and Wildlife Service regarding cooperative management of the habitats. Conservation easements could be negotiated with willing landowners to provide access to properties for population monitoring, habitat restoration, and research. Safe Harbor Agreements recognize the landowners willingness to cooperate with recovery efforts, but allow the landowner to change use of the land in the future with no obligations to maintain any restored or newly created habitat and exemption from the prohibitions against take of the listed species. Incidental take permits issued to private landowners also provide exemption from the take prohibitions with a commitment to a habitat conservation plan. Other agreements may also be available.

1.2. Acquire private land from willing sellers

Land parcels and/or their associated water rights should be acquired from willing sellers as available. The Bureau of Land Management draft

Tonopah Resource Management Plan identified an objective of acquiring private parcels at Lockes from willing sellers for inclusion in the Railroad Valley Area of Critical Environmental Concern. Acquisition of properties may be potentially facilitated through land exchanges.

1.3. Secure adequate instream flow for Railroad Valley springfish habitats on public lands

Non-consumptive instream flow water rights should be secured at each occupied Railroad Valley springfish habitat on public land to ensure maintenance of sufficient flows to maintain viable populations of Railroad Valley springfish. Instream flow requirements for springs on private and tribal lands will be negotiated and included in the cooperative management agreements. Appropriate measures should be taken to protect the aquifer(s) supporting each Railroad Valley springfish habitat to ensure that discharge rates and/or water quality are not indirectly adversely affected by any activity pertaining to the aquifer.

1.4. Determine the effects of artesian wells and oil and gas exploration and development on springs in Railroad Valley

The impact of existing artesian wells, oil and gas exploration, and oil well waste water reinjection in Railroad Valley on spring discharge and water quality should be evaluated. If potential adverse effects are identified, the Bureau of Land Management and Nevada Division of Environmental Protection should be notified and appropriate protective measures developed and implemented.

2. Improve and manage Railroad Valley springfish habitats and their populations

Recovery criteria for Railroad Valley springfish suggest the maintenance of a total of at least 21,000 fish, with at least 1,000 individuals at each historical habitat. To obtain this goal, the factors limiting Railroad Valley springfish at each habitat must be resolved and suitable habitat conditions restored in order to improve the status of each population. All populations have been affected to various degrees by previous physical and biological habitat modifications.

2.1. Determine historical and present habitat characteristics

Previous research has identified basic parameters of suitable Railroad Valley springfish habitat. Current habitat characteristics information should be collected for each spring occupied by Railroad Valley springfish. An indication of historic habitat conditions may be obtained by review of historical documents, photographs, and conversations with landowners. Comparison of historic and current habitat information may identify additional factors limiting Railroad Valley springfish populations and guide restoration efforts. This information would also provide a baseline for evaluating the effect of future changes, natural or human caused, on Railroad Valley springfish populations. Information collected should include parameters of basic spring ecology, such as spring flow rates, temperature regimes, water quality parameters, existing faunal and floral communities, substrate, measurements of extent and dimension, and identification of existing uses and modifications.

2.2. Develop and implement habitat management plans

A habitat management plan should be developed and implemented for each Railroad Valley springfish habitat. Each plan must be developed in coordination with all landowners when the spring and its outflow stream occur on lands of mixed ownership. The plans should strive to meet the habitat needs of the Railroad Valley springfish and the current and planned uses of the habitat by the landowner. The plans should identify habitat restoration, enhancement, and management actions required to minimize or eliminate limiting factors and ensure sufficient suitable habitat for Railroad Valley springfish population expansion at each spring. Current habitat conditions should be compared with available information on historical conditions to determine habitat restoration needs and/or potential. The plans should be based on the most recent information available on Railroad Valley springfish and each habitat and be flexible enough to be modified as new data are acquired. Preliminary plans should be prepared to address existing limiting factors and initiate restoration needs while long-term plans are being developed. The Bureau of Land Management should revise their existing habitat management plan as necessary to be consistent with these new plans. Implementation of actions identified in these habitat management plans must be in compliance with all applicable Federal, State, and local regulations.

2.2.1. Develop and implement a habitat management plan for Big Warm Spring and Little Warm Spring

Development of this habitat management plan should be coordinated with the Duckwater Shoshone Indian Tribe, Bureau of Land Management, and downstream private landowners.

2.2.2. Develop and implement a habitat management plan for Big Spring, North Spring, Hay Corral Spring, and Reynolds Springs

Development of this habitat management plan should be coordinated with the private landowners and Bureau of Land Management.

2.2.3. Develop and implement a habitat management plan for Chimney Spring

This habitat management plan should be developed in coordination with the Bureau of Land Management.

2.2.4. Develop and implement a habitat management plan for the Dugan Ranch

This habitat management plan should be developed in coordination with the private landowner.

2.2.5. Develop and implement a habitat management plan for Sodaville

Development of this habitat management plan should be coordinated with the private landowner.

3. Monitor Railroad Valley springfish populations and habitats

The stability and health of each Railroad Valley springfish population can only be assessed by regular monitoring to determine population size, age-class structure, and distribution. Habitat quality and quantity should also be evaluated regularly and compared to the baseline information collected under task 2.1. Information collected during regular monitoring may identify factors that may affect recovery as they occur so that appropriate actions can be taken, and be used to analyse the effectiveness of recovery programs. Ultimately, this information will be used to determine whether or not recovery has been achieved.

A monitoring plan should be developed to ensure consistent collection of information regardless of personnel changes. The plan should identify the data to be collected, appropriate techniques, time-frames, reporting requirements, etc. The reporting requirements are important so that any change in population status, habitat condition, or introduction of nonnative species can be immediately noted and appropriate remedial actions taken.

4. Establish a public information program

Recovery of the Railroad Valley springfish may require modifications of current management and use of public and private lands. An effective public information program should be developed to increase awareness and understanding of the Railroad Valley springfish recovery efforts. Interested parties should be continually involved in and updated on all aspects of this recovery effort so that conflicts can be identified and resolved as soon and as much as possible.

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Part IV. IMPLEMENTATION SCHEDULE

This implementation schedule outlines actions and estimated costs for the recovery of Railroad Valley springfish. This schedule indicates task priorities, numbers, and descriptions; duration of each task; responsible agencies; and estimated costs. These actions, when accomplished, should bring about the recovery of Railroad Valley springfish and protect its habitat. It should be noted that the estimated monetary needs for all parties involved in recovery are identified and, therefore, this schedule reflects the total estimated financial requirements for the recovery of this species.

In the implementation schedule, tasks are arranged in priority order. The assigned priorities are defined as follows:

Priority 1 - An action that *must* be undertaken to prevent extinction or to prevent Railroad Valley springfish from declining irreversibly in the *foreseeable* future.

Priority 2 - An action that *must* be undertaken to prevent a significant decline in Railroad Valley springfish population distribution or size, or habitat quality, or some other significant negative impact short of extinction.

Priority 3 - All other actions necessary to meet the recovery objective.

The following abbreviations are used in the implementation schedule:

Task Duration

Cont.	The action will be implemented continually once initiated.

Responsible Parties

BLM	Bureau of Land Management
DSIT	Duckwater Shoshone Indian Tribe
FWS	Fish and Wildlife Service
NBS	National Biological Service
NDF	Nevada Division of Forestry
NDOW	Nevada Division of Wildlife
*	Lead Party

Total Cost — Projected cost of task from start to finish.

Implementation Schedule for the Railroad Valley Springfish Recovery Plan

Priority Number	Task Number	Task Description	Task Duration (Years)	Responsible Parties	Total Estimated Cost ($1,000s)	Annual Cost Estimate Per Fiscal Year ($1,000s)						
						1997	1998	1999	2000	2001	2002	2003
2	1.1.	Obtain landowner cooperation	2	FWS* BLM NDOW	20 6 6	10 3 3	10 3 3					
2	1.2.	Acquire private land from willing sellers	2	BLM*	20	10	10					
2	1.3.	Secure instream flow on public land	2	BLM* NDOW	4 2	2 1	2 1					
2	1.4.	Determine effects of artesian wells and oil and gas development	2	BLM* FWS NDOW	4 2 2	2 1 1	2 1 1					
2	2.1.	Determine habitat characteristics	2	NBS*	60	30	30					
2	2.2.1.	Develop and implement habitat management plan for Big Warm and Little Warm Springs	Cont.	FWS* DSIT BLM NDOW	37 17 17 17	10 5 5 5	10 5 5 5	5 2 2 2	5 2 2 2	3 1 1 1	3 1 1 1	3 1 1 1

Implementation Schedule for the Railroad Valley Springfish Recovery Plan

Priority Number	Task Number	Task Description	Task Duration (Years)	Responsible Parties	Total Estimated Cost ($1,000s)	Annual Cost Estimate Per Fiscal Year ($1,000s)						
						1997	1998	1999	2000	2001	2002	2003
3	2.2.5.	Develop and implement habitat management plan for Sodaville	Cont.	NDOW* FWS NDF	14 5 5				5 2 2	3 1 1	3 1 1	3 1 1
TOTAL ESTIMATED COST					570	144	139	58	70	53	53	53

Implementation Schedule for the Railroad Valley Springfish Recovery Plan

Priority Number	Task Number	Task Description	Task Duration (Years)	Responsible Parties	Total Estimated Cost ($1,000s)	Annual Cost Estimate Per Fiscal Year ($1,000s)						
						1997	1998	1999	2000	2001	2002	2003
2	2.2.2.	Develop and implement habitat management plan for Big, North, Hay Corral, and Reynolds Springs	Cont.	BLM* NDOW FWS	39 39 12	10 10 5	10 10 5	5 5 2	5 5 2	3 3 1	3 3 1	3 3 1
2	3.	Monitor populations	Cont.	NDOW* DSIT	105 35	15 5	15 5	15 5	15 5	15 5	15 5	15 5
2	4.	Develop and implement public information program	Cont.	FWS* NDOW BLM DSIT	21 7 7 7	3 1 1 1	3 1 1 1	3 1 1 1	3 1 1 1	3 1 1 1	3 1 1 1	3 1 1 1
3	2.2.3.	Develop and implement habitat management plan for Chimney Spring	Cont.	BLM* FWS NDOW	20 7 7	3 1 1		5 2 2	3 1 1	3 1 1	3 1 1	3 1 1
3	2.2.4.	Develop and implement habitat management plan for Dugan Ranch	Cont.	NDOW* FWS	14 5				5 2	3 1	3 1	3 1

Part V. APPENDICES

Appendix A: Review of the Public/Agency Review Draft of the Railroad Valley Springfish Recovery Plan

The Public/Agency Review Draft of the Railroad Valley Springfish Recovery Plan was made available to the public for comment as required by the 1988 amendments to the Endangered Species Act of 1973. The public comment period was announced in the Federal Register on June 22, 1994, and closed on August 22, 1994. The Fish and Wildlife Service provided the document to the agencies and individuals identified below. During the 60-day comment period, the Fish and Wildlife Service received response letters from the nine individuals or agencies denoted with an asterisk (*) on the list below. The comments provided in these letters were considered in preparation of this final recovery plan and incorporated as appropriate. Appendix B consolidates, summarizes, and provides the Fish and Wildlife Service's response to the comments received. All letters of comment received are maintained as a part of the administrative record at the Fish and Wildlife Service's Nevada State Office, Reno, Nevada.

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Appendix B: Summary of Comments Received and the Fish and Wildlife Service's Responses

Written comments on the draft recovery plan were received from the Environmental Protection Agency, four Bureau of Land Management offices, the Nevada Division of Wildlife, the Duckwater Shoshone Indian Tribe, one private landowner, and one academic/scientific peer reviewer. These comments were considered in preparation of this final recovery plan, and incorporated as appropriate. This section consolidates, summarizes, and provides the Fish and Wildlife Service's response to comments received. Specific comments that reoccurred in the letters are addressed only once. All letters of comment on the draft recovery plan are on file in the Fish and Wildlife Service's Nevada State Office, Reno, Nevada.

COMMENT: Due to differences in personnel, sampling techniques and locations, and other variables, it is difficult to use available population estimates as directly comparable numerical indicators of status.

RESPONSE: The Service agrees with this comment. The text of the recovery plan has been edited to include statements summarizing the comparability of the available population information.

COMMENT: The presence of a viable population of Railroad Valley springfish in each of the six historically occupied habitats is not necessary or realistically obtainable within the given time frame. Four populations, with at least one each at Duckwater and Lockes would be sufficient to justify delisting.

RESPONSE: The Service disagrees with this comment. At the time the Railroad Valley springfish was listed as threatened, populations occurred in all six historically occupied habitats, therefore, these populations should be secured in these sites before the species is considered recovered. These habitats are still essentially intact, although each has been modified to various degrees by human activities, and continue to support springfish populations. Through the tasks identified in this recovery plan, these habitats can be restored and protected so that they may support springfish into the future. All six populations should be maintained because of genetic differences between the Lockes and Duckwater populations and to ensure against future catastrophic events.

COMMENT: One comment questioned the biological basis for selecting 5 years as a goal in the recovery criteria and suggested this be a short-term goal.

RESPONSE: The 5-year goal was selected because that time frame should allow the springfish populations to expand into restored habitats and contain several age classes. This time frame is preliminary and can be modified as indicated by information obtained during the recovery process. The long-term goals of the recovery plan revolve around obtaining cooperation with the landowners to allow for habitat restoration as well as protection the species and its habitat into the future. After agreements are made with landowners and habitats have been restored, 5 years of population monitoring should reveal whether or not these populations will meet the numerical criteria established.

COMMENT: To cite the removal of all threats as a criterion for delisting may be setting up the recovery plan for failure. Oil and gas resources, while possibly a threat to Railroad Valley springfish, have been and will continue to be developed in Railroad Valley.

RESPONSE: The recovery process includes examining all identified factors limiting Railroad Valley springfish populations to understand the extent of the possible effects on the listed species. By understanding the potential adverse effects, if any, of oil and gas resource development on the groundwater systems in Railroad Valley, measures can be identified to minimize those effects while continuing development. The Service recognizes that all limiting factors may not be entirely eliminated.

COMMENT: It may be desirable to establish additional refugia populations to prevent extinction or genetic bottlenecks brought on by catastrophic events.

RESPONSE: The recovery plan recommends maintaining the existing refugia populations for that purpose. Additional refugia populations established with Railroad Valley springfish from the Duckwater springs may be appropriate, but the primary emphasis of this recovery effort will be to restore the historical populations.

COMMENT: The draft recovery plan does not address the fact that public lands adjacent to Big Warm Spring and Little Warm Spring are within the Ely District of the Bureau of Land Management. Any agreements with the Duckwater Shoshone Indian Tribe for management of these habitats should also include the Ely District.

RESPONSE: The recovery plan refers only to the Bureau of Land Management, as an agency. Implementation of any specific task will include the appropriate local offices as well as the State Office of the Bureau of Land Management. The Service encourages all affected parties to be included in the implementation of this recovery program.

COMMENT: The Duckwater catfish facility is incompatible with maintenance of a viable population of springfish at Big Warm Spring. The facility needs to be relocated so that historical stream outflows can be reestablished, and the catfish in the spring system need to be controlled.

RESPONSE: The recovery plan recommends development of a cooperative management agreement and habitat management plan with the Duckwater Shoshone Indian Tribe. These documents would include alternatives for minimizing the effects of the catfish facility on the Railroad Valley springfish population at Big Warm Spring to ensure that the minimum population criterion of 1,000 individuals can be achieved and maintained.

COMMENT: The Recovery Section is overly vague and needs to clearly articulate specific recovery actions, rather than just recommend more planning activities.

RESPONSE: Although specific actions are not delineated as separate tasks, they are described in the narrative sections under other tasks. In some cases more information is needed before management actions can be specified.

COMMENT: The spring flows at Lockes should be diverted into historical channels.

RESPONSE: The recovery plan recommends the restoration of all spring systems occupied by Railroad Valley springfish, as feasible, to meet the needs of the springfish and landowner.

COMMENT: Tasks associated with Big Warm Spring and Little Warm Spring and monitoring of all populations should be assigned Task Priority 1.

RESPONSE: The definition of a Priority 1 task is "an action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future." Priority 1 is not appropriate for tasks for this threatened species, because it exists in four other historical habitats as well as three refugia habitats, in addition to the two springs mentioned, and the species will not go extinct if the identified tasks are not Priority 1.

COMMENT: The Nevada Division of Wildlife would be the appropriate agency to assume the lead agency responsibility for those tasks associated with monitoring and population and habitat management plans.

RESPONSE: The Nevada Division of Wildlife has been assigned lead responsibility for monitoring and for planning activities on private lands. The Fish and Wildlife Service has been assigned lead responsibility for planning activities on the Duckwater Indian Reservation, and the Bureau of Land Management has been assigned lead responsibility for planning activities on public lands. The lead agency's role will often be to coordinate joint efforts among all affected parties rather than to accomplish the task independently.

COMMENT: The Fish and Wildlife Service should place particular effort on developing a cooperative team approach to recovery, management, and monitoring, which includes full participation of the Nevada Division of Wildlife, Bureau of Land Management, and other appropriate entities.

RESPONSE: The Fish and Wildlife Service embraces cooperative efforts for the recovery of listed species and looks forward to working with all affected parties toward the recovery of the Railroad Valley springfish.

COMMENT: The commentor suggests that there may be other errors in the information contained in the recovery plan.

RESPONSE: Recovery plans can be amended or revised based on new information, including information that indicates the plan includes erroneous information. Every attempt was made to ensure that material included was reliable.

COMMENT: A recovery plan is not necessary. The Railroad Valley springfish is abundant in the ponds and streams at Lockes Ranch. The recovery costs proposed would only add more to an already over-burdened economy.

RESPONSE: The Endangered Species Act of 1973, as amended, requires that a recovery plan be prepared for all listed species. The Service encourages the participation of all affected parties, so that all possible alternatives for meeting the needs of the fish and landowners may be brought forward and the least costly alternative employed.

COMMENT: Figure 3 depicts only a portion of the critical habitat at Big Spring. This is either a typographical error, or the missing portion needs to be added to the legal description of critical habitat.

RESPONSE: The identified area was not designated as critical habitat. The Fish and Wildlife Service has no records indicating whether this was intentional or in error. If information gathered during the recovery process indicates that this portion of the Big Spring outflow should be designated critical habitat, the Fish and Wildlife Service would proceed through the rule-making process to have this portion added.

COMMENT: Pesticides may be present from surface and subsurface applications. The use of herbicides to control aquatic vegetation and on agricultural lands may affect the springfish. Oil and gas reinjection systems often include microbicides in the reinjected water.

RESPONSE: The presence of potentially detrimental contaminants in Railroad Valley springfish habitats should be evaluated during tasks recommended in the recovery plan.