SIGNATURES

In Witness Whereof, the parties have caused this Agreement for the Northeastern Nevada Columbia spotted frog to be executed as of the date of the last signature below:

APPROVED BY:

Robert V. Abbey, State Director U.S.D.I. Bureau of Land Management Nevada State Office	Date	Steve Thompson, Manager U.S.D.I. Fish and Wildlife Service California/Nevada Operations Office	Date
Terry R. Crawforth, Director Nevada Department of Wildlife	Date	Robert L. Vaught, Forest Supervisor U.S.D.A. Forest Service Humboldt-Toiyabe National Forest	Date
Glenn H. Clemmer, Program Manager Nevada Natural Heritage Program	Date	Board of Regents of the University and Community College System of Nevada, on behalf of the University of Nevada, Reno	Date

CONSERVATION STRATEGY
FOR THE
NORTHEASTERN NEVADA SUBPOPULATIONS OF THE COLUMBIA SPOTTED FROG (*RANA LUTEIVENTRIS*)

INTRODUCTION

In 1989, the U.S. Fish and Wildlife Service (USFWS) was petitioned to list the spotted frog (referred to as *Rana pretiosa*) under ESA (Federal Register 54[1989]:42529). The USFWS ruled on April 23, 1993, that the listing of the spotted frog was warranted and designated it a candidate for listing with a priority 3 for the Great Basin population, but was precluded from listing due to higher priority species (Federal Register 58[87]:27260). The major impetus behind the petition was the reduction in distribution apparently associated with impacts from water developments and the introduction of nonnative species in Nevada.

On September 19, 1997 (Federal Register 62[182]:49401), the USFWS downgraded the priority status for the Great Basin population of Columbia spotted frogs to a priority 9, thus relieving the pressure to list the population while efforts to develop and implement specific conservation measures were ongoing. As of January 8, 2001 (Federal Register 66[5]:1295-1300), however, the priority ranking has been raised back to a priority 3 due to increased threats to the species. This includes Great Basin Columbia spotted frog populations in both northeastern Nevada and the Toiyabe Range.

Other Nevada spotted frog populations are located in the eastern portion White Pine County at the Nevada/Utah border and are geographically and genetically associated with the West Desert population in Utah. These frogs were withdrawn from Federal candidate status in April 1998 in a decision based upon the reduction and/or elimination of threats to this population and a conservation agreement (UDWR 1998) which represents a ten year commitment for on-going protection and management.

PURPOSE

The purpose of this Conservation Strategy (Strategy) is to outline a framework for management actions that will provide for the goal of long-term conservation of the Columbia spotted frog, northeastern Nevada (NENV) subpopulations of the Great Basin population, and their habitats in the Jarbidge and Independence Ranges and the Ruby Mountains of Nevada. This Strategy identifies actions that are necessary to reduce or eliminate threats and provide for the long-term conservation of NENV Columbia spotted frogs in Nevada such that protection under the ESA may not be necessary.
"The Strategy is not intended to restore connectivity between the northeastern subpopulation of the Columbia spotted frog with other subpopulations within the Great Basin."

The conservation of the Columbia spotted frog will require reducing or eliminating threats, improving degraded habitat conditions, and restoring many of the natural functions of associated riparian systems. These habitat protection and restoration efforts will also benefit many other threatened and sensitive species that share these ecosystems (Appendix A). Columbia spotted frog conservation activities are likely to benefit the drainages associated with spotted frog habitat by maintaining and improving hydrologic function. Improving hydrologic function will not only benefit spotted frogs, fish, and other wildlife, but also, over the long term, reduce downstream flooding, enhance ranching and haying operations, and expand recreation opportunities.

DESCRIPTION AND ECOLOGY

The Columbia spotted frog belongs to the anuran family of "true frogs", Ranidae. Twenty-three species of ranids are native to the United States. The four true frogs native to Nevada are the Columbia spotted frog (*Rana luteiventris*), the northern leopard frog (*Rana pipiens*), the relict leopard frog (*Rana onca*), and the mountain yellow-legged frog (*Rana muscosa*). Two additional frogs have been successfully introduced into Nevada. These are the red-legged frog (*Rana aurora*) native to California and the bull frog (*Rana catesbeiana*) from east of the Rockies.

Ranids typically are characterized as slim-waisted, long-legged, smooth-skinned jumpers with webbed hind feet and usually with a pair of dorsolateral folds (glandular folds) that extend from behind the eyes to the lower back. Adult Columbia spotted frogs in Nevada measure approximately 5.6 cm from snout to vent, with females being larger than males. Dorsal colors and patterns include light brown, dark brown, or gray, with small spots. Ventral coloration can differ among geographic population units and may range from yellow to salmon; however, very young individuals may have very pale, almost white, ventral surfaces. The throat and the ventral region are sometimes mottled. The head may have a dark mask with a light stripe on the upper jaw and the eyes are turned slightly upward. Male frogs have swollen thumbs with darkened bases.

Columbia spotted frogs are similar to and often mistaken for leopard frogs. Specific characteristics that distinguish the Columbia spotted frog from the leopard frog include: rough skin, shorter limbs (the heel of the hind limb when adpressed seldom reaches the nostrils), larger webs between the toes, smaller typanum, and the smooth round eyes which are turned slightly upward. Distinguishing characteristics of the leopard frog are very large conspicuous spots and a mostly white ventral surface compared to the pigmented ventral surfaces of adult Columbia spotted frogs.

Columbia spotted frogs in Nevada are found closely associated with slow-moving or ponded surface waters which are clear and with little or no canopy cover (Reaser 1997). Reproducing populations were found in habitats characterized by springs, floating vegetation, and larger bodies of pooled water (e.g., oxbows, lakes, stock ponds, beaver-created ponds, springs, seeps in wet meadows, backwaters) (IDFG et al. 1995, Reaser 1997). A deep silt or muck substrate may be required for hibernation and torpor (Morris and Tanner 1969). Females may lay only one egg mass per year; yearly fluctuations in the sizes of egg masses are extreme (UDWR 1998). Successful egg production and the viability and metamorphosis of spotted frogs are susceptible to habitat variables such as temperature, depth, and pH of water, cover, and the presence/absence of predators (e.g., fishes and bullfrogs) (Morris and Tanner 1969, Munger et al. 1996, Reaser 1996).

The elimination, fragmentation, and/or degradation of any use area (e.g., adult foraging range, winter hibernaculum, breeding pool) will have a negative proximate effect on local population units because of the wide use of riparian areas by adult frogs (Munger et al. 1996, Patla and Peterson 1996, Reaser 1996). These effects on metapopulations may result in widespread declines. If corridors between population units are eliminated, dispersal from one population unit to another cannot occur (Lande and Barrowclough 1987, Hovingh 1990, Gotelli 1995).

In the Great Basin, Columbia spotted frogs are found in naturally fragmented habitats that are seasonally xeric, resource-limited, and often ephemeral. Such habitats are sensitive to disturbance, both natural and human-caused (Soulé 1983), thus increasing the chance of stochastic extirpation for its inhabitants (Lande and Barrowclough 1987).

SPECIES DISTRIBUTION AND SUBPOPULATIONS

The USFWS acknowledges species-specific genetic and geographic differences in spotted frogs based on Green (1991) and Green et al. (1996, 1997) and Bos and Sites (2001), who define populations in western Washington and Oregon and northeastern California as "Oregon" spotted frogs (*Rana pretiosa*) and the remainder of the populations as "Columbia" spotted frogs (*Rana luteiventris*) (Figure 1). Based on further geographic and genetic characterization, spotted frogs in Idaho, eastern Oregon, and Nevada are part of the "Great Basin" population of Columbia spotted frogs. A small population on the eastern border of White Pine County, Nevada and Toole County, Utah, has been determined through morphometric and allozyme data (Green et al. 1996, 1997) to be part of the "West Desert" population of Columbia spotted frogs and is not part of the Great Basin population discussed in this document (Figure 2).

Columbia spotted frogs in Nevada currently are found in the central (Nye County) and northeast (Elko and Eureka counties), usually persisting at elevations between 5600 and 8700 feet (1700 and 2650 meters), although they have been recorded historically in a broader range (Reaser 2000) (Figure 3). Based upon geography, Columbia spotted frogs in Nevada can be grouped further into three well-defined subpopulations: (1) a large subpopulation located across the Jarbidge and Independence Ranges and the Tuscarora Mountains located in the northern portion of Elko County and northern portion of Eureka County (Jarbidge - Independence subpopulation); (2) an isolated subpopulation located in the Ruby Mountains in southeastern portion of Elko County (Ruby Mountain subpopulation); and (3) an isolated subpopulation located in the Toiyabe Range in central Nevada in Nye County (Toiyabe Range subpopulation) (Figure 2). For the purposes of this planning effort the Jarbidge - Independence and Ruby Mountain subpopulations have been grouped into the Northeastern Nevada subpopulations (NENV Columbia spotted frog).

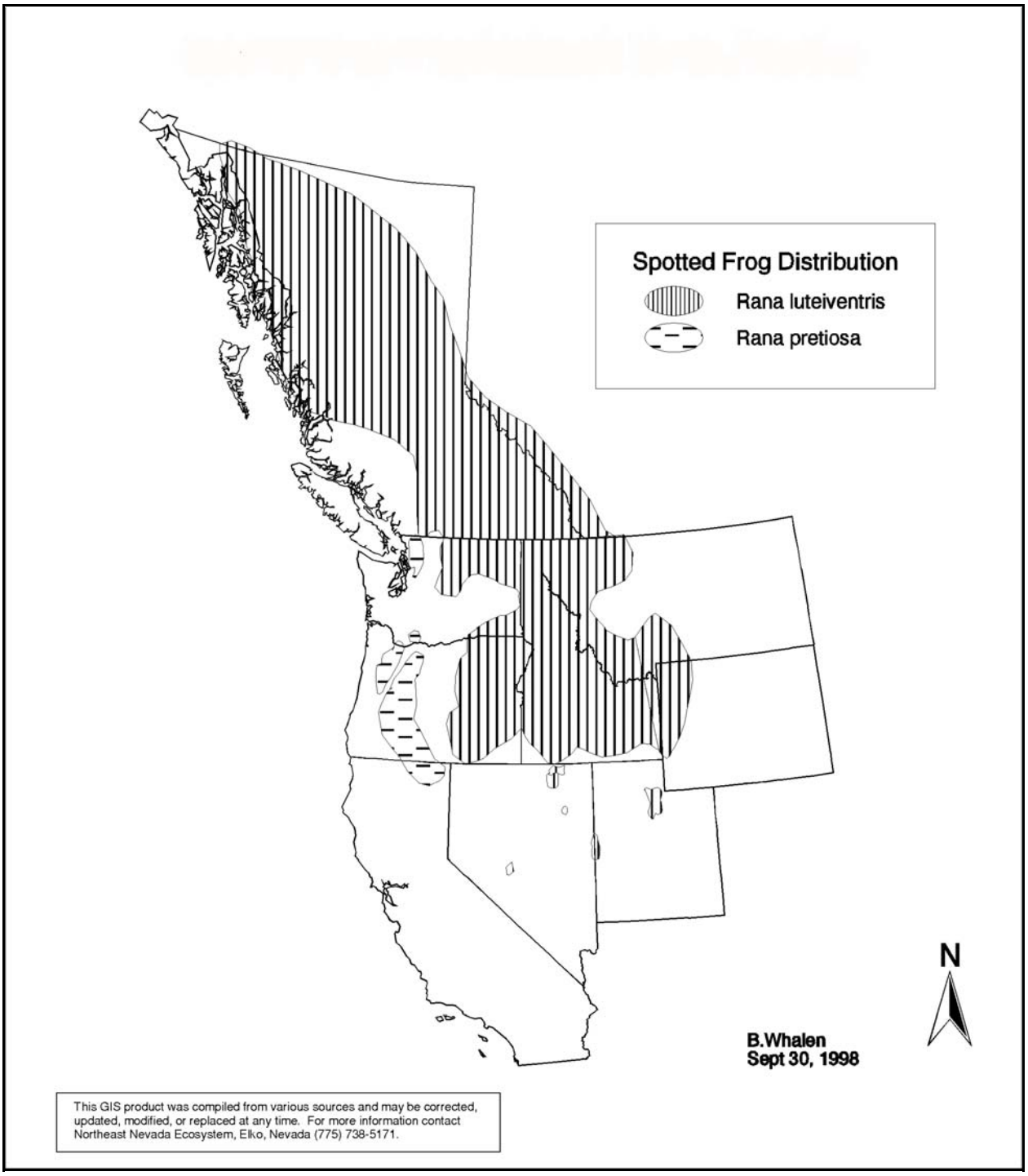

Figure 1. Distribution of the Columbia spotted frog (*Rana luteiventris*) and the Oregon spotted frog (*Rana pretiosa*) in North America (from IDFG et al. 1995, Green et al. 1996).

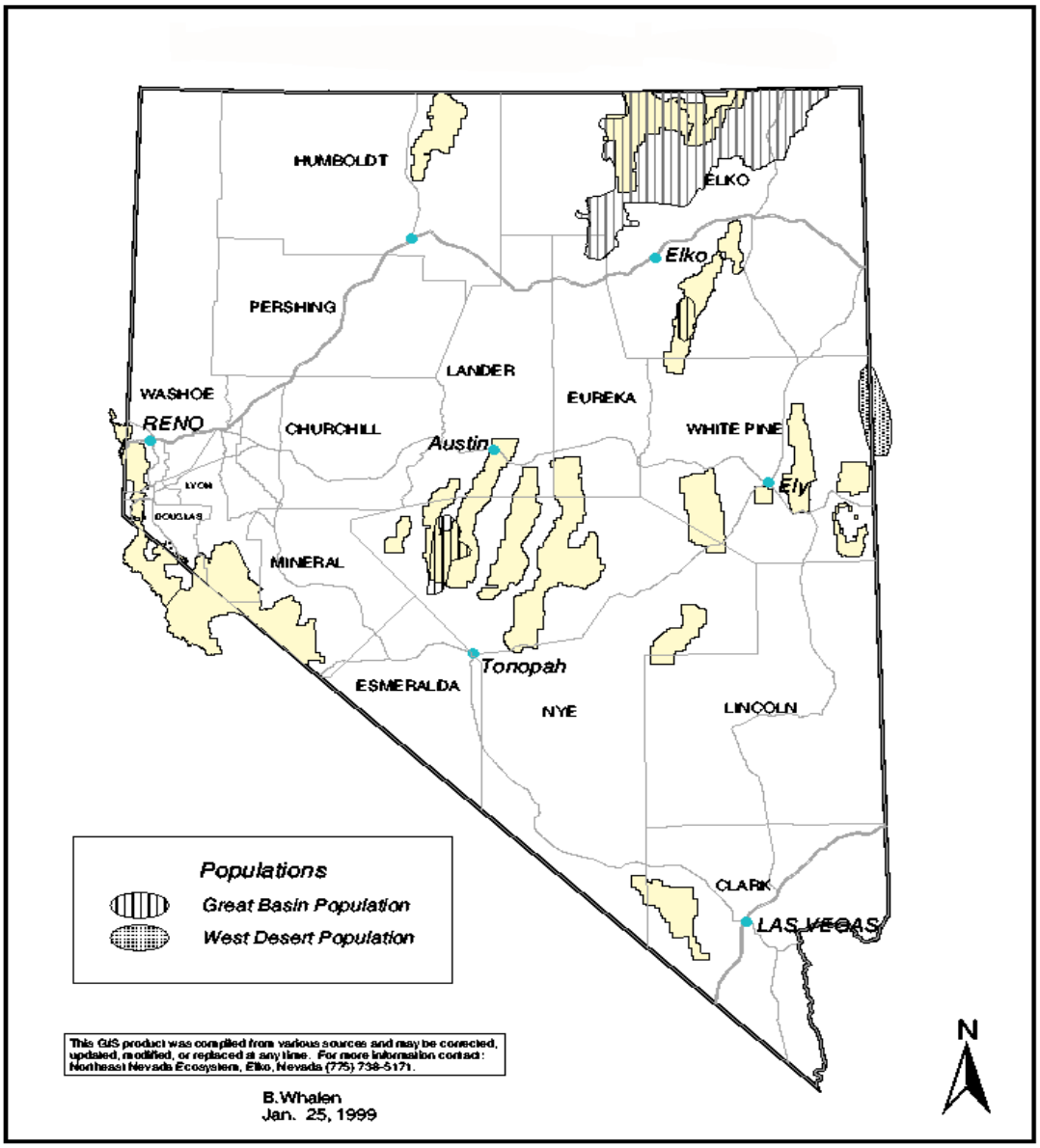

Figure 2. Distribution of the Great Basin and West Desert populations of the Columbia spotted frog (*Rana luteiventris*) in Nevada.

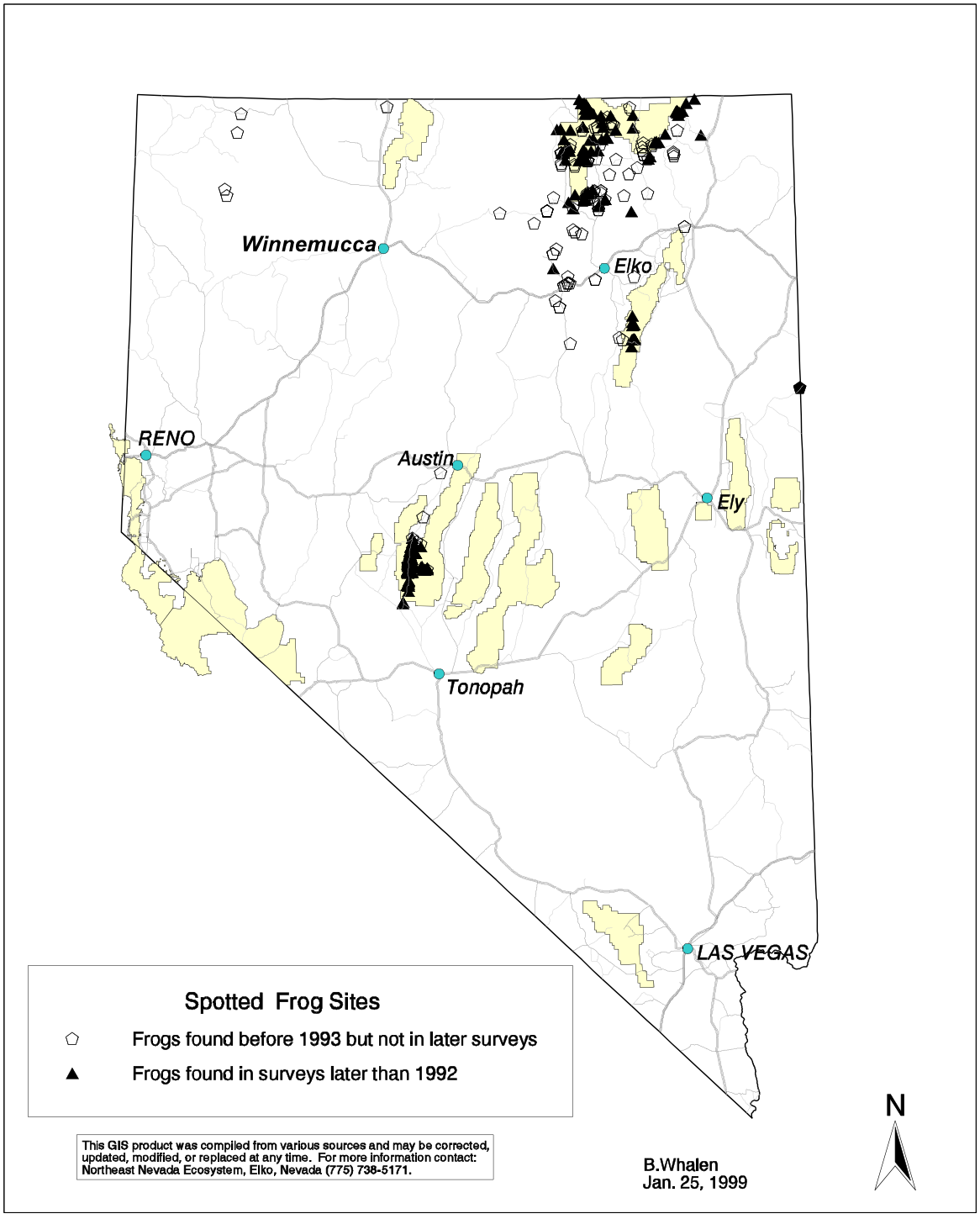

Figure 3. Survey sites for Columbia spotted frogs in Nevada.

Preliminary genetic analyses of Columbia spotted frogs from the Ruby Mountains and Jarbidge and Independence Ranges suggest that these frogs are distinct from frogs in the Toiyabe Range(Green et al.1996, 1997). Genetic (mtDNA) differences between the Toiyabe Range frogs and the Ruby Mountain frogs are less distinct than those between the Toiyabe Range frogs and the Jarbidge and Independence Ranges frogs, but this relationship may be an artifact of similar temporal and spatial isolation (Reaser 2000).

Two elements are considered regarding the potential recognition of a population segment as a species under ESA: discreteness and significance. A population segment could be considered discrete if it is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. Scientific evidence would be considered to determine the population segment's significance to the species to which it belongs (e.g., evidence that it differs markedly from other populations of the species in its genetic characteristics). These two elements were considered prior to addressing the Jarbidge - Independence and Ruby Mountain subpopulations of spotted frogs for conservation action apart from the Toiyabe subpopulation.

Ruby Mountain Subpopulation: The Ruby Mountains possess suitable spotted frog habitat that is disjunct from other suitable habitat (Figures 4 & 5). The Ruby Mountain subpopulation is considered discrete. This subpopulation may be considered significant to the species as a whole because it occupies a unique and unusual ecological setting and its loss would result in a substantial modification of the species' range.

The Ruby Mountain subpopulation occurs in the South Fork of the Humboldt River drainage, specifically on National Forest lands in the Green Mountain, Smith, Corral, and Rattlesnake Creek watersheds. This subpopulation is geographically isolated from the Jarbidge - Independence subpopulation area to the north and from the Toiyabe subpopulation area to the southwest by the discontinuity of the Humboldt River. The South Fork of the Humboldt River valley was extensively developed for irrigated agriculture, reducing stream flows by diversion and resulting in large scale habitat fragmentation. The recent completion of the South Fork Reservoir, with a corresponding dam, further reduced the potential for connectivity between these subpopulations.

Preliminary evaluation of recent and historic survey data suggests at least one conservation unit containing two population units and three isolated population units are found in the Ruby Mountain subpopulation area (Table S-1). The single conservation unit and the three isolated population units are listed below:

Smith Creek Conservation Unit: The Smith Creek Conservation Unit consists of several ponded locations in the Middle Fork and South Fork of Smith Creek, South Fork of the Humboldt River.

Isolated population units: Corral Creek, South Fork of Green Creek, and Rattlesnake Creek.

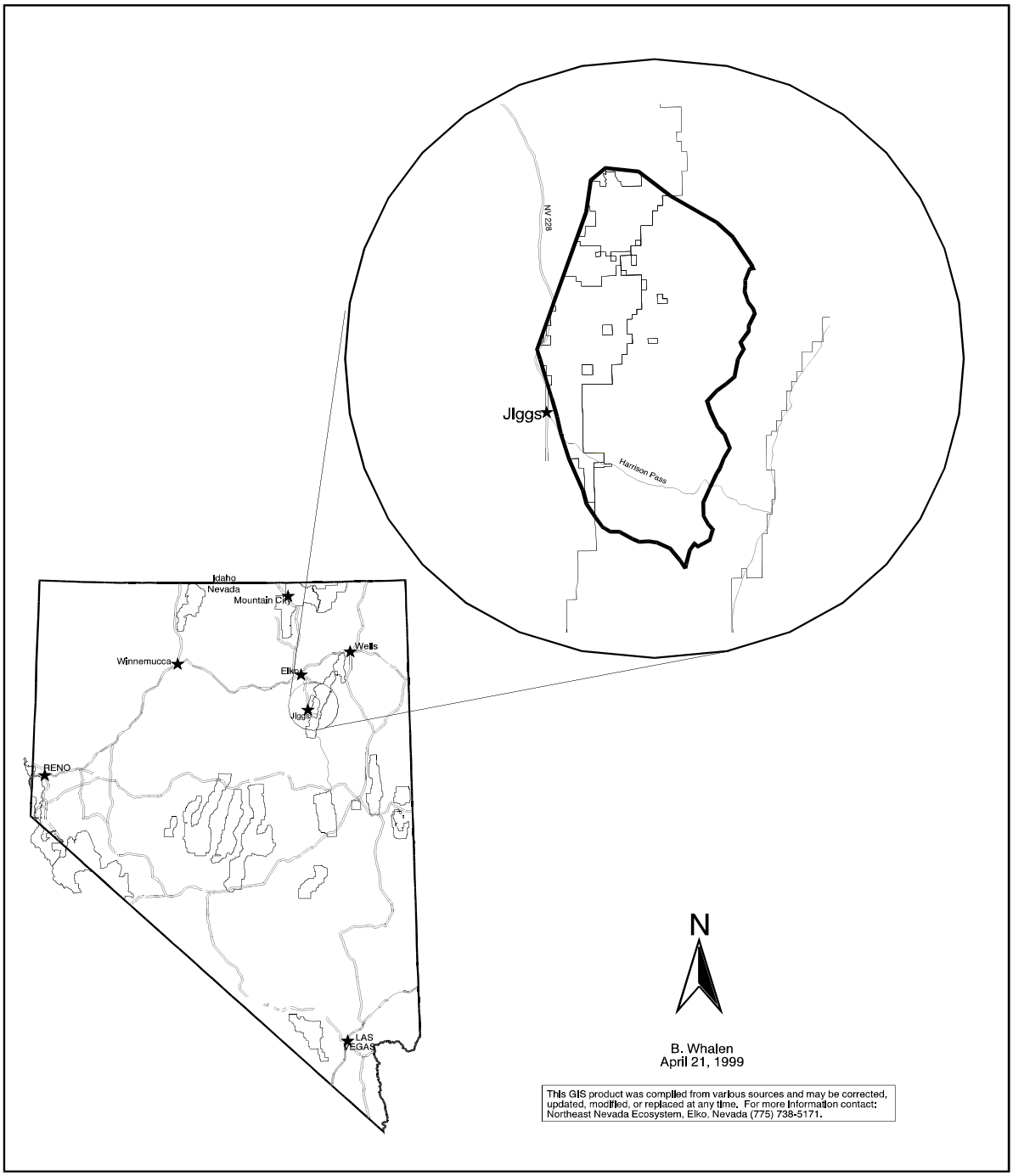

Figure 4. Location of the Ruby Mountain subpopulation of the Columbia spotted frog in Nevada.

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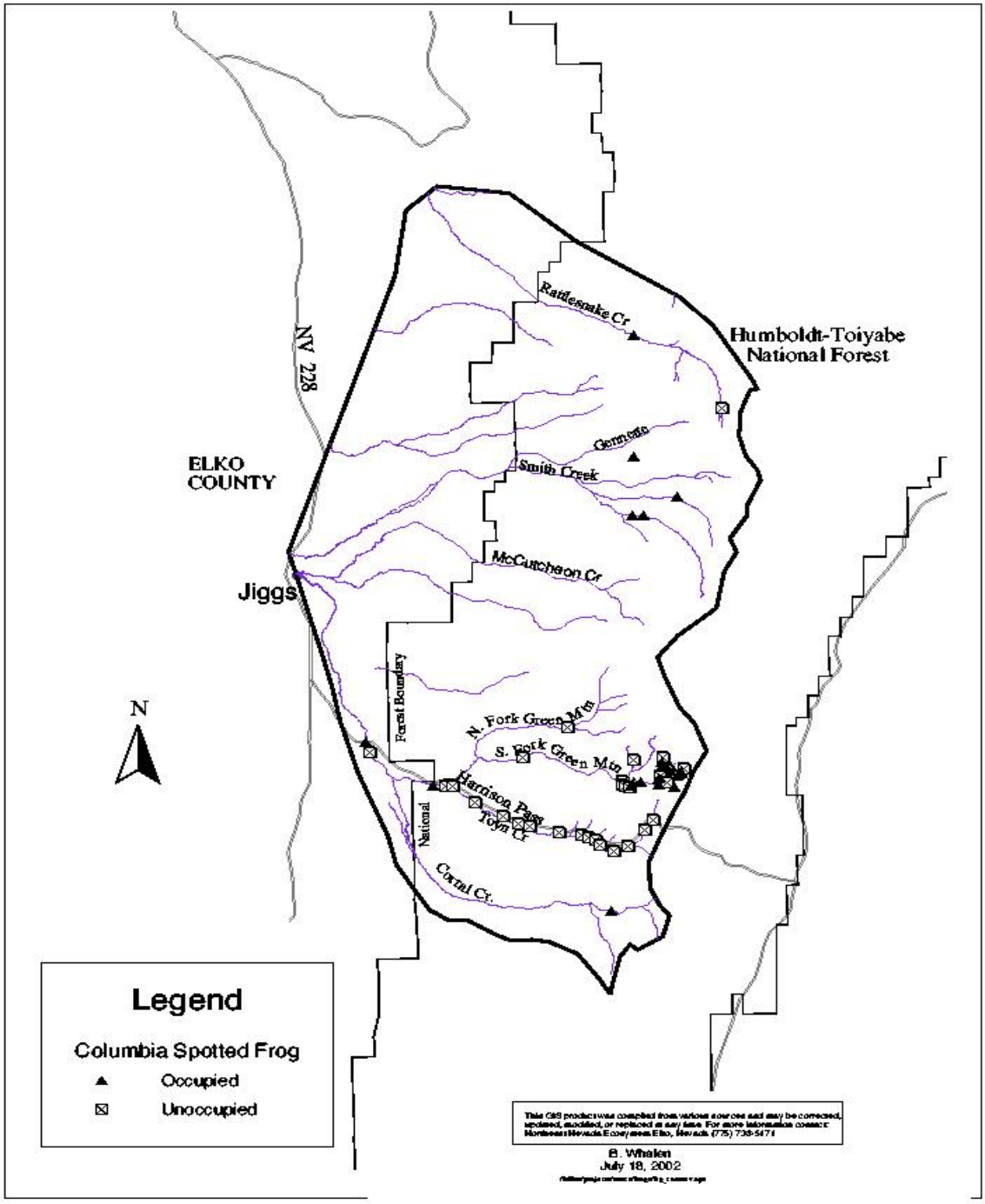


Figure 5. Survey sites for Columbia spotted frogs in the Ruby Mountain subpopulation area, showing occupied and unoccupied sites.

Jarbidge - Independence Subpopulation: The Jarbidge - Independence subpopulation area includes watersheds in both the Humboldt River and Snake River basins, and is the largest of Nevada's three subpopulation areas in both area and number of population units (Figures 6 & 7). Geographically and genetically, the Jarbidge - Independence subpopulation area is likely part of a larger subpopulation extending up into southern Idaho (Reaser 2000). Spotted frog population units in the Jarbidge - Independence subpopulation area are found on public and National Forest lands, and, to a lesser extent, privately-owned land.

Preliminary evaluation of recent and historic survey data suggests at least eight conservation units may be present in the Jarbidge - Independence subpopulation area (Table S-1). Each conservation unit is described below:

Merritt Creek Conservation Unit: This conservation unit is in the Bruneau River drainage and consists of six population units. The Ramsey Draw population unit is thought to have the largest population of these units (Table S-1).

North Fork of the Humboldt River Conservation Unit: This conservation unit consists of approximately three population units (Table S-1).

Pie Creek Conservation Unit: This conservation unit is in the North Fork of the Humboldt River basin, but is considered isolated from the *North Fork of the Humboldt River* conservation unit. An estimated five population units occur in this subwatershed; connectivity between these units is difficult to demonstrate (Table S-1).

Marys River Conservation Unit: Eight population units are currently known from the Marys River and tributaries (Table S-1).

Three previously undescribed population units were located in the Marys River and tributaries during 1998. These population units supported large numbers of frogs; the location of each suggests a large potential for the downstream dispersal into suitable habitat. Much of the Marys River system remains unsurveyed for Columbia spotted frogs.

Sun Creek Conservation Unit: Data are lacking on the distribution of spotted frogs in the Sun Creek Drainage, as portions of Sun Creek on private land have yet to be surveyed for this species. Frogs are present in at least two areas on National Forest lands. This presents an opportunity for a cooperative survey on private land in the Sun Creek watershed.

Pole Creek Conservation Unit: Four known population units constitute the Pole Creek Conservation Unit (Table S-1). The Orchard Creek population unit is connected to O'Neil Creek only by ephemeral flow, and therefore may be at risk for local extinction.

Doby George Conservation Unit: Spotted frogs have been found in three population units in the Doby George area in three different streams and one stock pond (Table S-1).

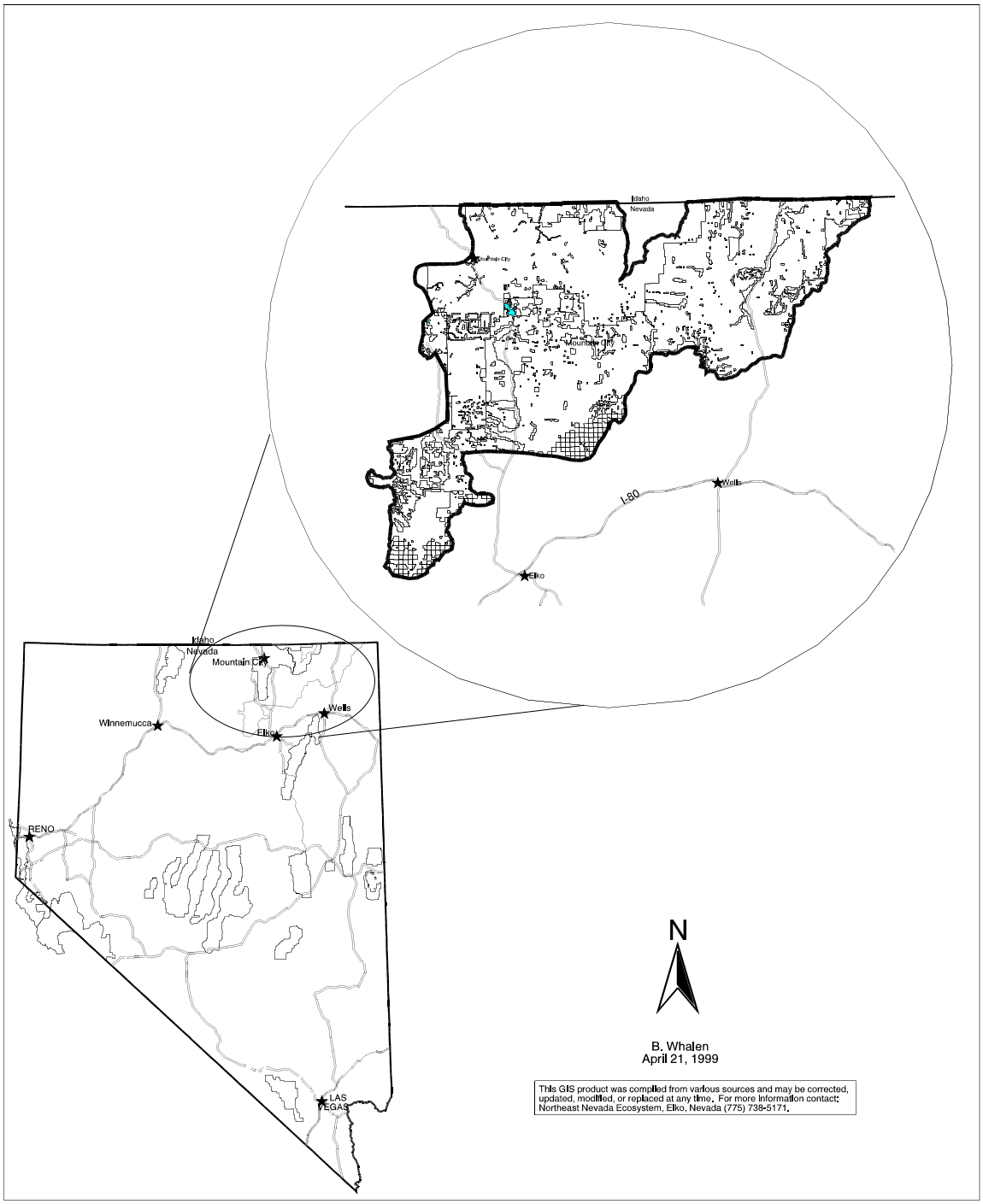
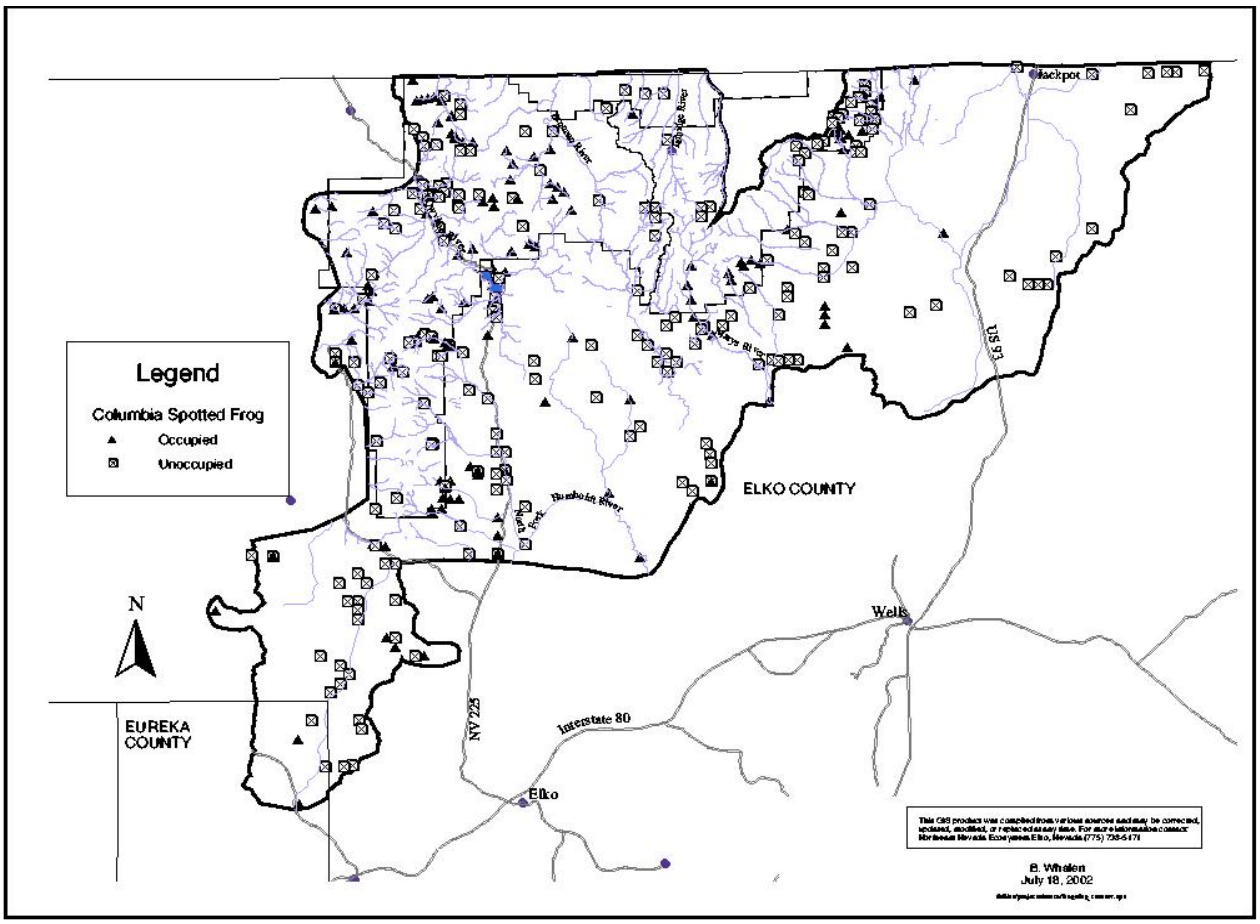


Figure 6. Location of the Jarbidge - Independence subpopulation of the Columbia spotted frog in Nevada.

Figure 7. Survey sites for Columbia spotted frogs in the Jarbidge - Independence subpopulation area, showing occupied and unoccupied sites.



Coleman Canyon Conservation Unit: Population units in Coleman Canyon are all on Coleman Creek (Table S-1).

Bear Creek Conservation Unit: Little is known about this conservation unit. Streams are intermittent in nature, and have been determined to be "functioning at risk" by recent survey work (Table S-1).

Table S-1. Columbia Spotted Frog Conservation and Population Units

Ruby Mountain Subpopulation Area			
Conservation Unit: Smith Creek	Watershed: South Fork Humboldt River		
Population Unit	Type of Aquatic Habitat	Date/Amphibian Survey(s)	Land Owner
South Fork Smith Creek	Ponded, Beaver	1997	USFS H-T NF
Middle Fork Smith Creek	Ponded, Beaver	1997	USFS H-T NF
Conservation Unit: Isolated Streams, Ruby Mountains	Watershed: South Fork Humboldt River		
Corral Creek	Ponded, Beaver	1998	USFS H-T NF
South Fork Green Mountain Creek	Ponded, Beaver	1994, 1998	USFS H-T NF
Rattlesnake Creek	Ponded, Beaver	1996	USFS H-T NF
Jarbidge - Independence Subpopulation Area			
Conservation Unit: Merritt Creek	Watershed: Bruneau River		
Merritt Creek	Ponded	1996	USFS H-T NF
Ramsey Draw	Ponded, Beaver	1996	USFS H-T NF
Log Creek	Ponded	1997, 1998	USFS H-T NF
Willis Creek	Ponded	1997, 1998	USFS H-T NF
Walker Creek	Stock-Pond	1997	USFS H-T NF
Yankee Bill	Ponded	1997	USFS H-T NF
Conservation Unit: North Fork, Humboldt River	Watershed: Humboldt River		
North Fork Humboldt	Ponded, Beaver	1996	USFS H-T NF
Conservation Unit: Pie Creek	Watershed: Humboldt River		
Gance Creek	Ponded		USFS H-T NF
Mahala Creek	Pond (1)	1992	USFS H-T NF
Pie Creek	Flowing with pools	1998	BLM Elko FO

Population Unit	Type of Aquatic Habitat	Date/Amphibian Survey(s)	Land Owner
Mahala Creek 2	Unknown		Independence Mining Co.
Gance Creek 2	Unknown		Private
Conservation Unit: Marys River	Watershed: Humboldt River		
Marys River 1	Ponded & Flowing	1998	USFS H-T NF
Marys River 2	Ponded & Flowing	1998	USFS H-T NF
Draw Creek	Ponded	1979	USFS H-T NF
T Creek	Ponded , Spr.W/ Stock Pond	1994	BLM Elko FO
Marys River 3 & 4	Flowing & Ponded	1991	BLM Elko FO
Marys River 5	Flowing & Ponded	1996	BLM Elko FO
Currant Creek 1	Ponded	1991	BLM Elko FO
Currant Creek 2	Ponded	1989	BLM Elko FO
Conservation Unit: Sun Creek	Watershed: Salmon Falls		
Sun Creek 1	Ponded, Beaver	1993, 1996	USFS H-T NF
Sun Creek 2	Ponded, Beaver	1994, 1996	USFS H-T NF
Wildcat Creek	Stock Pond	1993, 1996	USFS H-T NF
Conservation Unit: Pole Creek	Watershed: Salmon Falls		
Pole Creek	Ponded, Beaver	1997, 1998	USFS H-T NF
O'Neil Creek	Ponded, Beaver	1997, 1998	USFS H-T NF
Orchard Creek	Ponded , Beaver	1998	USFS H-T NF
Conservation Unit: Meadow Creek	Watershed: Bruneau River		
Meadow Creek	Ponded	1996	USFS H-T NF
Left Fork Tennessee Gulch	Unknown	1989	USFS H-T NF
Tennel Creek	Unknown	1989	USFS H-T NF
Sand Creek	Ponded	1996	USFS H-T NF

Population Unit	Type of Aquatic Habitat	Date/Amphibian Survey(s)	Land Owner
Indian Johnny Creek	Unknown	1989	USFS H-T NF
Telephone Creek	Ponded	1996	USFS H-T NF
Martin Creek	Ponded	1996	USFS H-T NF
Conservation Unit: Doby George	Watershed: Owyhee River		
Doby George	Stock Pond	1992	USFS H-T NF
Cap Winn	Ponded, Beaver	1997	USFS H-T NF
Blue Jacket Creek	Unknown	1996	USFS H-T NF
Conservation Unit: Coleman Canyon	Watershed: Owyhee River		
Coleman Canyon	Ponded, Beaver	1996	USFS H-T NF
Conservation Unit: Bear Creek	Watershed: Salmon Falls Creek		
Bear Creek	Beaver Pond	1995	BLM Elko FO
Conservation Unit: Isolated Streams, Independence Range	Watershed: Owyhee River		
Poorman Creek	Ponded	1996	USFS H-T NF
Chipman Meadow	Stock Pond	1996	USFS H-T NF
McCall Creek	Ponded	1996	USFS H-T NF
Winters Creek	Unknown	1996	USFS H-T NF
Mill Creek	Ponded	1991, 1994	USFS H-T NF
Lost Meadows	Unknown	1996	USFS H-T NF
Clear Creek	Ponded	1996	USFS H-T NF
Riffle Creek	Pond (1)	1996	USFS H-T NF
Beaver Creek	Ponded	1996	USFS H-T NF
Upper Trail Creek	Ponded	1997	USFS H-T NF
West Fork Slaughterhouse Creek	Ponded	1998	USFS H-T NF
Haystack Creek	Stock Pond	1996, 1998	USFS H-T NF
Conservation Unit: Isolated Streams, Jarbidge Range	Watershed: Salmon Falls		
Willow Creek	Stock Pond	1977	USFS H-T NF
Cottonwood Creek	Ponded, Beaver	1996	USFS H-T NF

Population Unit	Type of Aquatic Habitat	Date/Amphibian Survey(s)	Land Owner
Wilson Creek	Ponded, Beaver	1995	BLM Elko FO/USFS H-T NF
Conservation Unit: Isolated Streams, Independence Range	Watershed: Humboldt River		
Spring Creek	Flowing w/Pools		Newmont Mining Co.
Little Jack Creek	Flowing w/Pools		Newmont Mining Co.

POTENTIAL THREATS TO THE CONTINUED EXISTENCE OF COLUMBIA SPOTTED FROGS

The success of any conservation or recovery program depends on reducing or eliminating the threats to the species' existence. The following list of potential threats to the Columbia spotted frog is based on the five listing factors for federal listing of a species under section 4(a)(1) of the ESA. For each of these factors, specific activities potentially threatening the persistence of Columbia spotted frog populations are described below:

Habitat Degradation (Listing Factor 1): The present or threatened destruction, modification, or curtailment of Columbia spotted frog habitat or range.

Water Diversions: Water diversions may be a significant threat to Columbia spotted frogs where historic populations have been extirpated due to the diversion of water from streams or wetlands for activities associated with livestock grazing, agriculture, and fish culture, particularly where drainages terminate and water becomes a limiting factor. Because of appropriations under State of Nevada water law and land use practices on public, private, and tribal lands, water diversions continue to occur and may be problematic for Columbia spotted frog conservation and recovery in some locations, particularly at lower elevations (Reaser 1997; Worthing 1993).

Livestock Grazing: In those systems capable of supporting woody vegetation, improper management of livestock grazing in riparian areas may result in (1) loss of vegetation diversity and removal of vegetation that provides bank stabilization, cover from predators, protection from UV radiation, and shade from high temperatures, (2) trampling of frogs or larvae, (3) degradation of water quality by defecation and urination, (4) breakdown of bank overhangs and sedimentation, and (5) re-channelization of water and the resultant desiccation of meadows and ponds and the loss of oxbows and other slow-moving water (IDFG et al. 1995; Reaser 1997). The development of stock ponds for livestock grazing in some spotted frog habitats has been beneficial by creating ponded water. Bull and Hayes (2000) failed to find any negative impacts of grazing on reproduction and recruitment of Columbia spotted frogs in a lentic system. However, high variability in the results may have masked any grazing effects. Further research on grazing intensity and timing is needed to identify and evaluate potential effects on amphibians (Bull and Hayes 2000). The effects of grazing on woody vegetation is critical because of the importance of woody debris in providing nutrients, structure and pool formation and the streambank stability, shading and micro-climate effect of riparian trees and shrubs. On a stream rested from continuous grazing for 10 years, Claire and Storch (1977) found alders and willows provided 75 percent more shade cover than areas that had been devoid of shrub canopy cover before exclosures. Similar grazing-woody vegetation relationships have been reported by Coffin in litt. (1998), Duff (1979), and Kauffman et al. (1983).

However, not all livestock grazing is detrimental to riparian and aquatic habitat. Beginning in the mid-1980s, researchers began looking for grazing systems and livestock management strategies that might be compatible with healthy riparian and aquatic ecosystems. As a result of these efforts, investigators found that "riparian grazing" and "improper riparian grazing" were not necessarily synonymous (Ehrhart and Hansen 1997). Indeed, several grazing strategies for improving riparian habitats have been evaluated and found effective (Platts 1991, Masters et al. 1996 a & b, Leonard et al. 1997, Ehrhart and Hansen 1997), with improvement of riparian conditions occurring concurrently with implementation of these strategies. Various management strategies that limit livestock

loitering within the riparian zone of a given pasture have been found to be more important than either season of use or length of time in the pasture per se (Ehrhart and Hansen 1997).

Spring Development. Springs provide a permanent source of water for breeding, feeding and winter refugia. Springs serve as essential hibernacula by providing deep, protected areas for Columbia spotted frogs in cold climates. Springs have been developed for livestock use or for diversion of water for irrigation, rendering the springs unavailable to Columbia spotted frog use. The loss of springs as Columbia spotted frog habitat such as hibernacula, feeding or breeding sites, or just "wet spots" in dry years, may be a threat to Columbia spotted frogs (Munger et al. 1996).

Loss of Beavers. The reduction of beavers (*Castor canadensis*) has been linked to the reduction of suitable habitat for Columbia spotted frogs. Beaver are an important element in the creation of pools with slow-moving water for Columbia spotted frog reproduction and wet meadows for foraging and escape cover. Beavers are known to occur within drainages in NENV subpopulations' range, but their current distribution is undetermined. The value of introducing and maintaining beavers in Columbia spotted frog habitat to promote and maintain is not known at this time and needs to be determined before a management plan for beavers is drafted.

Mining. The effects of mining on receiving water systems may be a severe threat to Columbia spotted frogs, other amphibians, and aquatic organisms in localized situations. Concerns have been raised about the potential toxicological impacts of arsenic on aquatic organisms, which are known to be very sensitive to exposure to this metalloid (Miller et al. 1996). A 50 percent mortality and malformations of developing narrow-mouthed toad (*Gastrophryne carolinenis*) embryos occurred within seven days of exposure to low levels (0.04 mg/L) of arsenic in experimental studies (Eisler1994).

Another potential effect of mining is the cumulative dewatering and water management operations for proposed and existing mining projects in the Maggie Creek Subbasin. Mine dewatering could reduce water levels or flows in some springs and perennial stream reaches in the Maggie Creek Subbasin. Water level reductions in springs and potential loss of perennial stream segments could affect Columbia spotted frogs through the loss of habitat (BLM 2000).

Roads and Culverts. Construction of roads and culverts can pose a threat to Columbia spotted frogs by fragmenting habitat and creating barriers that prevent or curtail frog movement from one portion of their habitat to another (Reh 1989).

Overutilization (Listing Factor 2): Overutilization for commercial, recreational, scientific, or educational purposes.

Over-exploitation. Over-exploitation of amphibians for commercial markets is known for many species (Jennings and Hayes 1984). However, collection of Columbia spotted frogs in Nevada, other than controlled and low-level sampling for scientific purposes, is not currently known to occur.

Disease and Predation (Listing Factor 3): Disease, predation, competition, and hybridization.

Disease. Although a diversity of microbial species are naturally associated with amphibians, it is generally accepted that they are rarely pathogenic to amphibians except under stressful environmental conditions (Fellers et al. 2001). Chytridiomycosis (Chytrid) is an emerging panzootic fungal disease in the United States. Clinical signs of amphibian chytridiomycosis include abnormal posture, lethargy, and loss of righting reflex. Gross lesions, which are usually not apparent, consist of abnormal epidermal sloughing and epidermal ulceration; hemorrhages in the skin, muscle, or eye; hyperemia of digital and ventrum skin, congestion of viscera. Diagnosis by identification of characteristic intracellular flask-shaped sporangia and septate thalli within the epidermis. Chytrid can be identified in some species of frogs by examining the oral discs of tadpoles which may be abnormally formed or lack pigment (Fellers et al. 2001). Chytrid has been found in Columbia spotted frog populations in Idaho and Utah. To date chytrid fungus has not been found in spotted frog populations in Nevada (Amy pers. comm 2002; Hatch pers. comm 2002). The potential exists for biological survey and monitoring crews working with any aquatic species, or on other related activities including habitat enhancement and research, could transmit chytrid or other pathogens between frog populations if appropriate protocols are not used to clean field equipment and outerwear.

Predation -Bullfrogs. Nonnative bullfrogs (*Rana catesbeiana*) occur within the range of Columbia spotted frogs in the Great Basin. No bullfrogs have been reported at Columbia spotted frog-inhabited sites in Nevada (Moyle 1973; Hammerson 1982; Hayes and Jennings 1986).

Predation - Fishes. It is generally concluded that salmonid (native and non-native) and centrarchid fishes in aquatic systems can preclude the presence of native frogs or significantly decrease reproductive success by feeding on young frogs and frog eggs (Pilliod and Peterson 1997; Knapp and Matthews 2000a, 2000b) particularly where habitats have been altered or introduced fish species have become established. Both native and nonnative salmonids occur within habitats occupied by Columbia spotted frogs and under certain circumstances may pose a significant threat to their continued existence.

Predation - Snakes. According to Reaser (1997) the wandering terrestrial garter snake (*Thamnophis elegans vagrans*) is the most probable source of predation on Columbia spotted frogs in the Toiyabe Range. Mortality can occur directly through consumption by the snakes or indirectly through injury to the frogs by the snakes (Jennings et al. 1992).

Inadequate Regulatory Mechanisms (Listing Factor 4): The inadequacy of existing regulatory mechanisms.

A review of the existing laws and regulations has determined that regulatory mechanisms are adequate to protect Toiyabe spotted frogs in combination with the actions identified in the CAS. The spotted frog is afforded regulatory protection under Nevada State Law as a protected amphibian (NAC 503.075). Classification as a Candidate Species under ESA mandates an enhanced level of review and consultation relative to actions by Federal agencies. Under USFS and BLM policy guidance Candidate and sensitive/special status species receive an enhanced level of review relative to proposed actions.

Other Factors (Listing Factor 5**)**: Other natural or manmade factors affecting the continued existence of the Columbia spotted frog.

Climate. Several dry years may cause a reduction in the number of suitable sites available to Columbia spotted frogs and affect the connectivity of extant sites. Local extinctions from habitats that in normal years are available as frog habitat may eliminate source populations for recolonization. Dry years are likely to exacerbate the effects of other threats, increasing the possibility of stochastic extinction of subpopulations by reducing their size and their connectedness to other subpopulations (IDFG et al. 1995).

Ultraviolet-B (UV-B) radiation. UV-B radiation has been implicated as an important factor in the global decline of amphibians, especially those with low levels of the DNA repair enzyme photolyase (Blaustein 1994; Kiesecker and Blaustein 1995, Davidson et al. 2001). Evidence from recent experiments indicate that Columbia spotted frogs show variable, but high levels of the enzyme. Patterns of population decline in Nevada at low elevation sites, where UV-B effects should be minimal, do not support UV-B as a causative factor (Reaser 1997).

Toxins. Toxic chemicals released into the environment from activities such as mining, agriculture, mosquito abatement, and chemical controls can have lethal and sublethal effects on amphibians (Bishop 1991; Hall and Henry 1992; Davidson et al. 2001). No data have been reported on the relationship between agricultural toxins/mosquito abatement and amphibians in Nevada, but this relationship remains a potential threat. Toxins released as a result of mining activities are discussed above. The effects on Columbia spotted frogs of toxins released as a result of non-native trout stream treatment require further study. Gill-breathing tadpoles are most likely to be negatively affected (e.g., killed outright), but the effects of rotenone on frogs and other wet-skinned, cutaneous breathing amphibians need further study and should be regarded as potential threats to Columbia spotted frogs (Chandler 1982; Fontenet et al. 1994; McCoid and Bettoli 1996).

LCT Recovery Actions. Four LCT recovery actions that have the potential to adversely affect Columbia spotted frogs include: 1) the re-establishment of LCT into historic habitats which are also occupied by Columbia spotted frogs; 2) chemical control of non-native fish species; 3) use of electrofishing for LCT population monitoring; and 4) transmission of diseases and pathogens to uninfected frog habitats by field crews.

Re-establishment of LCT into historic habitats that are occupied by Columbia spotted frogs and presently do not have any fish predators may adversely affect Columbia spotted frogs. It is believed that LCT and Columbia spotted frogs naturally evolved together. However, the re-establishment of an historically present fish predator, in altered or degraded habitats and in combination with other threats, could negatively affect occupied frog habitats or individual populations.

1. The use of piscicides such as rotenone or antimycin for chemical control of non-native fish species in LCT habitats could negatively affect spotted frog populations as described in the toxin section above, depending on the timing of treatments and the specific chemicals used.

2. Electrofishing is known to result in injury and some mortality to salmonids and their eggs (Fredenberg
1996; . As vertebrates, Columbia spotted frogs could suffer the same injury and mortality as fish. Presently, there is no scientific literature to confirm or deny this hypothesis.

3. The movement of LCT field crews from one location to another could potentially transmit diseases and pathogens to uninfected frog populations, as described above under the Diseases section, if appropriate disease transmission protocols are not implemented and followed.

The movement of any aquatic survey or research personnel from one location to another has the potential to transmit diseases and pathogens to uninfected frog populations, as described above under the Diseases section, if appropriate disease transmission protocols are not implemented and followed.

ADAPTIVE MANAGEMENT

This Strategy depends upon the successful implementation of adaptive management and its principles. Adaptive management is designed to bring new information immediately into new management direction. All cooperators agree and recognize, consistent with the goals of this Strategy, that monitoring actions and conservation measures implemented through CAS will be conducted consistent with the concepts of adaptive management. The effectiveness of all conservation measures and monitoring methods will be periodically reviewed and evaluated by the implementing cooperators and by CSFTT. Based on such evaluation, appropriate modifications to methods, actions, and strategies will be made to ensure scientific rigor and the efficacy of conservation measures. It is critical that the signatories provide the resources necessary to ensure successful implementation of adaptive management and its principles.

The adaptive management strategy for CAS is shown in Figure 8. Figure 8 can be summarized as follows:

tep 1. Implement CAS conservation objectives, goals, and strategies.
Step 2. Initiate distribution and threat inventories, and habitat monitoring program.
Step 3. Review CAS conservation goals, objectives, and strategies and adjust as necessary based on updated information.
Step 4a. Prioritize conservation units for implementation of conservation actions and/or
Step 4b. Identify and prioritize research needs.
Step 5a. Initiate site-specific actions to reduce or eliminate threats.
Step 5b. Complete identified research projects.
Step 6. Establish monitoring plan to determine effectiveness of conservation actions.
Step 7. CSFTT analyzes/evaluates monitoring and research project results to determine progress toward attainment of conservation objectives.
Step 8. Repeat Step 3.

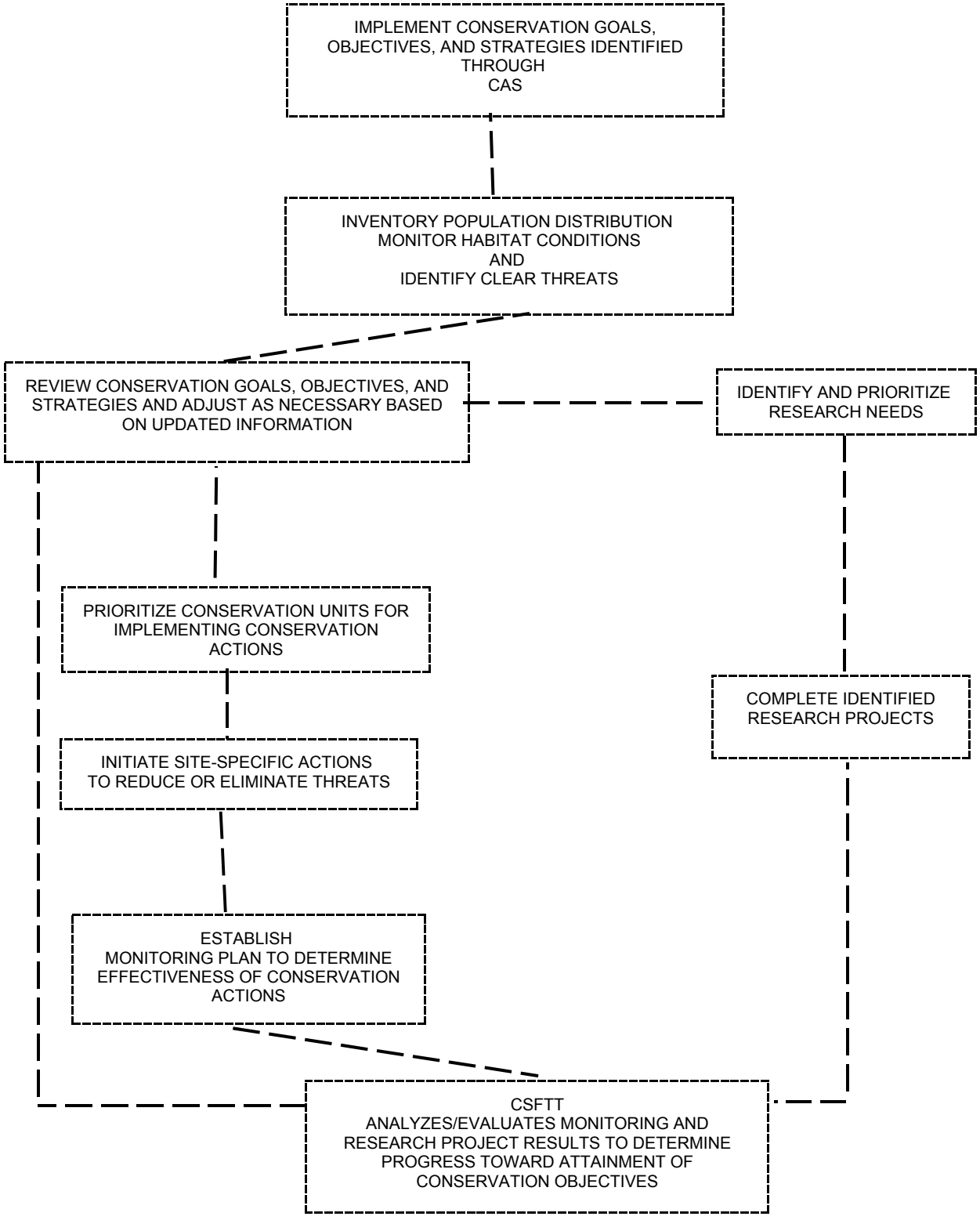


Figure 8. Adaptive management flow chart

CONSERVATION GOALS, OBJECTIVES, STRATEGIES, AND ACTIONS

Conservation Goals

1. To reduce threats to Columbia spotted frogs and their habitat to the extent necessary to prevent population units becoming extinct throughout all or a portion of their historic range.

1. To maintain, enhance, and restore a sufficient number of population units of Columbia spotted frogs and their habitat to ensure their continued existence throughout their historic range.

Conservation Objectives, Strategies, and Actions to be Implemented

The following conservation objectives, strategies, and actions require implementation to achieve the conservation goals and objectives for NENV subpopulations of Columbia spotted frog. Conservation objectives, strategies, and actions are listed in a step-down form in which the objectives are stepped down to strategies and strategies are stepped down to specific actions.

Objective 1. Determine the overall distribution of Columbia spotted frogs.

Strategy 1. Adopt and implement a standard protocol for inventory of Columbia spotted frogs.

Action 1. Develop a standard protocol for presence or absence surveys.

Action 2. Implement a standard protocol for presence or absence surveys.

Strategy 2. Determine the distribution of Columbia spotted frogs on Federal land.

Action 1. Assess the presence or absence of Columbia spotted frogs at all known historic sites.

Action 2. Develop a method for identifying potential sites.

Action 3. Assess the presence or absence of Columbia spotted frogs at potential sites.

Action 4. Verify and delineate conservation units.

Action 5. Create a detailed map of historic and potential sites using GPS and GIS.

Action 6. Maintain a detailed map of historic and potential sites using GPS and GIS.

Strategy 3. Determine the distribution of Columbia spotted frogs on non-federal land.

Action 1. Identify known and potential Columbia spotted frog sites from existing information.

Action 2. Secure permission from willing non-federal landowners or controlling authorities to access property.

Action 3. Assess the presence or absence of Columbia spotted frogs at all accessible sites.

Action 4. Verify and delineate conservation units.

Action 5. Create a detailed map of these sites using GPS and GIS.

Action 6. Maintain a detailed map of these sites using GPS and GIS.

Action 7. Evaluate the significance of Columbia spotted frog population units and habitat on non-federal lands to the conservation of Columbia spotted frogs.

Strategy 4. Prevent the spread of frog diseases and pathogens between populations.

Action 1. Adopt a disease and pathogen protocol for aquatic field crews to prevent the spread of frog diseases and pathogens between populations.

Action 2. Require state and federal aquatic field crews to implement adopted disease and pathogen protocol for the Columbia spotted frog and other aquatic species inventory and monitoring activities.

Action 3. Incorporate disease and pathogen protocols into research and collection permits issued under state and federal agency authorities.

Objective 2. Assess the abundance of Columbia spotted frogs, habitat conditions, and existing and potential threats at occupied sites.

Strategy 1. Monitor occupied sites on accessible lands to assess abundance of Columbia spotted frogs.

Action 1. Develop a process for prioritizing sites and monitor them on a cyclic basis to develop long-term trend data.

Action 2. Monitor occupied sites using developed prioritization protocol for long- term trend data collection.

Action 3. Establish sentinel sites and conduct annual monitoring to collect long-term trend data.

Strategy 2. Assess and evaluate habitat conditions at potential and occupied sites on accessible lands.

Action 1. Prioritize potential and occupied sites and develop a process for assessing, evaluating, and categorizing habitat conditions at each site on a cyclic basis.

Action 2. Incorporate standardized habitat monitoring protocols into animal survey and monitoring activities identified under Objectives 1 and 2.

Action 3. Identify the range of habitat conditions which are optimum to allow Columbia spotted frog persistence.

Strategy 3. Identify and assess the existing and potential threats at each occupied site.

Action 1. Identify the threats at each occupied site on a cyclic basis.

Action 2. Assess the degree and imminency of each threat at each site.

Strategy 4. Create and maintain database for the storage of data and other information collected.

Action 1. Create database for the storage of data and other information collected.

Action 2. Maintain database for data and other information collected.

Objective 3. Ensure that viable populations and their habitats are managed and enhanced to ensure the continued existence of Columbia spotted frogs throughout their historic range.

Strategy 1. Identify, prioritize and implement site-specific actions to reduce the existing and potential threats to Columbia spotted frogs on Federal lands as identified in Objective 2.

Action 1. Prioritize conservation units for conservation actions.

Action 2. Develop a detailed monitoring plan for Columbia spotted frog

populations and habitats.

Action 3. Develop a Columbia Spotted Frog Species Management Plan.

Action 4. Manage, restore, and/or enhance existing riparian and spring ecosystems to sustainable condition to benefit all life stages of Columbia spotted frogs.

Action 5. Identify, restore, and/or enhance and manage areas of historic unoccupied and potential Columbia spotted frog habitat within the presumed historic range of the species to benefit all life stages of Columbia spotted frogs.

Action 6. Identify and manage dispersal corridors, including terrestrial upland habitats important to Columbia spotted frogs, to maximize ecological connectivity between occupied/restored frog habitats.

Action 7. Implement activities identified in Actions 1 through 5 on an annual basis as defined in the Annual Action Plans developed by the CSFTT (Objective 6, Strategy 1, Action 6).

Strategy 2. Encourage non-federal landowners to conserve viable populations of Columbia spotted frogs and their habitats.

Action 1. Identify potential locations and cooperators for conservation efforts on non-federal lands.

Action 2. Provide technical assistance to willing landowners to develop Candidate Conservation Agreements with Assurances.

Action 3. Work with landowners to use available incentive programs such as the Partners for Fish and Wildlife Program and the Conservation Reserve Program to protect and restore Columbia spotted frog habitat.

Objective 4. Conduct research that directly supports conservation and management of Columbia spotted frogs and their habitat.

Strategy 1. Identify and recommend projects to address known research needs and incorporate data into the Conservation Strategy through the adaptive management process.

Action 1. Incorporate identified research needs into CSFTT annual action plan commitments (Objective 6, Strategy 1, Action 6).

Action 2. Utilize research findings in annual program assessments and adaptive management reviews of the Strategy.

Strategy 2. Implement and maintain a process for identifying future research needs and incorporating research projects into the Strategy.

Action 1. Assess research needs on an ongoing basis.

Action 2. Develop a prioritized list of research needs.

Action 3. Maintain a prioritized list of research needs.

Action 4. Incorporate research needs into the Strategy by identifying lead entity(s), budget and time schedule.

Action 5. Implement proposed research actions as approved by the CSFTT.

Action 6. Incorporate data findings into the Strategy through the adaptive management process to ensure that goals and objectives are ultimately met.

Objective 5. Implement through administrative procedures CAS and incorporate provisions of the Strategy into agency planning documents and budgets to ensure the conservation goals and objectives are met in a consistent manner.

Strategy 1. Enforce existing policies, laws and regulations.

Action 1. Review existing policies, laws and regulations at least biennially and assess their adequacy to protect Columbia spotted frogs and their habitat.

Action 2. Maintain the Columbia spotted frog on protected or sensitive species lists of cooperator agencies.

Action 3. Conduct section 7 consultation under ESA for Columbia spotted frog projects that may affect federally listed species.

Action 4. Periodically evaluate species status under section 4 of ESA.

Strategy 2. Identify and implement non-site-specific actions, policies, and procedures to reduce existing and potential threats to population units of Columbia spotted frogs as identified in Objective 3.

Action 1. Identify non-site-specific actions, policies, and procedures to reduce the existing and potential threats to Columbia spotted frogs.

Action 2. Implement non-site-specific actions, policies, and procedures to reduce the existing and potential threats to Columbia spotted frogs.

Strategy 3. Review forest, land, and resource management plans to determine if plan objectives are in conformance with spotted frog conservation goals, objectives, strategies, and actions.

Action 1. Consider and incorporate CAS conservation goals, objectives, strategies, and actions that would require an amendment to the Humboldt/Toiyabe Land and Resource Management Plan during the forest plan revision process scheduled for completion in 2006/2007.

Action 2. Consider and incorporate amendments to BLM management plan documents as appropriate and necessary to implement any of the CAS conservation goals, objectives, strategies, and actions, as those plan documents are scheduled for review and revision.

Action 3. Maximize retention of Federal lands supporting Columbia spotted frogs or potential frog habitat.

Strategy 4. Incorporate conservation goals, objectives, strategies, and actions of CAS into agency budget requests, and based on funding, revise Strategy as necessary, to update implementation schedule.

Action 1. Conduct annual workload analysis to determine the budgetary and biological staffing needs to accomplish conservation actions identified in the implementation schedule.

Action 2. Provide the CSFTT members' respective managers with annual conservation action proposals for funding the following year.

Action 3. Pursue alternative funding strategies and partnerships to supplement agency work programs as opportunities are identified and available.

Strategy 5. Ensure implementation of the CAS through the CSFTT partnership process.

Action 1. Implement team responsibilities as defined in the CAS implementation strategy.

Objective 6. Develop and implement an interagency adaptive management framework partnership.

Strategy 1. Develop and implement an interagency adaptive framework process to ensure that adaptive management is incorporated into the implementation of the Strategy.

Action 1. Review Strategy progress and implement any changes through an adaptive management process as needed.

Action 2. Monitor the effectiveness of each action on a set schedule to determine if the expected results are being attained within the given time frame.

Action 3. If actions are not effective, modify the strategy to implement alternative measures to ensure that goals and objectives are ultimately met.

Action 4. Ensure that the data from inventory, monitoring, and research efforts are incorporated into the Strategy through the adaptive management framework.

Action 5. Modify and/or update the implementation schedule yearly.

Action 6. Develop an annual action plan of site-specific management commitments by cooperator, which are keyed to conservation objectives of the Strategy and Species Management Plan, research findings, and adaptive management review.

Objective 7. Support the CAS by increasing public awareness and appreciation for Columbia spotted frogs and their habitat, and by making data and information available to interested parties and decision makers.

Strategy 1. Encourage citizen and landowner participation in CAS implementation.

Action 1. Develop brochures and other materials on Columbia spotted frogs and their management needs for dissemination to the public for education purposes.

Action 2. Distribute informational materials as developed to the general public, recreational users, private landowners and to other customers who may be involved in actions affecting Columbia spotted frogs and their habitat.

Action 3. Develop educational and informational materials on Columbia spotted frogs and their habitat/management needs for distribution through other media sources including newspapers and television.

Action 4. Develop a program to encourage volunteer public and private land conservation efforts.

Strategy 2. Develop a process for collecting and maintaining data and information for distribution to stakeholders and decision makers.

Action 1. Create a depository for storage of data from inventory, monitoring, and research efforts.

Action 2. Maintain the depository.

Action 3. Data and information developed through actions of this Strategy will be available to and shared among cooperators.