Environmental Assessment for Restoration of Rio Grande Cutthroat Trout to the Las Animas Creek Watershed

New Mexico Department of Game and Fish,
U.S. Fish and Wildlife Service, Southwest Region,
USDA Forest Service, Gila National Forest,
and Turner Ranch Properties, LP

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1.0 PURPOSE OF AND NEED FOR THE PROJECT

1.1 Introduction

The New Mexico Department of Game and Fish (Game and Fish), in cooperation with the U.S. Fish and Wildlife Service, Southwest Region (Fish and Wildlife Service), USDA Forest Service (Forest Service), and Turner Ranch Properties, L.P. (Ladder Ranch), has prepared this environmental assessment (EA) to analyze potential effects to physical, biological, and cultural resources and socioeconomic conditions that may result from restoration of Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*) to streams in the Las Animas Creek watershed in Sierra County, New Mexico. This EA will be used by Game and Fish, the Fish and Wildlife Service, and the Forest Service to decide whether or not the project would be implemented as proposed, if the proposed action requires refinement or additional mitigation measures, or if further analyses are needed through preparation of an environmental impact statement. If the proposed action is selected as described or with minimal changes and no further environmental analyses are needed, a decision notice and finding of no significant impact (FONSI) will be prepared.

Funding for this project would be provided through the Wildlife and Sport Fish Restoration Program managed by the U.S. Fish and Wildlife Service and state funding through the New Mexico Department of Game and Fish. Turner Ranch L.P. would also provide funding for project implementation. In addition, a portion of the project is located on federal lands administered by the U.S. Forest Service. Therefore, the proposal is subject to the National Environmental Policy Act (NEPA) provisions to analyze potential environmental effects that may result from the proposed action. This EA has been prepared pursuant to the requirements of NEPA as implemented by the Council on Environmental Quality regulations (40 CFR. 1500, et seq.), U.S. Department of Interior and U.S. Department of Agriculture NEPA procedures, the U.S. Forest Service NEPA Handbook 1909.15, U. S. Fish and Wildlife Service NEPA Reference Handbook, and the U.S. Fish and Wildlife Service NEPA Guidance to States Participating in the Federal Aid Program. The EA also incorporates other federal and state environmental policies and regulations.

1.2 Proposed Action

Game and Fish, the Fish and Wildlife Service, the Forest Service, and the Ladder Ranch (the project proponents) propose to use rotenone to remove nonnative trout and longfin dace (*Agosia chrysogaster*), the latter which is not native to the Las Animas Creek watershed, from approximately 32 miles of stream in the Las Animas Creek watershed located on the Ladder Ranch and the Gila National Forest (Figure 1). Prior to initiation of rotenone treatments, native fish would be salvaged from the project area and maintained in off-channel holding facilities for repatriation following stream renovation. Following removal of nonnative fish, the project proponents propose to restore native Rio Grande cutthroat trout and salvaged native fish to the renovated streams.

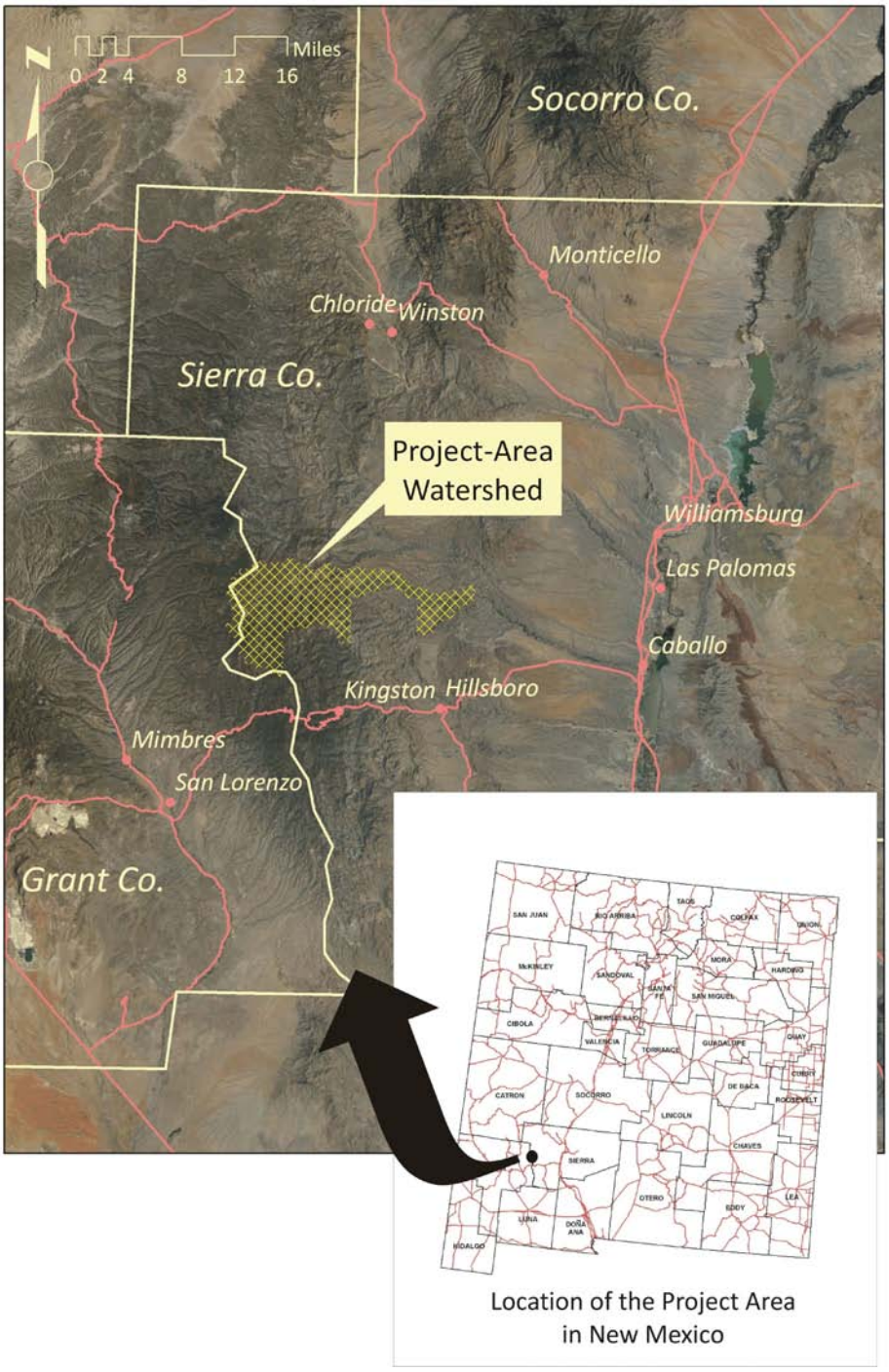


Figure 1. Location of the Las Animas Creek project-area watershed in west-central Sierra County. The project-area watershed consists of lands administered by the Gila National Forest and privately owned lands of the Ladder Ranch. The approximate center of the project area is located at 33° 3' 22" N latitude, 107° 38' 6" W longitude (North American Datum of 1983), and 253,969 meters E, 3,660,593 meters N (UTM Zone 13 North, North American Datum of 1983).

The Las Animas Creek watershed is located is west-central Sierra County (Figure 1). The project area includes streams within a 46,265-acre portion of the Las Animas Creek watershed located on the Ladder Ranch and the Gila National Forest (the "project-area watershed" shown in Figure 2). The project-area watershed is geographically defined by the Continental Divide on the west and includes the headwaters of Las Animas Creek, Las Animas Creek proper on the Gila National Forest and the Ladder Ranch, and the portion of Cave Creek on the Ladder Ranch (Figure 2). The downstream limit of the project-area watershed is the existing fish barrier located on the Ladder Ranch approximately 0.5 stream miles upstream from Warm Spring (Figure 2).

The project-area watershed consists of lands administered and managed by the Gila National Forest (35,118 acres, 76 percent) and privately-owned lands of the Ladder Ranch (11,147 acres, 24 percent). Of the approximately 32 miles of stream proposed for restoration of Rio Grande cutthroat trout, about 18 miles (56 percent) are located on the Gila National Forest and roughly 14 miles (44 percent) are located on the Ladder Ranch. About 14 miles (44 percent) of the stream segments proposed for renovation are located within the Aldo Leopold Wilderness, which is part of the Gila National Forest (Figure 2). Stream segments in the project area that would be renovated include the following:

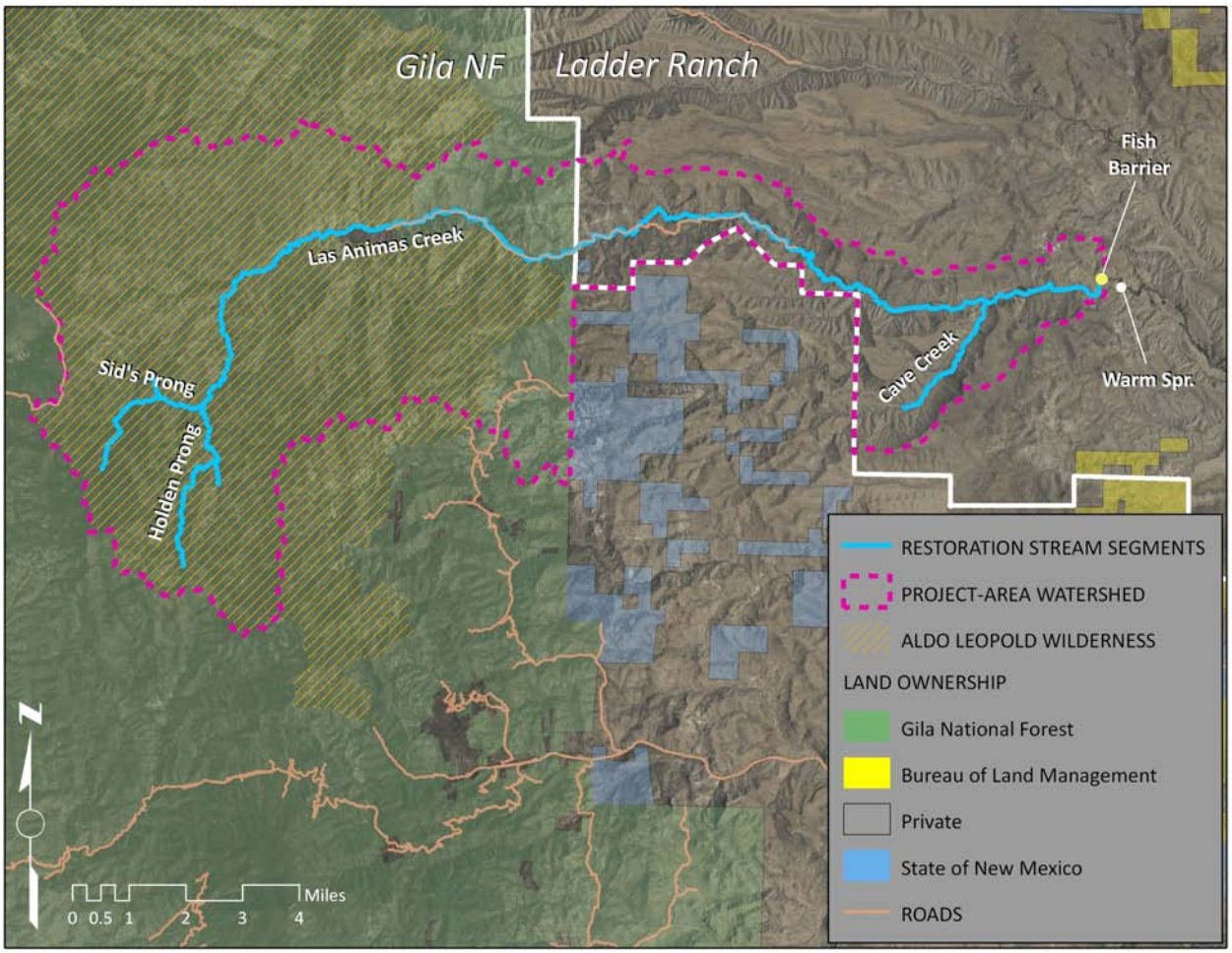
- The headwaters of Las Animas Creek including perennial flow in Holden Prong (*ca*. 3.69 miles), perennial flow in South Animas Canyon/Indian Canyon (*ca*. 0.43 miles), and Sid's Prong (*ca*. 2.93 miles) and Pretty Canyon (*ca*. 0.43 miles) from Las Animas Creek upstream to the limit of perennial flow. These stream segments are all on the Gila National Forest.

- The main-stem of Las Animas Creek from the confluence of Holden Prong and Sid's Prong downstream to the fish barrier on the Ladder Ranch (*ca*. 21.97 miles). Approximately 10 miles are on the Gila National Forest, and the remaining *ca*. 12 miles are on the Ladder Ranch.

- Cave Creek from the confluence with Las Animas Creek upstream to the limit of perennial flow on the Ladder Ranch (*ca*. 2.67 miles). This stream segment is entirely on the Ladder Ranch.

The project is anticipated to be implemented over a three-year period, beginning in the summer of 2014. Details of the Proposed Action are described in Chapter 2 - Alternatives.

Figure 2. Restoration stream segments in the Las Animas Creek project-area watershed. Of the approximately 32 miles of stream proposed for restoration of Rio Grande cutthroat trout, about 18 miles (56 percent) are located on the Gila National Forest and roughly 14 miles (44 percent) are located on the Ladder Ranch.



1.3 Rio Grande Cutthroat Trout

Rio Grande cutthroat trout (Figure 3) is one of 14 subspecies of cutthroat trout in North America (Behnke, 2002) and one of the three native cutthroat trout subspecies found in the southern Rocky Mountains (Figure 4). It is native to cold-water streams[1] in the Rio Grande watershed in New Mexico and Colorado, the Pecos River watershed in New Mexico, and the headwaters of the Canadian River in New Mexico (Behnke, 1992: 149-151; Sublette *et al.*, 1990: 55; Behnke, 2002: 207-210; Pritchard and Cowley, 2006: 13-15; Alves *et al.*, 2008: 10; Pritchard *et al.*, 2008; Figure 4). Rio Grande cutthroat trout may also have naturally occurred in cold-water streams tributary to the Pecos River in western Texas (Garrett and Matlock, 1991), and possibly in headwater streams of the Rio Conchos drainage in Mexico (Hendrickson *et al.*, 2002).

Rio Grande cutthroat trout is most closely related to Colorado River, greenback, Yellowstone, and Bonneville cutthroats. It likely originated from headwater transfer of ancestral trout populations from the Colorado River system into the Rio Grande drainage during the Pleistocene (Behnke, 2002). It is distinguished from the closely related Colorado River and greenback cutthroat trouts by more pyloric caecae (finger-like pockets along the intestine) and fewer scales along the lateral line (Behnke, 1992). Rio Grande cutthroat trout is genetically distinct from other closely related cutthroat trout subspecies (Pritchard *et al.*, 2008).

Figure 3. Rio Grande cutthroat trout from El Rito Creek on the Carson National Forest, Rio Arriba County, New Mexico (photo courtesy of the U.S. Forest Service).

[1] Cold-water streams refers to stream habitats where water temperature does not exceed 75°F (24°C) for extended periods of time (*cf*. Johnstone and Rahel, 2003). Similarly, New Mexico surface water quality standards define cold-water streams as those with a maximum water temperature of 75°F (§20.6.4.900.H(2) of the New Mexico Administrative Code).

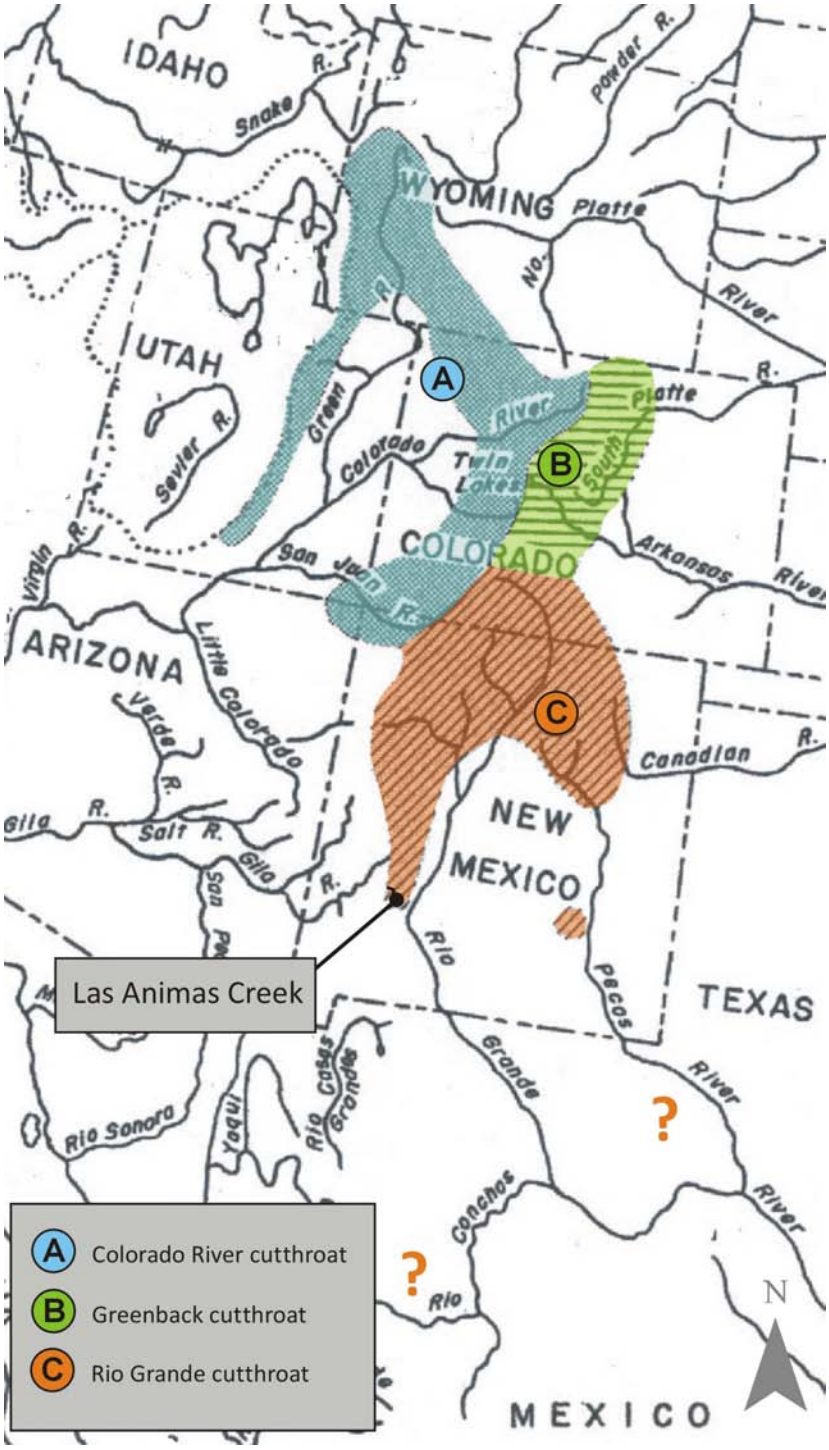


Figure 4. Native cutthroat trout of the southern Rocky Mountain river basins (excerpted and modified from Behnke, 1992: 143). Rio Grande cutthroat (C) occurs in the Rio Grande, Pecos, and Canadian river basins. The location of Las Animas Creek, at the southern limit of the known natural distribution of cutthroat trout (Behnke, 1992: 151), is also shown. The question marks indicate possible native occurrences of Rio Grande cutthroat trout in western Texas and the headwaters of the Rio Conchos drainage in Mexico.

1.4 Project Purpose and Need

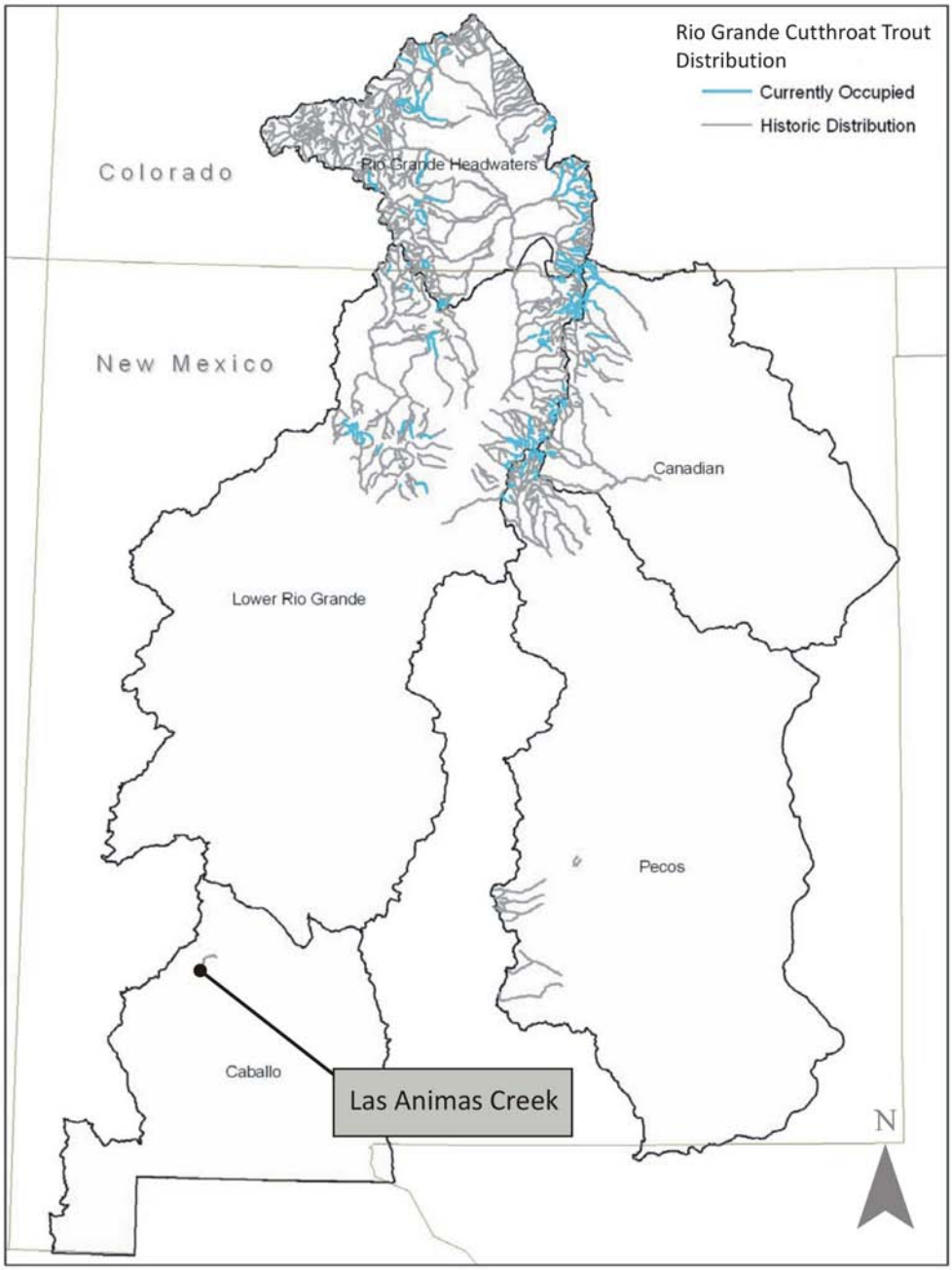
The purpose of the proposed action is to contribute to conservation of Rio Grande cutthroat trout by restoring it to suitable habitat within approximately 32 miles of interconnected stream in the Las Animas Creek watershed, which is in its historic range. Restoration of the species to Las Animas Creek is specified as a conservation action in the *Rio Grande Cutthroat Trout Conservation Plan* (Rio Grande Cutthroat Trout Conservation Team, 2013: 48).

At present, Rio Grande cutthroat trout occupies only about 690 stream miles, or approximately 11 percent of its historic range, which likely consisted of approximately 6,660 miles of cold-water stream habitat (Figure 5; Alves *et al.*, 2008: 13,58). The subspecies currently comprises 91 populations that are at least 99 percent pure (based on genetic testing) and another 29 populations that are at least 90 percent pure (Alves *et al.*, 2008: 31). Half of the 120 extant populations of Rio Grande cutthroat trout are protected by barriers, such as waterfalls, that prevent the upstream movement of nonnative trout into occupied habitat. The other half of the extant populations inhabit streams that do not have an effective barrier to upstream movement of fish, or that have only a partial barrier (Alves, 2008: 33). Only eight populations are considered to be secure based on factors including population size, presence of a fish barrier, absence of nonnative trout, and genetic integrity (U.S. Fish and Wildlife Service, 2008: 27904).

The marked decline in distribution of Rio Grande cutthroat trout is attributed to the negative effects of competition from and predation by nonnative salmonids (*i.e.* brook trout and brown trout), habitat degradation and fragmentation, and overfishing (Pritchard and Cowley, 2006: 13). Current threats to the species include genetic introgression, disease, habitat fragmentation, population isolation, habitat degradation resulting from climate change, genetic factors associated with small and isolated populations, and stochastic environmental events such as floods and wildfires (Alves *et al.*, 2008: 35-40; Pritchard and Cowley, 2006: 16; U.S. Fish and Wildlife Service, 2008).

In 2008, the U.S. Fish and Wildlife Service issued a status review of Rio Grande cutthroat trout, which concluded that "listing of Rio Grande cutthroat trout is warranted but is precluded by higher priority actions", and it was designated as a candidate for federal listing under the Endangered Species Act (U.S. Fish and Wildlife Service, 2008). In its status review, the U.S. Fish and Wildlife Service determined that threats affecting Rio Grande cutthroat trout have a moderate magnitude and are imminent. Rio Grande cutthroat trout is listed as a sensitive species in regions 2 and 3 of the U.S. Forest Service. It is designated as a "Species of Greatest Conservation Need" by the New Mexico Department of Game and Fish and is listed as a species of special concern in Colorado.

Figure 5. Current and historic distribution of Rio Grande cutthroat trout (excerpted and modified from Alves *et al.*, 2008: 12). Major watersheds are named and their boundaries are shown by solid black lines.



1.5 Decision to be Made

On 25 August 2003, the Regional Forester of the U. S. Forest Service, Southwest Region signed a decision, based on a Finding of No Significant Impact, to implement the Las Animas Creek Rio Grande Cutthroat Trout Restoration Project. The decision allowed for the use of the piscicide antimycin (Fintrol®) to remove nonnative fish from the project area and restore the native fish community. Specifically, the project included the removal of nonnative, hybrid trout and nonnative longfin dace, the concurrent collection and restocking of native Rio Grande chub and Rio Grande sucker, and the stocking of pure Rio Grande cutthroat trout in Las Animas Creek. Prior to implementation of the 2003 decision, antimycin became unavailable, and the project was postponed. Antimycin is still unavailable, and the current proposed action of utilizing rotenone (CFT Legumine®, 5% rotenone, and Prentox® Prenfish™ Fish Toxicant Powder) to implement the restoration project is being analyzed in this EA.

Based on the current proposal analyzed in this EA, two separate decisions will be made by the two federal agencies involved. The Director of the Southwest Region of the U.S. Fish and Wildlife Service will decide whether to fund implementation of the proposed activities described in this EA or whether further environmental studies and preparation of an environmental impact statement would be required. The Regional Forester of the U.S. Forest Service, Southwest Region will decide whether or not to issue a permit for application of the piscicide rotenone in a federal wilderness area to implement the project.

1.6 Compliance with Laws, Regulations, and Plans

1.6.1 National Regulations

This EA has been prepared in compliance with all applicable Federal statutes, regulations, and executive orders (E.O.) including, but not limited to, the following:

- National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code [U.S.C.] 4321 et seq.);
- Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] 1500-1508);
- Wilderness Act of 1964 (16 U.S.C. 1131-1136);
- Clean Air Act of 1972 (42 U.S.C. 7401-7671, as amended);
- Clean Water Act of 1977 (33 U.S.C. 1251 et seq.);
- Endangered Species Act of 1973 (16 U.S.C. 1531-1544, as amended);
- Fish and Wildlife Coordination Act of 1958 (16 U.S.C. 661 et seq., as amended);
- Migratory Bird Treaty Act of 1918;
- Farmland Protection Policy Act, 1981 (7 U.S.C. 4201, as amended);
- National Historic Preservation Act of 1966, as amended (16 U.S.C. 470);
- Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001-3013);
- American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996);
- Archaeological Resources Protection Act of 1979 (16 U.S.C. 470);

- Protection of Historic and Cultural Properties (36 CFR 800 et seq.);
- Federal Noxious Weed Act (7 U.S.C. 2801);
- E.O. 11514, Protection and Enhancement of Environment Quality;
- E.O. 11593, Protection and Enhancement of the Cultural Environment;
- E.O. 11988, Floodplain Management;
- E.O. 11990, Protection of Wetlands;
- E.O. 12898, Environmental Justice;
- E.O. 13007, Indian Sacred Sites;
- E.O. 13084, Consultation and Coordination with Indian Tribal Governments;
- E.O. 13112, Invasive Species Management; and
- E.O. 13186, Protection of Migratory Birds.

1.6.2 Forest Land Management Plan

The proposed action would be in compliance with the Gila National Forest Land Management Plan. The portion of the planning area that occurs within the national forest boundaries is located within the Black Range Ranger District and within Gila National Forest Plan Management Area 2F (U.S. Forest Service, 1986*a*). Almost 78 percent of the project area that is located on national forest lands is located within designated federal wilderness (Figure 4). The proposed action is in compliance with the Forest Plan and wilderness management guidance.

1.7 Public Participation

A project scoping letter was mailed to 69 individuals, organizations, and government agencies on 24 April 2013. For convenience of response, a comment form was included with the letter. The letter requested that comments be made by 24 May 2013.

Public scoping notices were also posted in two area newspapers. A legal notice was placed in the Sierra County Sentinel (published in Truth or Consequences, New Mexico) on 10 May and repeated on 17 May 2013. The same notice was also published in the Silver City Sun-News on three consecutive dates: 28-30 April 2013. The notices requested public comment on the project proposal be sent by 24 May 2013.

Twenty-seven comment forms, letters, and phone calls were received in response to the scoping letter and public notices. Of these, 24 respondents directly indicated support for (8) or opposition to (16) the proposed action with reasons for their preference. Of the remaining three responses, one had no concerns. Two had questions and comments, as did other respondents, regarding particular project components, project costs, NEPA procedural requirements, and concerns about human and wildlife safety from the use of piscicide. Comments were used to further define the proposed action (*i.e.* add details) in Chapter 2 and to develop issues to focus the analysis of project effects in Chapter 3.

1.8 Issues

From the comments received during scoping, significant issues were identified. Significant issues are those that met the following criteria:

- Issue is within the scope of the analysis.
- Issue has not been decided by law, regulation, or previous decision.
- Issue is related to the decision.
- Issue is directed at scientific analysis rather than conjecture.
- Issue is not limited in extent, duration, or intensity.

The following significant issues have been identified for the Las Animas Creek watershed renovation project. These issues were used to analyze effects of the proposed project in Chapter 3.

Aquatic and Terrestrial Wildlife

- Use of rotenone may have direct effects on aquatic invertebrates, amphibians, and fish, as well as terrestrial wildlife, from consumption of or contact with treated water.

Human Health and Safety

- Use of rotenone may affect human health through consumption of or contact with treated water.

1.9 Authorizations and Permits Required

The following permits or authorizations would be required for project implementation:

- coverage under the National Pollutant Discharge Elimination System Pesticide General Permit from the U.S. Environmental Protection Agency;
- approval from the New Mexico Water Quality Commission for application of rotenone in the Las Animas Creek watershed, pursuant to 20.6.4 New Mexico Administrative Code §16;
- permit from the U.S. Forest Service for use of a piscicide in a designated Wilderness area;
- completion of Endangered Species Act Section 7 consultation with the U.S. Fish and Wildlife Service, New Mexico Ecological Services Office; and
- cultural resources consultation with the New Mexico State Historic Preservation Officer.

2.0 ALTERNATIVES, INCLUDING THE NO ACTION ALTERNATIVE

This chapter describes the alternatives considered to meet the project purpose and need, and it summarizes and compares the environmental effects of the alternatives analyzed in detail in Chapter 3.

2.1 Alternatives Considered but Eliminated from Detailed Analysis

Two preliminary alternatives were considered but were eliminated from further analysis because they did not meet the project purpose and need.

2.1.1 Genetic Swamping

This preliminary alternative would involve repeatedly stocking large numbers of native, genetically intact Rio Grande cutthroat trout into the Las Animas Creek watershed with the intended purpose of reducing hybridization by nonnative trout through "genetic swamping" to an undetectable level. This technique has been employed in restoration of westslope cutthroat trout (*O. c. lewisii*) in Montana, but there are no peer-reviewed analyses evaluating effects of the program. The concept is that over a long period of time, such a program may reduce the occurrence of nonnative trout genetic material in the Las Animas Creek watershed. However, elimination of nonnative trout introgression would not be possible, and a native x nonnative trout hybrid swarm would continue to persist in the watershed. Consequently, genetic swamping would not achieve the purpose of the project, which is to restore genetically intact Rio Grande cutthroat trout to the Las Animas Creek watershed.

2.1.2 Removal of Nonnative Trout by Electrofishing

This preliminary alternative would consist of attempting to remove all nonnative trout by repeatedly electrofishing the approximately 32 miles of stream in the project area. However, this alternative was eliminated from further analysis because of: 1) ineffectiveness in removing all nonnative trout; 2) excessive cost and requisite multiple years of treatments; and 3) ineffectiveness for removing nonnative longfin dace.

Eradication of nonnative trout from large stream segments or complex drainage networks, such as the project area, is likely impossible (Finlayson *et al.*, 2010: 5). In some cases, electrofishing has been used to remove populations of nonnative trout in relatively small reaches of stream with simple habitat structure, but such efforts are very labor intensive, take many years to complete, and are very costly. For example, nonnative brook trout (*Salvelinus fontinalis*) was successfully removed from an approximately three-mile long segment of a Montana stream with very simple habitat structure (Shepard *et al.*, 2002). However, trout densities had previously been reduced by mining impacts, and the electrofishing removal program took eight years to complete. Similarly, nonnative rainbow trout (*O. mykiss*)

were successfully removed from a 0.5-mile segment of a small Appalachian stream by five electrofishing treatments, but abundance of a small cyprinid (*Rhinichthys atratulus*, similar in size to longfin dace) was not affected (Kulp and Moore, 2000).

Other studies have shown reduction in nonnative trout abundance by electrofishing but not complete removal. Nonnative rainbow trout in streams in Great Smoky Mountains National Park were reduced but not eliminated by a combination of angling and electrofishing (Larson *et al.*, 1986) or by a multi-year electrofishing removal programs (Moore *et al.*, 1983). In another study, a three-year electrofishing removal project on a 4.8-mile long stream segment in southwestern Idaho resulted in annual reductions of adult nonnative trout of up to 88 percent (Meyer *et al.*, 2006). However, abundance of age-0 nonnative trout increased over 780 percent two years following cessation of electrofishing efforts (Meyer *et al.*, 2006). Similarly, multiple-pass, multi-year electrofishing reduced the abundance of nonnative brook trout in small Rocky Mountain streams but did not result in eradication of nonnative trout (Thompson and Rahel, 1996).

2.2 Alternatives Analyzed in Detail

2.2.1 No Action Alternative

The No Action alternative provides a baseline for comparison of environmental effects of the proposed action discussed in Chapter 3. This alternative would not alter current conditions.

2.2.2 Proposed Action

The proposed action consists of three major components: 1) salvage of native fish and frogs for use in restocking following stream renovation; 2) nonnative fish removal; and 3) stocking of Rio Grande cutthroat trout and salvaged native species. Each of these elements is described in detail below.

2.2.2.1 Salvage of Native Species

Suitable numbers of Rio Grande chub and Rio Grande sucker (*ca.* 200 of each species) would be salvaged from the project area by electrofishing prior to initiating stream renovation treatments. These two native species occur in the project area from the fish barrier upstream to near the confluence of Water Canyon (*ca.* 19 stream miles). Salvage of Rio Grande sucker and Rio Grande chub would be conducted over a one-week period using up to three teams consisting of three to four workers each. Salvage operations outside of designated Wilderness would consist of electrofishing stream segments and placing captured Rio Grande sucker and Rio Grande chub in transport containers in pickup trucks or all terrain vehicles. If salvage operations are conducted in designated Wilderness, captured fish would be transported in backpacks or panniers fitted with transport containers. Electrofishing equipment settings would be adjusted to prevent injury to fish (*e.g.* output voltage less than 400 volts, pulse width less than 5 milliseconds, pulse rate less than 40 Hz). Applicable safety procedures would be adhered to by all workers involved in electrofishing operations (Professional Safety Committee, 2008).

In order to minimize potential adverse effects of the proposed action on Chiricahua leopard frog (*Lithobates chiricahuensis*), aquatic and wetland

habitats in the project area would be surveyed by Fish and Wildlife Service-permitted individuals prior to any rotenone treatments. Any Chiricahua leopard frog or tadpole found would be collected by a properly permitted individual, transferred to an appropriate, dedicated holding facility, and repatriated following successful stream renovation.

Salvaged fish would be transported and released to perennial stock tanks capable of supporting fish or perennial segments of Las Animas Creek on the Ladder Ranch downstream from the fish barrier. Sufficient numbers of Rio Grande sucker and Rio Grande chub to restock the restoration stream segments would be removed and translocated to these refuge habitats (*ca*. 200 of each species). It is not technically feasible to remove all individuals of the two species from the project area.

2.2.2.2 Removal of Nonnative Fish

Nonnative trout and longfin dace would be removed from streams in the project area through application of rotenone (CFT Legumine®, 5 percent rotenone, and Prentox® Prenfish™ Fish Toxicant Powder). Rotenone treatments would be conducted one to three times per year for up to three years to ensure complete removal of all nonnative trout. Application of rotenone would comply with all federal and state laws and all label requirements and would follow the standard operating procedures (SOP) for fisheries management (Finlayson *et al.*, 2010). The SOPs provide guidance on how to comply with the label and use rotenone in a safe and effective manner. The SOPs, which would be fully incorporated into project implementation, include the following (Finlayson *et al.*, 2010).

SOP 1 Public notification and treatment area restrictions, consisting of notification of the public at least one week prior to treatment and placement of placards in the treatment area.

SOP2 Supervisory training and qualifications and regulatory compliance, which requires full understanding of the label requirements, appropriate training, and licensing of certified applicator(s) that are supervising the project.

SOP 3 Safety training and hazard communication to ensure protection of workers involved in the project.

SOP 4 Rotenone storage, transportation, and spill containment, which provides a protocol for safe and effective handling of rotenone and procedures for spill prevention and containment.

SOP 5 Determining treatment rates and strategies.

SOP 6 Determining treatment areas and project effect areas.

SOP 7 Determining need and methods for chemically induced deactivation.

SOP 10 Transferring (mixing/loading) liquid rotenone concentrate.

SOP 11 Operation of drip stations for application of liquid rotenone.

SOP 12 Operation of sprayers for applying diluted liquid rotenone.

SOP 14 Use of *in situ* bioassays to monitor efficacy.

SOP 15 Collection and disposal of dead fish.

SOPs 5 through 10 address treatment areas, treatment rates, application methods, and treatment procedures. All rotenone treatments would be applied at concentrations below the maximum allowable concentration of 200 parts per billion (ppb) active ingredient (= 0.2 parts per million [ppm] active ingredient). Actual

concentrations would be determined based on flow rate and field bioassay to calculate the minimum effective dose, which would be doubled to determine actual treatment rate (Finlayson *et al.*, 2010: 61). The typical concentration used for eradication of nonnative trout is 50 ppb rotenone (active ingredient). The maximum concentration used may be need to be higher than 50 ppb (active ingredient) to be effective in removing longfin dace. In any event, the maximum concentration used would not be likely to exceed 100 ppb active ingredient (K. Patten, New Mexico Department of Game and Fish, pers. comm., 18 September 2013).

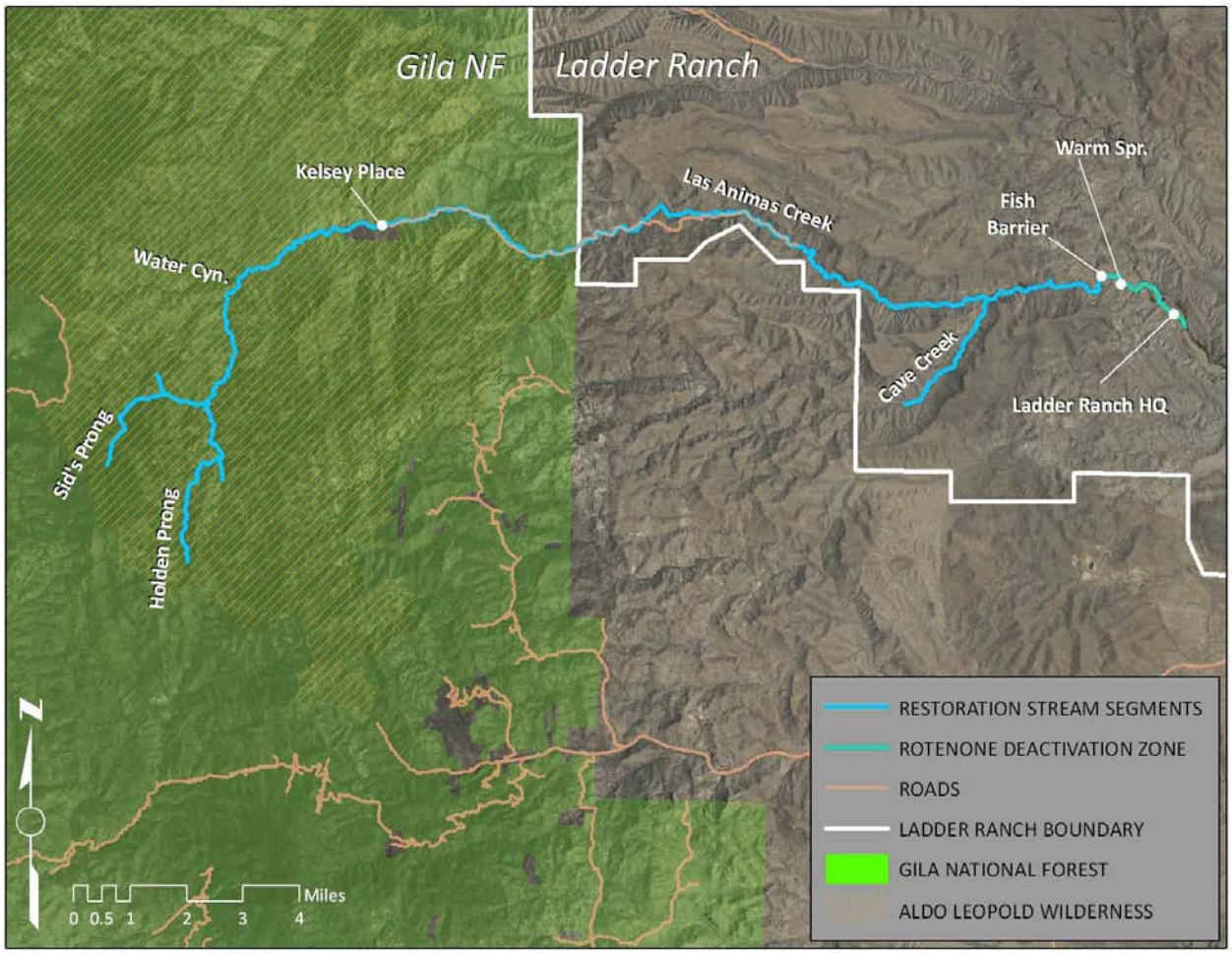
Rotenone would be applied using drip stations placed at intervals appropriate to maintain treatment rate. Isolated areas such seeps, springs, and backwater habitats would be treated using backpack sprayers and hand application of rotenone sandmix (a mixture of powdered rotenone, sand, and gelatin; Spateholts and Lentsch, 2001). Rotenone treatments would be conducted for a maximum of three years, with a minimum of two years of rotenone treatments in each restoration stream segment. Up to three treatments would occur per year in each stream segment. Typically, complete eradication of fishes with rotenone is obtained after two treatments spaced over a two-year period. Dead fish would be enumerated and allowed to decompose naturally.

Public notification and treatment area restrictions are described in SOP 1. The project area would be closed to public entry prior to application. Public access to the area would be prohibited during actual chemical application. A complete treatment of the project area could take up to two weeks to implement including project setup, weather delays, and demobilization.

Rotenone would be chemically deactivated at the downstream end of the project area by applying a potassium permanganate solution to Las Animas Creek using a metering device with a reservoir for holding the solution. Potassium permanganate would be applied to achieve a 1 ppm residual level at the downstream end of a 30-minute contact zone to ensure complete deactivation of residual rotenone (Finlayson *et al.*, 2010: 68) at the downstream end of the project area. Actual in-stream concentration of potassium permanganate would be approximately 3 to 4 ppm. The maximum extent of the rotenone deactivation zone would be approximately two stream miles downstream from the fish barrier (Figure 6).

Individual rotenone treatments are expected to occur over a seven-day period. Rotenone treatments would be conducted by a crew of 15 to 20 workers under the supervision of a certified pesticide applicator. Rotenone treatments in stream segments located in the Aldo Leopold Wilderness would comply with all relevant regulations including limiting the treatment group size to less than 25 individuals and 35 head of pack and saddle stock, and no use of motorized equipment. Rotenone treatments would be supported from the Animas trailhead at Kelsey Place, located on the Ladder Ranch, or at the Ladder Ranch headquarters. The Kelsey Place site is accessible by private road along Animas Creek from the Ladder Ranch headquarters. Pack animals and backpacks would be used to transport equipment, food, and camping equipment to the treatment sections not accessible by road. Individuals would camp for a period of up to four days in the Aldo Leopold Wilderness during individual rotenone treatments.

Figure 6. Location of the rotenone deactivation zone below the restoration stream segments.



No refuse or equipment associated with the proposed action would be left in the project area. Restoration stream segments downstream from the Aldo Leopold Wilderness boundary are accessible from the Animas Creek road and workers in those segments would either camp in the project area or retire to the Ladder Ranch headquarters in the evening after each day of work. All vehicle travel would be restricted to existing roads.

2.2.2.3 Stocking Rio Grande Cutthroat Trout and Other Native Species

Restoration stream segments would be sampled by electrofishing following individual rotenone treatments to assess persistence of nonnative fish. When it is found that nonnative fish are absent from restoration stream segments and aquatic macroinvertebrate biomass has recovered to pre-

renovation levels, stocking of Rio Grande cutthroat trout would commence. It would likely take four to five years to establish a self-sustaining, persistent population of Rio Grande cutthroat trout in the project area. If, during post-treatment surveys, species that were targeted for removal are found, the stream would be retreated following the procedures described above.

Rio Grande cutthroat trout, Rio Grande chub, and Rio Grande sucker would be stocked into stream segments once removal of nonnative trout has been confirmed. Source stock for Rio Grande cutthroat trout may include hatchery-raised fish from Seven Springs Hatchery in Sandoval County or wild fish collected from Cañones Creek (a tributary to the Chama River upstream from Abiquiu Reservoir in Rio Arriba County). The wild broodstock at Seven Springs are derived from annual collection of fertilized Rio Grande cutthroat trout following a broodstock management plan intended to increase genetic variability and inhibit domestication of Rio Grande cutthroat trout while in the hatchery. Other source streams may be considered as donor populations where warranted. Stocking of Rio Grande cutthroat trout into renovated streams may be conducted multiple times to ensure that a viable population is established in a reasonable period of time.

Following completion of renovation, Rio Grande sucker and Rio Grande chub would be collected from the refuge habitats (*i.e.* stock tanks or other stream segments) and translocated back into the project area. This would entail electrofishing and seining of the refuge habitats and translocation of fish back into the project area. Up to three teams of three to four workers each would collect fish, place them in transport containers in the back of pickup trucks or all-terrain vehicles (for areas outside of designated Wilderness) or backpacks or panniers (for areas within designated Wilderness), and repatriate the fish to the project area. Restocking of Rio Grande sucker and Rio Grande chub is expected to occur over a one-week period following completion of all stream renovation work.

2.2.2.4 Implementation Schedule

The project would begin with fish salvage which would be conducted in Spring to early Summer 2014. Initial rotenone treatments would commence in Summer 2014 following salvage of native fish. Rotenone treatments would be implemented over a period of up to three years (2014 to 2016). There would be a minimum of two years of rotenone treatments in each restoration stream segment, with up to three treatments in each stream segment per year. Rotenone treatments would be implemented from 2014 through 2016, followed by stocking of native Rio Grande cutthroat trout to establish a viable population in the Las Animas Creek watershed, and repatriation of other native fish that were salvaged from the project area prior to initiating rotenone treatments.

2.2.2.5 Design Criteria

A number of criteria that were used in developing the proposed action to ensure consideration and protection of other forest resources. These criteria are listed below by resource category.

Soil and Water

1. Camps and equipment maintenance areas would be located away from sensitive habitats, such as wetlands, where possible, in order to minimize impacts on these habitats.

2. Whenever five or more gallons of petroleum fuels are being used, spill kits would be available to minimize potential impacts to wetlands and water quality due to fuel spills. A spill kit would contain absorbent pads for petroleum products, absorbent powder, bag for disposal, rubber gloves, and rags.
3. The New Mexico Environment Department and Forest Service have an agreement that states the Forest Service will endeavor to minimize and mitigate all potential non-point source pollution activities. The agreed upon method to mitigate impacts is to implement and monitor Best Management Practices. The Southwest Region, Forest Service has developed site specific Soil and Water Conservation Practices (Forest Service Handbook 2209.18) to accomplish this goal.
4. Use of mechanized equipment (to be used outside of Wilderness only) in or adjacent to perennial streams would be kept to a minimum due to wet soil conditions, low soil strength, and to provide a filter for sediment entering the drainages from treated areas.

Wildlife

1. The project area would be surveyed for Chiricahua leopard frog prior to treatment. If frogs or tadpoles of the species are found, they would be removed and translocated to a holding facility on the Ladder Ranch and then returned to their previous locations after the stream renovation is completed.

Recreation and Wilderness

1. Minimum tool concept would be applied.
2. Motorized/mechanized equipment use would not occur within designated Wilderness.
3. Public notice of temporary closures of the project area would be made through news releases, mailings to interested parties, and public postings at least one week prior to each closure.

2.2.2.6 Monitoring and Adaptive Management Actions

The effectiveness of rotenone deactivation at the downstream end of the project area would be assessed by *in situ* bioassay to ensure that no aquatic biota are affected by rotenone, rotenone residue, or potassium permanganate downstream from the rotenone deactivation zone.

Restoration stream segments would be sampled by electrofishing following individual rotenone treatments to assess persistence of nonnative fish. Treatments would cease when it is confirmed that nonnative fish have been eradicated. If, during post-treatment surveys, species that were targeted for removal are found, the stream would be re-treated.

Sampling would be done to characterize the pre-project aquatic macroinvertebrate community in the project area. Following successful completion of rotenone treatments, the aquatic macroinvertebrate community would be monitored to assess recovery of the food base. Fish stocking would not be conducted until monitoring shows that the aquatic macroinvertebrate community has recovered to the point that it can support a fish community.

2.3 Comparison of Alternatives

Table 1 summarizes the primary environmental consequences of each of the alternatives, as discussed in detail in Chapter 3, as a basis for comparison.

Table 1. Summary of environmental consequences by alternative.

Resource Objective or Issue	Alternative	
	No Action	**Proposed Action**
Landscape Setting and Climate	No effect	No effect
Water Quality and Aquatic Biota	No effect	Project would have short-term impacts on water quality from rotenone application. Fish populations in the restoration steam segments would be eliminated. Salvage of native fish and amphibians and repatriation of salvaged biota following completion of rotenone treatments would result in short-term population reductions. Removal of longfin dace, which is not native to the Las Animas Creek watershed, would be of long-term benefit to native fish. Rotenone treatments would cause short-term reductions in aquatic macroinvertebrate abundance. Aquatic macroinvertebrate abundance and species richness would likely return to pre-project levels within one year following treatments. These impacts would not occur below the rotenone deactivation zone on the Ladder Ranch, located at the downstream end of the restoration stream segments.

Special Status Species, Management Indicator Species, and Migratory Birds	Status of Rio Grande cutthroat trout would not be improved through restoration of the species to the Las Animas Creek watershed. Native fish and other native aquatic biota would continue to be negatively affected by nonnative aquatic species (*i.e.* hybrid trout, longfin dace, American bullfrog).	Status of Rio Grande cutthroat trout would be substantially improved through restoration of the species to approximately 32 stream-miles in the Las Animas Creek watershed. Proposed action may affect and is likely to adversely affect Chiricahua leopard frog. Conservation measures to reduce adverse effects include pre-project survey, collection and holding of frogs, and repatriation of frogs following completion of rotenone treatments. No other listed species would be adversely affected by the proposed action. No effects to management indicator species other than Rio Grande cutthroat trout. No effects on migratory birds.
Terrestrial Wildlife	No effect	Consumption of rotenone-treated water or rotenone-killed fish would not have any toxicological effect on terrestrial wildlife. Short-term reduction of aquatic macroinvertebrates would occur but would not measurably affect terrestrial wildlife that prey on insects.
Recreation and Wilderness	Wilderness character would not be enhanced by restoration of a component of the native fish fauna.	Temporary displacement of recreationists due to project area closures during rotenone treatments. Nonnative trout, which provide a recreational fishery, would be removed from the Las Animas Creek watershed and stream may be closed to fishing for up to five years until Rio Grande cutthroat trout become established. However, the Silver Fire may have already caused the same result. Potential effect to Wilderness users' experience if encountering implementation of management actions.

Socioeconomic Factors	No effect	Surface and ground water downstream from the rotenone deactivation zone on the Ladder Ranch would not contain any rotenone or rotenone residue. The public would not be exposed to rotenone or rotenone residue outside of the project area. The project complies with E.O. 12898 (Environmental Justice). Implementation of the proposed action would result in minor economic benefits to local communities.
Heritage Resources	No effect	The proposed action would not involve any ground-disturbing activities. Heritage resources would not be affected.
Livestock Grazing	No effect	No effect. Maximum rotenone concentrations would not have any toxicological effect on livestock that may happen to consume treated water. Currently, there is no livestock grazing in the project area. Livestock downstream from the Ladder Ranch would not be exposed to rotenone or rotenone residues.

3.0 EXISTING CONDITIONS AND ENVIRONMENTAL EFFECTS

In this section the affected environment description is limited to factors pertinent to understanding the resource issues and effects described as environmental consequences. Where applicable, alternatives meet the Gila National Forest Plan standards and guidelines, policies, and statutes regarding protection of wilderness, sensitive species, wildlife habitat, water, soil, vegetation, heritage resources, and provision for recreation.

The discussion of environmental consequences describes the anticipated effects expected from each of the two alternatives - No Action and the Proposed Action. The No Action alternative describes the environmental baseline, which consists of the existing condition and projected future condition without the proposed action. Significant issues identified in Chapter 2 are included in this section under the respective resource categories where they are analyzed and discussed.

At the end of each resource section is a discussion of cumulative effects of the alternatives for that resource. Cumulative effects are the impacts from other land uses that are not part of this proposed project but which may have an additive effect when combined with the impacts expected from the proposed action. The cumulative effects analysis considered land management actions outside of the treatment areas, if they could have an additive effect on the resources affected by the proposed action. There are no commercial logging or mining uses occurring within the treatment areas. Actions within the treatment areas that could potentially contribute to cumulative effects include wildfire and suppression efforts, trail maintenance, wildlife management, recreation uses, and livestock grazing. Cumulative effects are discussed in greater detail in the appropriate resource sections.

3.1 Landscape Setting and Climate

This section includes a brief overview of landscape setting and climate to provide the overall environmental context in which the proposed action would be implemented.

3.1.1 Existing Conditions

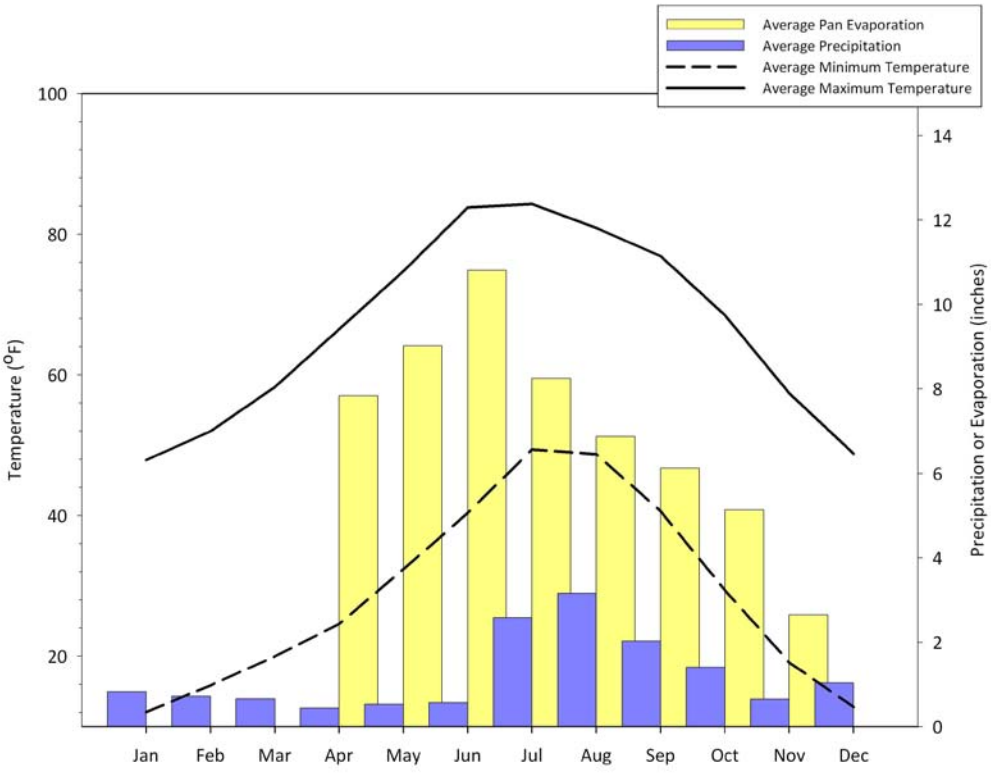
The project area is situated in the Datil-Mogollon Highlands of southwestern New Mexico, which is a landscape shaped primarily by Tertiary age volcanic eruptions (Chronic, 1987: 34). The planning area is located on the east side of the Black Range, which is a north-south oriented range of upthrust, granitic-core mountains formed during the Tertiary period (Kuellmer, 1954). Elevations within the planning area range from 4,880 feet at the downstream end of the two-mile long rotenone deactivation zone to 10,165 feet at McKnight Mountain. Topography of the planning area includes narrow ridge crests and rugged canyons, gentler mesa-like ridges, sloping meadows at higher elevations, forested slopes, and stream bottoms.

Average growing season in the project area is 130 days, beginning around 26 May and lasting

until about 3 October (Natural Resources Conservation Service, 2013). Average growing season, as used here, is defined as the period when there is a 50-percent or greater probability of soil temperature 28° F or higher. Average annual precipitation is 14.63 inches, with total annual snowfall averaging 17.9 inches (Western Regional Climate Center, 2013). Winter minimum temperatures are in the low-teens (°F) and summer average highs are in the mid-80s (°F; Figure 7). Rainfall is concentrated in July, August, and September (Figure 7).

These summer rains are typically associated with southeast circulation of air masses from the Gulf of Mexico, which brings moisture into the state. Strong surface heating combined with orographic lifting as air moves over higher terrain causes atmospheric moisture to condense and results in a common pattern of afternoon thunderstorms and rain showers. High intensity, longer duration storm events associated with cyclonic systems originating in the Gulf of Mexico or Pacific Ocean may occur from late summer into early fall.

Figure 7. Climate characteristics for the project area. Data are from the National Climate Data Center cooperator station number 290818 (Beaverhead Ranger Station, New Mexico) for the period from 21 May 1916 through 30 September 2008. The Beaverhead site is located at 6,770 feet elevation about 30 miles north-northwest of the project area.



Average air temperatures worldwide are predicted to increase beyond the current range of natural variability because human activities have, since the Industrial Revolution, caused accumulation of greenhouse gases (*e.g.* carbon dioxide, methane, nitrous oxide, chloroflourocarbons) in the atmosphere (U.S. Environmental Protection Agency, 1998). The potential impacts resulting from climate change are varied, even within the State of New Mexico (New Mexico Agency Technical Work Group, 2005). Summer air temperatures in the southwestern U.S. are predicted to rise considerably through 2039, average annual precipitation is expected to decrease, and mountain snow-packs are predicted to decrease significantly (Field *et al.*, 2007: 627; Karl *et al.*, 2009: 130-131).

3.1.2 Effects on Landscape Setting and Climate

No Action Selection of the No Action Alternative would not have any effects on landscape setting or climatic conditions in the project area.

Proposed Action The proposed action would not affect landscape setting or climate conditions in the project area. The proposed action does not include any components that would affect landscape features or climatic conditions.

3.2 Water Quality and Aquatic Biota

This section addresses existing conditions and potential effects of the alternatives on water quality and aquatic biota including fish, aquatic macroinvertebrates, and other aquatic life. Reports and data from the New Mexico Environment Department, Ladder Ranch, U.S. Forest Service, and the New Mexico Department of Game and Fish, and peer-reviewed scientific literature provided baseline information for the project area, as well as the basis for determining effects of the Proposed Action and No Action alternatives.

Issue: Use of rotenone may have direct effects on aquatic invertebrates, amphibians, and fish, as well as terrestrial wildlife, from consumption of or contact with treated water.

3.2.1 Existing Conditions

The project area is located in the following 12th-order hydrologic units: Holden Prong (hydrologic unit code [HUC] 130301010404). Headwaters Las Animas Creek (HUC 130301010406), Cave Creek (HUC 130301010405), and Outlet Las Animas Creek (130301010408). Stream gradient is high (up to approximately six percent) from the headwaters to the vicinity of Murphy Place near the confluence of Sand Canyon, where gradient gradually decreases to less than two percent and valley width increases. In-stream habitat in the upper, high-gradient reaches consists of step pools with substrate dominated by boulders, cobble, and gravel (Figure 8 and Figure 9). Pool-riffle habitat is prevalent in the lower-gradient reaches, and substrate is dominated by gravel. Bedrock outcrops in the channel occur locally throughout the project area and large woody debris is common.

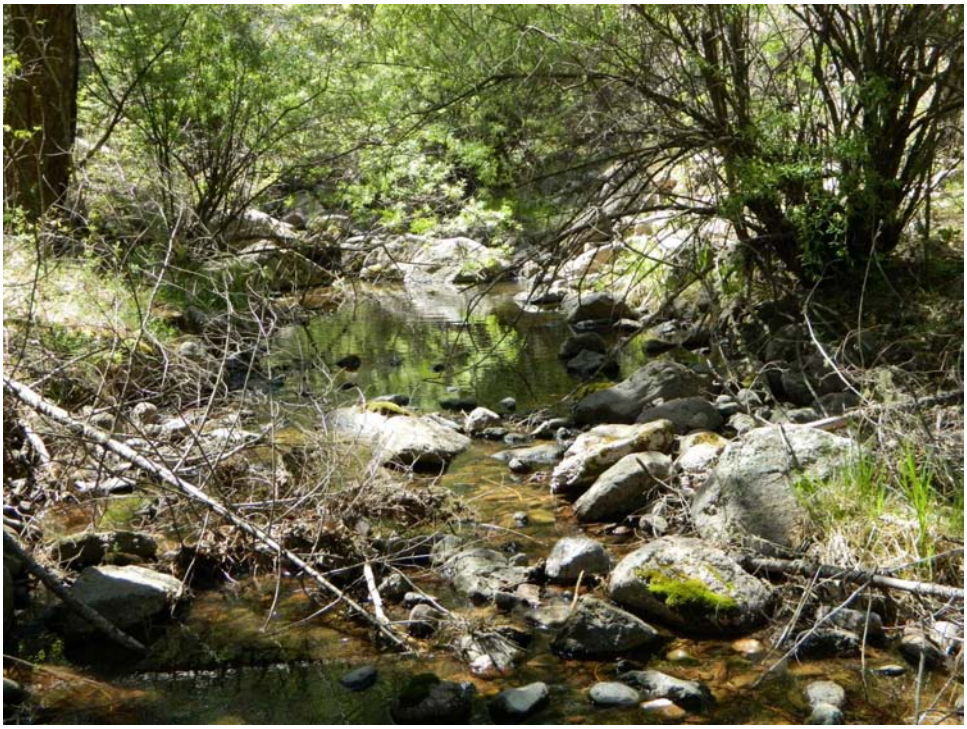


Figure 8. Stream habitat in Holden Prong just upstream from the confluence of Indian Canyon in the headwaters of the Las Animas Creek drainage. Photo courtesy of Carter Kruse, Aquatic Resources Coordinator, Turner Enterprises, Inc.

Figure 9. Stream habitat in Las Animas Creek near the confluence of Flower Canyon in the headwaters of Las Animas Creek. Photo courtesy of Carter Kruse, Aquatic Resources Coordinator, Turner Enterprises, Inc.

3.2.1.1 Water Quality

Designated uses for the proposed stream restoration segments are irrigation, livestock watering, wildlife habitat, marginal coldwater aquatic life, secondary contact and warmwater aquatic life (20.6.4.103 New Mexico Administrative Code). Las Animas Creek was assessed by the Surface Water Quality Bureau of the New Mexico Environment Department in 2010 (New Mexico Environment Department, 2012: 318). The stream was found to not support the marginal coldwater life and warmwater aquatic life designated uses. The cause of impairment was listed as a low benthic macroinvertebrate score, and the potential source of this impairment was indicated as "inadequate time for recovery (of the benthic macroinvertebrate community) following scouring flow prior to sampling" (New Mexico Environment Department, 2012: 318). No chemical water quality impairments of the stream were noted.

Sampling and analysis conducted by the New Mexico Environment Department in 2004 for major ions, nutrients, total and dissolved metals, bacteria, and field parameters found no exceedances of water quality standards (New Mexico Environment Department, 2009). Water temperature in Las Animas Creek did not exceed the New Mexico water quality standard of 77°F (25°C) based on analysis of thermograph data (New Mexico Environment Department, 2009).

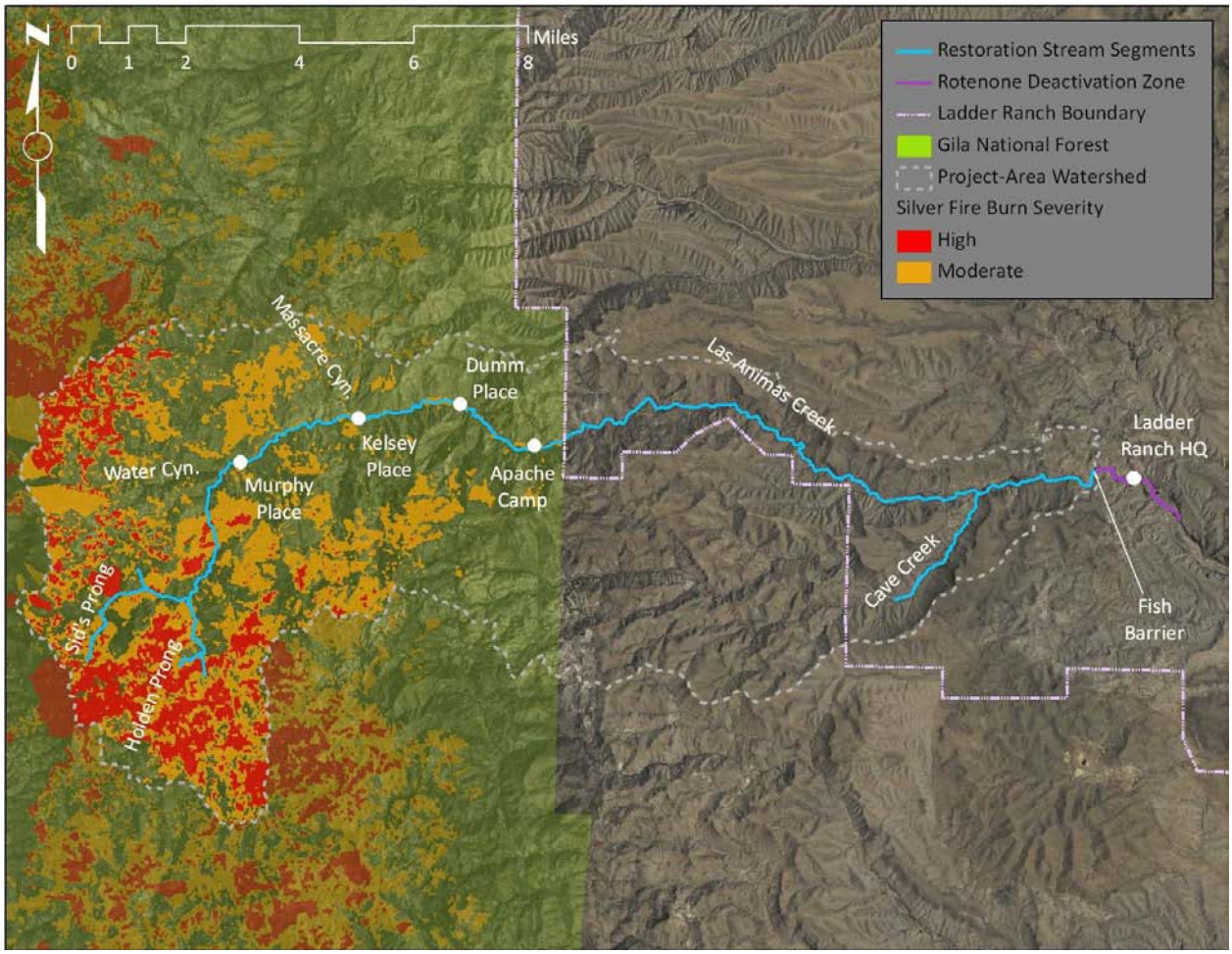
Average summer water temperatures in pool and run habitats in Las Animas Creek on the Ladder Ranch were below the 75°F (24°C) threshold for cutthroat trout before the Silver Fire burned the headwaters of the drainage in 2013. Pool habitat provided suitable thermal refuge habitat for cutthroat trout during summer months in the lower reaches of Las Animas Creek in the project area. The pH of Las Animas Creek ranged from 6.18 to 8.24, and dissolved oxygen concentration was typically near 100-percent saturation except for zones of groundwater discharge where dissolved oxygen concentrations were typically low (New Mexico Environment Department, 2009).

Most of the upper watershed of Las Animas Creek burned during the Silver Fire in the summer of 2013 (Figure 10). Approximately 4,287 acres of the headwaters had high severity burn, and another 10,068 acres had moderate severity burn. The extent of high- to moderate-severity burned acreage in the headwaters led to large increases in post-fire runoff flows in 2013. Post-fire flood flows were laden with ash. Elevated post-fire peak flows are expected to persist in Las Animas Creek until the watershed has recovered (U.S. Forest Service, 2013*a*).

3.2.1.2 Aquatic Biota

Prior to the Silver Fire in 2013, fish species that occurred in the proposed stream restoration segments included hybrid trout (Rio Grande cutthroat trout significantly introgressed with Yellowstone cutthroat trout [*O. c. bouvieri*] and rainbow trout), rainbow trout, longfin dace (*Agosia chrysogaster*), Rio Grande chub (*Gila pandora*), Rio Grande sucker (*Catostomus plebeius*), green sunfish, and largemouth bass (*Micropterus salmoides*; C. Kruse, Turner Enterprises, Inc., unpublished data; Patten, 2008: 6). Green sunfish and largemouth bass occurred downstream from the fish barrier. Before the Silver Fire, hybrid trout occurred from the fish barrier upstream to the headwaters of Las Animas Creek, and longfin dace were found in Las Animas Creek upstream to the vicinity of the Kelsey Place (Figure 10).

Figure 10. Silver Fire burn severity in the project-area watershed. The Silver Fire started on 7 June 2013 and was caused by a lightening strike. Burn severity data provided by the U.S. Forest Service, Gila National Forest.



Prior to the Silver Fire in 2013, Rio Grande sucker and Rio Grande chub were found in Las Animas Creek upstream to near the confluence of Water Canyon (Figure 6). Fish species found in Cave Creek on the Ladder Ranch included hybrid trout, Rio Grande chub, and longfin dace. As described in section 3.2.1.1, the Silver Fire burned the headwaters of the Las Animas Creek drainage resulting in subsequent flooding, high ash concentrations, and sediment deposition in downstream aquatic habitats. These post-fire effects may have eliminated fish from portions of the drainage, particularly hybrid trout populations in the headwaters including Holden Prong, Sid's Prong, and Indian Creek. Local extirpation of trout populations following high-severity wildfire has occurred in nearby Black Range stream drainages including Main Diamond Creek (Propst *et al.*, 1992) and South Diamond Creek (Propst and Stefferud, 1997).

Amphibian species occurring in project-area streams include American bullfrog (*Lithobates catesbeiana*, an introduced species), canyon treefrog (*Hyla arenicolor*, a native species), and Chiricahua leopard frog (*Lithobates chiricahuensis*, a native species listed as threatened; Kruse and Christman, 2007). American bullfrog and canyon treefrog occur in Las Animas Creek in the project area, while Chiricahua leopard frog is found in Las Animas Creek and Cave Creek in the project area (Kruse and Christman, 2007; C. Kruse, Turner Enterprises, Inc., pers. comm.). Southwestern toad (*Bufo microscaphus*) and red-spotted toad (*Bufo punctatus*) may also occur in project-area streams (Degenhardt *et al.*, 1996; Kruse and Christman, 2007). No turtles are known to occur in the project area (Degenhardt *et al.*, 1996). Blackneck gartersnake (*Thamnophis cyrtopsis*) and western terrestrial gartersnake (*T. elegans*) may both occur in the project area (Degenhardt *et al.*, 1996). While neither is an obligate aquatic species, both are closely associated with aquatic habitats (Degenhardt *et al.*, 1996: 312-313, 315).

The aquatic invertebrate community in Las Animas Creek consisted of 40 to 54 taxa in 2012, with densities ranging from 1,081 to 2,308 organisms per square meter (Table 2; Jacobi and McGuire, 2012). A total of 89 different taxa were found in the Las Animas Creek drainage. True flies (Diptera) were represented by 41 taxa, with midge larvae (Chironomidae) being the most diverse group consisting of 24 different taxa. Other species-rich groups included caddisflies (Trichoptera) with 14 taxa and mayflies (Ephemeroptera) and aquatic beetles (Coleoptera) with seven taxa each. Five groups each were represented by three taxa: stoneflies (Plecoptera), true bugs (Hemiptera), damselflies and dragonflies (Odonata), clams and snails (Mollusca), and segmented worms (Annelida). Groups represented by a single taxon included aquatic moths (Lepidoptera), helgrammites (Megaloptera), water mites (Hydrachnidia), seed shrimp (Ostracoda), and flatworms (Platyhelminthes).

The Surface Water Quality Bureau (Monitoring and Assessment Section) of the New Mexico Environment Department sampled aquatic macroinvertebrates at two sites in the project area from 2004 through 2011 (Las Animas Creek below Cave Creek and Las Animas Creek at the Gila National Forest boundary; New Mexico Environment Department, 2009 and unpublished data). These data indicated species richness ranging from 29 to 79 taxa, with lowest scores occurring following "scouring floods" (New Mexico Environment Department, 2012: 318). Dominant taxonomic groups in these samples were similar to the results reported by Jacobi and McGuire (2012) and were true flies (Diptera), mayflies (Ephemeroptera), caddisflies (Trichoptera), and aquatic beetles (Coleoptera). Also present in the samples, but at lower abundance, were stoneflies (Plecoptera) and dragon- and damselflies (Odonata).

McGuire (1999) reported results of aquatic invertebrate sampling at three sites in the Las Animas Creek drainage (Holden Prong above box, Holden Prong at Negro Bill Spring, and Cave Creek). A total of 67 taxa were documented from the samples with species richness ranging from 25 to 29 at the three sites. The water penny beetle *Psephenus* was the most abundant organism at the two sites on Holden Prong, followed by mayflies and caddisflies. McGuire (1999) reported Ephemeroptera-Plecoptera-Trichoptera (EPT) taxa richness values of 11 to 14 from the three sites.

Table 2. Las Animas Creek aquatic invertebrate density, species richness, and dominant taxa with sites ordered from downstream to upstream (from Jacobi and McGuire, 2012). The column titled **EPT Taxa** shows the combined number of mayfly (Ephemeroptera), stonefly (Plecoptera), and caddisfly (Trichoptera) taxa.

Location	Standing Crop (no./m^2)	Total Number of Taxa	EPT Taxa (% of Total)	Dominant Taxa
Las Animas Creek below Cave Creek	2,308	40	9 (22.5%)	*Simulium* (blackfly larvae), *Baetis* (mayfly nymph)
Las Animas Creek at Kelsey Place	1,299	54	15 (27.8%)	*Baetis* (mayfly nymph), *Tvetenia* (midge larvae)
Holden Prong	1,459	54	14 (25.9%)	*Baetis* (mayfly nymph), midge larvae (Chironomidae), beetles (Coleoptera)
Indian Creek	1,081	47	14 (29.8%)	*Baetis* (mayfly nymph), beetles (Coleoptera)

3.2.2 Effects on Water Quality and Aquatic Biota

No Action In the absence of the proposed restoration project, Rio Grande cutthroat trout would continue be absent from the native fish community in the Las Animas Creek drainage. The native fish fauna would continue to be detrimentally affected by the presence of nonnative hybrid trout (Pritchard and Cowley, 2006: 35) and nonnative longfin dace (McShane, 2007). The Las Animas Creek drainage would not contribute to conservation of Rio Grande cutthroat trout. Water quality in the approximately 34 miles of project-area streams, including the proposed two-mile rotenone deactivation zone, would not be impacted by rotenone treatments. Existing native fish populations would not be affected by proposed salvage and repatriation activities nor would aquatic invertebrates, larval life stages of amphibians, or other aquatic biota.

Proposed Action The rotenone formulations that would be used in the proposed action are Prentox® CFT Legumine™ liquid and Prentox® Prenfish™ Fish Toxicant Powder for use in sandmix applications at seeps, springs, and wetland areas. Prentox CFT Legumine® contains five percent rotenone, five percent "other associated resins", and 90 percent "other ingredients" (the product label and Material Safety Data Sheet are in Appendix A). The "other ingredients" portion of the formulation is 60 percent diethylene glycol monoethyl ether (also known as DEGEE), 10 percent 1-methyl-2-pyrrolidone (also known as MP), 17 percent Fennodefo 99™, and three percent other compounds (California Department of Fish and Game, 2010*a*: B-7). The "other ingredients" in rotenone formulations do not affect the toxicity of the end product, as evidenced by the fact that formulations are no more toxic than pure, technical grade rotenone (U.S. Environmental Protection Agency, 2006: 83-84).

Diethylene glycol monoethyl ether (DEGEE) and 1-methyl-2-pyrrolidone (MP) are water-soluble solvents for rotenone, and together compose approximately 93 percent of CFT Legumine by weight. Neither of these two solvents is volatile and both would be removed from water by aerobic biodegradation (ToxNet, 2013*a* and 2013*b*). At the maximum treatment concentration of 0.2 ppm rotenone (active ingredient), maximum concentrations of DEGEE and MP in solution would be 2.4 ppm and 0.4 ppm, respectively. Neither of these substances pose any toxicological risk to fish or wildlife in concentrations associated with the proposed rotenone applications (California Department of Fish and Game, 2010*b*: C-50 to C-51).

Fennodefo 99™, which composes approximately 17 percent of CFT Legumine by weight, aids in the emulsification and dispersion of rotenone in water. Fennodefo 99™ contains polyethylene glycol, hexanol, and a mixture of fatty acid esters. The mixture of fatty acid esters is likely derived from “tall oil” or "pine oil," which consists of naturally occurring fatty acids and resins that are a distilled byproduct of wood pulp manufacture. Tall oil is a common ingredient in soap formulations. At the maximum treatment concentration of 0.2 ppm rotenone (active ingredient), the maximum concentration of Fennodefo 99™ in solution would be 0.68 ppm, which poses no toxicological risk to fish or wildlife (California Department of Fish and Game, 2010*b*: C-51 to C-52).

Powdered rotenone (Prentox® Prenfish™ Fish Toxicant Powder) would be used in a sandmix formulation to treat springs, seeps and wetlands adjacent to restoration stream segments. Sandmix is composed of one pound of powdered rotenone, one pound of dry sand, two ounces of unflavored gelatin, and sufficient water to create a dough-like consistency (Finlayson *et al.*, 2010: 111). Prentox® Prenfish™ Fish Toxicant Powder consists of 7.4 percent rotenone, 11.1 percent other associated plant resins, and 81.5 percent other ingredients, such as clay or talc (as dry diluents) and wetting or dispersing agents (the product label and Material Safety Data Sheet are in Appendix B).

Potassium permanganate is proposed to deactivate rotenone at the downstream end of the project area to achieve a concentration that is two to four times the concentration of rotenone. As described in the proposed action, a potassium permanganate solution would be applied to achieve a concentration of 1.0 ppm (=1,000 ppb) at the downstream end of the rotenone deactivation zone. Potassium permanganate is toxic to freshwater fish with reported 96-hr LC50 values ranging from 750 ppb for channel catfish to 3,600 ppb for bluegill (Marking and Bills, 1976). The reported 96-hr LC50 for rainbow trout is1,220 to 1,800 ppb and 2,300 to 3,600 ppb for bluegill (Marking and Bills, 1976). The proposed maximum potassium permanganate application would not result in toxic conditions for aquatic biota that occur in the project area. Potassium permanganate is a strong oxidizing agent used in many industries and laboratories. It is used as a disinfectant in treating potable water. In fisheries and aquaculture, potassium permanganate is used at concentrations ranging from 2 to 25 ppm in a bath treatment for control of some fish parasites. The principal element in the permanganate solution with potential toxicity is manganese. Colloidal manganese hydroxides typically form in water above pH 5.5. These colloidal forms typically are not bioavailable. Permanganate reduces rotenone and in the process oxygen is liberated, which offsets the respiratory toxicity of rotenone. The reduction reaction also liberates potassium ions and results

in formation of manganese dioxide, which is insoluble and not bioavailable (California Department of Game and Fish, 2010*b*: C-35 to C-39).

Rotenone is rapidly degraded through hydrolysis and photolysis (U.S. Environmental Protection Agency, 2006: 12-13; U.S. Environmental Protection Agency, 2007:21) and may persist in ponds or lakes for a few days to several weeks (Ling, 2003; Finlayson *et al.*, 2001). In flowing water rotenone dissipates in less than 24 hours due to dilution, increased rates of hydrolysis, and photolysis (Cheng *et al.*, 1972). The rate of degradation of rotenone in pond or lake habitats is influenced by water temperature, light intensity, pH, sediments, and aquatic vegetation. Half-life of rotenone in ponds or lakes ranged from 10.6 hours at 73 to 81°F (23 to 27°C) to 23 hours at 41°F (5°C; Turner *et al.*, 2007: 32). Rotenone also binds strongly to sediments and aquatic vegetation (Gilderhus *et al.*, 1986; Dawson *et al.*, 1991; Turner *et al.*, 2007: 32). Toxicity of rotenone declines concurrent with chemical decay, which indicates that the breakdown products of rotenone degradation are comparatively non-toxic to aquatic life (Marking and Bills, 1976). Cheng and others (1972) identified 20 products of rotenone photodegradation, only one of which (6αβ, 12αβ-rotenolone) was considered toxic. Rotenolone has a half-life of 5.5 days at 48°F (9°C; U.S. Environmental Protection Agency, 2006: 38).

At the maximum allowable treatment concentration of 0.2 ppm (=200 µg/L), rotenone is toxic to many aquatic organisms, particularly fish. For example, for a 96-hour exposure the LC50[2] for rainbow trout is 1.94 µg/L and 4.9 µg/L for bluegill (U.S. Environmental Protection Agency, 2006: 52-53). The highest concentration at which there was no observed adverse effect of rotenone on early life stage rainbow trout was 1.01 µg/L (U.S. Environmental Protection Agency, 2006: 52). Eggs of salmonid species are much less sensitive to rotenone than are fish (Olson and Marking, 1975; Marking and Bills, 1976). Lethal concentrations of rotenone (*i.e.* the 24-hr LC50) for various fish species are shown in Table 3.

There are few studies of rotenone toxicity to reptiles. Aquatic turtles, particularly those in the family Kinosternidae (mud turtles), may be susceptible to rotenone poisoning, but no toxicity tests have been conducted (California Department of Game and Fish, 2010*b*: C-23). Amphibians are susceptible to rotenone poisoning but are generally more tolerant than fish (Table 4). Gilled larvae such as tadpoles or salamander neonates are the most sensitive to rotenone poisoning (California Department of Game and Fish, 2010*b*: C-22). In contrast, adult amphibians such as northern leopard frog appear to be tolerant of the proposed treatment-level rotenone concentration of 200 µg/L (0.2 ppm; Table 4).

[2] LC50 is the concentration of a chemical in the water that results in death of 50 percent of the test organisms over a specified period of time.

Table 3. Lethal concentrations of rotenone for selected fish species (from Marking and Bills, 1976). The 24-hr LC50 is the median concentration of rotenone that kills 50 percent of the test organisms in a 24-hour period.

Fish Species	Lethal Concentration of Rotenone, LC50 24-hr (µg/L)
Brook trout (*Salvelinus fontinalis*)	2.4
Rainbow trout (*Oncorhynchus mykiss*)	3.5
Common carp (*Cyprinus carpio*)	4.2
Fathead minnow (*Pimephales promelas*)	20
Channel catfish (*Ictalurus punctatus*)	20
Black bullhead (*Ameiurus melas*)	33.3
Smallmouth bass (*Micropterus salmoides*)	4.7
Largemouth bass (*Micropterus dolomieu*)	10
Green sunfish (*Lepomis cyanellus*)	10.9
Bluegill (*Lepomis macrochirus*)	7.5
White sucker (*Catostomus commersoni*)	3.5

Table 4. Lethal concentrations of rotenone for selected amphibian species (from California Department of Game and Fish, 2010*b*: C-23).

Amphibian Species	Lethal Concentration of Rotenone, LC50 24-hr (µg/L)
Northern leopard frog (*Rana pipiens*), tadpole	5
Northern leopard frog (*Rana pipiens*), juvenile	10
Northern leopard frog (*Rana pipiens*), adult	240 to 1,580
Tiger salamander (*Ambystoma tigrinum*), larvae	5

Aquatic invertebrates are much more tolerant of rotenone than are fish (Chandler and Marking, 1982; Vinson *et al.*, 2010; Table 5). Zooplankton appear to be the group of aquatic invertebrates most sensitive to rotenone. For example, the highest concentration at which there was no observed adverse effect of rotenone on *Daphnia magna* was 1.25 µg/L (U.S. Environmental Protection Agency, 2006: 52).

Table 5. Lethal concentrations of rotenone for selected aquatic invertebrate species (from Ling, 2003).

Aquatic Invertebrate Species	Lethal Concentration of Rotenone, LC50 24-hr (µg/L)
Flatworm (*Catenula*)	5,100
Cladoceran (*Daphnia pulex*)	27
Ostracod (*Cypridopsis*)	490
Dragonfly (*Macromia*), larvae	4,700
Stonefly (*Pteronarcys californica*), larvae	2,900
Backswimmer (*Notonecta*)	3,420
Caddisfly (*Hydropsyche*), larvae	605*
Whirligig beetle (*Gyrinus*)	3,550
Snail (*Oxytrema catenaria*)	1,750*
Bivalve mollusc (*Elliptio complanata*)	2,000*

*** Values are for the 96-hour LC50 (µg/L)**

The relatively rapid degradation of rotenone in flowing-water habitats indicates that aquatic organisms would be subject to the maximum treatment concentration of 200 µg/L for a relatively short period of time due to the combined effects of dilution, hydrolysis, and photolysis. After approximately 24 hours, the concentrations of rotenone and rotenolone residues would decline below the detection limit of 2 ppb (U.S. Environmental Protection Agency, 2006: 197; California Department of Fish and Game, 2010*b*: C16). Rotenone or rotenolone residues may persist in concentrations above the detection level of 30 µg/kg (= ppb) in stream sediments for up to seven days (Finlayson *et al.*, 2001: 49).

Based on the information presented above, the proposed action is likely to result in elimination of fish from the proposed restoration stream segments. Rio Grande chub and Rio Grande sucker would be salvaged from the project area prior to treatments, and these salvaged fish would be used to reestablish populations in the project area following completion of rotenone treatments (see the description of the proposed action in section 2.2.2). Also, native Rio Grande cutthroat trout would be restored to the project area

following completion of rotenone treatments. Nonnative hybrid trout would be eradicated from the project area, as would longfin dace which are not native to the Las Animas Creek drainage. Consequently, effects of the proposed action on native fish in the project area would be a reduction in abundance over the short term but improved population status in the long term through removal of nonnative species.

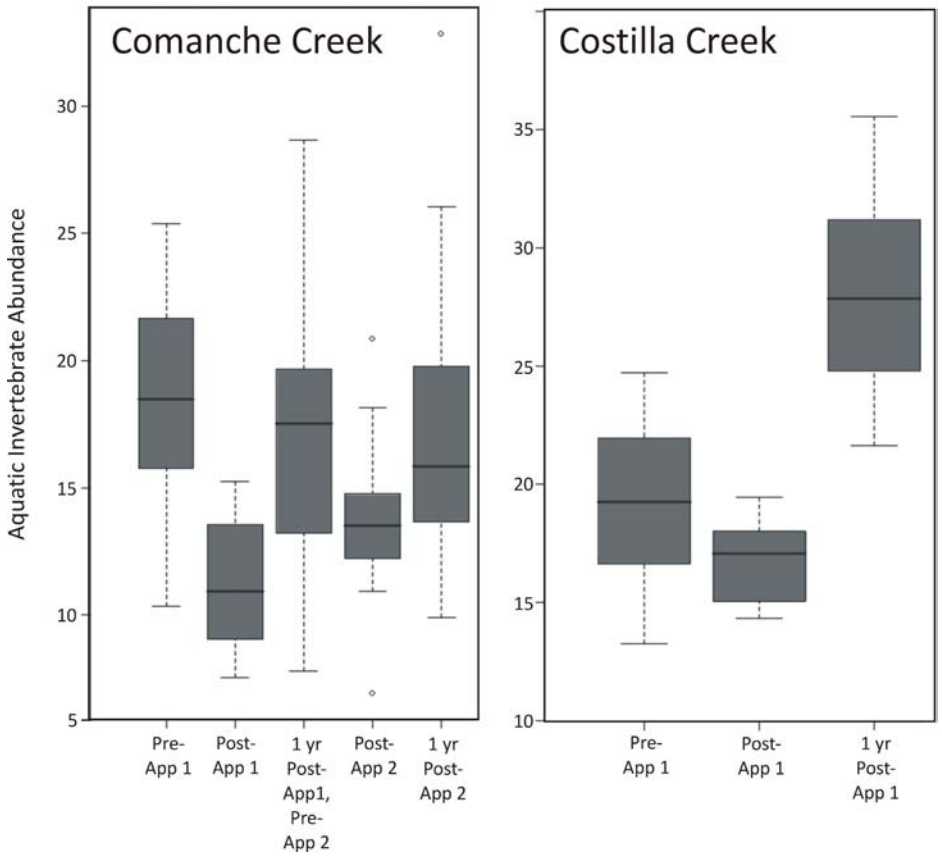
Rotenone treatments would be unlikely to affect adult frogs or toads, based on the acute toxicity threshold of 240 to 1,580 µg/L for adult northern leopard frog (Table 4) compared to the maximum allowable rotenone treatment concentration of 200 µg/L. However, tadpole mortality would be very likely at the maximum treatment concentration and may even occur at rotenone concentrations as low as 50 µg/L (*e.g.* Billman *et al.*, 2012). Consequently, amphibian populations in the project area may experience short-term population declines due to tadpole mortality but would persist in the long-term because adult frogs and toads would not be affected. In order to minimize potential adverse effects of the proposed action on Chiricahua leopard frog, aquatic and wetland habitats would be surveyed prior to any rotenone treatments. Any Chiricahua leopard frog found would be collected by a properly permitted individual, transferred to an appropriate, dedicated holding facility, and repatriated following successful stream renovation (see section 3.4 for detailed analysis of effects on special-status species, including Chiricahua leopard frog).

The effects of piscicidal rotenone treatments on aquatic macroinvertebrates depends primarily upon the concentration and duration of rotenone treatments, morphology and life history of individual taxa, occurrence of refuge areas, and distance from colonization sources (Vinson *et al.*, 2010). As discussed in section 2.2.2.2, the likely rotenone treatment concentration would be 50 ppb and would be unlikely to exceed 100 ppb. The maximum allowable rotenone concentration is 200 ppb. The project would likely consist of two treatments per year for two years, with a maximum of three treatments per year over a three-year period. Individual aquatic invertebrate taxa vary in their tolerance to rotenone (Table 5), as do different developmental stages of the same taxon (Kjærstad and Arnekleiv, 2011).

Skorupski (2011) studied the effects on aquatic invertebrates of rotenone treatments similar to those proposed for this project. The treatments were conducted in Costilla and Comanche creeks in northern New Mexico. Invertebrate responses included an increase in drift during exposure to rotenone (Skorupski, 2011: 61) and reductions in abundance and species richness (Skorupski, 2011: 88). Immediate post-treatment reductions in aquatic invertebrate abundance were approximately 42 percent at Comanche Creek after the first application and 28 percent after the second application, while the post-rotenone treatment reduction in aquatic invertebrates at Costilla Creek was only approximately 10 percent (Figure 11). Aquatic invertebrate abundance recovered to pre-treatments levels (approximately) within one year following individual treatments (Figure 11).

Refuge sites for aquatic invertebrates in the project area include fishless headwater and tributary habitats in the Las Animas Creek drainage, springs and seeps, and downstream, untreated reaches of Las Animas Creek. These areas, along with other aquatic habitats within dispersal distance such as Seco Creek as well as remaining populations of aquatic invertebrates in the project area, would provide recolonization sources.

Figure 11. Changes in aquatic invertebrate abundance following rotenone treatments in Comanche and Costilla creeks, New Mexico (excerpted from Skorupski, 2011; figures 37 and 38). The X-axis labels refer to rotenone applications, denoted by the abbreviation App. Post-application (Post-App) sampling was conducted immediately following completion of the rotenone treatment. Abundance is square-root transformed density. Rotenone treatments in the two streams were conducted from 2007 to 2009.



Cumulative Effects There are no known future actions that may affect water quality or aquatic biota in the project area. The effects of past and ongoing actions on water quality and aquatic biota is represented by the existing conditions of these resources. The principal actions that occurred in the past that have affected water quality and aquatic biota in the project area were stocking of nonnative fish and fire suppression. Water quality in the project area prior to the Silver Fire was good (New Mexico Environment Department, 2009 and 2012). The nonnative population of longfin dace has likely had a negative impact on Rio Grande chub and Rio Grande sucker in Las Animas Creek (McShane, 2007), and introduction of nonnative trout has resulted in the loss of the native population of Rio Grande cutthroat trout in the drainage (Patten, 2008). The proposed action would overlap spatially and temporally with these effects of past actions but would not add to them. The effect of the proposed action would be to

counteract these adverse effects from past actions.

3.3 Terrestrial Wildlife

This section includes a discussion of terrestrial wildlife in the project area and how it may be affected by the alternatives. Peer-reviewed scientific literature and agency databases provided baseline information on existing conditions for the project area as well as the analysis of potential effects of the alternatives.

Issue: Use of rotenone may have direct effects on aquatic invertebrates, amphibians, and fish, as well as terrestrial wildlife, from consumption of or contact with treated water.

3.3.1 Existing Conditions

Habitat for terrestrial wildlife in the project area consists of the riparian corridor along proposed restoration stream segments and adjacent forests and woodlands. Riparian habitat in the lower stream reaches of the project area is dominated by cottonwood (*Populus deltoides wislizeni*) and willow (*Salix gooddingii*). The middle portion of the project area has riparian vegetation characterized by Arizona sycamore (*Platanus wrightii*), New Mexico alder (*Alnus oblongifolia*) and cottonwoods (*P. deltoides wislizeni* and *P. angustifolia*). Riparian vegetation in the upper, higher elevation portion of the project area is characterized by species such as Douglas-fir (*Pseudotsuga menzesii*), ponderosa pine (*Pinus ponderosa*), bluestem willow (*Salix irrorata*), dogwood (*Cornus sericea*), and narrowleaf cottonwood. Adjacent forest and woodland habitat ranges from juniper (*Juniperus monosperma*) savanna at the lower elevations to mixed conifer forest at the upper elevations.

Mammal species that may occur in the riparian corridor in the project area and which may consume rotenone-treated water or rotenone-killed fish, are shown in Table 6. Also included in Table 6 are mammal species that may forage on larval or, more likely, adult forms of aquatic insects (*e.g.* bat species listed in the table). Bird species that have been observed along Las Animas Creek are shown in Table 7. While this list does not represent a comprehensive survey of all bird species likely to occur in riparian habitats in the project area, it does provide a representative range of species that may be found in the project area.

The project area is situated in Game Management Units 21A, which includes the portion of the project area on the Gila National Forest, and 21B, which includes the private lands of the Ladder Ranch in the project area. The portion of the project area in unit 21A is considered core occupied elk range, while the portion of the project area in unit 21B is not considered to be core occupied elk range. Estimated hunting harvest of elk in 2012 was 59 bulls and four cows in unit 21A and 88 bulls and 57 cows in unit 21B (New Mexico Department of Game and Fish, 2012). Estimated hunting harvest of deer in unit 21 (A and B combined) in 2012 was 307 (New Mexico Department of Game and Fish, 2013). Small numbers of mountain lions and bear are harvested by hunters from unit 21.

Table 6. Mammals associated with riparian or aquatic habitat in the project area and that may consume treated water, dead fish, or aquatic macroinvertebrates (larval or adult forms), adapted from Findley and others (1975)

COMMON NAME	SCIENTIFIC NAME
vagrant shrew	*Sorex vagrans*
Yuma myotis	*Myotis yumanensis*
little brown myotis	*Myotis lucifugus*
southwestern myotis	*Myotis auriculus*
long-eared myotis	*Myotis evotis*
fringed myotis	*Myotis thysanodes*
long-legged myotis	*Myotis volans*
California myotis	*Myotis californicus*
western pipistrelle	*Pipistrellus hesperus*
big brown bat	*Eptesicus fuscus*
western harvest mouse	*Reithrodontomys megalotis*
deer mouse	*Peromyscus maniculatus*
white-throated woodrat	*Neotoma albigula*
Mexican woodrat	*Neotoma mexicana*
Mexican vole	*Microtus mexicanus*
long-tailed vole	*Microtus longicaudus*
coyote	*Canis latrans*
gray fox	*Urocyon cinereoargenteus*
black bear	*Ursus americanus*
raccoon	*Procyon lotor*
western spotted skunk	*Spilogale gracilis*
striped skunk	*Mephitis mephitis*
common hog-nosed skunk	*Conepatus mesoleucus*
mountain lion	*Felis concolor*
bobcat	*Lynx rufus*
elk	*Cervus elaphus*
mule deer	*Odocoileus hemionus*
white-tailed deer	*Odocoileus virginianus*

Table 7. Bird species observed along Las Animas Creek, 1984 to 2009 (New Mexico Ornithological Society, 2013).

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
Great-blue Heron	*Ardea herodias*	Hutton's Vireo	*Vireo huttoni*
Green Heron	*Butorides virescens*	Steller's Jay	*Cyanocitta stelleri*
Black-bellied Whistling-Duck[V]	*Dendrocygna autumnalis*	Bridled Titmouse[M]	*Baeolophus wollweberi*
Common Merganser	*Mergus merganser*	Juniper Titmouse	*Baeolophus ridgwayi*
Turkey Vulture	*Cathartes aura*	Mountain Chickadee	*Poecile gambeli*
Gray Hawk	*Buteo plagiatus*	Red-breasted Nuthatch	*Sitta canadensis*
Zone-tailed Hawk	*Buteo albonotatus*	Winter Wren	*Troglodytes troglodytes*
Bald Eagle[1]	*Haliaeetus leucocephalus*	American Dipper	*Cinclus mexicanus*
Montezuma Quail	*Cyrtonyx montezumae*	Rufous-backed Robin	*Turdus rufopalliatus*
Wild Turkey	*Meleagris gallopavo*	Brown Thrasher	*Toxostoma rufum*
Yellow-billed Cuckoo[2]	*Coccyzus americanus*	Tennessee Warbler	*Vermivora peregrina*
Barn Owl	*Tyto alba*	Orange-crowned Warbler	*Vermivora celata*
Elf Owl	*Micrathene tuberculifer*	Lucy's Warbler	*Vermivora luciae*
Northern Flicker	*Colaptes auratus*	Yellow-rumped Warbler	*Dendroica coronata*
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Pine Warbler	*Dendroica pinus*
Acorn Woodpecker	*Melanerpes formicivorus*	Indigo Bunting	*Passerina cyanea*
Lewis's Woodpecker	*Melanerpes lewis*	Clay-colored Sparrow	*Spizella pallida*
Downy Woodpecker	*Picoides pubescens*	Bullock's Oriole	*Icterus bullockii*
Hairy Woodpecker	*Picoides villosus*	Scott's Oriole	*Icterus parisorum*
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Rusty Blackbird	*Euphagus carolinus*
Hammond's Flycatcher	*Empidonax hammondi*	Purple Finch	*Carpodacus purpureus*
Dusky-capped Flycatcher	*Myiarchus tuberculifer*	Lawrence's Goldfinch	*Carduelis lawrenci*
Brown-crested Flycatcher	*Myiarchus tyrannulus*		

[V] = vagrant (NatureServe, 2013)
[M] = migrant (NatureServe, 2013)
[1] = recorded as occurring in Sierra County
[2] = NMOS record 61756, 8/26/2001, pair, carrying food, likely breeding

3.3.2 Effects on Terrestrial Wildlife

No Action Terrestrial wildlife in the project area would not be exposed to rotenone in water or rotenone residues in treatment-killed fish. Wildlife species composition, abundance, behavior, and population status in the project area would not be altered from the existing condition.

Proposed Action Rotenone in a liquid or sandmix formulation would be applied directly to water. Consequently, there would be no exposure of terrestrial wildlife to rotenone via airborne, terrestrial soil, or terrestrial vegetation pathways. Terrestrial wildlife may be exposed to rotenone by ingestion of treated water or consumption of aquatic organisms or wetland vegetation in treated stream segments.

The maximum concentration of rotenone in water would be 0.2 ppm (= 200 µg/L or 200 ppb). Actual field concentrations used during the project would likely be in the range of 50 to 100 ppb (*cf.* section 2.2.2.2). Concentration of rotenone would decline following application in restoration stream segments. The rate of degradation of rotenone would depend upon local conditions (flow rate and turbulence, water temperature, light intensity, organic material, etc.). Measurable levels of rotenone residue were detected in Silver King Creek, California, for 18 hours following rotenone treatment (rotenone detection level = 2 ppb; U.S. Environmental Protection Agency, 2006: 197). Based on this information, a conservative estimate is that terrestrial wildlife may be exposed to rotenone in water for up to approximately 24 hours at concentrations not exceeding 0.2 ppm.

Rotenone has low potential for bioconcentrating in aquatic organisms (U.S. Environmental Protection Agency, 2006: 12). Bioconcentration factor (*i.e.* the chemical concentration in an organism divided by the chemical concentration in water), for rotenone in aquatic organisms was reported by the U.S. Environmental Protection Agency as ranging from 10.8 to 27.9 (U.S. Environmental Protection Agency, 2006: 13). Similarly, Rach and Gingerich (1986) reported that rotenone may bioconcentrate in aquatic organisms that are killed by treatments to a maximum level of approximately 20 times the ambient concentration of rotenone in treated water. A field study of 0.25-ppm rotenone treatments in Wisconsin yielded markedly lower tissue concentrations in rotenone-killed fish, with a maximum concentration of only about 0.7 ppm (*i.e.* bioconcentration factor of 2.8; U.S. Environmental Protection Agency, 2006: 38). In summary, a conservative estimate using a maximum rotenone concentration in water of 0.2 ppm and the maximum reported bioconcentration factor of 27.9 yields a maximum rotenone concentration in aquatic organisms in treated water of 5.58 ppm (mg/kg). Thus, at a maximum treatment concentration of 0.2 ppm, maximum rotenone concentration in killed fish would be approximately 5.6 ppm (=5.6 mg/kg).

Mammalian acute oral toxicity LD50[3] values for rotenone range from 39.5 mg/kg (ppm) for female rats to 1,500 mg/kg for rabbits. For birds the acute oral toxicity LD50 values range from 130 mg/kg for nestling English Song Sparrow to 2,200 mg/kg for adult Mallard Duck (California Department of Fish and Game, 2010*b*: C-21). Consequently, ingestion of water with a

[3] LD50 is the amount of a toxic substance that is required to kill 50 percent of the test organisms, typically within in 24-hr period.

maximum concentration of 0.2 ppm would not pose a toxicological risk to mammals or birds. For example, a 1.5-lb (0.7 kg) rabbit would have to ingest 1,050 mg of rotenone to meet the LD50 threshold of 1,500 mg/kg, which corresponds to ingestion of over 1,320 gallons (5,000 L) within a 24-hr period of water with a rotenone concentration of 0.2 ppm. Similarly, a 0.7-lb(0.3-kg) rat would have to ingest 11.85 mg of rotenone to meet the LD50 threshold of 39.5 mg/kg. This would require ingestion over a 24-hr period of approximately 16 gallons (60 L) of water with a 0.2 ppm rotenone concentration.

As indicated above, terrestrial wildlife may also be exposed to rotenone via consumption of rotenone-killed fish. Using the most sensitive oral toxicity LD50 value listed above (39.5 mg/kg) and assuming a rotenone residue concentration of 5.6 mg/kg in killed fish, a 2.2-lb (1-kg) mammal would have to consume approximately 16 lbs (7 kg) of rotenone-killed fish in a 24-hr period to reach the conservative acute oral toxicity threshold. Under the same scenario, a 1.1-lb (0.5-kg) carrion-feeding bird would have to consume approximately 51 lbs (23 kg) of rotenone-killed fish in a 24-hr period to reach the most sensitive avian oral toxicity threshold of 130 mg rotenone/kg body weight.

Estimated rates of food and water intake for various terrestrial wildlife species are shown in Table 8. Ingestion of water by the species listed in Table 8 would result in maximum rotenone exposures ranging from 0.0074 mg/kg for bald eagle to 0.053 mg/kg for marsh wren (Table 9), with the assumption that all water consumed in a 24-hour period had a rotenone concentration of 0.2 ppm.

Table 8. Estimated daily water and food ingestion rates for selected wildlife species (from: California Department of Fish and Game, 2010*b*: C-42).

Species	Adult Body Weight (g)	Daily Food Intake (g)	Daily Water Intake (ml)
Quail	190	19.5	19
Marsh Wren	11.25	8	3
Hairy Woodpecker	60	9.2	9
Bald Eagle	3,750	450	139
Mouse	21	2.8	7
Red fox	4,530	237	428
Mule deer	75,470	2,400	4,800
Black bear	128,870	3,900	7,800

Similarly, assuming that all food ingested had a rotenone concentration of 5.6 mg/kg, exposure via the food pathway would range from 0.18 mg/kg for black bear to 4.0 mg/kg for marsh wren (Table 9).

Estimated total daily exposure to rotenone, assuming maximum rotenone concentrations and consumption of only rotenone-contaminated food and water, ranges from 0.012 mg/kg for black bear and mule deer to 0.053 mg/kg for marsh wren (Table 9).

Table 9. Estimated maximum 24-hr exposure of selected wildlife species to rotenone using a water concentration of 0.2 mg/L and food concentration of 5.6 mg/kg.

Species	Water Intake Exposure (mg/kg)	Food Intake Exposure (mg/kg)	Total Daily Exposure (mg/kg)
Quail	0.0200	0.5747	0.5947
Marsh Wren	0.0533	3.9822	4.0356
Hairy Woodpecker	0.0300	0.8587	0.8887
Bald Eagle	0.0074	0.6720	0.6794
Mouse	0.0667	0.7467	0.8133
Red fox	0.0189	0.2930	0.3119
Mule deer	0.0127	0.1781	0.1908
Black bear	0.0121	0.1695	0.1816

In summary, in the case of terrestrial wildlife, hypothetical ingestion of vast quantities of water alone would prove lethal long before manifestation of any toxicological effects from rotenone. Consequently, ingestion of rotenone-treated water poses no toxicological risk to mammals or birds. Similarly, the quantities of rotenone-killed fish that would have to be consumed by birds or mammals in a 24-hr period to result in lethal poisoning are clearly well beyond what is physically possible. The estimated maximum daily exposure to rotenone, which very conservatively assumes that all food and water consumed contains maximum concentrations of rotenone, is well below toxicity thresholds. Consequently, the proposed application of rotenone poses no toxicological risk to terrestrial wildlife.

As described in section 3.2.2, the proposed action may result in depression of aquatic macroinvertebrate abundance in restoration stream segments following rotenone treatments. Stream habitats and adjacent riparian zones are linked by reciprocal energy and nutrient transfers (Vannote *et al.*, 1980; Rice *et al.*, 2001; Gomi *et al.*, 2002). One component of the aquatic-terrestrial linkage is the reciprocal flow of arthropods between riparian and aquatic habitats (Nakano *et al.*, 1999; Baxter *et al.*, 2005). Emergence of aquatic insects adds to the terrestrial arthropod prey base in the adjacent

riparian zone (*e.g.* Jackson and Fisher, 1986; Gray, 1993; Paetzold *et al.*, 2005; Fukui *et al.*, 2006), and terrestrial arthropods from the riparian zone enter the stream drift and add to the aquatic invertebrate prey base (Wipfli, 1997; Nakano *et al.*, 1999).

Biomass of flying terrestrial insects in headwater stream systems is typically much higher than the biomass of emergent adult aquatic insects (Fukui *et al.*, 2006) due to the relatively low primary productivity of headwater stream habitats (Wallace *et al.*, 1997; Richardson and Danehy, 2007) compared to the adjacent riparian zone. Consequently, emergent aquatic insects alone are unlikely to provide sufficient prey, particularly in headwater stream systems where productivity is relatively low, to support populations of terrestrial insectivores (*e.g.* Gray, 1993). Aquatic insects may, however, subsidize the diets of terrestrial insectivores, thereby reducing predation pressure on terrestrial arthropods (Sabo and Power, 2002; Paetzold *et al.*, 2005; Fukui *et al.*, 2006). The magnitude of the subsidy is determined, in part, by productivity (Polis *et al.*, 1997), which again is relatively low in headwater streams. Additionally, prey preferences of terrestrial insectivores may vary widely with some taxa utilizing emergent aquatic insects more than others (*e.g.* Gray, 1993; Yard *et al.*, 2004; Paetzold *et al.*, 2005; Fukui *et al.*, 2006).

Two main groups of terrestrial insectivores, birds and bats, are both highly mobile and move freely over large distances in response to seasonal and annual fluctuations in resource availability. These taxa would likely accommodate variations in insect prey abundance by expanding foraging areas, shifting foraging area boundaries, or moving to more suitable locations. These adaptations would occur under baseline conditions in response to fluctuations in prey caused by climatic variation, drought, floods, forest fire, insect population dynamics (*e.g.* irruptions), and other factors. Other less vagile taxa such as predaceous spiders, other insectivorous arthropods, or small vertebrates such as lizards, would be more closely tied to the stream corridor but would also exhibit movements or shifts in prey utilization in response to changes in emergent aquatic insect abundance.

Based on the discussion above and in section 3.2.2, effects of the proposed action on aquatic-terrestrial food web linkages would be conditioned by the following factors.

1. Short-term reductions in aquatic invertebrate abundance may occur ranging from about 10 to 40 percent following individual rotenone treatments, with recovery to pre-treatment levels likely within six to 12 months.

2. Emergent aquatic insects may subsidize the diet of terrestrial insectivores but are unlikely to constitute the sole source of food for any vertebrate or invertebrate insectivore species.

3. Terrestrial insectivores, such as bats and birds, are highly mobile and adapt to variation in prey availability by altering foraging areas and shifting to other prey (*e.g.* short-term shift to consumption of more terrestrial invertebrates).

Finally, experimental manipulations that removed all emergent aquatic insects from the terrestrial arthropod prey base showed short-term effects on behavior, growth, and abundance of terrestrial insectivores but did not result in elimination of any terrestrial insectivore taxa (Baxter *et al.*, 2005). Also, Baxter and others (2005) noted that the importance of emergent aquatic insect

production to the terrestrial insectivore prey base varies with in-stream productivity and declines exponentially with distance from the stream edge. In the case of the proposed action, emergent aquatic insect production in the project area would be reduced, short-term, not eliminated. The effect of this reduction on the terrestrial insectivore prey base would be limited to the relatively narrow riparian corridor in the project area. Consequently, effects of the proposed action on behavior, growth, and abundance of terrestrial insectivores are expected to be short-term (*i.e.* less than one year) and insignificant.

Cumulative Effects Because the proposed action is not likely to have any measurable effect on terrestrial wildlife, there would be no cumulative effects associated with the action alternative.

3.4 Special Status Species, Management Indicator Species, and Migratory Birds

This section describes special status species, management indicator species, and migratory bird species that may occur in the project area and the potential effects of the alternatives on those species. A separate biological assessment and evaluation (Blue Earth Ecological Consultants, Inc., 2014), management indicator species report (Blue Earth Ecological Consultants, Inc., 2013*a*), and migratory bird assessment report (Blue Earth Ecological Consultants, Inc., 2013*b*) was prepared for the proposed action. These reports are summarized here. The discussion of existing conditions presents a brief overview of the biology of the species and the environmental baseline.

3.4.1 Existing Conditions

3.4.1.1 Special Status Species

Special status species are defined as those species that are afforded protection under the federal Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) or two state laws: the Wildlife Conservation Act (17-2-37 NMSA) or the New Mexico Endangered Plant Species Act (9-10-10 NMSA). In addition to species listed under the federal Endangered Species Act or the two state laws, the special-status species analysis also includes U.S. Forest Service, Region 3 sensitive species. These are species that are being monitored to determine if they are declining and if legal protection is warranted.

The federal Endangered Species Act prohibits killing, harming, or harassing listed species and also prohibits the adverse modification of designated critical habitat for listed species. Section 7 of the Act requires federal agencies to conserve listed species on their lands and to ensure that any activity they fund, authorize, or carry out would not jeopardize the survival of a listed species. The two state laws prohibit the take of state-listed species without permit from the New Mexico Department of Game and Fish (for animal species) or the Rare Plants Program of the New Mexico Forestry and Resources Conservation Division (for plant species).

There are 88 special-status species that may occur in Sierra County (Appendix C). The habitat that each species is typically associated with is listed in the table in the "Habitat" column. Those species that are known to occur in aquatic, wetland, or riparian habitats in montane or

subalpine coniferous forest *and* whose known or suspected distribution includes the project area were considered as potentially occurring in the project area. Application of these selection criteria identified 13 special-status species. These species are highlighted in red in the table in Appendix C.

Eight of the 13 special-status species identified using the habitat and distribution criteria are terrestrial wildlife species (Northern Goshawk, Common Black-Hawk, Bald Eagle, American Peregrine Falcon, Mexican Spotted Owl, Southwestern Willow Flycatcher, Arizona myotis, and long-tailed vole).

Northern Goshawk and American Peregrine Falcon do not prey on aquatic species and would be unlikely to consume rotenone-killed aquatic biota. Therefore, they would not be affected by the proposed action. Common Black-hawk and Bald Eagle may forage on aquatic biota or rotenone-killed organisms. Loss of fish prey in Las Animas Creek for two to three years is not expected to affect these species because their diets are not restricted to aquatic biota in Las Animas Creek. Also, as discussed in section 3.3.2, the proposed application of rotenone poses no toxicological risk to terrestrial wildlife.

Southwestern Willow Flycatcher and Arizona myotis are insectivorous species. As discussed above in section 3.3.2, the proposed application of rotenone would not have any substantive effects on terrestrial insectivores. Furthermore, suitable habitat for Southwestern Willow Flycatcher is not found in the project area.

Long-tailed vole forages primarily on forbs, grasses and sedges, and fungi (Findley *et al.*, 1975: 260; Hoffmeister, 1986: 438), and therefore would not be directly or indirectly affected by the proposed action.

Mexican Spotted Owl is known to occur in the project area, and the project area is also within designated critical habitat. Therefore, Mexican Spotted Owl was included in the analysis.

The six potentially affected special-status species discussed in this analysis include two species listed as threatened under the ESA and one candidate for listing under the ESA (Table 10). Two of the species have no listing status under the ESA or New Mexico state law but are listed by the Forest Service as sensitive species (Table 10). The last potentially affected special-status species is considered a species of concern at the state level (Table 10).

Rio Grande Cutthroat Trout Rio Grande cutthroat trout is a candidate for listing under the federal Endangered Species Act and is also listed as a Forest Service sensitive species and a New Mexico state species of concern (Table 10). The U.S. Fish and Wildlife Service completed a status review of the species in 2008 with the conclusion that listing of the species under the federal Endangered Species Act was warranted but precluded by higher priority actions (U.S. Fish and Wildlife Service, 2008).

Rio Grande cutthroat is native to coldwater stream habitats in the Pecos, Canadian, and Rio Grande drainages in New Mexico and Colorado. Historically, the species likely occupied approximately 6,660 miles of stream, with about 52 percent of that total in New Mexico and the remaining 48 percent in Colorado (Alves *et al.*, 2008: 9).

Table 10. Special-status species in the project area that may be affected by the proposed action. Status categories are the federal Endangered Species Act (**ESA**), New Mexico Wildlife Conservation Act or New Mexico Endangered Plant Species Act (**NM**), U.S. Forest Service, Region 3 (**USFS SEN**), and species of concern (**SC**) identified at the federal (**F**) or state (**S**) level. **E** = endangered, **T** = threatened, and **C** = candidate.

COMMON NAME	SCIENTIFIC NAME	ESA			NM		USFS SEN	SC
		E	T	C	E	T		
Rio Grande cutthroat trout	*Oncorhynchus clarkii virginalis*			X			X	S
longfin dace	*Agosia chrysogaster*						X	
Rio Grande chub	*Gila pandora*							S
Chiricahua leopard frog	*Lithobates chiricahuensis*		X					S
Arizona toad	*Anaxyrus microscaphus microscaphus*						X	S
Mexican Spotted Owl	*Strix occidentalis lucida*		X				X	X

Most of the historic range of Rio Grande cutthroat trout was in the Rio Grande drainage basin (81 percent or 5,399 stream miles), followed by the Canadian (10 percent or 638 stream miles) and Pecos (nine percent or 638 stream miles) river drainages.

Genetic differences indicate that the three major population groups (Rio Grande, Canadian, and Pecos) have been geographically isolated for several thousand years (Pritchard *et al.*, 2008). Currently, Rio Grande cutthroat trout occupies approximately 758 miles of stream habitat within its historic range (Alves *et al.*, 2008: 11). The current fragmented distribution represents only about nine percent of the historic range of Rio Grande cutthroat trout.

Distinguishing features of Rio Grande cutthroat trout include a red to orange "cutthroat" mark in the gular fold on the underside of the lower jaw and relatively large, irregularly shaped dark spots on the body primarily posterior to the dorsal fin but which may also occur anterior to the dorsal fin and above the lateral line (Sublette *et al.*, 1990: 51). Body color of Rio Grande cutthroat trout varies from light rose to red-orange on the sides and pink or yellow-orange on the belly (Pritchard and Cowley, 2006: 12).

Rio Grande cutthroat trout occur in stream habitats with maximum water temperatures that do not exceed about 75°F (24°C) for extended periods (Pritchard and Cowley, 2006: 13). At the other end of the thermal spectrum, minimum mean daily water temperatures in the summer are above 46°F (7.8°C) in optimal habitat (Pritchard and Cowley, 2006: 18). In addition to these temperature thresholds, suitable water quality is also characterized by low levels of suspended sediment, high oxygen concentration, and low concentrations of metals, trace elements, and other pollutants over the long term.

Rio Grande cutthroat trout requires well-aerated gravel substrates (*i.e.* free of fine sediments) for spawning and egg development (Magee *et al.*, 1996). Optimum gravel size ranges from 0.5 to

3.3 inches (12 to 85 mm; Pritchard and Cowley, 2006: 26). Spawning occurs as spring snowmelt runoff diminishes; generally from mid-May to mid-June in New Mexico (Pritchard and Cowley, 2006: 25; U.S. Fish and Wildlife Service, 2008: 27902), depending on latitude and elevation. Rio Grande cutthroat trout typically become sexually mature at age 3, but some males may become sexually mature at age 2 (Pritchard and Cowley, 2006: 25).

Cutthroat trout form redds or nests in gravel substrate where eggs are deposited and fertilized. Egg production by individual female Rio Grande cutthroat trout is positively related to fish size (Pritchard and Cowley, 2006: 26). Hanson (1994) found that fertilized cutthroat trout eggs in the Rio de Truchas hatched in 29 to 37 days, accumulating 456 to 609 thermal units (Fahrenheit). After eggs hatch, the larval trout remain in the gravel substrate until the yolk sac is absorbed. Fry then move to shallow (less than eight inches deep), low-velocity (less than two feet per second) habitats (Pritchard and Cowley, 2006: 18).

Pools are an important habitat component for adult cutthroat trout, and optimal habitat is characterized by abundant deep pools, particularly those with cover such as large woody debris (Pritchard and Cowley, 2006: 18). Cutthroat trout feed on aquatic and terrestrial invertebrates. Fry prey mainly on midge larvae, mayfly larvae, and ostracods, while adult Rio Grande cutthroat trout typically forage on drifting aquatic and terrestrial invertebrates (Pritchard and Cowley, 2006: 25).

Principal factors affecting Rio Grande cutthroat trout include population isolation and habitat fragmentation, habitat degradation, genetic introgression with nonnative trout, competition with and predation by nonnative trout, drought, wildfire, disease, and potential habitat changes associated with climate change (U.S. Fish and Wildlife Service, 2008). Isolated populations experience loss of genetic diversity through genetic drift, and introgression threatens populations through risk of outbreeding depression (Pritchard and Cowley, 2006: 27-28). Introduction of nonnative trout typically results in decline of Rio Grande cutthroat trout populations through competitive exclusion and predation on early life stages (Harig *et al.*, 2000; Peterson *et al.*, 2004).

Historically, Rio Grande cutthroat trout occurred in the Las Animas Creek drainage (Sublette *et al.*, 1990: 55; Behnke, 1992) but was apparently extirpated from the watershed following the McKnight Fire in 1951 (Patten, 2008: 6). Subsequently, nonnative rainbow trout and hybrid cutthroat trout (Rio Grande *x* Yellowstone) were stocked into the drainage (Patten, 2008: 6-7). Currently, rainbow trout and a hybrid population of Yellowstone cutthroat *x* rainbow trout occupy suitable trout habitat in the Las Animas Creek watershed (Patten, 2008: 6). Much of the project-area watershed was moderately to severely burned during the Silver Fire in the summer of 2013, which likely resulted in elimination of fish populations in at least the headwaters of Las Animas Creek (*cf.* section 3.2.1.2, Figure 10).

Longfin Dace Longfin dace is a Forest Service sensitive species (Table 10). It does not have any status under the federal Endangered Species Act or the New Mexico Wildlife Conservation Act. The historic range of longfin dace includes streams in the Gila River drainage in Arizona, New Mexico. In New Mexico, longfin dace is native to the Gila River basin (including the San Francisco River drainage)

where populations of the species appear to be stable (Sublette *et al.*, 1990: 91). As early as the 1950s, longfin dace was introduced into the Rio Grande drainage basin downstream from Elephant Butte Reservoir, where it is now localized, and into an isolated pool on the Plains of San Augustin, where it apparently did not survive. In the 1960s, it was introduced into the Mimbres River (where it is now established), the Rio Hondo in Lincoln County (where it is localized), and Largo Creek in Catron County. The latter population is extirpated (Sublette *et al.*, 1990: 91).

Habitat of the longfin dace ranges from clear, cool mountain streams to small, intermittent desert streams with a sand or gravel substrate (Sublette *et al.*, 1990: 89-90). Spawning occurs from spring to fall. Saucer-shaped depressions in sandy bottom streams are used as nests. Nests are located along shorelines and stream margins at depths of 5 to 20 cm (2 to 8 in). Eggs hatch in about four days at 75°F (24°C) or higher. Typically life span is three years. Longfin dace feed primarily on detritus but may also consume filamentous algae, aquatic insects, and zoo-plankton (Sublette *et al.*, 1990: 90). Longfin dace is tolerant of high water temperatures and low dissolved oxygen concentrations (Sublette *et al.*, 1990: 90).

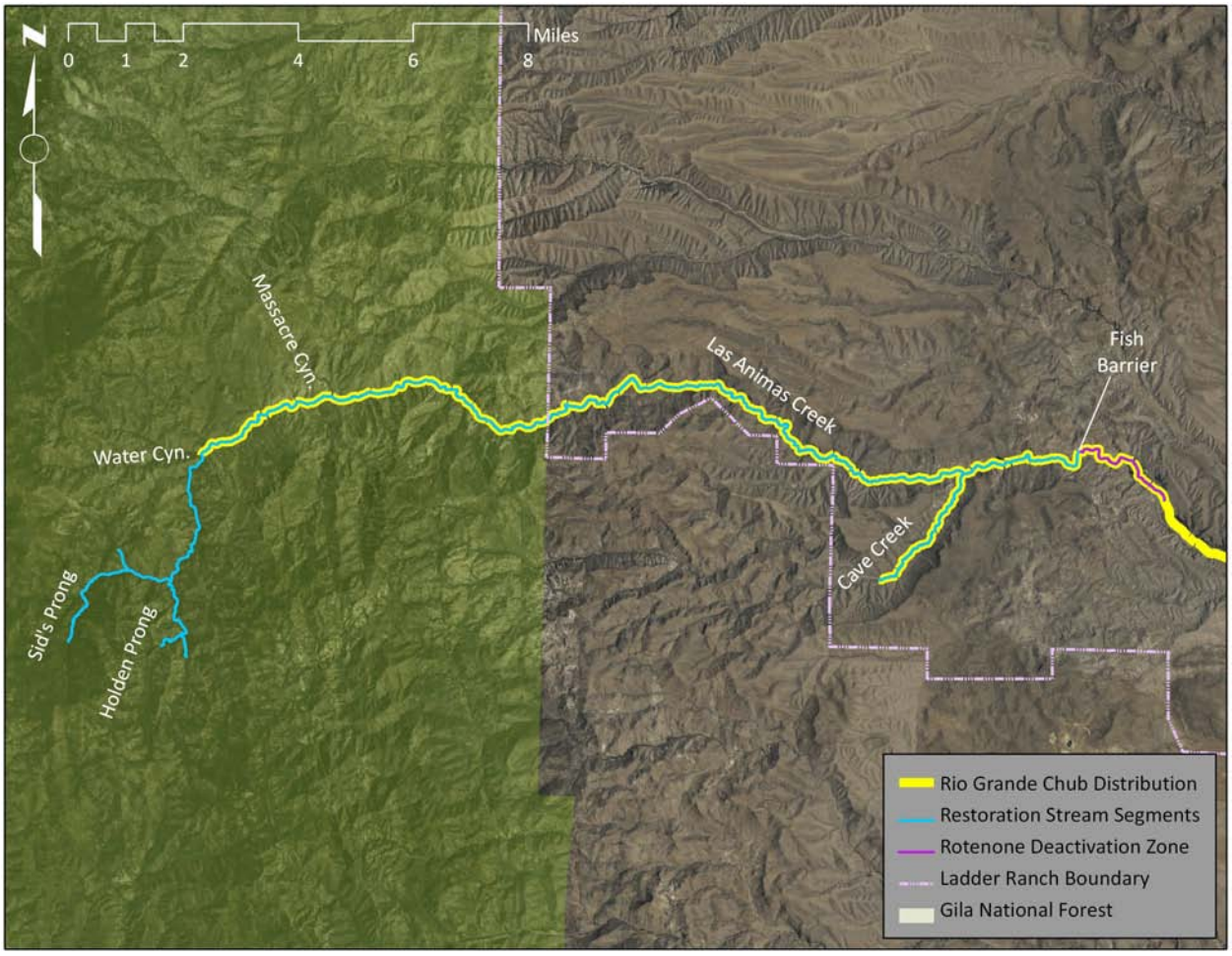
Longfin dace occurs in the Las Animas Creek drainage where it is an introduced species (it is native to the Gila River drainage). Longfin dace occurs in Las Animas Creek from below the fish barrier upstream to near the confluence of Victorio Park Canyon. Longfin dace also occurs in Cave Creek on the Ladder Ranch. As discussed above for Rio Grande cutthroat trout, the Silver Fire and resulting ash flows may have eliminated or markedly reduced fish populations from portions of the project area, particularly in the headwaters of Las Animas Creek.

Rio Grande Chub Rio Grande chub is a considered a species of concern by the New Mexico Department of Game and Fish (Table 10). The historic distribution of Rio Grande chub included cool-water reaches of the Rio Grande and Pecos River (and their tributaries) in northern and central New Mexico. Single populations of the species are found in Colorado and Texas (Sublette *et al.*, 1990: 125).

Rio Grande chub occupies perennial river and stream habitats. In main-stem Rio Grande and Pecos River habitats, the range of the species has contracted in the past 50 years, and it has declined in the upper Rio Grande drainage in Colorado. However, populations appear to be stable in tributaries of the upper Rio Grande drainage in northern New Mexico (Calamusso and Rinne, 1999). Rio Grande chub occurs in impoundments and pools of small to moderate streams and is frequently associated with aquatic vegetation. Spawning occurs in spring to early summer, and in a northern New Mexico stream, a bimodal spawning pattern was postulated with peaks occurring in March to June and again in September to October (Rinne, 1995). Spawning is associated with the descending limb of flow peaks (Rinne, 1995), such as occur with spring snow melt. Spawning aggregations have been observed in tailwaters of pools (J.S. Pittenger, pers. obs.). The species is typically associated with pool habitat, particularly with cover such as large woody debris, undercut banks, or overhanging vegetation (J.S. Pittenger, pers. obs.). Principal food items of Rio Grande chub include zooplankton, aquatic insects, juvenile fish, detritus (Sublette *et al.*, 1990: 125), molluscs, and filamentous algae (J.S. Pittenger, pers. obs.).

Rio Grande chub occurs in Las Animas Creek from the fish barrier upstream to the vicinity of the confluence of Water Canyon. It also occurs in perennial sections of Cave Creek on the Ladder Ranch (Figure 12). The Rio Grande chub population in Las Animas Creek likely was reduced by the Silver Fire and resulting ash and sediment flows.

Figure 12. Distribution of Rio Grande chub in the project area.



Chiricahua Leopard Frog Chiricahua leopard frog is listed as threatened under the federal Endangered Species Act. It is also considered a species of concern by the New Mexico Department of Game and Fish (Table 9). Chiricahua leopard frog was listed as threatened under the federal Endangered Species Act on 13 June 2002 (U.S. Fish and Wildlife Service, 2002). At the time of listing, it was estimated that the species had been eliminated from over 75 percent of its range. The reasons for listing the species were destruction or degradation of riparian and wetland habitats, predation by introduced, nonnative species (*e.g.* bullfrogs, crayfish, tiger salamanders, fish), disease (*i.e.* chytridiomycosis), and altered metapopulation dynamics (U.S. Fish and Wildlife Service, 2002: 40800). Critical habitat for Chiricahua leopard frog was designated on 20 March 2012 (U.S. Fish and Wildlife Service, 2012). Critical habitat consists of 39 locations distributed among eight recovery units in Arizona and New Mexico (U.S. Fish and Wildlife Service, 2012: 16346-16347).

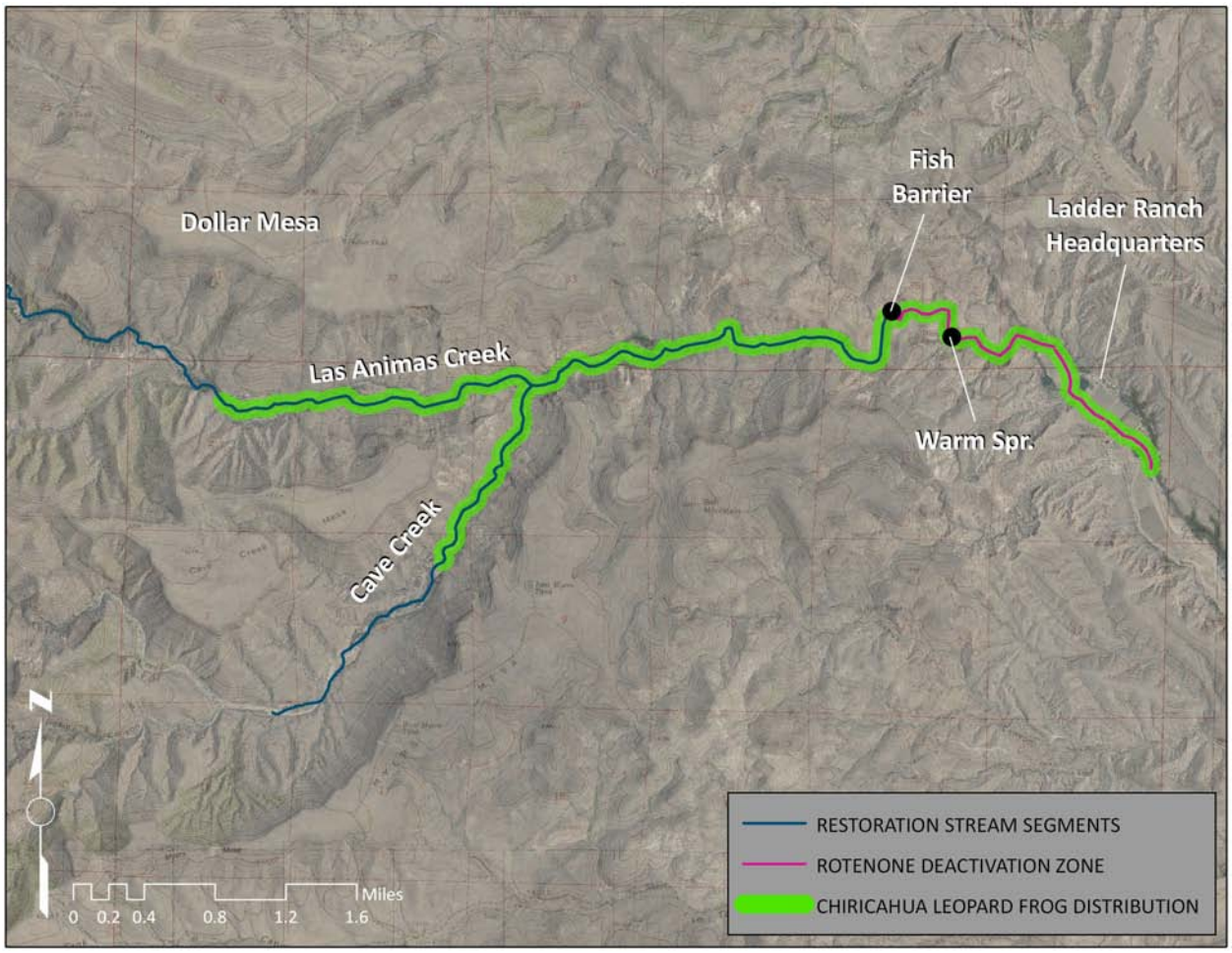
The range of Chiricahua leopard frog includes portions of Arizona and New Mexico in the U.S. and Sonora and Chihuahua in Mexico. In New Mexico, the species is found in Catron, Grant, western Sierra, southwestern Socorro, and southern Hidalgo counties as isolated, scattered populations (Degenhardt *et al.*, 1996: 85). This nocturnal species occurs in a variety of aquatic habitats ranging from intermittent, rocky creeks and stock tanks to springs and perennial streams. Eggs are laid in spring and summer. The time from egg hatching to metamorphosis ranges from eight to nine months except in thermally stable habitats where metamorphosis may occur within three months (Degenhardt *et al.*, 1996:85-87).

Chiricahua leopard frog occurs in the project area on the Ladder Ranch in Las Animas Creek from Warm Springs (located below the fish barrier) upstream to approximately two miles above the confluence of Cave Creek and in lower Cave Creek (Figure 13; C. Kruse, Turner Enterprises, pers. comm., 18 November 2013). American bullfrog (*Lithobates catesbeiana*), an introduced species, and canyon treefrog (*Hyla arenicolor*), a native species, occur in Las Animas Creek in the project area (Kruse and Christman, 2007). Crayfish are known to occur below the fish barrier and may also occur above the fish barrier in Las Animas Creek (C. Kruse, Turner Enterprises, pers. comm., 8 February 2013).

Critical habitat for Chiricahua leopard frog designated in Recovery Unit 8 (Black-Mimbres-Rio Grande, New Mexico) does not include Las Animas Creek or Cave Creek. Private lands on the Ladder Ranch are excluded from critical habitat designation under section 4(b)(2) of the Endangered Species Act because of the conservation partnership between the Ladder Ranch and the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service, 2012: 16370-16372).

Arizona Toad Arizona toad is a Forest Service sensitive species and is also a New Mexico species of concern (Table 10). Arizona toad occurs in perennial aquatic habitats such as ponds or rocky streams with relatively shallow water. The species breeds in early spring (*i.e.* April and May), with breeding activity likely triggered by a combination of temperature and day length. Metamorphosis from larval to adult form occurs in mid-summer (Degenhardt *et al.*, 1996: 56).

Figure 13. Distribution of Chiricahua leopard frog in the project area. The entire distribution of Chiricahua leopard frog in the project area is on the Ladder Ranch. Distribution information provided by C. Kruse, Aquatic Resources Coordinator, Turner Enterprises, Inc.



There are no documented collections or observations of Arizona toad in the Las Animas Creek drainage, including the major tributaries in the project area (Degenhardt *et al.*, 1996: 50; Kruse and Christman, 2007). The only toad species found during intensive surveys conducted in the project area was red spotted toad (*Bufo punctatus*; Kruse and Christman, 2007).

Mexican Spotted Owl Mexican Spotted Owl is listed as threatened under the federal Endangered Species Act (ESA) and is also listed as a Forest Service sensitive species and a species of concern by the New Mexico Department of Game and Fish (Table 10). Mexican Spotted Owls nest, roost, forage, and disperse in a diverse array of biotic communities. Nesting

habitat is typically in areas with complex forest structure or rocky canyons, and contains uneven-aged, multi-storied mature or old-growth stands that have high canopy closure. A wide variety of tree species is used for roosting; however, Douglas-fir is the most commonly used species in mixed-conifer forests. Mexican Spotted Owls generally use a wider variety of forest conditions for foraging than they use for nesting and roosting. Eggs are typically laid in late March or early April. Incubation begins shortly after the first egg is laid and is performed entirely by the female. The incubation period is about 30 days. Eggs usually hatch in early May with nestlings fledging four to five weeks later and then dispersing in mid-September to early October. Mexican Spotted Owls consume a variety of prey throughout their range but commonly eat small and medium-sized rodents (Blue Earth Ecological Consultants, Inc., 2014).

Two Mexican Spotted Owl PACs are located in the project area: the East Curtis PAC and the Gooseberry PAC. Roosting/nesting sites for both of these PACs are located in tributary drainages of Las Animas Creek. Proposed restoration stream segments in the project area flow through riparian forest (*ca.* 50 acres) that can be classified as Recovery Habitat. No nesting/roosting habitat is found along Las Animas Creek or Cave Creek on the Ladder Ranch, but these riparian areas may provide wintering habitat for owls. Proposed restoration stream segments from the Wilderness boundary upstream are within designated critical habitat for Mexican Spotted Owl.

3.4.1.2 Management Indicator Species

Twenty-five management indicator species (MIS) for the Gila National Forest were originally identified in the 1986 Forest Plan (U.S. Forest Service, 1986*a*). The MIS selection process involved evaluating the 450 species that occur on the Gila National Forest to "select species which would indicate successional stages of each vegetation type and serve as an indicator for detecting major habitat changes" (U.S. Forest Service, 1986*a*: 71). The intent of identifying and monitoring management indicator species is to "assure that wildlife habitat will be maintained or increased and that sensitive species will be protected" (U.S. Forest Service, 1986*b*: 289). The list of MIS was revised in a 2007 amendment (#11) to the Forest Plan. This revision reduced the number of MIS from 25 to 11. The revision also broadened the intent of monitoring MIS to "evaluate relationships of effects of Forest management activities to habitat changes and MIS populations" (U.S. Forest Service, 2007).

Appropriate MIS for the project are those identified for mid- to high-elevation riparian and wetlands or wet meadows (Blue Earth Ecological Consultants, Inc., 2013*a*). These species include Common Black-hawk (*Buteogallus anthracinus*), beaver (*Castor canadensis*), Rio Grande cutthroat trout, and long-tailed vole (*Microtus longicaudus*). Following is a summary of the status of each of these four MIS (Blue Earth Ecological Consultants, Inc., 2013*a*).

- Populations of Common Black-hawk appear to be stable on the Gila National Forest (U.S. Forest Service, 2013*b*: 39). Common Black-hawk has been observed along Las Animas Creek on the Ladder Ranch, and nesting birds have also been observed on Ladder Ranch (New Mexico Ornithological Society, 2013). However, the species has not been documented as nesting in the project area.

- Beaver habitat conditions on the Gila National Forest have improved. The Forest

Plan predicted an upward trend in habitat conditions for this species. Population levels on the Gila appear to be stable (U.S. Forest Service, 2013*b*: 40). Beaver are found in the Las Animas Creek watershed.

- There are no known, genetically intact populations of Rio Grande cutthroat trout on the Gila National Forest. The Las Animas Creek drainage is within the presumed historic range of the species (Behnke, 1992: 143).

- No information is available on the status or population trend of long-tailed vole on the Gila National Forest (U.S. Forest Service, 2013*b*). Long-tailed vole may occur in wetland habitats along restoration stream segments in the project area.

3.4.1.3 Migratory Birds

This analysis of potential effects of the project on migratory birds is excerpted from a migratory bird assessment report prepared for the project (Blue Earth Ecological Consultants, Inc., 2013*b*). Pursuant to the Migratory Bird Treaty Act (16 U.S.C. 703-712) it is unlawful to take, kill, or possess migratory birds, their parts, nests, or eggs. Take is defined as pursuit, hunting, shooting, wounding, killing, trapping, capturing, or collecting (50 CFR 10.12). This law applies to both intentional and unintentional harmful conduct. If taking of migratory bids, their parts, nests, or eggs is determined by a project proponent to be the only alternative, a Migratory Bird Permit must be obtained through the Migratory Bird Permit Office of the U.S. Fish and Wildlife Service (50 CFR 13, 21).

New Mexico Partners in Flight has identified conservation priorities for bird species in the state (New Mexico Partners in Flight, 2007). Level 1 vulnerability rank is defined as species that "are facing moderate to severe threats and showing unknown or declining population trends" and are considered "to be species in need of immediate conservation action." Level 2 vulnerability ranked species are considered to be of moderate or potential conservation concern (New Mexico Partners in Flight, 2007: 21). The broad goals of the New Mexico bird conservation plan are to: 1) keep all common species reasonably common; 2) keep all native species well distributed throughout their natural range; 3) keep all priority species populations stable and self-sustaining; and 4) accomplish all of the above by maintaining or restoring sufficient quality habitat of all types (New Mexico Partners in Flight, 2007: 41).

The project area would be implemented in mid- to high-elevation montane riparian habitat. Mid-elevation riparian is considered one of the highest priority habitats for bird conservation (New Mexico Partners in Flight, 2007: 40). Three Level 1 or Level 2 species that may occur in montane riparian habitats were considered as potentially occurring in the project area. These species are Warbling Vireo (*Vireo gilvus swainsonii*), Grace's Warbler (*Dendroica graciae graciae*), and Red-faced Warbler (*Cardellina rubrifrons*). The project area is not within an identified Important Bird Area. Important Bird Areas closest to the project area are Emory Pass and Elephant Butte Lake State Park (Blue Earth Ecological Consultants, Inc., 2013*b*).

3.4.2 Effects on Special Status Species, MIS, and Migratory Birds

3.4.2.1 Special Status Species

No Action In the absence of the proposed restoration project, Rio Grande cutthroat trout would continue be absent from the native fish community in the Las Animas Creek drainage. Nonnative hybrid trout and nonnative longfin dace would persist to the detriment of the native fish fauna. The Las Animas Creek drainage would not contribute to conservation of Rio Grande cutthroat trout.

Water quality in the approximately 34 miles of project-area streams, including the proposed two-mile rotenone deactivation zone, would not be impacted by rotenone treatments. Existing native fish populations would not be affected by proposed salvage and repatriation activities nor would aquatic macroinvertebrates, larval life stages of amphibians, or other aquatic biota.

Proposed Action The proposed action would have no effect on the following federal-listed, proposed, or candidate species because they do not occur in the project area or would not be affected by the proposed action:

- Todsen's pennyroyal (*Hedeoma todsenii*, endangered, critical habitat designated),
- Gila trout (*Oncorhynchus gilae*, threatened),
- Headwater chub (*Gila nigra*, candidate),
- Chihuahua chub (*Gila nigrescens*, threatened, critical habitat proposed),
- Rio Grande silvery minnow (*Hybognathus amarus*, endangered, critical habitat designated),
- Narrow-headed gartersnake (*Thamnophis rufipunctatus*, proposed threatened, critical habitat proposed),
- Northern Aplomado Falcon (*Falco femoralis septentrionalis*, endangered),
- Least Tern (*Sterna antillarum athalassos*, endangered),
- Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*, candidate),
- Southwestern Willow Flycatcher (*Empidonax traillii extimus*, endangered , critical habitat designated),
- Sprague's Pipit (*Anthus spragueii*, candidate),
- Mexican gray wolf (*Canis lupus baileyi*, endangered),
- Black-footed ferret (*Mustela nigripes*, endangered).

The project area is not within proposed or designated critical habitat for Todsen's pennyroyal, Rio Grande silvery minnow, narrow-headed gartersnake, or Southwestern Willow Flycatcher.

- The proposed action may affect but is not likely to adversely affect Rio Grande cutthroat trout. Successful implementation of the proposed action would have the beneficial effects of improving the conservation status and security of the species. Restoration of the species to suitable habitat in 32 miles of interconnected stream would result in establishment of a population with a high potential for persistence (Harig and Fausch, 2002; Rio Grande Cutthroat Trout Conservation Team, 2013: 18). The lack of large populations was cited as one of the primary factors influencing the conservation status of Rio Grande cutthroat trout (U.S. Fish and Wildlife Service, 2008: 27905).

Rio Grande cutthroat may potentially be adversely affected by the proposed action if fish are stocked prior to recovery of an adequate food base in treated stream segments. The aquatic invertebrate community will be sampled before treatments begin and then will be monitored following completion of treatments. Fish will not be stocked in the project area until post-treatment monitoring indicates that the aquatic invertebrate community has recovered. Incidental mortality of Rio Grande cutthroat trout may also occur during transport to the project area and stocking into renovated stream segments. However, standard fish transport and handling procedures will be implemented to reduce the likelihood and occurrence of mortality associated with transporting and stocking fish (Blue Earth Ecological Consultants, 2014).

- The proposed action may affect and is likely to adversely affect Chiricahua leopard frog. The proposed action would not affect critical habitat designated for Chiricahua leopard frog. Chiricahua leopard frog occurs in the project area on the Ladder Ranch in lower Cave Creek and Las Animas Creek from the Dollar Mesa area downstream to the end of the rotenone deactivation zone. This population may be an important contributor to genetic diversity of the species (Kruse and Christman, 2007). Chytrid fungus is present in the population, and consistent declines that have been documented in the past decade (Kruse and Christman (2007) have apparently ceased, as the population appears to have recently expanded (C. Kruse, Turner Enterprises, pers. comm., 18 November 2013).

  Rotenone treatments would be unlikely to affect adult frogs, based on the acute toxicity threshold of 240 to 1,580 µg/L for adult northern leopard frog (*cf.* Table 4) compared to the maximum allowable rotenone treatment concentration of 200 µg/L and the more probable actual concentrations ranging from 50 to 100 ppb. However, tadpole mortality would be very likely at the maximum treatment concentration and may even occur at rotenone concentrations as low as 50 µg/L (*e.g.* Billman *et al.*, 2012).

  Reduction or elimination of American bullfrog from the project area would be beneficial to Chiricahua leopard frog. Rotenone treatments would likely result in mortality of American bullfrog tadpoles in the project area. However, adult American bullfrogs would not be affected by rotenone treatments. Consequently, the proposed action is unlikely to have any long-term effect on abundance of American bullfrog in the project area.

  Conservation measures to minimize adverse effects of the proposed action on Chiricahua leopard frog include pre-treatment surveys, capture and holding of Chiricahua leopard frog, and repatriation to collection sites following completion of all rotenone treatments and recovery of the aquatic invertebrate community (Blue Earth Ecological Consultants, Inc., 2014).

- The proposed action may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability of Rio Grande chub. The tolerance of Rio Grande chub to rotenone is unknown. However, using fathead minnow as a surrogate (LC50 = 20 µg/L) suggests that Rio Grande chub

would be eliminated from restoration stream segments by the proposed rotenone treatments. However, pre-treatment salvage operations would allow for repatriation of the species following stream renovation. The Rio Grande chub population in the Las Animas Creek drainage would therefore experience a temporary decline, but the population would be expected to recover over time. Additionally, reduction or elimination of nonnative longfin dace may benefit Rio Grande chub by reducing competition and increasing food availability (McShane, 2007).

- The proposed action may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability of longfin dace. Longfin dace is not native to the Las Animas Creek drainage. Eradication of the species from the drainage would not affect its status within its native range. However, eradication of the species from the project area would be beneficial to the native fish fauna.

- The proposed action may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability of Arizona toad. Arizona toad is unlikely to occur in the Las Animas Creek drainage. Annual surveys conducted since 2001 have not identified the species from the drainage. If the species does occur in the drainage, adult toads would not be likely to suffer mortality from the proposed rotenone treatments. Therefore, in the unlikely event that a population of Arizona toad does occur in the project area, it would persist.

- The proposed action may affect but is not likely to adversely affect Mexican Spotted Owl. The proposed action would not affect critical habitat for Mexican Spotted Owl. Portions of proposed restoration stream segments along Las Animas Creek are within the East Curtis and Gooseberry PACs. Roosting/nesting sites for the two PACs are located in tributaries to Las Animas Creek. Additionally, the Wilderness boundary is within designated critical habitat for Mexican Spotted Owl.

  The proposed action would not result in any modification of forest stand structure in PACs or Recovery Habitat and would therefore comply with the recovery plan (U.S. Fish and Wildlife Service, 2012). Application of rotenone may result in trampling of some herbaceous vegetation but would not result in any impacts to woody vegetation in the project area, including the two PACs and Recovery Habitat. The proposed action would not affect the condition of any constituent elements of critical habitat.

  No owl nesting habitat is located in the riparian area where the project would be implemented. Project activities would occur during daytime hours when owls are not foraging, so there would not be disruption of feeding activities by Mexican Spotted Owl. Mexican Spotted Owl and its primary prey items do not depend on aquatic food sources or the aquatic ecosystem. Consequently, removal or fish would not affect the species. As described in section 3.3.2, consumption of rotenone-treated water or rotenone-killed fish would not have any toxicological effect on terrestrial wildlife species.

Cumulative Effects Effects of the proposed action may result in minor cumulative impacts to the five special-status species discussed above.

The effects of past and current actions on these four special-status species are represented by their current status. There are no known, planned future actions in the project area that may affect these species.

3.4.2.2 Management Indicator Species

No Action Selection of the No Action Alternative would not change the current status or trend of MIS on the Gila National Forest.

Proposed Action Effects of the proposed action on the four project-specific MIS are as follows (Blue Earth Ecological Consultants, Inc., 2014).

- The proposed action is not likely to measurably influence the status or population trend of Common Black-hawk on the Gila National Forest. Potentially suitable nesting habitat for Common Black-hawk is found along Las Animas Creek upstream to the vicinity of the Dumm Place. The proposed action would not affect the structure, density or composition of riparian vegetation. The proposed rotenone treatments would not result in any toxicological effects to terrestrial wildlife (*cf.* section 3.3.2). There would be a temporary reduction of fish prey in the project area. However, other prey items would not be affected nor would fish communities in the watershed that are outside of the project area.

- The proposed action is not likely to measurably influence the status or population trend of beaver on the Gila National Forest. Beaver may occur in the lower reaches of Las Animas Creek and in Cave Creek. The proposed action would not affect habitat of beaver in the planning area. The proposed rotenone treatments would not have any toxicological effects on mammals, including beaver, from ingestion of treated water or aquatic biota killed by rotenone treatments (*cf.* section 3.3.2).

- The proposed action would measurably improve the status and population trend of Rio Grande cutthroat trout on the Gila National Forest. Currently, there are no genetically intact populations of the species on the Forest. The proposed action would be major contribution toward improving the conservation status of Rio Grande cutthroat trout. Restoration of the species to 32 contiguous miles of stream habitat would result in establishment of a population with a high potential for persistence (Harig and Fausch, 2002; Rio Grande Cutthroat Trout Conservation Team, 2013: 18).

- The proposed action is not likely to measurably influence the status or population trend of long-tailed vole on the Gila National Forest. Potentially suitable habitat for long-tailed vole, which consists of wetlands and wet meadows along Las Animas Creek and Cave Creek, would not be affected by the proposed project. The proposed rotenone treatments would not have any toxicological effects on mammals, including long-tailed vole, from ingestion of treated water or aquatic biota killed by rotenone treatments (*cf.* section 3.3.2).

3.4.2.3 Migratory Birds

No Action Selection of the No Action Alternative would not change the existing population status and trend or habitat conditions for migratory birds in the project area.

Proposed Action Proposed salvage of native fish, rotenone treatments to eradicate nonnative fish, and restoration of Rio Grande cutthroat trout and other native fishes would not affect Warbling Vireo, Grace's Warbler, Red-faced Warbler, or other migratory birds in the project area. The proposed rotenone treatments would not pose any toxicological risks to birds through ingestion of treated water or consumption of aquatic biota exposed to or killed by rotenone (section 3.3.2).

Aquatic invertebrate abundance may be reduced from 10 to 40 percent following rotenone treatments, but would likely recover to pre-treatments levels (approximately) within one year following individual treatments (section 3.3.2). The short-term reduction in aquatic invertebrates would likely result in reduced emergent aquatic insect production in the project area. However, some aquatic invertebrate taxa that are more tolerant of rotenone, such as midge larvae, would not be likely to be affected. The effect of this reduction on the terrestrial insectivore prey base would be limited to the relatively narrow riparian corridor in the project area. Consequently, effects of the proposed action on behavior, growth, and abundance of terrestrial insectivores are expected to be short-term (*i.e.* less than one year) and insignificant (Blue Earth Ecological Consultants, 2013*b*).

3.5 Recreation and Wilderness

3.5.1 Existing Conditions

The approximately 32 miles of streams proposed for treatment include 14 miles (almost 44 percent) within the Aldo Leopold Wilderness. Access to the project area is only through use of the Forest Service trail system or cross-country travel; there is no public access road into the area. The national forest portion of the project area is difficult to access without the use of horses or mules. There is a road that accesses Animas Canyon through the Ladder Ranch, but is not open to public use.

Current recreation uses known in the project area are hunting, fishing, and hiking - activities that are not utilizing the services of outfitters or guides. Occasionally, some outfitter/guides pass through the area, but they are not typically known to set up camps in the area where the proposed project would be undertaken (R. Guaderrama, Black Range RD, Gila NF, pers. comm., 11 March 2013). Ash flows and floods from the 2013 Silver Fire are likely to have substantially reduced or eliminated nonnative trout populations in the headwaters of Las Animas Creek, possibly reducing current angling opportunities.

3.5.2 Effects on Recreation and Wilderness

No Action The No Action alternative would not entail any actions to renovate Las Animas Creek or its tributaries within the Aldo Leopold Wilderness. Therefore, there would be no effects to recreation use or Wilderness. Wilderness character would not be enhanced by reintroduction of a native Rio Grande cutthroat trout, and future fishing for Rio Grande cutthroat trout in Las Animas Creek would not be a possibility.

Proposed Action Short-term, periodic displacement of all recreationists, longer-term displacement of fishermen, and the potential for disturbing Wilderness visitor solitude are

potential effects of the proposed project on recreation and Wilderness.

Public access to the project area would be prohibited during nonnative fish removal activities (i.e., rotenone application). The project area would not be closed during native fish salvage or fish stocking activities. For removal of nonnative fish with Rotenone treatments, the Forest Service would provide public notice prior to temporary closure of the area through news releases (*e.g.*, local newspapers, Forest Service web site), mailing notices to interested parties, and postings in Forest Service offices and at trailheads at least one week prior to closures. For each treatment (up to three per year for three years), the project area would be closed to public access for approximately two weeks, forcing recreationists to alter the date or location of their plans to recreate in the area during project implementation.

Removal of nonnative trout may be unpopular with recreationists who prefer to fish for those species. In addition, no fishing would be allowed while the Rio Grande cutthroat population is being developed into a self-sustaining population, which may take up to five years. During that period, anglers would be displaced to alternative fishing sites.

As described in Chapter 2, the project has been designed to comply with regulations for management of the Aldo Leopold Wilderness, including limiting the treatment group size to no more than 25 individuals and 35 saddle and pack stock, applying the minimum tool concept of wilderness management, and restricting motorized equipment from being used in the Wilderness. This large group might pose an affect to Wilderness visitors attempting to seek solitude. It is unlikely that Wilderness users would encounter 25 persons and 35 stock, however, as these numbers would be likely be needed only during Rotenone treatments, when the project area is closed to the public.

During fish salvage and fish restoration activities, up to three teams consisting of three to four workers each would be the size of the groups that a Wilderness visitor would possibly encounter. Even so, visitors meeting workers conducting either of these two activities may feel that encountering these activities has degraded their Wilderness experience.

Cumulative Effects The effects of project area closure and possible encounter of restoration teams working in the Wilderness would be temporary and minor in nature. None of the effects is expected to overlap in time or space with other effects to recreation and Wilderness. Therefore, there would be no cumulative effects from the project.

3.6 Socioeconomic Factors

Issue: Use of rotenone may affect human health through consumption of or contact with treated water.

3.6.1 Existing Conditions

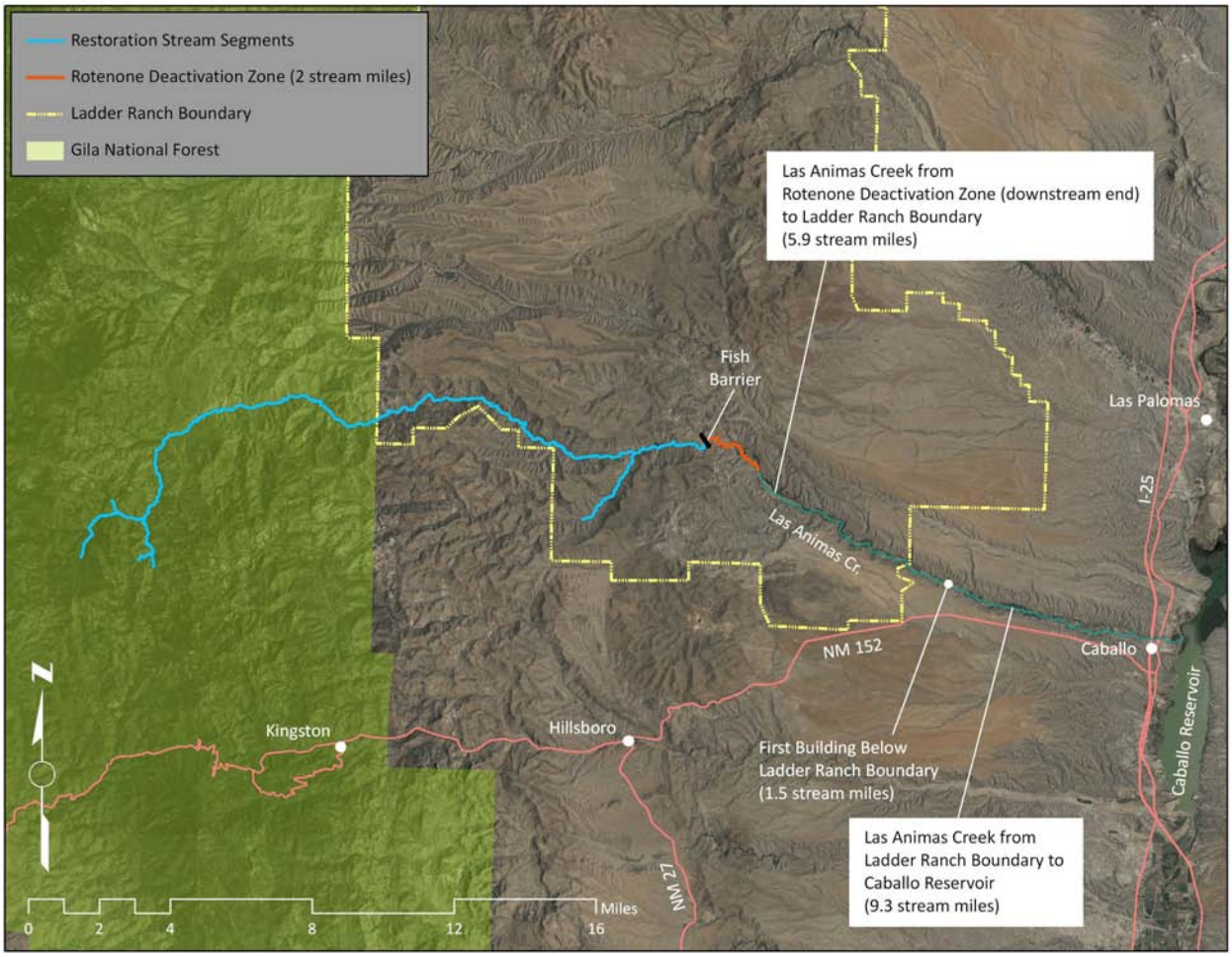
3.6.1.1 Land Ownership and People

Landownership within the project area includes federal lands managed by the Gila National Forest and the privately owned Ladder Ranch which is managed by Turner Ranch Enterprises, LP. The nearest downstream community, the Village of Caballo, is 15.2 stream miles

downstream from the lower end of the rotenone deactivation zone (Figure 14). Residences are scattered along Las Animas Creek from the Village of Caballo upstream to approximately 1.5 stream miles below the Ladder Ranch boundary (Figure 14). The first building along Las Animas Creek downstream from the Ladder Ranch boundary is 7.4 stream miles downstream from the lower end of the rotenone deactivation zone on the Ladder Ranch (Figure 14).

Domestic water sources include ground water wells in the alluvial aquifer underlying Las Animas Creek, which is designated as a highly sensitive source-water aquifer (New Mexico Environment Department, 2013).

Figure 14. Communities in the vicinity of the project area.



3.6.1.2 Environmental Justice

The population of the Village of Caballo was shown as 112 in the 2010 U.S. Census (U.S. Census Bureau, 2013). Of that population, 98 persons (88 percent) were white and not Hispanic or Latino. Thirty-six persons (32 percent) were age 65 or older. No income data was available from the Census.

3.6.1.3 Economics

The estimated cost of implementing the project is $250,000, consisting primarily of established salaries for federal and state agency personnel. Ladder Ranch staff costs for implementation are not included in this amount. Costs include the following major project components:

- pre-treatment fish and amphibian surveys and native fish and amphibian salvage,
- coordination, logistics and reporting,
- up to three years of rotenone treatments,
- post-treatment fish surveys,
- stocking of Rio Grande cutthroat trout and salvaged native fish and amphibians, and
- monitoring of aquatic invertebrates and water quality before, during, and after rotenone treatments.

3.6.2 Effects on Socioeconomic Factors

No Action Socioeconomic conditions in the project area and vicinity would not change as a result of selection of the No Action Alternative.

Proposed Action At excessively high doses and inapplicable exposure routes (*i.e.* intravenous injection), rotenone has been shown to cause neurological damage in mammals (Finlayson *et al.*, 2012). However, such dosages and exposure pathways would never occur in fisheries management applications, including the proposed action. Laboratory studies that have associated rotenone with symptoms of Parkinson's Disease in test animals have involved extraordinary routes of exposure, such as direct injection of rotenone into brain tissue and intravenous administration of rotenone into the bloodstream, and prolonged, continuous exposure periods (weeks to months) to highly concentrated rotenone (Finlayson *et al.*, 2012). Such conditions would not occur during application of rotenone to remove nonnative fish from restoration stream segments in the Las Animas Creek watershed, nor would such exposure conditions and rotenone concentrations be even remotely approached by the proposed action.

Applicators of liquid rotenone would be at greatest risk to exposure from oral, dermal, and inhalation routes. Use of liquid rotenone would prevent inhalation exposure because rotenone is not volatile (Finlayson *et al.*, 2012), and oral ingestion would be prevented by exercising care in handling of the material. The CFT Legumine® formulation of rotenone that would be used in the proposed action is poorly absorbed through human skin (0.37 percent absorption; Finlayson *et al.*, 2012). Applicators would wear chemically resistant gloves, eye protection, and protective clothing to prevent dermal contact with undiluted CFT Legumine® (a five percent rotenone solution).

Public exposure to treated water would be prevented by excluding non-project personnel from the project area until rotenone residues subside and by detoxifying stream water at the downstream terminus of the project area by application of potassium permanganate. Rotenone transport to and contamination of

groundwater would not occur with the proposed stream treatments (Finlayson *et al.*, 2001; U.S. Environmental Protection Agency, 2006: 36).

As there are no permanent adverse effects to Forest visitors or local area residents, there would be no disproportionate adverse effects to Forest visitors or to residents near the project area. Therefore, the project is in compliance with E.O. 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations*.

Cumulative Effects Because the proposed action would have no measurable effects on socioeconomic factors, including human health and safety, there would be no cumulative effects on socioeconomic factors arising from selection and implementation of the Proposed Action Alternative.

3.7 Heritage Resources

This section summarizes the known heritage resources in the project area and the potential effects of the alternatives on those heritage resources. Under Section 106 of the National Historic Preservation Act (NHPA) of 1966, and its amendments, important cultural resources must be given consideration in the environmental planning and permitting process.

3.7.1 Existing Conditions

Records show that two cultural resource surveys have been conducted by the Black Range Ranger District along Animas Creek. The first was a survey of 272 acres that was undertaken in 1980 for a proposed Cave Creek revegetation project. No sites were located during the survey. A second survey was in 2008 for a two-acre site for a road realignment project. No sites were located during the survey. In the Animas Creek area, one prehistoric site, the site of the Massacre Canyon Fight, and four historic cabins have been identified. The prehistoric site, recorded in 2004, consisted of several rooms; numerous decorated Mimbres pottery types were found, flakes were noted, and a bedrock mortar hole was identified. The prehistoric site was dated from A.D. 900 - A.D. 1100.

Of the four historic cabins found along Animas Creek, three were destroyed in the 2013 Silver Fire. The Murphy Place cabin remnant, located within the Aldo Leopold Wilderness, consisted of several stacked hand cut logs and historic trash that dated to the late 19th century. Kelsey Cabin (a.k.a. Kelso Cabin), located on the Ladder Ranch, consisted of one cabin structure, several outhouses, barn, and corral and dated to the late 19th century. The Dumm Cabin remnants, located on the Gila National Forest, Black Range District, consisted of several hand cut log remnants and historic trash that dated to the late 19th century. The Apache Camp Cabin, also on the Gila National Forest, Black Range District, was the only one of the four cabins that survived the 2013 Silver Fire. The Apache Camp cabin site consists of one cabin structure, hand-dug well, outhouse, shed and corral and dates to the late 19th century.

The September 18, 1879 Massacre Canyon Fight between Victorio and his Warm Springs Apaches and the U.S. Army 9th Cavalry occurred near Victorio Park. This particular Indian War fight has been written about many times, but the actual site has never been located. Because portions of the battle site were held in private hands, in 1997 a site dedication was conducted which included placement of monuments and headstones to commemorate this famous Apache fight.

3.7.2 Effects on Heritage Resources

No Action and Proposed Action No ground-disturbing activity would occur with either alternative. Therefore, there would be no effects on cultural resources.

Cumulative Effects As there would be no direct or indirect effects on cultural resources from the Proposed Action, there would be no cumulative effects on cultural resources.

3.8 Livestock Grazing

3.8.1 Existing Conditions

The project area includes parts of two grazing allotments on the Gila National Forest - the Animas and the Kingston allotments (Figure 15). About 85 percent of the Animas Allotment (*i.e.*, about 29,932 acres) are within the boundaries of the project area. Only about 15 percent or 5,201 acres of the Kingston Allotment are within the project area. Currently, the Animas Allotment is not stocked under a "No Graze" Memorandum of Understanding between the Forest Service and the Ladder Ranch. As a result of the 2013 Silver Fire, the Kingston Allotment is limited to four pastures. Stocking in the remaining pastures (*i.e.*, those affected by the fire) would be determined as fire recovery actions are planned and implemented.

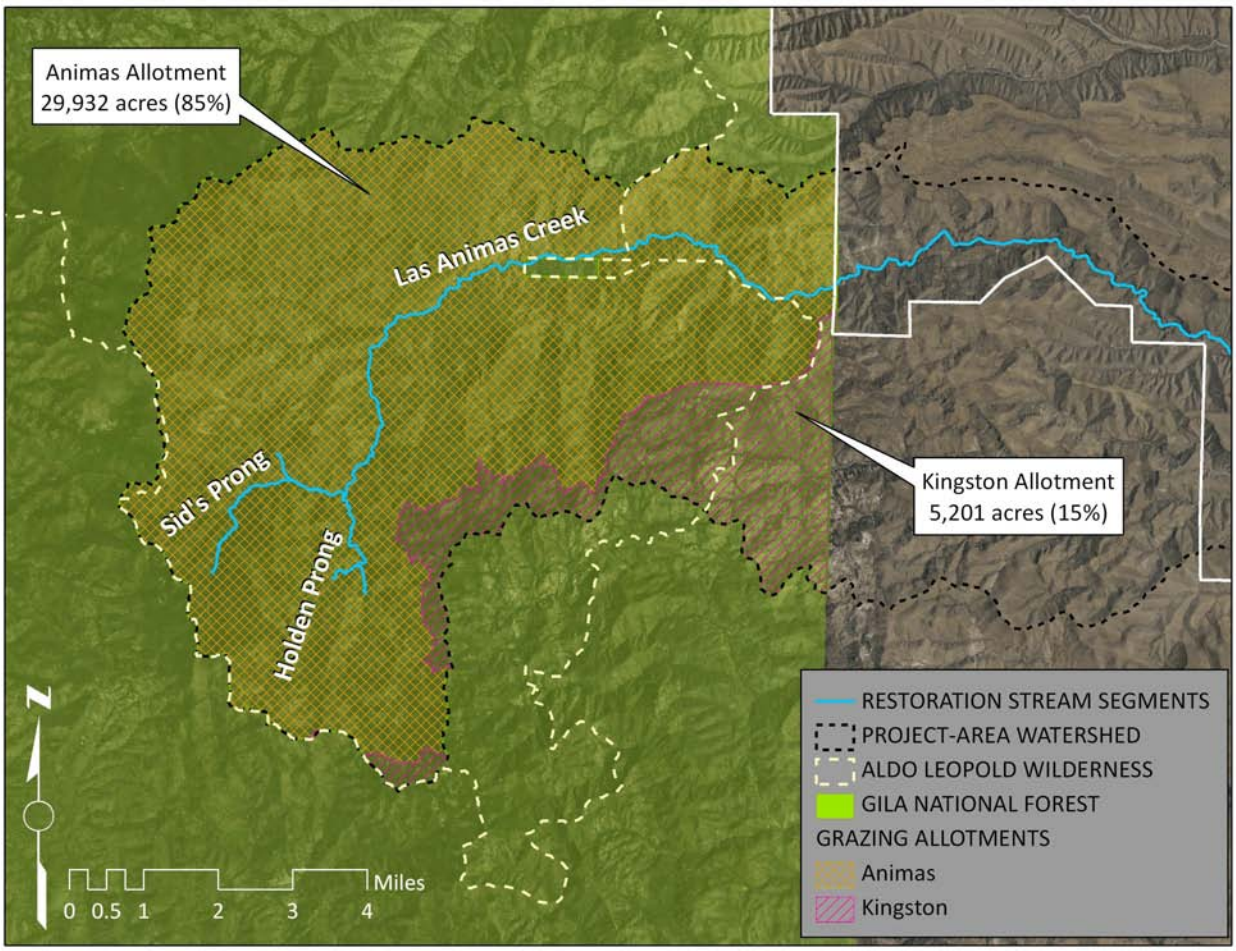
3.8.2 Effects on Livestock Grazing

No Action Any livestock grazing that may occur within the project area watershed would not be affected with selection of the No Action Alternative.

Proposed Action Domestic livestock are unlikely to occur along Las Animas Creek or Cave Creek during rotenone treatments due to the distance from stocked allotments to the streams. However, if domestic livestock do access Las Animas Creek or Cave Creek during or immediately after rotenone treatments and drink treated stream water, they may be exposed to rotenone. As noted in section 3.3.2, even at maximum treatment concentrations rotenone would not pose any toxicological risk to livestock. Domestic livestock on private lands downstream from the project area would not be exposed to rotenone due to 1) deactivation of rotenone at the downstream end of the proposed restoration stream segments and 2) the long distance of stream channel between the downstream end of the rotenone deactivation zone and the boundary of the Ladder Ranch (*i.e.* prolonged conditions of hydrolysis and photolysis).

Cumulative Effects As there would be no direct or indirect effects on livestock or grazing management activities, there would be no cumulative effects on livestock grazing.

Figure 15. Forest Service livestock grazing allotments within the project area watershed.



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5.0 AGENCY COORDINATION

The following entities were consulted in preparing this EA:

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U.S. Bureau of Land Management, Socorro Field Office
U.S. Senator Tom Udall
U.S. Senator Martin Heinrich
U.S. Representative Steve Pearce

State Government
New Mexico Department of Agriculture
New Mexico Environment Department, Surface Water Quality Bureau
New Mexico Interstate Stream Commission
New Mexico State Historic Preservation Division
New Mexico State Land Office

Native American Governments
Pueblo of Acoma
Alamo Navajo Chapter
Fort Sill Apache Tribe
Hopi Tribe
Pueblo of Laguna
Mescalero Apache Tribe
Navajo Nation
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White Mountain Apache Tribe
Ysleta del Sur Pueblo
Pueblo of Zuni

Local Government
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Sierra Soil and Water Conservation District
City of Truth or Consequences

Interest Groups
Trout Unlimited
- Gila/Rio Grande Chapter
- Truchas Chapter
- Bosque Chapter
- Enchanted Circle Chapter
- New Mexico Council
- National Office

Mesilla Valley Flyfishers, Inc.
New Mexico Trout
New Mexico Wildlife Federation
Albuquerque Wildlife Federation
Wild Turkey Federation
Wild Earth Guardians
The Wilderness Society
New Mexico Wilderness Alliance
Western Watersheds Project
New Mexico Environmental Law Center
Gila Conservation Coalition
Audubon Society, Southwest Chapter
The Sierra Club - El Paso, TX

Individuals
approximately 21 individuals

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APPENDIX A Prentox® CFT Legumine™ Product Label and MSDS

RESTRICTED USE PESTICIDE
Due to aquatic toxicity
For retail sale to, and use only by, Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.

CFT Legumine™

Fish Toxicant

For Control of Fish in Lakes, Ponds, Reservoirs, and Streams

ACTIVE INGREDIENTS:		
Rotenone	5.0%	w/w
Other Associated Resins	5.0%	
OTHER INGREDIENTS[1]	90.0%	
[1] Contains Petroleum Distillates	Total 100.0%	

CFT Legumine is a trademark of CWE Properties Ltd., LLC

KEEP OUT OF REACH OF CHILDREN
WARNING

FIRST AID Have product container or label with you when obtaining treatment advice.	
If swallowed	• Call a physician, Poison Control Center, or the National Pesticide Information Center at 1-800-858-7378 immediately for treatment advice. • Do not give any liquid to the person. · Do not anything to an unconscious person • Do not induce vomiting unless told to do so by the poison control center or doctor.
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a physician, Poison Control Center, or the National Pesticide Information Center at 1-800-858-7378 immediately for treatment advice.
If inhaled	• Move person to fresh air. • If person is not breathing, call an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. • Call a physician, Poison Control Center, or the National Pesticide Information Center at 1-800-858-7378 immediately for treatment advice.
If in eyes	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a physician, Poison Control Center, or the National Pesticide Information Center at 1-800-858-7378 immediately for treatment advice.
Note to Physician: Contains Petroleum Distillates. Vomiting may cause aspiration pneumonia. For information on this pesticide product (including health concerns, medical emergencies, or pesticide incidents), call the National Pesticide Information Center at 1-800-858-7378.	

EPA Reg. No. 655-899
Manufactured for CWE Properties Ltd., LLC, P.O. Box 336277, Greeley CO 80633

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
WARNING

May be fatal if inhaled or swallowed. Causes moderate eye irritation. Harmful if absorbed through skin. Do not breathe spray mist. Do not get in eyes, on skin, or on clothing. Wear goggles or safety glasses.

When handling undiluted product, wear either a respirator with an organic-vapor-removing cartridge with a prefilter approved for pesticides (MSHA/NIOSH approval number prefix TC-23C), or a canister approved for pesticides (MSHA/NIOSH approval number prefix 14G), or a NIOSH approved respirator with an organic vapor (OV) cartridge or canister with any R, P, or HE prefilter.

Wash thoroughly with soap and water after handling and before eating, drinking, or using tobacco. Remove contaminated clothing and wash before reuse. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

ENVIRONMENTAL HAZARDS

This pesticide is extremely toxic to fish. Fish kills are expected at recommended rates. Consult your State Fish and Game Agency before applying this product to public waters to determine if a permit is needed for such an application. Do not contaminate untreated water when disposing of equipment washwaters.

CHEMICAL AND PHYSICAL HAZARDS

FLAMMABLE: KEEP AWAY FROM HEAT AND OPEN FLAME. FLASH POINT MINIMUM 45°F (7°C).

For information on this pesticide product (including health concerns, medical emergencies, or pesticide incidents), call the National Pesticide Information Center at 1-800-858-7378.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

STORAGE: Store only in original containers, in a dry place inaccessible to children and pets. This product will not solidify nor show any separation at temperatures down to 40°F and is stable for a minimum of one year when stored in sealed drums at 70°F.

PESTICIDE DISPOSAL: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your state pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL: Triple rinse or equivalent. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

CFT Legumine is registered for use by or under permit from, and after consultation with State and Federal Fish and Wildlife Agencies.

GENERAL INFORMATION

This product is a specially formulated product containing rotenone to be used in fisheries management for the eradication of fish from lakes, ponds, reservoirs and streams.

Since such factors as pH, temperature, depth and turbidity will change effectiveness, use this product only at locations, rates, and times authorized and approved by appropriate State and Federal Fish and Wildlife Agencies. Rates must be within the range specified on the label.
Properly dispose of unused product. Do not use dead fish for food or feed.
Do not use water treated with rotenone to irrigate crops or release within ½ mile upstream of a potable water or irrigation water intake in a standing body of water such as a lake, pond or reservoir.
Re-entry Statement: Do not allow swimming in rotenone-treated water until the application has been completed and all pesticide has been thoroughly mixed into the water according to labeling instructions.
FOR USE IN PONDS, LAKES, AND RESERVOIRS
The actual application rates and concentrations of rotenone needed to control fish will vary widely, depending on the type of use (e.g., selective treatment, normal pond use, etc.) and the factors listed above. The table below is a general guide for the proper rates and concentrations.
This product disperses readily in water both laterally and vertically, and will penetrate below the thermocline in thermally stratified bodies of water.
Computation of Acre-Feet: An acre-foot is a unit of volume of a body of water having the area of one acre and the depth of one foot. To determine acre-feet in a given body of water, make a series of transects across the body of water taking depths with a measured pole or weighted line. Add the soundings and divide by the number made to determine the average depth. Multiply this average depth by the total surface area in order to determine the acre-feet to be treated. If number of surface acres is unknown, contact your local Soil Conservation Service, which can determine this from aerial photographs.
Amount of CFT Legumine Needed for Specific Uses: To determine the approximate number of gallons needed, find your "Type of Use" in the first column of the table below and then divide the corresponding numbers in the fourth column, "Number of Acre-Feet Covered by One Gallon" into the number of acre-feet in your body of water.

Type of Use	Parts per Million		Number of Acre-Feet Covered by One Gallon
	CFT Legumine	Active Rotenone	
Selective Treatment	0.10 to 0.13	0.005 to 0.007	30 to 24
Normal Pond Use	0.5 to 1.0	0.025 to 0.050	6.0 to 3.0
Remove Bullheads or Carp	1.0 to 2.0	0.050 to 0.100	3.0 to 1.5
Remove Bullheads or Carp in Rich Organic Ponds	2.0 to 4.0	0.100	1.5 to 0.75
Preimpoundment Treatment Above Dam	3.0 to 5.0	0.150 to 0.250	1.0 to 0.60

*Adapted from Kinney, Edward. 1965. Rotenone in Fish Pond Management. USDI Washington, DC Leaflet FL-576

Pre-Mixing and Method of Application: Pre-mix with water at a rate of one gallon of CFT Legumine to 10 gallons of water. Uniformly apply over water surface or bubble through underwater lines.

Detoxification: Water treated with this product will detoxify under natural conditions within one week to one month depending upon temperatures, alkalinity, etc. Rapid detoxification can be accomplished by adding chlorine or potassium permanganate to the water at the same rate as CFT Legumine in parts per million, plus enough additional to meet the chlorine demand of the untreated water.

Removal of Taste and Odor: Waters treated with this product do not retain a detectable taste or odor for more than a few days to a maximum of one month. Taste and odor can be removed immediately by treatment with activated charcoal at a rate of 30 ppm for each 1 ppm of CFT Legumine remaining. (Note: As this product detoxifies, less charcoal is required.)

Restocking After Treatment: Wait 2 to 4 weeks after treatment. Place a sample of fish to be stocked in wire cages in the coolest part of the treated waters. If the fish are not killed within 24 hours, the water may be restocked.

USE IN STREAMS IMMEDIATELY ABOVE LAKES, PONDS, AND RESERVOIRS

The purpose of treating streams immediately above lakes, ponds and reservoirs is to improve the effectiveness of lake, pond and reservoir treatments by preventing target fish from moving into the stream corridors, and not to control fish in streams per se. The term "immediately" means the first available site above the lake, pond or reservoir where treatment is practical, while still creating a sufficient barrier to prevent migration of target fish into the stream corridor.

In order to completely clear a fresh water aquatic habitat of target fish, the entire system above or between fish barriers must be treated. See the use directions for streams and rivers on this label for proper application instructions.

In order to treat a stream immediately above a lake, pond or reservoir you must: (a) Select the concentration of active rotenone, (b) Compute the flow rate of the stream, (c) Calculate the application rate, (d) Select an exposure time, (e) Estimate the amount of product needed, (f) Follow the method of application.

To prevent movement of fish from the pond, lake, or reservoir, the stream treatment should begin before and continue throughout treatment of the pond, lake or reservoir until mixing has occurred.

1. Concentration of Active Rotenone

Select the concentration of active rotenone based on the type of use from those listed on the table. Example: If you select "normal pond use" you could select a concentration of 0.025 parts per million.

2. Computation of Flow Rate for Stream

Select a cross section of the stream where the banks and bottom are relatively smooth and free of obstacles. Divide the surface width into 3 equal sections and determine the water depth and surface velocity at the center of each section. In slowly moving streams, determine the velocity by dropping a float attached to 5 feet of loose monofilament fishing line. Measure the time required for the float to move 5 feet. For fast-moving streams, use a longer distance. Take at least three readings at each point. To calculate the flow rate from the information obtained above, use the following formula:

$$F = \frac{Ws \times D \times L \times C}{T}$$

Where F = flow rate (cubic feet/second), Ws = surface width (feet), D = mean depth (feet), L = mean distance traveled by float (feet), C = constant (0.8 for rough bottoms and 0.9 for smooth bottoms), T = mean time for float (sec.).

3. Calculation of Application Rate

In order to calculate the application rate (expressed as gallons/second), convert the rate in the table (expressed as gallons/acre-feet) to gallons per cubic feet and multiply by the flow rate (expressed as cubic feet/second). Depending on the size of the stream and the type of equipment, the rate could be expressed in other units, such as ounces/hour, or cc/minute.

The application rate for the stream is calculated as follows:

$$R_s = R_p \times C \times F$$

Where R_s = application rate for stream (gallons/second), R_p = application rate for pond (gallons/acre-feet), C = 1 acre-foot/43560 cubic feet and F = flow rate of the stream (cubic feet/second).

4. Exposure Time

The exposure time would be the period of time (expressed in hours or minutes) during which CFT Legumine is applied to the stream in order to prevent target fish from escaping from the pond into the stream corridor.

5. Amount of Product

Calculate the amount of product for a stream by multiplying the application rate for streams by the exposure time.

$$A = R_s \times H$$

Where A = the amount of product for the stream application, R_s = application rate for stream (gallons/second) and H = the exposure time expressed in seconds.

FOR USE IN STREAMS AND RIVERS

Only state or Federal Fish and Wildlife personnel or professional fisheries biologists under the authorization of state or Federal Fish and Wildlife agencies are permitted to make applications of CFT Legumine for control of fish in streams and rivers. Informal consultation with Fish and Wildlife personnel regarding the potential occurrence of endangered species in areas to be treated should take place. Applicators must reference the Stream and River use Monograph before making any application to streams or rivers.

CFT LEGUMINE STREAM AND RIVER USE MONOGRAPH

USE IN STREAMS AND RIVERS

The following use directions are to provide guidance on how to make applications of CFT Legumine to streams and rivers. The unique nature of every application site could require minor adjustments to the method and rate of application. Should these unique conditions require major deviation from the use directions, a Special Local Need 24(c) registration should be obtained from the state.

Before applications of CFT Legumine can be made to streams and rivers, authorization must be obtained from state or federal Fish and Wildlife agencies. Since local environmental conditions will vary, consult with the state Fish and Wildlife agency to ensure the method and rate of application are appropriate for that site.

Contact the local water department to determine if any water intakes are within one mile downstream of the section of stream, river, or canal to be treated. If so, coordinate the application with the water department to make sure the intakes are closed during treatment and detoxification.

Application Rates and Concentration of Rotenone

Slow Moving Rivers: In slow moving rivers and streams with little or no water exchange, use instructions for ponds, lakes and reservoirs.

Flowing Streams and Rivers: Apply rotenone as a drip for 4 to 8 hours to the flowing portion of the stream. Multiple application sites are used along the length of the treated stream, spaced

approximately ½ to 2 miles apart depending on the water flow travel time between sites. Multiple sites are used because rotenone is diluted and detoxified with distance. Application sites are spaced at no more than 2 hours or at no less than 1-hour travel time intervals. This assures that the treated stream remains lethal to fish for a minimum of 2 hours. A non-toxic dye such as Rhodamine-WTR or fluorescein can be used to determine travel times. Cages containing live fish placed immediately upstream of the downstream application sites can be used as sentinels to assure that lethal conditions exist between sites.

Apply rotenone at each application site at a concentration of 0.25 to 1.0 part per million of CFT Legumine. The amount of CFT Legumine needed at each site is dependent on stream flow (see Computation of Flow Rate for Stream).

Application of Undiluted Material

CFT Legumine can drain directly into the center of the stream at a rate 0.85 to 3.4 cc per minute for each cubic foot per second of stream flow. Flow of undiluted CFT Legumine into the stream should be checked at least hourly. This is equivalent to from 0.5 to 2.0 ppm of this product, or from 0.025 to 0.100 ppm rotenone. Backwater, stagnant, and spring areas of streams should be sprayed by hand with a 10% v/v solution of CFT Legumine in water to assure a complete coverage.

Calculation of Application Rate:

$$X = F (1.699 B)$$

X = cc per minute of CFT Legumine applied to the stream, F = the flow rate (cu.ft/sec.) see Computation of Flow Rate for Stream section of the label, B = parts per million desired concentration of CFT Legumine

Total Amount of Product Needed for Treatment: Streams should be treated for 4 to 8 hours in order to clear the treated section of stream of fish. To determine the total amount of CFT Legumine required, use the following equation:

$$Y = X (0.0158 C)$$

Y = gallons of CFT Legumine required for the stream treatment, X = cc per minute of CFT Legumine applied to the stream, C = time in hours of the stream treatment.

Application of Diluted Material

Alternatively, for stream flows up to 25 cubic feet per second, continuous drip of diluted CFT Legumine at 80 cc per minute can be used. Flow of diluted CFT Legumine into the stream should be checked at least hourly. Use a 5 gallon reservoir over a 4 hour period, a 7.5 gallon reservoir over a 6 hour period, or a 10 gallon reservoir over an 8 hour period. The volume of the reservoir can be determined from the equation:

$$R = H \times 1.25$$

Where R = the volume of the reservoir in gallons, H = the duration of the application in hours.

The volume of CFT Legumine diluted with water in the reservoir is determined from the equation:

$$X = Y(102\ F)H$$

Where X = the cc of CFT Legumine diluted in the reservoir, Y = parts per million desired concentration of CFT Legumine, F = the flow rate (cubic feet/second), H = the duration of the application (hours).

For flows over 25 cubic feet per second, additional reservoirs can be used concurrently. Back-water, stagnant and spring areas of streams should be sprayed by hand with a 10% v/v solution of CFT Legumine in water to assure a complete coverage.

Detoxification

To limit effects downstream, detoxification with potassium permanganate can be used at the downstream limit of the tre ated area. Within ½ to 2 miles of the furthest downstream CFT Legumine application site, the rotenone can be detoxified with a potassium permanganate solution at a resultant stream concentration of 2 to 4 parts per million, depending on rotenone concentration and permanganate demand of the water. A 2.5% (10 pounds potassium permanganate to 50 gallons of water) permanganate solution is dripped in at a continuous rate using the equation:

$$X = Y(70\ F)$$

Where X = cc of 2.5% permanganate solution per minute, Y = ppm of desired permanganate concentration, F = cubic feet per second of stream flow.

Flow of permanganate should be checked at least hourly. Live fish in cages placed immediately above the permanganate application site will show signs of stress signaling the need for beginning detoxification. Detoxification can be terminated when replenished fish survive and show no signs of stress for at least four hours.

Detoxification of rotenone by permanganate requires between 15 to 30 minutes contact time (travel time). Cages containing live fish can be placed at these downstream intervals to judge the effectiveness of detoxification. At water temperatures less than 50°F detoxification may be retarded, requiring a longer contact time.

WARRANTY STATEMENT

Our recommendations for the use of this product are based upon tests believed to be reliable. The use of this product being beyond the control of the manufacturer, no guarantee, expressed or implied, is made as to the effects of such or the results to be obtained if not used in accordance with directions or established safe practice. To the extent consistent with applicable law, the buyer must assume all responsibility, including injury or damage, resulting from its misuse as such, or in combination with other materials.

CWE Properties Ltd., LLC – P.O. Box 336277 – Greeley, CO 80633

CFT Legumine™ EPA Reg. No. 75338-2

Material Safety Data Sheet

SECTION 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT/CHEMICAL NAME: CFT Legumine™

Emergency Contact: 1-800-858-7378 (National Pesticide Information Center)

Transportation Emergency Contact: 1-800-858-7378 (National Pesticide Information Center

Manufactured for: CWE Properties Ltd., LLC
P.O. Box 336277
Greeley, CO 80633

SECTION 2: HAZARDS IDENTIFICATION SUMMARY

KEEP OUT OF REACH OF CHILDREN –WARNING – May be fatal if inhaled. May be fatal if swallowed. Causes substantial, but temporary, eye injury. Causes skin irritation. Do not breathe spray mist. Do not get in eyes, on skin, or on clothing. Wear goggles or safety glasses. This product is an orange, viscous liquid with slight petroleum odor.

SECTION 3: COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Ingredients:	Percentage By Weight	CAS No.	TLV (Units)
Rotenone	5.00	83-79-4	5 mg/m3
Other Associated Resins	5.00		
Inert Ingredients, Including N-Methylpyrrolidone	90.00	872-50-4	not listed

SECTION 4: FIRST AID MEASURES

IF SWALLOWED: Call a physician, Poison Control Center, or the National Pesticide Information Center at 1-900-858-7378 immediately for treatment advice. Do not induce vomiting unless told to do so by the Poison Control Center or physician. Do not give any liquid to the person. Do not give anything by mouth to an unconscious or convulsing person.

IF INHALED: Remove victim to fresh air. If not breathing, give artificial respiration, preferably by mouth-to-mouth. Call a physician, Poison Control Center, or the National Pesticide Information

Emergency Telephone Number: 1-800-858-7378

Revision Date: July 12, 2007

Center at 1-800-858-7378 immediately for treatment advice.

IF IN EYES: Hold eyelids open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a physician, Poison Control Center, or the National Pesticide Information Center at 1-800-858-7378 immediately for treatment advice.

IF ON SKIN OR CLOTHING: Take off contaminated clothing. Rinse skin with plenty of water for 15-20 minutes. Call a physician, Poison Control Center, or the National Pesticide Information Center at 1-800-858-7378 immediately for treatment advice.

Note: Have the product container or label with you when obtaining treatment advice.

SECTION 5: FIRE FIGHTING MEASURES

Flash Point (Method Used): 192°F (89°C) (Closed Cup)

Flammable Limits: LFL: Not established
UFL: Not established

Extinguishing Media: CO_2, foam, dry chemical water spray.

Special Fire Fighting Procedures: Use self-contained breathing apparatus and full protective equipment. Fight fire from upwind from a safe distance and keep non-essential personnel out of area.

SECTION 6: ACCIDENTAL RELEASE MEASURES

SPILL/LEAK PROCEDURES: Wear protective clothing as described in Section 8 (Exposure Controls / Personal Protection) of this MSDS. Absorb liquid with material such as clay, sand, sawdust, or dirt. Sweep up and place in a suitable container for disposal and label the contents. Area can be washed down with a suitable solution of bleach or soda ash and an appropriate alcohol (methanol, ethanol, or isopropanol). Follow this by washing with a strong soap and water solution. Absorb any excess liquid as indicated above, and add to the disposal container. This product is extremely toxic to fish. Fish kills are expected at recommended use rates. Keep spills and cleaning runoff out of municipal sewers and open bodies of water.

Emergency Telephone Number: 1-800-858-7378

Revision Date: July 12, 2007

CWE Properties Ltd., LLC – P.O. Box 336277 – Greeley, CO 80633

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SECTION 7: HANDLING AND STORAGE

HANDLING: Avoid inhalation of vapors. Harmful if swallowed, inhaled or absorbed through skin. Avoid contact with skin. Wear clean protective clothing. Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet. Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

STORAGE: Store in original containers only. Store in a dry place away from children and domestic animals. Do not store at temperatures below 40 F/4.4°C. This product is stable for a minimum of 1 year when stored in sealed drums at 70°F/21.1 °C. Do not contaminate water, food or feed by storage or disposal.

SECTION 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHS PELs (see section 3).
RESPIRATORY PROTECTION: When working with an undiluted product in a confined space, use a non-powered air purifying respirator equipped with an N–, R-, or P-series filter. For emergency or non-routine operations (cleaning reactor vessels or storage tanks), wear an SCBA"

Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **PROTECTIVE CLOTHING/EQUIPMENT:** Wear chemical-resistant gloves, boots, and aprons to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Viscous liquid
Appearance and Odor: Orange liquid with slight solvent odor.
Specific Gravity: 1.019 g/ml
Bulk Density: 8.506 lbs./gal.

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SECTION 10: STABILITY AND REACTIVITY

Stability: Stable at room temperature in closed containers under normal storage and handling conditions.
Conditions to Avoid: None known.
Incompatibility: Strong acids and strong oxidizers,
Hazardous Decomposition Products: Oxides of carbon.
Hazardous Polymerization: Will not occur.

SECTION 11: TOXICOLOGICAL INFORMATION

Acute Oral LD_{50} (rat): 55.3 – 264 mg/kg
Acute Dermal LD_{50} (rabbit): >2020 mg/kg
Inhalation LC_{50} (rat): 0.048 mg/L (4 HR)
Eye Irritation (rabbit): Moderately irritating
Skin Irritation (rabbit): Moderately irritating
Skin Sensitization (guinea pig): Not a sensitizer
Carcinogenic Potential: Not listed by IARC, NTP, or OSHA. ACGIH lists Rotenone as TLV A4: Not classifiable as to human carcinogenicity.

SECTION 12: ECOLOGICAL INFORMATION

This product is extremely toxic to fish. Fish kills are expected at recommended usage rates. Consult local Fish and Game agencies before applying this product to public waters to determine if a permit is needed for such an application.

SECTION 13: DISPOSAL CONSIDERATIONS

Do not reuse empty containers. **Plastic:** Triple rinse (or equivalent), then offer for recycling, or puncture and dispose of in a sanitary landfill, or incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke. **Metal:** Triple rinse (or equivalent), then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill or by other procedures approved by state and local authorities. Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal law and may contaminate groundwater. Do not contaminate water, food or feed by storage or disposal.

SECTION 14: TRANSPORT INFORMATION

U.S DOT Shipping Description: Pesticide, Liquid, Toxic, N.O.S. (Rotenone), 6.1, UN2902, III, Marine Pollutant, ERG Guide 151Emergency Telephone Number: 1-800-858-7378

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CFT Legumine™ EPA Reg. No. 75338-2

SECTION 15: REGULATORY INFORMATION

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) HAZARD RATINGS:

Category	Rating
Health	4
Flammability	2
Instability	0

0: Least
1: Slight
2: Moderate
3: High
4: Severe

SARA Hazard Notification/Reporting:
SARA Title III Hazard Category:
Immediate: Yes – Fire: No – Delayed: No – Reactive: No
Reportable Quantity (RQ) U.S. CERCLA: Not listed
SARA Title III, Section 313: N-methylpyrrolidone (CAS: 872-50-4) 10.0%
RCRA Waste Code: Not listed
California Proposition 65: WARNING: This product contains chemicals known to the State of California to cause cancer or birth defects or other reproductive harm.

SECTION 16: OTHER INFORMATION

Prepared by: ERR
Issue Date: July 12, 2007
Revision Notes: July 12, 2007
NOTE: *CFT Legumine is a Restricted Use Pesticide due to Aquatic Toxicity*

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, expressed or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state, and local laws and regulations.

Emergency Telephone Number: 1-800-858-7378
Revision Date: July 12, 2007

APPENDIX B Prentox® Prenfish™ Fish Toxicant Powder Product Label and MSDS

RESTRICTED USE PESTICIDE
DUE TO AQUATIC, ACUTE ORAL AND INHALATION TOXICITY
For retail sale to, and use by, Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.

ROTENONE FISH TOXICANT POWDER

ACTIVE INGREDIENTS:

Rotenone- Minimum Guaranteed	7.4% w/w
Other Associated Resins	11.1%
OTHER INGREDIENTS:	81.5%
TOTAL:	100.0% w/w

ROTENONE ASSAY _____ % ROTENONE

PRENTOX® - Registered Trademark of Prentiss Incorporated

KEEP OUT OF REACH OF CHILDREN

DANGER
POISON

FIRST AID
Have the product container or label with you when calling a poison control center or physician, or going for treatment.

If swallowed	• Call a Poison Control Center, physician, or the National Pesticide Information Center at 1-800-858-7378 immediately for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by the Poison Control Center or physician. • Do not give anything by mouth to an unconscious or convulsing person.
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a Poison Control Center, physician, or the National Pesticide Information Center at 1-800-858-7378 for treatment advice.
If in eyes	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a Poison Control Center, physician, or the National Pesticide Information Center at 1-800-858-7378 for treatment advice.
If inhaled	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. • Call a Poison Control Center, physician, or the National Pesticide Information Center at 1-800-858-7378 for treatment advice.

For information on this pesticide product (including health concerns, medical emergencies, or pesticide incidents), call the National Pesticide Information Center at 1-800-858-7378.

SEE INSIDE LEAFLET FOR ADDITIONAL PRECAUTIONARY STATEMENTS AND DIRECTIONS FOR USE

Manufactured by: 5/02

E.P.A. REG. NO. 655-691
E.P.A. EST. NO. 655-GA-1

PRENTISS INCORPORATED
Plant: Kaolin Road, Sandersville, GA 31082
Office: C.B. 2000, Floral Park, NY 11002-2000

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
DANGER

Fatal if inhaled or swallowed. Harmful if absorbed through the skin. Causes moderate eye irritation. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Do not breathe dust. Use a dust/mist filtering respirator (MSHA/NIOSH approval number prefix TC-21C), or a NIOSH approved respirator with any N, R, P or HE filter. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling and before eating, drinking or using tobacco. Remove contaminated clothing and wash clothing before reuse.

ENVIRONMENTAL HAZARDS

This pesticide is extremely toxic to fish. Fish kills are expected at recommended rates. Consult your State Fish and Game Agency before applying this product to public waters to determine if a permit is needed for such an application. Do not contaminate untreated water when disposing of equipment washwaters.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.
STORAGE: Store only in original container, in a dry place inaccessible to children and pets. If spilled, sweep up and dispose of as below.
PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.
CONTAINER DISPOSAL: Completely empty bag into application equipment. Then dispose of bag in a sanitary landfill or by incineration, or if allowed by State and local authorities by burning. If burned, stay out of smoke.

DIRECTIONS FOR USE
It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

USE RESTRICTIONS:
Use against fish in lakes, ponds, and streams (immediately above lakes and ponds).

Since such factors as pH, temperature, depth, and turbidity will change effectiveness, use this product only at locations, rates, and times authorized and approved by appropriate state and Federal fish and wildlife agencies. Rates must be within the range specified in the labeling.

Properly dispose of dead fish and unused product. Do not use dead fish as food or feed.

Do not use water treated with rotenone to irrigate crops or release within ½mile upstream of a potable water or irrigation water intake in a standing body of water such as a lake, pond or reservoir.

Note to User: Adjust pounds of Rotenone according to the actual Rotenone Assay as noted under the Ingredient Statement on this label. For example, if the required amount of 5% rotenone is 21 pounds, and the Rotenone Assay is 7%, use 5/7 of 21 pounds or 15 pounds of this product to yield the proper amount of active rotenone.

APPLICATION DIRECTIONS:

Treatment of Lakes and Ponds

1. **Application Rates and Concentrations of Rotenone**

The actual application rates and concentrations of rotenone needed to control fish will vary widely, depending on the type of use (e.g. selective treatment, normal pond treatment, etc.) and the factors listed above. The table below is a general guide for the proper rates and concentrations.

2. **Total Amount of Product Needed for Treatment**

To determine the total number of pounds needed for treatment, divide the number of acre-feet covered by one pound for a specific type of use (e.g., selective treatment, etc.), as indicated in the table below, into the number of acre-feet in the body of water.

General Guide to the Application Rates and Concentrations of Rotenone Needed to Control Fish in Lakes and Ponds[1]

Type of Use	No. of Acre-Feet Covered by One Pound	Parts Per Million	
		Active Rotenone	5% Product
Selective Treatment	3.7 to 2.8	0.005 - 0.007	0.10 - 1.3
Normal Pond Use	0.74 to 0.37	0.025 - 0.050	0.5 - 1.0
Remove Bullheads or Carp	0.37 to 0.185	0.050 - 0.100	1.02 - 2.0
Remove Bullheads or Carp in Rich Organic Ponds	0.185 to 0.093	0.100 - 0.200	2.0 - 4.0
Pre-impoundment Treatment above Dam	0.123 to 0.074	0.150 - 0.250	3.0 - 5.0

5. **Restocking**

Waters treated with this product detoxify within 2 to 4 weeks after treatment, depending on pH, temperature, water hardness, and depth. To determine if detoxification has occurred, place live boxes containing samples of fish to be stocked in treated waters. More rapid detoxification can be accomplished by adding Potassium Permanganate or chlorine at a 1:1 ratio with the concentration of rotenone applied, plus sufficient additional compound to satisfy the chemical oxidation demand caused by organic matter that may be present in the treated water.

Treatment of Streams Immediately Above Lakes and Ponds

The purpose of treating streams immediately above lakes and ponds is to improve the effectiveness of lake and pond treatments and not to control fish in streams per se. The term "immediately" means the first available site above the lake or pond where treatment is practical.

In order to treat a stream immediately above a lake or pond, you must select a concentration of active rotenone, compute the flow rate of a stream, calculate the application rate, select an exposure time, estimate the amount of product needed, and follow the method of application.

1. **Concentration of Active Rotenone**

Select the "Concentration of Active Rotenone" based on the type of use from those on the table. For example, if you select "Normal Pond Use" you could select a concentration of "0.025 Parts per Million".

2. **Computation of Flow Rate for Stream**

Select a cross section of the stream where the banks and bottom are relatively smooth and free of obstacles. Divide the surface width into 3 equal sections and determine the water depth and surface velocity at the center of each section. In slowly moving streams, determine the velocity by dropping a float attached to 5 feet of loose, monofilament fishing line. Measure the time required for the float to move 5 feet. For fast-moving streams, use a longer distance. Take at least three readings at each point. To calculate the flow rate from the information obtained above, use the following formula:

$$F = \frac{Ws \times D \times L \times C}{T}$$

where F = flow rate (cu. ft./sec.), Ws = surface width (ft.), D = mean depth (ft.), L = mean distance traveled by float (ft.), C = constant (0.8 for rough bottoms and 0.9 for smooth bottoms), and T = mean time for float (sec.).

For example, after using the above formula, you might have computed the stream's flow rate to be "10 cu. ft. per sec."

3. **Calculation of Application Rate**

In order to calculate the application rate (expressed as "pound per sec"), you convert the rate in the table (expressed as "pound per acre-feet"), to "pound per cu. feet" and multiply by the flow rate (expressed as "cu. ft. per sec."). Depending on the size of the stream and the type of equipment, the rate could be expressed in other units, such as "ounces per hr."

The application rate for the stream above is calculated as follows:

$$R_s = R_p \times C \times F$$

where R_s = Application Rate for Stream (lb/sec), R_p = Application Rate for Pond (lb/acre feet), C = 1 acre foot/43560 cu. ft., and F = Flow Rate (cu. ft/sec).

In the example, the Application Rate for Stream would be:
R_s = 1 lb/0.74 acre-foot x 1 acre-foot/43560 cu. ft. x 10 cu. ft./sec.
R_s = .00031 lb/sec or 17.9 oz./hr.

4. **Exposure Time**

The "Exposure Time" would be the period of time (expressed in hours or seconds) during which target fish should **not** enter the lake or pond under treatment. In the example, this period of time could be 4 hours.

5. **Amount of Product**

Calculate the "Amount of Product" for a stream by multiplying the "Application Rate for Stream" by the "Exposure Time". In the example, the "Amount of Product" would be 71.6 oz. (17.9 oz./hr. x 4 hr.) or 4.5 lb.

RE-ENTRY STATEMENT
Do not allow swimming in rotenone-treated water until the application has been completed and all pesticide has been thoroughly mixed into the water according to labeling instructions.

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[1]Adapted from Kinney, Edward, 1965 Rotenone in Fish Pond Management. USDI Washington, D.C. Leaflet FL-576.

Computation of acre-feet for lake or pond: An acre-foot is a unit of water volume having a surface area of one acre and a depth of one foot. Make a series of transects across the surface, taking depths with a measured pole or weighted line. Add the measurements and divide by the number made to determine the average depth. To compute **total acre-feet**, multiply this average depth by the number of surface acres, which can be determined from an aerial photograph or plat drawn to scale.

3. **Pre-Mixing Method of Application**

Pre-mix one pound of Rotenone with 3 to 10 gallons of water. Uniformly apply over water surface or bubble through underwater lines.

Alternately place undiluted powder in burlap sack and trail behind boat. When treating deep water (20 to 25 feet) weight bag and tow at desired depth.

4. **Removal of Taste and Odor**

Rotenone treated waters do not retain a detectable taste or odor for more than a few days to a maximum of one month. Taste and odor can be removed immediately by treatment with activated charcoal at a rate of 30 ppm. for each 1 ppm. Rotenone remaining (Note: As Rotenone detoxifies, less charcoal is required).

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Product: 655-691 Prentox® Prenfish™ Fish Toxicant Powder

Material Safety Data Sheet
U.S. Department of Labor (OSHA 29 CFR 1910.1200)

Section 1: Product and Company Identification

Product: 655-691 Prentox® Prenfish™ Fish Toxicant Powder

Manufacturer's Name: **Prentiss Incorporated**
C. B. 2000
Floral Park, NY 11001
Telephone Number: **(516) 326-1919**

Section II: Composition/Information on Ingredients

Ingredient Name:	OSHA PEL	ACGIH TLV	%
Rotenone (CAS # 83-79-4)	(TWA) 5 mg/M³	(TWA) 5 mg/M³	7.4
Other Cube Resins	None	None	11.1
Other Ingredients	None	None	81.5

Section 3: Hazards Identification:

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Emergency Overview:

A tan powder with a wet chalk or dirt-like odor.

- Fatal if inhaled or swallowed
- Harmful if absorbed through skin
- Causes moderate eye irritation
- May cause allergic skin reactions in some individuals
- This pesticide is extremely toxic to fish

Potential Health Effects:

Primary Route(s) of Entry:
Ingestion, inhalation, and skin contact

Eyes:
Causes moderate eye irritation

Skin:
Harmful if absorbed through the skin. Prolonged or frequently repeated skin contact may cause allergic skin reactions in some individuals.

Ingestion:
Fatal if swallowed

Inhalation:
Fatal if inhaled

Signs and symptoms of acute overexposure:
May cause irritation of the eyes, nose and throat in addition to temporary numbness. Prolonged or repeated exposure can cause nausea, vomiting, abdominal cramps, muscle tremors, poor muscle coordination, seizures, shallow breathing, skin rashes and eye, nose and mouth lesions.

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Product: 655-691 Prentox® Prenfish™ Fish Toxicant Powder

Section 4: First Aid Measures:

Eyes:
Flush eyes with plenty of water for 15 minutes. Get medical attention if irritation persists

Skin:
Wash with plenty of soap and water. Get medical attention if irritation persists

Ingestion:
Call a physician or Poison Control Center. Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to an unconscious person.

Inhalation:
Remove person to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth. Get medical attention

Note to Physician:
If a small amount is ingested (or if treatment is delayed), oral administration of large amounts of activated charcoal and a cathartic is probably sufficient therapy.
Do not administer milk, cream or other substances containing vegetable or animal fats, which enhance the absorption of lipophilic substances.

Section 5: Fire Fighting Measures:

Extinguishing Media:
Carbon dioxide, dry chemical, foam or water

Fire Fighting Instructions:
As in any fire, wear self-contained breathing apparatus, pressure demand, MSHA/NIOSH approved (or equivalent), and full protective gear. Keep upwind. Isolate hazard area. Avoid inhalation of smoke and fumes. Use water or foam to reduce fumes. Do not touch spilled material. If possible, move containers from area. Extinguish only if flow can be stopped. Use flooding amounts of water as a fog. Cool containers with flooding amounts of water from as far a distance as possible. Avoid breathing vapors.

Flammability Classification/Rating:
NFPA/OSHA Class: IIIB
NFPA Rating (Fire): 1

Section 6: Accidental Release Measures:

General and Disposal: Use proper protective equipment to minimize personal exposure (see Section 8). Take all necessary action to prevent and to remedy the adverse effect of the spill. Ensure that the disposal is in compliance with all Federal, State/Provincial, and local regulations (see Section 13 for applicable RCRA number). Refer to Section 15 for applicable Reportable Quantity (RQ) and other regulatory requirements.

Land Spill: Sweep or shovel spilled material into a tightly sealed container. Dispose of with chemical waste.

Product: 655-691 Prentox® Prenfish™ Fish Toxicant Powder

Section 7: Handling and Storage:

Handling Precautions:
Do not breathe dust. Avoid contact with eyes, skin or clothing.

Storage Precautions:
Do not contaminate water, food or feed by storage. Store in a dry place, away from excessive temperature extremes.

Work/Hygienic Practices:
Wash thoroughly with soap and water after handling and before eating, drinking or using tobacco. Remove contaminated clothing and wash before reuse.

Section 8: Exposure Controls/Personal Protection:

Manufacturing, formulation and other Non-Agricultural uses.

Engineering controls:
Control airborne concentrations below the appropriate exposure guideline (see Section 2 for applicable OSHA/ACGIH Exposure Limits). Local exhaust ventilation may be necessary.

Eye/Face Protection:
Wear safety glasses, splash goggles or face shield.

Skin Protection:
Wear chemical resistant gloves (Neoprene, Nitrile rubber or PVC) and other protective clothing to avoid skin contact.

Respiratory Protection:
Ensure good ventilation. If not adequate, use a chemical cartridge type respirator approved by the National Institute of Occupational Health and Safety.

General Protection:
Eye wash facility and safety shower should be available. Wear a protective apron, long sleeves and pants to prevent skin contact.

Section 9: Physical and Chemical Properties:

Appearance:
Tan powder

Odor:
Wet chalk or dirt-like odor.

Basic Physical Properties:

Physical State: Solid

Solubility (H_2O): Insoluble

Bulk Density: Fluffed – 0.24 gm/cm^3 (14.7 lb./cu. Ft.). Packed – 0.45 gm/cm^3 (28.1 lb./cu. Ft.)

Section 10: Stability and Reactivity:

Stability: Stable.

Conditions to Avoid (Stability): High temperatures and constant exposure to sunlight

Incompatible Materials: Avoid strong oxidizers and reducing agents

Hazardous Polymerization: Will not occur

Product: 655-691 Prentox® Prenfish™ Fish Toxicant Powder

Section 11: Toxicological Information:

The following data were developed with rotenone dust containing 5% rotenone.

Eye Effects:

Irritation (Rabbit): Slightly irritating.

Skin Effects:

Irritation (Rabbit): Non-irritating.

Absorption (Rabbit): LD_{50} > 2,020 mg/kg (Slightly Toxic).

Sensitization (Guinea Pig): Sensitizing

Acute Oral Effects:

LD_{50} (Rat, male): 874 mg/kg (Slightly Toxic).

(Rat, female): 99.2 mg/kg (Moderately Toxic).

Acute Inhalation Effects:

4 hour LC_{50} (Rat, Male): 0.087 mg/L (Moderately Toxic).

4 hour LC_{50} (Rat, Female): 0.045 mg/L (Highly Toxic).

4 hour LC_{50} (Rat): 0.056 mg/L (Moderately Toxic).

Note: the severity classifications listed above are those of Prentiss Incorporated, and, particularly for eye irritation, may not always coincide with EPA-mandated Precautionary Statements.

The following data were developed with rotenone, the active ingredient in this product.

Chronic (Cancer) Information:

Rotenone was not carcinogenic when tested in rats and mice.

Carcinogenicity: **NTP:** No **IARC:** No **OSHA:** No

Teratogenicity (Birth Defects):

Rotenone was not teratogenic or fetotoxic when tested in rats and mice.

Reproductive Effects:

Rotenone had no adverse effects on reproduction when tested over two successive generations in rats.

Mutagenicity (Genetic Effects):

Rotenone was not mutagenic nor clastogenic when tested in the Ames test, Yeast test, Mouse Lymphoma test, Mouse Micronucleus test, Chromosome Aberration test and the Mitotic Recombination test in Yeast.

Section 12: Ecological Information:

Other Environmental Information:

This pesticide is extremely toxic to fish. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters, unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA

Product: 655-691 Prentox® Prenfish™ Fish Toxicant Powder

Section 13: Disposal Considerations:

Do not contaminate water, food or feed by disposal.

Pesticide Disposal:

Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency or the Hazardous Waste Representative at the nearest EPA Regional Office for guidance.

Container Disposal:

Completely empty liner by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application equipment. Then dispose of liner in a sanitary landfill or by incineration if allowed by State and local authorities. If drum is contaminated and cannot be reused, dispose of in the same manner.

RCRA Information:

RCRA Hazardous Waste Ingredients: None.

Section 14: Transport Information:

Proper Shipping Name: Pesticide, Solid, Toxic, n.o.s. (Rotenone)
Hazard Class: 6.1, PG I
DOT Identification Number: UN2588
DOT Shipping Label: POISON

Additional Shipping Paper Description: Marine Pollutant

Note: For transport purposes (49 CFR Part 173.132), the calculated 1 hour LC_{50} (Rat) is: 0.224 mg/L (dust)

Section 15: Regulatory Information:

U.S. Federal Regulatory Information:

EPA Reg. No.: 655-691
TSCA Inventory: Registered pesticide, exempt from TSCA.
SARA Title III Notification and Information:

Section 302 (EHS) ingredients: None.
Section 304 (CERCLA & EHS) ingredients (RQ): None.
Section 313 ingredients: None.

SARA Title III Notifications and Information:

SARA Title III Hazard Classes:

Acute Health Hazard: Yes
Chronic Health Hazard: No
Fire Hazard: No
Sudden Release of Pressure Hazard: No
Reactivity Hazard: No

Product: 655-691 Prentox® Prenfish™ Fish Toxicant Powder

Regulated Ingredients:
Ingredient: Rotenone
CAS Number: 83-79-4
Percent by Weight: 7.4
Regulations:
Illinois Toxic Substance
Massachusetts Hazardous Substance
New Jersey Special Health Hazardous Substance
New Jersey Workplace Hazardous Substance
Pennsylvania Workplace Hazardous Substance

U.S. State Regulatory Information:
California (Proposition 65): This product does not contain any chemical which is known to the State of California to cause cancer or birth defects, or other reproductive harm.

Canadian Regulatory Information:
CPC Number: None
WHMIS Classification for Control Product Regulations (CPR): Registered pesticide under US FIFRA regulations; exempt from CPR classification.
The MSDS contains all CPR required hazard-related information.
WHMIS Hazard Rating: See HMIS rating (Section 16).

Section 16: Other Information:

NFPA Hazard Rating:
Health: 2 – Moderate
Fire: 1 – Slight
Reactivity: 0 – Negligible
Special:

HMIS Hazard Rating:
Health: 2 – Moderate
Fire: 1 – Slight
Reactivity: 0 – Negligible
Protection: J

Date Prepared: August 14, 2000
Supersedes: November 3, 1997
Reason: Revision of sections 3, 5, 6, 7, 8, 9, 11, 13, 14, 15

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein.

APPENDIX C Potentially Affected Special Status Species in the Project Area

Special-status species that may occur in Sierra County. Status is provided for three agency categories: **USFWS** (U.S. Fish and Wildlife Service), **USFS** (U.S. Forest Service, Region 3); and **NM** (status accorded to plant species by the New Mexico Rare Plants Program of the New Mexico Energy Minerals, and Natural Resources Department or to animal species by the New Mexico Department of Game and Fish). Species protected under the federal Endangered Species Act are coded under the **USFWS** column as endangered (**FE**), threatened (**FT**), or candidate for federal listing (**FC**). The code **FSC** denotes a federal species of concern identified by the U.S. Fish and Wildlife Service. The code **SEN** under the **USFS** column indicates species listed as Forest Service, Region 3 sensitive. Species protected under the New Mexico Wildlife Conservation Act or the New Mexico Endangered Plant Species Act are coded under the **NM** column as endangered (**SE**) or threatened (**ST**). The code **SSC** denotes a state species of concern identified by either the New Mexico Rare Plants Program or a sensitive species identified by the New Mexico Department of Game and Fish. **HABITAT** is coded as: **SCF** = subalpine coniferous forest; **MCF** = Rocky Mountain upper or lower montane coniferous forest; **SAG** = subalpine-montane grassland; **PJW** = piñon-juniper woodland; **MSC** = montane scrub; **MWD** = mixed deciduous woodland; **PMG** = plains-mesa grassland; **DGR** = desert grassland; and **CDS** = Chihuahuan desert scrub. Special habitats are coded as: **Rip** = riparian; **Wet** = wetlands; **Aq** = aquatic; **Rck** = rock outcrops, rocky areas or cliffs. Species that occur in aquatic (**Aq**), wetland (**Wet**), or riparian (**Rip**) habitats in montane (**MCF**) and subalpine (**SCF**) coniferous forest *and* whose known or suspected distribution includes the project area are highlighted with red text.

COMMON NAME	SCIENTIFIC NAME	STATUS			HABITAT
		USFWS	USFS	NM	
PLANTS (22 taxa)					
grayish-white giant hyssop	*Agastache cana*	---	---	SSC	DGR,PJW
Castetter's milkvetch	*Astragalus castetteri*	---	---	SSC	PJW
Wright's marsh thistle	*Cirsium wrightii*	---	---	SE	DGR-MCF/Wet
Warner's dodder	*Cuscuta warneri*	---	---	SSC	DGR/Wet
Metcalfe's ticktrefoil	*Desmodium metcalfei*	---	SEN	SSC	PMG-PJW/Rip
Mogollon whitlowgrass	*Draba mogollonica*	---	---	SSC	MCF
Standley's whitlowgrass	*Draba standleyi*	---	---	SSC	PMG-PJW/Rck
rock fleabane	*Erigeron scopulinus*	---	---	SSC	MCF/Rck
Duncan's pincushion cactus	*Escobaria duncanii*	FSC	---	SE	CDS
Sandberg pincushion cactus	*Escobaria sandbergii*	---	---	SSC	CDS-PJW
New Mexico gumweed	*Grindelia arizonica* var. *neomexicana*	---	---	SSC	PJW-MCF
Todsen's pennyroyal	*Hedeoma todsenii*	FE/CH	---	SE	PJW
Arizona coralroot	*Hexalectris spicata* var. *arizonica*	---	SEN	SE	PJW-MCF

COMMON NAME	SCIENTIFIC NAME	STATUS			HABITAT
		USFWS	USFS	NM	
Vasey's bitterweed	*Hymenoxys vaseyi*	---	---	SSC	PJW
Metcalfe's penstemon	*Penstemon metcalfei*	---	SEN	SSC	MCF
Pinos Altos flame flower	*Phemeranthus humilis*	FSC	SEN	SSC	PMG-PJW
San Andres rock daisy	*Perityle staurophylla* var. *homoflora*	---	---	SSC	PJW-MCF/Rck
New Mexico rock daisy	*Perityle staurophylla* var. *staurophylla*	---	---	SSC	PJW-MCF/Rck
Goodding's bladderpod	*Physaria gooddingii*	---	---	SSC	PJW,MCF
Plank's campion	*Silene plankii*	---	---	SSC	DGR-MCF/Rck
Thurber's campion	*Silene thurberi*	---	---	SSC	PJW-MCF/Rck
Wright's campion	*Silene wrightii*	---	---	SSC	MCF,SCF/Rck
INVERTEBRATES (10 taxa)					
Iron Creek woodlandsnail	*Ashmunella mendax*	---	SEN	---	PMG-SCF
Dry Creek woodlandsnail	*Ashmunella tetrodon animorum*	---	SEN	---	MCF
Dry Creek woodlandsnail	*Ashmunella tetrodon mutator*	---	SEN	---	MCF
Black Range mountainsnail	*Oreohelix metcalfei acutidiscus*	---	SEN	---	PMG-PJW/Rck
Black Range mountainsnail	*Oreohelix metcalfei metcalfei*	---	SEN	---	PMG-MCF/Rck
Mineral Creek mountainsnail	*Oreohelix pilsbryi*	FSC	SEN	ST	PJW/Rck
Morgan Creek mountainsnail	*Oreohelix swopei*	---	SEN	---	MCF
subalpine mountainsnail	*Oreohelix subrudis*	---	SEN	---	PJW-SCF/Rck
desert viceroy butterfly	*Limenitis archippus obsoleta*	FSC	---	---	CDS-DGR/Rip
Moore's fairy shrimp	*Streptocephalus morrei*	---	---	SSC	CDS/Wet
FISH (8 taxa)					
Rio Grande cutthroat trout	*Oncorhynchus clarkii virginalis*	FC	SEN	SSC	MCF-SCF/Aq
Gila trout	*Oncorhynchus gilae*	FT	SEN	ST	MCF-SCF/Aq
longfin dace	*Agosia chrysogaster*	---	SEN	---	PMG-MCF/Aq
headwater chub	*Gila nigra*	FC	SEN	SE	CDS-PJW/Aq
Rio Grande chub	*Gila pandora*	---	---	SSC	CDS-PJW/Aq
Rio Grande silvery minnow	*Hybognathus amarus*	FE/CH	---	SE	CDS-PJW/Aq
Sonora sucker	*Catostomus insignis*	FSC	---	SSC	CDS-MCF/Aq

COMMON NAME	SCIENTIFIC NAME	STATUS			HABITAT
		USFWS	USFS	NM	
White Sands pupfish	*Cyprinodon tularosa*	FSC	---	ST	CDS/Aq
AMPHIBIANS (2 taxa)					
Chiricahua leopard frog	*Lithobates chiricahuensis*	FT	---	SSC	CDS-MCF/Aq
Arizona toad	*Anaxyrus microscaphus microscaphus*	---	SEN	SSC	PMG-MCF/Aq
REPTILES (2 taxa)					
Big Bend slider	*Trachemys gaigeae*	---	---	SSC	CDS/Aq
Narrow-headed gartersnake	*Thamnophis rufipunctatus*	PT/PCH	SEN	ST	PJW-MCF/Aq
BIRDS (27 taxa)					
Brown Pelican	*Pelecanus occidentalis*	---	---	SE	CDS,DGR/Aq
Neotropic Cormorant	*Phalacrocorax brasilianus*	---	SEN	ST	DGR-MCF/Aq
Northern Goshawk	*Accipiter gentilis*	FSC	SEN	SSC	MCF
Common Black-hawk	*Buteogallus anthracinus*	FSC	SEN	ST	CDS-MCF/Rip
Bald Eagle	*Haliaeetus leucocephalus*	---	SEN	ST	CDS-MCF/Rip
Northern Aplomado Falcon	*Falco femoralis septentrionalis*	FE	---	SE	CDS-DGR
American Peregrine Falcon	*Falco peregrinus anatum*	FSC	SEN	ST	CDS-MCF/Rck
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	FSC	---	ST	CDS-MCF
Mountain Plover	*Charadrius montanus*	FSC	---	SSC	DGR,PMG
Least Tern	*Sterna antillarum athalassos*	FE	---	SE	CDS-PJW/Aq
Black Tern	*Chilodonias niger*	FSC	---	---	CDS-PJW/Wet
Common Ground-dove	*Columbina passerina pallescens*	---	SEN	SE	CDS-DGR
Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	FC	SEN	SSC	CDS-PJW/Rip
Mexican Spotted Owl	*Strix occidentalis lucida*	FT/CH	---	SSC	PJW-SCF
Western Burrowing Owl	*Athene cunicularia hypugaea*	FSC	SEN	---	CDS,DGR,PMG
Elegant Trogon	*Trogon elegans canescens*	---	---	SE	MCF/Rip
Broad-billed Hummingbird	*Cynanthes latirostris magicus*	---	---	ST	CDS-PJW/Rip
Lucifer Hummingbird	*Calothorax lucifer*	---	---	ST	CDS-DGR
Costa's Hummingbird	*Calypte costae*	---	SEN	ST	CDS
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	FE/CH	---	SE	CDS-MCF/Rip,Wet

COMMON NAME	SCIENTIFIC NAME	STATUS			HABITAT
		USFWS	USFS	NM	
Thick-billed Kingbird	*Tyrannus crassirostris*	---	---	SE	CDS-PJW/Rip
Loggerhead Shrike	*Lanius ludovicianus*	---	---	SSC	CDS,DGR,PMG
Bell's Vireo	*Vireo bellii*	FSC	SEN	ST	CDS-PJW/Rip
Gray Vireo	*Vireo vicinior*	---	SEN	ST	PJW
Sprague's Pipit	*Anthus spragueii*	FC	SEN	---	CGR, PMG
Baird's Sparrow	*Ammodramus bairdii*	FSC	---	ST	DGR,PMG
Varied Bunting	*Passerina versicolor*	---	---	ST	CDS/Rip
MAMMALS (19 taxa)					
Arizona myotis	*Myotis occultus*	---	---	SSC	CDF-MCF/Rip
Yuma myotis	*Myotis yumanensis*	---	---	SSC	CDS-DGR/Water
long-eared myotis	*Myotis evotis evotis*	---	SEN	SSC	MCF-SCF
fringed myotis	*Myotis thysanodes thysanodes*	---	---	SSC	DGR-MSC
long-legged myotis	*Myotis volans interior*	---	---	SSC	MCF
western small-footed myotis	*Myotis ciliolabrum melanorhinus*	---	---	SSC	PJW-MCF
Allen's big-eared bat	*Idionycteris phyllotis*	FSC	SEN	SSC	MCF/Rip,Rck
Townsend's pale big-eared bat	*Corynorhinus townsendii pallescens*	FSC	SEN	SSC	CDS-MCF
Gunnison's prairie dog	*Cynomys gunnisoni*	---	SEN	SSC	PMG
desert pocket gopher	*Geomys aernarius brevirostris*	---	---	SSC	CDS-DGR
White Sands woodrat	*Neotoma micropus leucophaea*	FSC	---	---	CDS-DGR
long-tailed vole	*Microtus longicaudus*	---	SEN	---	MCF/Rip
Pecos River muskrat	*Ondatra zibethicus ripensis*	---	---	SSC	CDS-PJW/Aq
Mexican gray wolf	*Canis lupus baileyi*	FE	---	SE	PJW,MCF
ringtail	*Bassariscus astutus*	---	---	SSC	DGR-PJW/Rip
black-footed ferret	*Mustela nigripes*	FE	---	---	CDS-PJW
western spotted skunk	*Spilogale gracilis*	---	---	SSC	CDS-PJW
common hog-nosed skunk	*Conepatus leuconotus*	---	---	SSC	CDS-MWD
desert bighorn sheep	*Ovis canadensis mexicana*	---	SEN	---	DGR-SAG/Rck


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