

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
LAHONTAN REGION

**BOARD ORDER NO. R6T-2010-0015**  
**WDID NO. 6A020405008**  
**NPDES NO. CA0103209**

**WASTE DISCHARGE REQUIREMENTS AND  
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT**

**FOR**

**CALIFORNIA DEPARTMENT OF FISH AND GAME  
PAIUTE CUTTHROAT TROUT RESTORATION PROJECT**

\_\_\_\_\_ Alpine County \_\_\_\_\_

The California Regional Water Quality Control Board, Lahontan Region (Water Board) finds:

1. Discharger

The California Department of Fish and Game (hereinafter Discharger) is responsible for carrying out a variety of fishery management activities. These activities are designed to protect and maintain valuable aquatic ecosystems and sport fisheries. The Discharger is also responsible under State and federal law for the restoration and protection of threatened and endangered species.

2. Project Purpose

The Discharger, in cooperation with the U.S. Fish and Wildlife Service (USFWS) and the U.S. Department of Agriculture, Humboldt-Toiyabe National Forest (USFS), proposes to use the aquatic pesticide rotenone as part of recovery efforts for Paiute Cutthroat Trout, *Oncorhynchus clarki seleniris*, at Silver King Creek. Paiute Cutthroat Trout is one of the rarest subspecies of trout in North America, indigenous only to the Silver King Creek watershed. Paiute Cutthroat Trout was listed by the USFWS as federally endangered on October 13, 1970 (Federal Register 35:16047) and reclassified as federally threatened on July 16, 1975 (Federal Register 40:29863). Rotenone will be used to eradicate introduced fish species that can out-compete and interbreed with Paiute Cutthroat Trout, from portions of Silver King Creek and associated tributaries, prior to introduction of the native trout.<sup>1</sup>

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<sup>1</sup> U.S. Fish and Wildlife Service (USFWS), 2004. Revised Recovery Plan for the Paiute Cutthroat Trout (*Oncorhynchus clarkia seleniris*). Portland, Oregon. Ix + 105 pp.).

The Paiute Cutthroat Trout was successfully reintroduced to upper portions of Silver King Creek, above a natural fish barrier (Llewellyn Falls), following rotenone treatments in 1991, 1992, and 1993. The Discharger is concerned that non-native fish from below this barrier could be introduced by humans into the area where the pure population of Paiute Cutthroat Trout has been reestablished, threatening restoration efforts. The current project would help safeguard the restoration of Paiute Cutthroat Trout by re-introducing the endangered fish to six miles of the main-stem Silver King Creek downstream of Llewellyn Falls, and five miles of associated tributary streams, all of which comprise the historic range of the fish.

This project is identified in the USFWS Revised Recovery Plan for the Paiute Cutthroat Trout (2004)<sup>1</sup> as Priority 1: an action that must be undertaken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

### 3. Rotenone

Rotenone is a naturally-occurring pesticide found in the roots of certain plants. It is used for insect control and for fisheries management. Rotenone acts by interfering with oxygen use. It is especially toxic to fish because it is readily absorbed through the gills.

The California Department of Pesticide Regulation (DPR) regulates rotenone as a restricted material. Commercial rotenone formulations contain certain "inert" ingredients (solvents, dispersants, emulsifiers, etc.) as well as the active ingredient rotenone.

The active ingredient rotenone and some of the inert ingredients are potentially toxic chemicals. Chemical concentration, duration and route of exposure must all be considered in determining potential risk to non-target organisms. At the concentrations proposed for the Silver King Creek project, the rotenone formulations will be toxic to fish and may be toxic to other gill breathing organisms such as amphibians in aquatic life stages, and aquatic organisms such as invertebrates. There is no evidence of adverse effects to humans or terrestrial wildlife such as deer from incidental contact (for example, through drinking water) with rotenone formulation ingredients applied to surface waters at concentrations typical of fishery management projects.

Under normal field conditions (water temperature greater than 5 °C), when applied to water, rotenone breaks down naturally to non-toxic substances via photooxidation and biodegradation within approximately five days. Inert ingredients in rotenone product formulations are generally more volatile chemically, and are subject to dissipation by volatilization, as well as photooxidation and biodegradation, typically dissipating within two weeks under natural, normal conditions. Both rotenone and inert formulation ingredients will be detoxified by oxidation with potassium permanganate in the project neutralization zone at an accelerated rate of between 15 to 30 minutes. Rotenone binds readily to organic matter in soil where it is held in place and is detoxified by natural processes such as microbial biodegradation. Consequently, rotenone does not persist as a pollutant in groundwater.

#### 4. Project Location

The Discharger will apply rotenone formulation and potassium permanganate into Silver King Creek and associated tributaries between Snodgrass Creek (Silver King Canyon) and Llewellyn Falls (see map, Attachment A). The project area is within the East Fork Carson River Hydrologic Unit, Markleeville Hydrologic Area (Hydrologic Unit #632.10).

#### 5. Basin Plan

In compliance with the Porter-Cologne Water Quality Control Act, the Water Board adopted an updated *Water Quality Control Plan for the Lahontan Region* (Basin Plan) that became effective on March 31, 1995. The Basin Plan incorporates State Water Resources Control Board (State Water Board) plans and policies by reference, contains beneficial use designations and water quality objectives for all waters of the Lahontan Region, and provides a strategy for protecting beneficial uses of surface and ground waters throughout the Lahontan Region. The Basin Plan can be viewed or downloaded on the Internet at [http://www.swrcb.ca.gov/rwqcb6/BPlan/BPlan\\_Index.htm](http://www.swrcb.ca.gov/rwqcb6/BPlan/BPlan_Index.htm), reviewed at the Water Board office, or purchased at a nominal cost. This permit implements the Basin Plan.

#### 6. Water Board Policy for Discharger Rotenone Use

In 1990, the Regional Board adopted Resolution No. 6-90-43, amending the Basin Plan to permit limited use of the fish toxicant rotenone by the Department of Fish and Game (DFG). The Regional Board and the Discharger entered into a 1990 MOU to facilitate implementation of the amendments. The MOU specifies the detailed information to be provided by the DFG (Discharger) to the Regional Board before undertaking a rotenone application project, and the type of pre- and post-project monitoring to be undertaken. It also sets forth the criteria to be used by the Regional Board Executive Officer in evaluating rotenone application projects. The Basin Plan rotenone policy allows use of rotenone by the DFG (Discharger) for certain specific types of fishery management activities, including restoration or enhancement of threatened or endangered species. Eligibility criteria and conditions are set forth in Chapter 4 of the Basin Plan. For DFG (Discharger) projects meeting the eligibility criteria and conditions, the Basin Plan rotenone policy allows the Water Board the ability to grant the Discharger a variance from meeting Basin Plan water quality objectives (such as the pesticides and toxicity objectives) that would otherwise apply.

DFG (Discharger) Requirements to qualify for a variance to execute rotenone projects are given in Chapter 4 of this Basin Plan, under the section entitled "Rotenone Use in Fisheries Management," and are listed in section 14 of this Order. Water quality objectives for rotenone are in Chapter 3 of this Basin Plan, under the

section entitled "Water Quality Objectives for Fisheries Management Activities Using the Fish Toxicant Rotenone." This includes rotenone project specific water quality objectives for color, pesticides, species composition, and toxicity, which are covered in detail in the Monitoring and Reporting Program Section of this Order.

## 7. Reason for Action

In 2001, the Ninth Circuit Court of Appeals held that point-source discharges of pollutants associated with use of aquatic pesticides in waters of the United States require a National Pollutant Discharge Elimination System (NPDES) permit if the pollutant leaves any residue in the water after its application that would qualify as a chemical waste product. (Headwaters, Inc. v. Talent Irrigation District<sup>2</sup>) In 2005, the Ninth Circuit further held that the use of aquatic pesticides applied intentionally and in accordance with the EPA-approved FIFRA label does not require an NPDES permit if there are no unintended effects associated with the use of the product and no residue remains after the pesticide performs its intended function. (Fairhurst v. Hagener)<sup>3</sup> In 2009, the Sixth Circuit Court of Appeal vacated EPA's regulation exempting pesticides applied in accordance with the FIFRA label from NPDES permit requirements as inconsistent with the Clean Water Act. (National Cotton Council of America v. U.S. E.P.A.)<sup>4</sup> Accordingly, because of the likelihood of unintended effects on macroinvertebrates from the application of rotenone at some or all project locations, the discharge of pollutants associated with the application of rotenone for the Silver King Creek Project requires an NPDES permit.

## 8. Project Description

The Discharger proposes to apply rotenone in September 2010, with a second treatment planned for August or September 2011. A third treatment could be scheduled for 2012 if it is necessary to ensure complete eradication of non-native fish (for the purposes of this permit, non-native fish refer to any fish species capable of interbreeding with pure Paiute Cutthroat trout (PCT) , or capable of significant competition with PCT for their ecological niche in Silver King Creek).

Under this permit, the Discharger will use CFT Legumine. Use of other formulations is not authorized under this permit.

CFT Legumine: The CFT Legumine<sup>TM</sup> formulation contains approximately 5% rotenone, 10% methyl pyrrolidone (MP), 60% diethylene glycol monoethyl ether (DEGEE), 17% Fennodefo 99<sup>TM</sup> (Fennodefo), and 3% other compounds (CDFG, 2007).<sup>5</sup> The two primary inactive carrier components in CFT Legumine<sup>TM</sup> are MP and DEGEE, which comprise approximately 93 percent of the formulation by weight. Both of these

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<sup>2</sup> Headwaters, Inc. v. Talent Irrigation District, (9<sup>th</sup> Cir. 2001) 243 F.3d 526.

<sup>3</sup> Fairhurst v. Hagener (9<sup>th</sup> Cir. 2005) 422 F.3d 1146;

<sup>4</sup> Nat'l Cotton Council of America v. U.S.E.P.A., (6<sup>th</sup> Cir. 2009) 553 F.3d 927.

<sup>5</sup> California Department of Fish and Game (CDFG). 2007. Lake Davis Northern Pike Eradication EIS/EIR.

chemicals are infinitely soluble in water and have an estimated organic carbon partition coefficient (i.e., the “ $K_{oc}$ ”) of 12, indicating their water solubility and tendency not to adsorb to sediment particles.<sup>4</sup> Based on their low Henry’s Law constants, these chemicals do not readily volatilize from surface water, and neither chemical is expected to undergo hydrolysis or direct photolysis.<sup>4</sup>

Aerobic biodegradation would be the most important mechanism for the removal of 1-methyl-2-pyrrolidinone and diethylene glycol monoethyl ether from aquatic systems. The small amount of these chemicals that may volatilize into ambient air would be readily degraded by reaction with photochemically-produced hydroxyl radicals, with an atmospheric half-life of up to 12 hours (NLM, 2006).<sup>6</sup> The Fennodefo 99™ constituent in CFT Legumine facilitates emulsification and dispersion of the otherwise relatively insoluble rotenone. Two classes of constituents, polyethylene glycols (PEGs) and the solvent (alcohol) hexanol, are part of the inert additive Fennodefo 99™ in CFT Legumine, which also contains fatty acid esters. As stated in the “Screening Level Risk Analysis of Previously Unidentified Rotenone Formulation Constituents Associated with the Treatment of Lake Davis,” (ENVIRON 2007)<sup>7</sup>, the fatty acid ester mixture in Fennodefo 99™ is likely derived from ‘tall oil’. Tall oil has been independently reported as a mixture of naturally occurring fatty acids, resins and neutrals that are a by-product of wood pulp, and is a common constituent of soap formulations. The fatty acids in tall oil, principally oleic and linoleic acids, are naturally occurring constituents that are also part of the building blocks that make up fats and oils (triglycerides). Highly unsaturated fatty acids, like linoleic, are considered essential dietary constituents in humans, as they cannot be synthesized. Polyethylene glycols (e.g., propylene glycol) are common ingredients in a variety of consumer products, including soft drink syrups (as an antioxidant), in plasticizers, suntan lotions and antifreeze, among other uses.<sup>4</sup>

The structures and oral toxicities of the two most concentrated constituents in CFT Legumine are summarized below.

#### DIETHYLENE GLYCOL MONOETHYL ETHER

- Approximate concentration in formula: 569,000 mg/L
- Toxicology: RAT ORAL LD50: 4,700-9,740 mg/kg.
- Chemical formula: C<sub>6</sub>H<sub>14</sub>O<sub>3</sub>
- Chemical structure: C<sub>2</sub>H<sub>5</sub>OCH<sub>2</sub>CH<sub>2</sub>OCH<sub>2</sub>CH<sub>2</sub>OH

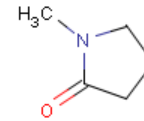


<sup>6</sup> National Library of Medicine (NLM). 2006. *Hazardous Substances Data Bank (HSDB)*. Toxicology Data Network (TOXNET), On-Line Database <toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB>. National Institutes of Health, Department of Health and Human Services, Bethesda, MD. Reviewed April 2, 2006.

<sup>7</sup> ENVIRON International Corporation. 2007. Screening Level Risk Analysis of Previously Unidentified Rotenone Formulation Constituents Associated with the Treatment of Lake Davis. Prepared by Jeff Fisher for California Department of Fish and Game. September 17, 2007.

### 1-METHYL-2-PYRROLIDINONE

- Approximate concentration in formula: 90,000 mg/L
- Toxicology: RAT ORAL LD50: 3,914 mg/kg
- Chemical formula: C<sub>5</sub>H<sub>9</sub>NO



CFT Legumine™ will be applied to achieve a target concentration of 0.5 to 1.0 mg/L formulation (25 to 50 µg/L rotenone) to all flowing streams. The discharge will take place over a period of 4-6 hours. Rotenone will be applied to streams using drip stations, with hand spraying in backwater areas as necessary. Mini-drips and gel or sand matrices may be used on small seeps if the possibility exists that they provide a sufficient amount of fresh water that fish may use to escape from treated waters.

To contain the effects of rotenone within the project area and prevent a fish kill downstream of the Silver King Canyon, a neutralization station would be operated near Snodgrass Creek. The oxidizing agent potassium permanganate would be applied to Silver King Creek near Snodgrass Creek to neutralize rotenone, approximately 0.75 miles downstream of the lowest falls in Silver King Canyon.

Potassium permanganate would be applied at the resulting concentration of 2 to 4 mg/L. A generator powered auger would be used to apply the granular potassium permanganate. A back-up auger system would be on site in the event of primary auger failure. Potassium permanganate could also be applied from 30 to 55 gallon drums in a liquid form as a backup. The project area extends to the 30-minute travel time mark, which prior experience has shown to be approximately one-quarter to one-half mile downstream of the potassium permanganate infusion station (see Section 12 for a more detailed explanation of the neutralization zone). A 1 mg/L potassium permanganate residual would be maintained at the 30-minute travel time downstream location by increasing or decreasing the amount of permanganate to ensure complete neutralization of rotenone leaving the project area.

Block nets would be placed at selected locations throughout the project area to catch the dead fish. Dead fish collected at the block nets would be buried no closer than 300 feet from the stream and away from known camping areas to minimize bear/human interactions. The USFS would approve all burial sites before any ground disturbing activity occurred. Fish not collected at the block nets would be left in the stream to decompose and become part of the food chain. The Discharger evaluated the potential toxicity of these dead fish to foraging wildlife in its Programmatic Environmental Impact Report, *Rotenone Use for Fisheries Management, July 1994*, and concluded that foraging wildlife will not be adversely affected by consuming these fish.

During the treatment, water quality will be monitored. The monitoring would determine: 1) that effective piscicide concentrations of rotenone are applied; 2) that complete degradation of rotenone has occurred prior to the resumption of public contact; and 3) that rotenone toxicity does not occur outside the project area. An analytical laboratory would analyze water samples for rotenone and rotenolone concentrations as well as for volatile organic compound and semi-volatile organic compound concentrations. Table 1

gives the project treatment chemical concentration ranges and analytical reporting limits.

**Table 1. CFT Legumine® Formulation and Potassium Permanganate: Treatment Concentrations and Reporting Limits**

Chemical Name	Treatment Concentration (Est.) <sup>1</sup>	Reporting Limit
	ug/l	ug/l
Rotenone (active ingredient)	25.5 - 50.9	2
Rotenolone	3.67 - 7.34	2
1-Methyl-2-pyrrolidinone (Methyl pyrrolidone)	49.5 - 98.9	5
Diethylene glycol monoethyl ether (Diethylene glycol ethyl ether)	305 - 610	5
1-Hexanol	2.12 - 4.14	5
sec-Butylbenzene	0.00195 - 0.0039	0.3
1-Butylbenzene (n-Butylbenzene)	0.0120 - 0.0239	0.3
1,4-diethylbenzene	0.25 - 0.50	5
1,2,4-Trimethylbenzene	0.0174 - 0.0348	0.2
1,3,5-Trimethylbenzene (mesitylene)	0.002 - 0.004	0.1
1,2,4,5-tetramethylbenzene	0.201 - 0.402	5
Toluene	0.111 - 0.222	0.5
4-Isopropyltoluene (isopropyltoluene)	0.00255 - 0.0051	0.3
Methylnaphthalene	0.07 - 0.14	5
Naphthalene	0.127 - 0.253	5
Potassium Permanganate	2.0-4.0 mg/L	0.00288 mg/L

<sup>1</sup> Range corresponds to 0.5 to 1.0 mg/L rate of CFT-Legumine product application

9. Project Boundaries

The Basin Plan defines the project boundaries for rotenone projects as encompassing the treatment area, the detoxification area, and the area downstream of the detoxification station at Snodgrass Creek, up to a thirty-minute in-stream travel time. The project boundaries are determined in the field based on stream flow measurements immediately prior to treatment.

## 10. Proposition 65 Considerations

Four inert ingredients present in one or both proposed rotenone formulations (N-methyl-2-pyrrolidone, toluene, trichloroethylene, and naphthalene) are on the Proposition 65 list of chemicals known to the state of California to cause cancer or reproductive toxicity.

The Proposition 65 statute is contained in California Health and Safety Code sections 25249.5-25249.13. Proposition 65 prohibits the discharge of chemicals known to cause cancer or reproductive toxicity. The California Department of Public Health is the state agency responsible for enforcing Proposition 65.

Section 25249.5 states that “No person in the course of doing business shall knowingly discharge or release a chemical known to the state to cause cancer or reproductive toxicity into water or onto or into land where such chemical passes or probably will pass into any source of drinking water.” Proposition 65 defines “person” for purposes of its prohibitions as “an individual, trust, firm, joint stock company, corporation, company, partnership, limited liability company, and association.” (Section 25249.11, subd. (a).) Proposition 65 specifically states that “person in the course of doing business” does not include “the state or any department or agency thereof or the federal government or any department or agency thereof.” (Section 25249.11, subd. (b).) Thus, because neither the state government nor the federal government nor their respective agencies and departments are “persons” or “persons in the course of doing business” within the meaning of Proposition 65, the prohibition in Section 25249.5 does not apply to the Discharger.

## 11. Impacts to Non-target Aquatic Life—Benthic Macroinvertebrates

Rotenone treatment is expected to have short-term (yearly) effects on benthic macroinvertebrate communities (invertebrates are expected to repopulate treated areas following treatment and beneficial uses must be restored within two years of the final treatment). The Discharger conducted benthic macroinvertebrate monitoring studies before, during, and for three consecutive years following rotenone treatments that occurred in portions of the Silver King Creek basin in 1991 through 1993. The Discharger also conducted a study of rotenone impacts on macroinvertebrates in Silver Creek (Mono County), which was treated for three years from 1994 to 1996. (Trumbo et al., 2000a<sup>8</sup> and 2000b<sup>9</sup>). These studies] suggested that rotenone may have short-term impacts (yearly) to sensitive aquatic invertebrates . . .” Based on those studies and the

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<sup>8</sup> Trumbo, J., S. Siepmann, and B. Finlayson. 2000a. Impacts of rotenone on benthic macroinvertebrate populations in Silver King Creek, 1990 through 1996. Office of Spill Prevention and Response, Administrative Report 00-5, March 2000. Pesticide Investigations Unit, Office of Spill Prevention and Response, California Department of Fish and Game. 40 p.

<sup>9</sup> Trumbo, J., S. Siepmann, and B. Finlayson. 2000b. Impacts of rotenone on benthic macroinvertebrate populations in Silver Creek, 1994 through 1998. Office of Spill Prevention and Response, Administrative Report 00-7, December 2000. Pesticide Investigations Unit, Office of Spill Prevention and Response, California Department of Fish and Game. 37 p.



metrics evaluated, the Discharger concluded that the data do not suggest any significant long-term (greater than one year, up to five years, the study period) impacts to invertebrates lasting beyond the study periods. Vinson and Vinson (2007)<sup>10</sup> could not find long term impacts of rotenone treatments to aquatic macroinvertebrates in the dataset they reviewed for the Silver King Creek basin.

The Discharger submitted the Silver King Macroinvertebrate Monitoring Plan, August 2007-2015, including plans for pre- and post-project macroinvertebrate surveys and statistical analysis. This monitoring plan incorporates recommendations by Vinson. The Discharger will implement in the Monitoring and Reporting Program as part of the current project.

At this time, no macroinvertebrate species have been identified that are strictly endemic to the Silver King Creek basin. However, several studies suggest that springs are likely habitat for rare and endemic species, such as spring snails, which have not been detected in macroinvertebrate surveys. Mitigation measures to protect potential rare and endemic species include using the lowest concentration of rotenone formulation yet still maintaining efficacy of treatment, not treating headwater tributaries that are deemed fishless at time of treatment, and not treating springs and seeps that are determined to be fishless. Protocol for and protection of potential rare and/or endemic species involves: surveying springs and seeps in the project area for non-native fish, with subsequent flagging and mapping of fishless refugia, which will not be treated with rotenone (see Monitoring and Reporting Program for a more detailed description). Additionally, since treatment will occur in late summer/early fall, springs and ephemeral surface waters dry at the time of treatment will not be treated.

## 12. Impacts to Non-target Aquatic Life—Amphibians

Amphibians in the terrestrial life stage should not be affected by the rotenone treatment. However, amphibians in the gill breathing life stages are susceptible, if present.

Sierra Nevada yellow-legged frogs (formerly known as mountain yellow-legged frog) (*Rana sierrae*, formerly *muscosa*) are known to inhabit portions of the Silver King Creek basin. No Yosemite toads (*Bufo canorus*) have been found in the basin. Silver King is at the northern extent of the range of the Yosemite toad. Some toads were thought to be hybrids, and it is now thought that these were western toads (*Bufo boreas*). Sierra Nevada yellow-legged frogs and Yosemite toads are candidates for listing under the federal Endangered Species Act. The Discharger recently completed six years of amphibian surveys within the project area and nearby upstream areas. Although Sierra Nevada yellow-legged frogs have been found in certain areas upstream of the project area (Upper Fish Valley and Fly Valley Creek), none have been observed in the project

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<sup>10</sup> M. R. and D.K. Vinson. 2007. An analysis of the effects of rotenone on aquatic invertebrate assemblages in the Silver King Creek Basin, California. Moonlight Limnology. Report Prepared for the Humboldt-Toiyabe National Forest. 255 pp.

area. A few Western toad/Yosemite toad adult and terrestrial sub-adult hybrids were observed within the project area. Discharger biologists determined that during the August 2004 and 2005 surveys, tadpoles within the project area had already metamorphosed into terrestrial lifestages due to an early spring/summer and low water year.

The Discharger will conduct additional amphibian surveys immediately before treatment, according to protocols described in the Monitoring and Reporting Program. If adult or tadpole life stages of any threatened, endangered, sensitive, candidate or rare amphibians are found during pre-project surveys, they will be captured by net and relocated out of the project area to suitable nearby habitat.

### 13. Past Discharger Rotenone Projects in the Lahontan Region

The Discharger has completed several rotenone projects in the Lahontan Region since the late 1980s. Those projects included treatments of portions of the Upper Truckee River (Alpine County), Mill Creek (Mono County), Silver Creek (Mono County) Wolf Creek (Mono County), and the 1991-1993 treatments in upper portions of the Silver King Creek drainage for Paiute Cutthroat Trout restoration.

The Water Board waived waste discharge requirements for those projects. Following the Ninth Circuit Court of Appeal's decisions in Headwaters, Inc. v. Talent Irrigation District and Fairhurst v. Hagener, and the Sixth Circuit Court of Appeal's decision in National Cotton Council of America v. U.S. E.P.A., NPDES permits are required for the discharge of aquatic pesticides to waters of the U.S. if any residue remains after the pesticide has performed its intended function or there are any unintended effects of the use of the pesticide. Because of the likelihood of unintended effects on macroinvertebrates from the application of rotenone throughout the project area, there is no basis to waive waste discharge requirements for this rotenone treatment project.

On July 6, 2005, the Discharger received an NPDES permit from the State Water Board (Order No. 2005-0010-DWQ) for a rotenone treatment project in the Silver King Creek drainage for Paiute Cutthroat Trout restoration. Californians for Alternatives to Toxics and several other organizations and individuals filed suit in both state and federal court seeking to have the NPDES permit vacated and to enjoin the Discharger (in the state case) and USFS (in the federal case) from engaging in any acts in reliance on that permit.

The state case was filed in the Sacramento County Superior Court and the petitioners sought a writ of mandate (Case No. 050501160). On September 12, 2005, the Court denied the petitioners' application for a temporary restraining order. In so doing, the Court found a "strong and legitimate interest in preserving the Paiute cutthroat trout." The petitioners subsequently dismissed the state case after the federal district court issued an injunction barring the project.

The federal case was filed in the United States District Court, Eastern District of California (Case No. Civ. S-05-1633 FCD KJM). The district court issued a temporary restraining order on August 31, 2005 and a preliminary injunction on September 1, 2005, prohibiting USFS from conducting or allowing to be conducted any portion of the Paiute cutthroat trout restoration project. The Court found both that the plaintiffs demonstrated a strong likelihood of success on their claim that macroinvertebrates would be irreparably harmed and that they raised serious questions as to the adequacy of the USFS's Environmental Assessment and as to whether USFS should have conducted an Environmental Impact Statement.

On September 30, 2005, the Discharger requested that the State Water Board rescind the NPDES permit for the project. On October 20, 2005, the State Water Board rescinded the NPDES permit.

The Discharger has historically conducted several rotenone treatments in the Lahontan Region. These are detailed in the environmental document (USFWS/CDFG, 2010<sup>11</sup>). Lessons learned from these earlier treatments, involving both success and failure, were used to develop improved field methods using state-of-the-art equipment and a more robust command and control structure. The current project uses a precision dry-chemical permanganate dispensing auger that is inherently more reliable, with less potential for breakdown, error, freezing, etc., than the former system of dispensing permanganate solutions. The current command and control structure includes real-time field permanganate testing at the two-and thirty-minute stream travel times below the neutralization station, with immediate communication between neutralization station staff and the samplers. These three sites in the neutralization area will be attended by Discharger staff continuously, day and night, during project implementation.

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<sup>11</sup> USFWS/CDFG. 2010. Final EIS/EIR, Paiute Cutthroat Trout Recovery Project.

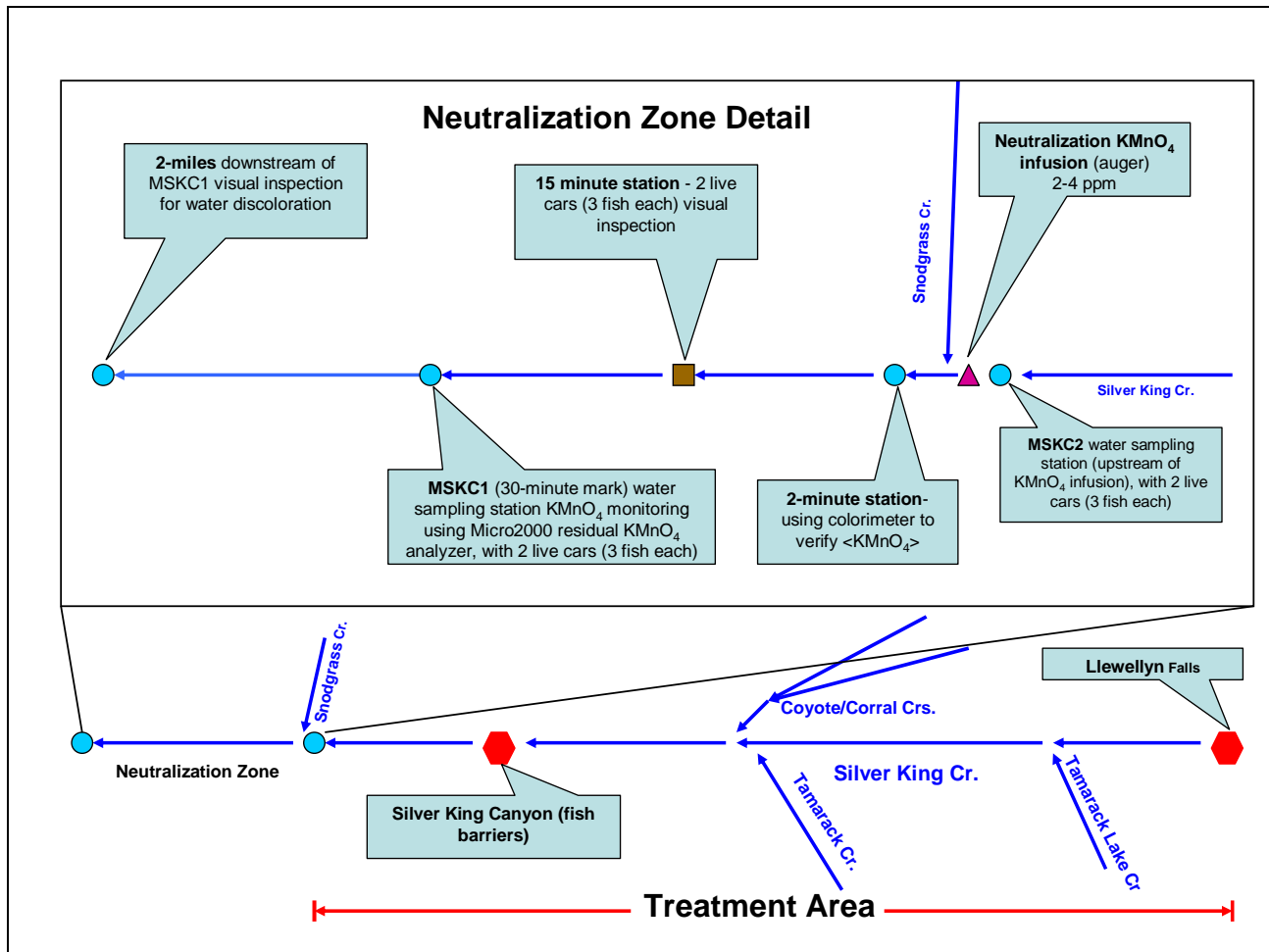


Figure 1: Silver King Creek Paiute Cutthroat Trout Restoration Project Treatment Area with Neutralization Zone Detail

Figure 1 depicts the chain of components in the neutralization system along Silver King Creek. From right-to-left, the upstream sampling station (MSKC2) with the first trout toxicity test station; the potassium permanganate (KMnO<sub>4</sub>) Neutralization infusion station; the first KMnO<sub>4</sub> sampling station at the two-minute stream travel time mark; the second trout toxicity test station at the 15-minute mark; the downstream sampling station (MSKC1) including the third trout toxicity test station located at the 30-minute stream travel time below the KMnO<sub>4</sub> infusion station; and the water color inspection station two miles downstream of MSKC1. The lower project boundary is at MSKC1, which also serves as the point-of-compliance for rotenone and other constituents in the product formulation. Two miles below MSKC1 is the point-of-compliance for the color water quality objective, as required by the Basin Plan, Chapter 3, "Water Quality Objectives for Fisheries Management Activities Using the Fish Toxicant Rotenone" section.

#### 14. Project Information Submitted by Discharger Meets Requirements for Variance

Chapter 4 of the Basin Plan, under the section entitled "Rotenone Use in Fisheries Management" requires that rotenone projects meet the following conditions:

1. The purpose of the proposed project must be one of the following:
  - (a) The restoration and protection of threatened or endangered species.
  - (b) The control of fish diseases where the failure to treat could result in significant damage to fisheries resources or aquatic habitat.
  - (c) The elimination of prohibited species (as defined in CA Fish and Game Code section 2118), where competition or predation from such species threatens valuable sport fish or native fish populations, or populations of other valuable organisms.

*The Discharger's proposed project is eligible by virtue of the above condition 1.(a) for restoration of a threatened species (Paiute Cutthroat trout).*

2. Chemical residues resulting from rotenone treatment must not exceed the narrative or numerical limitations established in Chapter 3 of this Basin Plan, under the section entitled "Water Quality Objectives For Fisheries Management Activities Using the Fish Toxicant Rotenone."

*The Discharger has provided detailed plans for effective and complete neutralization of rotenone and formulation products using potassium permanganate, refined by historic rotenone treatment experience (see Finding 13). Additionally the Discharger must execute a comprehensive chemical monitoring plan for compliance.*

3. Within two years of the last treatment for a specific project, a fisheries biologist or related specialist from the DFG (Discharger) must assess the restoration of applicable beneficial uses to the treated waters, and certify in writing that those beneficial uses have been restored. A project will be considered to have been completed upon written acceptance by the Regional Board's Executive Officer of such certification.

*This Order requires that the DFG (Discharger) perform an assessment of restoration of applicable beneficial uses of treated water and certify in writing that those beneficial uses have been restored.*

4. Based on information and project plans submitted by the DFG (Discharger), the Regional Board's Executive Officer must determine that the proposed project will meet all applicable provisions (including subsequent amendments or revisions) of this Basin Plan, the DFG's (Dischargers) Environmental Impact Report *Rotenone Use for Fisheries Management* (1994) regarding rotenone use. Whenever the language contained in the above-mentioned documents may overlap, the requirements that will provide the most restrictive protection of water quality shall apply. Furthermore, the Regional Board's Executive Officer must determine that the project meets all of the following additional criteria:

(a) The limitations on chemical residue levels referenced in Condition #2 (above) can be met.

*See explanation below Condition #2 (above).*

(b) The planned treatment protocol will result in the minimum discharge of chemical substances that can reasonably be expected for an effective treatment.

*The Discharger is using a rotenone formulation containing no harmful synergists, such as piperonyl butoxide, with the least concentration of inert ingredients of any commercially available. The application concentrations used are the least that is possible, and still meet project objectives.*

(c) Chemical transport, spill contingency plans, and application methods will adequately provide for protection of water quality.

*The Discharger is required under this Order to provide adequate, detailed spill contingency plans and chemical handling and disposal plans*

(d) Suitable measures will be taken to notify the public, and potentially affected residents.

*The Discharger has detailed public notification requirements in the environmental document (USFWS/CDFG. 2010), and is required under this Order to carry out those requirements.*

(e) Suitable measures will be taken to identify potentially affected sources of potable surface and ground water intakes, and to provide potable drinking water where necessary.

*This does not apply to this project—no water intakes exist within or near the project area.*

(f) A suitable monitoring program will be followed to assess the effects of treatment on surface and ground waters, and on bottom sediments.

*The attached Monitoring and Reporting Program covers surface water monitoring. Monitoring of ground waters, and on bottom sediments are not a concern for the reasons given above.*

(g) For each project, the DFG (Discharger) has satisfied the requirements of the California Environmental Quality Act (CEQA).

*The Discharger has provided an adequate, certified environmental document (USFWS/CDFG. 2010).*

(h) The chemical composition of the rotenone formulation has not changed significantly (based on analytical chemical scans to be performed by the DFG (Discharger) on each formulation lot to be used) in such a way that potential hazards may be present which have not been addressed.

*The Discharger is required under this Order to provide up-to-date and detailed lot analysis of the rotenone formulation before project implementation.*

(i) Plans for disposal of dead fish are adequate to protect water quality.

*This Order requires proper disposal of dead fish following a protocol that is adequate to protect water quality.*

The project meets the Basin Plan eligibility requirements, as it is a restoration project for a federally threatened species, the Paiute Cutthroat Trout.

The Water Board has considered this information submitted by the Discharger and determined that this project meets Basin Plan conditions and eligibility criteria for Discharger rotenone projects. On that basis, the project qualifies for the variance, established in the Basin Plan, from meeting water quality objectives that would

otherwise apply. The project is subject, however, to specific water quality objectives for rotenone use contained in the Basin Plan, and to numeric criteria for priority pollutants contained in the California Toxics Rule, unless the project qualifies for an exception.

#### 15. Consideration of Alternatives to Chemical Treatment

The Discharger has considered alternatives to chemical treatment in the environmental document, and determined that rotenone treatment is the superior option to ensure the complete eradication of non-native fish necessary to reestablish the Paiute Cutthroat Trout for this project. The Water Board has reviewed the alternatives, and concurs that there is currently no other effective option available in California at this time.

#### 16. Beneficial Uses of Silver King Creek

The beneficial uses of Silver King Creek as set forth and defined in the Basin Plan are: Municipal and Domestic Supply, Agricultural Supply; Groundwater Recharge; Water Contact Recreation; Non-contact Recreation; Commercial and Sport Fishing; Cold Freshwater Habitat, Wildlife Habitat; Rare, Threatened or Endangered Species; and Spawning, Reproduction, and Development.

#### 17. Effluent Limitations

NPDES permits for discharges to surface waters must meet all applicable provisions of sections 301 and 402 of the CWA. These provisions require controls that use best available technology economically achievable (BAT), best conventional pollutant control technology (BCT), and any more stringent controls necessary to reduce pollutant discharges and meet water quality standards.

Pursuant to section 122.44(k)(3) of Title 40 of the Code of Federal Regulations (CFR), Best Management Practices (BMP) may be required in NPDES permits in lieu of numeric effluent limits, to control or abate the discharge of pollutants, when numeric effluent limits are infeasible. Numeric effluent limits for pollutant discharges associated with the application of rotenone formulation and potassium permanganate neutralizing agent are not feasible, because in this case there is no definable "effluent" upon which limits can be placed. Rotenone and potassium permanganate are commercial products of formulated chemical composition, rather than an effluent waste stream from a controllable process or activity.

After being mixed with receiving waters and achieving their intended effect, excess and residual amounts of these materials and their breakdown products may be considered pollutants. This permit requires that the Discharger implement BMPs to control or abate pollutants in the receiving water, and comply with numeric receiving water limitations. Those BMPs constitute BAT and BCT and will be implemented to minimize the area and duration of impacts caused by the discharge of aquatic pesticides in the treatment area.



This approach will allow for restoration of water quality and the long-term protection of beneficial uses of the receiving water following completion of a treatment event.

#### 18. California Toxics Rule

The U.S. Environmental Protection Agency (USEPA) promulgated the California Toxics Rule (CTR, Code of Federal Regulations, Title 40, Part 131.38), establishing numeric criteria for priority toxic pollutants for the State of California. The State Board adopted the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (State Implementation Policy), which establishes procedures for implementing water quality standards in NPDES permits. Section 5.3.1 of the State Implementation Policy allows the Water Board to grant short-term or seasonal categorical exceptions from meeting the CTR priority pollutant criteria/objectives for:

“resource or pest management (i.e., vector or weed control, pest eradication, or fishery management) conducted by public entities or mutual water companies to fulfill statutory requirements, including, but not limited to, those in the California Fish and Game, Food and Agriculture, Health and Safety, and Harbors and Navigation codes.”

The Discharger qualifies for this exemption, as it is a public entity (specifically the Department of Fish and Game), engaged in fulfilling a statutory requirement to restore Federally-threatened species, such as Paiute Cutthroat trout.

Among other requirements, entities seeking an exception to complying with water quality standards for priority pollutants must submit California Environmental Quality Act (CEQA, Public Resources Code Section 21000, et seq.) documents.

The Discharger prepared an EIS/EIR in compliance with CEQA. The Silver King Creek rotenone project meets the qualifications for a categorical exception from meeting CTR priority pollutant criteria/objectives, and an exception is granted in the provisions of this permit. Therefore, effluent and receiving water monitoring for priority pollutants, as described in the State Implementation Policy, is not required for this project.

#### 19. California Environmental Quality Act (CEQA) Compliance

This action to adopt an NPDES permit is exempt from the provisions of the California Environmental Quality Act (Public Resources Code Section 21000, et seq.) in accordance with Section 13389 of the California Water Code.

Though the Water Board's adoption of this NPDES permit is exempt from CEQA, pursuant to California Code of Regulations, title 14, section 15096, subdivision (g)(2), the Water Board is nonetheless proceeding as a CEQA Responsible Agency. The Water Board has evaluated the Paiute Cutthroat Trout Restoration Project EIS/EIR for potentially significant impacts to water quality, concurs with the EIS/EIR's findings

regarding significant water quality-related effects, and finds that there are no additional feasible, less-damaging alternatives or mitigation measures that would accomplish the project's objectives except for rotenone application.

While adoption of this NPDES permit by the Water Board is exempt from CEQA, Section 5.3 of the State Implementation Policy (SIP) requires public entities requesting exceptions from meeting CTR priority pollutant criteria/objectives to submit CEQA documentation to the Water Board for approval. In 1994, the Discharger completed a Programmatic Environmental Impact Report entitled *Rotenone Use for Fisheries Management, July 1994*. In addition, in 2009 the US Fish and Wildlife Service and the Discharger completed a joint NEPA/CEQA environmental document "Paiute Cutthroat Trout Recovery Project, Silver King Creek, Humboldt-Toiyabe National Forest, Alpine County, California," and filed a CEQA Notice of Determination for the project with the Governor's Office of Planning and Research on March 17, 2010. This CEQA documentation has been submitted to the Water Board and Water Board hereby finds the Discharger in compliance with SIP, Section 5.3 CEQA requirements.

California Code of Regulations, title 14, section 15096, subdivision (g)(2) states: "When an EIR has been prepared for a project, the Responsible Agency shall not approve the project as proposed if the agency finds any feasible alternative or feasible mitigation measures within its powers that would substantially lessen or avoid any significant effect the project would have on the environment."

California Code of Regulations, title 14, section 15096, subdivision (h) states: "The Responsible Agency shall make the findings required by Section 15091 for each significant effect of the project and shall make the findings in Section 15093 if necessary."

The Water Board's approval of this project will result in the following potentially significant and unavoidable impacts pursuant to California Code of Regulations, title 14, section 15091, subdivision (a), even with the implementation of all feasible mitigation:

- (1) The proposed Action could result in the loss of individual benthic macroinvertebrate taxa, potentially including rare (unquantified) and/or unidentified species endemic to Silver King Creek.
- (2) The proposed Action will result in temporary changes in species composition in non-target aquatic invertebrate communities.

Pursuant to California Code of Regulations, title 14, section 15093, subdivision (a)(1), "changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the final EIR" that apply to both impacts (1) and (2) above include:

- Removal of Tamarack Lake from the project area after extensive monitoring efforts during the Summer of 2009 that determined the lake to be fishless.

- Use CFT Legumine™ (liquid rotenone), a formulation that does not contain *pipeornyl butoxide* (pbo) a substance that has been shown to increase toxicity to aquatic macroinvertebrates. In addition, this formulation has been shown not to have adverse human health concerns.
- Use the lowest concentration of formulated rotenone, yet still maintain efficacy to reduce impacts non-target aquatic organisms.
- The Discharger will conduct pre-project amphibian surveys, and if any amphibians are encountered, the Discharger will relocate them to outside the project treatment area.
- The Discharger will identify fishless areas (tributary headwaters, springs, and seeps) that will not provide refugia for fish seeking to escape the chemical treatment and can be maintained in a fishless condition. These areas will serve as aquatic macroinvertebrate refugia for post-project recolonization. These designated non-treatment areas will be mapped (GPS) and flagged. These areas will not be chemically treated.

Pursuant to California Code of Regulations title 14, section 15093, subdivision (a)(1), a change or alteration required in, or incorporated into, the project to avoid or substantially lessen the significant environmental effect of impact (1) above only, is the identification by the Discharger of fishless tributary headwaters, springs, and seeps that will not provide refugia for fish seeking to escape the chemical treatment and can be maintained in a fishless condition. These designated non-treatment areas will be mapped (GPS), flagged, and will not be chemically treated. These areas will additionally serve as aquatic macroinvertebrate refugia for post-project recolonization. Additionally, the Water Board has imposed application specifications that prohibit the Discharger from applying rotenone when water temperatures are less than 5°C, to assure the effectiveness of treatment.

As a Responsible Agency, the Water Board pursuant to the California Code of Regulations, title 14, section 15093, subdivision (a)(3), the Water Board considers these potentially unavoidable adverse environmental effects. The adverse effects are “acceptable” because of the economic, legal, social, technological or other benefits of the project. These benefits include:

- Restoration of the native species Paiute Cutthroat Trout, representing heritage resources that future generations should be able to enjoy. These species of fish are of ecological, educational, historical, recreational, esthetic, economic, and scientific value to the people of this state, and the conservation, protection, and enhancement of these species and their habitat is of statewide concern.

- More than doubling the existing habitat for, and re-establishing Paiute cutthroat trout to its entire historic range. The reach of Silver King Creek between Llewellyn Falls and Silver King Canyon that will be recovered has more complexity and diversity than the existing habitat occupied by the Paiute cutthroat trout. The population estimates for the existing non-native hybridized populations downstream of Llewellyn Falls are approximately double that of the Paiute populations upstream of Llewellyn Falls.
- Removal of the principal threat to the continued existence of Paiute cutthroat trout by the eliminating sources of hybridized fish in close proximity to existing populations of the sub-species, which will effectively isolate the species in the Silver King Creek basin.
- Reduced threats from genetic bottlenecking and stochastic environmental events (e.g., forest fires and floods) through the expansion of habitat and connectivity with other populations within the Silver King Watershed.
- Accomplishing a critical and necessary step leading to the goal of eventually delisting the Paiute cutthroat trout from the federal Threatened Species List.
- Maintenance and expansion of fishless habitats in headwater habitats and lakes within the Silver King Creek watershed for the benefits of sensitive native amphibians and invertebrates.
- Restoration of native species in the Carson-Iceberg Wilderness is a benefit and the enhancement of the genetic diversity of the Paiute cutthroat trout will allow for less management by the Discharger, and would preserve and enhance the long-term wilderness and ecological values.

The Water Board finds that the biological and ecological, social, and other benefits of the project outweighs the significant and unavoidable adverse impacts of the project and is therefore "acceptable", pursuant to California Code of Regulations, title 14, section 15093, and consistent with the Discharger's statement of overriding considerations (CDFG, 2010<sup>12</sup>).

## 20. Nondegradation/Antidegradation

The Water Board has made certain findings consistent with State Water Resources Control Board (State Board) Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California", and with the Federal Antidegradation Policy contained in 40 CFR 131.12, that allowing the temporary degradation of water quality, which will result from implementation of the proposed project, is necessary to

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<sup>12</sup> CDFG, 2010. CEQA Findings of Fact And Statement of Overriding Considerations of the California Department of Fish And Game for the Paiute Cutthroat Trout Restoration Project, March 8, 2010.

protect and maintain important economic and social resources. Specifically, these resources are valuable fisheries and aquatic habitats within the Lahontan Region. Protection of these resources, and establishment of threatened and endangered species, is consistent with maximum benefit to the people of the state. The Basin Plan states:

*The temporary deterioration of water quality due to the use of rotenone by the DFG is justifiable in certain situations. The Water Board recognizes that the State and federal Endangered Species Acts require the restoration and preservation of threatened and endangered species . . . These resources are of important economic and social value to the people of the State, and the transitory degradation of water quality and short-term impairment of beneficial uses that would result from rotenone application is therefore justified provided suitable measures are taken to protect water quality within and downstream of the project area.*

Therefore, this Permit is consistent with the State non-degradation and federal anti-degradation policies.

#### 21. Species Composition Considerations and Non-degradation/Anti-degradation

The Basin Plan rotenone policy requires that, within two years following the last treatment for a specific project, a fisheries biologist or related specialist from the Discharger must assess the condition of the treated waters, and certify in writing whether all applicable beneficial uses have been restored. Pursuant to the Basin Plan, that assessment must consider the condition of fish and invertebrate populations in the affected waters.

The Basin Plan water quality objectives for rotenone include a species composition objective that states:

“Where species composition objectives are established for specific water bodies or hydrologic units, the established objective(s) shall be met for all non-target aquatic organisms within one year following rotenone treatment [or within one year following the final rotenone application for multi-year projects].”

And:

“Threatened or endangered aquatic populations (e.g., invertebrates, amphibians) shall not be adversely affected. The Discharger shall conduct pre-project monitoring to prevent rotenone application where threatened or endangered species may be adversely impacted.

- I. No species composition objective has been established in the Basin Plan specifically for Silver King Creek or for the East Fork Carson River Hydrologic Unit.

However, Basin Plan anti-degradation provisions require protecting non-target aquatic organisms so that aquatic species composition is not degraded over the long-term. The Discharger has included measures to protect threatened and endangered species, which may be potentially present, in compliance with the Basin Plan requirement (see Section 11 and Monitoring and Reporting Program protocol "Identification and Protection of Sensitive Macroinvertebrate Refugia Habitats" for more information).

The Discharger will also conduct benthic macroinvertebrate monitoring to evaluate the assertion that rotenone treatment will not adversely affect populations of non-target aquatic organisms and beneficial uses of water over the long-term, and to better establish the duration of short-term impacts.

## 22. Notification of Interested Parties

The Water Board has notified interested agencies and persons of its intent to adopt an NPDES permit for the discharge, and has provided them with an opportunity to submit comments.

## 23. Consideration of Public Comments

The Water Board, in a public meeting, heard and considered all comments pertaining to the discharge.

## 24. NPDES Permit

This Order shall serve as an NPDES permit pursuant to section 402 of the Clean Water Act and shall take effect upon the date of adoption.

**IT IS HEREBY ORDERED** that:

### I. DISCHARGE SPECIFICATIONS

#### A. Receiving Water Limitations

The Discharger must comply with the following receiving water limitations. The discharge of rotenone formulation and potassium permanganate to surface waters shall not cause, or contribute to, violation of the following water quality objectives contained in the Basin Plan rotenone policy:

##### 1. Color

The characteristic purple discoloration resulting from the discharge of potassium permanganate shall not be discernible more than two miles downstream of project boundaries at any time. Twenty-four hours after shutdown of the

detoxification operation, no color alteration(s) resulting from the discharge of potassium permanganate shall be discernible within or downstream of project boundaries.

## 2. Pesticides

- a. The concentration of naphthalene outside of project boundaries shall not exceed 25 µg/L at any time.
- b. The concentration of rotenone, rotenolone, toluene, methyl pyrrolidone, diethylene glycol ethyl ether, 1-hexanol, sec-butylbenzene, n-butylbenzene, 1,4-diethylbenzene, 1,2,4-trimethylbenzene, mesitylene, 1,2,4,5-tetramethylbenzene, isopropyltoluene, and ethylnaphthalene outside of project boundaries shall not exceed the reporting limits<sup>13</sup> for these respective compounds at any time.
- c. After a two-week period has elapsed from the date that rotenone application was completed, no chemical residues resulting from the treatment shall be present at detectable levels within or downstream of project boundaries.
- d. No chemical residues resulting from rotenone treatments shall exceed detection levels in ground water at any time.

## 3. Toxicity

Chemical residues resulting from rotenone treatment must not exceed the limitations listed above for pesticides.

### B. Application Specifications

1. The Discharger must use only the rotenone formulations which it has previously identified and characterized for this project (specifically, CFT Legumine™). At least 21 calendar days before the implementation of the proposed project, the Discharger shall provide Water Board Executive Officer with the name, manufacturer and lot number of the commercial rotenone formulation to be used, as well as the results of organic analytical analyses for each lot of formulation to be used, performed by the DFG Water Pollution Control Laboratory or other laboratory certified in appropriate organic analyses, if applicable. Analytes shall include, at a minimum, rotenone, rotenolone, volatile organics, and semivolatile compounds. The chemical composition of the rotenone formulation must not be significantly changed, in such a way that potential hazards may be present which have not been addressed. Prior to the implementation of the proposed project,

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<sup>13</sup> "Reporting Limit" is defined as the minimum level that can be routinely detected using laboratory methodology and equipment common to current practices of the analytical laboratory community, and found acceptable to the regulatory community.

the Executive Officer will make a determination on whether the formulation has significantly changed or not, as it relates to anticipated adverse environmental effects.

2. Rotenone applications must be made in accordance with label specifications. Consistent with label detoxification requirements, formula concentrations may not exceed one part per million (50 parts per billion rotenone concentration).
3. Applications must be supervised by a licensed applicator in accordance with regulations of the Department of Pesticide Regulation.
4. Applications of rotenone and potassium permanganate must be made in compliance with the Basin Plan and the project EIS/EIR.
5. The Discharger must implement the Spill Contingency plan submitted with the 2010 Rotenone Application.
6. The Discharger must conduct macroinvertebrate surveys according to protocols described in the Monitoring and Reporting Program, including pre- and post-application surveys.
7. The Discharger must conduct thorough surveys of springs, seeps, and headwaters in the project area no more than two weeks prior to treatment according to the protocol given in the Monitoring and Reporting Program. The Discharger shall not treat any of these sites they determine to be fishless (where insufficient habitat or water volume exists at time of treatment to contain a fish). The Discharger shall communicate these locations to applicators through flagging and/or mapping. The Discharger shall submit a draft map of no treatment areas to the Water Board one day prior to treatment. **By November 1** of each year of any chemical treatment, the Discharger shall submit a final map certifying areas that received no rotenone application.
8. The Discharger must conduct additional amphibian surveys immediately before treatment, according to protocols described in the Monitoring and Reporting Program. If adult or tadpole life stages of any threatened, endangered, sensitive, candidate or rare amphibians are found during pre-project surveys, they will be captured by net and relocated out of the project area to suitable nearby habitat.
9. The Discharger is prohibited from applying rotenone treatments when water temperatures are below 5°C, to assure the effectiveness of treatment.



### C. General Requirements

1. During Project implementation, the Discharger is required to implement Best Management Practices. Required BMPs include, but are not limited to: applying rotenone in accordance with label instructions by a licensed applicator; using potassium permanganate to detoxify rotenone before it escapes the treatment area; applying the minimum concentration of chemicals determined necessary to achieve an effective rotenone treatment; maintaining and implementing a suitable spill prevention and response plan; applying rotenone only when ambient water temperatures are sufficiently high to promote its rapid post-treatment breakdown; and conducting water quality monitoring inside and outside the treatment area.
2. All project operations must be conducted consistent with plans and management practices contained in documents submitted by the Discharger prior to the adoption of this permit, including the Discharger's EIS/EIR for the project.
3. The Discharger must provide the public with adequate notice of the treatments, and post signs in the project area prior to treatment with appropriate warnings against public contact with water and fish while chemical residues are present, will bury the dead fish, and shall direct wilderness users to alternative potable water sources as appropriate.
4. Mechanical disturbance of soils (for example, to bury fish or construct earthen spill containment berms) in wetland or riparian habitats is prohibited.

## II. PROVISIONS

### A. Standard Provisions for NPDES Permits

The Discharger must comply with the "Standard Provisions for NPDES Permits," (Attachment B), which is made a part of this Order.

### B. Monitoring and Reporting

1. Pursuant to California Water Code Section 13383, the Discharger shall comply with Attachment C - Monitoring and Reporting Program No. R6T-2010-0015, which is made a part of this Order, and with any revisions thereto.
2. The Executive Officer may require additional monitoring pursuant to California Water Code Section 13267, as necessary, to establish the recovery of aquatic macroinvertebrate communities following treatment, or to ensure compliance with other requirements and conditions of this NPDES Permit.

### C. General Provisions for Monitoring and Reporting

The Discharger must comply with the "General Provisions for Monitoring and Reporting," (MRP Attachment 5), which is made a part of this Order.

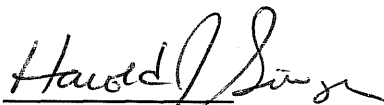
D. Expiration

This Order expires five years from the date of its adoption, on April 13, 2015.

III. EXCEPTION FROM PRIORITY POLLUTANT CRITERIA/OBJECTIVES GRANTED

A categorical exception from meeting priority pollutant criteria/objectives is hereby granted subject to the provisions of State Implementation Policy section 5.3. The Discharger shall comply with all provisions of section 5.3 that are applicable to categorical exceptions.

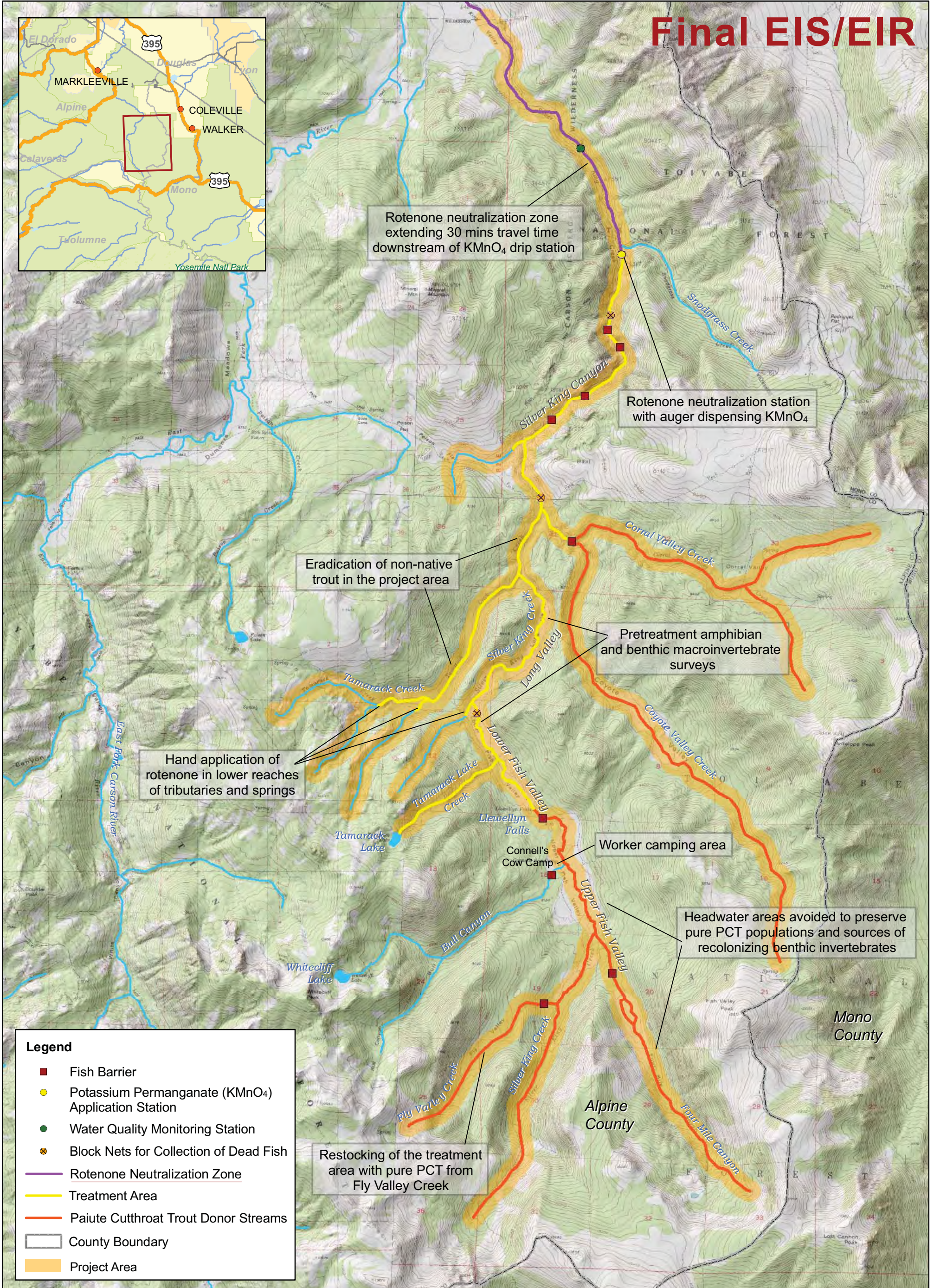
I, Harold J. Singer, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Lahontan Region, on April 14, 2010.



HAROLD J. SINGER  
EXECUTIVE OFFICER

- Attachments: A. Project Location Map  
B. Standard Provisions for NPDES Permits  
C. Monitoring and Reporting Program







**ATTACHMENT B**  
**STANDARD PROVISIONS**  
**FOR**  
**NATIONAL POLLUTANT DISCHARGE**  
**ELIMINATION SYSTEM (NPDES) PERMITS**

1. The permittee must comply with all of the terms, requirements, and conditions of this NPDES Permit. Any violation of this Permit constitutes violation of the Clean Water Act (CWA), its regulations and the California Water Code, and is grounds for enforcement action, permit termination, permit revocation, and reissuance, denial of an application for permit reissuance; or a combination thereof.
2. The permittee shall comply with effluent standards or prohibitions established under 307(a) of the CWA for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if this Permit has not yet been modified to incorporate the requirement. [40 CFR 122.41(a)(1)]

The California Water Code provides that any person who violates a Waste Discharge Requirement (same as permit condition), or a provision of the California Water Code, is subject to civil penalties of up to \$1,000 per day or \$10,000 per day of violation, or when the violation involves the discharge of pollutants, is subject to civil penalties of up to \$10 per gallon per day or \$20 per gallon per day of violation; or some combination thereof, depending on the violation, or upon the combination of violations.\*

Violations of any of the provisions of the NPDES program, or of any of the provisions of this Permit, may subject the violator to any of the penalties described herein, or any combination thereof, at the discretion of the prosecuting authority; except that only one kind of penalty may be applied for each kind of violation.\*

3. The CWA provides that any person who violates a Permit condition implementing Sections 301, 302, 306, 307, or 308 of the CWA is subject to a civil penalty not to exceed \$10,000 per day of such violation. Any person who willfully or negligently violates Permit conditions implementing these Sections of the CWA is subject to a fine of not less than \$2,500, nor more than \$25,000 per day of violation, or by imprisonment for not more than one year, or both. [40 CFR 122.41(a)(2)]
4. If the permittee wishes to continue an activity regulated by this Permit after the expiration date of this Permit, the permittee must apply for and obtain a new Permit. [40 CFR 122.41(b)]
5. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Permit. [40 CFR 122.41(c)]
6. The permittee shall take all reasonable steps to minimize or prevent any discharge that has a reasonable likelihood of adversely affecting health or the environment. [40 CFR 122.41(d)]
7. The permittee shall, at all times, properly operate and maintain all the facilities and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with this Permit.

Proper operation and maintenance includes adequate laboratory controls, and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities, or similar systems that are installed by a permittee only when necessary to achieve compliance with the conditions of this Permit. [40 CFR 122.41(e)]

8. This Permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a Permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition. [40 CFR 122.41(g)]
9. This Permit does not convey any property rights of any sort, or any exclusive privilege. [40 CFR 122.41(f)]
10. The permittee shall furnish, within a reasonable time, any information the Regional Board or EPA may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Permit. The permittee shall also furnish to the Regional Board, upon request, copies of records required to be kept by this Permit. [40 CFR 122.41(h)]
11. The Regional Board, EPA, and other authorized representatives shall be allowed:
  - (a) Entry upon premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this Permit;
  - (b) Access to copy any records that are kept under the conditions of this Permit;
  - (c) To inspect any facility, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit; and
  - (d) To photograph, sample, and monitor for the purpose of assuring compliance with this Permit, or as otherwise authorized by the CWA. [40 CFR 122.41(I)]
12. Monitoring and records.
  - (a) Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.
  - (b) The permittee shall retain records of all monitoring information, including all calibration and maintenance monitoring instrumentation, copies of all reports required by this Permit, and records of all data used to complete the application for this Permit, for a period of at least three years from the date of the sample, measurement, report, or application. This period may be extended by request of the Regional Board or EPA at any time.
  - (c) Records of monitoring information shall include:
    - (i) The date, exact place, and time of sampling or measurements;
    - (ii) The individual(s) who performed the sampling or measurements;
    - (iii) The date(s) analyses were performed;
    - (iv) The individual(s) who performed the analyses;
    - (v) The analytical techniques or methods used; and
    - (vi) The results of such analyses.
  - (d) Monitoring must be conducted according to test procedures under 40 CFR Part 136, unless other test procedures have been specified in this Permit.

- (e) The CWA provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device, or method required to be maintained under this Permit shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

[40 CFR 122.41(j)]

- 13. All applications, reports, or information submitted to the Regional Board shall be signed and certified in accordance with 40 CFR 122.22 [40 CFR 122.41(k)(1)]
- 14. The CWA provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this Permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than six months per violation, or by both. [40 CFR 122.41(k)(2)]
- 15. Reporting requirements:
  - (a) The permittee shall give advance notice to the Regional Board, as soon as possible of, any planned physical alterations, or additions to the permitted facility.
  - (b) The permittee shall give advance notice to the Regional Board of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.
  - (c) This Permit is not transferable to any person, except after notice to the Regional Board. The Regional Board may require modification, or revocation and reissuance of the Permit to change the name of the permittee, and incorporate such other requirements as may be necessary under the CWA.
  - (d) Monitoring results shall be reported at the intervals specified elsewhere in this Permit.
    - (i) Monitoring results must be reported in a Discharge Monitoring Report (DMR).
    - (ii) If the permittee monitors any pollutant more frequently than required by this Permit using test procedures approved under 40 CFR Part 136 or as specified in this Permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.
    - (iii) Calculations for all limitations that require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this Permit.
  - (e) Report of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any compliance schedule of this Permit shall be submitted no later than 14 days following each schedule date.
  - (f) Twenty-four hour reporting.
    - (i) The permittee shall report any noncompliance that may endanger health or the environment to the Regional Board. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the permittee

becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and time and, if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

- (ii) The following shall be included as information that must be report within 24 hours under this paragraph:
  - (A) Any unanticipated bypass that exceeds any effluent limitation in the Permit.
  - (B) Any upset that exceeds any effluent limitation in the Permit.
  - (C) Violation of a maximum daily discharge limitation for any of the pollutants listed in this Permit to be reported within 24 hours.
- (iii) The Regional Board may waive the above-required written report on a case-by-case basis.
- (g) The permittee shall report all instances of noncompliance, not otherwise reported under the above paragraphs, at the time monitoring reports are submitted. The reports shall contain all information listed in paragraph 15(f) above.[40 CFR 122.41(1)]

16. Bypass (the intentional diversion of waste streams from any portion of facility) is prohibited. The Board may take enforcement action against the permittee for bypass unless:

- (a) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage. (Severe property damage means substantial physical damage to property, damage to the treatment facilities that causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.);
- (b) There were no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated waste, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that could occur during normal periods of equipment downtime or preventive maintenance; and
- (c) The permittee submitted a notice, at least ten days in advance, of the need for a bypass to the appropriate Board.

The permittee may allow a bypass to occur that does not cause effluent limitations to be exceeded, but only if it is for essential maintenance to assure efficient operation. In such a case, the above bypass conditions are not applicable.

The permittee shall submit notice of an unanticipated bypass as required in paragraph 15(f) above. [40 CFR 122.41(m)]

17. Upset means an exceptional incident in which there is unintentional and temporary noncompliance with permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or

careless or improper action. A permittee that wishes to establish the affirmative defense of an upset in an action brought for noncompliance shall demonstrate, through signed, contemporaneous operating logs, or other relevant evidence that:

- (a) an upset occurred and that the permittee can identify the cause(s) of the upset;
- (b) the permitted facility was being properly operated at the time of the upset;
- (c) the permittee submitted notice of the upset as required in paragraph 15(f) above; and
- (d) the permittee complied with any remedial measures required under paragraph 7.

No determination made before an action for noncompliance, such as during administrative review of claims that noncompliance was caused by an upset; is final administrative action subject to judicial review.

In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof. [40 CFR 122.41(n)]

18. All existing manufacturing, commercial, mining, and silvicultural dischargers must notify the Regional Board as soon as they know or have reason to believe:

- (a) that any activity has occurred or will occur that would result in the discharge of any toxic pollutant that is not limited in this Permit, if that discharge will exceed the highest of the following "notification levels:"
  - (i) One hundred micrograms per liter (100 µg/L);
  - (ii) Two hundred micrograms per liter (200 µg/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 µg/L) for 2-4dinitrophenol and 2-methyl-4-b-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;
  - (iii) Five (5) times the maximum concentration value reported for that pollutant in the Permit application; or
  - (iv) The level established by the Regional Board in accordance with 40 CFR 122.44(f).
- (b) that they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant that was not reported in the Permit application.  
[40 CFR 122.42(a)]

\* This paragraph was added or modified by the State Water Quality Control Board to the California Water Code.



## APPENDIX C

### CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD LAHONTAN REGION

MONITORING AND REPORTING PROGRAM NO. R6T-2010-0015  
WDID NO. 6A020405008  
NPDES NO. CA0103209

FOR

### CALIFORNIA DEPARTMENT OF FISH AND GAME PAIUTE CUTTHROAT TROUT RESTORATION PROJECT

ALPINE COUNTY

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#### I. MONITORING PROGRAM GOALS

- A. To ensure compliance with receiving water limits established in Water Board Order R6T-2010-0015
- B. To establish the nature and duration of rotenone treatment impacts to benthic macroinvertebrate populations, and verify that those populations and beneficial uses have been restored following treatment.
- C. To detect, capture, and relocate out of the project area any threatened, endangered, sensitive, candidate or rare amphibians prior to rotenone treatment.

#### II. DETERMINATION OF PROJECT BOUNDARIES

The project boundaries for rotenone projects are defined, pursuant to the Basin Plan, as encompassing the treatment area, the detoxification area, and the area downstream of the detoxification station up to a thirty-minute in-stream travel time.

The California Department of Fish and Game (DFG, the Discharger) shall estimate the distance from the detoxification station to the downstream thirty-minute travel time endpoint, based on measurements of stream flow and/or average velocities, prior to commencement of rotenone application. This endpoint will define the downstream extremity of the project boundaries. The location of the project boundaries shall be identified one- to two-weeks before project implementation and recorded, along with any calculations used in making the determination.

### III. SURFACE WATER MONITORING

#### A. Temperature

The Discharger shall measure and record water temperature whenever samples are collected for chemical analysis (according to the schedule described below), at the corresponding monitoring station and at the same time as sample collection.

#### B. Color

The Discharger shall visually inspect the stream water downstream of project boundaries at least three times a day during daylight operations, to ascertain whether discoloration due to potassium permanganate is discernible more than two miles downstream of project boundaries, and shall keep records of the observations.

#### C. Sample Location

Samples will be collected at the following locations, depicted in Attachment 1:

<u>Station Code</u>	<u>Location Description</u>
MSKC1	Silver King Creek, at project boundaries
MSKC2	Silver King Creek, immediately upstream of detoxification station
MSKC3	Silver King Creek, Lower Fish Valley
MSKC5	Silver King Creek, Long Valley
MSKC7	Silver King Creek Canyon
MTC1	Tamarack Creek, trail crossing
MTC2	Tamarack Creek
MTLC	Tamarack Lake Creek

All locations will be flagged and GPS locations will be determined and provided to the Water Board at least 24-hours prior to project implementation. Sample sites may need to be added or subtracted depending upon stream flow conditions and logistics on a given year. Changes in sampling protocol will be mutually agreed upon between the Discharger and the Water Board in advance of sample collection.

#### D. Sampling Methods, Analyses and Analytical Methods

Sampling protocols shall conform to the July 2, 2004 Monitoring Plan submitted by the Discharger, and incorporated herein by reference. Samples collected by the Discharger will be analyzed at the Department of Fish and Game laboratory certified by the California Department of Health Services. Water Board staff may independently sample and have samples analyzed at a separate laboratory for quality control. Constituents shall be sampled and results reported according to the following table:

Constituent	Analytical Methods	Units	Sample Type
Rotenone	McMillin and Finlayson, 2008 <sup>1</sup>	µg/L	Grab
Rotenolone	McMillin and Finlayson, 2008 <sup>1</sup>	µg/L	Grab
Volatile Organic Compounds (VOCs)	USEPA 8260	µg/L	Grab
Semi-Volatile Organic Compounds (SVOCs)	USEPA 8270	µg/L	Grab
Di(ethylene glycol) ethyl ether (DEE)	McMillin and Finlayson, 2008 <sup>1</sup>	µg/L	Grab
1-methyl1-2-pyrrolidone (MP)	McMillin and Finlayson, 2008 <sup>1</sup>	µg/L	Grab

<sup>1</sup> *McMillin, S. and B.J. Finlayson. 2008. Chemical residues in water and sediment following rotenone application to Lake Davis, California 2007, Appendix A: Water Pollution Control Laboratory Analytical Methods. California Department of Fish and Game, Pesticide Investigations Unit, OSPR Administrative Report 08-01, Rancho Cordova, California.*

#### E. Sampling Schedule

Samples shall be collected for analysis according to the schedule indicated in the following table. Pre-treatment samples shall be collected not more than 24 hours prior to application of rotenone. Sample timing may need to be changed depending upon stream flow conditions and logistics on a given year. Changes in sampling protocol will be mutually agreed upon between the Discharger and the Water Board in advance of sample collection.

Analysis	Site	Pre-Treatment	During Treatment	Day After Treatment	Weekly Post-Treatment
Rotenone & Rotenolone	MSKC1	X	every 2 hrs	X	X <sup>2</sup>
"	MSKC2	X	every 2 hrs	X	X <sup>2</sup>
"	MSKC3		Twice	X	X <sup>2</sup>
"	MSKC5		Twice	X	X <sup>2</sup>
"	MSKC7		Twice	X	X <sup>2</sup>
"	MTLC1		Twice	X	X <sup>2</sup>
"	MTC1		Twice	X	X <sup>2</sup>
"	MTC2		Twice	X	X <sup>2</sup>
VOC/SVOC	MSKC1	X	Twice		X <sup>2</sup>
"	MSKC2	X	Twice		
DEE/MP	MSCK1	X	Twice	X	X <sup>2</sup>
"	MTC1	X	Twice		
"	MTC2	X	Twice		

<sup>2</sup> If any chemical treatment residues are detected on the day after treatment at any sampling station, weekly samples shall be collected and analyzed at that station and any downstream station(s), until no residues are detected. Samples collected and analyzed pre-treatment and during treatment are done for operational purposes.

The Discharger shall take up to three additional samples within the treatment area the day after treatment as directed by Water Board staff, in collaboration with Department of Fish and Game personnel, where water is ponded, stagnant or slow moving. These locations will be identified using GPS equipment and shall be documented in monitoring reports that are available to the public.

#### F. Toxicity

Caged fish shall be used to determine whether detoxification is effective and ascertain whether rotenone toxicity has escaped beyond project boundaries. Prior to the discharge of rotenone formulation, caged fish shall be positioned just above the neutralization station, midway at the 15-minute stream travel time location, and at the project boundary 30 minutes travel time downstream of the detoxification station. The caged fish shall be maintained and observed for stress at least twice per day during treatment and detoxification operations, and observations shall be recorded. Stressed or dead caged fish will be replaced in accordance with the Discharger's Neutralization Implementation Plan. Use of caged fish shall cease two days after cessation of rotenone application.

### G. Benthic Macroinvertebrate Monitoring

The Discharger shall conduct aquatic macroinvertebrate monitoring according to the Silver King Creek Macroinvertebrate Monitoring, August 2007-2015 study plan submitted by the Discharger, and incorporated herein as Attachment 2, which is made a part of this Monitoring and Reporting Program.

### H. Amphibian Surveys

The Discharger shall conduct amphibian surveys immediately prior to treatment, according to protocols described in Attachment 4.

### I. Identification and Protection of Sensitive Macroinvertebrate Refugia Habitats

The Discharger shall use aerial photography, previous fishery and amphibian surveys, and field surveys to identify potential areas for sensitive macroinvertebrates. These waters shall be sampled or verified for the presence of non-native fish. Project team leaders shall reach consensus that the habitat or reach is fishless and will chemically treat only those sites that could not be verified as fishless, so as to not put the success of restoration project at risk for failure. After a decision is made, the water or habitat will be flagged and GPS waypoints logged for incorporation on project area maps as “no treatment areas.”

Annual inspections of no-treatment sensitive benthic macroinvertebrate refugia habitats will be performed to verify the absence of fish. Should annual inspections prior to subsequent treatments indicate that fish have colonized one or more of the habitats the no-treatment status of that specific habitat would be removed.

Project implementation teams will be provided treatment area maps with the non-treatment areas clearly identified and GPS waypoints would be loaded on each team member’s portable GPS unit. Prior to treatment individual team leaders would be oriented to each non-treatment habitat to ensure that every applicator has knowledge of the non-treatment status.

The Discharger shall conduct these surveys of springs, seeps, and headwaters in the project area no more than two weeks prior to treatment to determine whether or not they are fishless (where insufficient habitat or water volume exists at time of treatment to contain a fish). The Discharger shall communicate these locations to applicators and to Water Board staff through flagging, mapping, and GPS

coordinates, as described above. The Discharger shall submit this information to the Water Board at least one day prior to treatment. **By November 1** of each year of any chemical treatment, the Discharger shall submit a final map certifying areas within project boundaries that received no rotenone application.

## II. REPORTING

- A. One day before treatment, the Discharger shall submit a draft map of treatment and “no treatment” areas. By November 1 of each year of any chemical treatment, the Discharger shall submit a final map certifying areas within project boundaries that received no rotenone application.
- B. No later than 60 days of completion of each season’s treatment, the Discharger shall submit a monitoring report to the Water Board within The report shall include the following:
  1. Data required by this monitoring and reporting program;
  2. Approximate volumetric flow rate of each creek discharged to on application day;
  3. Volume of rotenone product used, by location applied;
  4. Amount of potassium permanganate used;
  5. Summary of project; and
  6. Evaluation of project success (eradication of non-native fish species after the third year of the project).

In reporting the monitoring data, the Discharger shall arrange the data in tabular form so that the date, the constituents, and the concentrations are readily discernible. The data shall be summarized in such a manner to clearly illustrate compliance with this Order.

- B. The monitoring report shall include a cover letter containing the information and certification in the Monitoring and Reporting Cover Letter form (Attachment 3), which is hereby made a part of this Monitoring and Reporting Program.
- C. The Discharger shall clearly identify in the monitoring report any violations of Board Order R6T-2010-(PROP), and submit a statement of corrective actions taken or proposed, including a timetable for implementation.
- D. The Discharger shall submit a report to comply with condition 3 of Basin Plan Section 4.9, which states: “Within two years of the last treatment for a specific project, a fisheries biologist or related specialist from the DFG must assess the restoration of applicable beneficial uses to the

treated waters, and certify in writing that those beneficial uses have been restored. A project will be considered to have been completed upon written acceptance by the Regional Board's Executive Officer of such certification."

- III. The Discharger shall implement the above monitoring program immediately upon the commencement of the initial discharge covered by the Order. This Monitoring and Reporting Program may be modified by the Executive Officer.

Ordered by:   
HAROLD J. SINGER  
EXECUTIVE OFFICER

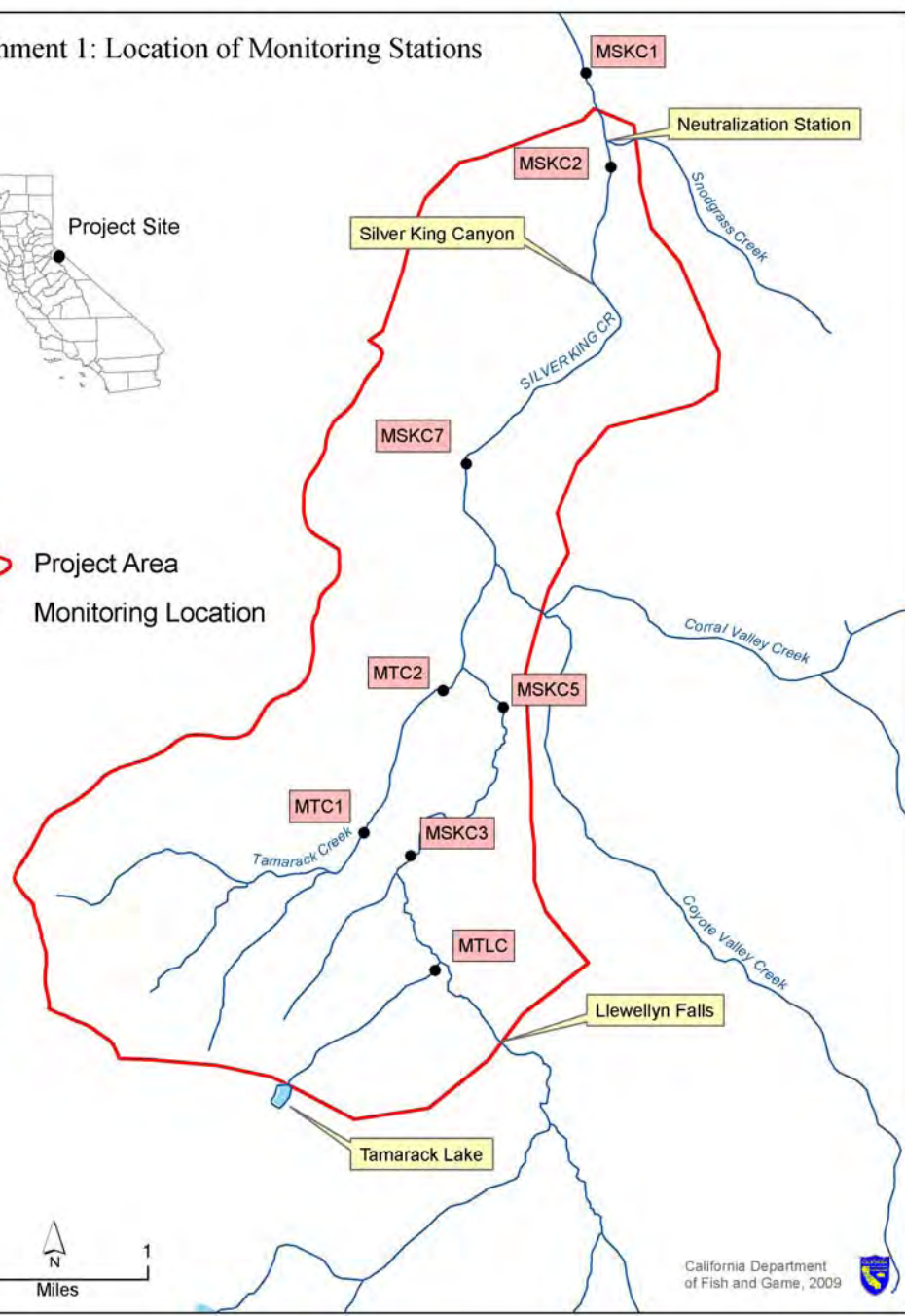
Dated: April 14, 2010

- Attachments:
1. Map - Location of Monitoring Stations
  2. Silver King Creek Macroinvertebrate Monitoring, August 2007-2015
  3. Monitoring Report Cover Letter form
  4. 2007 Sierra Nevada Fish and Amphibian Inventory Data Sheet Instructions

# Attachment 1: Location of Monitoring Stations



- Project Area
- Monitoring Location





## **Silver King Creek Macroinvertebrate Monitoring August 2007-2015**

### **Background**

The California Department of Fish and Game and the U.S. Fish and Wildlife Service propose to treat Silver King Creek basin with rotenone during the late summer of 2009, 2010, and possibly 2011. The goal of this project is to restore Paiute cutthroat trout (*Oncorhynchus clarkii seleniris*), a federally listed threatened species, to its historic habitat.

While rotenone is intended to eradicate non-native trout, it is also toxic to some aquatic macroinvertebrates. Rotenone was first used in the Silver King Creek basin in 1964, and on various occasions and locations up to 1993. Macroinvertebrate sampling within the basin began in 1984 and has occurred periodically up to 2007.

This monitoring study differs from the June 15, 2003, Interagency Study Proposal in that it incorporates more sampling stations throughout the basin as well as additional “control” and “treatment” sites. The sampling methodology is also changed to allow for additional analyses such as the River Invertebrate Prediction and Classification System (RIVPACS) analysis model (Hawkins et al. 2000).

### **Objectives**

The primary objectives of this study are to: 1) analyze changes in macroinvertebrate assemblages and taxa from the use of rotenone during Paiute cutthroat trout recovery activities, 2) collect and identify taxa from the Silver King Creek basin, and 3) reestablish historic collection sites in selected streams.

### **Study Design**

Twenty-three quantitative and 5 qualitative sampling site locations were established during August 2007 (Table 1). This study design differs from the June 15, 2003, Interagency Study Proposal in that it incorporates more sampling stations throughout the basin as well as additional “control” and “treatment” sites (nine pairs) (Figures 1 and 2). Five qualitative sampling sites were established within the area to be treated to increase the likelihood of collecting taxa with low relative abundances, i.e. rare taxa (Figure 3). The sampling methodology is also changed to allow for additional analyses.

Past analyses to evaluate the effects of rotenone on aquatic biota are hampered by the lack of data on aquatic invertebrate assemblages prior to the use of rotenone (Vinson and Vinson 2007). This monitoring effort includes five quantitative sampling sites (SKC Site 1 & 2, Tamarack Sites 1-3) and 3 qualitative sampling sites (SKC Site 1, Tamarack Sites

1 & 2) in areas that have never been treated with rotenone which are expected to be treated in the future.

Pre-treatment sampling will be conducted at all sites during mid-August 2007, and 2008. Further pre-treatment sampling will also be conducted at all sites during mid-August 2009, immediately prior to treatment. Post-treatment monitoring will be conducted during mid-August the first year after treatment, 3 years post-treatment, and 5 years post-treatment.

Table 1. Sample type and locations within the Silver King Creek basin.

<b>Stream</b>	<b>Site Number</b>	<b>Sample Type</b>	<b>Site Type</b>	<b>UTM North</b>	<b>UTM East</b>	<b>Elev. (m)</b>
Bull Creek	Bull Site 1	Quantitative		4259066	273218	2457
Corral Creek	Corral Site 1	Quantitative		4263805	274123	2424
Corral Creek	Corral Site 2	Quantitative		4263251	275248	2510
Coyote Creek	Coyote Site 1	Quantitative	Control	4262687	273342	2411
Coyote Creek	Coyote Site 2	Quantitative	Control	4261839	273608	2481
Coyote Creek	Coyote Site 3	Quantitative	Control	4260799	274522	2492
Fly Valley Creek	Fly Site 1	Quantitative		4256568	272140	2653
Four Mile Creek	Four Mile Site 1	Quantitative		4257098	274165	2560
Silver King Creek	SKC Site 1	Quantitative	Treatment	4264901	272645	2333
Silver King Creek	SKC Site 2	Quantitative	Treatment	4263842	272756	2345
Silver King Creek	SKC Site 3	Quantitative	Treatment	4262456	272874	2376
Silver King Creek	SKC Site 4	Quantitative	Treatment	4262005	272675	2383
Silver King Creek	SKC Site 5	Quantitative	Treatment	4260832	272085	2416
Silver King Creek	SKC Site 6	Quantitative	Treatment	4260099	272602	2426
Silver King Creek	SKC Site 7	Quantitative	Control	4259608	273247	2456
Silver King Creek	SKC Site 8	Quantitative	Control	4259289	273140	2460
Silver King Creek	SKC Site 9	Quantitative	Control	4258963	273359	2462
Silver King Creek	SKC Site 10	Quantitative	Control	4258354	273562	2473
Silver King Creek	SKC Site 11	Quantitative	Control	4257651	273471	2503
Silver King Creek	SKC Site 12	Quantitative	Control	4257022	273187	2506
Tamarack Creek	Tamarack Site 2	Quantitative	Treatment	4261479	271383	2422
Tamarack Creek	Tamarack Site 1	Quantitative	Treatment	4262448	271943	2400
Tamarack Creek	Tamarack Site 3	Quantitative	Treatment	4261437	270915	2443
Silver King Creek	SKC Site 1	Qualitative		4264901	272645	2333
Silver King Creek	SKC Site 2	Qualitative		4260655	272242	2416
Silver King Creek	SKC Site 3	Qualitative		4259883	272755	2425
Tamarack Creek	Tamarack Site 1	Qualitative		4261873	271653	2411
Tamarack Creek	Tamarack Site 2	Qualitative		4261457	270972	2439

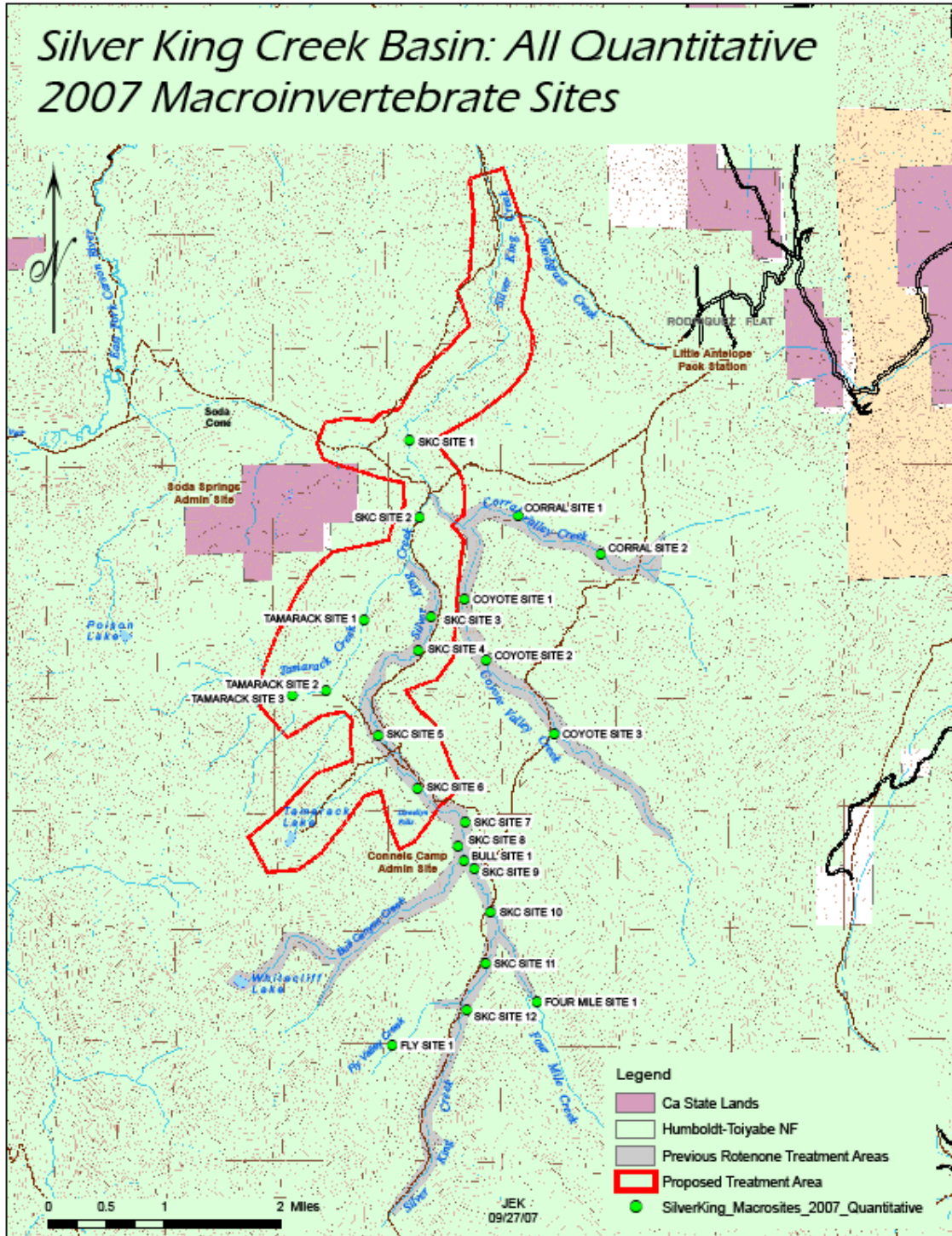


Figure 1. Quantitative sampling sites within the Silver King Creek basin.

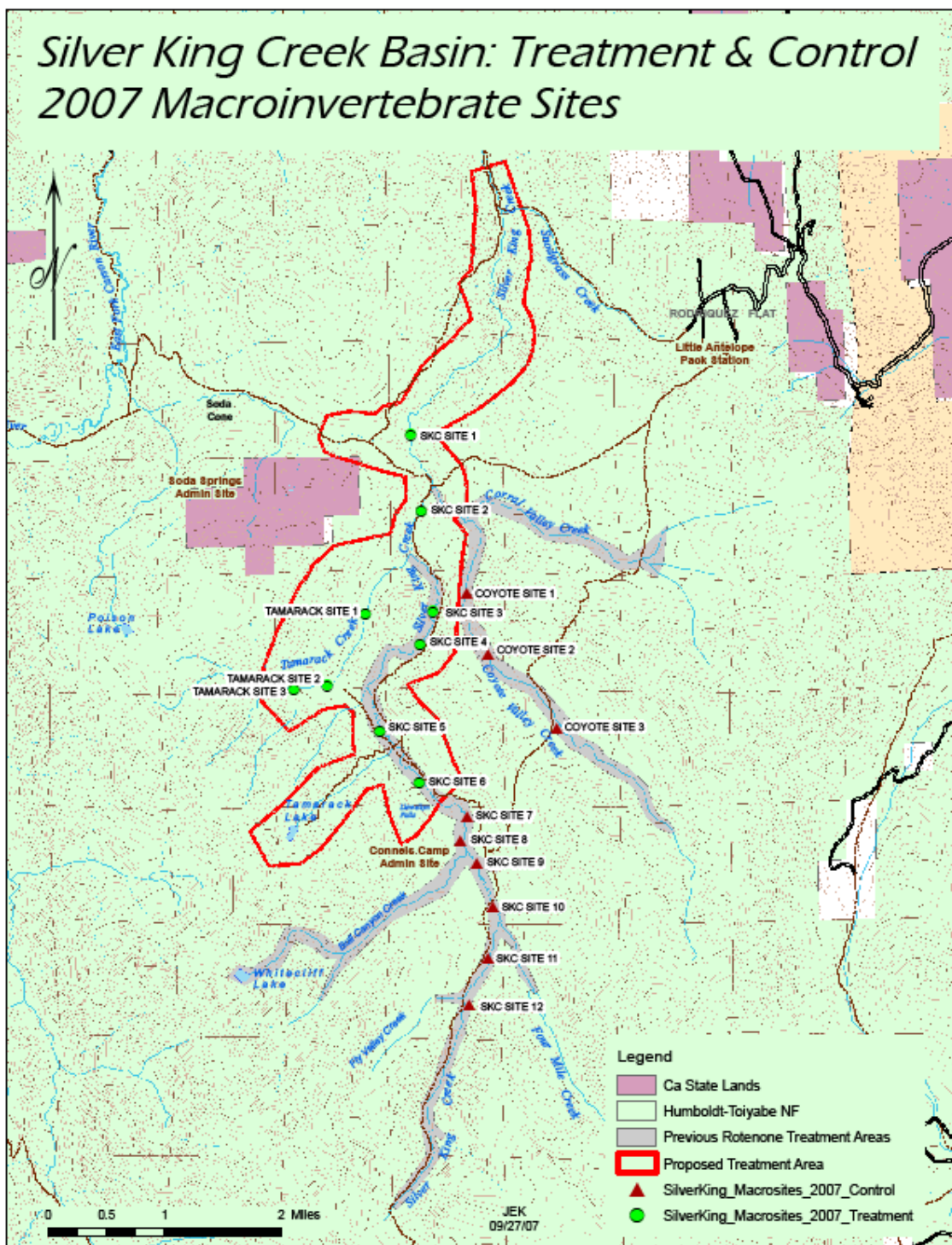


Figure 2. Quantitative sampling “control” and “treatment” sites within the Silver King Creek basin.



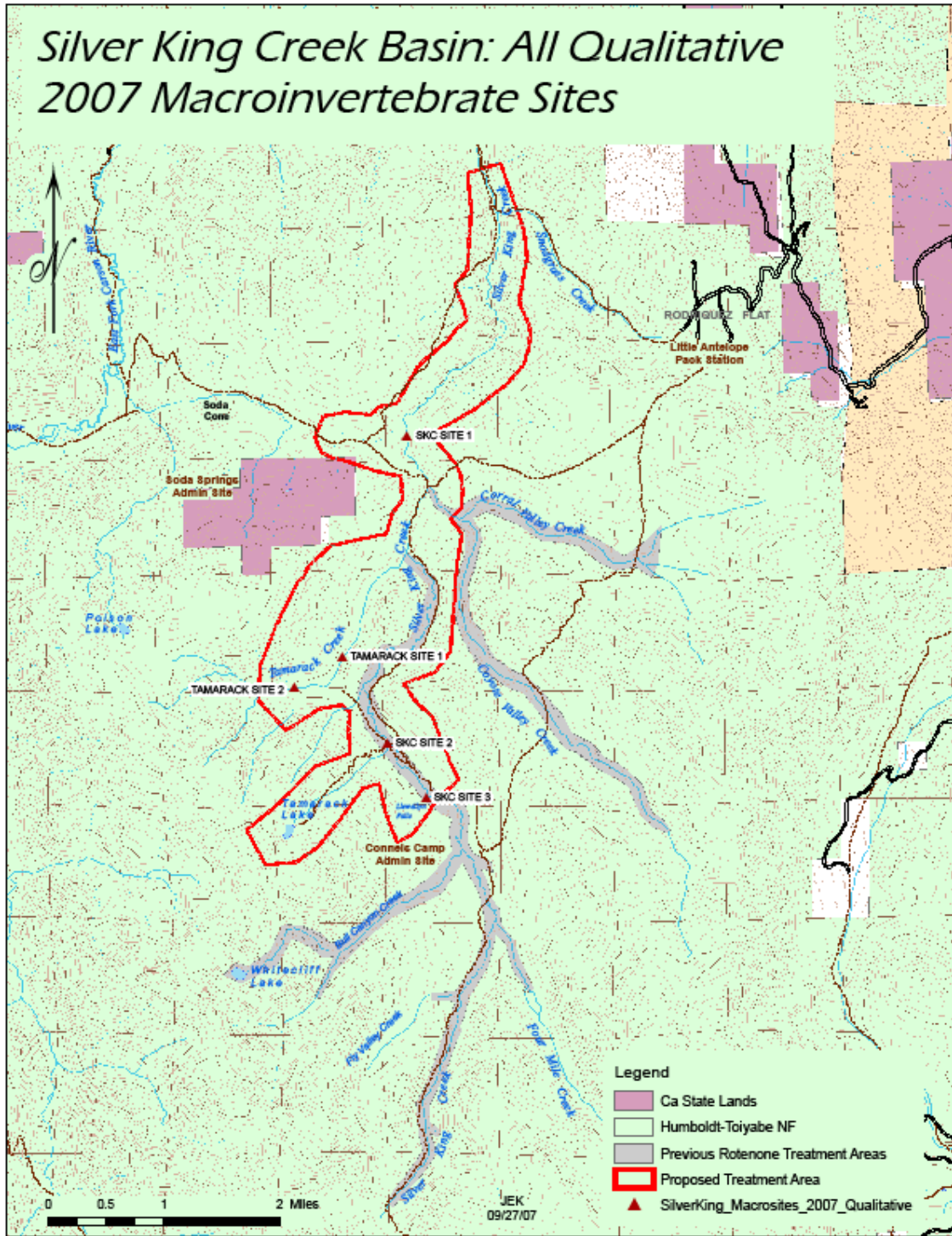


Figure 3. Qualitative sampling sites within the Silver King Creek basin.

## Sampling Methods

Stream Invertebrate Collection Procedures as described by the National Aquatic Monitoring Center at Utah State University, Logan, Utah ([www.usu.edu/buglab/](http://www.usu.edu/buglab/)) will be followed. Samples will be sent to the National Aquatic Monitoring Center at Utah State University, Logan, Utah for processing (see [www.usu.edu/buglab/](http://www.usu.edu/buglab/) for laboratory methods). Table 2 provides the normal taxonomic resolution of processed samples.

### *Fixed Area Quantitative Samples*

The objective of quantitative invertebrate sampling is to collect the more common invertebrates at a site and estimate their relative abundances. Quantitative samples are collected using a Surber net (0.09 m<sup>2</sup>) with a 500 micron mesh net. Eight samples are collected in 4 different riffles (2 samples from each riffle) and composited to make a single sample of approximately 0.74 m<sup>2</sup> for each location on each sampling date.

### *Qualitative Invertebrate Collections*

The objective of qualitative invertebrate collections is to collect as many different kinds of invertebrates living at a site as possible. Samples are collected with a Surber net or a kicknet (457 x 229 mm) with a 500 micron mesh net and by hand picking invertebrates from woody debris and large boulders. All major habitat types (e.g., riffles, pools, back waters, macrophyte beds) are sampled and all samples are composited to form a single sample from each site.

Table 2. Normal taxonomic resolution provided by the National Aquatic Monitoring Center.

<b>Taxon or Taxa group</b>	<b>BugLab's Current Standard Taxonomic Level</b>	<b>Northwest Bioassessment Work Group Minimum Standard Taxonomic Effort</b>
Annelida		
Hirudinea	Genus/species	Genus
Oligochaeta	Order	Family
Arthropoda		
Hydracarina	Family/Genus/species	Order
Crustacea		
Anostraca	Genus/species	Genus/species
Cladocera	Genus/species	
Copepoda	Genus/species	
Decapoda	Genus/species	Genus
Ostracoda	Order/Family/Genus	

Table 2. Continued.		
<b>Taxon or Taxa group</b>	<b>BugLab's Current Standard Taxonomic Level</b>	<b>Northwest Bioassessment Work Group Minimum Standard Taxonomic Effort</b>
Arthropoda		
Crustacea		
Amphipoda	Genus/species	Genus
Isopoda	Genus	Genus
Collembola	Order	
Insecta		
Coleoptera	Genus/species	Genus
Except Curculionidae, Heteroceridae, Ptiliidae	Family	Family
Diptera		
Atherceridae	Genus/species	Genus
Blephariceridae	Genus/species	Genus
Ceratopogonidae	Genus	Subfamily
Chaoboridae	Genus	
Chironomidae	Subfamily	Genus
Culicidae	Genus	
Deuterophlebiidae	Genus/species	Genus
Dixidae	Genus	Genus
Dolichopodidae	Family	Family
Empididae	Genus	Genus
Ephydriidae	Family	Family
Muscidae	Family	Family
Pelecorhynchidae	Genus	Genus
Psychodidae	Genus	Genus
Ptychopteridae	Genus	Genus
Sciomyzidae	Family	
Simuliidae	Genus	Genus
Stratiomyidae	Genus	Genus
Tabanidae	Genus	Family
Tanyderidae	Genus	Genus
Thaumaleidae	Genus	Genus
Tipulidae	Genus	Genus
Ephemeroptera	Genus/species	Genus
Ephemerellidae	species	species
Hemiptera	Genus/species	Genus

Table 2. Continued.		
Taxon or Taxa group	BugLab's Current Standard Taxonomic Level	Northwest Bioassessment Work Group Minimum Standard Taxonomic Effort
Arthropoda		
Lepidoptera	Genus	Genus
Megaloptera	Genus/species	Genus
Odonata	Genus/species	Genus
Plecoptera	Genus/species	Genus
Pteronarcyidae	species	species
Taeniopterygidae	Family/Genus	Family
Trichoptera	Genus/species	
Coelenterata	Class	Class/Order
Mollusca		
Gastropoda	Family/Genus/species	Genus
Pelecypoda	Order/Family/Genus	Genus
Sphaeriidae	Genus/species	Family/Genus
Nematoda	Phylum	Phylum
Nematophora	Phylum	Phylum
Porifera	Phylum	Phylum
Turbellaria	Class	Class

### Data summarization

As part of the National Aquatic Monitoring Center standard reporting, the following metrics or ecological summaries are provided for each sampling station:

- |  |                                   |
|--|-----------------------------------|
| Taxa richness, Genera richness           | Abundance                         |
| EPT                                      | Number of families                |
| Percent taxon or family dominance        | Shannon Diversity Index           |
| Biotic indices - Hilsenhoff Biotic Index | Evenness                          |
| USFS Community tolerant quotient         | Functional feeding group measures |
| Shredders                                | Scrapers                          |
| Collector-filterers                      | Collector-gatherers               |
| Predators                                | Unknown feeding group             |
| Clinger taxa                             | Long-live taxa                    |

Additional information on the metrics and how they are calculated can be found at [www.usu.edu/buglab/](http://www.usu.edu/buglab/).



## **Statistical analyses**

An equal number (nine pairs) of control and treatment sites will be sampled before and after the treatment with rotenone. Pre-treatment sampling will occur in 2007, 2008, and 2009; post-treatment monitoring will be conducted during mid-August the first year after treatment, 3 years post-treatment, and 5 years post-treatment. This will allow for a BACI (Before-After-Control-Impact) analysis to be used to detect treatment effects to biological metrics. BACI analyses will follow 2 methodologies, designed to detect both short and long-term impacts. The first method is the standard BACI, where the time scale is constrained to the sampling period immediately before and after treatment. A 2-way ANOVA on selected metrics (e.g. abundance, tolerance values) with Time (Before/After) and Site (Control/Impact) is then performed, with rotenone effects assessed using the interaction term (Green 1979). Long-term effects will be analyzed using a BACIPS (Before-After-Control-Impact Paired Series) (Stewart-Oaten 1996). In this, an average metric value for each sampling period for Control sites and Treatment sites are determined, and the difference between the averages is the response variable analyzed statistically. The differences in pre-treatment versus post-treatments are then analyzed using a basic *t*-test. Metrics to be analyzed may also include aquatic invertebrate abundance and taxa richness (genera) which Vinson and Vinson 2007 suggest that differences would be detectable following a rotenone treatment. ANOVA may be also used to evaluate differences in aquatic invertebrate assemblage measures between pre-treatment and post-samples to detect treatment effects. Simple graphs of before and after comparisons will be used to evaluate differences in invertebrate assemblage measures and diversity indices between pre-treatment and post-treatment periods (Vinson and Dinger 2006).

RIVPAC analysis will also be conducted. This analysis allows for the prediction of what taxa should occur at a site in the absence of anthropogenic actions and factors in the probability of occurrences for all individual.

Accumulation curves will be used to provide information on the adequacy of sampling and on the relative number of taxa that may be present but are yet uncollected. These methods will be used following treatment to evaluate assemblage recovery. Rare taxa, (those whose individual abundances are less than 1% of the total sample abundance) will be identified in pre-treatment sampling and tracked post-treatment to detect treatment effects. Of particular interest will be sampling sites, Tamarack 1-3 and Silver King 1 & 2, which are areas that haven't been treated with rotenone.

## **Historic Site monitoring**

Long-term sampling sites have been reestablished on Fly Valley Creek, Four-mile Creek, Bull Canyon, and at upstream historic sites in Silver King Creek. Although this monitoring study uses a different sampling design from those used historically, sampling these sites could provide additional information on historic assemblages. The Fly Valley

and Four-mile creeks sites are in areas that were never chemically treated and will not be treated.

## References

Green, R.H. 1979. Sampling design and statistical analysis for environmental biologists. Wiley-Interscience. New York.

Hawkins, C.P., R.H. Norris, J.N. Hogue, and J.W. Feminella. 2000. Development and evaluation of predictive models for measuring the biological integrity of streams. *Ecological Applications* 10:1456-1477.

Stewart-Oaten, A. 1996. Problems in the analysis of environmental monitoring data. Pages 109 – 132 In Schmitt, R.J. and C.W. Osenberg, eds. *Detecting Ecological Impacts: Concepts and applications in coastal habitats*. Academic Press. New York.

Vinson, M.R., and E. Dinger 2006. Rotenone effects on the aquatic macroinvertebrates of the Virgin River in the vicinity of the Webb Hill Barrier near St. George, Utah, 2003-2005. Final Report for Project Number: IV.A.1. Washington County Water Conservancy District. St. George, Utah. 33 pp.

Vinson, M.R., and D. K. Vinson. 2007. An Analysis of the Effects of Rotenone on Aquatic Invertebrate assemblages in the Silver King Creek Basin, California. Final Report prepared for U.S. Forest Service, Humboldt-Toiyabe National Forest Carson City, NV. 255 pp.

**Attachment 3**

Date \_\_\_\_\_

**Monitoring Report Cover Letter**

California Regional Water Quality Control Board  
Lahontan Region  
2501 Lake Tahoe Boulevard  
South Lake Tahoe, CA 96150

**Facility Name:**

\_\_\_\_\_  
\_\_\_\_\_

**Address:**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Contact Person:**

\_\_\_\_\_

**Job Title:**

\_\_\_\_\_

**Phone:**

\_\_\_\_\_

**Email:**

\_\_\_\_\_

**WDR/NPDES Order Number:**

\_\_\_\_\_

**WDID Number:**

\_\_\_\_\_

**Type of Report (circle one):**

Monthly    Quarterly    Semi-Annual    Annual    Other

**Month(s) (circle applicable month(s)\*:**

JAN    FEB    MAR    APR    MAY    JUN  
JUL    AUG    SEP    OCT    NOV    DEC

\*annual Reports (circle the first month of the reporting period)

**Year:**

\_\_\_\_\_

**Violation(s)? (Please check one):**

\_\_\_\_\_ **NO**                      \_\_\_\_\_ **YES\***

**\*If YES is marked complete a-g (Attach Additional information as necessary)**

**a) Brief Description of Violation:**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**b) Section(s) of WDRs/NPDES Permit Violated:**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

c) Reported Value(s) or Volume:

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d) WDRs/NPDES  
Limit/Condition:

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e) Date(s) and Duration of  
Violation(s):

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f) Explanation of Cause(s):

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g) Corrective Action(s)  
(Specify actions taken and a schedule  
for actions to be taken)

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I certify under penalty of law that this document and all attachments were prepared under my direction or supervision following a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my knowledge of the person(s) who manage the system, or those directly responsible for data gathering, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

If you have any questions or require additional information, please contact \_\_\_\_\_ at the number provided above.

Sincerely,

Signature: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

## 2007 Sierra Nevada Fish and Amphibian Inventory Data Sheet Instructions Version 2.3 May-15-07

California Department of Fish & Game  
Fish/Amphibian Survey Protocols

### Overview

Fill out a separate data sheet (substitute "Palm entry" for "data sheet" as necessary) for **every** lake and pond that has a Site ID, regardless of how un-lake like the site is. If the site is dry, frozen, part of another sampled water body, or is a widening of a stream (i.e., there is a current flowing through the site), indicate why a full datasheet was not filled out on the map portion of the datasheet or the notsampled field and comment field of survey main (e.g., "pond was dry"). Some data subforms will still need to be filled out in the Palm unit (see below). If you encounter ponds not shown on the 7.5' maps, fill out a data sheet if they contain fish, amphibians, and/or fairy shrimp. Meadows, marshes, and spring seeps should always be surveyed, even if they do not have Site IDs. When you visit non-lake habitat such as marshes that contain extensive ponded water, complete a single survey for the entire area. It is critical that all relevant portions of each data sheet be filled out, and that non-relevant portions be indicated as such, not simply left blank. Remember, if the data sheet is improperly filled out, the visit was a complete waste of time and money.

When you complete surveys in habitats that do not contain ponded water (e.g., streams), record the start and end UTM coordinates in the amphibian/reptile visual survey section and complete all other pertinent sections. Many stream sections that will be surveyed are associated with other Site IDs (e.g., 200 m of each inlet and outlet) and the survey data should be entered on the associated Site ID's data sheet. Record all observations in ball point pen. Keep data notebooks and otoliths in separate Ziplock bags to prevent labels from being erased by leaking alcohol.

**Recording Numbers:** Use the dot-line method for recording the number of "hits" in fields that require a count (4 hits: ● ● ● ●; 8 hits: □ □ □ □; 10 hits: ⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗), instead of the more typical four vertical lines and a slash. The dot-line method is much more space-efficient and is easier to read. In addition to categorizing the substrate type at each spot, record the presence or absence of aquatic vegetation at each spot (record hits using the dot-line method).

### General Lake Description / Survey Main

**Site ID:** This is a *critical* number, as it will be used to link the data sheet to a particular body of water and to identify all samples. This ID is written on the 7.5' maps available for crews to take into the field. Check the Site ID carefully before recording it on the data sheet. If you encounter a lake or pond that is not shown on the 7.5' map or a marsh, meadow or spring seep that does not have a Site ID, its Site ID will be the number of the **nearest lake or pond that has a Site ID** plus a decimal place identifier (e.g., 70377.01). Additional Site ID's for nearby unnumbered lake features will be made using consecutive numbers (e.g., 70377.02, 70377.03).

**Location:** This description should **always** be provided, and must be detailed enough to allow someone not familiar with the area to pinpoint the lake on a topographic map. This information is particularly critical for unnamed lakes because the GPS point is the only other reference for the location of the water body. Do not leave this space blank, no matter how obvious the lake feature is. At a minimum, give the distance and the compass direction from the site to two nearby prominent named geographical features (e.g., lakes, peaks, etc.). Lake and peak names, distances, and compass directions should be taken from 7.5' maps. Palm - Use the survey main comment field to note location.

**Date:** Write as month-day-year (Aug-10-01) and always use the three letter abbreviation for month. Palm- ensure this field auto-populates correctly. If your palm's date is incorrect this field will also be incorrect. If entering data in a palm after the survey was conducted, be sure to change the value of this field to the appropriate survey date BEFORE opening any subforms.

**Lake name:** Lake names generally originate from the 7.5' topo map. However, CDFG has also implemented its own naming system for the stocking program. Field crews should have a pre-generated field lake checklist with the proper CDFG lake name and corresponding Site ID. Use this list to populate the Lake name field.

Palm - Lake names should be auto-populated based upon the names from the high\_mountain\_lakes.shp in the GIS data framework. These names are not always correct. If the correct name is known, or the name was not auto-populated, replace the auto-populated contents with the correct name as appropriate.

Note – consecutively numbered lakes (i.e. Big Pine Lake 1, Big Pine Lake 2, etc.) are numbered starting from lowest elevation and ending at the highest elevation lake.

**Water type:** Circle the appropriate descriptor for the water type you are surveying (lake, unmapped pond, stream, marsh/meadow, spring seep). Palm-depending on the watertype, certain subforms must be completed.

Lakes should always receive the full protocol and have all applicable fields filled out.

Any unmapped lotic water body that is surveyed, regardless of size, falls under the category of “unmapped pond”, circle water type = 3 (unmapped pond). Unmapped ponds should be completely surveyed as are lakes. Visual fish surveys are not acceptable if fish are present even if the site is small and unmapped.

Stream sites should have a complete VES, visual fish survey, shrimp survey, and photo, but do not require littoral and shoreline habitat surveys or inlet and outlet surveys. Palm - Remember to record the start and end GPS points of the stream reach surveyed in the amphibian header subform.

Marsh/Meadow sites should be surveyed as a single site. GPS the perimeter of the site and record the coordinates in the comment field (these will be used to generate a GIS polygon for the site). Record as many points as needed to characterize the general shape of the marsh/meadow. Usually less than 10 points will suffice. Complete a VES, visual fish survey, shrimp survey, photo, and inlet/outlet surveys (if applicable). Littoral and shoreline habitat surveys do not apply.

Spring seep sites should have a VES, visual fish survey, shrimp survey, and photo. Littoral and shoreline habitat surveys do not apply.

**Seasonality:** The determination of whether a water body is perennial or ephemeral should be made based on field determination. Cues such as grass or terrestrial vegetation on the lake bottom; undecomposed duff; obvious bath tub ring; or low lake level can be used to assess status. 7.5' maps may help the surveyor make a call. Perennial lakes and ponds are shown in dark blue, ephemeral lakes and ponds are shown in white with blue diagonal lines, and marshes are indicated by a marsh symbol.

**Not Sampled:** If the water body indicated on the map is frozen, dry, not found, part of another water body, or is a stream widening, your sampling will be limited. Circle the appropriate reason why the water body was not fully sampled: stream widening, frozen, dry, not found, or part of another water body.

Frozen water bodies can usually be handled in one of two ways. Completely frozen sites offer little to no opportunity to survey for animals, thus indicate the site is frozen in the appropriate check box and comment fields and move on. Partially frozen sites may offer some opportunity to VES for amphibians, furthermore, this is often the time when high mountain species begin breeding. Indicate in the comments that the site is partially frozen, take an overview photo, and conduct a VES.

Dry sites can often have newly metamorphosed bufo species and hyla regilla. VES the site, including any tributaries, and take an overview photo.

Sites that are not found should have only the top box of the data sheet filled out, indicating that the site was not found in the “Location” box. Palm – fill out a survey main and indicate in the comment field that the site was not found.

Stream widenings are those water bodies shown as perennial ponds but that have more than 10% of their surface area with noticeable current, i.e., these are more like stream pools than ponds.

If the water body of interest is actually part of another water body, sample and complete a data sheet for the larger water body, and fill out only the top box of the data sheet for the smaller water body, indicating that it is actually part of the larger water body in the “Location” box. In other words, the site that is considered part of another

waterbody, will receive a full survey under the Lake ID of the larger site. Palm – fill out a survey main for the site but indicate in the comments that the full data set is associated with a different site and list the site ID.

**Planning Watershed:** The watershed name for all lakes is given on the "Lakes Checklist." Do not use the name of the outlet creek given on the 7.5' map as the drainage name, as this may not be a complete description. Palm - The watershed name should be auto-populated for all pre-identified site IDs (i.e. those ending in .00). If a new site is being surveyed, use your survey map to identify which planning watershed the new site is located in, and pick the appropriate watershed name from the picklist.

**County:** Record the county (from 7.5' map) in which the lake feature lies.

**Elevation:** Record the elevation from the 7.5' map, or a calibrated altimeter (such as the altimeter feature in the Garmin eTrix Vista GPS). When using the map look for labeled contour lines to determine contour interval distance and units. Be aware that maps generated in the office by GIS software that span multiple 7.5' quads may display intervals in both meters and feet. The lake elevation is the average of the contour line below the lake and the contour line above the lake. Thus, if a lake is between the 9860' contour and the 9900' contour, the lake elevation should be recorded as 9880'. A common mistake is to assume that the proximity of a lake to a contour line indicates that the elevation of the lake is close to the value of that contour line. The horizontal distance between two points on a topographic map bears no relationship to the vertical distance between those same two points. Record the units used (m or ft).

If the lake has a water level elevation (i.e. WL 9832), use this number in the elevation field (note- water level elevations are a good source to calibrate an altimeter).

Avoid using the GPS estimated elevation because this number is highly inaccurate (+/- 200meters in many cases).

**UTM Coordinates:** This is a pair of numbers that are basically x and y coordinates. In our area, they are North and East. These numbers need only be obtained for lakes not shown on the 7.5' maps or for those lakes lacking a Site ID. Use a GPS unit to obtain the UTM coordinates. Also record the UTM zone that you are in. **Make sure your GPS is setup in UTM NAD83.** These coordinates are critical as they will be used to map the lake.

**Topographic map:** Record the name of the 7.5' topographic map (or "quad") that contains the lake feature. These are listed in the legend on our CDFG navigation maps. Palm- not used in Palm.

**Maximum lake depth:** Measure maximum lake depth with the Speedtech SM-5 Depthmate Portable Sounder. Do not spend inordinate amounts of time sounding every part of the lake to find exactly the deepest part. By sounding the deepest-looking piece of the lake, you will quickly get a feel for where the deepest spot actually is. Precise measurements of "maximum depth" are not very important in large deep lakes. However, in shallow lakes (< 5 m) a precise depth ( $\pm 0.5$  m) is very important. Plan to take maximum depths when setting or retrieving gill nets, but the data must still be collected even when nets are not set. **This data field was ignored too often in the past but is one of the more important data for determining future management options!** Enter this value on the Fish Data Form at the top of page 3, or at the bottom on page 2 if no gill net fish survey was completed for a site. In the Palms the Max Depth field is located in the Fish Header Subform.

Maximum lake depth should be measured even when field crews are not equipped with a depth sounder. There are many methods to improvise and collect depth measurement, but the simplest is often a known length of cord and a rock.

**Team Members:** Use complete names. Palm - All crew involved in data collection should be recorded in the Surveyors Subform. The VES crew should be listed in the amphibian surveyors subform.

## **Lake Characteristics**

The habitat characterization is perhaps the most subjective of the measurements made using this protocol., and we hope to reduce the potentially high observer bias by stressing the need for survey consistency. In other words, it is important to practice the protocol, calibrate visual estimates with real measurements, check each other's data, and maintain consistent survey methods.

**Littoral zone substrate composition:** While walking around the lake perimeter during the VES survey (see Amphibian/Reptile Surveying, below), stop after a set number of paces (see below) and categorize the **dominant** substrate at the lake edge as one of the following: silt, sand (<2mm), gravel (2-32mm), small cobble (32-64mm), large cobble (64-256mm), boulder (>256mm), bedrock, or woody debris (pine needles and pine cones = “woody debris”).

Categorize the substrate along an imaginary transect line starting at the lake edge, extending perpendicular from shore, and lying along the first **3 meters** (10 feet) of the lake bottom. Record the number of hits for each substrate category in the appropriate field. Record a “0” for categories with no hits. Only record aquatic vegetation hits on transect with at least 10% coverage. This avoids over-representing aquatic vegetation in the lake characterization. Record this information under "Substrate transects with aquatic vegetation". Increase the number of paces between transects when surveying large lakes and decrease the number of paces for small ponds. Shoot for fifty transects, as this is a sufficient number to provide an accurate description of the littoral zone of lakes. Lake perimeter (auto-populated in survey main for existing sites, or estimated) can be divided by 50 for number of meters between transects.

For very small sites where you can observe the entire littoral zone substrate from a single location, it is permissible to estimate the littoral substrate composition by size category visually, and then to record your estimates as percent values for each size category (make sure the total of all substrate categories equals 100%). If the lake contains large numbers of amphibians, conduct the amphibian/reptile survey first and then walk around the lake a second time to measure substrate composition.

Record the name of the person conducting the survey of lake characteristics ("Person recording habitat information").

**Littoral zone depth:** At each of the littoral zone transects, also record the water depth at **one meter** from the shoreline and record in one of the following depth categories (in centimeters): 0-15, 16-30, 31-45, 46-60, >60. As with the littoral zone substrate composition for very small sites, it is permissible to estimate the water depth at one meter visually, and then to record your estimates as percent values for each size category (make sure the total of all depth categories equals 100%).

**Shoreline terrestrial substrate composition:** At each of the littoral zone transects, also record the dominant substrate along an imaginary line starting at the lake shore (or the top of the “bath tub ring” if the lake’s water level is below full pool) and running for **1.5 meters** (5 feet) perpendicular and away from the lake shoreline. The substrate categories are silt-64mm, 65-256mm, bedrock, grass/sedge/forbe, and woody debris. As with the littoral zone substrate composition for very small sites, it is permissible to estimate the terrestrial substrate composition by size category visually, and then to record your estimates as percent values for each size category (make sure the total of all substrate categories equals 100%). Note: brush = willows and other woody plants; forbs = non-woody plants.

**Percentage Method:** if you are able to stand in one spot and view the entire lake shore, substrate, etc. you may estimate the above categories using percentages of the entire lake, rather than the transect method. This can save time on small water bodies. Make sure the percentage check box is checked on your datasheet or palm and that the numbers for one category add up to 100%.

### **Tributary Characteristics**

Each significant tributary to the water body should be surveyed for 100 meters (200m for R6 crews) for fish and amphibians. In addition general characteristics of each tributary should be recorded, see below.

Any tributary displayed on a 7.5' map should generally be surveyed and inlet or outlet information completed. Small rills should be surveyed for amphibians, but not necessarily included as a distinct tributary. Within the continuum of tributary sizes and complexities, field crews will be required to distinguish “significant” tributaries from those which do not warrant full tributary surveys. Keep in mind the primary purpose of tributary information is to assess important habitat for fish and amphibians, but not to be bogged down with intense micro-habitat analysis.



**Palm** – It is very important that palm users realize there is no inherent method of tracking barrier photo data to a specific tributary. Thus, ALWAYS assign a number for each tributary (i.e Inlet 2, or Outlet 1) even if there is only one tributary. It is important to make sure the same tributary number is listed on the barrier photo subform. Also, tributary numbers must be recorded on lake sketches.

**Tributary GPS points:** Record a GPS point where each tributary joins the lake. Also record a GPS point at the end of your tributary survey. This will help to match inlet/outlet data to the correct tributary.

**Tributary number:** Record number assigned for each tributary (i.e. Inlet 1, Inlet 2, or Outlet 1). This same number is to be recorded on lake sketch and included in barrier information, so that the correct barrier can be associated with the correct tributary.

**Width and depth of inlets & outlets:** While walking the lake perimeter, record the average width and depth at bank full of each tributary, even if dry. Inlets generally are widest at the point at which they enter the lake, so obtain the average width and depth upstream of this point. If there are no inlets, circle "no inlets". If inlet is dry enter "Dry" and continue to survey for barriers and amphibians. If there are no outlets, circle "no outlets". If outlet is dry enter "Dry" and continue to survey for barriers and amphibians.  
Palm – if there are no inlets check "Inlets NOT Present". If there are no outlets check "Outlets NOT Present".

**Presence of fish in inlets and outlets:** Record whether there are fish present in the first 100 m (200m for R6 crews) of each inlet and outlet stream by circling "Y" or "N" for each feature. If the stream habitat in a particular inlet or outlet is such that seeing fish would be difficult and you don't see any fish, circle "?". If there are no inlets or outlets, leave this section blank. If inlets and outlets are dry, fish may be present in isolated pools and this is data that needs to be captured.

**Distance to first barrier on inlets and outlets:** Pace off 100 meters (200m for R6 crews) of each tributary, recording the distance from the lake to the first impassable barrier. Dry tributaries should still be surveyed. The barrier location should be recorded as the number of meters from the lake. Barriers are falls >0.75 m high if there is no pool at the base, falls >1.5 m if there is a pool at the base, or steep cascades higher than approximately 1.5 m. Logjams can float during high water, and should generally not be considered barriers. Because fish can often get over remarkable obstacles, be conservative in what you call a barrier. Provide a description of each barrier on page 2 of the data sheet (see Detailed lake and inlet/outlet description, below) or in the barrier description field in the Palm. If there are no barriers write "none". If there are no inlets or outlets, leave this section blank.

**Description of fish barrier(s), UTM coordinates, photo number:** Provide a GPS UTM coordinate, photo number, and a brief description of each barrier in the spaces provided. If additional space is needed, use page 2 of the data sheet (see Detailed lake and inlet/outlet description, below). Record the photo file number. It is important to read the appropriate protocols for camera setup and file naming information. Make sure your GPS is setup with the proper settings referenced in the appropriate protocol.

**Spawning habitat in inlets and outlets:** Up to the first barrier of each inlet and outlet or to the end of the survey reach if no barrier exists, make a visual estimate of the amount of the streambed **between the lake and the first barrier** that is suitable trout spawning habitat. The amount of spawning habitat should be recorded in terms of the number of square meters of stream bottom with the following characteristics: gravel 0.5-4 cm in diameter and not cemented into the streambed, water depths of 10-50 cm, and water velocities of 20-60 cm/s for successful spawning.

Spawning habitat data is used to estimate whether fish populations are self-sustaining. Use good calibration techniques and real measurements as necessary to assure accuracy.

**Evidence of spawning in inlets and outlets:** Check each inlet and outlet for evidence of spawning **between the lake and the first barrier**, if a barrier is present. This could be spawning trout, redds (nests), or newly-hatched fry (20-30 mm). Redds are often very obvious, being patches of freshly cleaned gravel 0.5-1 m in length. If you aren't sure if what you are seeing is in fact a redd, dig into the downstream portion of the disturbed gravel while holding a net downstream. If it is a redd, you should find eggs in the net after disturbing the gravel. For each inlet and outlet, circle all types of evidence that you find. If you don't find any evidence of spawning, circle "None".

**Area of in-lake spawning habitat:** Estimate the amount of suitable spawning habitat (using the spawning habitat criteria given above) in the lake at the mouth of each inlet and outlet. Look for the presence of spawning trout and completed redds.

**Description of other in-lake spawning habitat:** Restrict your description of "other in-lake spawning habitat" to areas where you observe spawning fish, redds, or large numbers of fry in areas of the lake away from inlets and outlets.

### **Fairy Shrimp**

During the amphibian survey, be on the look out for schools of fairy shrimp. The distribution of these 2-3 cm crustaceans is poorly known for the Sierra Nevada, so we are interested in describing localities. Look for them in all bodies of water you sample. When walking around a lake, take a few minutes to also look in small pools and ponds adjacent to the lake.

If you find fairy shrimp either in your samples or during the survey of lake characteristics, indicate this on the data sheet by circling "Y" or "N" to the questions about fairy shrimp locations ("Present in lake?", "In lake-associated pools?", "Other locations?"). "Lake associated pools" are pools within 2 m of the lake. Be specific in your location descriptions, and provide a brief description of these locations (e.g., "1 m<sup>2</sup> pool 0.5 m from lakeshore on N side of lake 70675, pool is 10 cm deep"). Information on the fairy shrimp populations should include, at a minimum, location, surface area, and depth of the habitats.

Palm – If fairy shrimp are not found, be sure to check "Fairy Shrimp NOT Present". If found, uncheck box and fill out a fairy shrimp subform.

For all habitats that contain mature fairy shrimp (1.5-3 cm long, females carrying eggs) and are separated by  $\geq 1$  km from other fairy shrimp samples in the same drainage, collect approximately 10 adults, being sure to collect at mostly large non-egg bearing individuals (look for tusks, these are likely to be males, and males are needed to key these animals out to species). Preserve the fairy shrimp in a 20 ml vial using 95% ethanol. Make an internal label out of a page from your notebook. The label should contain the date, the Site ID, and the drainage name (in pencil). To simplify the process of determining whether a population is  $\geq 1$  km away from the last fairy shrimp population from which a collection was made, on the topographic map write "(F)" next to the Site ID from which fairy shrimp collections were made.

### **Amphibian/reptile surveying**

**Introduction:** We will be conducting amphibian and reptile surveys at all bodies of water shown on 7.5' topographic maps, streams, and at sites not shown on the map but found during surveys and while traveling between sites.

To conduct an amphibian survey, walk **slowly** around the perimeter of the site, or along the stream, counting the number of adults, sub-adults, metamorphs, larvae, and egg masses you find of each species. Pause often to look ahead for basking animals. Use your dip net to sweep habitat and banks in an effort to spook animals. When surveying a lake, VES all inlets and outlets (see above) and lump with the lake VES data. Meadow/marsh sites should be surveyed systematically with multiple surveyors in an effort to survey the entire site. As needed, use the sterilized D-net or aquarium net to catch amphibians and reptiles for identification. Consult the field guide provided for adult and larval identification.

Record total numbers of individuals observed by species and life stage in the appropriate field. If no animals are seen during the VES, record "none" in the field. Species abbreviations are given on the data sheet. Palm- use the pick lists for species abbreviations. If no animals are seen make sure that the "Amphibians NOT Present" checkbox is checked on the amphibian header subform and do not fill out an amphibian data subform.

Under "Comments", record any interesting observations made during the survey (e.g., mountain yellow-legged frog larvae found only in shallow lagoon on NW side of lake). Also record locations of interesting observations on the map of the lake that you draw (see below). If you are surveying inlets or outlets of a lake and encounter amphibian species, record your observations on a separate line on the data sheet and note the approximate locations and species

on the inlet and/or outlet diagrams on page two. Palm – use the comment field in amphibian header to note interesting or important observations, or the numbers of animals seen in inlets/outlets, or numbers of multi-age class tads observed.

Time of day, temperature, and weather are important factors affecting the quality of any VES survey. Time your surveys to be during the warm portions of the day (roughly 9am – 6pm, however time window can vary depending upon time of year and local conditions). If the weather is too cold or stormy, VES surveys can be very inaccurate and should not be conducted.

**Amphibian/reptile observers:** Record the names of all people looking for herpetofauna.

**Survey start time and end time:** Record the time at which the survey began and ended. The start time is the time the amphibian survey began, not the time you arrived at the site. The end time is the time you finished the VES. Record time as 24 hr time.

**Total survey duration:** Record the total time spent searching for amphibians/reptiles. Do not include time spent surmounting lake-side obstacles (e.g., cliffs), identifying specimens, or recording notes. If two people survey the same site by walking in opposite directions around the lake perimeter, the total survey duration should include the time spent surveying by each person. This data tells how much effort went into the survey.

**Weather/wind/color/turbidity:** Circle the appropriate descriptor for each.

**Stream survey:** Using the GPS unit, record the UTM locations at the beginning and end of your stream survey.

**Stream order:** Stream order is a classification based on branching of streams. On a map showing all intermittent and permanent streams, the smallest unbranched tributaries are designated order 1. Where two first order streams meet, a second order stream is formed. Where two second order streams meet, a third order stream is formed (and so on...). Using your 7.5' topo map, identify which order of stream you are surveying, and record it in the box provided.

**Calling?:** Were any frogs calling during your survey? Circle yes or no.

**Voucher specimens/tissue samples:** Will be collected from populations of mountain yellow-legged frogs. Note that this is done on a population basis and not for each site. Use best judgment in determining the parameters of the population. Up to 20 disease swabs from different individuals, usually adults, will be taken at the sites that support each population.

**Survey Method:** Circle the method used. Note: Mountain yellow-legged frogs do not have a significant call, so aural surveys will not apply.

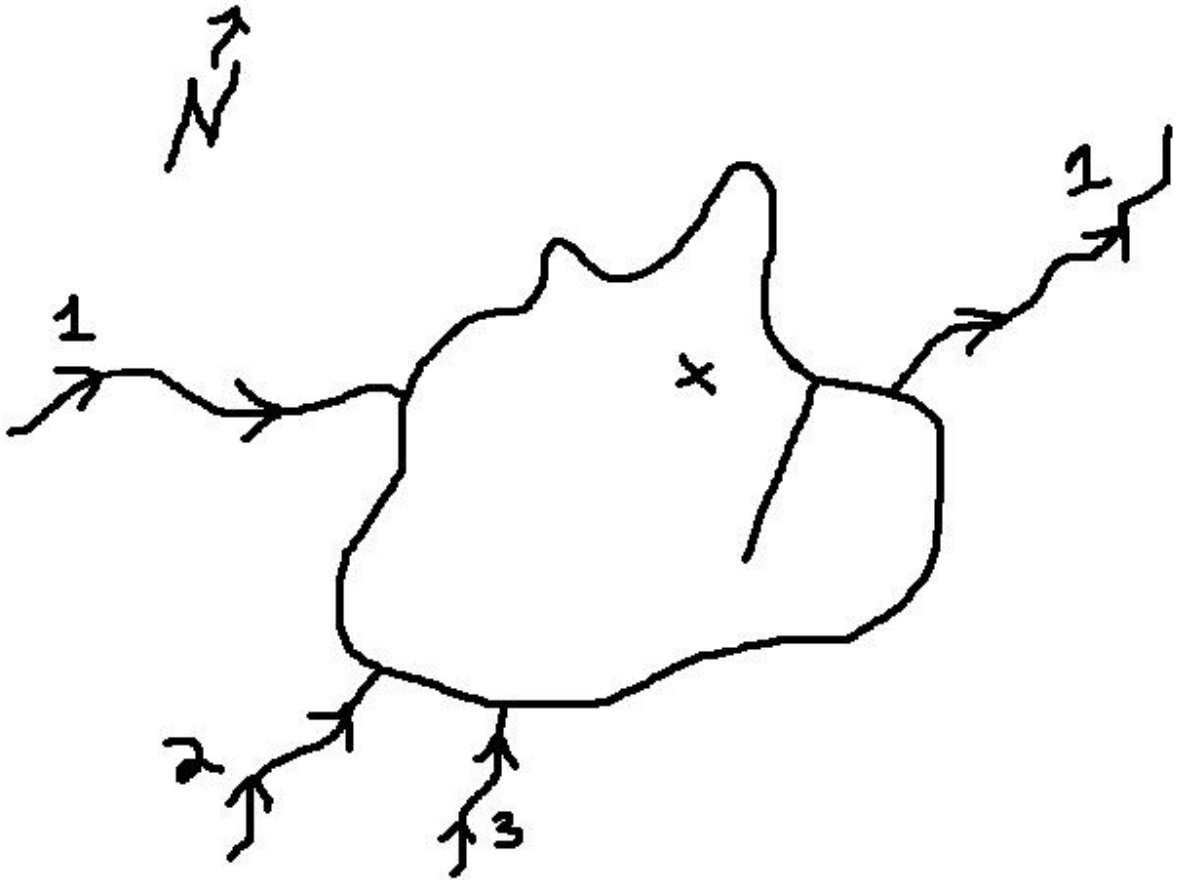
**Air and Water Temperatures:** Measure the air temperature from the lake shore at 1 meter above the lake surface. Measure water temperature approximately 0.5m out from shore and 10cm under the water surface. When possible, temperatures should be measured during midday (1100 – 1500). Record the time that temperatures were measured after the @ symbol and the temperature units (C or F).

### **Detailed Lake and Inlet/Outlet Sketches**

**Drawing of lake perimeter, inlets, outlets and areas of special interest:** Draw the lake perimeter as best you can, use the shape on the 7.5' map if necessary. The most important information that should be included on the sketch is the inlet and outlet locations and corresponding tributary number, max depth location, net set location, North arrow (see symbology below). If there is room, note any important Mountain yellow-legged frog habitat features, such as egg mass or larvae clusters. Add a second sketch if needed. The Palms do not have a lot of room for clutter on the sketch, so keep sketches simple and not cluttered with unnecessary information such as locations of trees, boulders, small islands, good cliff jumping locations, snow fields or talus fields.

**Sketch symbology:** North arrow = an N with a little arrow at the top; max depth = X ; net set location = a line from the shore; Inlets and Outlets should have tributary number and can be simplified to In1 or In2 for inlets and O1

or O2 for outlets. Also include arrows <<< for directional flow (i.e. either towards or away from lake). See example below:



**Description of inlets/outlets:** Provide a detailed description of the physical characteristics of inlets, outlets, and barriers. For example, are inlets and outlets very steep cascades or meandering streams? How high are the barriers? Are they falls or cascades? If fish were present in inlets, were they found only below any barriers, or were they also found above the barriers? Note locations of any amphibians observed. Provide a similar description for the outlets.

### Overview Photos

**Introduction:** All surveyed sites should have an overview photo taken. Try to find a location that allows you to capture the entire site and the habitat provided by that site. Thus a lake overview photo should capture the entire lake as well as the shoreline and any inlet or outlet marsh complexes that may be present. Use the panoramic photo functionality of the camera as needed and note how many photos were taken (Palm - in photo comments).

Often forests or flat terrain inhibit good overview photos. In these cases, do the best you can.

**Photo Device:** Record the device number of the camera – generally the serial number

**Photo Type:** Choose from the selection the reason or subject of the photo. If a panoramic photo was taken be sure to specify that in the photo type field.

**Photo Numbers:** Record photo file number. See Appendix for camera setup and additional file naming information.

**Photo Times:** The times are used to reference a photo to a particular site. It is important to record these times accurately and to ensure that both the camera and Palm date and times are properly set up.

## **Fish Surveying**

**Introduction:** We will be conducting fish surveys at all bodies of water shown on 7.5' topographic maps and at sites not shown on the map but found during surveys and while traveling between sites.

Our fish survey methods are designed to provide an accurate representation of fish species composition and size structure in lakes and ponds, as well as provide an estimate of catch per unit effort (CPUE) at each location. In order to quantify the size structure of each fish species present at a particular location, we need a sample of at least 20 fish, and preferably not more than 50. Obviously, in lakes that have a very small fish population, capturing even 10 fish may not be possible.

We will set one net in each lake for 8-12 hours. Nets can be set at any time of day. To minimize logistical problems and safety hazards, do not pull nets at night. Time your net sets appropriately. For example, don't set a net at 5 PM, since this would mean either pulling the net at 1-5 AM or waiting until morning and exceeding the 12 hour maximum set duration. You should plan on setting nets in the late evening or early morning.

If you are setting a net in a lake with an extremely dense trout population (typically lakes with brook trout), you may want to paddle over the net with a float tube after 4 hours and get a rough count of the number of fish captured. If you have 40 or more fish after 4 hours, pull the net to avoid capturing an inordinate number of specimens. Use this 4 hour net set duration only when absolutely necessary. If gill-netting a lake that contains amphibians, you need not worry that the net will trap them. If turtles are present, set the gill nets during the day only and check the nets frequently to ensure that these species are not getting entangled.

Before setting a gill net, submerge the entire net (still contained on the handle); dry nets are much more susceptible to tangling. To set the net, put a small rock into each of two mesh bags and clip one bag to the shore end of the net (end with loop). Get in your float tube and wedge the bag between rocks at the lake shore and pull on it gently to ensure that it is firmly anchored. With the net lying across the float tube (lead-line on your left and net handle in your right hand or vice versa), paddle backwards slowly while feeding out the net. The net should be set perpendicular to the shore. If you encounter a tangle while feeding out the net, shake the net. Do not pull on the net as this will often tighten the tangle. Shaking will nearly always rid the net of the tangle. When you get to the end of the net, attach a float to the handle and then clip the second bag to the bottom of the net. Paddle backwards until the net is taught, and then drop the bag. Record the time when you finish setting the net.

After 8-12 hours, retrieve the net by pulling the mid-lake end of the net up by the float. Detach the float and the bag. Pull the net toward you, placing the float line on one side of the float tube and the lead line on the other. Continue pulling in the net until you reach the shore. Remove the second bag. To carry the net to an area for fish removal, cradle the net over your arms keeping the lead line on one side and the float line on the other. Lay the net down in a meadow or on a sandy flat (a meadow is preferable, but nearly any place will work; stay away from areas with lots of woody vegetation, pine needles, pine cones, and sharp rocks since they will get snagged in the net). Spread out the first 10 feet of net and remove the fish. After removing all fish from the first 10 feet of net, spread the next 10 feet of net and fold up the first 10 feet. Continue until you have removed all fish from the net. Restring the net onto the handle, rinse the net in the lake, dry the net in the shade, tie the net in a knot to prevent tangling, and stuff it into a sack. The net may be set again without sterilization if the receiving water is located downstream from the previous netting site. If the next netting site is located above the previous site, or in a separate drainage (even a small side drainage within the same basin) then the net must be sterilized (see sterilization protocol).

**Fish survey method:** If fish are observed, generally set a net. Record whether fish were surveyed visually or using gill nets. Except for small, shallow (<2 m) bodies of water in which the surveyor can see the entire lake bottom, we typically sample fish populations using gill nets. If there is any question as to whether fish are present in a lake, set a net. The only other exception is lakes/ponds where populations of yellow-legged frogs are present. The decision whether to set a gill net in a shallow pond is up to the crew leader, but keep in mind that fish can live in some very marginal habitats. If only a visual fish survey is needed (e.g., because the lake is < 2 m deep and you can see the entire bottom and there is positively no fish, or because there is a healthy population of frogs), you need not fill out the third and fourth pages of the datasheet. (For Palms this is the "Fish Subform.")

**Visual Survey Justification:** If you surveyed for fishes visually, provide a brief justification as to why you chose this method (e.g., "pond only 50 cm deep, entire bottom visible, no fish seen or frog population present"). Remember, if fish are seen you should almost always set a net.

**Net set time and date:** Record the time when you completed the net setting process, not the time when you started setting the net. Record the time as 24 hr time. Record the date on which the net was set.

**Net pull time and date:** Record the time when you began pulling the net. Record the date on which the net was pulled.

**Site ID:** If you are setting a gill net to survey a fish population, fill out pages 3 and 4 of the datasheet. First, record the Site ID again. This identifier will ensure that both sheets of the datasheet are associated with the correct lake. Make sure that the Site ID you record is the correct one and matches the Site ID on the first page of the datasheet.

**Water temperature:** Measure water temperature approximately 0.5 m out from shore and 10 cm under the water surface. Record temperature in Celsius. Temperature should be measured during midday (1100-1500) when possible.

**Description of net location/setting nets:** Circle the appropriate location and provide a brief description of the area in which the net was set ("Comments"). Gill nets should always be set at the lake outlet, if present and if conditions allow. If an outlet does not exist, or is located in an area that is difficult to net (water <2 m deep, log jams, etc.), set nets at the inlet. If an inlet is not present or is not suitable, set the net in a suitable location anywhere along the lake shore. If possible, choose an area that is 3-8 m deep.

**Fish Data:** If no fish were captured, write "no fish" across the fish portion of the data sheet. If fish were captured, record the species, length, and weight of all fish. Species abbreviations are given at the bottom of the data sheet. Measure fish using the vinyl tape laid out on the ground. Measure fish total lengths to the nearest mm. Weigh fish using a Pescola spring scale. Before weighing fish, ensure that all debris (small rocks, etc.) are removed from the fish. Use the 60g scale for all fish <100 g, and the 300g scale for larger fish. Outliers may need to be weighed in parts.

All fish will need to be cut open to determine sex. If someone on your crew is able, also note the general contents of fish stomachs (e.g., chironomid pupae, terrestrial insects, etc.). If you encounter a lake that contains both fish and amphibians, look through the fish stomachs very carefully for amphibian remains.

Female fish will have eggs ranging from very small (early) to large and flaccid (late, deflated looking). Make a check mark in the appropriate box for each female fish sampled.

Fish age-analysis can be used to determine if a population that has been supported by biennial (or less frequent) stocking is self-sustaining. Otoliths (ear-bones) should be collected from up to twenty of the sampled fish over the range of sizes captured that are less than 200 mm total length, and **only** from lakes where it is difficult to determine whether fish are self-sustaining (young-of-the-year are not visibly present in tributaries or around margins of lake). Do not collect otoliths from brook trout, since the Department no longer stocks them in most waters. Place otoliths from each fish into a separate vial labeled with the Fish #. Label the vial with a fine-tip Sharpie. Keep all vials for a particular lake's otolith sample in a small Ziplock bag with an internal paper label that includes the date, the Site ID, the drainage, and the species of fish.

Be careful about disposing of fish carcasses, as we don't want the carcasses attracting the attention of backpackers or bears. The best disposal method is to pop the fish's swim-bladders, paddle out into the lake until you reach a relatively deep area, and dump them. Burial of fish on land should generally be avoided, as animals can smell the fish and will dig them up (no matter how deep you bury them).

**Net sterilization:** When moving to a different drainage or when one site does NOT flow into the next site gear (float tube, waders, fins and gill nets) must be sterilized. Sterilize using 5 ml of Quat 128 per 1.5 gallons of water. Gear must be soaked for at least 20 minutes and dried for at least 20 minutes. Dispose of Quat 128 on rocks or soil away from waterways. Consider rinsing gear in fresh water away from potential amphibian sites before next use.

**Field review of datasheets**

At the end of each day, the crew leader should review all datasheets for completeness and clarity. Once review of a datasheet is completed, the crew leader should initialize the field review box on pages 2 and 3 of the datasheets. Make sure all of the spaces on the data sheets have been filled in. These data sheets are all the state has to show for the time and money that went into each survey. Protect the data sheets as if they were your most prized possession!