7th Biennial Report
Aquatic Habitat Conservation Plan

Submitted to

National Marine Fisheries Service

and

United States Fish and Wildlife Service

By
Green Diamond Resource Company

in fulfillment of requirements pursuant to
NMFS Permit No. 1613
and
USFWS Permit No. TE156839-0

March 15, 2021

Revised April 27, 2021

Certification of Report

Under penalty of law, I certify that, to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of this report, that information submitted is true, accurate, and complete.

Jason Carlson, Vice President and General Manager
Green Diamond Resource Company

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I. Introduction

On June 12, 2007 the National Marine Fisheries Service and the United States Fish and Wildlife Service accepted Green Diamond Resource Company's (GDRCo) Aquatic Habitat Conservation Plan and Candidate Conservation Agreement with Assurances (AHCP). On this date, NMFS issued GDRCo an ESA section 10(a)(1)(B) permit authorizing incidental take coverage for listed and unlisted populations of three fish under its jurisdiction: Chinook salmon, coho salmon, and steelhead. In addition, the USFWS issued Green Diamond an enhancement of survival permit for two unlisted fish and two unlisted amphibians under its jurisdiction: resident rainbow trout, coastal cutthroat trout, tailed frog, and southern torrent salamander. The incidental take permit (ITP) and the enhancement of survival permit (ESP) collectively are cited as "Permits". NMFS and USFWS collectively are cited as "the Services." The species identified above collectively are cited as the "Covered Species."

GDRCo began implementing the AHCP on July 1, 2007. The AHCP includes management measures for riparian zones, geologically sensitive areas, forest roads, and harvesting activities. The riparian management zones provide shade, nutrients and large woody debris recruitment potential for streams through tree retention. The slope stability measures provide protection for upslope areas to minimize management-related landslides and sediment delivery to streams. The road management plan consists of an accelerated road upgrading and decommissioning program to reduce road-related sediment delivery to streams. The harvest-related measures consist of seasonal and equipment restrictions for silvicultural and logging activities to minimize the level of ground disturbance.

The AHCP also includes a monitoring program that was designed to evaluate the implementation and overall effectiveness of the plan and to fine-tune specific conservation measures as needed through adaptive management. The effectiveness monitoring will measure the success of the conservation measures in relation to specific biological goals. These biological goals are to maintain cool water temperatures for aquatic species covered by the AHCP, minimize management related sediment inputs to streams, provide for recruitment of large woody debris for stream habitat, maintain amphibian populations across the landscape, and monitor and adapt the plan as needed to optimize conservation measures to benefit the Covered Species.

The following report documents the twelfth and thirteenth full year of the AHCP implementation and includes details to comply with the AHCP and the Implementation Agreement (IA). Included are sections related to the application of conservation measures in timber harvest plans, compliance training programs for employees and contractors, road management implementation, and other information required for the biennial reports as specified in Section 8.0 of the Implementation Agreement.

The reporting period for this report is January 1, 2019 through December 31, 2020.

II. AHCP Compliance

A. AHCP Implementation Plan

During the early stages of implementing the AHCP it was mutually agreed upon by GDRCo and the Services that an Implementation Plan should be prepared that would serve as a road map outlining how GDRCo will achieve the biological goals of the AHCP through implementing the Plan. GDRCo developed an AHCP Implementation Plan (IP) and submitted a revised version in February 2009. NMFS, on September 29, 2009, and the USFWS, on October 13, 2009 provided letters to GDRCo acknowledging receipt of the IP and had no objections to the content of the document. The Services and GDRCo acknowledge that the IP serves as a foundational document that summarized recent activities to implement the AHCP to date, as well as planned approaches that GDRCo will use to ensure the AHCP is successfully implemented. It was also understood by all Parties that the IP provides guidance for the initial stages of implementing the AHCP and is intended to remain flexible and adaptive throughout the life of the AHCP, as future conditions warrant.

B. Field Trials and Demonstrations with Mechanized Equipment

Under AHCP Section 6.2.4.1 GDRCo may conduct field trials with mechanized equipment for silvicultural operations provided that we have given assurances to the Services that the equipment will not cause compaction or soil displacement that is measurably greater than the equipment or methods previously used. GDRCo has also proposed a new operation via a demonstration to show the feasibility of conducting the activity with very careful planning and assessment and by following specific conditions with oversight. The field trials and demonstrations that were conducted during the reporting period for this Biennial Report are described below.

1. Field Trials with Cut-to-Length Harvester

In 2016 GDRCo began assessing the use of state of the art cut-to-length equipment manufactured by Ponsse for ground based commercial thinning operations during the summer period. The ground based cut-to-length equipment used consisted of a feller-buncher harvester (Ponsse Bear model) with a H8 processor head. The feller-buncher has eight low pressure rubber tires with independent suspension. The tires are interconnected in pairs with tracks that provide additional traction and further reduce overall ground pressure. The feller-buncher has an articulating processor head that cuts, delimbs, bucks and bunches logs. As each harvested tree is processed, logging slash is laid out in front of the harvester to travel on to avoid bare mineral soil and to reduce ground compaction. Like a shovel logger, the feller-buncher operates on the terrain without the need for constructed skid trails because it has ample ground clearance to clear cut stumps and other obstacles (AHCP Section 6.2.4.7). During thinning operations, the harvester only processes short logs which are loaded onto a forwarder (e.g., Ponsse ElephantKing model), so there is no dragging of logs which is typical during tractor and skidding operations. The ElephantKing forwarder has a similar frame, tire and suspension configuration as the feller-buncher except it is capable of loading and carrying processed logs. The forwarder follows the same access path as the feller-buncher which has created a slash packed trail. The original language in the AHCP provided provisions for feller-buncher operations during the summer and winter period however it limited forwarding operations to the summer period only (AHCP Section 6.2.4.7).

On August 1, 2016 GDRCo submitted a letter to the Services describing the intent to conduct a field trial using state of the art cut-to-length forwarding equipment manufactured by Ponsse for ground based commercial thinning operations during the winter period. As described above GDRCo conducted preliminary evaluations of the equipment during the summer of 2016 to assess the viability of the forwarding operations and its potential for wintertime use and determined the results were very favorable. GDRCo had multiple discussions with the Services and held a field trip on August 18, 2016 at a summer-based cut-to-length operation with the equipment proposed for use during the winter.

In October 2016 GDRCo submitted a revised letter to the Services that included additional measures proposed by the Services and a description and proposal for quantitatively evaluating the site impacts from the forwarding operations related to potential water quality effects, fire hazard and stand condition following operations. GDRCo also worked with Dr. Han, former professor at Humboldt State University, who had two graduate students that conducted studies to evaluate cost and productivity of the cut-to-length operations (Baek, 2018) as well as impacts on soils and residual trees (Hwang, 2018).

In November 2016 GDRCo received support from the Services on the proposed winter field trial with the Ponsse forwarder for use on slopes less than or equal to 45%. In December 2016, GDRCo and the Services had a field visit to both an active and recently completed winter cut-to-length forwarding operation. In June 2017 GDRCo and the Services had a field visit to the completed winter cut-to-length forwarding operations. We walked several access trails in several units to review the data collection process and summary results from GDRCo's evaluation of the operations as well as the Dr. Han's graduate student projects. In October 2017, GDRCo provided the Services a final summary report on the results of the 1st year field trial with the Ponsse forwarder.

Due to the success of the winter forwarding operation in the 1st year field trial, GDRCo proposed and received concurrence from the Services in October 2017 to conduct a 2nd year field trail which included operating forwarders on slopes up to 45% during the winter period. Forwarding during the 1st year field trial occurred on slopes that averaged less than or equal to 15%. In May 2019, GDRCo provided the Services with a summary report from the 1st and 2nd year field trial results.

The results from the 1st and 2nd year field trials suggest that winter forwarding with the cut-to-length low ground pressure equipment is a viable operation that does not construct or require the use of skid trails and can minimize bare mineral soil and minimize ground disturbance by placing and operating on slash generated by the activity. Based on these results, GDRCo included a minor modification request to add winter forwarding with cut-to-length equipment to the AHCP. The Services provided GDRCo interim authorization to continue the field trial for a 3rd season while the minor modification was being developed and approved. On July 10, 2019, the Services approved the minor modification authorizing forwarding operations during the winter period with specific provisions that were incorporated in the AHCP (see Section II.D.3 below).

2. Demonstration for Road Rocking During the Winter Period

The AHCP permits road rocking operations during the period when road upgrading can occur (AHCP Section 6.2.3.9.2 #3) which is during the summer period and the dry fall and early spring drying conditions (AHCP Sections 6.2.3.4.2 and 6.2.3.4.3). Occasionally there are extended periods of dry weather that occur during the winter period when conditions are likely suitable to conduct road rocking activities without causing negative environmental effects. In 2019 GDRCo developed a proposal to conduct a road rocking demonstration during the 2019/2020 winter period to show the feasibility of this potential winter season activity. A field trip with the Services was held on September 13, 2019 to discuss the proposed winter road rocking demonstration. We visited several road segments that GDRCo propose for the demonstration and reviewed and discussed all the mitigation measures that would be followed. GDRCo submitted the proposal on September 27, 2019 and the Services approved the winter road rocking demonstration on October 25, 2019. GDRCo and the Services conducted another field visit on February 10, 2020 to observe an active winter road rocking operation as well as visit a couple road segments that were rocked earlier in the winter period and had experienced winter storms to evaluate how the roads performed following rain events. It was evident that the operations were successfully being implemented.

Following the 2019/2020 winter period, GDRCo's Sr. Aquatic Biologist conducted field visits with the Roads Supervisors to all the road segments that were included in the winter road rocking demonstration to photograph and assess the road conditions since the COVID-19 pandemic prevented the Services from participating in field trips during the 2020 summer period. GDRCo provided the Services with a summary report of the assessments on October 12, 2020. GDRCo determined that the winter road rocking demonstration was very successful. GDRCo also submitted a proposal for a minor modification request to Services requesting the AHCP be modified to allow for winter road rocking with specific provisions. The Services' approval of the proposed minor modification is pending.

C. Commercial Thinning

In 2010, GDRCo implemented a study to evaluate the economic viability and operational feasibility of conducting commercial thinning on certain properties within the Plan Area. GDRCo uses the Functional Approach to thinning that has been adapted to young-growth, even-aged stands of Redwood and Douglas-fir. With this method, trees from all size classes and crown positions may be removed to create open spaces in the canopy to promote growth of the retained trees. Small intermediate and understory trees may be harvested if they are of commercial size and economical to harvest. Codominant and dominate trees with poor form or low live crown ratio are selected for harvest to open up the canopy, and some trees are selected for harvest to reduce stand density and improve leave tree spacing. The crop trees retained exhibit the highest quality and fastest growth rates to take advantage of the crown openings. The overall objective is to accelerate diameter growth, increase heartwood production, and improve log quality. GDRCo's Functional Approach to thinning is very similar to the Commercial Thinning Method in the State Forest Practice Rules. In some site-specific cases, GDRCo may utilize a Forest Practice Rule "Alternate Prescription" that meets these same silvicultural objectives but is a better fit due to stand structure and forest practice rule requirements.

GDRCo forestry staff carefully prepares THPs to ensure that this management technique incorporates mitigations that are consistent with the AHCP requirements. GDRCo has not experienced any issues with the current AHCP measures outlined in AHCP Section 6.2.4.3. We are not conducting any thinning operations in the riparian areas of the thinning THPs as per AHCP Sections 6.2.1.2 and 6.2.1.4. As per the requirements in this AHCP section, riparian management zones are identified and mapped as no harvest areas in each thinning unit and a selection harvest entry within these riparian areas will coincide with the future even-aged harvest of the stand. However, GDRCo has recently been discussing with the Services the idea of applying GDRCo's Functional Approach to thinning in riparian zones to similarly promote faster diameter growth of trees in these areas. GDRCo anticipates submitting a proposal to the Services in 2021, requesting authorization of additional entries into RMZs that will provide benefits to terrestrial and aquatic species and their habitats.

In the past 10 years, GDRCo has commercially thinned approximately 2,000 to 4,000 acres per year depending on availability of timber stands that are suitable for thinning and economic factors that are favorable to thinning. GDRCo plans to continue to conduct thinning operations on approximately 2,000 to 4,000 acres per year over the next 10 years. As a result of the thinning operations, we expect to see increased vigor and growth of the remaining stands.

D. AHCP Minor Modifications

Under Section 12.1 of the Implementation Agreement (IA), GDRCo, NMFS, or USFWS (referred to collectively as "Parties" or individually as "Party") may propose minor modifications to the Plan, the Permits, or the IA by providing written notice to all the other Parties. A proposed minor modification becomes effective and the Plan deemed modified accordingly, immediately upon unanimous approval from all Parties. Any Party that objects to a proposed modification must provide written notice to the other two Parties. As per Section 12.1.1 of the IA, a receiving Party may object to a proposed minor modification based on reasonable belief that the modification would result in, 1) operations, burdens or obligations under the Plan that are significantly different from those analyzed in connection with the original Plan, 2) adverse effects on the environment that are new or significantly different from those analyzed in connection with the original Plan, or 3) additional take not analyzed in connection with the original Plan.

There were 3 minor modifications proposed by GDRCo that the Services evaluated and approved under IA Section 12.1 during the reporting period for this Biennial Report. The modifications that were made to the AHCP are summarized below.

1. Minor Modification to AHCP Sections 6.2.5.1.5 and 6.2.5.1.6 (Long-Term Coastal Tailed Frog and Southern Torrent Salamander Monitoring Protocol Revisions)

Coastal Tailed Frog – Property-Wide Occupancy Surveys (10-year cycle)

As stated in the 4th Biennial Report, Appendix D, Part 3 (GDRCo 2015), "Since the early 1990's, Plan Area-wide occupancy surveys have indicated that the distribution and abundance of tailed frog populations have been at a minimum stable, but most likely increasing. We have also learned from 16 years of monitoring larval tailed frog populations that although much of their high annual variation remains unexplained, no biologically meaningful variation was associated with impacts from timber management activities. Finally, we know that emerging eDNA techniques provide major potential advances for efficient and effective monitoring of tailed frog populations while simultaneous being able to monitor for disease threats. We assert that barring any unforeseen circumstances, this leads to the overwhelming conclusion that under the provisions of the AHCP, tailed frog populations will remain stable or increasing and there is no longer a need to have the entire focus of monitoring on potential impacts of timber harvesting. Rather the future monitoring should be designed to be more extensive in area and with a broader focus to detect new threats to the tailed frog populations in the Plan Area that may arise from factors such as a new emerging infectious disease or threats associated with climate change."

During the first two rounds of property-wide occupancy surveys (1995 and 2008), each stream was searched until tailed frog larval presence was documented or 1000 m of stream was covered, concentrating the search effort on best available habitat. As mentioned above, we collaborated with Dr. Caren Goldberg to evaluate the use of eDNA for detecting stream amphibians on GDRCo property in 2013. Dr. Goldberg developed specific assays for tailed frog, southern torrent salamander, and coastal giant salamander. In this study, 88 samples ranging from known occupied sites to tap water were analyzed for the presence of eDNA of a variety of species. Of the sites that were known to be occupied by tailed frogs, there was a 95% probability of detection with eDNA samples (Goldberg 2014). In 2014, GDRCo implemented a pilot project in collaboration with Humboldt State University graduate student Lauren Smith (Smith 2017) in which eDNA samples were collected from three streams located on GDRCo property to compare results obtained by light touch/visual encounter surveys and eDNA surveys for tailed frogs, as well as estimate the detectability of tailed frog eDNA. Findings from this project showed that the probability of detecting tailed frog eDNA was high (83-87%), suggesting that eDNA samples taken at a single location within a stream even with low abundance will provide high confidence in determining occurrence (Carlisle and McDonald 2017).

As a result of these findings, GDRCo proposed that instead of sampling up to a maximum of 1000 m, we will now sample up to a maximum of 200 m, employing a light touch/visual encounter survey for larvae in the best available habitat. If larval tailed frogs are not detected during the visual encounter survey an additional screening tool will be employed; water samples will be collected for eDNA testing for tailed frogs. In addition, because Chytrid fungus can have a negative effect on amphibian populations, GDRCo also proposed to collect water samples for eDNA, testing for the presence of Chytrid fungus from all sites in the next round of surveys. Dr. Caren Goldberg (Washington State University, School of the Environment, Quantitative Spatial Ecology) will conduct the laboratory screening for the eDNA.

On April 27, 2018, GDRCo submitted to the Services a revised protocol for the long-term, property-wide occupancy surveys for coastal tailed frogs. The Services evaluated and approved the modified protocol on May 20, 2019. Field work for the third round of surveys for this project was initiated May 20, 2019 and concluded March 20, 2020. A summary of the results from the surveys is presented in Section VIII.A.2 below.

Southern Torrent Salamander – Property-Wide Occupancy Surveys (10-year cycle)

During our previous property-wide occupancy surveys (1994 and 2008) for larval southern torrent salamanders, we collected presence/absence data, as well as relative abundance data. However, we have observed that the collection of relative abundance data at southern torrent salamander sites has proven to have deleterious effects on the habitat and therefore the animals (GDRCo 2011). For the next 10-year cycle surveys, GDRCo proposed to only collect presence/absence data. The same change was made to the annual monitoring effort documented in the 3rd Biennial Report which stated, "On July 24, 2012, the Services were provided with the revised protocol for this monitoring program. No revisions were requested by the Services and the revised protocol has been implemented for this monitoring program through 2014." (GDRCo 2013). These revisions removed the relative abundance portion of the annual monitoring to alleviate negative impacts of the survey methodology.

GDRCo has committed to investigate less intrusive ways to monitor population size. An evaluation of the effectiveness of using environmental DNA (eDNA) has proven to be infeasible for southern torrent salamanders due to general habitat characteristics (low flow), logistics (sedimentation of filters associated to getting enough water to process), analysis (low detection probability and no indication of increased eDNA when more animals were detected visually) and effort (time). In 2013 we collaborated with Dr. Caren Goldberg (Washington State University) to evaluate the use of eDNA for detecting stream amphibians on GDRCo property. Dr. Goldberg developed specific assays for tailed frog, southern torrent salamander, and coastal giant salamander. In this study Dr. Goldberg found a 48% probability of detection of southern torrent salamanders from sites known to be occupied (Goldberg 2014). These results are clearly not satisfactory to implement eDNA sampling as an occupancy tool for this species at this time. Additional samples and increased water volume per sample could increase the detection probability however both of these approaches are impracticable given the issues with collecting eDNA samples in torrent salamander habitat described above.

On April 27, 2018, GDRCo submitted to the Services a revised protocol for the long-term, property-wide occupancy surveys for southern torrent salamanders. The Services evaluated and approved the modified protocol on May 20, 2019. Field work for the third round of surveys for this project began in 2019 and concluded on March 5, 2020. A summary of the results is presented in Section VIII.A.3 below.

2. Minor Modification to AHCP Section 6.2.5.1.6 (Annual Southern Torrent Salamander Monitoring Protocol Revision)

This annual southern torrent salamander monitoring project began as a pilot study in 1998 with 18 monitoring reaches. In 2000, the number of monitored reaches was expanded to 30. Initially, sample reaches were surveyed annually, documenting occupancy as well as abundance; however, modifications to the field protocol have occurred. From 1998 through 2004 study sites were surveyed using the original field protocol (see AHCP 2006, Appendix D.1.6.3 for details). It became apparent by 2003 that salamander abundance at both treatment and control reaches was declining. Given the fragile nature of torrent salamander habitat, GDRCo was convinced that annual monitoring activities were causing degradation of the salamander habitat. This observation justified modifying the field protocol in 2005 so that field sampling had a “lighter touch.” Under this updated protocol, salamander abundance surveys were halted, focusing on the objective of documenting larval torrent salamander presence at monitoring sites. This resulted in less potential habitat disturbance. The frequency of surveys was also changed from annual to biennial, and monitoring was discontinued at 5 sites that seemed most affected by the original protocol. Finally, stream discharge and substrate sampling was discontinued. The shallow water depth at most sites precluded collecting discharge and substrate sampling produced highly variable results with low statistical power. By 2009, this modified field protocol seemed to have reduced the survey effect on monitored reaches since larval torrent salamanders were being found with minimal searching. Consequently, in 2010 the sampling frequency was increased back to annually and the 5 discontinued sites were reinstated. More recently, larval torrent salamander occupancy has becoming more difficult to determine at some sites, dropping from 93% larval occupation in 2015 to 80% in 2016. During the 2016 surveys, four of the six sites with no larval torrent salamander detections had previously been suspended from surveys between 2004 and 2008 due to concerns of decreasing habitat quality.

As noted above, torrent salamander habitat is fragile, making monitoring this cryptic species difficult to do without the potential for degradation of the available habitat in these small watercourses and seeps that the salamanders inhabit. To minimize the impacts of these survey on these animals and their habitat, GDRCo proposed a change to the monitoring protocol, returning to a biennial sampling schedule where half of the monitoring sites are randomly selected to be surveyed during the fall of odd years, the other half will be surveyed during the fall of even year, allowing a one-year recovery period for monitoring sites between sampling visits. On April 23, 2019, GDRCo submitted to the Services a revised protocol reflecting the biennial sampling schedule described above. All other aspects of our southern torrent salamander annual larval occupancy surveys remained the same. The Services evaluated and approved the modified protocol on May 20, 2019. The results for the 2019 and 2020 biennial surveys conducted under the approved minor modification are presented in Section VIII.A.3 below.

3. Minor Modification to AHCP Section 6.2.4.5 (Winter Forwarding Operations)

In 2016 GDRCo began investigating new state of the art cut-to-length equipment to conduct ground based commercial thinning operations which were initially initiated during the summer period. Following successful outcomes with the equipment, GDRCo submitted a letter to the Services in August 2016 describing our interest to conduct a field trial with the cut-to-length forwarding equipment for ground based commercial thinning operations during the winter period. GDRCo conducted a multi-year field trial as described above in Section II.B above. Following the successful testing of the equipment and evaluation of the ground impacts during winter use, we determined that this is a viable operation. On May 31, 2019, GDRCo submitted to the Services a minor modification proposal to allow winter forwarding with cut-to-length equipment.

On July 10, 2019, the Services submitted a letter to GDRCo approving the minor modification request. The minor modification created a third sub-section in the existing AHCP Section 6.2.4.5.1 (Time of Year Restrictions) under Section 6.2.4.5 (Tractor, Skidder, and Forwarder Operations). The new subsection (6.2.4.5.1.3) governs the use of ground-based forwarders during the winter period.

Note the text in *italics* are excerpts from the AHCP and underlined text is the language that was added with this minor modification.

6.2.4.5 Tractor, Skidder, and Forwarder Operations

6.2.4.5.1 Time of Year Restrictions

1. *Green Diamond will limit the construction and reconstruction of skid trails to the period beginning May 15th and ending October 15th.*

2. *Ground-based yarding with tractors, skidders, and forwarders (that fully suspend or drag logs) may occur from May 15th through October 15th on existing skid trails. This period for skid trail use (which excludes construction and reconstruction of skid trails) may be extended to include the periods May 1st to May 15th or October 16th to November 15th when the following procedures are followed:*

   a. *Skid trail use during this period will not result in visibly turbid water that flows into hydrologically connected drainage facilities, or discharges directly into watercourses, seeps, or springs.*

      1) *If an increase in turbidity does occur as the result of such operations, interim erosion control measures will be installed and the operations causing the increase will be immediately ceased.*

2) *Use of skid trails by ground-based logging equipment will not occur when soil moisture conditions would result in (a) reduced traction by equipment as indicated by spinning or churning of wheels or tracks in excess of normal performance; (b) inadequate traction without blading wet soil, or (c) soil displacement in amounts that cause movement of waterborne sediments off of a skid trail surface.*

3) *If any of the foregoing conditions is caused during skid trail use, interim erosion control measures will be installed and the operation causing the condition will be immediately ceased.*

b. *Ground-based yarding operations will use minimal ground disturbing equipment without bladed skid trail construction or reconstruction where feasible. Where this is not feasible, yarding operations during this period will be limited to existing skid trails for ground-based equipment that are hydrologically disconnected from Class I, II, or III watercourses or drainage facilities that discharge into Class I, II, or III watercourses.*

c. *Use of skid trails during the period will not occur within at least 100 feet, slope distance, of the upper extent of any designated Class II watercourse, and on slopes greater than 30% within at least 100 feet of Class III watercourses. Long-line yarding or lifting logs with a shovel from outside these zones may occur as long as the skid trails are hydrologically disconnected from Class I, II, or III watercourses or drainage facilities that discharge into Class I, II or III watercourses.*

d. *During the period, all bare mineral soils greater than 100 square feet created by ground-based yarding that are within an RMZ or EEZ will be treated with seed, mulch or slash by the end of the working day. Such treatment outside the zones will be performed at the discretion of the RPF or Green Diamond's supervisor based on an evaluation of the potential of the site to deliver sediment to a watercourse or hydrologically connected facility, taking into consideration the potential for large storm events to cause sediment delivery.*

e. *During the period, prior to commencement of yarding operations, sufficient erosion control materials, including but not limited to straw, seed (barley seed and/or the Green Diamond's seed mix), and application equipment will be retained on-site or otherwise accessible (so as to be able to procure and apply that working day) in amounts sufficient to provide at least two inches depth of straw with minimum 90% coverage, and 30 pounds per acre of Green Diamond's seed mix. In lieu of the above listed materials, native slash may be substituted and applied if depth, texture, and ground contact are equivalent to at least two inches straw mulch.*

f. *If operations expose an area of bare mineral soil late in the day and it is not feasible to completely finish erosion control treatment that day, the erosion control treatment may be completed the following morning prior to start of yarding operations provided there is no greater than a 30% chance of rain forecasted by the National Weather Service within the next 24 hours.*

3. <u>*Ground-based forwarders that transport logs fully suspended in bunks and that do not require the use of constructed skid trails may occur during the winter period when the following procedures are followed:*</u>

   a. <u>*Forwarders will only operate on slopes ≤ 45%.*</u>

   b. <u>*Forwarder operations will be limited to areas with either low or moderate erosion hazard ratings.*</u>

   c. <u>*No skid trials will be constructed for forwarding operations (existing stable skid trails may be utilized).*</u>

   d. <u>*Equipment access trails for forwarders will be slash packed during and after operations to avoid bare mineral soil, minimize surface erosion and facilitate the management of logging slash.*</u>

   e. <u>*Forwarding operations will cease during storm events where operations, combined with significant rainfall, are likely to cause delivery of sediment to Class I, II, or III watercourses.*</u>

E. Forms for RPFs and Conservation Planning Staff to Document Pre-Harvest Conservation Measures for Each THP and Compliance with Those Measures Post-Harvest

RPFs, Operations personnel and other GDRCo Conservation Planning professionals utilize a combined form to identify, categorize, and document THP items that are managed and monitored under the Northern Spotted Owl and Aquatic HCPs. The form is used to summarize the specific application of HCP measures for each THP to help track these measures and features on the landscape. The summarized information is used to monitor compliance with GDRCo's NSO and Aquatic HCPs and is used to meet the reporting requirements of these Conservation Plans. A summary of the information collected on the Forms related to the implementation of the AHCP for approved THPs is provided in Section II.F.2 below. A summary of the information collected on the Forms related to the implementation of the AHCP for completed THPs is provided in Section II.F.3. It should be noted that the information collected for approved THPs is a "plan" and is subject to change for a variety of reasons or circumstances that might occur during the life of the THP. Some of these reasons/circumstances include but are not limited to; GIS errors, depletion corrections based on final harvest data, plan amendments, canceled plans, and resubmitted plans. Although the information associated with approved THPs may be subject to change during the life of the THP, it typically does not result in substantial variances in the average or total THP values.

F. Summary of THP Conservation Measures and Compliance with Those Measures While Operating Under the AHCP

1. Notice of Filings

As required in AHCP Section 6.2.7.2 and IA Section 4.1 (c), GDRCo has provided the Services with 55 new notification letters from January 1, 2019 through December 31, 2020, indicating that GDRCo has submitted a proposed THP within the AHCP Plan Area. The letter to the Services includes the Official Notice of Filing signifying the THP has been accepted by CalFire for filing, a copy of the THP map(s), a copy of the road-work table that will be completed as part of the Annual Work Plan associated with the Master Agreement for Timber Operations (if applicable), and a description and justification of any allowable AHCP exceptions (if applicable).

2. Summary of Conservation Measures for Approved AHCP THPs

<u>Overall totals/averages</u>

There were 86 THPs approved by CalFire within the Plan Area between January 1, 2019 and December 31, 2020. Table 1 is a general summary of acres approved for harvest, by harvest type, for the reporting period. The approved THPs consist of 17,979 total acres from 519 individual harvest units. The THPs range in size from 14 to 494 acres and average 209 acres. There are on average 6 harvest units per THP and the average unit size is 35 acres.

Due to a change in GDRCo's harvesting philosophy around 2010, our silviculture methods now include a substantial amount of commercial thinning (see Section II.C for additional discussion of this activity). Due to a technicality in the state rules for commercial thinnings, GDRCo sometimes determines that the most appropriate silviculture designation for the commercial thinnings would be Alternative Prescription. As a result, there is an inflated amount of Alternative Prescription acres shown in Table 1 which, in early reporting years, would have been represented in the "Other" harvest type. The number of acres of true Commercial Thinning (according to the state rules) for approved plans has also increased since that time; so those acres have been separated out from the "Other" category.

The total area listed in Table 1 does not equal the sum of the silviculture acres in the same table; there is a difference of 69 acres. The difference is attributable to rounding errors and a variance in the way road Right-of-Way acres can be reported as they are typically not included in the Total Acres of a harvest unit.

3. Summary of Conservation Measures for Completed AHCP THPs

Overall totals/averages

Completed THPs for this report include AHCP THPs where all the felling, logging, loading, and hauling have been completed for all the units in the timber harvest plan. Road work associated with completed THPs may or may not be finished and therefore will not necessarily match the completion of a THP according to CalFire's definition. Compliance of the AHCP regarding completion of road work is based on the amount of work accomplished each year as measured in dollars spent on treating high and moderate priority sites and not at the THP scale (see Section V.C). Therefore, the status of road work associated with individual THPs is not necessary in considering a THP as completed for purposes of this biennial report.

There was a total of 62 THPs that met the criteria for completed THPs during the current reporting period. The completed THPs ranged from a total of 77 to 602 acres in size and included a total of 407 harvest units that ranged in size from 5 to 193 acres. The Post-harvest completion forms for individual THPs are provided in Appendix A. Table 2 provides a summary of the acres harvested by harvest type for the 62 completed THPs.

The total area listed in Table 2 does not equal the sum of the silviculture acres in the same table; there is a difference of 159 acres. The difference is attributable to rounding errors and a variance in the way road Right-of-Way acres can be reported as they are typically not included in the Total Acres of a harvest unit.

Riparian

The average area of riparian features (aside from seeps, ponds, and wet areas) provided per THP was 10 acres. Table 3 summarizes the number of completed THPs that contained riparian features and the length of each feature in approved THPs with prescribed AHCP protection measures. There were a total of 18 wet areas, 57 seeps/springs and 7 ponds in 26 THPs that were provided with an average of 0.18 acres of protection.

Roads

All but one of the 62 completed THPs had proposed road work associated with them. As summarized in Table 4, the most common proposed road work associated with a THP was temporary road construction. As described in the AHCP, temporary road construction is designed for single use in a THP and is decommissioned upon completion of operations. This practice minimizes the risk

Table 1. Summary of areas (acres) for each harvest type for the 86 approved THPs.

	Harvest Type							
	Total Area	Clearcut	Selection	No Harvest	Alternative Prescription[a]	Right-of-way	Commercial Thin	Other
Total Area (acres)	17,979	9,228	2,668	1,531	376	101	3,982	162
Number of THPs	86	77	77	85	8	19	21	11
Number of THP Units	519	426	394	375	15	N/A	80	17
Average Area (acres) per Unit	35	22	6	4	25	N/A	50	NA

[a] The majority of the Alternative Prescription acres are associated with GDRCo's commercial thinning operations as described in Section II.C.

Table 2. Summary of areas (acres) for each harvest type for 62 completed THPs.

	Harvest Type							
Summary Statistics	Total Area	Clearcut	Selection	No Harvest	Alternative Prescription[a]	Right-of-way	Commercial Thin	Other
Total Area (acres)	13,171	7,790	2,060	994	1,099	173	1,151	63
Number of THPs	62	60	59	61	12	41	11	7
Number of THP Units	407	355	331	292	33	N/A	24	9
Average Area per Harvest Unit (acres)	32	22	6	3	92	N/A	48	N/A

[a] The majority of the Alternative Prescription acres are associated with GDRCo's commercial thinning operations as described in Section II.C.

Table 3. Summary of the riparian features and the average length of each feature in the 62 completed THPs with prescribed AHCP protection measures, during the reporting period.

Riparian Features	Number of THPs with Riparian Features	Total Length of Riparian Features with AHCP Protection (feet)
Class I	46	189,603
Class II-1	62	300,142
Class II-2	62	377,247
Class III Modified Tier A	10	12,523
Class III Tier A	47	144,719
Class III Tier B	14	6,049

Table 4. Summary of proposed road work and the average length of proposed road work in the 62 completed THPs with road work, during the reporting period.

Road Work Type	Number of THPs with Proposed Road Work	Average Length of Proposed Road Work per THP (feet)
New Permanent Road Construction	3	3,340
New Seasonal Road Construction	41	228,443
Temporary Road Construction	59	274,403
Temporary Road Decommissioning	15	59,144
Reconstruction	25	72,733

of sedimentation from unused roads and reduces the amount of future road maintenance liability. It is also important to note that if temporary road construction is proposed in a THP, it does not mean that the road was constructed. In many cases the RPF provides additional flexibility to operators by identifying areas where a temporary road can be built if it is needed for operations.

Geology

Geomorphic features defined within the AHCP include; deep-seated landslides (DSL), headwall swales (HWS), riparian slope stability management zones (RSMZ), slope stability management zones (SMZ), shallow rapid landslides (SRL), channel migration zones (CMZ), and floodplains.

Table 5 summarizes the geomorphic features GDRCo observed within the 62 completed THPs for the current reporting period. RSMZs were the most frequently observed feature, which is to be expected as they are associated with steep slopes adjacent to Class I and Class II watercourses.

The distribution of geomorphic features and their association with the different types of watercourses is outlined in Table 6. The geomorphic features were most commonly associated Class II-2 watercourses. This is a logical observation as there was more linear length of Class II-2 watercourse in the approved THPs than any of the other watercourse types, which in turn equals more area of hill slopes adjacent to the Class II-2 watercourses that may intersect a geomorphic feature. It shall be noted that channel migration zones and floodplains are not included in this table as they are only associated with Class I watercourses.

All SSSs have an RSMZ but they may or may not have an SMZ associated with them. There are fewer SMZs than RSMZs since the SSS prescriptions are based on slope and may terminate once a qualifying break-in-slope has been identified (AHCP Section 6.2.2.1). Therefore, a SSS buffer may not extend as far as the SMZ resulting in more RSMZs than SMZs. There was a total of 42 THPs with RSMZs and a total of 13 THPs with SMZs delineated in the 62 completed THPs during the reporting period. Table 7 provides a more detailed summary of GDRCo's SSS prescriptions observed during the reporting period.

Table 5. Summary of geomorphic features observed within THPs during the reporting period.

Geomorphic Features	Number of THPs per Feature Type	Area of Features that were Afforded Default Protection (acres)
DSL	26	187
HWS	6	3
RSMZ (SSS)	42	306
SMZ (SSS)	13	26
SRL	45	168
CMZ	10	9.9
Floodplain	1	1.6

Table 6. The distribution of geomorphic features by watercourse type.

	Geomorphic Feature				
Watercourse Type	DSL	HWS	RSMZ	SMZ	SRL
Class I	29.5%	-	25%	22%	27%
Class II-1	23%	57%	28%	52%	25%
Class II-2	29.5%	14%	47%	26%	41%
Class III Modified Tier A	1.5%	-	-	-	1%
Class III Tier A	15%	29%	-	-	5%
Class III Tier B	1.5%	-	-	-	1%
Total	100%	100%	100%	100%	100%

Table 7. Summary of SSS prescriptions associated by watercourse type.

	Watercourse Type		
	Class I	Class II-1	Class II-2
Total Area of SSS (combined RSMZ and SMZ) (acres)	105	53	139
Average Area of SSS per THP (acres)	4.2	2.4	4.0
Total Area of RSMZ (acres)	96	46	135
Average Area of RSMZ per THP (acres)	3.9	2.1	3.9
Total Area of SMZ (acres)	8.3	7.1	3.5
Average Area of SMZ per THP (acres)	1.4	1.0	1.2

Note: There were 42 THPs with RSMZs and 13 THPs with SMZs.

Exceptions

There were a total of 51 exceptions that were applied to 20 completed THPs during the reporting period; of the 51 exceptions, 28 were associated with AHCP geologic areas (harvest and road related). Table 8 summarizes the number of AHCP exceptions and Table 9 summarizes the total area of alternative geologic prescriptions that were applied to geomorphic features. The majority of AHCP exceptions were associated with alternative geologic prescriptions on geologic areas of concern. Most of the alternative geologic prescriptions were composed of varying levels of "selection" (Table 10). Clearcut areas accounted for 15% of the alternative geologic prescription areas and typically involve slides that do not deliver to a watercourse or road construction on or near a landslide that involves clearing of trees. Aside from no harvest, each of the other alternative geologic prescription types were recommended by a Professional Geologist based on site specific review.

Table 8. Summary of AHCP exceptions.

AHCP Exception Type	Number of AHCP Exceptions
Alternative Geologic Prescription	28
Class II Skid Intrusion	2
Class III Skid crossing	8
Class III Skid Intrusion	3
Partial Log Suspension in an RMZ	6
Use of landings within an RMZ	3
Road Construction in an RSMZ/SMZ	3

Table 9. Summary of timber harvest plans with alternative geologic prescriptions.

Geomorphic Feature	Total Area (acres) of Alternative Geologic Prescriptions by Feature Type
DSL	36
HWS	-
RSMZ (SSS)	-
SMZ (SSS)	-
SRL	5.5

Table 10. Summary of harvest-related alternative geologic prescriptions and area of alternative geologic prescriptions applied per THP.

Alternative Prescription Type	Area of Alternative Geologic Prescription (acres)	Numbers of THPs with Alternative Geologic Prescription
No Harvest	6	1
75 ft² Basal Area Retention	18.2	4
125 ft² Basal Area Retention	13.6	1
Clearcut	2.6	4

Hazard Abatement Operations

There are five types of hazard abatement activities utilized across the ownership: biomass harvesting, burning of slash piles in clearcuts and landings, broadcast burning, and mastication. Biomass harvesting involves the removal of logging debris that typically is piled during active harvesting operations. The debris is removed from the harvesting area and is used as hog fuel rather than being burned on site. Clearcut pile burning is a form of hazard abatement where logging debris is accumulated into piles throughout the harvesting area during or after operations and burned on site during the winter period. Landing pile burning is also a form of hazard abatement where logging debris accumulates on designated landings rather than throughout the harvest unit; the landing piles are subsequently burned during the winter period. Broadcast burning involves a prescribed fire to burn over a designated area with well-defined boundaries to reduce the level of fuels and improve reforestation access. Mastication is mechanical grinding of slash material into small pieces of debris in order to reduce fuel levels and improve reforestation.

With the use of biomass harvesting, hazard abatement operations can be applied to harvest units over multiple reporting periods. Therefore, we summarize these operations separately for all units, regardless of THP completion status, that have been treated within the biennial reporting period. The three types of hazard abatement activities applied to 90 harvest units during the current reporting period were burning of clearcut piles, burning of landing piles, and mastication of piles (Table 11). There was no broadcast burning or biomass harvest activities utilized during the current reporting period. All but one of the hazard abatement activities were completed as planned. The one exception was related to a pile burn that escaped to an adjacent riparian zone, which is described in more detail below.

Table 11. Summary of hazard abatement activities.

Type of Hazard Abatement	Number of Harvest Units	Total Area of Hazard Abatement Activities (Acres)	Average Area of Hazard Abatement Activities per Harvest Unit (Acres)
Mastication	2	49	24
Burned Clearcut Piles	63	1,326	21
Burned Landing Piles	25	548	22
Biomass Harvesting	-	-	-
Broadcast Burned	-	-	-

Hazard Abatement Exceptions:

1-19-161 HUM, GDRCo 26-1901 Unit G: On December 11, 2020, the IFM department treated 14 harvest units. Unit G of this THP responded differently than the other units ignited on that day. Given the fuel moisture conditions in this unit, ignition across the unit was too fast. A high overstory canopy cover within the RMZ also created drier ground fuel conditions than anticipated within the RMZ. As a ground fire, the fire pushed into and through the RMZ in the middle-upper portion of the Unit. Only the overstory canopy on the edge of was affected, and only by heat not actual fire, thus not killing the trees. Overstory canopy in the zone remains intact. Straw bales were used as waddles in key areas to monitor any streambank sediment transport. None was noted as this watercourse is in the very upper segment of the Class II-1 and has only seep/spring like flows during rainfall events. Monitoring of the site continued through runoff producing storms and no side slope sediment delivery was noted as overstory canopy continued to provide effective raindrop interception.

Violations and Other Observations

There were twelve violations associated with the 62 completed harvest plans during the current reporting period. A summary of each notice of violation is listed below.

THP 1-16-068HUM (GDRCo 43-1601):

- VIOLATION OF 14 CCR 916.4(c)(3) Watercourse and Lake Protection - Johns Trucking, as LTO, left soil in a Class III watercourse channel, and did not remove it prior to October 15.
    - *Mitigation* - Prior to November 22, 2017, the LTO shall remove the loose soil from the channel at the outboard side of Road Point 13.
- VIOLATION OF 14 CCR 1035.3(d) Licensed Timber Operator Responsibilities - Johns Trucking, as LTO, failed to comply with the plan by failing to stabilize areas of bare mineral soil greater than 100 square feet within a WLPZ and EEZ.

- *Mitigation* - Prior to November 15, 2017, the LTO shall mulch or otherwise stabilize the areas of bare mineral soil at Road Points 13 and 16.

THP 1-18-186HUM (GDRCo 47-1803):

- Violation per section 4604 of the Public Resource Code, LTO Complies with Rules - Timber fallers cut un-marked trees in a Class II RMZ. A minimum of 6 trees within a WLPZ were felled that were not marked. This has resulted in an opening in the canopy of the RMZ, however CALFIRE indicated no environmental damage.
  - *Mitigation* – None, no environmental impacts observed.

THP 1-17-137HUM (GDRCo 51-1702):

- Violation per California practice rule 14 CCR 1035.1(f) - The LTO instructed equipment to be unloaded at this site and clean up a rubble/spoils pile to make it easier to turn the equipment transport around. The plants identified for protection were located on the rubble/spoils pile. The RPF failed to establish an EEZ prior to timber operations.
  - *Mitigation* - Avoid remaining populations. Adhere to CDFW monitoring and reporting requirements.

THP 1-16-120HUM (GDRCo 56-1603):

- Violation per Order No. R1-2012-0087, Waste Discharge Requirements for Discharges Related to Green Diamond Resource Company's Forest Management Activities - Staff observed saturated soil conditions, vehicular ruts and sediment-laden riparian vegetation at the Site. These observations indicate: the Discharger did not cease use of Road TT-100 when use was resulting in runoff sufficient to cause a visible increase in turbidity in the ditch and road surface draining to the Class II watercourse; the Discharger carried out hauling during the winter period on an unrocked road surface; and sediment was likely discharged from the Site to the Class II watercourse due to a lack of adequate drainage and road surface protection. Furthermore, the conditions of the Site posed an imminent threat of further discharges of sediment to the Class II watercourse below if not immediately addressed.
  - *Mitigation*: On February 21, 2018, the Discharger submitted the Notice of Discharge to Staff, which documented that the Site was cleaned and re-rocked on February 14, 2018 (Attachment C). As a result, the Discharger is not required to take further action at this time to resolve the conditions that lead to issuance of this NOV.

THP1-17-047HUM (GDRCo 56-1608):

- Violation per California practice rule 14 CCR 923.6(g). Use of Logging Roads and Landings - The LTO, Larry Zuber, was conducting logging operations on a road that did not have a stable operating surface and exhibited saturated soil conditions as per 14 CCR 895.1: Stable Operating

Surface means a road or landing surface that can support vehicular traffic and has a structurally sound road base appropriate for the type, intensity and timing of intended use.
  - *Mitigation*: Prior to resuming winter operations logging roads shall be surfaced with rock to a depth, quality and quantity sufficient to maintain such a surface.

THP1-17-053HUM (GDRCo 56-1610):

- Violation per California practice rule 14 CCR 913.1(a)(4)(A) Regeneration Methods Used in Evenaged Management - Green Diamond Resource Company, as Timberland Owner, commenced timber operations upon an even aged unit without an approved report of stocking for a contiguous unit.
  - *Mitigation* – Not Correctable. An approved Report of Stocking is now on file.

THP 1-17-065DEL (GDRCo 56-1701)

- Violation per California practice rule 14CCR 1035.3(b) Licensed Timber Operator Responsibility. - The LTO's operator operated during the Winter Period upon a seasonal road prohibited for use in the approved Winter Period Operating Plan. Operations resulted in an unstable operating surface which led to rutting which caused inadequate road drainage and damage to the condition and functionality of the seasonal road.
  - *Mitigation* - The LTO shall waterbar the effected portion of the seasonal road to provide adequate drainage and straw mulch the seasonal road where it intersects the permanent road to a depth of 2"-4" to prevent accumulation of soil onto the permanent road system. This shall be conducted as soon weather conditions allow for operations upon a stable operating surface. Following the conclusion of the Winter Period, the LTO shall reestablish the road surface to a condition that is suitable for maintaining a stable operating surface during the period of intended use and install drainage structures to the seasonal road specifications listed in the Plan.

THP (GDRCo 71-1701)

- Violation per California practice rule 14CCR1035.3(d) Licensed Timber Operator Responsibilities - Page 39 of the Plan directs installation of DRC or other similar drainage structure to hydrologically disconnect the road from the adjacent watercourse "Prior to log hauling in the Winter Period". The LTO, Green Diamond Resource Company (GDRCo), did not perform the required work in the timeframe specified in the plan.
  - *Mitigation* – Ditch disconnects installed at locations specified in the plan prior to hauling in the Winter Period.

- Violation per California practice rule 14CCR 916.4 (d) Watercourse and Lake Protection. - Equipment was used within the standard protection buffer of a Class III watercourse near Road Point 10.
    - *Mitigation* – 1) Cover the exposed bare areas with straw, mulch or slash. 2) reestablish drainage for overland flow to a location to prevent delivery into a watercourse until RP 10 can be installed outside the Winter Period. Items 1 and 2 have been done and no further actions are necessary.

THP 1-16-096DEL (GDRCo 93-1604)

- Violation per California practice rule 14CCR 916.4(d) Heavy equipment shall not be used in timber falling, yarding, or site preparation within the WLPZ unless such use is explained and justified in the THP and approved by the Director. - A tractor was used within a WLPZ to push open an area to set the tractor as an anchor for a yarder guyline adjacent to Road RW - 1210C. The operation resulted in displacing and exposing of approximately two cubic yards of soil directly adjacent to the channel of a Class II watercourse.
    - *Mitigation* - The bare areas created by the timber operations have been stabilized with straw mulch. The site was again visited on 1/9/19 and work appears appropriate to protect the resource. No further mitigations are warranted.

THP 1-18-008DEL (GDRCo 94-1701)

- Violation per Public Resource Code (PRC) 4581. No person shall conduct timber operations unless a timber harvesting plan prepared by a registered professional forester has been submitted for such operations to the department pursuant to this article. Such plan shall be required in addition to the license required in Section 4571. - Norm Tyrell, the feller buncher operator and employee for Green Diamond Resource Company, LTO #A-100, conducted harvest operations outside of the Plan area. The operator cut trees for harvest, on an area where a Timber Harvest Plan had not been submitted.
    - *Mitigation* - None.

III. Land Transactions and Plan Area Adjustments

The AHCP Implementation Agreement (IA) has two distinct requirements involving both the reporting of land transactions as well as the accounting of these transactions as they relate to Plan Area limitations described in the IA.

The following is a description of GDRCo's compliance with Sections 8.2, 11 and 12 of the IA regarding Land Transactions and Plan Area Adjustments and a summary of transactions reported to the Services as required in Section 8.1(c) of the IA.

A. Notice of Transactions

Section 8.2 of the IA requires GDRCo to notify the Services of any transfer of ownership of real property or harvesting rights subject to the AHCP at the time of the transfer of ownership (except where prior notification is required pursuant to IA Section 11 – which is discussed below). To comply with IA Section 8.2, GDRCo has a comprehensive pre-transaction "Notice Approval Record" which provides a routing and approval format for all real property transactions resulting in a change in the Plan Area. GDRCo has an internal policy that the employee responsible for negotiating a proposed transaction involving the acquisition or disposal of land or timber harvesting rights within the Plan Area also is responsible for addressing the effect of the transaction on the AHCP Plan Area and preparation of a pre-transaction notice letter to the Services. Prior to submission of the pre-transaction notification letter, approval is obtained from the Vice President of Green Diamond's California Timberlands Division if the transaction will result in an addition or deletion of Plan Area acres. This notification and approval record provides assurances that the transaction is properly identified as a specific real property transaction and that the required information is documented and submitted to the Services as well as key GDRCo employees. This notification and approval record also ensures that changes to the Plan Area are recorded in GDRCo's Forest Resources Information System (FRIS), which is used to track and report Plan Area changes. Each notification to the Services provides GDRCo's best estimate of the acreage involved in the transaction and the resulting change in the Plan Area. However, the Company relies on FRIS as the official record for calculating, tracking, and reporting Plan Area changes.

The following is a list of transactions that occurred during this reporting period:

a) Russ
b) Oace
c) Eaves
d) Waters
e) Campodonico
f) Lemmons
g) Copher
h) Alder Camp
i) Cool Springs
j) Lucchesi
k) Viltrakis
l) Fort Dick 40
m) McKay Phase II

The results of these transactions on the Plan Area and the 15% cumulative net expansion or contraction limit are provided in Section III.C below.

B. Land Transactions

1. Plan Area Additions

Section 11.2 of the IA, stipulates that pre-transaction notice letters will be sent to the Services for any acquisition within the Eligible Plan Area that will result in an addition to the Plan Area with a description of the proposed transaction and an assessment of how the transaction will affect the AHCP. Green Diamond will provide any such notices to the Services, which will be approved and result in an automatic addition to the Plan Area unless the Services object within 60 days of notification or the addition would exceed the Plan Area adjustment limits described below. Each notification to the Services provides GDRCo's best estimate of the acreage involved in the acquisition. However, the Company relies on FRIS as the official record for calculating, tracking, and reporting Plan Area changes.

2. Plan Area Deletions

Section 11.3 of the IA provides that any deletion from the Plan Area will be automatically accepted upon notice to the Services unless the deletion would exceed the Plan Area adjustment limits described below or GDRCo seeks special consideration for the Plan Area deletion so that it is not counted against the Plan Area adjustment limits.

3. Limitations on Plan Area Transactions

As described in Section 11 of the IA, the Plan Area may not expand or contract by more than 15% of the Initial Plan Area (406,962 acres) without an amendment to the AHCP or Permits. Green Diamond may purchase and divest properties without amending the AHCP as long as the cumulative net acreage effect does not result in a Plan Area increase or decrease of more than 61,044 acres.

There are exceptions and qualifiers related to this general limitation outlined in Section 11 of the IA. Section 11.3 of the IA requires a pre-transaction notice and determination by the Services in instances where GDRCo will remove covered lands or timber harvesting rights from the Plan Area and GDRCo seeks confirmation that the deletion from the Plan Area will not be counted against the cumulative net acreage change in the Plan Area because the Services find that the new owner will manage the transferred property under enforceable conditions that will not compromise the effectiveness of the AHCP. In these instances, GDRCo will provide the Services with a pre-transaction notice that includes a justification for the exemption and GDRCo's best estimate of the acreage involved in the transaction and the resulting change in the Plan Area. The Services will provide GDRCo with a response and GDRCo will ensure that the Plan Area adjustment is accurately recorded in FRIS as a change in the Plan

Area that does or does not count against the limitation on the cumulative net increase or decrease in the Plan Area.

4. Minor Modifications to the Plan Area

Under IA Section 12.1, Minor Modifications to the Plan Area may occur due to ownership acreage corrections that are not associated with a real property transaction. An example of these minor adjustments are property line boundary changes that integrate real world coordinate information from recent land surveys into the GIS system and correcting the location of property lines accordingly. Another example would be a mapping error correction identified during routine GIS work. The Initial Plan Area (406,962 acres) will be used for the duration of the AHCP Period to calculate the 15% cumulative, net expansion or contraction limitations based on transactions, but Minor Modifications will not change the Initial Plan Area in that they are, by definition, minor and would not affect operations under the AHCP or the Covered Species.

These minor acreage adjustments can fluctuate up or down during any one year and during the term of the AHCP, therefore GDRCo will identify and account for these specific adjustments using FRIS. This biennial report serves as the notification to the Services of these Minor Modifications to the Plan Area. A summary of the Minor Modifications to the Plan Area such as property line boundary changes and GIS corrections are provided in Table 12 below.

C. Summary of Land Transactions and Plan Area Adjustments

The current AHCP Plan Area consists of 358,594 acres (Table 12). As a result of Plan Area additions, deletions and minor modifications that occurred from January 1, 2019 through December 31, 2020 there was an increase of 869 acres to the current Plan Area reported in the 6th Biennial Report. Since the approval date of the AHCP, there has been a decrease of 48,368 acres in the AHCP Plan Area, with a net contraction of 25,770 acres due to non-comparable transferee transactions. The remaining decrease in acreage is accounted for in land transactions with comparable transferees as well as minor modifications to the Plan Area.

Table 12. Summary of land transactions and minor modifications that occurred between January 1, 2019 and December 31, 2020.

Property Transactions	Does the Transaction Affect the Plan Area?	Direction of Plan Area Change (+ / - / None)	GIS Transaction Area (Acres)	Plan Area Adjustment (Acres)	Does the Transaction Affect the 15% Limit?
Plan Area Additions					
Russ (a)	Yes	(+)	44.6	44.6	Yes
Oace (b)	Yes	(+)	21.1	21.1	Yes
Eaves (c)	Yes	(+)	40.8	40.8	Yes
Waters (d)	Yes	(+)	205.7	205.7	Yes
Campodonico (e)	Yes	(+)	41.8	41.8	Yes
Lemmons (f)	Yes	(+)	20.1	20.1	Yes
Copher (g)	Yes	(+)	39.1	39.1	Yes
Alder Camp (h)	Yes	(+)	67.9	67.9	Yes
Cool Springs (i)	Yes	(+)	539.3	539.3	Yes
Lucchesi (j)	Yes	(+)	48.1	48.1	Yes
Total			**1068.5**	**1068.5**	
Plan Area Deletions					
Viltrakis (k)	Yes	(-)	1.1	-1.1	Yes
Fort Dick 40 (l)	Yes	(-)	0.6	-0.6	Yes
McKay Phase II (m)	Yes	(-)	197.3	-197.3	Yes
Total			**199.1**	**-199.1**	
Minor Modifications					
Other increases (n)	Yes	(+)	4.0	4.0	No
Other decreases (o)	Yes	(-)	4.9	-4.9	No
Total			**8.8**	**-0.9**	
			Total	**868.5**	

	Total (Acres)
Initial Plan Area	406,962
Current Plan Area (as of 12/31/2020) (p)	358,594
15% of Initial Plan Area (q)	61,044
Net Expansion (+) / Contraction (-) Acreage (as of 12/31/2020) (r)	-25,770

(a) Notice of the Russ transaction was provided to the Services in a letter dated February 8, 2019. The transaction included the purchase of commercial timberland in fee.
(b) Notice of the Oace transaction was provided to the Services in a letter dated May 23, 2019. The transaction included the purchase of commercial timberland in fee.
(c) Notice of the Eaves transaction was provided to the Services in a letter dated May 23, 2019. The transaction included the purchase of commercial timberland in fee.
(d) Notice of the Waters transaction was provided to the Services in a letter dated October 23, 2019. The transaction included the purchase of commercial timberland in fee.
(e) Notice of the Campodonico transaction was provided to the Services in a letter dated November 27, 2019. The transaction included the purchase of commercial timberland in fee.
(f) Notice of the Lemmons transaction was provided to the Services in a letter dated January 28, 2020. The transaction included the purchase of commercial timberland in fee.
(g) Notice of the Copher transaction was provided to the Services in a letter dated January 28, 2020. The transaction included the purchase of commercial timberland in fee.
(h) Notice of the Alder Camp transaction was provided to the Services in a letter dated September 8, 2020. The transaction included the purchase of commercial timberland in fee.

(i) Notice of the Cool Springs transaction was provided to the Services in a letter dated September 8, 2020. The transaction included the purchase of commercial timberland in fee.
(j) Notice of the Lucchesi transaction was provided to the Services in a letter dated December 31, 2020. The transaction included the purchase of commercial timberland in fee.
(k) Notice of the Viltrakis transaction was provided to the Services in a letter dated February 5, 2019. The transaction included the transfer of real property to Viltrakis.
(l) Notice of the Fort Dick 40 transaction was provided to the Services in a letter dated April 15, 2019. The transaction included the transfer of real property, via dedication, to the County of Del Norte.
(m) Notice of the McKay Phase II transaction was provided to the Services in a letter dated July 15, 2020. The transaction included the transfer of real property to the County of Humboldt, a legal subdivision of the State of California.
(n) Minor Modifications that result in increases in the Plan Area due to property surveys and GIS upgrades.
(o) Minor Modifications that result in decreases in the Plan Area due to property surveys and GIS upgrades.
(p) Reported acreage adjustments to the Initial Plan Area are rounded to the nearest whole acre.
(q) The expansion or contraction limit relative to the Initial Plan Area (406,962 acres) without an amendment to the Plan or Permits. There are exceptions and qualifiers related to this limitation outlined in Section 11 of the IA.
(r) Limited to 15% of Initial Plan Area.

IV. AHCP Training Programs

As specified in AHCP Section 6.2.3.14, training is required for all company and contract equipment operators and supervisors involved with the Road Implementation Plan along with RPFs and forestry technicians involved with road design, layout and development of road treatment prescriptions. The training is offered annually as necessary for new employees or new contractors. Refresher training courses on the Road Management Plan are provided as needed to review concepts, introduce any new state-of-the-art techniques, and to present any new relevant regulatory information.

As specified in AHCP Section 6.2.2.5, training will be administered by a qualified PG or CEG to all RPFs that write THPs to review issues related to the AHCP Slope Stability Measures. The purpose of the training is to help RPFs identify and more fully understand the slope stability measures as well as the possible implications of various timber management scenarios for landslides and other unstable areas. The training is offered annually to accommodate new contractors and new employees. Refresher training courses are provided as necessary to employees and contractors to present new relevant scientific or regulatory information.

A. 2019 Training Programs

On March 8th, the AHCP Roads Supervisor conducted a training at the annual contractors' breakfast meeting to review road cost tracking, water drafting and general road treatment procedures. On April 8th, the AHCP Roads Supervisor also conducted a road training program for company supervisors, RPFs, forestry technicians and contractor operators. The North Coast Water Quality Control Board (NCRWQCB) staff was also invited and attended this training. The training covered general road plan measures, the specific measures related to Road

Upgrading, Decommissioning, Maintenance, and Construction and the associated provisions related to GDRCo's programmatic road permits. The company Professional Geologist conducted four trainings in 2019 covering worker safety when conducting road activities in areas proximal to rock types containing asbestos and general forest geology topics. Table 13 summarizes the AHCP related training programs held in 2019.

Table 13. Summary of 2019 training programs.

Training Dates	Groups	AHCP Orientation and Geologic Training	AHCP Updates and Geologic Training	General Road Management Measures	Road Design and Layout	Road Upgrading, Decommissioning, Maintenance, and Construction Standards
Mar 8	Contract operators					x
Apr 9	Company supervisors, RPFs, forestry technicians, contract operations, NCRWQCB staff			x		x
May 13	Company supervisors, RPFs, forestry technicians, operations		x			
June 3	Company forestry technicians, operations		x			
Aug 12	Company supervisors, RPFs, forestry technicians		x			
Dec 11	Company supervisors, RPFs, operations		x			

B. 2020 Training Programs

Due to the COVID-19 pandemic, the annual contractors' breakfast meeting was not held in 2020. Instead, GDRCo employees met on several days with individual contractors during the late spring of 2020 to review the content of the training binder which contains general company safety procedures as well as HCP training materials that we typically review collectively at the breakfast meeting. The standard road related topics we review are road cost tracking, water drafting and general road treatment procedures. The company Professional Geologist conducted seven trainings in 2020 covering worker safety when conducting road activities in areas proximal to rock types containing asbestos and general forest geology topics. Table 14 summarizes the AHCP related training programs held in 2020.

Table 14. Summary of 2020 training programs.

Training Dates	Groups	AHCP Orientation and Geologic Training	AHCP Updates and Geologic Training	General Road Management Measures	Road Design and Layout	Road Upgrading, Decommissioning, Maintenance, and Construction Standards
Spring	Contract operators					x
Mar 13	Company forestry technicians		x			
Nov 3	Company forestry technicians		x			
Dec 18	Company forestry technicians, operations		x			
Dec 21	Company RPFs, forestry technicians, operations		x			
Dec 22	Company RPFs, operations		x			
Dec 28	Company forestry technicians		x			
Dec 30	Company RPFs		x			

V. Road Management Measures

The principal purpose of the Road Management Measures (AHCP Section 6.2.3) is to eliminate major sources of sediment discharges into watercourses from roads. The objective of the Road Implementation Plan (AHCP Section 6.2.3.2) is to carry out a systematic road upgrade and decommissioning program using the Plan's road assessment and prioritization system (AHCP Section 6.2.3.1) that will maximize sediment reduction and conservation benefits within the Plan Area for the Covered Species. To achieve additional conservation benefits from this effort, the Road Implementation Plan has an acceleration period for the first 13.5 years of the Plan; GDRCo is providing for an average of $2.5 million (inflation adjusted to 2002 dollars) each year of the acceleration period to carry out the upgrade and decommissioning program. The work to be done and the sediment savings to be achieved by the Road Implementation Plan are tied to the results of the Road Assessment Process. The main objective of the Road Maintenance Program (AHCP Section 6.2.3.9) is to ensure that the sediment saving conservation benefits of the road upgrading program are maintained throughout the life of the Plan after the roads are upgraded.

A. Programmatic Road Permits

On June 10, 2010, NCRWQCB adopted Road Management Waste Discharge Requirements (RMWDR: Order No. R1-2010-0044) and on June 15, 2010, CDFW issued a Master Agreement for Timber Operations (MATO: No. 1600-2010-0114-R1) that would allow GDRCo to conduct road activities related to the AHCP Road Implementation Plan and the Road Maintenance and Inspection Program. These agreements allow GDRCo to notify CDFW and NCRWQCB of all planned watercourse crossing activities on an annual basis through a report (Annual Work Plan). There is an initial 60-day review period, with methods to revise and update the plan throughout the operating season.

The acquisition of the programmatic permits also significantly changed the approach to assessing roads for THPs. Prior to acquiring the permits, roads were assessed and treated according to the “fully functional” concept per THP. This concept forced mitigation efforts and treatment on a wide spectrum of issues and sediment introduction risk levels including diversion potential, presence of erosion, blockages of inlets and outlets, lack of hydrological disconnection and pipe integrity, for example. Through discussions with NMFS, USFWS, CDFW, NCRWQCB and CalFire a streamlined approach to road assessment was developed, approved, and is implemented as part of the programmatic permits. The “Imminent Risk of Failure” concept, as it is referred to, uses six general elements of watercourse crossings within a decision tree to guide road assessment. The assessor follows this decision tree to conclude whether a crossing should be upgraded or decommissioned, monitored or deferred for mitigation. The primary reason for this new approach is to focus mitigation efforts on sites which have the highest potential risk for failure or significant sediment delivery in a property-wide approach rather than on a THP by THP basis, and also, to utilize and fully implement the Routine Road Maintenance and Inspection Plan set forth in AHCP Section 6.2.3.9.

During 2010, the first year of implementing the “Imminent Risk of Failure” concept, issues arose during pre-harvest inspections. The primary issue was related to interpretation of the key during assessment of crossings. These interpretations varied from the determinations made by Forest Operations Technicians responsible for completing road work orders in THPs and the agency representatives who inspect the THPs for consistency and regulatory compliance. As a result of these issues, an intent document was created which discussed each section of the key including a description of the issue, diagnosis of issues and what appropriate mitigation measures to apply. This intent document was circulated within GDRCo, CalFire, CDFW and NCRWQCB for input and suggested revisions. Once the document was finalized it was distributed to GDRCo staff and all field agency representatives to help establish a consistent evaluation and interpretation of road related mitigation measures. Since this distribution issues during pre-harvest inspections have been minimized. The intent document will be revised as needed to reflect new techniques and issues as they arise over time.

The 2019 Annual Work Plan included road sites for 51 THPs, 74 sites related to RMA #1 and Terwer Creek RWU, 1 non-THP site and 1 instream restoration grant project. The 2020 Annual Work Plan included road sites for 41 THPs, 1 additional RMA #1 site, 4 water drafting sites, 3 revisions to enrolled THP sites and 12 sites related to emergency salvage operations outside the AHCP covered plan area.

B. Road Assessment Process

Road assessments are conducted using a standardized protocol which addresses site priority and volume of potential sediment delivery. Site priority is assigned based on volume of potential sediment delivery, treatment immediacy and overall cost-effectiveness of the proposed treatment. Volume of potential sediment delivery is calculated using a systematic approach of cross-sectional analysis of stream crossing fill prisms. The “Imminent Risk of Failure” concept has also allowed an even greater level of standardization as well as consistent treatment prescriptions in THPs and work required within the Routine Maintenance Areas and for mainline roads.

In 2009, GDRCo successfully completed the consolidation of all previous road assessments into a single, useable database. Database reporting tools were added to the database which allows the AHCP Roads Supervisor to analyze and publish data to support other AHCP working groups, operational staff and various regulatory requirements. In 2011, a project was completed to increase the accuracy of the spatial database link through the process of correcting GIS points to LiDAR-corrected road and stream data as well as digitizing data from paper maps. Further refinements to the database were completed in 2014 to increase speed and incorporate new tools to allow for more accurate and time saving processes. No significant changes to the road data in the timberlands management information system (TMIS) are planned in the future.

The fundamental processes of AHCP Section 6.2.3.1 are to have qualified personnel accurately identify road-related erosion sites and apply a prioritized treatment. The transition from RPFs conducting road assessments to the AHCP Roads department conducting the assessments was completed in early 2009. Presently, Forest Operations Technicians assess all THPs within the AHCP Plan Area to ensure consistency and compliance with all requirements in AHCP Section 6.2.3. In addition, they attend Pre-Harvest Inspections (PHI) and assist RPFs, as necessary, during the THP review process. Consolidating and coordinating the road assessment process through the AHCP Roads department has helped ensure consistency between THPs, efficient calculations of required statistics, accurate operational planning and compliance with AHCP standards.

As mentioned above GDRCo obtained programmatic road permits from CDFW and the NCRWQCB to conducted road-related activities associated with the AHCP Road Management Plan. Assessment and road treatment work to date has occurred coincident with THP activities and within the Routine Maintenance Areas associated with the Routine Road Maintenance and Inspection Plan (AHCP Section 6.2.3.9). This effort has allowed GDRCo to implement the “Imminent Risk of Failure” concept described above and focuses resources on sites that have the highest potential risk for failure.

C. Road Implementation Plan

The Road Implementation Plan (AHCP Section 6.2.3.2) is the natural extension and completion of a process GDRCo started in 2001 to address sediment-related issues associated with roads on the Plan Area landscape. Beginning in 2000, State agencies involved with reviewing THPs began mandating substantial road improvements on appurtenant haul routes. These road upgrading activities mirror the type of upgrading requirements that were adopted and included within the AHCP and became one of the AHCP's focal points.

Under AHCP Section 6.2.3.2, GDRCo is required to provide for an average of $2.5 million (inflation adjusted in 2002 dollars) per year during the acceleration period to treat high and moderate priority road sites. As a result of the annual spending requirement, GDRCo developed a process to track the costs of treating individual high and moderate priority sites. This information is recorded by site and submitted to GDRCo administrative office staff. Each site is then cross-checked with treatment priority to determine if it qualifies as a high or moderate treatment site utilizing a database which has been continually refined since 2007.

During the 2011 Annual Meeting the Services requested that GDRCo provide a summary of road work in the biennial reports that distinguishes between sites that were completed in conjunction with THP operations and those sites that were completed outside the THP process (e.g., non-THP maintenance activities and grant-related activities). Table 15 summarizes these data for 2019 and 2020.

Table 16 summarizes the number, volume and associated costs of treating high and moderate priority sites, for each operating area, from 2007 through 2020. Maps are also included that show the locations of the high and moderate priority sites that were treated from 2007 through 2020 (Figures 1-6).

AHCP Section 6.2.3.2 requires GDRCo to provide for an average of $2.5 million (inflation adjusted in 2002 dollars) per year during the acceleration period. GDRCo utilizes the GDP Price Index to adjust for inflation because it provides a broader measure of inflation that is not as consumer focused as the Consumer Price Index. In addition, there are multiple sources that provide multiple year forecasts of the GDP Price Index until the official values are published by the Bureau of Economic Analysis. Reliable forecasts of the GDP Price Index are critical to ensure that GDRCo is on track to spend the appropriate average annual amount of money because the true inflation rates are not published until the following year. The actual expenditures that GDRCo provided for in 2007-2020 are presented in Table 17. As noted in Table 17 the actual inflation rate for 2020 will not be available until late March 2021, therefore the actual inflation adjusted dollars spent in 2020 will not be known until that time. The actual values will be reflected in the next biennial report due in 2023. Additionally, the published inflation rates for the some of the previous operating years have changed since the last biennial report. These changes were provided by the

Table 15. Summary of the number of sites, volume of sediment savings and total costs of treating high and moderate priority sites, by operating area, from 2019 through 2020.

	Korbel THP(1)	Klamath THP(2)	Korbel Non-THP(3)	Klamath Non-THP(4)	Korbel GDRCo Grant Contribution(5)	Korbel Grant Sources(6)	Klamath GDRCo Grant Contribution(7)	Klamath Grant Sources(8)	Total
Year 2019									
High/Moderate Sites (#)	151	149	6	9	1		-		316
High/Moderate Volume (cu. yds.)	12,423	22,117	800	4,516	874		-		40,730
Amount GDRCo Provided For to Treat High/Moderate Priority Sites	$839,826	$1,130,448	$61,926	$345,055	-	$103,464	-	-	$2,480,719
Year 2020									
High/Moderate Sites (#)	145	249	-	3	-		-		397
High/Moderate Volume (cu. yds.)	27,711	32,646	-	3,311	-		-		63,668
Amount GDRCo Provided For to Treat High/Moderate Priority Sites	$1,089,432	$2,494,213	-	67,195	-	-	-	-	$3,650,840
Totals for 2019-2020									
High/Moderate Sites (#)	296	398	6	12	1		-		713
High/Moderate Volume (cu. yds.)	40,134	54,763	800	7,827	874		-		104,398
Amount GDRCo Spent Treating High/Moderate Priority Sites	$1,929,258	$3,624,661	$61,926	$412,250	-	$103,464	-	-	$6,131,559

1 THP related road sites within the Korbel operating area which is the geographical area south of the Bald Hills Road which intersects Highway 101 at Orick.

2 THP-related road sites within the Klamath operating area which is the geographical area north of Bald Hills Road which intersects Highway 101 at Orick.

3 Non-THP related road work for Routine Maintenance Area #3 and mainline roads within the Korbel operating area. No grant funding is associated with Non-THP work.

4 Non-THP related road work for Routine Maintenance Area #3 and mainline roads within the Klamath operating area. No grant funding is associated with Non-THP work.

5 Dollars GDRCo provided for as direct cost share (cash) to grant-related projects in the Korbel operating area.

6 Funding for grant-related road work within the Korbel operating area with sources from the Fisheries Restoration Grant Program (CDFW).

7 Dollars GDRCo provided for as direct cost share (cash) to grant-related projects in the Klamath operating area.

8 Funding for grant-related road work within the Klamath operating area with sources from the Fisheries Restoration Grant Program (CDFW), the Yurok Tribe, USFWS or EPA.

Table 16. Summary of the number of sites, volume of sediment savings and total costs of treating high and moderate priority sites, from 2007 through 2020.

	Korbel[1]	Klamath[2]	Total
2007-2018 Total			
High/Moderate Sites (#)	1,847	1,166	3,013
High/ Moderate Volume (cu. yds.)	538,400	579,624	1,118,024
Amount GDRCo Provided For to Treat High/Moderate Priority Sites	$19,017,509	$15,128,065	$34,145,573
2019-2020 Total			
High/Moderate Sites (#)	303	410	713
High/ Moderate Volume (cu. yds.)	41,808	62,590	104,398
Amount GDRCo Provided For to Treat High/Moderate Priority Sites	$2,094,648	$4,036,911	$6,131,559
Grand Total			
High/Moderate Sites (#)	2,150	1,576	3,726
High/ Moderate Volume (cu. yds.)	580,208	642,214	1,222,422
Amount GDRCo Provided For to Treat High/Moderate Priority Sites	$21,112,157	$19,164,976	$40,277,132

[1] Korbel operating area is the geographical area south of the Bald Hills Road which intersects Highway 101 at Orick.

[2] Klamath operating area is the geographical area north of Bald Hills Road which intersects Highway 101 at Orick.

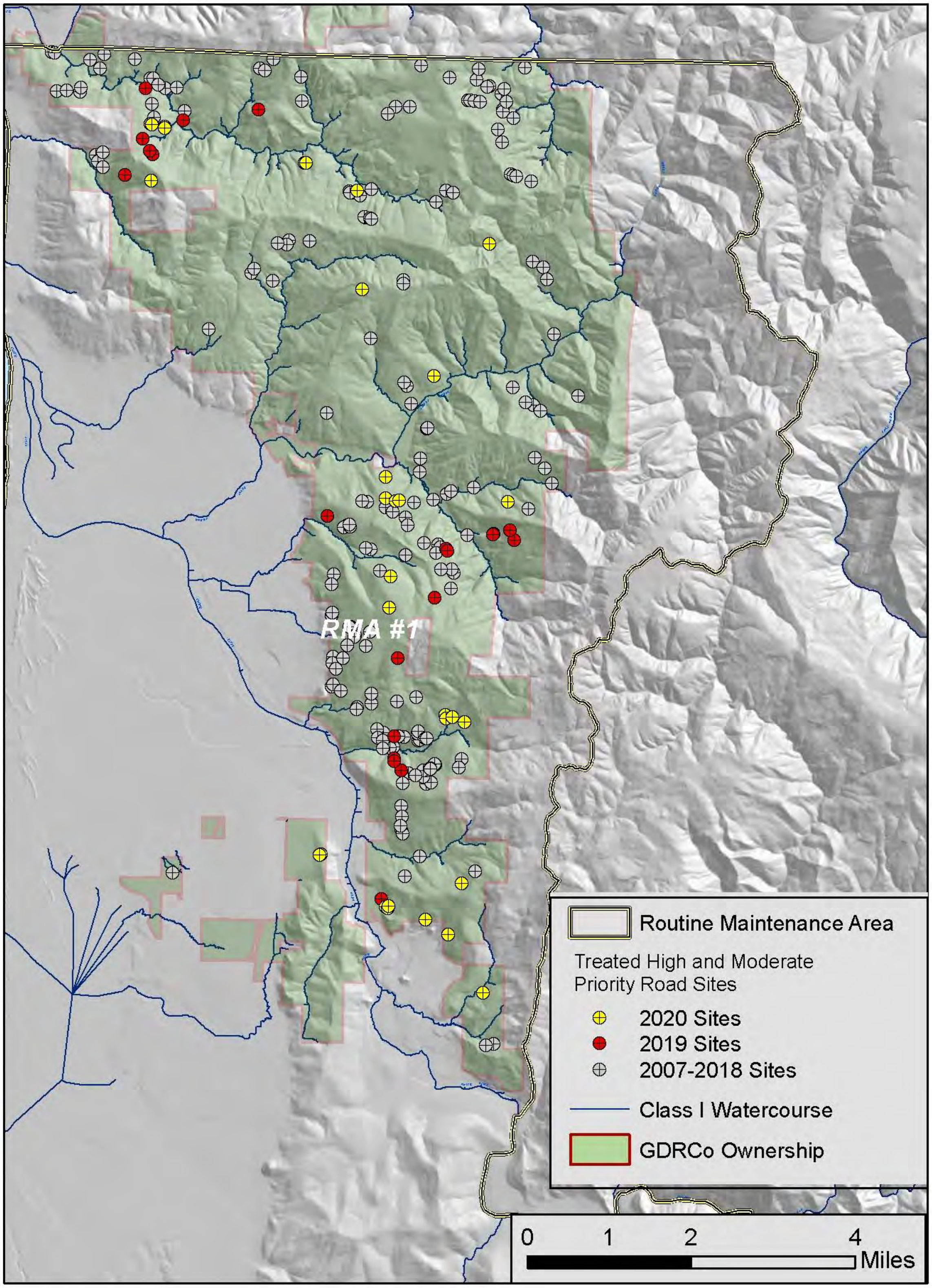

Figure 1. Location of High and Moderate priority road sites treated from 2007-2020 (Smith River area).

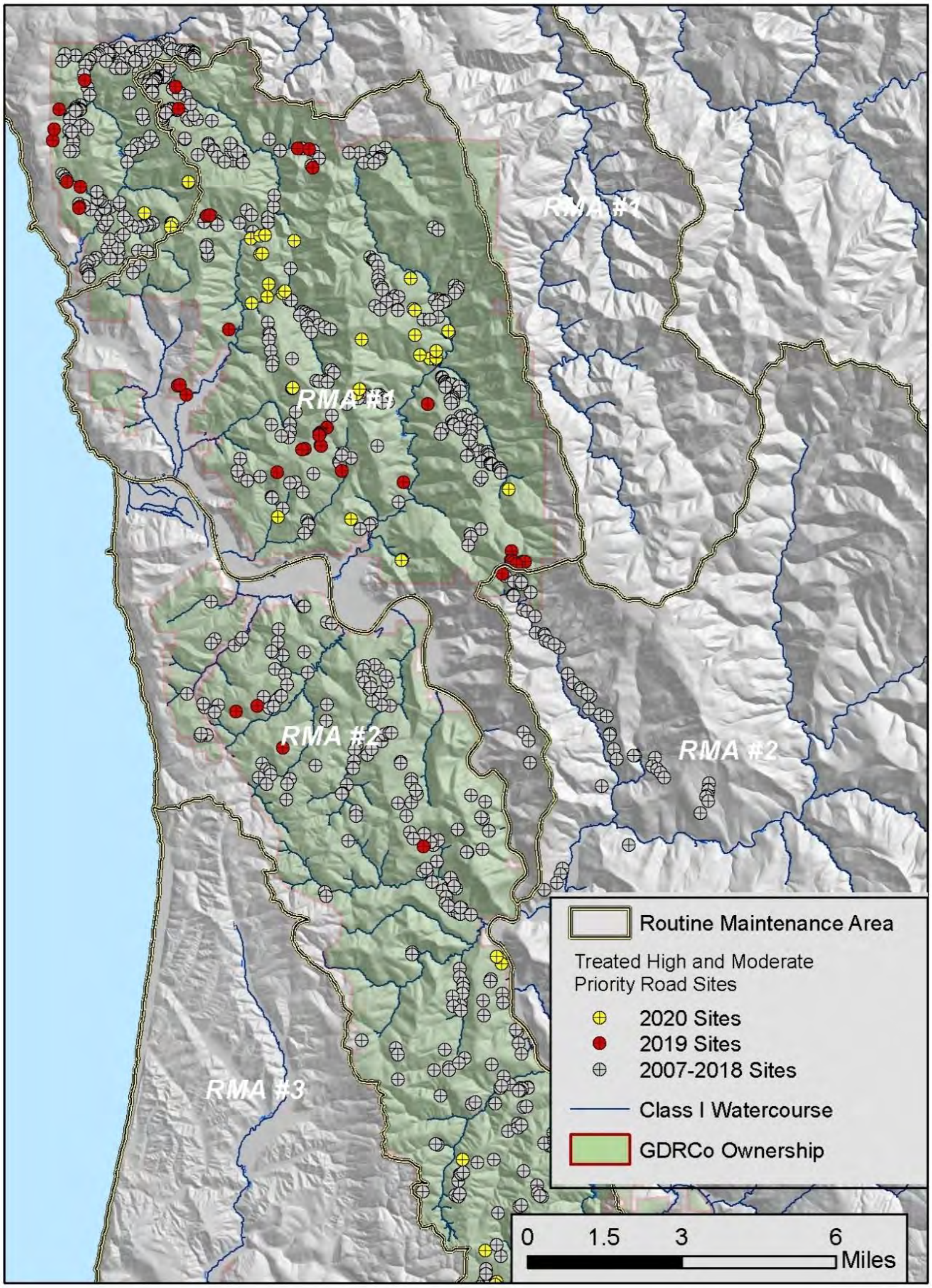

Figure 2. Location of High and Moderate priority road sites treated from 2007-2020 (Coastal Klamath area).

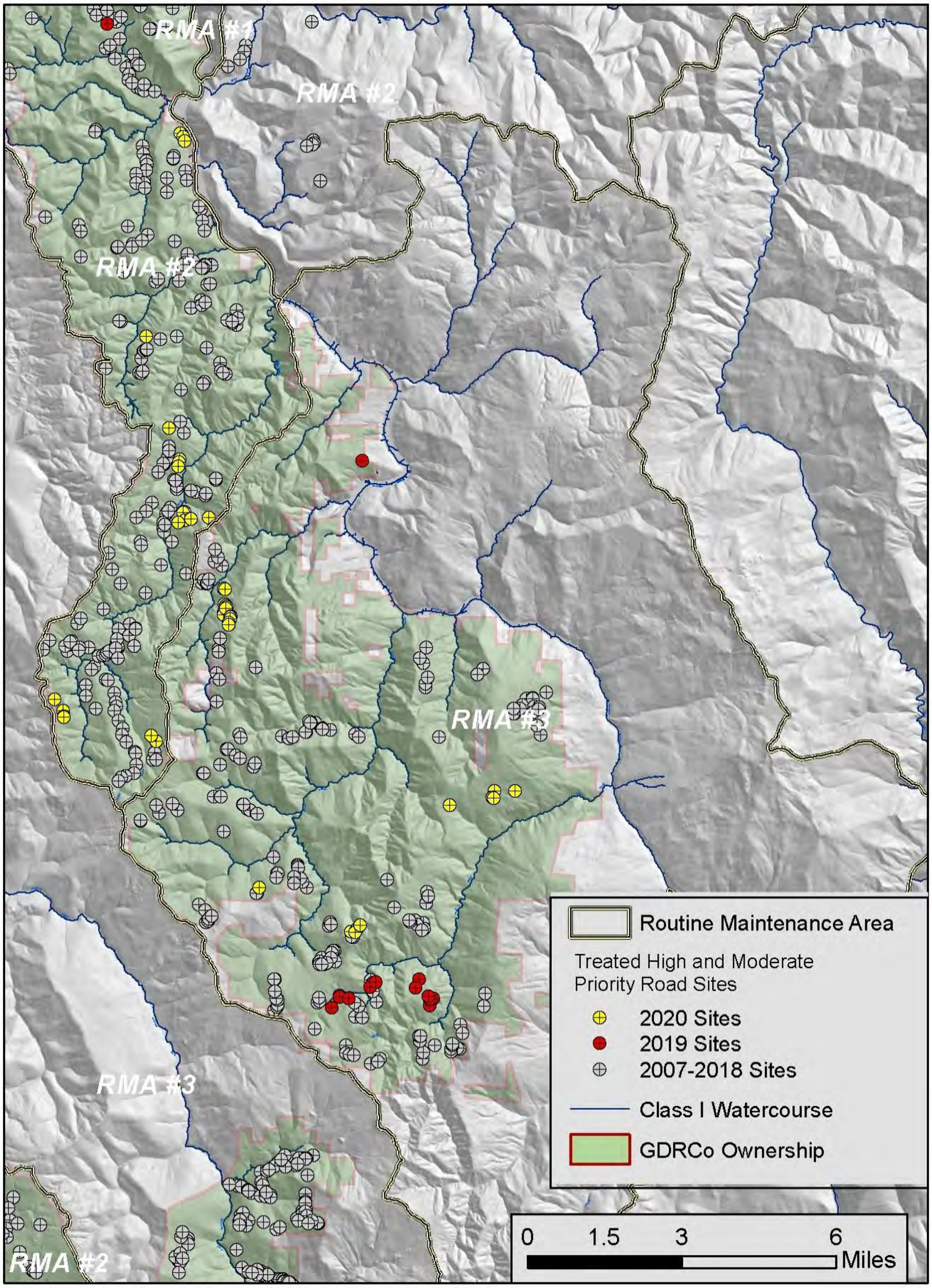

Figure 3. Location of High and Moderate priority road sites treated from 2007-2020 (Interior Klamath area).

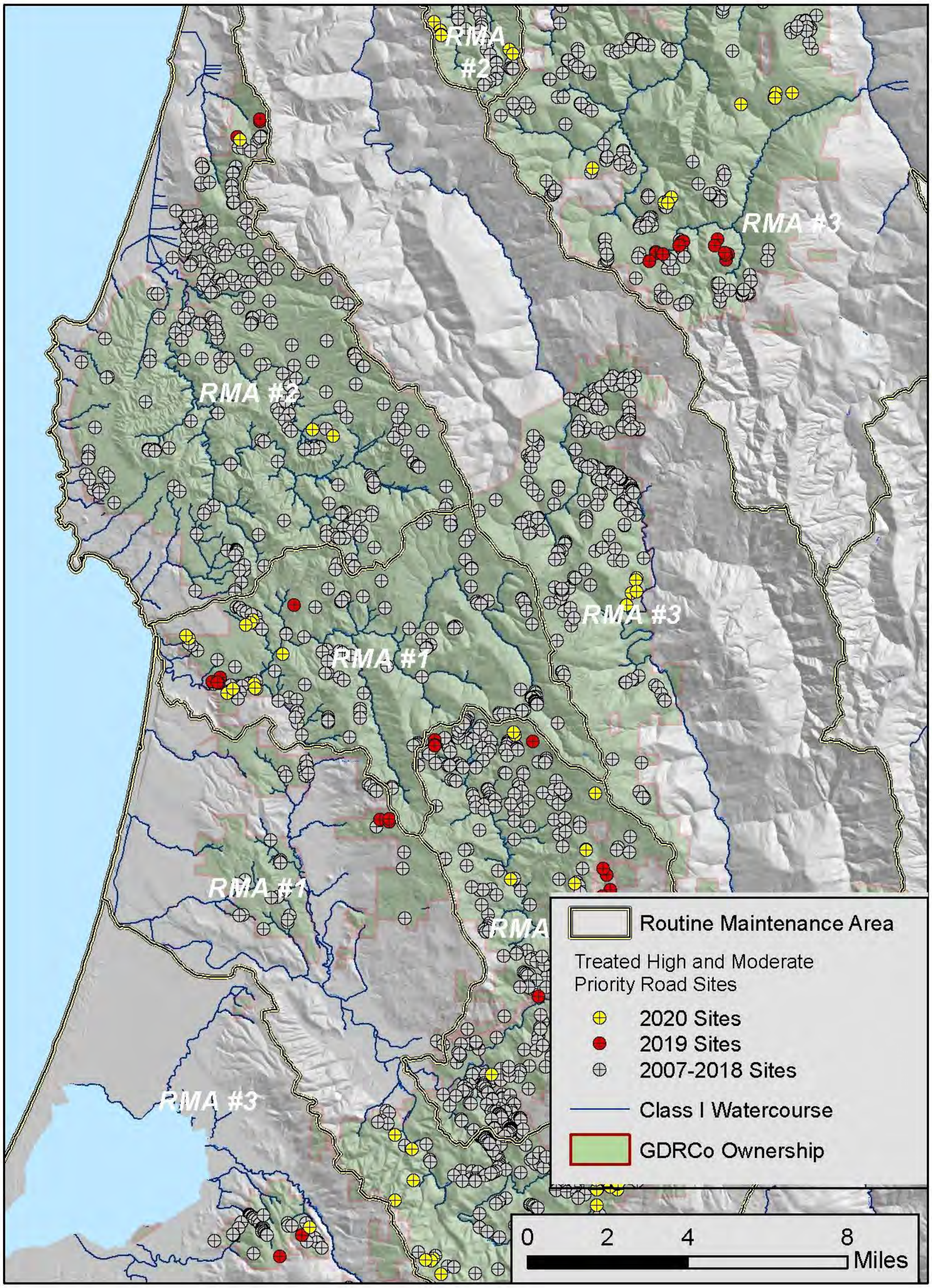

Figure 4. Location of High and Moderate priority road sites treated from 2007-2020 (Maple Creek, Little River, Lower Mad River area).

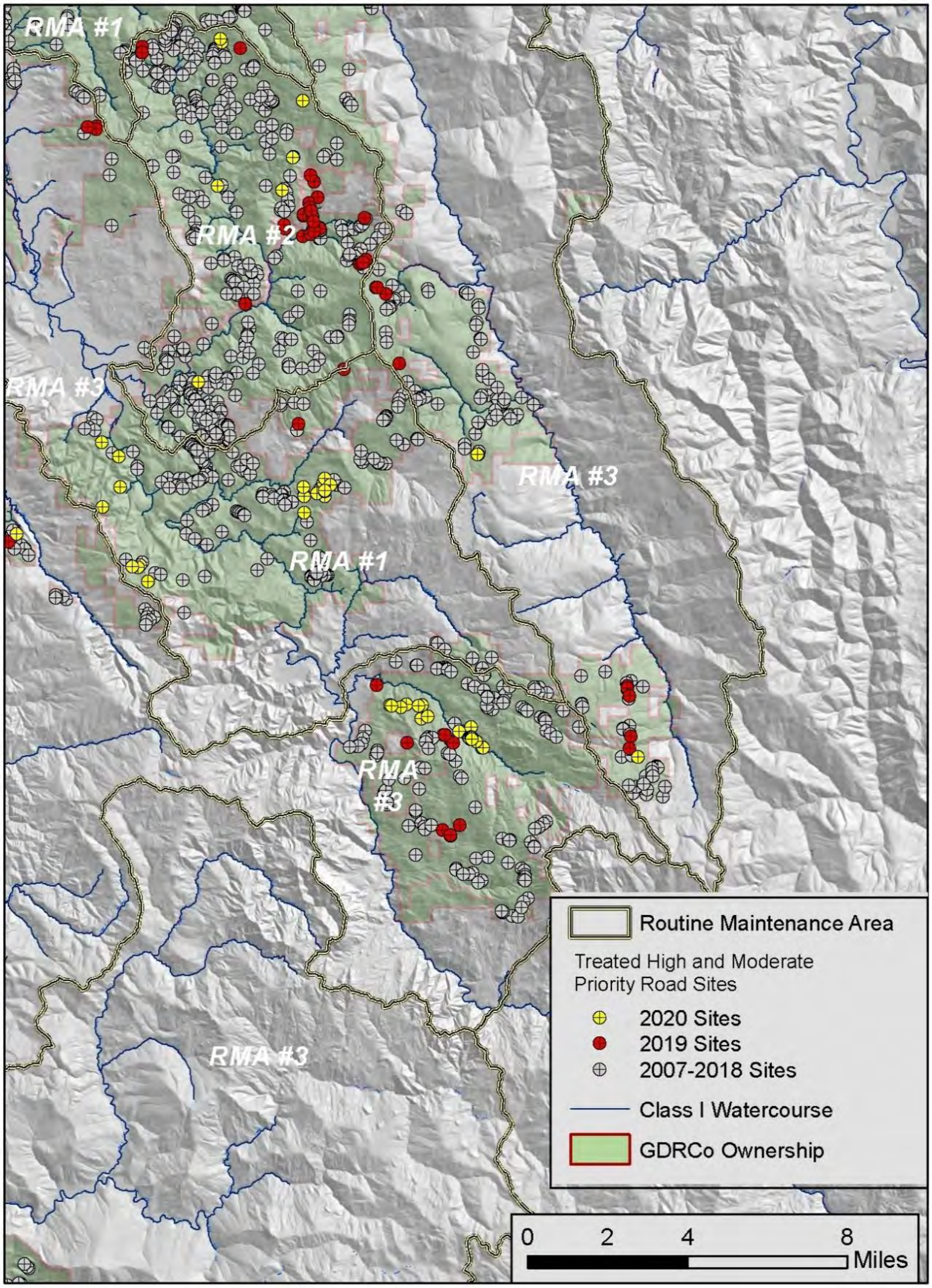

Figure 5. Location of High and Moderate priority road sites treated from 2007-2020 (Mad River area).

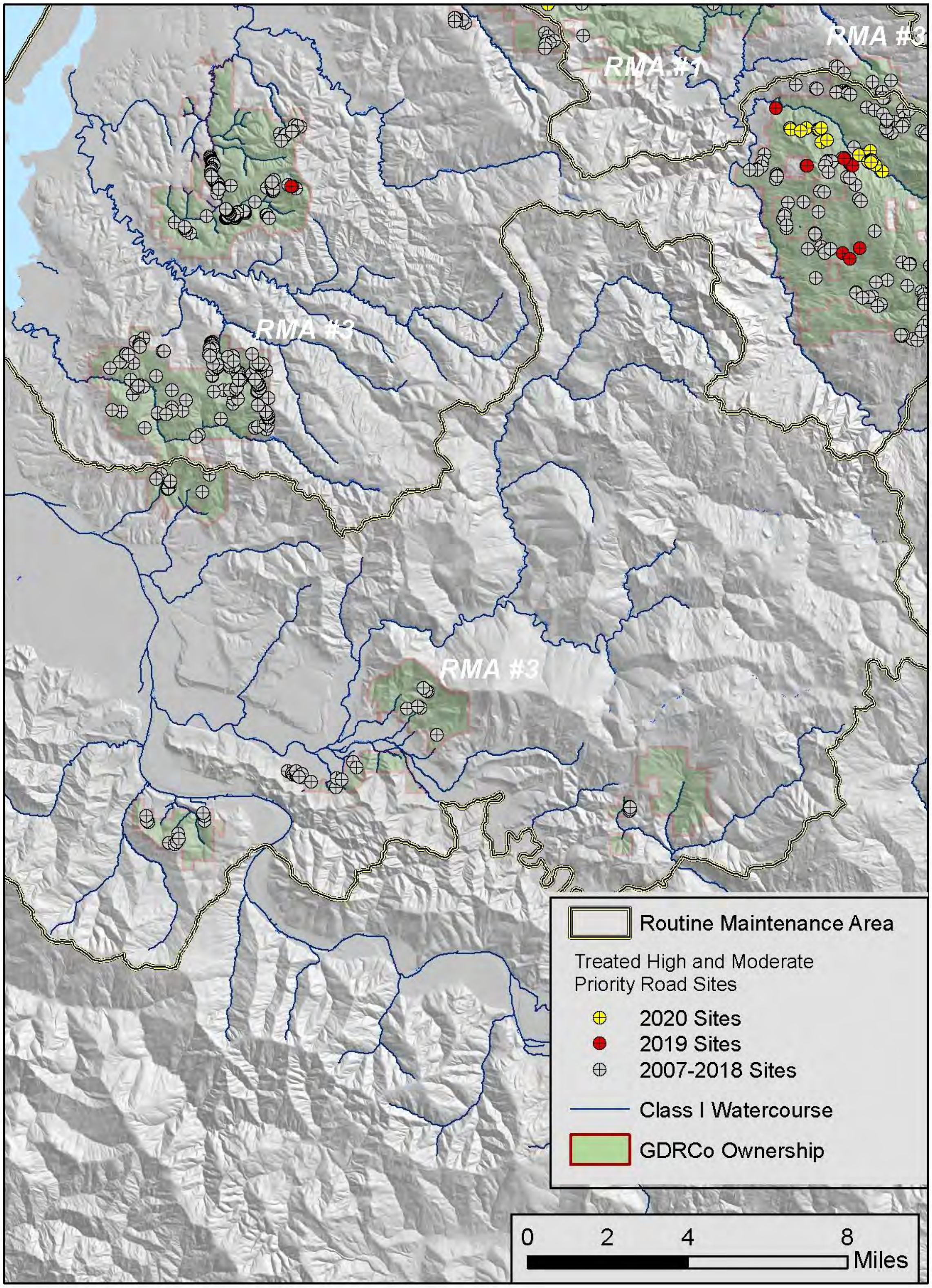

Figure 6. Location of High and Moderate priority road sites treated from 2007-2020 (Humboldt Bay and Eel River area).

Table 17. Actual, preliminary and forecasted Gross Domestic Product (GDP) Price Index inflation rates published by the Bureau of Economic Analysis including actual and planned expenditures by year for treating high and moderate priority road sites during the Acceleration Period.

	Base	Actual [(1)]													Preliminary [(2)]	Forecasted [(2)]
Year	**2002**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
GDP Price Index (% change from preceeding period)	0.00%	2.69%	1.91%	0.78%	1.17%	2.08%	1.92%	1.77%	1.84%	0.96%	1.05%	1.91%	2.39%	1.81%	1.08%	1.65%
Cumulative Inflation Rate (2002 Base)	0.00%	14.14%	16.32%	17.23%	18.60%	21.07%	23.40%	25.58%	27.90%	29.12%	30.48%	32.96%	36.13%	38.60%	40.10%	42.41%
Required Average Annual Spending in 2002 $ ($MM)		$ 0 [(3)(4)]	$2.50	$2.50	$2.50	$2.50	$2.36 [(5)]	$2.30 [(5)]	$2.97 [(5)]	$2.25 [(5)]	$2.25 [(5)]	$2.20 [(5)]	$2.20 [(5)]	$2.20 [(5)]	$2.20 [(5)]	$1.10 [(6)]
Required Average Annual Spending After Adjusting for Inflation Using 2002 as Base ($MM)		$ 0	$2.91 [(7)]	$2.93	$2.96	$3.03	$2.91	$2.89	$2.94	$2.91	$2.93	$2.92	$2.99	$3.05	$3.09	$1.57 [(6)]
Actual and Budgeted Spending by year ($MM)		$1.676	$4.073	$1.171	$2.179	$4.710	$3.966	$3.346	$3.468	$3.396	$2.336	$1.910	$1.914	$2.480	$3.650	$0.00 [(8)]

(1) The Bureau of Economic Analysis has revised the "Actual" GDP Price Index values that w ere reported in the last Biennial Report (See page 1-7 in the follow ing methodology paper: http://w w w .bea.gov/national/pdf/NIPAch1-4.pdf).

(2) The Bureau of Economic Analysis usually releases the "Actual" GDP Price Index for the previous year at the end of the first quarter of the follow ing year. The reported values for 2020 and 20221 are based on the preliminary and forcasted estimates, respectively, for GDP PI.

(3) Reflects the AHCP Minor Modification to the acceleration period to have funds be measured on a calendar year

(4) Reflects the AHCP Minor Modification to the acceleration period to have funds provided for the 3-year ramp-up period begin on the effective date of the Plan through the end of the third calendar year.

(5) Reflects the revised annual spending requirement based in the proportional adjustment in the current Plan Area in relation to the Initial Plan Area, as per IA Section 7.2 and AHCP Section 6.2.3.2.1 #4.

(6) Reflects the required spending amount for the last half year of the 13.5 year acceleration period.

(7) Beginning $2.5MM at 2002 base inflation.

(8) Total spending requirement for the acceleration period w as met in 2020. Tracking and forecasting road expenditures is no longer required.

Bureau of Economic Analysis, and are updated annually as inflation data are revised. It is expected that similar changes will occur and be reflected in the next biennial report, and will be noted similarly.

AHCP Section 6.2.3.2.1 #4 and IA Section 7.2 requires GDRCo to adjust the annual commitment proportionally with changes in the Plan Area in relation to the acreage of the Initial Plan Area. Table 12 summarizes all the land transactions and minor modifications which occurred in 2019 and 2020. The current Plan Area, as of December 31, 2020 is 358,594 acres which is 88.1% of the Initial Plan Area of 406,962 acres (see Section III.C). Based on these Plan Area adjustments, the $2,500,000 annual spending requirements (in 2002 dollars) were proportionally adjusted each year by the proportional changes in Plan Area beginning in 2012 (see Table 17).

AHCP Section 6.2.3.2.2 required an assessment of future sediment yields at the end of the first five-year period (Five-year Assessment of Future Sediment Yield). The intent of this assessment from the AHCP was to evaluate and potentially revise the preliminary estimated sediment savings of 6,440,000 cubic yards from treating high and moderate priority road sites. The results of this study were submitted to the Services on December 20, 2013 per AHCP Section 6.2.3.2.3. The letter submitted to the Services with the complete results was included in the 4^{th} AHCP Biennial Report (GDRCo 2015). The results of this study indicated the refined estimate is 30.5% less than the original estimate which exceeded the maximum allowed reduction for the Acceleration Period; therefore, the Acceleration Period was reduced by 1.5 years (the maximum adjustment allowed) with a corresponding spending reduction of $3.75 million. To reflect this result, the Acceleration Period was revised to 13.5 years with $33.75 million (to be inflation adjusted in 2002 dollars for each year of the acceleration period) provided for by GDRCo over this period.

Based on the annual property transactions that have occurred since the beginning of the AHCP, the target spending requirement has also been reduced to $31.35 million (to be inflation adjusted in 2002 dollars). Accounting for inflation, the target spending in real dollars is $40.02 million. As presented in Table 16 and Table 17, the total amount that GDRCo has provided for through 2020 is $40.277 million; therefore, GDRCo met the spending requirement in year 13 of the 13.5 year Acceleration Period. With the Acceleration Period spending requirement being met in 2020 rather than in 2021, there is no longer an average annual spending target or need to forecast or report the annual road expenditures for high or moderate priority road sites.

D. Road Maintenance and Inspection Plan

AHCP Section 6.2.3.9 specifies the road maintenance and inspection plan. The Services approved a minor modification of the schedule for the Routine Maintenance Areas (RMAs) as well as the schedule for mainline roads (See 6th Biennial Report, Section II.D.3.; GDRCo 2019). Road inspections were conducted in accordance with the process outlined in AHCP Section 6.2.3.9.5 and the approved minor modifications. The rotating annual schedule of RMAs are defined in distinct sections covering the entire Plan Area. The maintenance assessment was separated into a two-tier approach. The AHCP Roads Department was responsible for surveying the non-appurtenant roads and the Operations department was responsible for surveying the roads appurtenant to THPs.

During the winters of 2019 and 2020 inspections of the appurtenant roads (including mainline and secondary roads) were conducted by the Operations department. These inspections were focused on identification and treatment of “active erosion sites” and others related to compliance with California Forest Practice rules and the AHCP. Any sites identified for treatment were scheduled and completed by the Operations department. During the summer of 2019 and the spring of 2020 Forest Operations Technicians surveyed mainline roads and appurtenant roads associated with THP development.

Assessment of RMA #2 late 2018 and was completed in late 2019. This area consists of Coastal Klamath South, Coastal Lagoons and NF Mad River HPAs. All sites associated with RMA #2 were included in the 2020 Annual Work Plan and work is expected to be completed by October 2021. Assessment of RMA #3 began in early 2020 and was completed in late 2020. This area consists of Interior Klamath HPA, Redwood Creek HPA, Humboldt Bay HPA included the Boulder Creek RWU and the Eel River HPA. All sites associated with RMA #3 were included in the 2021 Annual Work Plan and work is expected to be completed by October 2023.

VI. Geology

The AHCP requires GDRCo to conduct several geologic assessments across the Plan Area. The following discussion summarizes these individual projects.

A. CMZ/Floodplain Delineation

Green Diamond revised the CMZ/Floodplain Delineation project through a minor modification submitted in March of 2011. Since that time GDRCo has completed the CMZ/Floodplain mapping concurrent with THP development throughout the life of the ITP and ESP Permits. A summary of CMZ's and Floodplains delineated during the current reporting period is shown in Section II.F.

B. SSS Delineation Plan (AHCP Section 6.2.5.3.2)

Steep Streamside Slope's (SSS) are a default mass wasting prescription that are applied to steep slopes directly adjacent to Class I and Class II watercourses on GDRCo timberlands. These areas vary in size, depending on slope gradients, and are thought to require the retention of more timber than a Riparian Management Zone.

The stated goal of the SSS prescription is to achieve a 70 percent reduction of landslide volumes delivering to watercourses in comparison to historical management related landslide volumes. The original AHCP contained initial default prescriptions that GDRCo applied to qualifying SSS. In December of 2014 GDRCo completed the SSS Delineation Study (see AHCP Section 6.2.3.5.2 that modified the initial SSS default prescriptions across the property. A copy of the final SSS Delineation Study was included in the 4th AHCP Biennial Report (GDRCo 2015).

C. SSS Assessment (AHCP Section 6.2.5.3.3)

As described above, Steep Streamside Slopes are a mass wasting prescription that was developed specifically for GDRCo lands. The prescription was developed through a landslide study for GDRCo's AHCP. The proposed goal of the SSS prescription is to achieve a 70 percent reduction in sediment associated with shallow landslide volumes delivering to watercourses in comparison with historical landslide volumes associated with historically clearcut slopes about the referenced areas of the AHCP. With the proposed SSS Assessment we will attempt to determine the effectiveness of the default SSS prescriptions across the property. A scientific review panel will be assembled to analyze the resulting data. The panel will consist of a three-person team of independent experts in the field of timber management and slope stability. In July of 2014 we discussed modifications to the SSS Assessment with the Services which was described in detail in the 5th Biennial Report (GDRCo 2017).

1. Current Status of the SSS Assessment

In December of 2013 we began reviewing the SSS sample areas and one year later completed our preliminary review of all 58 SSS sample areas that total 92 acres of SSS. Our initial review was reported in the 4th Biennial Report (GDRCo 2015) and included a summary of four landslides. After further review of the landslide data and sample areas for this assessment we discovered an error in the classification of one of the landslides. It was determined that landslide LS8953 (found in Ryan Slough of the Humboldt Bay HPA) is not a SSS landslide. This slide was found to have initiated outside of the SSS zone adjacent to a

Class III watercourse. The revised sediment delivery estimate for the three remaining landslides from 4th Biennial Report is 79 cubic yards, down from the original estimate of 87 cubic yards. One additional post-harvest landslide was found in 2017 and discussed in the 6th Biennial Report (GDRCo 2019). GDRCo continues to review the SSS sample areas. Our review of these sites in 2019 and 2020 did not reveal any new indications of post-harvest landsliding. To date, it is estimated that a combined total of 137 cubic yards of sediment has been delivered to streams associated with the SSS Assessment sample areas since 2013. It would be inaccurate to calculate a delivery rate from the sample areas because of the difficulty in estimating an appropriate contributing landscape area. The sample areas are discrete locations identified within THPs; not at a watershed or ownership level. An attempt to calculate a rate from these data would not be directly comparable to the delivery rates reported in the preliminary Mass Wasting Assessment. Utilizing only the sample area, volume and duration of the project would grossly overestimate delivery rates and is biased to only SSS slopes which are identified as landslide prone terrain. In order to calculate comparable delivery rates we would need to estimate the total SSS within the ownership, which is a significant GIS analysis that has not yet been conducted.

Historical sediment delivery rates were established as part of the preliminary Mass Wasting Assessment. We intend to utilize the historical landslide sediment delivery rates for comparison and evaluation of the SSS Assessment sample areas. These rates are discussed in the Preliminary Mass Wasting Assessment, which was included as Appendix B in the 5th Biennial Report (GDRCo 2017).

D. Mass Wasting Assessment (AHCP Section 6.2.5.3.4)

The goal of the Mass Wasting Assessment (MWA) is to examine the relationship between landslide processes and timber management practices. This study will be based on the collection of a thorough landslide and land use history data set. We intend to utilize, and build upon, the existing landslide and land use history data sets that are being compiled for the SSS projects. The field data from each of these projects will also be incorporated into the MWA and will also be built upon as needed. For this study we will use the aforementioned data to focus on the causal mechanisms of the various mass wasting processes we observe throughout the ownership and specifically their relationship to timber management practices. In addition, we will examine other contributing factors such as climate, bedrock geology, and structural geology.

1. Purpose and Scope of the Assessment

The purpose of the MWA is to evaluate the influence of timber management practices on Mass Wasting for each of the 11 HPAs identified in GDRCo's AHCP.

The scope of work for the assessment is generally based on the standard methodology for mass wasting analysis as defined in The State of Washington's Forest Practice Board (WSFPB) watershed analysis manual. As described above we will consider a variety of factors in this assessment followed by detailed review and therefore this study would likely fall under the criteria of a Level 2 analysis as discussed in the mass wasting section of WSFPB's watershed analysis manual. This project will be completed within 20 years from the effective date of GDRCo's AHCP (July 1, 2027).

2. Current Status

The preliminary results of the Mass Wasting Assessment were submitted to the Services and other state agencies in November of 2016. To date our data collection has focused largely on shallow landslides due to the nature of our data collection efforts being centered on the SSS Delineation and Assessment projects. Mass wasting associated with deep-seated failures will be addressed in the future and although Class III watercourses have not yet been specifically assessed for mass wasting; our preliminary data suggests that it is unlikely that there is a significant amount of mass wasting resultant sediment associated with Class III watercourses. None the less, these areas will be reviewed prior to completing the final Mass Wasting Assessment. Our preliminary data show sediment delivery and erosion rates related to shallow mass wasting have declined. Analysis of the available rainfall data appears to dismiss climatic factors as significant driving influences in this decline. However, as we acquire more detailed landslide initiation data this relationship will continue to be monitored to address any positive correlations we may find.

In conjunction with evolving forest practice rules, GDRCo has continued to reduce impacts related to management practices. Since 2000, GDRCo has made a significant effort to reduce sediment inputs and improve terrestrial and aquatic habitat by improving management practices on its own accord. These efforts include; adapting to less impactful logging (yarding) methods such as shovel yarding in early 2000 (GDRCo was the first company in northern California to do so), implementing our AHCP specific Riparian Management Zones in 2007 (which are equivalent to or exceeded the level of protection of the Forest Practice Rules), implementing our own AHCP road management measures in 2007 that hydrologically disconnect roads from streams, and, as noted above, established steep streamside slope buffers designed to reduce streamside mass wasting. It is our judgment that the reduction in shallow landslides and related erosion and sediment delivery is the result of improvements to management practices with specific attention directed to mass wasting areas of concern. A copy of the "Preliminary Mass Wasting Assessment" was provided as Appendix B in the 5th Biennial Report (GDRCo 2017).

VII. Budget

Implementation Agreement Section 8.1(b) requires GDRCo to submit a detailed budget for measures pursuant to the Operating Conservation Program that require out-of-pocket expenditure that will be implemented in each subsequent calendar year before the next biennial report is due. In previous biennial reports the planned and anticipated budgets included expenditures for road work associated with treating high and moderate sites to demonstrate compliance with the annual spending requirement for the Acceleration Period for the Road Management Plan (See AHCP Section 6.2.3.2). As described in Section V.C above, GDRCo met the total spending requirements for the Acceleration Period in 2020 (a half year early). With the successful completion of this AHCP requirement, there is no longer an average annual spending target or need to forecast the annual road expenditures for high or moderate priority road sites. GDRCo will continue to perform road treatments across the property associated with THP activities and with implementation of the Road Maintenance and Inspection Plan associated with the AHCP; however, tracking the costs associated with these activities is no longer required. Table 18 summarizes the planned budget for implementing the monitoring requirements of the AHCP for 2021.

Table 19 summarizes the anticipated budget for implementing the monitoring requirements of the AHCP for 2022. The 2021 planned budget formed the basis for projecting the anticipated 2022 budget and is therefore similar in many ways.

Table 18. Planned budget for 2021.

Item	Amount
Payroll	
Salaries	$907,923
Benefits	$207,062
Misc. Supplies (including fuel, monitoring equip, computer hardware/software, etc.)	$121,036
Equipment Maintenance	$40,983
Professional Services (contract geology, contract statistical analysis, property-wide programmatic permits, contract legal, etc.)	$93,700
Other Misc. Costs	$59,165
Total	$1,429,869

Table 19. Anticipated budget for 2022.

Item	Amount
Payroll	
Salaries	$935,161
Hourly	$213,274
Misc. Supplies (including fuel, monitoring equip, computer hardware/software, etc.)	$124,667
Equipment Maintenance	$42,212
Professional Services (contract geology, contract statistical analysis, contract legal, etc.)	$93,700
Other Misc. Costs	$60,198
Total	$1,469,212

VIII. Effectiveness Monitoring

Effectiveness monitoring and adaptive management are key components of Green Diamond's AHCP. The AHCP sets specific biological goals and objectives related to the abundance, distribution, and habitat of the Covered Species (AHCP Section 6.1) and it defines an Operating Conservation Program intended to achieve those goals and objectives (AHCP Section 6.2). The role of the Effectiveness Monitoring Program is to track the success of the Operating Conservation Program in meeting the AHCP's biological goals and objectives, and to provide the feedback needed for adaptive management if those goals and objectives are not being met. The Effectiveness Monitoring Program is described in AHCP Sections 6.2.5 and 6.3.5, with detailed protocols included in AHCP Appendix D.

The monitoring projects and programs fall into four categories: Rapid Response Monitoring, Response Monitoring, Long-term Trend Monitoring and Research, and Experimental Watersheds Program. The first three categories are based on the minimum time frame over which feedback for adaptive management is likely to occur. The time scales are a product of the specific variables or processes being measured as well as the available monitoring protocols currently used.

The Rapid Response and Response Monitoring projects form the backbone of the adaptive management process. Each project has (or will establish) measurable thresholds which, when exceeded, initiate a series of steps for identifying appropriate management responses. To provide the ability to respond rapidly to early signs of potential problems while providing assurances that negative monitoring results will be adequately addressed, a two-stage "yellow light, red light" process is employed. The yellow light threshold serves as an early warning system to identify and rapidly address a potential problem. As such, the yellow light thresholds can typically be exceeded by a single negative monitoring result (i.e., summer water temperatures). The red light threshold is usually triggered by multiple negative monitoring responses (a series of yellow light triggers) and indicates a more serious condition than the yellow light threshold. The intent is to provide a timely review of monitoring data to allow for corrective actions to occur, if necessary, prior to the next season.

A. Rapid Response Monitoring

The Rapid Response Monitoring projects and programs will provide the early warning signals necessary to ensure that the biological goals and objectives of the AHCP will be met. While trends which occur over longer time scales will also be monitored through these projects, they are distinguished from the response and trend monitoring projects by their potential to provide rapid feedback for adaptive management. The yellow light threshold for these projects can typically be triggered in less than one year, although the annual analysis of results will be necessary to identify the yellow light condition. The red light threshold will generally take two to three years to be triggered.

1. Property-wide Water Temperature Monitoring

Objectives and Thresholds

Maintaining cool water temperature regimes consistent with the requirements of the Covered Species is a biological goal of the AHCP. To inform appropriate biological objectives and adaptive management thresholds for achieving this goal, an analysis was conducted of 400 stream temperature profiles collected in the Plan Area from 1994 to 2000. The results pointed to watershed area as a key factor in water temperatures, and were used to help set the following biological objectives:

1. Summer water temperatures in 4^{th} order or smaller Class I and II watercourses with drainage areas less than approximately 10,000 acres will have a 7DMAVG below the upper 95% Prediction Interval (PI) described by the following regression equation: *Water Temperature* (^{o}C) = *14.35141 + 0.03066461x square root of Watershed Area (acres)*

2. No significant increases (>2 ^{o}C) in the 7DMAVG water temperature in Class I or II watercourses following timber harvest that are not attributable to annual climatic variation.

Yellow and red light thresholds for adaptive management were adopted based on these objectives.

- The yellow light threshold in Class I and II watercourses with drainage areas generally less than 10,000 acres is:
  a) A 7DMAVG water temperature above the upper 95% PI, as described by the regression equation: *Water Temperature* (°C) = *14.35141 + 0.03066461x square root of Watershed Area (acres);* or
  b) Any statistically significant increase in the 7DMAVG water temperature of a Class I or II watercourse where recent timber harvest has occurred, which cannot be attributed to annual climatic effects.

- The red light threshold in Class I and II watercourses with drainage areas generally less than 10,000 acres is:
  a) A 7DMAVG water temperature above the upper 95% PI plus one °C, as described by the regression equation: *Water Temperature (°C) =15.35141+ 0.03066461x square root of Watershed Area (acres)*;
  b) An absolute water temperature of 17.4 °C (relevant for fish); or
  c) A 7DMAVG water temperature that triggers a yellow light for three successive years.

Project Status

Monitoring of Class I (fish-bearing) and Class II (non-fish bearing) stream temperatures is operational and has been ongoing since 1994. More than 2,700 stream temperature profiles have been collected since 2000 from throughout the AHCP Plan Area. Over 140 temperature loggers are deployed annually.

The objective of this project is accomplished by installing temperature dataloggers (Onset Computer Corp.) in Class I and II streams across the Plan Area. Dataloggers are deployed where the water is well-mixed; typically at the head of a shallow pool just below a riffle input. Dataloggers are usually deployed in May after the winter flows have subsided, and they are typically retrieved in October. This monitoring period ensures that the warmest period of the year is measured. Each datalogger is fixed in the stream and covered with cobble to assure that the sensor stays submerged and is not exposed to direct sunlight. Water temperature measurements are logged every 1.2 hours for the duration of the monitoring period. A database has been developed to store data, assess thresholds, and calculate summary statistics. Improvements were made to the accuracy of monitoring site locations (current and many historical sites). This improvement also allowed for upgrading the accuracy of the watershed areas calculated for each monitoring sites. Watershed area was calculated with a Flow Accumulation Model using the best available data from either GDRCo LiDAR digital elevation model (DEM, accuracy = ± 1 meter) or USGS 10-meter DEM.

A reanalysis of the appropriate adaptive management thresholds was proposed to the Services in the March 2011 request for Minor Modifications. The intent of this request was to address the finding that current thresholds are regularly exceeded without causal links to management activities under AHCP/CCAA prescriptions. Reanalysis could potentially establish a better Prediction Interval and minimize the apparent false positives detected using the current thresholds. After review and consideration, the Services recommended that the current thresholds be maintained at this time. Green Diamond acknowledges this decision and will maintain using the original thresholds established for this monitoring program.

Reporting Requirements

Sites that exceed a yellow or red light threshold are reported to the Services within 30 days after an analysis indicating that a threshold has been exceeded (AHCP Section 6.2.6.1.1). The temperature recorders are typically recovered from the field in October and the data are downloaded shortly after. Prior to analysis data are proofed for quality assurance. After completing the analysis, the results are reported to the Services via email correspondence.

Results

A combined total of 316 stream temperature profiles were collected in 2019 and 2020 at Class I and II streams for the property-wide water temperature monitoring program. During this two-year monitoring period twenty-four yellow light and seven red light thresholds were exceeded (Table 20). Compared to past monitoring efforts, the 2019 and 2020 monitoring seasons experienced a higher than average (10.5) number of exceedances with 14 and 17 exceedances, respectively (Table 20). Of the 14 sites that exceeded in 2019, the average amount of exceedance was 0.31°C (range = 0.02°C – 0.68°C). The average 7DMAVG of the 14 sites that exceeded in 2019 was 15.4°C (range = 14.5°C – 16.8°C). Of the 17 sites that exceeded in 2020, the average amount of exceedance was 0.36°C (range = 0.06°C – 0.85°C). The average 7DMAVG of the 17 sites that exceeded in 2020 was 15.5°C (range = 14.4°C – 17.0°C). Only stream temperature sites from the Plan Area that have <10,000 acres of watershed upstream are evaluated for threshold exceedances and included in this summary.

Table 20. Summary of property-wide water temperature monitoring threshold exceedances documented from 2007-2020.

		Threshold Exceedences			
Year	**# Sites Monitored**	**Yellow light**	**Red light**	**Total**	**%**
2007	158	9	2	11	6.96
2008	168	3	0	3	1.79
2009	157	1	1	2	1.27
2010	141	0	0	0	0.00
2011	143	0	0	0	0.00
2012	162	0	0	0	0.00
2013	157	10	0	10	6.37
2014	155	6	0	6	3.87
2015	161	16	3	19	11.80
2016	155	4	5	9	5.81
2017	160	35	16	51	31.88
2018	160	4	1	5	3.13
2019	159	11	3	14	8.81
2020	157	13	4	17	10.83
Mean	156.6	8.0	2.5	10.5	6.61

Discussion

Variation in summer weather conditions is the most probable explanation for the variation in exceedances documented since 2007. It appears that there is a correlation between minimum August air temperatures and the number of water temperature threshold exceedances (Figure 7). The relationship between air temperature and stream temperature is well established (Mohseni and Stefan 1999) and based on this relationship the results from 2019-2020 were not unexpected. It appears that the driver for the number of water temperature threshold exceedances is the deviation of the minimum air temperature from the 30-year normal at the water temperature sites (Figure 7A).

Over the past 14 years, the deviation of the August average minimum air temperature has been elevated. In general, when there have been higher daily minimum air temperatures in August; air temperatures have not been cooling off as much at night. This translates to increased water temperatures because the water temperature, similarly, is not able to cool off at night allowing the water temperature to increase more the following day with the water starting at a warmer temperature to begin with. In 2019, the August average minimum air temperature was 1.7 °C above the 30-year normal for all monitoring sites and correspondingly 8.8% of the water temperature sites experienced exceedances. In 2020, August average minimum air temperature for all the temperature sites was 2.0 °C above the 30-year normal (0.3 °C warmer than 2019). As a result, three more sites experienced exceedances in 2020. Generally, when the August

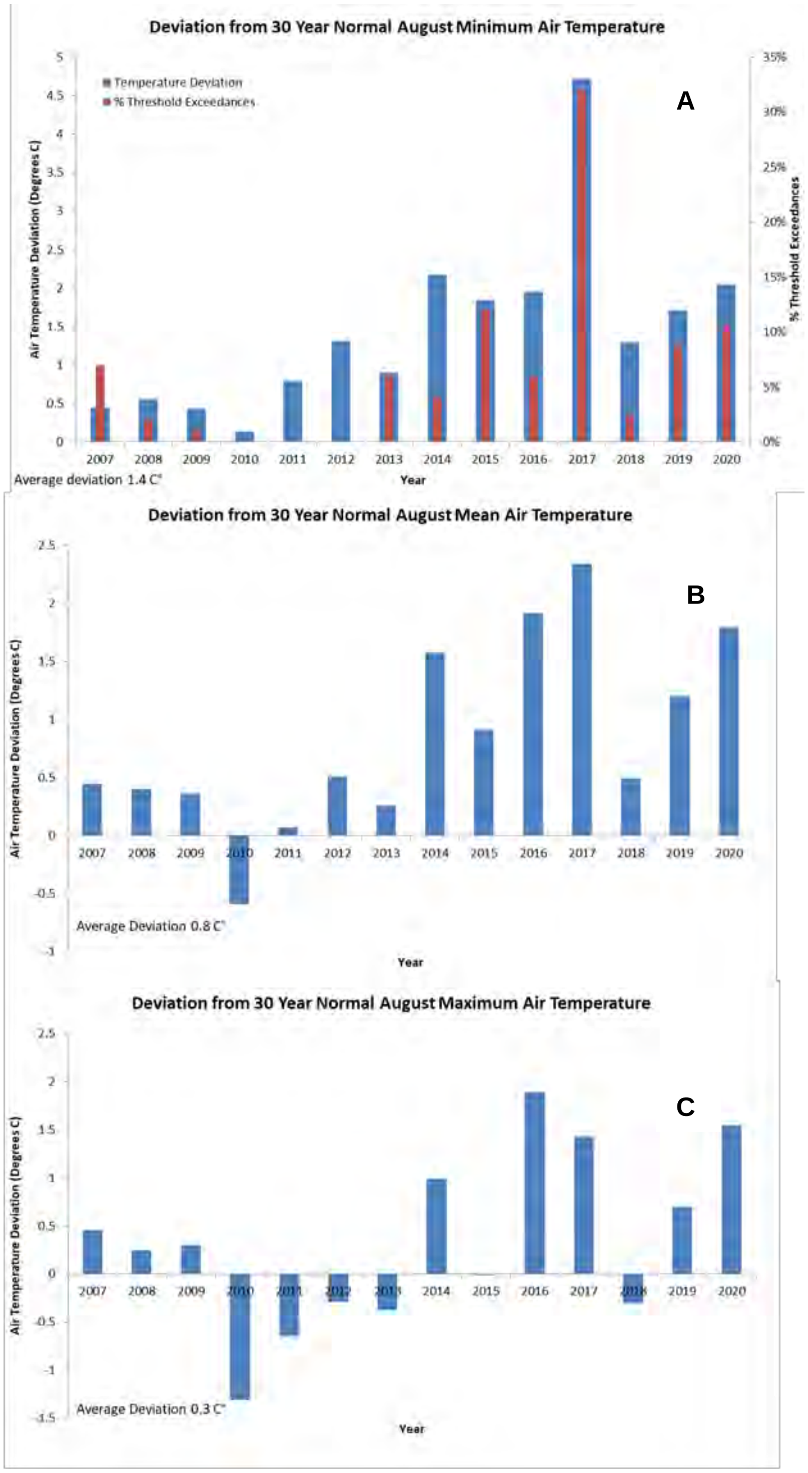

Figure 7. Deviation in minimum (A), mean (B) and maximum (C) air temperature from the 30-year normal for the month of August. Additionally, histogram (A) includes percent of monitoring sites (red bars with secondary y-axis) that experienced a threshold exceedance each year to show the association with this climatic metric.

average minimum air temperature is close to the 30-year normal, there are few water temperature exceedances; and, when the August average minimum air temperature deviates above the 30-year normal, more temperature exceedances occur.

The average percentage of sites exceeding the 95% PI over the last fourteen years has generally been within the expected range. Given the 95% PI basis for the thresholds; by definition, an average of 5% of sites should fall outside of the PI, with half above and half below. The probability distribution on which these water temperature monitoring thresholds were established ensures that some thresholds will be exceeded in most years. The number of exceedances in 2019 and 2020 were above the expected amount and were likely caused by increased summer air temperatures.

Despite the red and yellow light water temperature thresholds that were exceeded during the 2019 and 2020 monitoring periods, following an extensive review of AHCP Covered Activities upstream and immediately adjacent to water temperature monitoring sites as well as historical water temperature data, it was determined that the observed water temperature exceedances at these sites were not biologically significant for the Covered Species. Salmonids thrive in dynamic environments as long as the water is fairly cool (< 22 °C maximum; Moyle 2002). During our summer monitoring period, there are three primary salmonid species that may be encountered in Class I streams located on GDRCo ownership: Coho (*Oncorhynchus kisutch*), Steelhead (*Oncorhynchus mykiss irideus*) and Coastal Cutthroat (*Oncorhynchus clarkii clarkii*).

These animals are cold water adapted and generally inhabit streams ranging in temperature from 10 to 16 °C, but may be found in warmer conditions if food is plentiful and habitat conditions are favorable (Moyle et al. 2016). Two amphibian species that are often encountered in Class I streams are Coastal Giant Salamanders (*Dicamptodon tenebrosus*) and Coastal Tailed Frogs (*Ascaphus truei*). These two species also inhabit Class II streams. Southern Torrent Salamanders (*Rhyacotriton variegatus*) inhabit Class II streams but are usually associated with seeps and headwater habitats. These amphibian species are cold water adapted and generally inhabit streams ranging in temperature from 7 to 16 °C but can tolerate warmer temperatures under certain conditions (Adams and Frissell 2001, Bury 2008, Brown 1975, Diller and Wallace 1996, Diller and Wallace 1999). Additionally, these threshold temperatures are not sustained for long periods of time and drop to levels that are more favorable to the species.

While some of the sites that had water temperature exceedances also had some level of timber harvest above the monitoring site, it is unlikely that timber harvest overall had a significant negative influence on water temperatures at these sites. Some sites had temperature threshold exceedances in previous years when no recent timber harvest had occurred. The exceedances triggered are likely from site specific situations associated with regional climatic conditions (e.g., air temperature). GDRCo believes that the results to date indicate that the Operating Conservation Program is achieving its goal of maintaining water temperatures that meet the needs of the Covered Species.

2. Coastal Tailed Frog Monitoring

Objectives

The Coastal Tailed Frog (*Ascaphus truei*) component of the headwaters amphibian monitoring program consists of two objectives. The primary objective is to determine if timber harvest activities have a measurable impact on larval tailed frog populations. These sites are monitored on an annual basis (Figure 8). The secondary objective is to document long-term changes in larval Coastal Tailed Frog populations over GDRCo's ownership (Figure 9). Occupancy surveys will be repeated approximately every ten years. Change in occupancy of larval Coastal Tailed Frog populations in Class II watercourses throughout the plan area will be assessed using the historical baseline established in 1995 of 75% occupancy.

In 2013 pilot surveys using environmental DNA (eDNA) were conducted to test the efficacy of using eDNA to survey for the occurrence of Coastal Tailed Frogs. This led to a collaboration with a Humboldt State University (HSU) graduate student involving eDNA sampling in three sub-basins in which multiple water samples were collected every 100 m over approximately 2 km stream reaches, coupled with 100% rubble-rouse/visual encounter surveys (VES) for larval Coastal Tailed Frogs. The objectives of this study were to relate the occurrence and density of eDNA in water samples with the distribution and abundance of larval Coastal Tailed Frogs. Detection rates for eDNA sampling (≥94%) were higher than those for our traditional sampling (≥91%), showing that eDNA sampling is an effective method of monitoring Coastal Tailed Frog presence (Smith 2017).

Project Status

-Primary Objective-*Annual Monitoring*

The annual monitoring program to assess timber harvest impacts on larval Coastal Tailed Frog populations was reviewed in 2014. A summary of the history of research and monitoring in addition to the results from recent data analyses and a proposed future monitoring direction were compiled into a report which was included in the 4th Biennial Report (GDRCo 2015, Appendix D, Part 1). After completing the 2013 sampling season, the original larval Coastal Tailed Frog monitoring objectives and thresholds (see AHCP Appendix D.1.6.2.1.1 for details), as well as the revised protocol submitted to the Services in 2012 were discontinued. A formal data analysis was conducted in 2014 by Western EcoSystems Technology Inc. (WEST Inc.) and the results justified discontinuing this project. Details on the data analysis for the project and results were provided in the 4th Biennial Report (GDRCo 2015, Appendix D, Part 2). Based on the findings from this study, we have concluded that modifications to the original study design and established thresholds were warranted. The Services were briefed on the results during a meeting in 2014 and were also introduced to the proposed direction of future monitoring efforts for this project (GDRCo 2015, Appendix D, Part 3). Upon acceptance of the proposed monitoring protocol by the Services, the current monitoring protocol uses a light-touch rubble rouse/VES method to confirm larval Coastal Tailed Frog presence and is conducted during early spring in conjunction with the deployment of water temperature sensors. Occupancy specific sampling was initiated in 2015 and has continued through 2020.

-Secondary Objective-*Property-wide Occupancy Surveys*

Changes to the protocol regarding long-term monitoring of property-wide larval Coastal Tailed Frog occupancy have been reviewed and modifications to this monitoring project have been approved. The 2nd Biennial Report (GDRCo 2011) provided a summary of the project history and results from a preliminary analysis completed in 2009 by WEST Inc. Additional analyses were conducted and the results were provided in the 4th Biennial Report (GDRCo 2015, Appendix D, Part 2). Based on the findings from this study, we have concluded that modifications to the original study design and established triggers were warranted. The Services were briefed on the results in 2014 and were also introduced to the proposed direction of future monitoring for this project (GDRCo 2015, Appendix D, Part 3). On April 27, 2018, GDRCo submitted a minor modification request with the proposed revisions to the property-wide occupancy survey protocol. Revisions to this protocol were approved by the Services on May 20, 2019 (See Section II.D.1). Field work for this project was initiated May 20, 2019 and concluded March 20, 2020.

The following is a summary of the revised property-wide larval Coastal Tailed Frog occupancy survey protocol: Upon arrival at each stream a 1L water sample was obtained to test for the presence of Coastal Tailed Frog eDNA. Biologists then collected habitat data (e.g., wetted width, active channel width, water depth, stream gradient, substrate composition, substrate embeddedness, riparian tree composition), as well as searched for larval Coastal Tailed Frogs using the same light-touch methodology employed during our annual monitoring efforts. Each stream was searched until larval presence was documented or until 200 m of stream habitat was searched. If larval presence was documented within the 200 m stream segment surveyed, the first eDNA sample was not tested for Coastal Tailed Frog but was run to test for the presence of the chytrid fungus and collection of the second eDNA sample was not necessary. If larval Coastal Tailed Frogs were not detected within the 200 m survey, a second eDNA sample was obtained at the top of the reach. Both samples were run to test for Coastal Tailed Frog presence, but only the first sample was run for the presence of chytrid. In changing from a relative abundance-based rubble-rouse survey to a presence/absence survey employing a combination of light-touch rubble rouse/VES techniques and eDNA sampling, we were able to reduce the amount of habitat searched (from 1000 m to 200 m), therefore reducing the disturbance to stream habitats. Occupancy (naïve) was calculated as the proportion of sites with at least one detection (MacKenzie et al. 2006).

Results

-Primary Objective-*Annual Monitoring*

Ten paired sites (n = 20; Figure 8) were monitored for larval Coastal Tailed Frog occupancy and population estimates between 1997 and 2013, having 100% larval tailed frog occupancy every year (Table 21). In 2014, data were analyzed for this period and it was determined that there were no biologically meaningful management impacts (negative or positive) on larval Coastal Tailed Frog populations (GDRCo 2015, Appendix D, Part 2). It was decided that the objectives of this phase of monitoring were met and the new objective of monitoring larval Coastal Tailed Frog occupancy at these sites was initiated. One set of our paired sites in the Bear Creek drainage was located on property sold in 2013, which brought our number of paired sites to 9 (n = 18; Figure 8). In 2015 annual larval occupancy surveys were initiated at the remaining sites. We have had 100% larval Coastal Tailed Frog occupancy all of our annual monitoring sites every year since the start of this new monitoring objective (Table 21).

-Secondary Objective-*Property-wide Occupancy Surveys*

Following formal analyses of the 1995 and 2008 data sets, results for the long-term Coastal Tailed Frog occupancy monitoring study across GDRCo's ownership were provided in the 4th Biennial Report (GDRCo 2015, Appendix D, Part 2). In this report we are presenting a comparison of the proportion of sites occupied during each survey period (1995, 2008, 2019), as a formal analysis has not yet been performed on all three sampling periods. As a result of land acquisitions and sales between 1995 and 2019, there was some variation in the sites surveyed during each of the three sampling periods (Figure 9).

Our initial property-wide occupancy surveys in 1995 established a baseline occupancy rate of 75% (54 of 72 sites; Table 22) for larval Coastal Tailed Frogs. During the 2008 survey, 85 sites were surveyed across the property (Figure 9), resulting in a larval occupancy rate of 83.5% (71 of 85; Table 22). Of the 85 sites surveyed in 2008, 67 were initially surveyed in 1995. Occupancy rates of these original 67 sites increased from 77.6% (1995) to 83.6% (2008). During our third round of property-wide occupancy surveys in 2019, a total of 72 sites were surveyed, 55 of which were from the original set of sites surveyed in 1995 and revisited in 2008 (Table 23). Our 2019 survey used light-touch rubble rouse and VES coupled with eDNA sampling to determine Coastal Tailed Frog occupancy, as well as test for the presence of the chytrid fungus, which can have detrimental effects to amphibian populations (Skerratt et al. 2007). Because eDNA sampling was used, we reduced our light-touch rubble rouse/VES sampling reaches from 1000 m to 200 m, and in turn were sampling much less of any given site. With our revised sampling protocol, we detected larval Coastal Tailed Frogs at 77.8% of the sites via light-touch rubble rouse/VES sampling (Table 22). However, the occupancy rate for Coastal Tailed Frogs of any life history stage was 83.3% and when factoring in results from eDNA sampling, our occupancy rate jumped to 87.5% (Table 22), a higher occupancy rate than our two previous survey periods. Of the 55 sites surveyed during all three periods, in 2019 we saw 87.2% occupancy for any life history stage and 81.8% larval occupancy, a 10.9% increase in any life history stage occupancy and 5.5% increase in larval occupancy when compared to the original surveys in 1995 (Table 23). When factoring in our eDNA results these 55 sites we saw an occupancy rate of 90.9% (Table 22). Out of 72 sites surveyed in 2019, four sites (5.6%) tested positive for the presence of the chytrid fungus (Figure 9).

Discussion

Previous studies on GDRCo property have indicated that many streams inhabited by Coastal Tailed Frogs had at least some evidence of habitat being negatively impacted by past unregulated timber harvest (Wallace and Diller 1998, Diller and Wallace 1999). This was particularly evident in lower gradient reaches where fines were likely to accumulate and substrates became embedded; however, most populations persisted, particularly in high gradient reaches and where the underlying geology was generally favorable (e.g., not young uplifted marine or unconsolidated bedrock). We have learned from 25 years of monitoring larval Coastal Tailed Frog populations that the distribution and abundance of populations have been at a minimum stable, but most likely increasing. This is likely due to improved protections allotted to aquatic habitats in more recent years through the AHCP. Other factors that may have ameliorated the negative effects of unregulated timber harvest on Coastal Tailed Frog populations include cool summer temperatures and coastal fog, as well as shorter larval periods (1-2 years) compared to higher elevation, inland populations (up to five years; Wallace and Diller 1998)

Based on a combination of light-touch rubble-rouse/VES and eDNA sampling, our 2019 property-wide Coastal Tailed Frog occupancy rate was 87.5%. When looking at larval detections using only the light-touch rubble-rouse method, our 2019 occupancy rate was 77.8%, exceeding the baseline occupancy of 75% established during the 1995 surveys (Table 22 and Table 23); however, when excluding eDNA sampling the 2019 larval occupancy rate was lower than the 2008 larval occupancy rate (Table 22 and Table 23). This decrease in larval detection was likely due to the reduction in rubble-rouse reach lengths from 1000 m to 200 m during our 2019 surveys. On some streams during the 1995 and 2008 surveys, larvae were not detected until well past the 200 m reach lengths searched during our 2019 surveys. It should be noted that eDNA occupancy cannot account for life history stage, therefore we cannot say with confidence that the streams that did not have larval detections through light-touch rubble-rouse/VES, but had positive results via eDNA sampling, do indeed support breeding populations of Coastal Tailed Frogs. Nonetheless, we can say that the frogs are present within these drainages.

Out of 72 sites tested in 2019 for the presence of the chytrid fungus through eDNA sampling, four sites tested positive for the presence of the fungus, indicating that the fungus is not present on a large scale in streams inhabited by Coastal Tailed Frogs across GDRCo's ownership. Conversely, of the 90 larval Coastal Tailed Frogs captured during the property-wide and annual occupancy surveys (90 sites) none showed signs of chytridiomycosis. Decontamination measures have been and will continue to be followed by GDRCo at all sampling sites for all projects to avoid the potential spread of harmful pathogens.

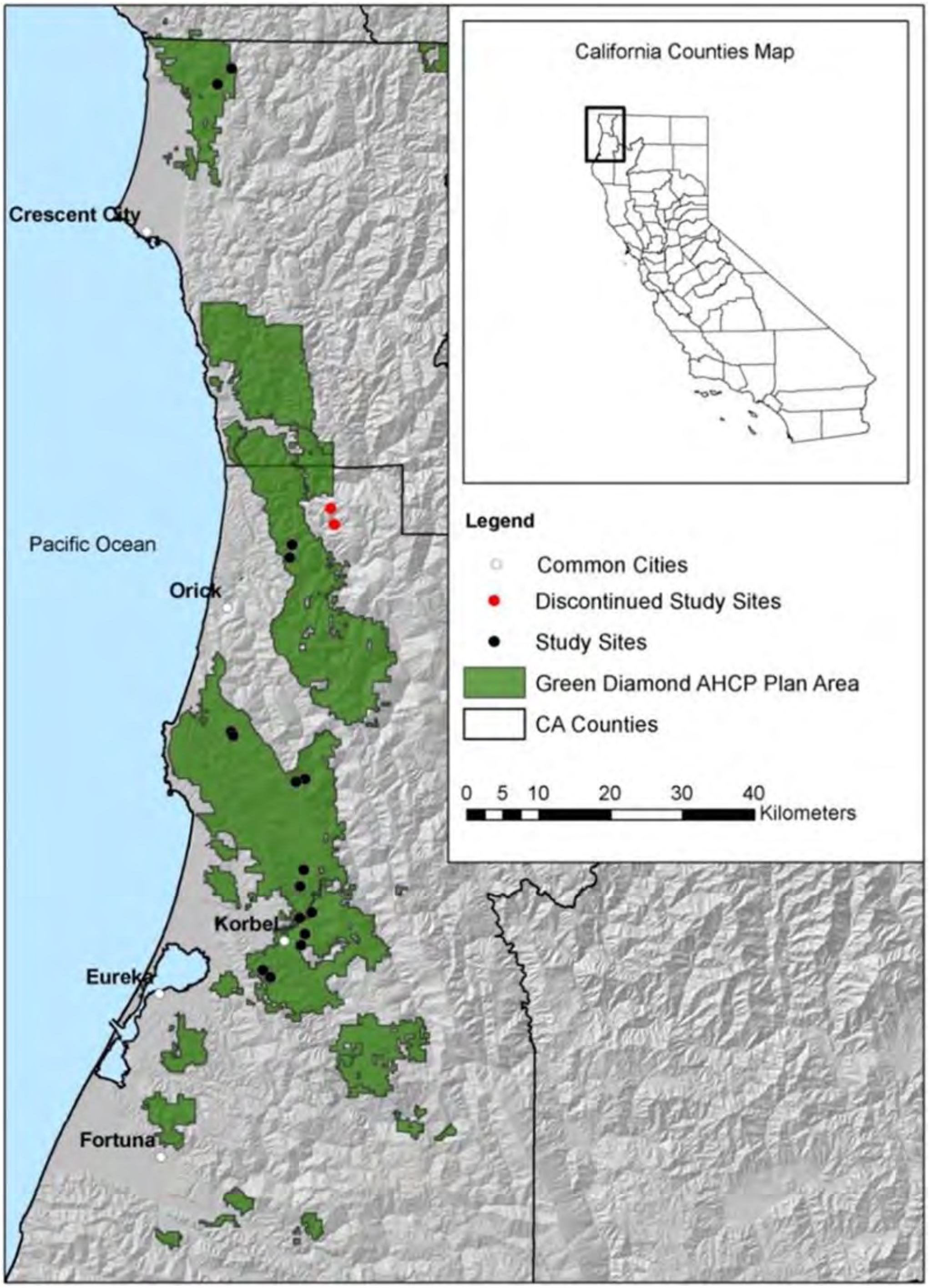

Figure 8. Locations of current annual Coastal Tailed Frog monitoring sites (n = 18), as well as, discontinued sites (n = 2), Del Norte and Humboldt Counties, California (n = 20; at this map scale, some site locations overlap).

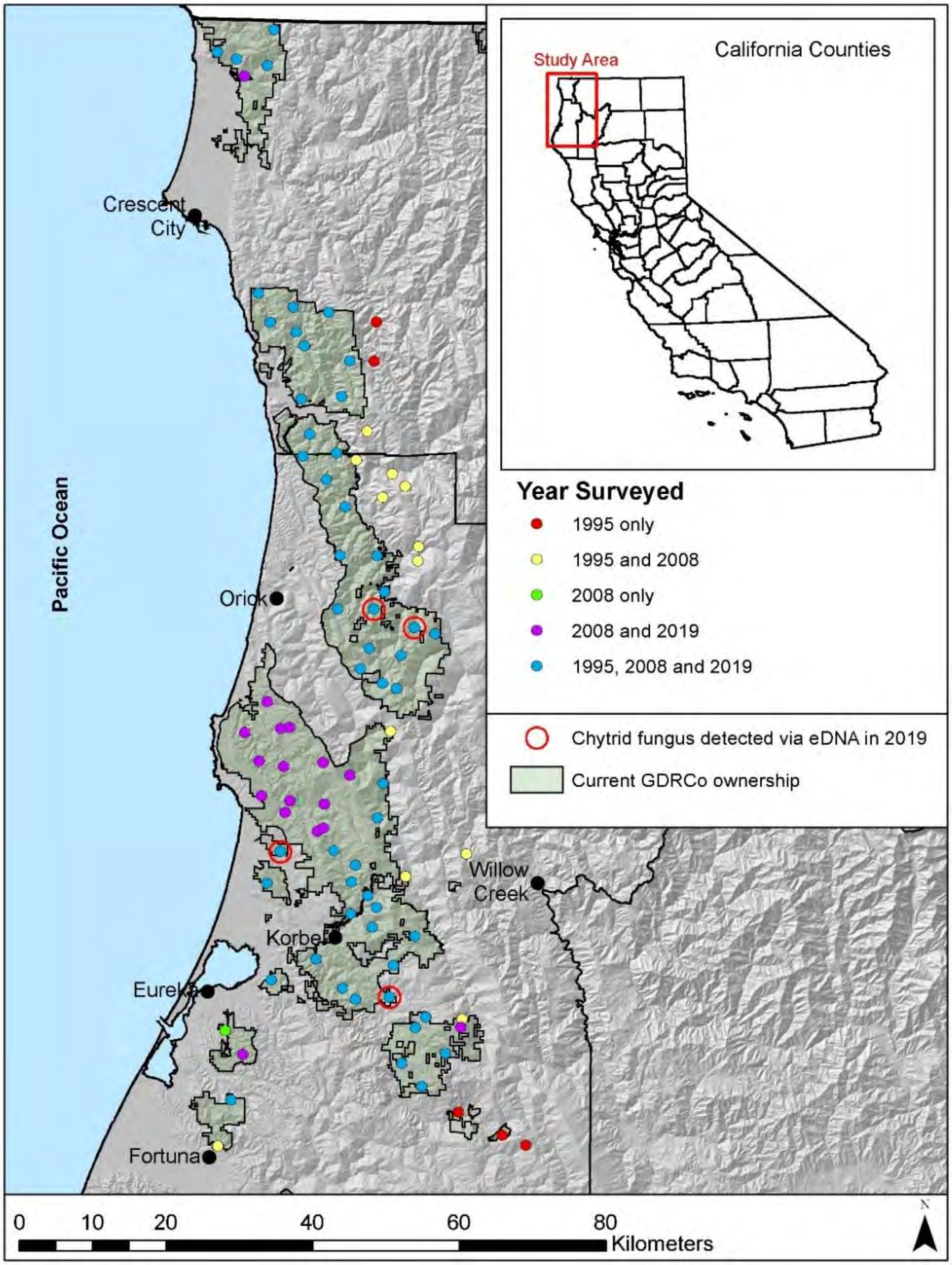

Figure 9. Locations of larval Coastal Tailed Frog property-wide occupancy survey sites (1995, 2008 and 2019) and where the chytrid fungus was detected (2019 only) via eDNA sampling, Del Norte and Humboldt Counties, California.

Table 21. Coastal Tailed Frog larval occupancy between 1997 and 2020 at GDRCo's northern California annual monitoring sites ("+" = occupied by larval tailed frogs; "-" = not surveyed; sites that were not surveyed prior to 2009 had not yet been established, sites not surveyed after 2013 were on property that was sold). Paired sub-basin larval population monitoring was suspended upon the completion of the 2013 field season (analyses pending), no sites were surveyed during the transitional 2014 season. In 2015 occupancy surveys were initiated at our annual monitoring sites.

	Year																							
Site Name	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Black Dog 5300	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Black Dog 5400	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Mule	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Pollock	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Poverty	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Jiggs	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Hatchery	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Canyon	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Panther CR2960	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Panther CR 2970	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
NF Maple BL2000	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
NF Maple BL 2600	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Surpur West	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Surpur South	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Bear BC200	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-
Bear BC270	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-
Rowdy R1700	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Rowdy R1000	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Tectah T190	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	+	+	+	+	+	+
Tectah T100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	+	+	+	+	+	+
Occupancy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	-	100%	100%	100%	100%	100%	100%

Table 22. Comparison of landscape-level Coastal Tailed Frog occupancy at all sites, each year. (LHS = life history stage; eDNA samples only collected during the 2019 survey).

Year	Streams Surveyed	% Occupied (any LHS)*	% Occupied (Larva)*	% Occupied (eDNA)^
1995	72	75.0	75.0	x
2008	85	84.7	83.5	x
2019	72	83.3	77.8	87.5

* = Detected via rubble rousing; ^ = Detected via rubble rousing or eDNA

Table 23. Comparison of Coastal Tailed Frog occupancy amongst streams originally surveyed in 1995 and revisited in 2008 and 2019 (LHS = life history stage; eDNA samples only collected during the 2019 survey).

Year	Streams Surveyed	% Occupied (any LHS)*	% Occupied (Larva)*	% Occupied (eDNA)^
1995	55	76.3	76.3	x
2008	55	83.6	81.8	x
2019	55	87.2	81.8	90.9

* = Detected via rubble rousing; ^ = Detected via rubble rousing or eDNA

3. Southern Torrent Salamander Monitoring

<u>Objectives</u>

There are two objectives associated with the Southern Torrent Salamander (*Rhyacotriton variegatus*) component of the headwaters amphibian monitoring program. Like the Coastal Tailed Frog monitoring program, the primary objective of the Southern Torrent Salamander monitoring program is to determine if timber harvest activities have a measurable impact on salamander populations at our annual monitoring sites (Figure 10). The secondary objective is to document long-term changes in Southern Torrent Salamander populations across GDRCo's ownership. Property-wide occupancy surveys have been repeated at approximately 10-year intervals (1994, 2008 and 2019; see Diller and Wallace 1996, GDRCo 2009; Figure 11). Change in occupancy of Southern Torrent Salamander sub-populations in Class II watercourses throughout the Plan Area will be assessed using the historical baseline of 80% occurrence established in 1994.

<u>Project Status</u>

<u>-Primary Objective-*Annual Monitoring*</u>
Since GDRCo began monitoring Southern Torrent Salamander populations for potential impacts of current timber harvest practices, the protocol has undergone minor revisions. Modifications to the original AHCP protocol (AHCP Appendix D.1.6.1) were proposed to the Services in the March 2011 request for Minor Modifications. The intent of this request was to adjust to the challenges and issues experienced with past monitoring efforts. Details on the history of this monitoring project and past challenges were provided in the 2nd Biennial Report (GDRCo 2011). After review and consideration, the Services concurred with the proposed modifications and requested the revised protocol be provided for review and approval.

On July 24, 2012, the Services were provided with the revised protocol for this monitoring program. No revisions were requested by the Services and the revised protocol was implemented for this monitoring program at all 30 of our annual monitoring sites. More recently we have noticed larval detections at some of our annual sites declining, therefore with the approval of the Services, we initiated a return to a biennial survey schedule where we randomly selected half of our annual monitoring sites (n=15) to be surveyed for larval Southern Torrent Salamander occupancy in 2019 and the outstanding sites (n = 15) in 2020 allowing sites a longer recovery period between surveys. On April 23, 2019, GDRCo submitted the revised protocol reflecting this biennial sampling schedule. The Services evaluated and approved the modified protocol on May 20, 2019 (See Section II.D.2).

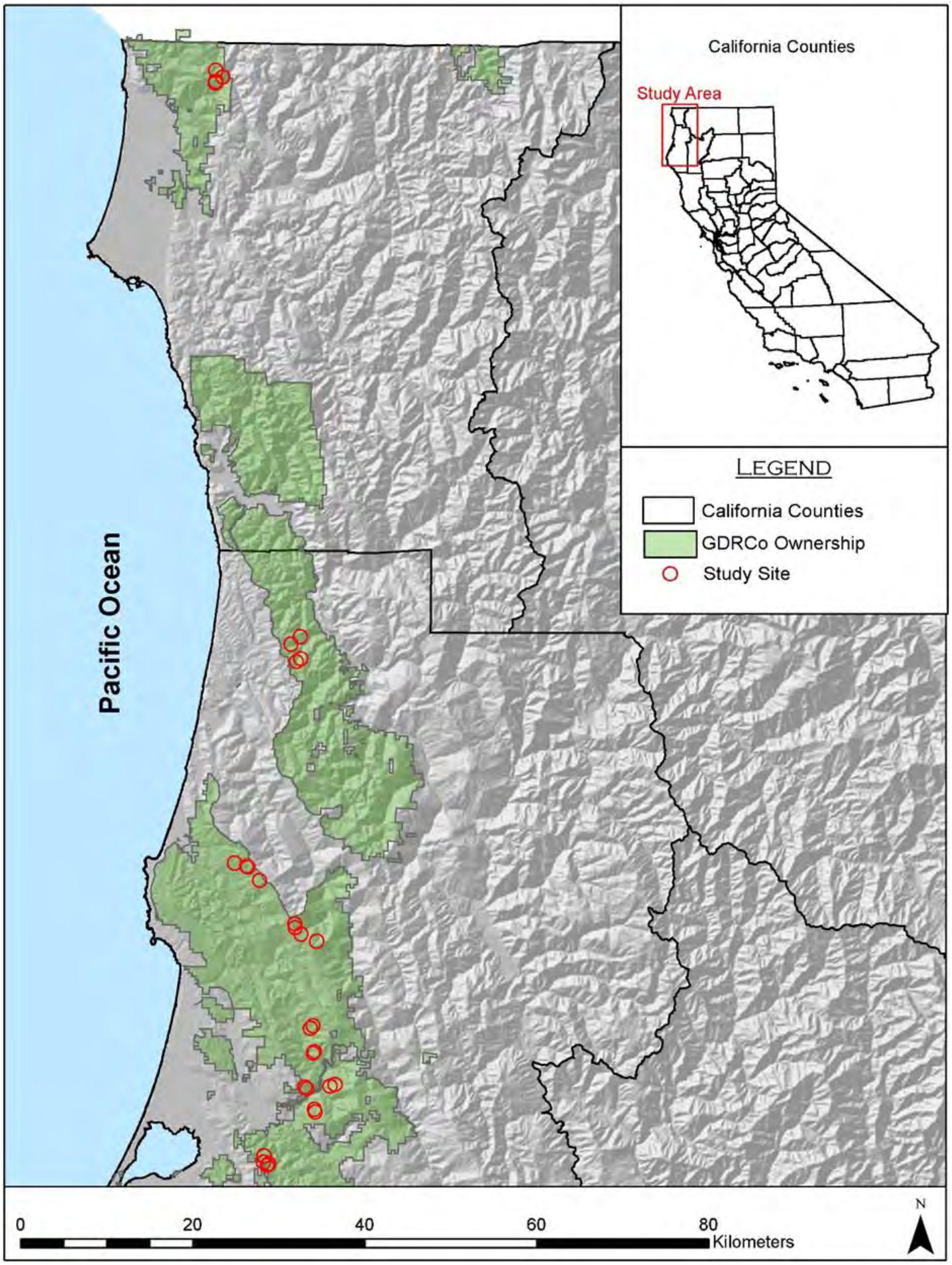

Figure 10. Southern Torrent Salamander annual occupancy survey sites, Del Norte and Humboldt Counties, California (n = 30; some sites are overlapping at this scale).

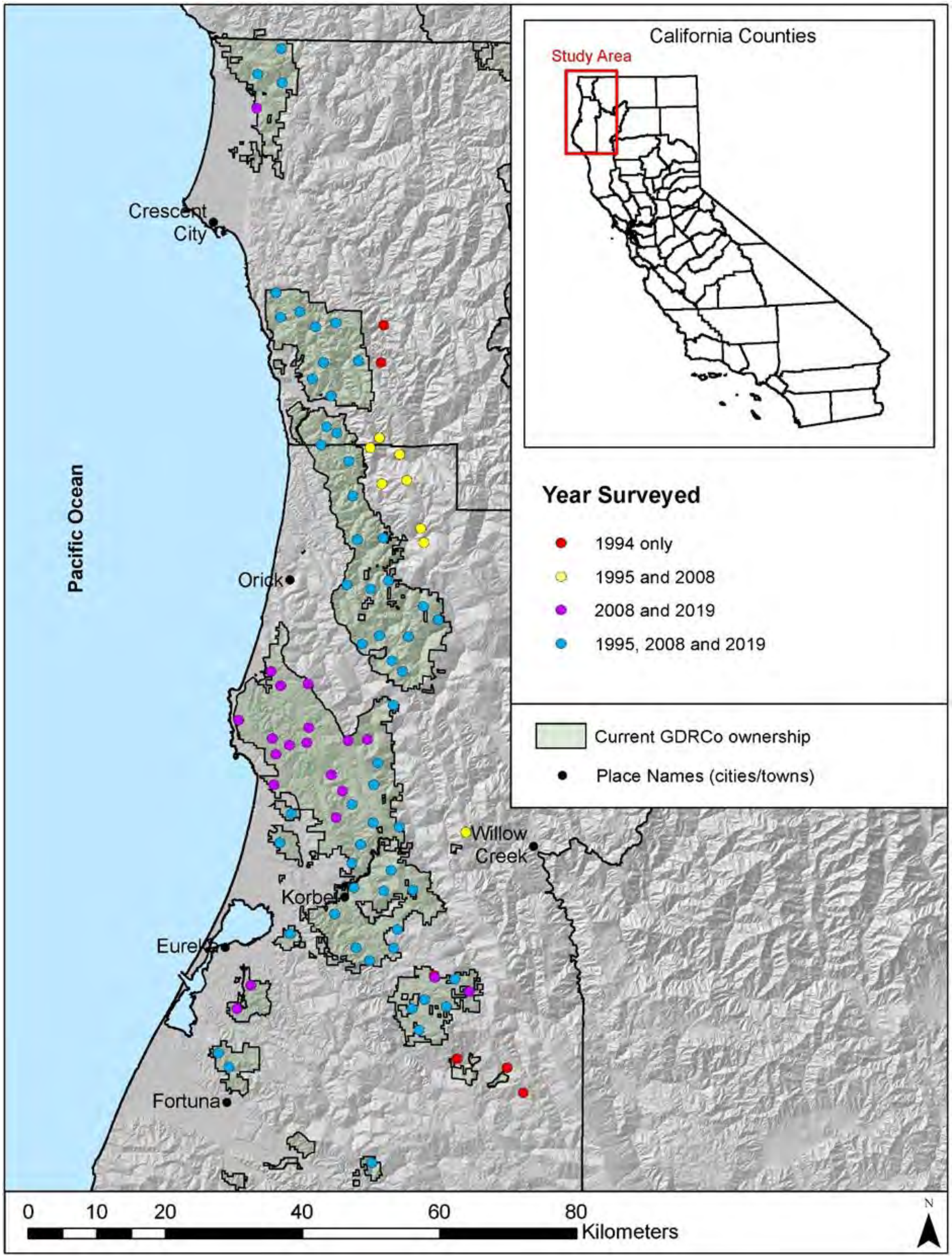

Figure 11. Locations of larval Southern Torrent Salamander property-wide occupancy survey sites (1994, 2008 and 2019), Del Norte and Humboldt Counties, California.

The current monitoring protocol uses a light-touch visual encounter method to confirm larval Southern Torrent Salamander presence and is conducted during late fall/early winter in conjunction with the retrieval of water temperature sensors. Occupancy specific sampling was initiated in 2015 and has been conducted through 2020 (Table 24).

<u>-Secondary Objective-*Property-wide Occupancy Surveys*</u>
The long-term monitoring of Southern Torrent Salamander occupancy was initiated in 1994, with the 2nd and 3rd rounds occurring in 2008 and 2019. The 2nd Biennial Report (GDRCo 2011) provided a summary of the project history and results from a preliminary analysis completed in 2009 by WEST Inc. Additional analyses were conducted and the results were provided in the 4th Biennial Report (GDRCo 2015, Appendix D, Part 2). Based on the findings from this study, we have concluded that modifications to the original study design and established triggers were warranted. The Services were briefed on the results during a meeting in 2014 and were also introduced to the direction of the proposed future monitoring for this project (GDRCo 2015, Appendix D, Part 3).

On April 27, 2018, GDRCo submitted a minor modification request to the Services with the proposed revisions to the property-wide Southern Torrent Salamander occupancy protocol. The change proposed was a shift from an occupancy and relative abundance-based survey to just an occupancy survey. As the presence of larval salamanders indicate that the site provides sufficient habitat for reproduction and rearing, it was decided that this was an appropriate metric for monitoring potential impacts of timber harvest on populations. A maximum of 500 m of habitat would be searched; however, once a larval Southern Torrent Salamander was encountered, the survey would end, without continuing the additional 20 m previously surveyed to estimate relative abundance, resulting in less habitat disturbance. For each amphibian encountered, the following information was recorded: species, life history stage, sex (if possible), snout-vent length, total length and location (distance upstream from start of survey). Although the goal was to detect larval Southern Torrent Salamander presence, any Southern Torrent Salamander encountered was considered occupancy due to the understanding that these salamanders are considered to be highly aquatic even in postmetamorphic stages and have relatively small home ranges (Nussbaum et al. 1983, Petranka 1998, Welsh and Karraker 2005). Occupancy (naïve) was calculated as the proportion of sites with at least one detection (MacKenzie et al. 2006).

The number of sites surveyed from 1994 to 2008 has changed because of property sales and acquisitions. As a result of property transactions, from 1994 to 2008, six sites were dropped, and 20 new sites were added (Figure 11). During the 2019 surveys, 75 sites were surveyed, 55 of which were first surveyed in 1994 and revisited in 2008 and 2019. On April 27, 2018, GDRCo submitted to the Services a revised protocol for the long-term, property-wide occupancy surveys for Southern Torrent Salamanders. Revisions to the protocol were approved by the Services on May 20, 2019 (See Section II.D.1). Most of the field work for the third round of this project was performed during 2019 and concluded March 5, 2020.

Results

-Primary Objective-*Annual Monitoring*

The original eight paired sub-basins (30 sites) have been monitored routinely for population persistence for 23 years (Table 24). Overall, our monitoring results show that Southern Torrent Salamanders have persisted at all sites despite concerns of an apparent negative effect from the original sampling protocol. Over the last three years we have had 100% occupancy of Southern Torrent Salamanders (any life history stage) at our sites, with an average of 92% occupancy over the duration of this project (Table 24). Over the span of the 23-year monitoring period the sites have had an average of 84% larval occupancy, with 100% larval occupancy for each year surveyed at seven sites (Table 24). Over the years, a handful of sites (e.g., Pollock A, Jiggs A & B) have shown inconsistencies in larval persistence at the sub-population level; however, Pollock A has had larval detections the last two years it was surveyed (2018 & 2020) and Jiggs A & B have been consistently occupied by postmetamorphic Southern Torrent Salamanders since 2009. Larval detections for Jiggs A & B last occurred in 2017 (Table 24).

-Secondary Objective-*Property-wide Occupancy Surveys*

Our initial property-wide Southern Torrent Salamander occupancy surveys in 1994 established a baseline occupancy rate of 80% (56 of 70 sites, any life history stage present; Diller and Wallace, 1996). This baseline threshold was met and exceeded during the 2008 (71 of 84 sites, 85.9%) and 2019 (64 of 76 sites, 84.2%) surveys (Table 25). When looking at larval occupancy, in 1994 occupancy was 70% (49 of 70 sites), 84.5% (71 of 84 sites) in 2008 and 82.9% (63 of 76 sites) in 2019 (Table 25). As a result of the property transactions mentioned in the introduction, there have been changes in the number of sites surveyed since 1994, with 56 of the original sites being surveyed all three rounds (Table 26). When looking at these 56 original sites, we see an increase in occupancy, as well as continued stability through the 2008 and 2019 surveys. Additionally, when looking at the subset of sites surveyed in both 2008 and 2019, we see continued occupancy stability as well (Table 27).

Discussion

With the variety of site characteristics at our annual monitoring sites and varying survey methods, it is difficult to assess the exact causes of the results observed; however, it appears that timber harvest under the AHCP has not had a significant negative impact on the percent of sites occupied by larval torrent salamanders, with an average annual occupancy rate of 84% (Table 24). Conversely, when looking at occupation of these monitoring sites by postmetamorphic Southern

Table 24. Southern Torrent Salamander annual larval occupancy survey sites; number of sites surveyed and percent occupied by year (1998-2020), including whether site had larval salamanders detected (Y/N) or was not surveyed (-).

Site Name	Site Type	Year 1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Number of Years Sampled	% Years with Larval RHVA	% Years with any RHVA Life Stage Detection
BlackDog_5300_A	T	Y	N*+	Y	Y	Y	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	20	95%	100%
BlackDog_5300_B	T	Y	Y	N*	N*+	N*	Y	-	-	-	-	N+	Y	Y	Y	Y	Y	Y	Y	N*	Y	Y	-	Y	18	72%	94%
BlackDog_5400_A	C	Y	Y	Y	Y	Y	N	-	N*+	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	20	90%	95%
BlackDog_5400_B	C	Y	Y	Y	Y	Y	N*	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	20	95%	100%
Mule_A	T	Y	Y	Y	Y	Y	N*	N	-	N+	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	Y	19	84%	89%
Mule_B	T	Y	Y	Y	N*	N*	N	N	-	N	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	19	74%	84%
Pollock A	T	Y	Y	Y	Y	N	N	-	N	-	N+	N+	Y	N+	N	N+	N	N*+	N+	N	N	Y	-	Y	20	35%	40%
Pollock_B	T	Y	Y	Y	N*	Y	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	20	95%	100%
Poverty_A	C	Y	Y	Y	Y	Y	N*	Y	-	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	Y	19	95%	100%
Poverty_B	C	Y	Y	Y	Y	Y	Y	Y	-	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	Y	19	100%	100%
Jiggs_A	T	Y	N*+	N*+	Y	N*	N	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y	N*	Y	N*	-	N*	17	59%	94%
Jiggs_B	T	N*+	N*	N*	N*	Y	N*	-	-	-	-	-	N*	N*	N*	N*	N*	N*+	Y	N*	Y	N*	-	N*	17	18%	100%
Canyon_A	C	Y	Y	Y	Y	Y	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	20	100%	100%
Canyon_B	C	Y	Y	Y	Y	N*	Y	-	-	-	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	Y	18	94%	100%
Panther_CR2970A	T	Y	Y	Y	Y	N*	Y	Y	-	-	-	-	Y	Y	Y	Y	Y	N*	N*+	N*+	Y	Y	Y	-	18	78%	100%
Panther_CR2970B	T	Y	Y	Y	Y	N*	Y	N	-	N+	-	Y	-	N*+	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	19	79%	89%
Panther_ CR2960A	C/H	Y	Y	Y	Y	N+	N	N	-	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	Y	19	84%	84%
Panther_ CR2960B	C/H	Y	Y	Y	Y	Y	Y	Y	-	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	19	100%	100%
NF_Maple_A	T	-	Y	Y	Y	Y	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	19	100%	100%
NF_Maple_B	C/H	-	N*+	N*	Y	Y	Y	-	N*+	-	N+	-	N*+	Y	Y	Y	N+	Y	Y	N+	Y	Y	Y	-	18	61%	83%
NF_Maple_C	C/H	-	Y	Y	N+	Y	N	-	N	-	N+	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	Y	18	78%	78%
NF_Maple_D	T	-	Y	Y	Y	Y	N	-	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	Y	18	94%	94%
Surpur_B700	C	-	-	Y	Y	N*	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	Y	18	94%	100%
Surpur_1042	T	-	-	N*	Y	N*	N*	-	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	Y	17	82%	100%
Surpur_A400_A	C	-	-	Y	Y	Y	Y	-	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	Y	17	100%	100%
Surpur_A400_B	T	-	-	Y	Y	Y	N+	-	Y	-	Y	-	Y	Y	Y	Y	N*+	Y	Y	Y	Y	Y	-	Y	17	88%	94%
Rowdy_R1700_A	C/H	-	Y	Y	Y	Y	Y	Y	-	N*	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	19	95%	100%
Rowdy_R1700_B	C/H	-	Y	Y	Y	Y	Y	Y	-	Y	-	Y	N*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	19	95%	100%
Rowdy_R1000_A	T	-	Y	Y	Y	Y	Y	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	19	100%	100%
Rowdy_R1000_B	T	-	Y	Y	Y	Y	Y	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	19	100%	100%
# of sites sampled		18	26	30	30	30	30	12	14	11	14	21	23	30	30	30	30	30	30	30	30	30	15	15			
# of sites occupied by larvae		17	22	25	25	20	17	8	10	7	11	19	20	27	28	28	26	27	28	24	29	28	15	13			
% sites occupied by larvae		94%	85%	83%	83%	67%	57%	67%	71%	64%	79%	90%	87%	90%	93%	93%	87%	90%	93%	80%	97%	93%	100%	87%			
% sites occupied by RHVA (any life history stage)		100%	100%	100%	97%	93%	73%	67%	86%	73%	79%	90%	100%	97%	97%	97%	93%	100%	97%	93%	97%	100%	100%	100%			

Site Type: T = Treatment, C = Control, C/H = Control with some timber Harvest associated. * indicates juvenile or adult RHVA detected at site; + indicates larval *Dicamptodon tenebrosus* detected at site.
-indicates site not sampled that year

Table 25. Comparison of property-wide Southern Torrent Salamander occupancy (LHS = life history stage).

Year	No. Streams Surveyed	% Occupied (any LHS)	% Occupied (Larvae)
1994	70	80.0	70.0
2008	84	84.5	84.5
2019	76	84.2	82.9

Table 26. Comparison of property-wide Southern Torrent Salamander occupancy amongst streams originally surveyed in 1994 and revisited in 2008 and 2019.

Year	No. Streams Surveyed	% Occupied (any LHS)	% Occupied (Larvae)
1994	56	78.6	67.9
2008	56	89.3	89.2
2019	56	89.3	87.5

Table 27. Comparison of property-wide Southern Torrent Salamander occupancy amongst streams surveyed in 2008 and 2019.

Year	No. Streams Surveyed	% Occupied (any LHS)	% Occupied (Larvae)
2008	76	82.9	82.9
2019	76	84.2	82.9

Torrent Salamanders, we see a 94% occupancy rate. It is notable that out of 559 total site visits between 1998 and 2020, only 85 visits (15%) resulted in no larval Southern Torrent Salamander detections. When there were no larval Southern Torrent Salamander detections, 35% of the time (30 out of 85 visits) at least one larval Coastal Giant Salamander was detected, reinforcing the fact that these sites are perennial and can support larval salamanders that require more than one year to achieve metamorphosis. Additionally, 60% of the time (51 out of 85 visits) larval Southern Torrent Salamander were not detected, at least one postmetamorphic Southern Torrent Salamander was detected, indicating that these salamanders are continuing to use these sites as habitat. Only 3% (19 out of 559) of our annual surveys yielded zero salamander detections. Out of our 30 monitoring sites, 7 have had 100% larval Southern Torrent Salamander detections every year they were surveyed and 18 sites have had 100% occupancy, either larval, postmetamorphic or both, every year they were surveyed. A detailed analysis is needed to determine the likely drivers that are influencing the results observed. Unintended consequences from the more intensive sampling (decreased habitat quality and declines in captures) from 1998 to 2003, resulted in the switch to “light-touch” presence/absence surveys. From 2004 to 2009 some sites were either not surveyed or surveyed every other year as an attempt to give the sites time to recover from the effects of the survey. Sites appeared to have recovered and annual surveys were resumed in 2010. As we have observed another decline in our larval Southern Torrent Salamander detections in more recent years at some sites, we have reinstated biennial occupancy surveys. We plan to continue with this sampling schedule into the future of this project.

With our property-wide occupancy surveys, we saw an increase in Southern Torrent Salamander occupancy rates from 80% in 1994 to 84.5% in 2008, and essentially maintained that same rate (84.3%) in 2019 (Table 25). When looking only at larval occupancy, we also saw an increase in occupancy from 70% in 1994 to 84.5% in 2008 and only a slight decline to 82.9% occupancy in 2019 (Table 25). The increase in occupancy rates, especially larval occupancy, from the 1994 surveys is promising in regard to potential impacts of timber management on the persistence of the species. Diller and Wallace (1996) found that Southern Torrent Salamander presence was closely tied to the geological formation of the stream drainage. They observed that during the 1994 surveys, Southern Torrent Salamander presence was closely tied to consolidated geologic regions and the small portion of stream habitats that Southern Torrent Salamanders were not found in, generally consisted of unconsolidated materials, which appears to be unfavorable to these salamanders. This was also observed during the 2008 and 2019 surveys, as Southern Torrent Salamanders were not detected in many of the same sites surveyed in 1994 that consisted of unconsolidated materials. Overall, it would appear that the protections afforded by the AHCP are contributing to the continued persistence of this species across GDRCo’s ownership.

4. Road Treatment Implementation and Effectiveness Monitoring

Objective

The objectives of this monitoring program are to ensure that site specific road treatment prescriptions were implemented as designed, monitor the effectiveness of road treatment prescriptions, and attempt to improve road management measures when deficiencies are identified.

Project Status

In accordance with the minor modification approved on June 15, 2011 the AHCP effectiveness monitoring programs for road-related surface erosion monitoring (AHCP Section 6.3.5.2.4) and road-related mass wasting monitoring (AHCP Section 6.3.5.4.1) were substituted with the monitoring program required under the MATO and RMWDR. Under the programmatic permits, each completed activity must be inspected twice to evaluate the implementation and effectiveness of the completed treatment; once prior the winter period and once following a full winter. If the site has stabilized and there is no reasonable potential for significant sediment delivery then future monitoring will coincide with the Routine Maintenance Inspection program (AHCP Section 6.2.3.9).

Results

A combined total of 493 road sites were monitored in 2019 and 2020 as part of the road treatment implementation and effectiveness monitoring for road sites enrolled in the MATO. The results of the individual road site inspections for 2019 and 2020 are provided in Appendix B. All road sites were monitored by the AHCP road staff, RPF staff and contract supervisors. One site (0.002%) required or will require follow-up monitoring, treatment or maintenance after post-winter assessments (Table 28). In addition to the required pre- and post-winter inspections, GDRCo personnel perform incidental inspections during the winter period.

The process of road treatment monitoring involves staff entering results of inspections into the road database and reports are generated showing the site, THP number associated with the site, date of pre- and post- inspection, whether the site meets AHCP standards and any comments regarding the condition of the site. The number of pre-winter and post-winter inspections should be equal for any given year with the exception for sites that required follow-up treatments or maintenance should have additional inspections. Table 28 shows there are issues for years 2012-2020 with results not being entered, results being entered erroneously (data entered for a site which has not been treated or not required to be monitored), or a combination thereof. In order to correct this discrepancy, RPF staff and AHCP road staff were given additional field and database training and updated field inspection forms in May 2015. In addition, changes to the road database were made to link site completion dates to inspection data to ensure when a site is complete, staff can be notified to perform a pre-winter inspection. These changes did not have the intended effect of greater accuracy. In January 2016, the AHCP Roads group was moved into the Operations Department. The added exposure to contract administration and considering the continued issues with collecting effectiveness monitoring data the decision was made to focus only AHCP Road technician staff on data collection and data entry. Further refinements occurred in April 2017 to ensure road contractor invoices are received with specific information on completed road work to assist in scheduling site visits to collect data. Internal discussions related to this issue speculate that site visits are likely taking place according to protocols and any issues identified are being addressed but are not being always being documented (the data entry does not always occur which results in incomplete annual summaries as reflected in the present results).

Table 28. Summary of monitoring efforts completed for the road treatment implementation and effectiveness monitoring from 2010 through 2020.

Assessment Type	Year	Assessments Completed	Maintenance Issues Recorded
Pre-Winter	2010	25	0
Post-Winter	2011	25	5
Pre-Winter	2011	244	1
Post-Winter	2012	244	2
Pre-Winter	2012	348	0
Post-Winter	2013	309	2
Pre-Winter	2013	234	0
Post-Winter	2014	259	0
Pre-Winter	2014	334	0
Post-Winter	2015	146	0
Pre-Winter	2015	186	0
Post-Winter	2016	188	11
Pre-Winter	2016	220	1
Post-Winter	2017	214	8
Pre-Winter	2017	262	3
Post-Winter	2018	262	1
Pre-Winter	2018	137*	1
Post-Winter	2019	137	0
Pre-Winter	2019	148	0
Post-Winter	2020	148	1
Pre-Winter	2020	208	0

*Previous Biennial Report included an erroneous figure due to a summing function issue with the data and has been corrected here.

B. Response Monitoring

The Response Monitoring projects, like the Rapid Response projects described above, monitor the effectiveness of the conservation measures in achieving specific biological goals and objectives of the AHCP. These monitoring projects are distinguished from the Rapid Response projects by the greater lag time required for feedback to the adaptive management process. The Response Monitoring projects are focused on the effects of cumulative sediment inputs on stream channels. Natural variability in stream channel dimensions, combined with the potential time lag between sediment inputs and changes in the response variables of these projects, make it difficult to determine appropriate thresholds for adaptive management at this time. When yellow and/or red light thresholds are determined, they are expected to require more than three years of results to be triggered in most cases.

1. Class I Channel Monitoring

Objectives

The objective of the Class I Channel Monitoring project is to track trends in sediment inputs in fish-bearing streams as evidenced by changes in surface particle size distributions and metrics associated with the longitudinal channel profile including overall aggradation and degradation. This monitoring approach is based on the fundamental premise that selected depositional reaches within a watercourse act as a response surface for sediment that has been transported downstream from the hillside via the upper high gradient transport stream reaches. The long-term channel monitoring project is not designed to identify the potential sources or causes of changes in the sediment budget, only to document if they are occurring. These changes are currently monitored using thalweg longitudinal profiles and pebble counts. This channel monitoring technique is generally best suited for establishing long term trends due to the potential lag times between sediment inputs and the measured response in the monitoring reach.

Class I channel monitoring is a complex study, and most likely a completely new analysis will need to be designed in order to develop thresholds. As described in AHCP Section 6.3.5.3.1, it is estimated that it will take approximately ten to fifteen years of initial trend monitoring before the appropriate thresholds can be developed and applied.

Project Status

This monitoring program is operational, ongoing, and data analysis is in progress. This monitoring effort began as a pilot study in 1993-1994, was implemented at the first site in 1995, and by 2008 the number of study sites increased to 12 streams. One additional site (North Fork Mad River) has been studied using the channel monitoring protocol and was included in past biennial reports, but this site was not intended to be part of the AHCP Response monitoring and will no longer be associated with this project.

The protocol implemented for this monitoring project has undergone modifications to the collection methods, parameters collected, and sampling schedule over the years. Minor modifications to the original Class I Channel Monitoring protocol (see AHCP Appendix D.2.2.2) were proposed to the Services in the March 2011 request for Minor Modifications. A summary and justification for the requested modifications were provided in the 2nd Biennial Report (GDRCo 2011) and the 2011 modifications request, respectively. The intent of this request was to update the protocol to reflect the current monitoring efforts being implemented for this project. After review and consideration, the Services concurred with the proposed modifications and requested the revised protocol be provided for review and approval. In August 2011, the Services were provided with the revised protocol for this monitoring program. No revisions were requested by the Services and the revised protocol was implemented for this monitoring program through 2014.

In late 2014, we initiated the process of analyzing data collected through the 2014 sampling season and in September 2016 a morphometric based evaluation of the data was presented at the 2016 Coast Redwood Science Symposium. Quantile regression was used to evaluate trends in size distributions of bed surface substrate measured at riffle crossovers. Trends in the longitudinal profiles of each site were also evaluated. We first normalized the longitudinal survey data by creating an average profile to spatially align each year's survey data. This process controlled for annual changes in stream sinuosity which can affect the overall length and gradient of the surveyed channel. Efforts to combine long-profile data collected pre-2002 (i.e., collected with original methods) with post-2001 data were attempted but these different data proved to be incompatible and the identified issues could not be resolved. Some of the challenges with combining these data were described in the 3rd Biennial Report (GDRCo 2013). Based on this assessment, we concluded that the pre-2002 long-profile and cross-section data would not satisfy the study objectives and these data have been excluded from the analysis at this time.

During analysis of the Class I Channel Monitoring data, as anticipated in the 4th Biennial Report (GDRCo 2015), modifications to the revised protocol were initiated prior to the 2015 season and implemented through 2020. Collection of cross-section and roughness coefficient (Manning's) data were discontinued. Both of these data were found to be inadequate to evaluate the parameters and meet the monitoring objectives of this study. The modifications also included adding a way to delineate upstream and downstream extents of pool habitats from other depressions in the longitudinal profile. This allows for a more robust comparison of pool habitat metrics (e.g., count; maximum and average depth; and longitudinal area). Also, additional thalweg points are now obtained in conjunction with the standard ten-foot measurement intervals. This allows for more accurate longitudinal representation of the upstream and downstream extents of pool habitat features and channel sinuosity. These additional thalweg points are coded in the data so that current data can still be compared to previous years when thalweg points were strictly collected at ten-foot increments. Green Diamond continues to monitor both substrate particle size and longitudinal profiles for the 12 long term monitoring reaches with plans to investigate and develop thresholds that will be used to evaluate the effectiveness of the Plan.

Results

To date, twelve Class I Channel Monitoring sites have been established and routinely monitored for up to twenty-six years (Table 29). On average, sites have been sampled 21.5 times and the monitoring duration has spanned 23.3 years. Cañon Creek is the site with longest record (twenty-six years) of continuous monitoring.

Analysis of the pebble count data through 2014 indicate a statistically significant positive trend in the coarsening of substrate particles across the entire size class distribution for 11 of the 12 stream reaches throughout the monitoring period (Table 30). Beach Creek was the one site that had a statistically significant decrease in a larger size class (e.g., Tau 0.84) but experienced coarsening in the smaller size classes (e.g., Tau 0.16 and Tau 0.50). In quantile regression, Taus represent individual specified quantiles. Tau 0.16 represents a diameter of particles where 16% of the sediment in the sample is smaller (this is also often represented as a D16). The quantile regression slopes shown in Table 30 are the annual rates of change in particle sizes at the specified Taus. For example, in Tectah Creek, the particle size at the 16^{th} percentile is increasing over time by 1mm per year.

Analysis of the longitudinal profile data through 2014 indicate that 5 sites had a statistically significant decrease in bed elevation, 2 sites had a statistically significant increase in bed elevation, and 6 sites had no statistically significant change in bed elevation over the study period (Table 31).

Discussion

Analysis of the pebble count data indicates that all of the reaches are exhibiting a reduction in fine sediment inputs. In fact, there was a trend in coarsening across the entire range of particle sizes for all sites except Beach Creek. Beach Creek did exhibit a reduction in substrate size however it occurred only in the larger particle size classes which we expect would not have a negative effect on fish spawning success. Examination of the longitudinal profile data indicate that at 85% of the study reaches the streambed is either stable or downcutting.

Over the course of the study period there have been improvements in forest management practices including the application of measures designed to minimize fine and course sediment inputs such as enhanced riparian protections, geologic prescriptions and extensive road upgrading and decommissioning activities as part of GDRCo's AHCP. The results of this study indicated that the implementation of these measures has been effective in reducing the amount of sediment delivered to watercourses as evidenced by the general overall trend in coarsening of the substrate and lowering or no change in the bed elevation.

GDRCo intends to analyze the pebble count and longitudinal profile data to include the most recent data in the same manner as was completed in 2014. These results will be shared with the Services when available and are expected to assist with the establishment of threshold values for this monitoring project.

Table 29. Summary of Class I Channel Monitoring survey efforts conducted by Green Diamond from 1995-2020 (Y = site was surveyed, N = site was not surveyed).

Site Name	# Years Monitored	Monitoring Duration	Year																									
			1995	1996	1997	1998	1999	2000	2001	2002 [1]	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015 [2]	2016	2017	2018	2019	2020
Cañon Creek	26	26	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hunter Creek #1	24	25		Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Salmon Creek	22	25		Y	Y	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Canyon Creek	22	25		Y	Y	N	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF Winchuck River	21	25		Y	Y	N	Y	N	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hunter Creek #2	23	24			Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Tectah Creek	22	24			Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Beach Creek	20	23				Y	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Maple Creek	21	23				Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ah Pah Creek	19	20							Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF Ah Pah Creek	19	20							Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Little River	19	19								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of sites		-	1	5	7	7	7	5	9	10	12	5	9	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12

Blank cells represent years prior to site being developed for survey protocol.

[1] Field protocol modified to utilize total station and discontinue bank full channel dimensions.

[2] Field protocol modified to discontinue cross sectional and roughness coefficient surveys.

Table 30. Summary of pebble count quantile regression analysis. Data used was collected by Green Diamond from 1995-2014.

	Quantile Regression Slope[1]			Tau 0.16		Tau 0.50		Tau 0.84	
Site Name	**Tau 0.16**	**Tau 0.50**	**Tau 0.84**	**Lower 95% CI**	**Upper 95% CI**	**Lower 95% CI**	**Upper 95% CI**	**Lower 95% CI**	**Upper 95% CI**
Cañon Creek	1.571	1.909	2.118	1.50	1.67	1.80	2.00	1.89	2.26
Hunter Creek #1	1.111	1.167	0.800	1.00	1.18	1.00	1.29	0.57	1.07
Salmon Creek	1.286	1.500	1.600	1.20	1.40	1.36	1.63	1.40	1.80
Canyon Creek	0.900	1.438	2.000	0.81	1.00	1.30	1.56	1.75	2.20
SF Winchuck River	1.143	1.200	0.727	1.07	1.22	1.11	1.33	0.54	0.92
Hunter Creek #2	1.600	1.900	2.125	1.50	1.71	1.76	2.00	1.91	2.38
Tectah Creek	1.000	1.250	1.091	0.91	1.14	1.13	1.42	0.90	1.33
Beach Creek	0.375	0.154	-0.333	0.25	0.53	0.00	0.33	-0.50	-0.08
Maple Creek	0.933	1.400	1.538	0.90	1.00	1.33	1.50	1.38	1.67
Ah Pah Creek	0.818	1.200	1.000	0.67	1.00	1.10	1.36	0.80	1.31
SF Ah Pah Creek	1.636	2.125	3.273	1.50	1.80	2.00	2.33	3.00	3.63
Little River	1.333	1.667	2.000	1.13	1.60	1.44	2.00	1.71	2.67

Superscript definition: 1 = In quantile regression Tau's represent individual specified quantiles. A Tau 0.16 represents a diameter of particles where 16% of the sediment in the sample is smaller (this is also often represented as a D16). The quantile regression slopes shown here are the annual rates of change in particle sizes at the specified Taus. For example in Tectah Creek, the particle size at the 16th percentile is increasing over time by 1mm per year.

Table 31. Summary of longitudinal profile data aggradation/scour analysis. Data used was collected by Green Diamond from 2002-2013.

Site Name	**Slope (m/yr)**	**Significant?**	**p-value**	**Overall channel elevation change from 2002 to 2013 (m)**
Cañon Creek	-0.0171	Yes	0.0003	-0.232
Hunter Creek #1	-0.0043	No	0.6250	-0.146
Salmon Creek	0.0057	No	0.1016	0.016
Canyon Creek	-0.0379	Yes	0.0006	-0.413
SF Winchuck River	0.0017	No	0.8137	0.126
Hunter Creek #2	-0.009	No	0.2170	-0.157
Tectah Creek	0.0002	No	0.9697	-0.119
Beach Creek	0.0039	Yes	0.0479	0.040
Maple Creek	-0.013	Yes	0.0014	-0.121
Ah Pah Creek	-0.0119	Yes	0.0060	-0.161
SF Ah Pah Creek	-0.0096	Yes	0.0000	-0.104
Little River	0.0038	Yes	0.0456	0.079

2. Class III Sediment Monitoring

Objective

The objective of the Class III sediment monitoring was to quantify the amount of sediment delivered from Class III channels following timber harvest. This monitoring project was designed to test the null hypothesis that sediment delivery does not significantly change in Class III channels following timber harvest operations along Class III channels. To satisfy this objective, multiple methodologies were originally employed (i.e., channel morphology, sediment tray, turbidity monitoring, and sediment basins) to assess and quantify sediment delivery and test the hypothesis using a BACI study design.

Project Status

The protocol implemented for this monitoring project has undergone modifications to the collection methods and parameters collected over the years. Three of the methodologies originally proposed in the AHCP (i.e., channel morphology, sediment tray, and turbidity monitoring) were discontinued in 2011 and the remaining methodology that utilized sediment basins was suspended in 2014. A brief summary of these changes and current status is provided below.

Minor modifications to the original Class III sediment monitoring protocol (see AHCP Appendix D.2.3) were proposed to the Services in the March 2011 request for Minor Modifications. A summary and justification for the requested modifications were provided in the 2nd Biennial Report (GDRCo 2011) and the 2011 modifications request, respectively. The intent of this request was to update the protocol to reflect the current monitoring efforts being implemented for this project and improve the study design for this monitoring program. After review and consideration, the Services concurred with the proposed modifications and requested the revised sampling design be developed with the Services prior to future sampling. On July 24, 2012, the Services were provided with the revised protocol for the monitoring project and updated on the status. No revisions were requested by the Services and the revised protocol was implemented through the 2014 sampling season. In May 2017, GDRCo provided the Services with a proposal to suspend the Class III sediment monitoring project based on the review of the data and the associated challenges with implementing the monitoring project. On February 13, 2018, GDRCo met with the Services to review and discuss the proposal.

Issues were experienced in 2013 and 2014 with the newest paired sites and no new additional sites have been established since then. The challenges we experienced included difficulties identifying suitable paired sites, coordinating the timing of harvest, ensuring that planned treatments were implemented during harvest, and preventing damage to sediment basins during harvest operations. These challenges have highlighted the need to suspend this monitoring project until a new study methodology can be identified. We had discussions with the Services about the future objective, threshold/trigger, and protocol associated with this monitoring project. All monitoring associated with this project has been suspended at this time.

C. Long-Term Trend Monitoring

The Long-term Trend Monitoring projects are those monitoring projects for which no thresholds for adaptive management are set. For some projects, this reflects the multitude of factors which affect the response variables, in others, the long timescales required to distinguish the ‘noise’ from the underlying relationships. Research projects designed to reveal relationships between habitat conditions and long-term persistence of the Covered Species are also included in this section. Each of these projects has the potential to provide feedback for adaptive management, but in some circumstances, decades may be required before that can occur.

1. Long-Term Habitat Assessment

Objectives

In 2018, GDRCo completed its third round of property wide Long-Term Habitat Assessments. This project has been conducted approximately every ten years, beginning in 1994 and in 2007 it became part of the Effectiveness Monitoring Program under the approved AHCP. The objective of the Long-Term Habitat Assessment is to document trends in fish habitat quality and quantity over time on anadromous stream reaches located throughout GDRCo’s California timberlands. As we get further into the life of the AHCP, these trends will be valuable for comparison with the results of the other, more specific monitoring projects to ensure that the individual biological objectives described elsewhere (i.e., channel morphologies, water temperature, etc.) are accurately capturing the larger picture of overall aquatic stream health and function.

Project Status

This project was initiated by GDRCo in 1994 and has been conducted approximately every ten years (Table 32). It takes crews approximately 3 years to complete each round of surveys. Three full assessments have been completed. A total of 58 streams were originally surveyed within the GDRCo ownership by various organizations, both public and private. Two creeks located within the Coastal Klamath HPA that were surveyed in the first and second assessments, Bear Creek and WF Blue Creek, were not sampled during the third assessment. Both of these watersheds were sold as part of land transactions with the Yurok Tribe and are no longer owned by GDRCo. Three creeks within the Eel River HPA, Wilson, Stevens and Howe Creeks were surveyed by California Department of fish and Game during the first round of surveys but were not surveyed by GDRCo during the second and third assessments. The second and third assessments, initiated in 2005 and 2015, were conducted solely by GDRCo on 53 and 51 streams, respectively.

Table 32. Summary of the three habitat typing assessment efforts by HPA.

	1st Assessment 1991-1998		2nd Assessment 2005-2008		3nd Assessment 2015-2018	
HPA	**No. streams**	**Miles**	**No. streams**	**Miles**	**No. streams**	**Miles**
Smith River	4	23.0	7	24.9	7	25.6
Coastal Klamath	22	87.8	17	69.6	16	65.5
Blue Creek	4	21.6	1	4.5	0	0.0
Interior Klamath	11	30.2	3	20.5	3	17.7
Redwood Creek	0	0.0	0	0.0	0	0.0
Coastal Lagoons	0	0.0	7	28.3	8	30.4
Little River	4	18.0	8	23.6	7	25.6
Mad River	3	11.3	3	7.1	3	7.0
NF Mad River	2	18.0	5	21.1	5	20.7
Humboldt Bay	4	14.1	2	13.5	2	13.7
Eel River	4	5.8	0	0.0	0	0.0
TOTALS	**58**	**229.9**	**53**	**213.2**	**51**	**206.2**

Methods and Results

During the initial surveys, channel and habitat typing assessments were conducted using CDFW methods described by Flosi and Reynolds (1994) and during the second and third assessments under the revised CDFW methods described by Flosi et al. (2002). The primary changes involved the addition of classifications in some measurement categories, and the upgrade from the DOS-based Habitat 8 program to a Microsoft Access based Stream Habitat program, used for summarization and reporting of results. Refer to The California Salmonid Stream Habitat Restoration Manual, Flosi and Reynolds (1994) and Flosi et al (2002) for a complete description of methodologies. Prior to the onset of assessments, GDRCo’s aquatic field technicians participated in a four-day training seminar sponsored by CDFW in order to become familiar with the methodology. During the channel and habitat assessments the following variables were collected: percent canopy cover, structural shelter for all pool habitats, habitat types as a percent of length, pool-tailout embeddedness and maximum residual pool depths these data are intended to provide information about the health of streams, especially with regard to salmonid habitat, across the California ownership. The following summaries are grouped by Hydrographic Planning Area (HPA) as defined under the AHCP (Tables 33-41). Results presented make comparisons from the oldest to most recent data collected.

Table 33. Stream habitat assessment summaries for seven streams sampled within the Smith River HPA.

	Site																	
	South Fork Winchuck River			South Fork Winchuck River Tributary 1		South Fork Winchuck River Tributary 2		Dominie Creek			Wilson Creek			Rowdy Creek			South Fork Rowdy Creek	
	Year																	
Metric	1995	2005	2015	2005	2015	2005	2015	1995	2007	2016	1994	2005	2015	1995	2007	2016	2008	2017
Total Length of Main Channel Assessed (ft)	31,906	30,437	31,203	3,048	3,127	2,046	2,170	15,115	15,001	14,857	35,937	32,042	37,504	35,792	38,230	35,645	10,794	10,425
Mean % Closed Canopy Density	92	83	85	92	82	92	72	98	90	88	78	58	65	59	54	78	81	79
% deciduous	99	NA	93	-	98	-	100	92	86	92	94	93	83	97	100	94	99	89
% conifer	1	NA	7	-	2	-	0	8	14	8	6	7	17	3	0	6	1	11
Mean Shelter Rating for All Pools	74.4	22.7	58.0	17.8	12.8	32.8	18.5	59.1	65.2	40.2	58.0	61.7	35.0	60.2	56.6	33.7	45.4	28.5
% LWD as Structural Shelter in All Pools	19.2	24.7	23.0	14.8	9.2	7.0	5.0	15.7	23.2	23.9	28.3	29.9	40.8	8.5	11.8	10.8	23.8	18.5
Habitat Types as % of Total Length																		
Riffles	40.8	53.2	24.2	74.4	10.0	88.6	30.0	48.9	35.1	26.1	25.2	29.5	3.1	24.4	29.9	19.7	50.9	12.7
Flat-water	31.1	9.2	30.3	2.1	54.5	0.0	49.0	30.2	43.6	43.3	41.4	33.1	19.4	42.7	31.0	31.4	36.3	52.4
Pools	28.1	37.6	35.1	23.5	27.6	11.4	20.2	20.9	21.3	30.6	26.6	37.4	16.5	32.9	39.1	48.9	12.7	34.9
Marsh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry Channel	0.0	0.0	10.4	0.0	7.9	0.0	0.8	0.0	0.1	0.0	6.8	0.0	61.0	0.0	0.0	0.0	0.0	0.0
Culvert	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pool Tailout Embeddedness as % Occurrence																		
0-25%	26.2	20.7	1.9	20.0	50.0	20.0	30.8	1.1	9.7	6.2	36.4	27.9	13.9	32.4	16.2	23.2	57.1	50.0
26-50%	38.6	39.9	37.3	32.0	22.2	5.0	23.1	10.6	34.4	50.0	46.4	40.7	52.5	44.6	44.1	69.6	40.0	27.9
51-75%	22.1	37.9	39.9	44.0	0.0	55.0	0.0	33.0	26.9	36.9	17.2	28.6	26.7	20.3	18.0	1.4	0.0	7.4
76-100%	13.1	0.0	6.3	0.0	0.0	0.0	0.0	55.3	1.1	0.8	0.0	0.7	0.0	2.7	2.7	0.0	0.0	2.9
Not Suitable for Spawning†	-	1.5	14.6	4.0	27.8	20.0	46.1	-	28.0	6.1	-	2.1	6.9	-	18.9	5.8	2.9	11.8
Maximum Residual Pool Depths as % Occurrence																		
<1' deep	0.6	6.6	1.9	48.0	38.9	25.0	23.1	12.9	16.1	13.3	0.0	1.4	1.0	0.0	1.8	2.9	0.0	26.5
1'-2' deep	28.4	53.5	38.6	48.0	55.6	60.0	69.2	76.2	62.4	66.7	19.1	15.0	32.7	5.1	22.5	34.8	54.3	47.0
2'-3' deep	47.7	27.3	40.5	0.0	5.5	15.0	7.7	8.9	12.9	16.3	42.1	35.7	41.6	38.5	34.2	26.8	31.4	14.7
3'-4' deep	20.7	11.6	15.2	4.0	0.0	0.0	0.0	2.0	7.5	3.7	19.1	32.9	17.8	24.4	16.2	15.2	11.4	10.3
>4' deep	2.6	1.0	3.8	0.0	0.0	0.0	0.0	0.0	1.1	0.0	19.7	15.0	6.9	32.0	25.2	20.3	2.9	1.5

† Not suitable for spawning may include sand, bedrock, LWD or other conditions

- was not assessed

Table 34. Stream habitat assessment summaries for six streams (group 1) sampled within the Coastal Klamath River HPA.

	Site																	
	Hunter Creek			East Fork Hunter Creek			Mynot Creek			Hoppaw Creek			North Fork Hoppaw Creek			Terwer Creek		
	Year																	
Metric	**1996**	**2007**	**2016**	**1996**	**2007**	**2016**	**1996**	**2008**	**2017**	**1996**	**2008**	**2017**	**1996**	**2008**	**2017**	**1996**	**2008**	**2017**
Total Length of Main Channel Assessed (ft)	54,764	33,143	31,503	11,846	10,023	10,094	10,912	13,012	8,682	23,322	19,102	19,134	4,026	4,470	4,262	77,126	70,352	71,310
Mean % Closed Canopy Density	79	61	82	89	94	87	78	96	90	90	79	87	95	91	86	61	52	73
% deciduous	90	98	89	93	97	85	94	92	95	92	88	86	74	81	68	82	94	89
% conifer	10	2	11	7	3	15	6	8	5	8	12	14	26	19	32	18	6	11
Mean Shelter Rating for All Pools	26.3	64.4	45.0	31.3	50.9	65.0	28.9	10.4	63.2	33.6	60.4	60.5	20.6	28.8	86.7	79.8	24.0	38.9
% LWD as Structural Shelter in All Pools	39.3	38.0	25.7	54.5	46.0	43.9	15.8	23.0	30.1	45.8	54.3	40.8	34.2	48.2	37.4	14.6	17.9	16.1
Habitat Types as % of Total Length																		
Riffles	3.5	12.0	11.8	0.6	14.0	19.5	0.4	15.0	9.1	15.2	31.0	21.4	23.5	56.0	27.7	10.2	36.3	7.7
Flat-water	30.0	24.0	19.8	40.8	32.0	23.9	6.2	12.0	28.1	27.8	16.0	39.0	9.9	15.0	37.6	42.1	21.3	30.3
Pools	24.5	21.0	23.6	13.6	16.0	15.4	6.5	6.0	23.8	18.8	16.0	31.1	51.1	22.0	34.7	29.3	21.1	41.0
Marsh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		15.5	0.0	0.0	0.0	0.0	0.0
Dry Channel	42.0	43.0	44.8	45.0	38.0	41.2	86.0	67.0	39.0	37.9	37.0	8.5	0.0	7.0	0.0	18.4	21.3	21.0
Culvert	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.3	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Pool Tailout Embeddedness as % Occurrence																		
0-25%	6.4	19.7	36.1	0.0	14.3	13.5	0.0	25.0	58.9	0.7	6.4	40.8	0.0	34.7	40.8	48.3	22.5	33.0
26-50%	42.5	47.9	45.4	19.1	46.9	35.1	10.5	10.7	32.1	16.8	46.4	39.1	38.2	26.5	44.4	45.8	34.3	23.0
51-75%	44.7	22.2	13.9	51.1	28.6	51.4	79.0	39.3	7.2	70.6	27.3	15.1	61.8	28.6	14.8	5.9	22.5	7.5
76-100%	6.4	0.9	0.9	29.8	0.0	0.0	10.5	17.9	0.0	11.9	11.8	2.8	0.0	2.0	0.0	0.0	5.4	2.5
Not Suitable for Spawning†	-	9.4	3.7	-	10.2	0.0	-	7.1	1.8	-	8.2	2.2	NA	8.2	0.0	0.0	15.2	34.0
Maximum Residual Pool Depths as % Occurrence																		
<1' deep	1.1	4.3	4.6	10.4	12.2	2.6	26.3	7.1	17.9	29.0	11.8	13.8	14.9	26.5	32.7	11.3	0.5	8.1
1'-2' deep	23.3	28.2	30.3	56.2	46.9	65.8	52.6	60.7	53.6	55.6	59.1	55.8	61.7	67.3	56.4	41.1	17.6	30.6
2'-3' deep	36.5	35.0	36.7	27.1	28.6	31.6	15.8	28.6	25.0	14.8	25.5	24.9	23.4	6.1	10.9	28.0	30.9	27.5
3'-4' deep	24.3	18.8	19.2	4.2	8.2	0.0	0.0	3.6	3.5	0.6	3.6	4.4	0.0	0.0	0.0	11.0	26.0	16.0
>4' deep	14.8	13.7	9.2	2.1	4.1	0.0	5.3	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	8.6	25.0	17.8

† Not suitable for spawning may include sand, bedrock, LWD or other conditions

\- not assessed

Table 35. Stream habitat assessment summaries for five streams (group 2) sampled within the Coastal Klamath River HPA.

	Site														
	McGarvey Creek			West Fork McGarvey Creek			Tarup Creek			Omagar Creek			Ah Pah Creek		
	Year														
Metric	**1996**	**2008**	**2017**	**1996**	**2008**	**2017**	**1996**	**2008**	**2017**	**1996**	**2008**	**2017**	**1995**	**2007**	**2016**
Total Length of Main Channel Assessed (ft)	29,025	29,707	28,269	12,988	12,800	12,213	26,012	29,580	25,271	13,276	15,924	15,001	17,393	19,836	19,792
Mean % Closed Canopy Density	89	93	88	94	87	86	97	94	90	95	90	91	87	84	91
% deciduous	92	94	94	89	97	95	93	95	91	90	89	82	97	94	86
% conifer	8	6	6	11	3	5	7	5	9	10	11	18	3	6	14
Mean Shelter Rating for All Pools	32.2	35.3	58.7	33.8	34.3	44.1	26.6	22.0	37.2	30.8	19.2	59.4	97.2	77.2	45.2
% LWD as Structural Shelter in All Pools	38.3	40.7	39.9	42.0	53.0	49.4	25.8	46.1	36.2	45.6	46.6	43.5	30.3	26.4	34.3
Habitat Types as % of Total Length															
Riffles	3.9	28.0	8.7	4.1	34.3	7.6	10.3	26.0	19.6	10.2	50.0	10.5	27.4	29.4	18.8
Flat-water	25.9	35.0	27.6	21.3	33.1	23.8	18.5	33.0	28.2	39.5	16.0	46.6	30.3	19.5	31.0
Pools	69.4	36.0	63.5	73.7	32.5	68.4	71.2	14.0	52.1	25.6	13.0	30.0	17.9	25.8	25.9
Marsh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry Channel	0.4	1.0	0.2	0.9	0.0	0.2	0.0	27.0	0.1	24.7	21.0	12.9	24.5	25.3	24.3
Culvert	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pool Tailout Embeddedness as % Occurrence															
0-25%	0.0	43.2	54.0	0.0	44.2	76.2	3.1	31.8	48.6	2.9	35.9	67.4	10.9	28.6	26.7
26-50%	15.6	34.4	31.2	3.4	23.9	16.1	36.2	35.5	38.6	51.1	31.5	22.9	30.1	30.0	48.3
51-75%	69.7	12.8	7.2	66.0	11.5	0.0	60.1	23.6	11.0	41.0	13.0	6.9	31.3	22.9	19.8
76-100%	14.7	0.9	0.0	30.6	8.8	0.0	0.6	5.5	1.0	5.0	5.4	0.0	27.7	0.7	3.4
Not Suitable for Spawning†	-	8.8	7.6	-	11.5	7.7	-	3.6	0.8	-	14.1	2.8	-	17.9	1.8
Maximum Residual Pool Depths as % Occurrence						.									
<1' deep	18.1	4.8	18.4	21.1	4.4	26.3	3.4	0.0	18.1	42.0	7.6	26.9	5.5	14.3	8.2
1'-2' deep	42.2	37.4	40.5	47.0	53.1	44.3	37.3	46.4	40.6	47.3	66.3	49.7	50.5	54.3	53.7
2'-3' deep	24.6	30	25.7	23.3	31.9	21.5	41.5	42.7	30.7	8.7	21.7	21.4	30.8	22.1	29.8
3'-4' deep	10.6	21.6	10.6	7.3	10.6	6.7	14.8	9.1	9.6	2.0	4.3	2.0	8.8	5.7	5.8
>4' deep	4.5	6.2	4.8	1.3	0.0	1.2	3.0	1.8	1.0	0.0	0.0	0.0	4.4	3.6	2.5

† Not suitable for spawning may include sand, bedrock, LWD or other conditions

- not assessed

Table 36. Stream habitat assessment summaries for five streams (group 3) sampled within the Coastal Klamath River HPA.

	Site														
	South Fork Ah Pah Creek			North Fork Ah Pah Creek			Surpur Creek			Little Surpur Creek			Tectah Creek		
	Year														
Metric	**1995**	**2007**	**2016**	**1995**	**2007**	**2016**	**1996**	**2008**	**2018**	**1996**	**2008**	**2018**	**1996**	**2007**	**2016**
Total Length of Main Channel Assessed (ft)	8,284	7,192	6,685	24,450	17,854	17,369	17,582	17,808	17,468	11,126	14,997	13,231	66,655	46,958	45,647
Mean % Closed Canopy Density	96	87	91	95	91	95	89	87	88	92	91	89	87	74	83
% deciduous	94	89	73	89	91	86	93	87	80	90	87	84	88	96	86
% conifer	6	11	27	11	9	14	7	13	20	10	13	16	12	4	14
Mean Shelter Rating for All Pools	70.4	45.2	51.3	76.1	68.6	35.4	22.2	25.1	82.4	20.5	35.0	102.4	22.6	37.4	36.5
% LWD as Structural Shelter in All Pools	35.6	33.7	36.8	26.0	26.3	26.3	13.2	30.9	27.8	17.8	31.2	39.4	13.2	11.0	12.3
Habitat Types as % of Total Length															
Riffles	47.3	46.5	8.3	32.3	23.5	19.7	4.0	57.4	18.8	0.4	54.1	14.5	5.4	18.2	10.3
Flat-water	24.3	24.4	56.0	30.7	29.3	36.1	24.2	22.6	51.6	32.7	30.2	49.0	46.5	42.8	39.4
Pools	17.9	22.1	30.2	26.7	33.2	36.0	71.8	20.0	29.6	60.8	15.7	36.5	48.1	38.9	44.1
Marsh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry Channel	10.5	6.9	5.5	10.3	13.9	8.2	0.0	0.0	0.0	6.1	0.0	0.0	0.0	0.2	6.2
Culvert	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pool Tailout Embeddedness as % Occurrence															
0-25%	14.9	32.8	12.5	7.6	15.6	8.8	1.2	31.5	24.3	0.0	22.6	14.9	0.0	19.7	27.5
26-50%	20.9	22.4	40.0	13.4	27.9	23.0	39.5	49.1	19.6	37.0	30.1	46.8	73.4	30.8	28.7
51-75%	19.4	23.9	47.5	25.5	23.8	26.6	54.6	17.6	30.9	63.0	16.1	31.9	26.6	20.3	18.7
76-100%	44.8	9.0	0.0	53.5	6.6	26.6	3.5	0.0	15.9	0.0	9.7	4.3	0.0	1.0	4.8
Not Suitable for Spawning[†]	-	11.9	0.0	-	26.2	15.0	-	1.9	9.3	-	21.5	2.1	-	28.1	20.3
Maximum Residual Pool Depths as % Occurrence															
<1' deep	9.0	29.9	10.0	0.6	4.1	3.5	6.8	1.9	19.3	5.4	4.3	32.6	21.5	8.5	4.3
1'-2' deep	80.6	53.7	67.5	46.1	54.9	36.3	48.6	57.4	53.5	44.6	63.4	51.1	36.4	37.6	37.4
2'-3' deep	9.0	14.9	20.0	37.0	27.9	39.9	31.8	30.6	21.9	37.5	25.8	15.2	22.6	28.1	26.4
3'-4' deep	1.4	1.5	2.5	13.9	9.0	16.8	10.1	7.4	4.4	12.5	5.4	1.1	10.6	11.5	17.7
>4' deep	0.0	0.0	0.0	2.4	4.1	3.5	2.7	2.8	0.9	0.0	1.1	0.0	8.9	14.2	14.2

[†] Not suitable for spawning may include sand, bedrock, LWD or other conditions

- not assessed

Table 37. Stream habitat assessment summaries for three streams sampled within the Interior Klamath River HPA.

	Site								
	Johnson Creek			Roach Creek			Tully Creek		
	Year								
Metric	1996	2008	2018	1997	2008	2018	1997	2008	2018
Total Length of Main Channel Assessed (ft)	11,906	16,061	11,805	38,876	49,379	38,725	41,995	43,013	42,752
	94	96	89	78	66	72	79	76	74
% deciduous	97	96	97	70	90	82	92	99	93
% conifer	3	4	3	30	10	18	8	1	7
Mean Shelter Rating for All Pools	16.5	28.9	80.2	36.2	20.3	37.4	25.7	24.7	37.4
% LWD as Structural Shelter in All Pools	9.3	10.9	21.9	3.5	6.4	3.2	12.7	3.4	8.8
Habitat Types as % of Total Length									
Riffles	3.0	57.2	14.1	4.0	29.0	12.2	5.0	40.2	16.4
Flat-water	24.0	15.4	52.4	48.0	33.0	36.0	70.0	27.2	46.9
Pools	60.0	11.2	22.0	45.0	26.0	49.1	24.0	26.7	30.8
Marsh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry Channel	13.0	16.2	11.5	3.0	12.0	2.7	2.0	5.8	5.9
Culvert	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pool Tailout Embeddedness as % Occurrence									
0-25%	0.0	43.2	24.0	0.0	34.1	25.7	27.6	25.7	27.4
26-50%	6.0	29.6	38.0	0.0	37.8	25.2	54.6	24.9	29.3
51-75%	93.0	8.6	21.1	100.0	3.0	13.7	0.0	18.4	10.8
76-100%	1.0	0.0	4.2	0.0	0.6	8.0	0.0	2.0	10.8
Not Suitable for Spawning[†]	-	18.5	12.7	-	24.4	27.4	-	29.0	21.7
Maximum Residual Pool Depths as % Occurrence									
<1' deep	4.2	9.9	23.3	1.1	0.6	2.8	0.8	4.5	12.3
1'-2' deep	46.9	64.2	60.3	30.6	16.5	25.6	28.0	49.0	38.2
2'-3' deep	33.3	21.0	12.3	30.6	36.6	34.7	41.4	30.6	29.7
3'-4' deep	11.5	4.9	4.1	21.0	22.0	21.6	19.2	9.0	8.0
>4' deep	4.2	0.0	0.0	16.7	24.4	15.3	10.7	6.9	11.8

[†] Not suitable for spawning may include sand, bedrock, LWD or other conditions

- not assessed

Table 38. Stream habitat assessment summaries of eight streams within the Coastal Lagoon HPA.

	Site															
	Maple Creek		North Fork Maple Creek		Pitcher Creek		M-Line Creek		M-Line Creek Tributary		Clear Creek		Diamond Creek		Beach Creek	
	Year															
Metric	**2005**	**2015**	**2005**	**2015**	**2005**	**2015**	**2005**	**2015**	**2005**	**2015**	**2005**	**2015**	**2005**	**2015**	**2005**	**2015**
Total Length of Main Channel Assessed (ft)	85,748	91,392	16,355	17,015	5,188	5,703	17,851	19,570	5,211	5,562	6,317	6,597	852	1,125	12,872	13,626
Mean % Closed Canopy Density	64	74	69	88	70	94	84	81	82	52	92	89	79	94	83	94
% deciduous	90	86	95	87	96	99	62	42	49	44	51	58	30	40	90	88
% conifer	10	14	5	13	4	1	38	58	51	56	49	42	70	60	10	12
Mean Shelter Rating for All Pools	41.5	24.6	44.0	66.2	38.2	43.5	46.8	86.3	96.2	112.2	22.9	53.9	20.0	110.0	48.3	60.1
% LWD as Structural Shelter in All Pools	37.1	28.1	6.7	9.1	25.8	15.5	67.7	48.5	55.7	49.4	49.8	35.6	31.7	18.8	45.9	41.6
Habitat Types as % of Total Length																
Riffles	22.8	3.6	43.6	7.1	2.6	1.4	49.6	6.2	17.7	7.6	69.1	16.2	2.0	0.0	33.6	17.2
Flat-water	35.2	50.2	22.3	39.1	40.4	37.0	0.0	27.7	28.1	28.5	0.9	59.7	69.5	68.4	30.7	9.9
Pools	42.0	46.2	34.1	52.9	44.6	61.6	50.4	62.5	54.2	59.9	30.0	23.9	7.6	17.6	35.7	72.5
Marsh	0.0	0.0	0.0	0.0	12.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.9	14.0	0.0	0.0
Dry Channel	0.0	0.0	0.0	0.9	0.0	0.0	0.0	3.6	0.0	4.0	0.0	0.2	0.0	0.0	0.0	0.4
Culvert	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pool Tailout Embeddedness as % Occurrence																
0-25%	80.5	31.8	44.0	19.6	94.7	27.7	12.4	28.3	58.0	17.9	36.8	5.0	66.7	75.0	56.9	95.4
26-50%	10.9	27.5	24.0	30.4	5.3	19.1	28.3	28.3	0.0	30.5	42.1	35.0	0.0	25.0	29.3	2.3
51-75%	2.1	16.7	5.3	22.8	0.0	36.2	41.6	14.3	0.0	26.3	19.3	32.5	0.0	0.0	8.6	0.0
76-100%	0.3	6.5	0.0	0.0	0.0	4.2	14.2	4.2	0.0	0.0	0.0	27.5	0.0	0.0	0.0	0.0
Not Suitable for Spawning[†]	6.2	17.5	26.7	27.2	0.0	12.8	3.5	24.9	42.0	25.3	1.8	0.0	33.3	0.0	5.2	2.3
Maximum Residual Pool Depths as % Occurrence																
<1' deep	1.2	1.4	0.0	3.3	0.0	2.1	4.4	15.9	0.0	11.5	15.5	7.5	0.0	0.0	0.0	5.3
1'-2' deep	20.0	19.8	19.2	16.3	47.4	55.3	47.8	53.6	70.0	54.8	58.6	65.0	100.0	75.0	14.0	35.9
2'-3' deep	36.2	32.7	24.7	32.6	39.5	34.0	31.9	23.4	18.0	26.0	24.1	25.0	0.0	25.0	31.6	32.1
3'-4' deep	17.9	21.0	28.8	22.8	13.2	4.3	14.2	5.4	10.0	7.7	1.7	2.5	0.0	0.0	40.4	20.6
>4' deep	24.7	25.1	27.4	25.0	0.0	4.3	1.8	1.7	2.0	0.0	0.0	0.0	0.0	0.0	14.0	6.1

[†] Not suitable for spawning may include sand, bedrock, LWD or other conditions

- not assessed

Table 39. Stream habitat assessment summaries of seven streams within the Little River HPA.

	Site													
	Upper South Fork Little River		Lower South Fork Little River		Railroad Creek		Little River		Carson Creek		Carson Creek Tributary		Heightman Creek	
	Year													
Metric	**2005**	**2015**	**2005**	**2015**	**2005**	**2015**	**2005**	**2015**	**2005**	**2015**	**2005**	**2015**	**2005**	**2015**
Total Length of Main Channel Assessed (ft)	9,673	9,774	9,847	15,568	6,877	7,371	77,326	79,609	12,356	14,273	3,021	3,326	4,618	4,969
Mean % Closed Canopy Density	81	88	73	79	85	93	71	77	81	70	87	75	87	79
% deciduous	71	56	54	50	74	78	82	74	88	87	60	45	87	58
% conifer	29	44	46	50	26	22	18	26	12	13	40	55	13	42
Mean Shelter Rating for All Pools	53.2	56.2	48.6	44.9	59.8	80.9	27.6	68.2	45.6	14.2	76.7	60.4	53.3	55.2
% LWD as Structural Shelter in All Pools	34.3	35.4	38.2	38.5	31.4	33.7	23.8	19.8	34.9	24.8	53.8	31.1	40.3	21.5
Habitat Types as % of Total Length														
Riffles	39.9	30.2	24.0	6.2	54.6	17.6	44.6	15.0	23.2	1.0	25.3	6.6	53.2	6.5
Flat-water	10.2	43.7	21.0	59.5	1.7	54.4	19.6	41.1	21.3	36.6	25.4	50.5	21.9	62.3
Pools	50.0	26.1	55.0	34.3	43.7	27.7	35.8	43.9	55.4	62.2	49.3	41.9	24.9	31.2
Marsh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry Channel	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.2	0.0	1.0	0.0	0.0
Culvert	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pool Tailout Embeddedness as % Occurrence														
0-25%	57.4	22.2	50.8	6.7	17.3	18.6	26.0	25.4	23.8	69.6	60.0	13.6	54.5	16.7
26-50%	26.5	38.9	39.3	41.9	38.7	39.5	36.7	33.4	39.0	16.0	20.0	22.7	36.4	43.3
51-75%	14.7	38.9	8.2	33.8	30.7	25.6	17.2	27.4	27.6	4.8	20.0	45.5	9.1	26.7
76-100%	0.0	0.0	0.0	5.4	4.0	0.0	0.2	2.0	1.9	3.2	0.0	4.6	0.0	10.0
Not Suitable for Spawning†	1.5	0.0	1.6	12.2	9.3	16.3	19.8	11.8	7.6	6.4	0.0	13.6	0.0	3.3
Maximum Residual Pool Depths as % Occurrence														
<1' deep	8.7	2.7	0.0	2.6	10.8	0.0	7.9	3.4	1.0	2.4	0.0	0.0	6.1	16.1
1'-2' deep	34.8	18.9	32.8	15.8	58.1	60.9	35.7	33.9	41.0	46.4	25.0	56.5	63.6	58.1
2'-3' deep	27.5	51.4	31.1	43.4	18.9	32.6	26.9	29.9	42.9	36.0	65.0	34.8	27.3	19.4
3'-4' deep	20.3	16.2	19.7	18.4	9.5	4.3	16.8	17.0	10.5	13.6	10.0	8.7	3.0	6.4
>4' deep	8.7	10.8	16.4	19.8	2.7	2.2	12.6	15.8	4.8	1.6	0.0	0.0	0.0	0.0

† Not suitable for spawning may include sand, bedrock, LWD or other conditions

- not assessed

Table 40. Stream habitat assessment summaries of three streams within the Mad River HPA and two streams within the Humboldt Bay HPA.

	Mad River HPA									Humboldt Bay HPA					
	Site														
	Canon Creek			Mather Creek			Dry Creek			Salmon Creek			Ryan Creek		
	Year														
Metric	1994	2005	2015	1995	2007	2016	1994	2005	2015	1994	2008	2018	1995	2009	2018
Total Length of Main Channel Assessed (ft)	24,862	22,296	23,476	2,224	11,511	9,835	4,512	3,877	3,876	37,153	36,628	35,560	27,682	34,427	36,833
Mean % Closed Canopy Density	81	74	59	98	83	95	92	62	90	88	77	86	94	86	87
% deciduous	85	82	78	90	51	44	75	84	81	83	80	70	68	70	61
% conifer	15	18	22	10	49	56	25	16	19	17	20	30	32	30	39
Mean Shelter Rating for All Pools	74.0	36.8	40.1	96.2	62.6	57.2	60.5	43.8	55.6	78.7	23.6	58.5	32.1	36.6	61.9
% LWD as Structural Shelter in All Pools	16.7	10.9	14.9	18.4	18.8	35.4	14.0	21.5	14.4	27.5	33.6	31.9	49.1	35.9	27.0
Habitat Types as % of Total Length															
Riffles	26.0	47.9	18.0	9.3	4.8	2.2	67.0	87.5	15.2	27.0	32.2	18.7	5.0	4.5	1.1
Flat-water	27.0	0.6	54.4	64.6	80.6	72.0	14.0	6.8	71.3	29.0	35.7	33.1	29.0	61.3	37.5
Pools	47.0	51.5	27.6	26.1	9.3	14.4	16.0	5.7	13.5	44.0	31.8	48.2	65.0	34.1	61.1
Marsh	0.0	0.0	0.0	0.0	3.9	11.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry Channel	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.3	0.0	1.0	0.1	0.3
Culvert	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pool Tailout Embeddedness as % Occurrence															
0-25%	16.7	14.1	22.5	0.0	12.1	2.0	30.5	69.2	12.6	9.8	44.9	41.7	7.5	50.2	29.7
26-50%	41.0	25.0	23.8	0.0	0.0	0.0	40.8	15.4	43.7	24.5	24.4	28.9	22.4	4.3	10.9
51-75%	32.1	12.8	21.2	0.0	0.0	0.0	18.3	15.4	43.7	34.5	17.6	21.0	33.5	0.0	2.5
76-100%	11.2	3.8	0.0	100.0	0.0	0.0	11.1	0.0	0.0	30.6	1.7	3.1	36.6	0.0	0.0
Not Suitable for Spawning†	-	44.2	32.5	-	87.9	98.0	-	0.0	0.0	-	11.4	5.3	-	45.5	56.9
Maximum Residual Pool Depths as % Occurrence															
<1' deep	1.0	4.5	1.3	5.9	15.2	25.0	6.1	0.0	18.7	0.6	0.0	3.5	6.0	1.4	8.2
1'-2' deep	19.6	21.0	13.9	70.6	63.6	56.2	78.8	61.5	62.5	12.6	25.6	34.3	44.8	28.9	39.7
2'-3' deep	39.0	37.6	32.9	23.5	15.2	10.4	9.1	30.8	12.5	42.5	40.3	40.0	30.7	43.1	34.1
3'-4' deep	22.7	21.0	29.1	0.0	3.0	4.2	3.0	7.7	6.3	26.5	22.2	10.0	12.2	16.6	12.6
>4' deep	17.6	15.9	22.8	0.0	3.0	4.2	3.0	0.0	0.0	17.9	11.9	12.2	6.2	10.0	5.4

† Not suitable for spawning may include sand, bedrock, LWD or other conditions

- not assessed

Table 41. Stream habitat assessment summaries of five streams within the North Fork Mad River HPA.

	Site											
	North Fork Mad River			Long Prairie Creek			South Fork Long Prairie Creek		Sullivan Gulch		Watek Creek	
	Year											
Metric	1994	2007	2016	1994	2007	2016	2007	2016	2005	2015	2005	2015
Total Length of Main Channel Assessed (ft)	80,278	86,331	84,050	14,928	14,680	11,442	1,469	4,633	2,945	3,214	5,800	5,952
Mean % Closed Canopy Density	73	69	83	95	89	90	95	83	83	71	94	85
% deciduous	95	83	70	87	91	89	100	94	79	100	84	86
% conifer	5	17	30	13	9	11	0	6	21	0	16	14
Mean Shelter Rating for All Pools	64.0	35.5	39.4	59.0	57.7	49.2	40.8	29.8	42.7	68.4	30.2	59.0
% LWD as Structural Shelter in All Pools	12.1	17.1	18.3	10.4	20.2	22.4	8.9	14.1	23.8	19.8	47.4	23.3
Habitat Types as % of Total Length												
Riffles	11.0	27.5	10.5	47.0	41.5	36.9	15.7	44.7	62.2	41.6	93.9	47.3
Flat-water	38.0	30.2	32.6	23.0	27.1	32.7	60.9	35.2	2.8	24.0	0.0	46.7
Pools	42.0	42.2	56.9	30.0	31.4	30.4	23.5	20.1	35.1	30.1	6.1	5.3
Marsh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry Channel	10.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
Culvert	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.7
Pool Tailout Embeddedness as % Occurrence												
0-25%	18.1	30.4	24.2	6.0	18.8	37.3	5.6	15.4	3.2	37.9	0.0	44.0
26-50%	19.3	33.8	35.4	21.3	41.7	34.3	50.0	0.0	29.0	48.3	0.0	12.0
51-75%	28.6	15.9	25.6	20.9	30.2	19.4	22.2	3.8	64.5	13.8	25.9	4.0
76-100%	33.6	1.7	6.4	51.9	1.0	7.5	0.0	80.8	3.2	0.0	70.4	0.0
Not Suitable for Spawning†	-	18.2	8.4	-	8.3	1.5	22.2	0.0	0.0	0.0	3.7	40.0
Maximum Residual Pool Depths as % Occurrence												
<1' deep	7.4	8.4	8.7	3.5	16.7	4.4	27.8	10.7	19.4	20.7	48.1	73.1
1'-2' deep	10.7	34.0	30.4	41.6	47.9	53.6	55.6	78.6	58.1	51.7	51.9	26.9
2'-3' deep	33.6	28.5	29.2	39.8	21.9	30.4	11.1	10.7	16.1	20.7	0.0	0.0
3'-4' deep	26.6	16.4	14.1	12.6	11.5	8.7	5.6	0.0	6.5	6.9	0.0	0.0
>4' deep	28.2	12.8	17.6	2.3	2.1	2.9	0.0	0.0	0.0	0.0	0.0	0.0

† Not suitable for spawning may include sand, bedrock, LWD or other conditions

- was not assessed

Riparian Canopy

The percentage of canopy closure along stream channels is important for the regulation of stream water temperatures and as a source of nutrients for the aquatic organisms. Canopy cover density was collected using a modified handheld densitometer. Measurements were collected at the end of every third unit as well as every fully described unit which equates to approximately a 30% sub-sample. At these same locations, tree species (the percent deciduous or coniferous) was also estimated visually along the riparian zone.

Property-wide average percent canopy cover was observed to have decreased slightly from 85% during the first assessment to 83% during the last assessment. CDFW's Salmonid Restoration Manual recommends that a mean canopy closure of approximately 80% is required/desirable to maintain suitable summer water temperatures for juvenile coho salmon (Flosi and Reynolds 1994). Although both of these values are above the recommended 80%, they are close and appear to be slowly trending towards the recommended percentage.

Percent conifer was observed to have increased at 66.7%, decreased at 29.4% and was the same at 3.9% of the streams surveyed from the first assessment to the most recent. Conifers compared to deciduous trees have higher intrinsic value for future aquatic habitat. The riparian conservation measures in the AHCP are expected to increase LWD over the life of the Plan. The process of LWD naturally recruiting into the channel is very slow. Optimally, we would like to see the percent conifer within all of our riparian zones increasing over time but, tree and plant succession within these zones is complex and unique to each location. The most recent data collected suggests that conifers are increasing within our riparian zones at over half of the anadromous streams across the property. Future data will be necessary to better understand how species composition is changing across the property.

Structural Shelter in Pool Habitats

Instream structural shelter is an important habitat requirement that salmonids utilize to maintain healthy populations. Categories for structural shelter were, undercut bank, small woody debris, large woody debris, roots, terrestrial vegetation, aquatic vegetation, whitewater, boulder and bedrock ledge. Each classified pool was given a shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high). This value is multiplied by the percent cover for the entire pool unit to generate a shelter rating. Each of the shelter ratings are averaged to generate a mean shelter rating (range 0-300) for each stream. CDFW's Salmonid Restoration Manual recommends mean shelter values of 80 or higher. The average mean shelter rating for all pools in all streams during the first assessment was 46.7 and 53.9 during the last assessment, respectively. Both pool shelter values are below the recommended 80. Average shelter in pools for a specific creek was calculated above 80 only 3 times during the first round of surveys and 8 times during the last. This site-specific data combined with the average mean shelter rating for the entire property suggests shelter in pools may be increasing. When evaluating the importance of all these cover types, LWD may be the most important considering how it interacts with the streambed and provides aquatic species with critical cover habitat. Of the 51 streams surveyed during the last assessment, 26 streams experienced an increase in the percentage that LWD occurs as a shelter component in all pools (average increase per stream = 6.6%) and 25 experienced a decrease (average decrease per stream = 9.3%). These shelter values for LWD do not necessarily mean that there is more or less LWD within the stream, it illustrates how LWD, as a shelter type, is changing as a cover type over time.

Stream Habitat Types

Level II (Flosi and Reynolds 1994) partitioning of habitat units separates the stream channel into riffles, flat-water, pools and dry channel. All units were measured for mean length and each had a requirement that the minimum length must be equal or greater than the mean wetted width. Individual habitat unit data were summarized as percent of total length. During the first assessment average pool habitat for all sites combined was 36.5%, flatwater 27.7%, riffle 28.1% and dry 6.8%. During the last assessment pool habitat for all sites was 36.7%, flatwater 41.0%, riffle 15.3% and dry 6.4%. Pools are the most critical of the three habitats and seem stable over the years. Flatwater appears to be increasing and with the stability of pools, it may be possible some of the riffle habitat across the property is undergoing the transformation to pool habitat.

Generally, forming conclusions about the relative health of a stream with respect to salmonids from a Level II partitioning of habitat units is difficult. Local geology, channel type, water level, and channel gradient will all influence the relative proportions of each habitat type.

Embeddedness of Tails in Pools

The embeddedness of channel substrate in pool tail-outs is an indication of the amount of fines present in spawning gravels which, in turn, may reduce the survival to emergence of salmonid alevins. The embeddedness was visually measured by estimating the amount of sediment covering cobbles in pool tail-outs. An embeddedness value of 1=0-25%, 2=25-50%, 3=50-75%, 4=75-100% and 5=not suitable for spawning was assigned to each pool tail-out. Category 5 had not been established during the first round of surveys. Embeddedness values greater than 50% are considered high (Flosi and Reynolds 1994). During the most recent surveys, 32 (62.7%) out of the 51 streams experienced a decrease in the occurrence of embeddedness values >50% compared to the first time they were surveyed. It is worth noting that the visual pool tail embeddedness assessment is fairly subjective and the results from this portion of the survey should be interpreted cautiously. We will be examining possible ways to increase the accuracy and consistency of this metric during the next round of surveys scheduled to begin in 2025.

Pool Depth

Maximum pool depths are used by CDFW to calculate the percentage of primary pools, which are known to provide critical summer habitat for juvenile coho and steelhead under low flow conditions (Flosi et al. 2002). From CDFW's habitat typing assessments, there are indications that the better coastal coho streams may have as much as 40% of their total habitat length in primary pools (Flosi et al. 1998). A primary pool in a third order or larger stream would be expected to have a depth of three feet or greater. A primary pool in a first and second order stream is considered to have a depth of 2 feet or greater (Flosi and Reynolds 1994). The average percentage of pools of pools greater than 2 feet for all streams was 44.8% during the first assessment and 41.2% during the last, respectively. A total of 22 reaches experienced an increase, 27 a decrease, and 2 had no change in the occurrence of pools greater than 2 feet.

Discussion

Overall, the results from the habitat assessment project should be interpreted cautiously. The intent of the habitat assessment survey presented by Flosi and Reynolds (1998) is to identify streams in need of site-specific stream restoration. We are utilizing it for its intended purpose, and also as an assessment tool for determining how the in-channel stream and riparian habitat is changing over time. The natural processes occurring within these riparian zones are very slow, and more data will help to understand if trends are occurring. The effects of pre-Forest Practice Rules management practices removed most merchantable conifers from riparian zones adjacent to stream channels and in many cases conifers have not adequately re-established in these areas. As a result, most riparian zones in sampled watersheds tend to be dominated by alder, willow, and younger conifers. One of the objectives of the AHCP is to increase conifer frequency within the riparian zone creating increases in redwood and other conifers available as LWD to the stream channel. Also, through the process of developing Timber Harvest Plans the company continually identifies and retains riparian trees with high recruitment potential (e.g., conifers close to and leaning towards the stream) so they may someday fall naturally into the stream as LWD.

Depending on the site, there have been only two or three data points collected to date and more data and time are needed to better understand if the anticipated measures of the AHCP are leading to improved riparian habitat across the property. Conifers appear to be increasing, pool habitat has been stable and embeddedness in pool tails seems to be improving. Mean shelter in pool habitat for all sites combined was below the CDFW recommended 80 threshold during all 3 assessments and the average occurrence of pool depths greater than 2 feet appears to have decreased since the last time they were surveyed. In general, more time and more data are needed for this long-term monitoring project. Furthermore, an analysis linking the data observed to management within the watershed could help assess some of the subjectivity of the survey and provide some insight on the differences between management effect under the AHCP and natural succession of riparian corridors and aquatic habitat. The process of LWD naturally recruiting to the stream occurs over decades and centuries along with the associated instream habitat conditions the LWD helps create. In the meantime, the data is being used to focus restoration projects to high-priority areas. Before the next round of surveys scheduled for 2025, the methods presented by Flosi and Reynolds 1998 will be further analyzed to determine if additional variables need to be collected in order to better understand how the riparian and stream habitat is changing over time.

2. LWD Monitoring

Objectives

The importance of Large Woody Debris (LWD) on the health of a stream and its direct relationship to healthy salmonid populations has been well documented. Instream LWD provides cover habitat which benefits salmonids at multiple life stages throughout the year. LWD also interacts with the streambed creating pools and altering the channel in a way that provides fish with improved more complex habitats. These habitats can offer cooler water temperatures and improved cover from predators. The objectives of the project are to document long-term trends in the abundance, size class, species and function of in-channel LWD under the AHCP. The development of potential LWD in riparian areas throughout the Plan Area is relatively predictable. Collectively, the conservation measures are expected to increase potential LWD over the life of the AHCP. However, the recruitment of potential LWD into the stream (i.e., in-channel LWD) is less predictable because it results from highly stochastic processes which occur over long time scales. For this reason, the LWD Monitoring does not lend itself to develop measurable thresholds for adaptive management. This monitoring project will document whether the expected increase of LWD to the riparian areas will result in an increase to in-channel LWD.

This study is integrated into the long-term habitat assessment study and is designed for the same Class I streams to be assessed every ten years. As such, it takes approximately three years to complete each round of assessment. LWD summaries on average piece count and volume per 100 feet were generated to better understand how the conservation measures of the AHCP are performing with regard to LWD within the stream channel.

Project Status

The LWD monitoring program is operational and ongoing. Surveys are initiated on a ten-year interval. The second round of monitoring, conducted from 2005-2009, implemented a modified sampling protocol described in the AHCP (AHCP Appendix D.3.7.2). Details on the differences between the parameters collected and sampling designs were provided in the 2nd Biennial Report (GDRCo 2011). The third round of LWD monitoring, similar to the second round, began in 2015 and was completed in 2018.

Methods

Surveys completed during the first assessment utilized the methods described by Flosi and Reynolds (1994). This sampling design was intended to be a more rapid assessment with the objective of quickly identifying stream reaches lacking in LWD for prioritizing restoration projects. Details on function, origin, and total volume were not collected in the 1990’s. During 2005 and 2015 the methodologies presented in the revised Flosi et al. (2002) were used. This is a survey where pieces are counted, measured, and classified within a given reach (20% surveys) or for the entire anadromous stream length (100% surveys). Regardless of sample design, all LWD ≥0.5 feet in diameter and ≥ 6 feet in length within the sample reach are inventoried. This provides a comprehensive and repeatable measure of abundance, volume, distribution, origin, species and functionality for all in-channel LWD. Live trees and LWD within the "recruitment zone," are no longer included in the surveys. Summary data presented makes comparisons from the oldest to most recent data collected.

Results and Discussion

The presence of inchannel LWD may be the most critical habitat component salmonids need to maintain healthy populations. LWD was categorized into 8 size classes and then averaged per 100 feet of stream channel. Volume per 100 feet was also calculated for the second and third assessments, but not for the first due to different sampling techniques. Thirteen streams were surveyed during the first assessment and 49 reaches during the second and third assessments, respectively. LWD inventories were conducted by GDRCo in all but two (Diamond Creek and Heightman Creek) of the same streams that were surveyed for Long Term Habitat Assessments. Tables 42-51 display the piece count and volume by size class per 100 feet for the 8 HPA’s.

Average total volume for all categories combined per 100 feet, increased at 31 (63.3%) streams and decreased at the remaining 18 (36.7%). Average piece count per 100 feet for all categories combined increased at 37 (75.5%) streams and decreased at 12 (24.5%) streams. Overall, for all sites combined across the property, the average LWD volume for all size categories combined per 100 feet, increased by 439.8 (ft^3) and average piece count for all streams combined increased 0.88 pieces per 100 feet for all size categories combined.

Similar to the Habitat Assessment Project, the LWD Monitoring Project is a long-term study and more data and time is needed to understand how LWD presence and volume is changing across the property over the life of the AHCP. The process of LWD naturally recruiting to the stream is very slow, particularly with regard to large conifers that will persist over time. The results collected during the last assessment indicate that LWD piece count and volume is increasing at over half of the streams monitored. Considering how slow natural LWD recruitment is, the results from the most recent assessment are encouraging. Species composition and function have not yet been analyzed but will be investigated in future work.

Restoration project prioritization on the property has shifted in recent years away from road decommissioning and stream crossing rehabilitation to off-channel habitat and LWD installation type projects. Instream restoration projects that have occurred on the property over the last 10 years have likely contributed to the observed increases in LWD. The data associated with this monitoring project will be utilized to inform grant proposal development and focus restoration projects where deficiencies in LWD have been identified.

Table 42. Summary of LWD inventory (averages per 100 feet by piece count and volume), Smith River HPA.

Stream	Year	Target Percent	Stream Length (feet)	Surveyed Length (feet)	Metric	Size Classes of Inchannel LWD: 1' - 1.9' dia.[a]; ≤20'	1' - 1.9' dia.[a]; >20'	2' - 2.9' dia.[a]; ≤20'	2' - 2.9' dia.[a]; >20'	3' - 3.9' dia.[a]; ≤20'	3' - 3.9' dia.[a]; >20'	≥4' dia.[a]; ≤20'	≥4'dia.[a]; >20'	All Size Classes
South Fork Winchuck River	1995	20		6,200	Piece	0.8	0.4	0.3	0.1	0.1	0.0	0.1	0.0	1.7
	2005	100		30,437	Piece	0.7	0.4	0.2	0.0	0.1	0.0	0.1	0.0	1.5
					Volume (ft^3)	34.8	33.0	27.6	15.2	21.3	3.3	70.2	5.2	210.6
	2015	100	31,203	31,203	Piece	1.5	0.7	0.3	0.1	0.1	0.0	0.1	0.0	2.7
					Volume (ft^3)	65.9	71.7	46.0	21.5	26.4	24.3	59.6	12.0	327.4
South Fork Winchuck River	2005	100	3,048	3,048	Piece	0.5	0.3	0.2	0.1	0.0	0.0	0.0	0.0	1.1
Main Tributary					Volume (ft^3)	31.9	37.0	44.6	35.5	0.0	0.0	0.0	0.0	149.0
	2015	100	3,127	3,127	Piece	0.9	0.8	0.3	0.1	0.0	0.0	0.0	0.0	2.1
					Volume (ft^3)	40.4	102.5	35.6	14.7	0.0	31.1	6.2	0.0	230.4
South Fork Winchuck River	2005	100	2,046	2,046	Piece	1.3	0.3	0.1	0.0	0.0	0.0	0.0	0.1	2.0
West Tributary of Main Tributary					Volume (ft^3)	82.1	47.3	37.0	0.0	8.3	35.8	0.0	428.9	639.4
	2015	100	2,170	2,170	Piece	1.7	0.5	0.2	0.5	0.0	0.2	0.0	0.1	3.1
					Volume (ft^3)	72.5	72.1	28.8	216.4	0.0	190.2	0.0	486.7	1,066.6
Dominie Creek	1995	20		3,600	Piece	1.5	0.2	0.4	0.3	0.2	0.2	0.1	0.0	3.0
	2007	20	15,001	3,000	Piece	2.3	0.3	0.9	0.2	0.3	0.0	0.1	0.0	4.1
					Volume (ft^3)	124.6	45.4	130.7	57.9	67.5	11.9	34.3	0.0	472.2
	2016	20	14,857	3,200	Piece	1.7	0.8	1.2	0.5	0.4	0.4	0.3	0.2	5.4
					Volume (ft^3)	84.7	94.8	182.7	187.9	157.3	303.6	257.5	406.9	1,675.5
Wilson Creek	1995	20		7,600	Piece	0.4	0.4	0.4	0.3	0.1	0.1	0.2	0.2	2.1
	2005	20	32,042	6,200	Piece	1.0	0.5	0.5	0.4	0.1	0.1	0.2	0.1	2.9
					Volume (ft^3)	59.0	77.9	90.0	178.4	40.4	131.7	167.1	257.8	1,002.2
	2015	20	37,504	7,000	Piece	1.8	0.8	0.7	0.3	0.2	0.1	0.3	0.2	4.4
					Volume (ft^3)	87.1	116.2	111.3	133.0	56.7	108.2	205.9	360.3	1,178.5
Rowdy Creek	1995	20		7,400	Piece	0.2	0.2	0.1	0.0	0.2	0.1	0.1	0.0	0.9
	2007	20	38,230	7,245	Piece	1.1	0.2	0.2	0.0	0.1	0.0	0.1	0.0	1.8
					Volume (ft^3)	42.1	20.7	26.2	12.0	30.6	0.0	36.1	0.0	167.8
	2016	20	35,645	7,000	Piece	0.6	0.7	0.3	0.1	0.2	0.0	0.2	0.0	2.0
					Volume (ft^3)	28.9	72.3	35.3	25.3	27.8	48.2	77.8	0.0	315.5
South Fork Rowdy Creek	2008	100	10,794	10,794	Piece	1.5	0.5	0.4	0.1	0.1	0.1	0.3	0.1	3.1
					Volume (ft^3)	73.5	61.7	60.5	40.6	36.3	54.1	232.5	179.2	738.4
	2017	100	10,425	10,425	Piece	1.8	1.0	0.6	0.1	0.3	0.1	0.4	0.1	4.4
					Volume (ft^3)	75.3	119.3	92.0	24.3	96.5	62.2	499.0	339.1	1,307.7

Table 43. Summary of LWD inventory (averages per 100' by piece count and volume), Interior Klamath HPA.

Stream	Year	Target Percent	Stream Length (feet)	Surveyed Length (feet)	Metric	1' - 1.9' dia.[a]; ≤20'	1' - 1.9' dia.[a]; >20'	2' - 2.9' dia.[a]; ≤20'	2' - 2.9' dia.[a]; >20'	3' - 3.9' dia.[a]; ≤20'	3' - 3.9' dia.[a]; >20'	≥4' dia.[a]; ≤20'	≥4'dia.[a]; >20'	All Size Classes
						Size Classes of Inchannel LWD								
Johnson Creek	2008	20	16,061	3,200	Piece	3.3	0.9	0.5	0.9	0.0	0.1	0.1	0.0	5.7
					Volume (ft³)	174.5	151.0	101.3	499.4	15.0	97.5	45.5	0.0	1,084.2
	2018	20	11,805	2,200	Piece	1.8	0.2	1.0	0.4	0.3	0.0	0.2	0.3	4.3
					Volume (ft³)	81.2	34.5	124.3	142.6	108.0	21.7	193.5	408.1	1,113.9
Roach Creek	2008	20	49,379	7,000	Piece	0.7	0.4	0.2	0.2	0.1	0.1	0.1	0.0	1.8
					Volume (ft³)	35.4	63.1	38.6	72.7	26.2	101.0	112.4	0.0	449.4
	2018	20	38,594	7,000	Piece	0.4	0.3	0.1	0.1	0.0	0.1	0.0	0.0	0.9
					Volume (ft³)	18.2	37.5	11.1	36.9	18.8	51.9	54.3	0.0	228.7
Tully Creek	2008	20	43,013	8,600	Piece	1.2	0.4	0.4	0.2	0.1	0.2	0.3	0.1	3.1
					Volume (ft³)	58.2	51.6	65.2	75.7	35.9	179.1	169.0	149.7	784.3
	2018	20	42,752	7,400	Piece	1.0	0.6	0.3	0.1	0.1	0.1	0.3	0.2	2.7
					Volume (ft³)	50.5	64.8	56.1	42.3	33.9	78.7	337.7	261.9	926.0

Table 44. Summary of LWD inventory (averages per 100’ by piece count and volume), Coastal Klamath HPA.

Stream	Year	Target Percent	Stream Length (feet)	Surveyed Length (feet)	Metric	Size Classes of Inchannel LWD: 1' - 1.9' dia.[a]; ≤20'	1' - 1.9' dia.[a]; >20'	2' - 2.9' dia.[a]; ≤20'	2' - 2.9' dia.[a]; >20'	3' - 3.9' dia.[a]; ≤20'	3' - 3.9' dia.[a]; >20'	≥4' dia.[a]; ≤20'	≥4'dia.[a]; >20'	All Size Classes
Hunter Creek	1994	20		11,200	Piece	0.8	0.4	0.3	0.3	0.2	0.2	0.3	0.2	2.6
	2007	100	33,143	33,143	Piece	2.6	0.3	1.0	0.1	0.5	0.1	0.6	0.2	5.2
					Volume (ft^3)	121.2	33.0	156.9	26.3	138.7	45.4	565.4	317.9	1,404.8
	2016	100	31,503	31,503	Piece	2.0	1.0	0.6	0.2	0.3	0.1	0.3	0.1	4.7
					Volume (ft^3)	98.8	118.2	106.7	89.5	99.1	110.1	372.8	401.3	1,396.5
East Fork Hunter Creek	2007	100	10,023	10,023	Piece	4.2	0.3	1.7	0.1	0.9	0.1	0.6	0.1	7.9
					Volume (ft^3)	186.6	34.5	209.9	49.1	235.7	77.7	387.4	196.9	1,377.7
	2016	20	10,094	2,000	Piece	2.5	1.0	0.8	0.3	0.4	0.2	0.5	0.3	5.7
					Volume (ft^3)	112.3	119.4	137.3	131.4	70.7	194.8	336.1	477.7	1,579.7
Mynot Creek	2008	20	13,012	2,403	Piece	1.4	0.5	0.6	0.5	0.2	0.2	0.1	0.4	3.8
					Volume (ft^3)	82.5	90.2	118.2	207.4	60.7	140.1	68.0	1,467.8	2,235.0
	2017	20	8,682	2,000	Piece	2.8	0.6	1.6	0.5	0.7	0.5	0.4	0.5	7.4
					Volume (ft^3)	145.4	74.9	230.8	200.9	241.1	371.5	350.7	2,760.7	4,375.9
Hoppow Creek	2008	20	19,102	3,400	Piece	2.9	0.7	0.9	0.4	0.5	0.2	0.2	0.4	6.1
					Volume (ft^3)	152.6	88.7	157.2	150.3	174.6	134.7	183.1	1,235.2	2,276.3
	2017	20	19,134	3,800	Piece	2.4	0.9	1.2	0.4	0.6	0.1	0.7	0.2	6.5
					Volume (ft^3)	112.2	125.3	150.6	162.6	169.2	127.5	547.7	660.8	2,055.9
North Fork Hoppow Creek	2008	20	4,470	894	Piece	4.7	0.2	2.6	0.7	0.4	0.2	0.4	0.2	9.5
					Volume (ft^3)	260.2	49.4	332.0	316.8	145.9	163.4	271.6	1,484.6	3,023.7
	2017	20	4,262	800	Piece	6.6	1.9	3.0	0.4	0.8	0.5	1.0	0.8	14.9
					Volume (ft^3)	290.4	312.8	405.7	171.4	170.5	381.0	1,117.7	2,332.9	5,182.4
Terwer Creek	1994	20		12,400	Piece	0.7	0.6	0.3	0.4	0.2	0.3	0.2	0.5	3.1
	2008	20	70,352	11,800	Piece	1.2	0.4	0.5	0.4	0.2	0.1	0.2	0.3	3.4
					Volume (ft^3)	61.2	54.4	69.1	192.8	70.9	123.1	372.0	714.2	1,657.6
	2017	20	71,462	13,400	Piece	2.7	0.9	0.7	0.5	0.3	0.3	0.3	0.4	6.0
					Volume (ft^3)	133.4	116.4	97.9	198.0	96.2	233.5	427.7	1,365.1	2,668.3

Table 45. Summary of LWD inventory (averages per 100' by piece count and volume), Coastal Klamath HPA.

						Size Classes of Inchannel LWD								
Stream	Year	Target Percent	Stream Length (feet)	Surveyed Length (feet)	Metric	1' - 1.9' dia.[a]; ≤20'	1' - 1.9' dia.[a]; >20'	2' - 2.9' dia.[a]; ≤20'	2' - 2.9' dia.[a]; >20'	3' - 3.9' dia.[a]; ≤20'	3' - 3.9' dia.[a]; >20'	≥4' dia.[a]; ≤20'	≥4'dia.[a]; >20'	All Size Classes
McGarvey Creek	2008	100	29,707	29,707	Piece	2.6	0.5	1.1	0.3	0.4	0.2	0.3	0.1	5.3
					Volume (ft³)	109.8	66.5	141.4	120.3	102.3	118.4	232.1	217.4	1,108.2
	2017	20	28,269	5,600	Piece	4.8	1.4	1.5	0.4	0.7	0.4	0.5	0.4	9.9
					Volume (ft³)	225.6	160.9	218.8	139.1	201.2	382.3	505.6	1,568.4	3,402.0
West Fork McGarvey Creek	2008	100	12,800	12,800	Piece	2.6	0.3	1.3	0.4	0.4	0.2	0.2	0.1	5.5
					Volume (ft³)	137.7	49.0	199.2	152.7	129.2	181.9	159.4	505.2	1,514.4
	2017	20	12,213	2,600	Piece	3.2	0.8	1.9	0.3	0.9	0.4	0.7	0.4	8.6
					Volume (ft³)	154.9	97.8	323.2	116.2	359.7	442.5	1,298.4	1,836.7	4,629.4
Tarup Creek	2008	20	29,580	5,600	Piece	2.4	0.3	1.0	0.1	0.3	0.1	0.3	0.1	4.7
					Volume (ft³)	133.2	47.5	155.2	47.5	145.5	109.5	259.1	158.0	1,055.6
	2017	20	25,271	5,400	Piece	3.9	1.3	1.3	0.3	0.8	0.1	0.7	0.2	8.5
					Volume (ft³)	175.3	145.1	174.1	103.9	220.8	69.1	523.0	276.1	1,687.4
Omagar Creek	2008	20	15,924	2,800	Piece	4.0	0.3	1.5	0.1	0.5	0.1	0.6	0.2	7.3
					Volume (ft³)	200.6	38.1	240.6	23.1	182.4	74.4	637.2	681.5	2,077.9
	2017	20	15,008	2,600	Piece	2.4	0.9	1.6	0.4	0.6	0.1	0.4	0.4	6.8
					Volume (ft³)	110.6	117.2	274.4	117.2	229.7	76.2	419.8	1,336.9	2,681.9
Ah Pah Creek	2007	100	19,836	19,836	Piece	2.5	0.4	1.0	0.1	0.4	0.0	0.3	0.1	4.9
					Volume (ft³)	123.3	42.5	147.3	45.0	118.8	34.9	264.6	114.9	891.2
	2016	100	19,792	19,683	Piece	1.3	0.6	0.6	0.2	0.3	0.1	0.3	0.1	3.3
					Volume (ft³)	72.0	76.5	94.7	77.8	95.2	51.8	277.6	160.1	905.6

Table 46. Summary of LWD inventory (averages per 100’ by piece count and volume), Coastal Klamath HPA.

Stream	Year	Target Percent	Stream Length (feet)	Surveyed Length (feet)	Metric	1' - 1.9' dia.[a]; ≤20'	1' - 1.9' dia.[a]; >20'	2' - 2.9' dia.[a]; ≤20'	2' - 2.9' dia.[a]; >20'	3' - 3.9' dia.[a]; ≤20'	3' - 3.9' dia.[a]; >20'	≥4' dia.[a]; ≤20'	≥4'dia.[a]; >20'	All Size Classes
						Size Classes of Inchannel LWD								
South Fork Ah Pah Creek	1995	20		1,800	Piece	2.6	0.3	1.0	0.5	0.3	0.3	0.3	0.3	5.7
	2007	100	7,192	7,192	Piece	2.7	0.4	1.7	0.1	0.5	0.1	0.6	0.1	6.3
					Volume (ft³)	127.4	38.7	260.9	54.0	146.7	68.8	546.9	211.4	1,454.7
	2016	100	6,685	6,685	Piece	1.9	0.7	1.5	0.4	0.3	0.2	0.2	0.1	5.2
					Volume (ft³)	102.3	98.9	255.6	188.3	93.0	195.1	128.5	244.7	1,306.3
North Fork Ah Pah Creek	1995	20		5,800	Piece	2.1	0.7	1.0	0.2	0.2	0.1	0.5	0.2	4.9
	2007	100	17,854	17,854	Piece	2.5	0.7	0.9	0.1	0.3	0.0	0.6	0.1	5.1
					Volume (ft³)	107.7	71.8	121.9	21.0	104.4	23.4	491.6	241.9	1,183.8
	2016	20	17,369	3,800	Piece	2.6	0.7	1.0	0.2	0.4	0.1	1.0	0.1	6.2
					Volume (ft³)	115.5	78.0	135.4	64.1	137.8	120.3	1,300.2	276.4	2,227.7
Surpur Creek	2008	20	17,808	3,600	Piece	4.9	0.6	2.0	0.4	0.8	0.3	0.5	0.2	9.7
					Volume (ft³)	196.5	79.3	239.8	132.3	171.1	216.5	275.5	426.3	1,737.2
	2018	20	17,468	3,400	Piece	2.0	0.6	1.4	0.2	0.5	0.1	0.7	0.2	5.7
					Volume (ft³)	107.6	69.7	223.5	78.0	133.9	28.8	1,171.2	179.9	1,992.6
Little Surpur Creek	2008	20	14,997	3,000	Piece	3.4	0.3	1.2	0.3	0.3	0.1	0.3	0.1	6.0
					Volume (ft³)	174.5	46.2	194.8	166.2	83.3	68.9	208.3	65.0	1,007.3
	2018	20	13,174	2,600	Piece	1.8	0.4	1.4	0.4	0.5	0.1	0.6	0.2	5.4
					Volume (ft³)	84.1	41.3	174.7	137.8	119.0	78.7	716.7	93.8	1,446.1
Tectah Creek	2007	100	46,958	45,842	Piece	0.6	0.5	0.3	0.3	0.1	0.2	0.2	0.1	2.3
					Volume (ft³)	32.7	76.2	55.6	150.8	28.1	180.7	148.2	486.0	1,158.3
	2016	100	45,561	45,647	Piece	0.9	0.6	0.3	0.3	0.2	0.2	0.3	0.2	2.9
					Volume (ft³)	46.0	77.9	52.3	134.4	59.1	154.3	250.1	568.4	1,342.3

Table 47. Summary of LWD inventory (averages per 100’ by piece count and volume), Coastal Lagoons HPA.

Stream	Year	Target Percent	Stream Length (feet)	Surveyed Length (feet)	Metric	Size Classes of Inchannel LWD: 1' - 1.9' dia.[a]; ≤20'	1' - 1.9' dia.[a]; >20'	2' - 2.9' dia.[a]; ≤20'	2' - 2.9' dia.[a]; >20'	3' - 3.9' dia.[a]; ≤20'	3' - 3.9' dia.[a]; >20'	≥4' dia.[a]; ≤20'	≥4'dia.[a]; >20'	All Size Classes
Maple Creek	2005	20	85,748	15,400	Piece	1.0	0.7	0.5	0.2	0.2	0.2	0.1	0.2	3.3
					Volume (ft³)	54.3	112.3	85.2	116.3	80.9	167.4	135.1	460.5	1,212.0
	2015	20	91,426	18,000	Piece	2.1	0.9	0.6	0.4	0.3	0.2	0.3	0.3	5.0
					Volume (ft³)	101.1	125.1	96.0	138.7	96.3	122.8	191.4	550.2	1,421.5
North Fork Maple Creek	2005	100	16,355	16,355	Piece	1.2	0.4	0.7	0.1	0.2	0.1	0.3	0.2	3.2
					Volume (ft³)	55.7	40.9	107.6	59.8	64.0	132.1	228.4	407.1	1,095.7
	2015	20	17,015	3,400	Piece	1.0	0.5	0.3	0.2	0.2	0.1	0.1	0.3	2.8
					Volume (ft³)	56.2	64.4	70.4	81.9	64.7	79.6	77.0	697.3	1,191.6
Pitcher Creek	2005	100	5,188	4,446	Piece	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
					Volume (ft³)	0.7	1.2	0.0	0.0	4.7	0.0	10.5	124.7	141.7
	2015	20	5,703	1,400	Piece	0.5	0.8	0.1	0.0	0.0	0.0	0.0	0.1	1.4
					Volume (ft³)	32.8	112.6	6.5	0.0	0.0	0.0	0.0	174.5	326.3
M-Line Creek	2005	20	17,801	3,600	Piece	4.5	0.9	1.5	0.1	0.4	0.1	0.4	0.1	8.1
					Volume (ft³)	248.4	104.0	252.7	49.9	155.1	90.0	391.1	124.0	1,415.1
	2015	20	19,570	4,000	Piece	6.1	1.3	3.4	0.7	1.6	0.3	0.8	0.4	14.4
					Volume (ft³)	328.2	198.1	555.3	303.1	468.2	293.5	689.2	864.3	3,699.9
M-Line Creek Tributary	2005	100	5,211	5,211	Piece	2.0	0.6	1.7	0.5	0.9	0.3	0.5	0.4	7.1
					Volume (ft³)	110.7	90.2	334.5	242.9	368.5	249.5	433.9	949.8	2,780.1
	2015	20	5,562	1,000	Piece	7.8	1.2	2.9	0.3	1.4	0.6	0.3	0.5	15.0
					Volume (ft³)	429.2	212.8	474.5	102.3	495.1	518.9	249.3	1,463.7	3,945.7
Clear Creek	2005	20	6,317	1,400	Piece	4.7	1.9	1.2	0.7	0.4	0.1	0.7	0.1	9.9
					Volume (ft³)	220.9	209.0	159.3	277.4	183.9	82.7	631.3	186.7	1,951.2
	2015	20	6,597	1,400	Piece	2.4	0.9	0.8	0.6	0.4	0.0	0.3	0.0	5.4
					Volume (ft³)	124.5	96.2	130.6	245.1	137.8	0.0	225.8	0.0	960.0
Beach Creek	2005	100	12,772	12,872	Piece	3.9	0.7	2.7	0.5	1.2	0.3	0.8	0.4	10.5
					Volume (ft³)	216.5	105.4	451.5	234.1	434.3	225.3	612.1	779.6	3,058.9
	2015	100	13,626	13,626	Piece	6.8	1.2	2.4	0.6	0.9	0.4	0.3	0.2	12.8
					Volume (ft³)	321.2	168.1	360.5	215.8	319.8	256.4	305.8	497.0	2,444.6

Table 48. Summary of LWD inventory (averages per 100' by piece count and volume), Humboldt Bay HPA.

Stream	Year	Target Percent	Stream Length (feet)	Surveyed Length (feet)	Metric	Size Classes of Inchannel LWD: 1' - 1.9' dia.[a]; ≤20'	1' - 1.9' dia.[a]; >20'	2' - 2.9' dia.[a]; ≤20'	2' - 2.9' dia.[a]; >20'	3' - 3.9' dia.[a]; ≤20'	3' - 3.9' dia.[a]; >20'	≥4' dia.[a]; ≤20'	≥4'dia.[a]; >20'	All Size Classes
Salmon Creek	1995	20		7,800	Piece	0.8	0.8	0.5	0.3	0.4	0.4	0.5	0.4	4.2
	2008	100	36,628	36,628	Piece	2.3	0.5	1.3	0.4	0.5	0.2	0.5	0.3	6.0
					Volume (ft^3)	119.7	74.1	176.6	153.9	139.3	165.9	440.2	521.7	1,791.3
	2018	20	35,560	7,000	Piece	2.8	0.6	1.3	0.3	0.7	0.2	1.0	0.4	7.4
					Volume (ft^3)	145.5	67.0	183.8	114.3	191.5	176.1	1,402.0	1,140.7	3,420.9
Ryan Creek	2009	100	37,427	37,427	Piece	2.4	0.2	1.0	0.1	0.4	0.1	0.4	0.1	4.8
					Volume (ft^3)	116.5	31.8	147.7	56.5	120.5	58.0	303.7	205.8	1,040.5
	2018	20	36,833	7,200	Piece	2.5	0.3	1.4	0.2	0.7	0.1	1.3	0.2	6.7
					Volume (ft^3)	115.4	32.5	185.7	87.8	209.3	113.3	981.4	307.4	2,032.7

Table 49. Summary of LWD inventory (averages per 100’ by piece count and volume), Mad River HPA.

Stream	Year	Target Percent	Stream Length (feet)	Surveyed Length (feet)	Metric	Size Classes of Inchannel LWD: 1' - 1.9' dia.[a]; ≤20'	1' - 1.9' dia.[a]; >20'	2' - 2.9' dia.[a]; ≤20'	2' - 2.9' dia.[a]; >20'	3' - 3.9' dia.[a]; ≤20'	3' - 3.9' dia.[a]; >20'	≥4' dia.[a]; ≤20'	≥4'dia.[a]; >20'	All Size Classes
Dry Creek	1995	20		1,200	Piece	0.9	0.1	0.3	0.1	0.0	0.0	0.0	0.0	1.3
	2005	100	3,877	3,877	Piece	2.2	0.4	0.6	0.2	0.1	0.1	0.1	0.0	3.7
					Volume (ft^3)	113.0	62.3	93.1	82.1	25.9	38.3	102.4	56.4	573.6
	2015	20	3,876	800	Piece	0.6	0.5	0.3	0.1	0.0	0.0	0.4	0.0	1.9
					Volume (ft^3)	18.3	83.9	28.7	36.2	0.0	0.0	463.8	0.0	630.9
Canon Creek	1994	20		4,800	Piece	0.6	0.6	0.2	0.1	0.1	0.0	0.2	0.0	1.8
	2005	100	22,296	22,296	Piece	0.5	0.3	0.1	0.1	0.1	0.0	0.2	0.0	1.3
					Volume (ft^3)	29.8	37.3	26.7	26.4	15.1	22.6	182.1	7.0	347.1
	2015	100	23,476	23,476	Piece	0.6	0.6	0.1	0.2	0.1	0.1	0.2	0.1	2.0
					Volume (ft^3)	30.7	86.5	19.2	89.2	33.6	75.7	213.1	113.0	661.0
Mather Creek	2007	20	11,511	1,865	Piece	3.4	0.5	0.8	0.1	0.1	0.1	0.1	0.0	5.0
					Volume (ft^3)	156.3	53.2	141.5	23.8	40.5	116.8	80.5	0.0	612.5
	2016	20	9,835	2,000	Piece	1.7	0.4	0.7	0.1	0.4	0.1	0.2	0.1	3.5
					Volume (ft^3)	90.6	55.1	111.0	35.9	146.3	109.5	104.7	177.4	830.3

Table 50. Summary of LWD inventory (averages per 100' by piece count and volume), North Fork Mad River HPA.

Stream	Year	Target Percent	Stream Length (feet)	Surveyed Length (feet)	Metric	Size Classes of Inchannel LWD								
						1' - 1.9' dia.[a]; ≤20'	1' - 1.9' dia.[a]; >20'	2' - 2.9' dia.[a]; ≤20'	2' - 2.9' dia.[a]; >20'	3' - 3.9' dia.[a]; ≤20'	3' - 3.9' dia.[a]; >20'	≥4' dia.[a]; ≤20'	≥4'dia.[a]; >20'	All Size Classes
North Fork Mad River	1995	20		16,800	Piece	0.2	0.3	0.1	0.1	0.1	0.0	0.2	0.0	1.0
	2005	100	86,331	86,331	Piece	1.0	0.4	0.3	0.2	0.2	0.1	0.2	0.1	2.5
					Volume (ft^3)	51.7	50.9	58.5	82.6	55.6	81.0	192.5	150.7	723.4
	2016	20	84,102	15,600	Piece	0.8	0.4	0.4	0.3	0.1	0.1	0.1	0.1	2.4
					Volume (ft^3)	41.3	61.9	56.8	142.4	35.6	151.9	112.7	305.2	907.9
Long Prarie Creek	1995	20		3,400	Piece	1.0	0.5	0.1	0.4	0.0	0.2	0.0	0.0	2.3
	2007	100	14,680	14,680	Piece	1.4	1.0	0.4	0.5	0.1	0.2	0.1	0.0	3.7
					Volume (ft^3)	70.6	164.4	57.4	245.7	30.0	198.8	82.3	62.4	911.5
	2016	20	11,442	2,400	Piece	0.6	0.8	0.3	0.4	0.0	0.0	0.1	0.0	2.2
					Volume (ft^3)	46.4	188.6	70.5	216.3	16.1	0.0	145.7	0.0	683.6
South Fork Long Prairie Creek	2005	100	1,469	1,469	Piece	1.9	0.4	0.7	0.4	0.3	0.0	0.1	0.0	3.9
					Volume (ft^3)	95.7	47.8	114.0	152.8	117.4	0.0	123.6	0.0	651.2
	2016	20	4,633	1,200	Piece	1.1	0.4	0.3	0.2	0.1	0.1	0.0	0.1	2.2
					Volume (ft^3)	51.5	38.5	54.6	44.2	48.3	113.9	0.0	188.5	539.5
Sullivan Gulch	2005	100	2,945	2,945	Piece	1.3	0.4	0.4	0.0	0.1	0.0	0.1	0.0	2.3
					Volume (ft^3)	56.0	49.2	48.5	19.6	24.8	0.0	110.0	0.0	308.0
	2015	100	3,214	3,214	Piece	1.1	0.3	0.4	0.2	0.2	0.2	0.1	0.1	2.7
					Volume (ft^3)	39.0	49.9	47.7	66.5	23.5	111.0	266.8	228.5	832.8
Watek (Mill) Creek	2005	20	5,800	1,000	Piece	0.8	0.4	0.3	0.1	0.0	0.0	0.1	0.0	1.7
					Volume (ft^3)	39.0	56.5	38.7	41.6	0.0	0.0	44.3	0.0	220.1
	2015	20	5,952	1,200	Piece	0.6	0.2	0.2	0.1	0.1	0.1	0.0	0.0	1.2
					Volume (ft^3)	35.5	30.5	17.2	38.2	48.3	59.0	0.0	0.0	228.5

Table 51. Summary of LWD inventory (averages per 100' by piece count and volume), Little River HPA.

Stream	Year	Target Percent	Stream Length (feet)	Surveyed Length (feet)	Metric	1' - 1.9' dia.[a]; ≤20'	1' - 1.9' dia.[a]; >20'	2' - 2.9' dia.[a]; ≤20'	2' - 2.9' dia.[a]; >20'	3' - 3.9' dia.[a]; ≤20'	3' - 3.9' dia.[a]; >20'	≥4' dia.[a]; ≤20'	≥4'dia.[a]; >20'	All Size Classes
						Size Classes of Inchannel LWD								
Upper South Fork Little River	2005	100	9,673	9,673	Piece	1.9	0.6	1.0	0.2	0.5	0.1	0.4	0.3	5.0
					Volume (ft³)	101.3	93.3	164.3	102.6	154.8	82.6	480.0	678.6	1,857.5
	2015	100	9,774	9,774	Piece	2.4	0.7	1.1	0.5	0.5	0.2	0.5	0.3	6.2
					Volume (ft³)	129.6	111.0	192.6	181.4	163.7	164.0	486.6	834.3	2,263.3
Lower South Fork Little River	2005	100	9,847	9,847	Piece	3.4	1.1	1.2	0.7	0.5	0.3	0.3	0.3	7.6
					Volume (ft³)	182.9	221.6	189.5	293.3	166.2	233.2	221.8	694.2	2,202.8
	2015	100	15,568	15,568	Piece	4.3	0.9	1.3	0.5	0.3	0.2	0.4	0.3	8.2
					Volume (ft³)	206.0	132.5	196.8	177.1	108.4	185.3	381.4	557.2	1,944.6
Little River	2005	20	77,326	14,800	Piece	1.7	0.4	0.5	0.1	0.3	0.1	0.2	0.1	3.3
					Volume (ft³)	91.3	45.4	79.3	49.4	93.7	48.3	392.3	179.5	979.0
	2015	20	79,609	15,000	Piece	1.6	0.8	0.6	0.2	0.2	0.1	0.2	0.1	3.8
					Volume (ft³)	84.4	122.2	95.8	97.5	48.1	107.6	197.2	141.2	893.9
Railroad Creek	2005	100	6,877	6,877	Piece	2.8	0.8	1.6	0.4	0.7	0.2	0.7	0.3	7.6
					Volume (ft³)	134.9	115.1	220.0	155.8	238.4	169.2	825.6	810.3	2,669.4
	2015	20	7,371	1,600	Piece	3.8	0.8	1.1	0.6	0.6	0.1	0.4	0.3	7.5
					Volume (ft³)	177.2	93.4	158.1	226.1	186.2	58.5	318.7	366.2	1,584.3
Carson Creek	2005	100	12,356	12,356	Piece	4.5	0.6	1.1	0.3	0.5	0.1	0.3	0.1	7.6
					Volume (ft³)	220.7	88.2	181.0	124.7	176.5	100.0	290.3	421.1	1,602.5
	2015	100	14,273	14,273	Piece	2.9	0.5	0.7	0.3	0.2	0.2	0.2	0.1	5.1
					Volume (ft³)	135.7	62.5	98.8	106.5	63.0	113.2	196.4	764.8	1,541.0
Carson Creek Tributary	2005	100	3,021	3,021	Piece	3.9	0.3	1.8	0.2	0.8	0.2	0.4	0.1	7.7
					Volume (ft³)	202.4	56.3	308.2	99.5	293.4	152.8	325.2	329.2	1,767.0
	2015	100	3,326	3,326	Piece	2.5	0.3	1.7	0.2	0.8	0.3	0.5	0.2	6.5
					Volume (ft³)	99.6	41.4	186.0	68.0	210.6	174.5	1,079.7	229.7	2,089.4

3. Summer Juvenile Population Estimates

Objectives

The objectives of the summer population estimates are to estimate summer populations of young-of-the-year (YOY) coho salmon, and age 1+ and older (parr) steelhead and cutthroat trout, and to track trends in these populations over time. In the Little River HPA, the population estimate information may be combined with outmigrant trapping data in an attempt to understand the mortality associated with specific life-history stages (particularly over-winter survival). This study is a long-term trend monitoring project, and has no associated thresholds. As enough data are acquired, it will be possible to conduct a trend analysis associated with other monitoring projects discussed in the AHCP.

Project Status

This monitoring program is operational and ongoing. The number of creeks sampled has changed over time from three in 1995 to a high of fifteen through 2014. Currently, there are eleven summer juvenile population estimate monitoring sites established that have been routinely monitored (Table 52). An additional nine sites were briefly monitored but discontinued due to their unsuitability for the study objectives. Additional details on justification for discontinuing these sites were provided in the 2nd Biennial Report (GDRCo 2011) and 4th Biennial Report (GDRCo 2015).

The original field protocol has also been slightly modified from the protocol described in the AHCP (AHCP Appendix D.3.8). There have also been modifications to the sampling design and habitat classification over the years as well as to the estimators used to calculate annual salmonid population estimates. An update to the original Summer Juvenile Population Estimate Monitoring protocol was proposed to the Services in the March 2011 request for Minor Modifications. Details and justifications for the requested modifications were provided in the 2nd Biennial Report (GDRCo 2011). The intent of this request was to update the protocol to reflect the current monitoring efforts being implemented for this project. After review and consideration, the Services concurred with the proposed update to the monitoring protocol. In 2012, the Services were provided with the revised protocol for this monitoring program. No revisions were requested by the Services and the revised protocol has been implemented since.

A functional data management system is established and operational for this project. All historical data has been incorporated into this database and these data have been audited for quality assurance/quality control. Juvenile salmonid population estimates are generated annually using custom reporting functions and the results are reported to NMFS and CDFW in accordance with permit requirements.

On average, the current monitoring sites have been sampled 20.5 times and the monitoring duration has spanned 20.6 years. Wilson Creek and South Fork Winchuck River are the sites with the longest continuous monitoring efforts; both have been monitored for the last 26 years. Detailed information on this project can be obtained from Appendix C which is GDRCo's 2020 Summer Juvenile Salmonid Population Sampling Program annual report to NMFS. This report summarizes the results from the 2020 survey season and compares select variables to historical data.

Table 52. Summary of the summer juvenile population estimate survey efforts conducted by Green Diamond from 1995-2020 (Y = site was surveyed, N = site was not surveyed).

	# Years	Monitoring	Monitoring Year																									
Site Name	**Monitored**	**Duration**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
SF Winchuck River	26	26	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Wilson Creek	26	26	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cañon Creek	25	26	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hunter Creek	23	23				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lower SF Little River	23	23				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Railroad Creek	17	17				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N
Upper SF Little River	23	23				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sullivan Gulch	22	22					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF Rowdy/Savoy Creel	20	20							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
EF Hunter Creek	12	12									Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N
Heightman Creek	9	10											Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N
Ah Pah Creek	14	14													Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF Ah Pah Creek	14	14													Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Little Surpur Creek	10	10																	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Tarup Creek	3	3																		Y	Y	Y	N	N	N	N	N	N
Moon Creek	3	3													Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N
NF Ah Pah Creek	2	2													Y	Y	N	N	N	N	N	N	N	N	N	N	N	N
Lower Beach Creek	1	1												Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Lower Maple Creek	1	1												Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Upper Maple Creek	1	1												Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Number of sites	-	-	3	3	3	6	8	8	9	9	10	10	11	13	15	15	14	13	14	15	15	15	11	11	11	11	11	11

Blank cells represent years prior to site being developed for survey protocol.

4. Outmigrant Trapping

Objectives

The objectives of the outmigrant trapping project are to monitor the abundance, size, and timing of out-migrating salmonid smolts and look for long-term trends in any or all of these variables. This information may be used to estimate overwinter survival of juvenile coho cohorts by comparing outmigrant abundance to the previous summer population estimates.

Project Status

The outmigrant trapping monitoring program is operational and ongoing. The number of creeks monitored has changed over time. In 1999, three tributaries were selected in Little River followed by a fourth in 2000. In 2004, one additional site was selected in Ryan Creek. In 2015, two sites were discontinued: the site in Ryan Creek and the Railroad Creek site (one of the tributary sites in Little River). In 2015, one additional site was selected on Mainstem Little River, bringing the total to four sites monitored in Little River since 2015.

The original field protocol implemented for this monitoring program is described in the AHCP (AHCP Appendix D.3.9) and has undergone minor changes with the addition of the site on Mainstem Little River and the discontinuation of the Ryan Creek and Railroad Creek sites. An update to the original outmigrant trapping protocol was proposed to the Services in the March 2011 request for Minor Modifications. Details and justifications for the requested modifications were provided in the 2nd Biennial Report (GDRCo 2011) and the 2011 modifications request, respectively. The intent of this request was to update the protocol to reflect the current monitoring efforts being implemented for this project. After review and consideration, the Services concurred with the proposed update to the monitoring protocol. On July 24, 2012, the Services were provided with the revised protocol for this monitoring program. No revisions were requested by the Services and the revised protocol was implemented for this monitoring program through 2020. As described above, there were changes to the sites monitored for this project as well as a few changes to procedures related to scientific collecting permit limitations.

A database was developed which stores and summarizes data for estimates and reports. All historical data have been incorporated into this database and smolt estimates are generated annually for the sites, the results of which are reported to NMFS and CDFW in accordance with permit requirements. This study is a long-term trend monitoring project and does not have associated thresholds. As enough data are acquired, it will be possible to conduct a trend analysis associated with other monitoring projects discussed in the AHCP.
Currently, four outmigrant trapping sites are established and annually monitored (Table 53). Among these sites, the Mainstem Little River site has been monitored for

the shortest period. Detailed information on this project can be obtained from Appendix D which is GDRCo's 2020 Juvenile Salmonid Outmigrant Trapping Program annual report to NMFS. This report summarizes the results from the 2020 trapping season and compares select variables to historical data.

Table 53. Summary of the outmigrant trapping efforts conducted by Green Diamond from 1995-2020. (Y = site was surveyed, N = site was not surveyed).

			Monitoring Year																					
Site Name	**Watershed**	**# Years Monitored**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Upper SF Little River	Little River	22	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lower SF Little River	Little River	22	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Railroad Creek	Little River	16	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N
Carson Creek	Little River	21		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mainstem Little River	Little River	6																	Y	Y	Y	Y	Y	Y
Ryan Creek	Ryan Creek	11						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N
Number of sites		-	3	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	4	4	4	4	4	4

Blank cells represent years prior to site being developed for survey protocol.

5. Turbidity Threshold Sampling

Objective

The objective of the turbidity threshold sampling (TTS) is to collect continuous stage and turbidity data, and water samples (to measure suspended sediment concentrations, SSC) throughout each water year (i.e., October 1 through July 1). These data can be used to help detect trends that might indicate changes in the levels of erosion at the watershed scale upstream of each station and to calculate suspended sediment loads by establishing a relationship between SSC and turbidity for a sampling period of interest. These data can also be integrated into existing monitoring projects as hydrologic explanatory variables, including watershed scale assessment of the effectiveness of road upgrading and decommissioning.

Project Status

This monitoring program is operational and ongoing but has been separated from the road-related surface erosion monitoring program (AHCP Section 6.3.5.2.4). This modification is in accordance with the minor modification to the Effectiveness Monitoring Program approved on June 15, 2011. This project will be retained as a long-term monitoring project under the Effectiveness Monitoring Program and annual monitoring at established sites was implemented through 2020.

The TTS monitoring effort began in 2002 at three sites in Little River and the number of sites has expanded over time. Reasons for initiating and suspending sites can be found in Section IX.C.5 of the 4th Biennial Report (GDRCo 2015).

Results

Throughout the 2019 and 2020 water years, twelve TTS monitoring sites were monitored (Table 54). On average, the current monitoring sites have been operated for 11.75 water years and the maximum monitoring duration has spanned 19 years.

The three sites in Little River have the longest continuous monitoring efforts. The sites with the shortest monitoring duration are located in the Klamath River watershed.

Table 54. Summary of the turbidity threshold sampling efforts (Y = yes, protocol implemented) conducted by Green Diamond Resource Company during the 2002-2020 water years.

			# Years	Years Protocol Implemented																		
Watershed	Stream Name	Site Name	Monitored	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Little River	Lower South Fork Creek	LSF	19	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Little River	Upper South Fork Creek	USF	19	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Little River	Railroad Creek	RR	13	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	-	-	-	-	-
Little River	Carson Creek	CC	18	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Humboldt Bay	Ryan Creek	RC-1	12	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	-	-	-	-	-
Maple Creek	North Fork Maple Creek	NFM	17	-	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Maple Creek	Mainstem Maple Creek	MSM	17	-	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Humboldt Bay	McCloud Creek	MC-2	14	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ah Pah Creek	Mainstem Ah Pah Creek	MSAP	13	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ah Pah Creek	North Fork Ah Pah Creek	NFAP	7	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y	-	-	-	-	-	-
Ah Pah Creek	South Fork Ah Pah Creek	SFAP	13	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Winchuck River	South Fork Winchuck River	SFW	13	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Redwood Creek	Panther Creek	PAN	3	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	-	-	-	-	-	-
Klamath River	Tarup Creek	TAR	2	-	-	-	-	-	-	-	-	-	-	-	Y	Y	-	-	-	-	-	-
Klamath River	Little Surpur Creek	LSUR	8	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y	Y
Klamath River	East Fork Tectah Creek	EFT	6	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y
Klamath River	West Fork Tectah Creek	WFT	6	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y
Number of sites				3	5	7	7	7	8	12	12	12	12	13	15	15	12	12	12	12	12	12

"-" = monitoring was not conducted (i.e., no data available).

Discussion

A data management system (Aquarius Time-Series v3.10; Aquatic Informatics Inc.) was acquired in 2016 for this monitoring program. The major advantages of this database are that it combines field and lab data into one database, allows for a continuous plotting and analysis of multiple water years, and provides more user-friendly rating development tools. All past field and lab data have been incorporated into this database and quality assurance/quality control assurances are complete. A software upgrade in May 2019 (Aquarius Time-Series v.2019.1) resulted in a loss of functionality for rating development. These issues carried over into the current version of the Aquarius Time-Series software (v. 2020.2) which was implemented in August 2020. GDRCo's aquatic program staff are currently working directly with the Aquarius software development team to resolve these issues and ensure that the new rating development tool will provide the functionality that meets the objectives of our TTS monitoring program. This new rating development tool is expected for release in 2022 by the vendor and will provide additional data management tools and analysis capabilities. Several different applications are used to collect field data electronically on field computers and database import routines are operational. This study is a long-term trend monitoring project and does not have associated thresholds. As enough data are acquired, it will be possible to conduct trend analyses associated with other monitoring projects discussed in the AHCP.

D. Experimental Watersheds

While the majority of the AHCP's monitoring projects will be conducted throughout the Plan Area, experimental watersheds judged to be representative of the different geologic and physiographic provinces across the Plan Area have been specifically designated where additional monitoring and research on the interactions between forestry management and riparian and aquatic ecosystems will be conducted. Those watersheds are the Little River (Little River HPA), South Fork Winchuck River (Smith River HPA), and Upper Tectah Creek, Little Surpur Creek, and Ah Pah Creek (Coastal Klamath HPA).

As stipulated in AHCP Section 6.2.5.4, the program will entail:

- Effectiveness monitoring projects and programs that due to their complexity and expense of implementation can only be applied in limited regions (these include turbidity monitoring, Class III sediment monitoring, and road-related mass wasting monitoring;

- Studies related to harvested and non-harvested areas, allowing for more effective evaluation of conservation measures and increased understanding of the effects of forest management on the habitats and populations of the Covered Species;

- Studies of conservation and management measures, allowing for a refinement of measures and an assessment of the relative benefits of different measures under the AHCP; and

- Development and implementation of new or refined monitoring and research protocols.

Below is a summary of the studies or pilot studies, past and present, which have been carried out in an Experimental Watershed.

<u>SF Winchuck River Watershed</u>
- Property Wide Water Temperature Monitoring
- Class II BACI Water Temperature Monitoring
- Class I Channel Monitoring
- Long Term Habitat Assessment Monitoring
- LWD Monitoring
- Summer Juvenile Salmonid Population Estimates
- Turbidity Threshold Sampling (TTS) monitoring

<u>Ah Pah Creek Watershed</u>
- Property Wide Water Temperature Monitoring
- Class I Channel Monitoring
- Long Term Habitat Assessment Monitoring
- LWD Monitoring

- Summer Juvenile Salmonid Population Estimates
- Turbidity Threshold Sampling (TTS) monitoring
- Riparian Canopy Modification Experiment

Upper Tectah Creek Watershed (watershed added per Minor Modification; GDRCo 2017)

- Property Wide Water Temperature Monitoring
- Turbidity Threshold Sampling (TTS) monitoring
- Riparian Canopy Modification Experiment

Little Surpur Creek Watershed (watershed added per Minor Modification; GDRCo 2017)

- Property Wide Water Temperature Monitoring
- Long Term Habitat Assessment Monitoring
- LWD Monitoring
- Summer Juvenile Salmonid Population Estimates
- Turbidity Threshold Sampling (TTS) monitoring

Little River Watershed

- Property Wide Water Temperature Monitoring
- Class II BACI Water Temperature Monitoring
- Tailed Frog Life History Monitoring
- Class I Channel Monitoring
- Class III Channel Monitoring
- Long Term Habitat Assessment Monitoring
- LWD Monitoring
- Summer Juvenile Salmonid Population Estimates
- Outmigrant Trapping
- Turbidity Threshold Sampling (TTS) monitoring
- BACI Class II RH Cross Section Monitoring

Ryan Creek Watershed (watershed removed per Minor Modification; GDRCo 2017)

- Property Wide Water Temperature Monitoring
- Class III Channel Monitoring
- Outmigrant Trapping *
- Long Term Habitat Assessment Monitoring
- LWD Monitoring
- Turbidity Threshold Sampling (TTS) monitoring *

The development and implementation of new research and monitoring protocols will provide an opportunity for GDRCo to refine existing conservation measure to make them more effective and efficient. This will include state-of-the-art existing study designs along with original research approaches that will require the input from academic, agency, and private scientists.

1. Riparian Canopy Modification Experiment

GDRCo has been in the process of developing a watershed level experiment since shortly after the approval of our AHCP in 2007 in conjunction with numerous collaborators including Humboldt State University, Oregon State University, USGS, U.S. Forest Service, California Department of Fish and Wildlife (CDFW), CalFire and others. The conceptual framework for the experiment is focused on the response of stream systems to modifications of the riparian canopy that would increase the amount of solar radiation reaching the stream. The fundamental premise is that increases in sunlight will increase primary productivity in the stream ecosystem. A field experiment was designed and implemented to test effects of modifications to the riparian canopy on primary productivity as measured by fish and amphibian abundance and growth while at the same time minimizing negative impacts to aquatic life or water quality.

The potential that riparian canopy modifications may increase stream productivity is based on prior studies suggesting that light limitation of primary production often overrides nutrient limitation in small, forested streams (e.g., Lowe et al. 1986; Rand et al. 1992; Hill et al. 2001). This may be particularly common in the Pacific Northwest, where both coniferous vegetation and an increasing dominance of alder (Alnus spp.; Hu et al. 2001) can provide heavy riparian shade. In coastal settings in northern California, summer fog also reduces light reaching streams. Where light limits algal production, the ability of stream systems to respond to nutrient enrichment such as adding salmon carcasses may be affected and transfer pathways to salmonids may be restricted. Autotrophic pathways are particularly important in sustaining salmonid growth during spring and summer (Bilby and Bisson 1992) and are at the basis of the finding that logged streams often support higher salmonid production than their forested counterparts (e.g., Murphy and Hall 1981; Wilzbach et al. 1986).

The potential benefit of additional sunlight to resident salmonids has already been demonstrated by Wilzbach et al. (2005) in north coastal California. They conducted an experiment in which 100-m stream reaches were treated with complete removal of deciduous canopy to increase solar radiation. Half of these reaches were also treated with additions of salmon carcasses to increase nutrient levels. There was no measurable effect from the carcass additions on the initial and a follow-up study (Harvey and Wilzbach 2010), but removal of the riparian canopy had a strong positive impact on salmonid biomass, density, and growth. However, the implications from this study are limited to the stream reach scale, and what is lacking is additional experimentation to determine if similar results can be achieved at the stream or watershed scale.

The potential benefits of increased sunlight on a stream are not limited to fish species. Increases in primary productivity that indirectly benefits salmonid species through increases in the aquatic invertebrate fauna should also indirectly benefit many stream associated headwater amphibians. In addition, tailed frogs can be directly impacted since the larvae are benthic grazers that feed on unicellular algal periphyton. In two small coastal streams in British Columbia, Mallory and Richardson (2005) documented an increase in larval tailed frog growth with experimental increases in light, but no affect from nutrient additions.

Active management of second-growth stands to accelerate the acquisition of mid to late-seral characteristics using silvicultural treatments has also recently emerged as a top priority in forest parks and reserves in northern coastal California (Porter et al. 2007; Keyes et al. 2010; O'Hara et al. 2010). For example, Redwood National Park recently completed an Environmental Assessment and Finding of No Significant Impact to thin 1,125 acres in the Middle Fork Little Lost Man Creek watershed (RNP 2014a and RNP 2014b). In contrast, little attention has been given to achieving similar management goals on private managed timberlands. Compared to late-seral stand condition, second-growth riparian stands typically have a much higher stem density with a shift to a greater proportion of red alder *(Alnus rubra*) and Douglas-fir (*Pseudotsuga menziesii*) and fewer redwoods (*Sequoia sempervirens*) (Keyes and Teraoka 2014). In addition to potentially increasing productivity in the aquatic environment, there are similar opportunities to restore and enhance tree species composition and size in the near stream riparian environment.

Although there is increasing evidence supporting the need for watershed level experiments, the complexity of initiating a long term study of this spatial extent with the potential for negative impacts raises many legitimate concerns that need to be overcome with small incremental steps. As a result, we initiated a pilot study (see Section VIII.D.2 below) with the fundamental goal of determining the feasibility of expanding the study to a larger scale watershed level experiment. Following the successful implementation of the pilot study, we initiated a watershed scale study in upper Tectah Creek to look at how changes in riparian canopy affects stream shading, light, water temperature, trophic pathways, and the growth and bioenergetic responses of cutthroat trout (see Section VIII.D.3 below for more details). Coupled with this project was a study conducted by CDFW designed to look at how different levels in riparian thinning affect the long-term development of different size classes of trees, snags and dead wood (see Section VIII.D.4 below for more details). More recently, GDRCo hosted another larger scale watershed level experiment that was funded by the Effectiveness Monitoring Committee (EMC) of the California Board of Forestry and Fire Protection (Board), to assess the effectiveness of the Board's recently enacted Forest Practice Rules (FPR) for Class II-L watercourses. In addition to evaluating the FPR Class II-L prescription this study was also designed to evaluate the AHCP Class II-2 prescriptions which are similar to the Class II-2 watercourses in their biological and geological attributes (see Section VIII.D.5 below for more details).

2. Pilot Project: SF Ah Pah Creek

<u>Objectives</u>

A pilot study was initiated on a single stream reach with several objectives. We evaluated the feasibility of marking and removing riparian trees as part of a timber harvest operation to achieve an approximate 50% overstory canopy cover post-harvest. We also monitored the treated reach to determine if there was any evidence of bank erosion or measured increases in turbidity/suspended sediments or any biologically significant increases in water temperature in the treatment or downstream reaches relative to the water entering the upstream portion of the treatment reach. Although the primary objectives were related to the physical variables, prior to conducting the treatment (i.e., felling of riparian canopy trees), we also captured and marked juvenile cutthroat and steelhead trout and coastal giant salamanders to test field methodologies and to provide an opportunity to record movements and growth. The data collected on the physical variables with potential for negative impacts were evaluated from this pilot treatment to ensure that treatment of additional stream reaches associated with watershed level experiments was warranted and unlikely to produce negative biological impacts.

Project Status

The pilot study was located on GDRCo's ownership in the South Fork (SF) Ah Pah Creek sub-basin that drains into the Lower Klamath River Basin. The single riparian treatment was conducted on an approved Timber Harvesting Plan (GDRCo # 56-1302; CalFire # 1-13-106HUM, Unit B) in SF Ah Pah Creek (Figure 12). The riparian management zone (RMZ) along the west side of the mainstem SF Ah Pah Creek in Unit B was marked by a forester to achieve approximately 50% overstory canopy after the trees were felled and yarded out of the RMZ. Trees marked for harvest included alder, maple, bay, tanoak, hazelnut, and cascara. The marked trees with commercial value were yarded out of the RMZ, wherever feasible. Felling of the harvest unit was completed on March 31, 2015 and yarding was completed by April 3, 2016.

The stream reach immediately upstream of the treated RMZ served as a control for all the physical variables recorded in and immediately downstream of the treated reach. A 100-m reach immediately above and below the treated reach served as biological control areas for recording movement and growth response of marked juvenile cutthroat and steelhead trout and coastal giant salamanders (Figure 12).

Habitat mapping and animal sampling occurred in August 2014 and February 2015 to assess pre-treatment fish growth rates during what was believed to be a low growth rate period (Late fall / Early winter) (Figure 13). Post-treatment data collection occurred bimonthly from May 2015 until February 2018 (Figure 13).

Hemispherical photographs were taken in September 2014 (during leaf-on conditions) and January 2015 (during leaf-off conditions) to assess pre-treatment canopy closure and solar radiation in the control and treatment reaches (Figure 13). Post-treatment, from fall of 2015 to spring of 2018, there were six rounds (3 leaf-on and 3 leaf-off) of hemispherical photographs taken. Photographs are processed and analyzed using Hemi-View 2.1 software (Dynamax Inc., 1999).

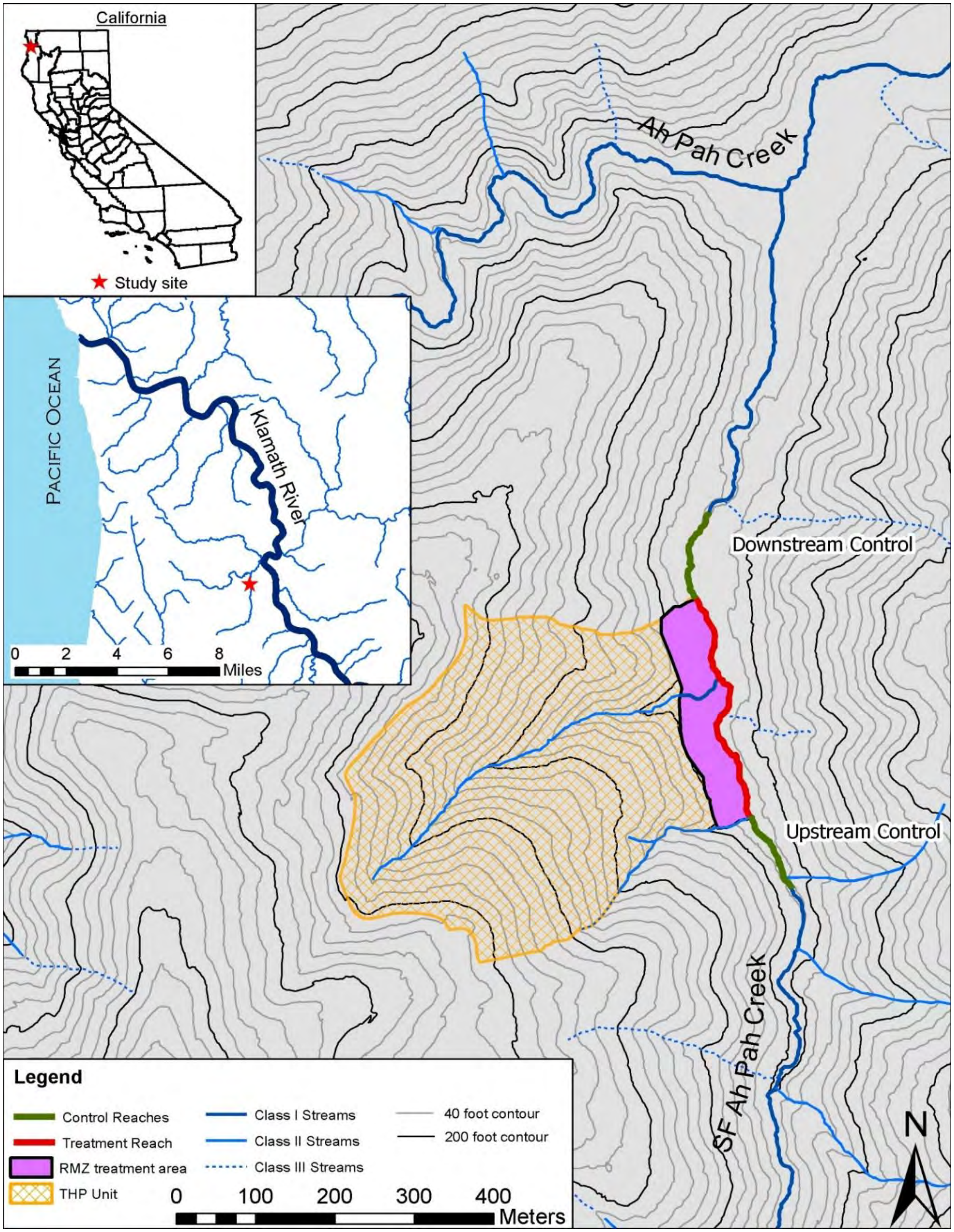

Figure 12. Overview map of treatment area and study reaches associated with the Pilot Project in SF Ah Pah Creek.

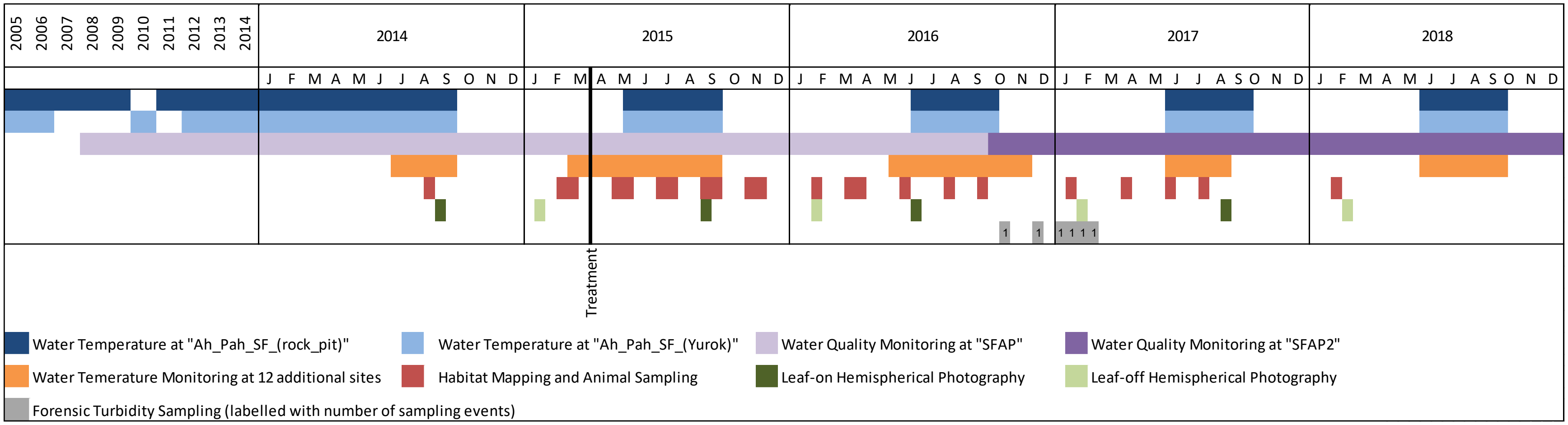

Figure 13. Chronological summary of key monitoring activities associated with the Pilot Project in SF Ah Pah Creek. From 1995 through 2014, the water temperature monitoring was generally conducted from April to October.

Two of GDRCo's summer water temperature sites, one upstream (Ah_Pah_SF_(Yurok)) and one downstream (Ah_Pah_SF_(rock_pit)) of the treatment reach, have been monitored for 13 years and 10 years, respectively. In 2014, as part of a graduate student project from HSU (Wick 2016), 12 additional summer water temperature sites (Ah_Pah_SF_4 through Ah_Pah_SF_15) were deployed to get a finer detailed assessment of water temperature conditions prior to treatment within the project area. All 14 of these sites were also monitored from 2015 through 2018 to assess water temperature conditions post-treatment (Figure 13).

Water quality characteristics (stage, discharge, turbidity and suspended sediment concentration) have been monitored from water year 2008-2015 (October – September; WY) downstream of the treatment reach as part of GDRCo's annual monitoring. This same monitoring was also conducted in WY 2016 and 2017 to assess any differences post-treatment. The site was moved upstream approximately 340 feet due to changes in the channel configuration that compromised the quality of data collection at the previous site. Additionally, starting in WY 2017, "forensic turbidity sampling" was conducted following any three-inch cumulative rain event that occurred in a 24-hour period to determine if any post-treatment effect could be detected at the site scale (Figure 13). For each forensic turbidity sampling, water samples were collected manually from 9 stations whenever the three-inch rainfall threshold was met.

Some preliminary results and observations from this pilot project were presented in the 6th Biennial Report (GDRCo 2019) and were reviewed with the Services. The Services were satisfied with these preliminary results to justify proceeding with the watershed level experiments in Class I watercourses (see the Tectah Creek Riparian Canopy Experiment in Section VIII.D.3) and Class II watercourses (see the Effectiveness of Class II Riparian Prescriptions in Section VIII.D.4).

3. Tectah Creek Riparian Canopy Experiment

The Tectah Creek Riparian Canopy Experiment is a watershed level project located on GDRCo's ownership in Tectah Creek, tributary to the Lower Klamath River Basin. The riparian treatment areas were incorporated into a Timber Harvesting Plan (GDRCo # 56-1601; CalFire # 1-16-091HUM) in Upper Tectah Creek (Figure 14). The target overstory canopy retention level post-harvest within the treatment reaches was 50%. Based on information learned from the pilot project in SF Ah Pah Creek, canopy was removed along both sides of the stream in each treatment reach to ensure adequate solar radiation reached the stream to observe a treatment response. Trees marked for harvest included alder, maple, tanoak, madrone, Douglas-fir, redwood, and hemlock. The marked trees with commercial value were yarded out of the RMZs, wherever feasible. Stream reaches immediately upstream of the experimental RMZs served as the control

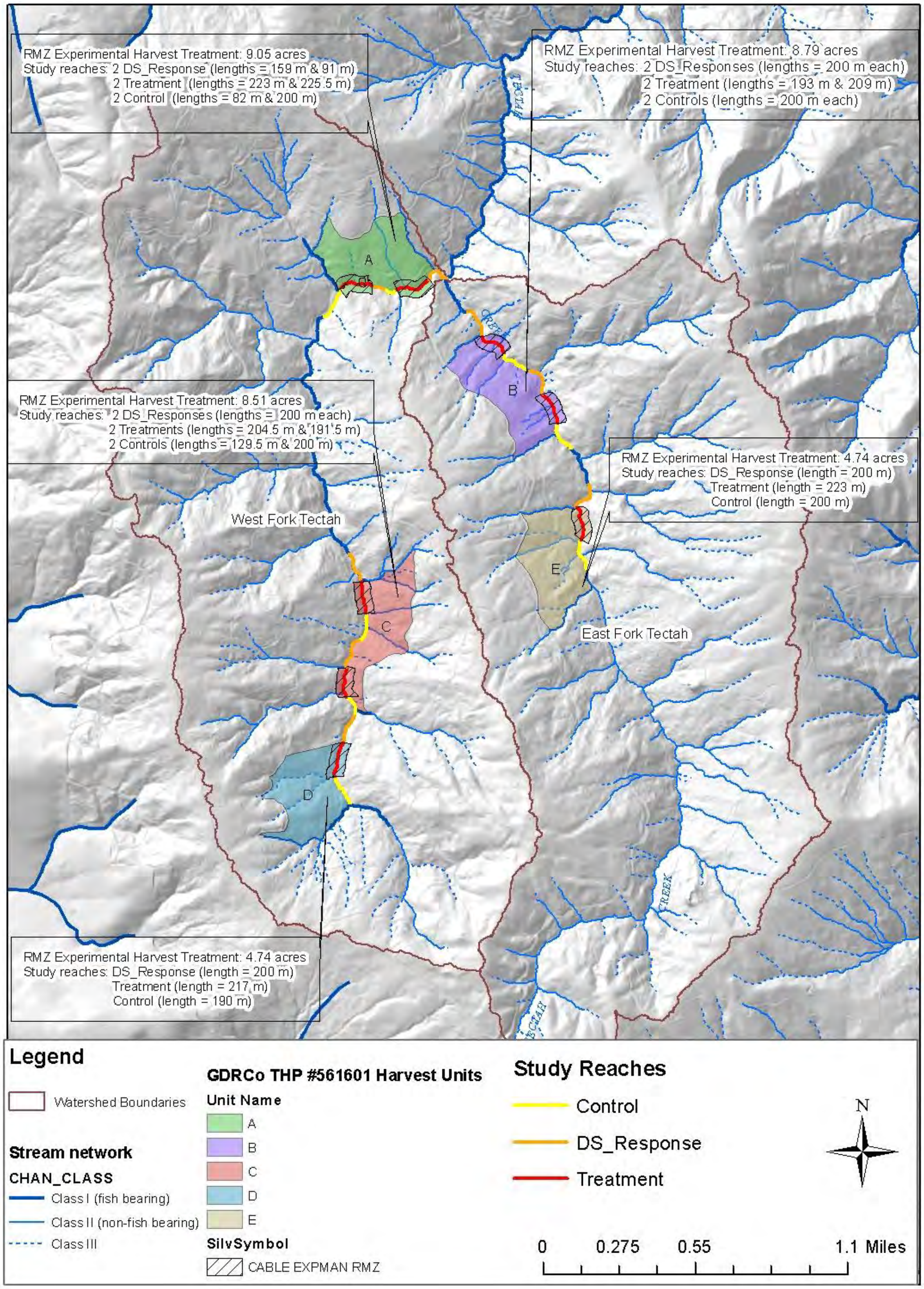

Figure 14. Map of experimental thinning treatments in Upper Tectah Creek.

for each harvest unit and the stream reach immediately downstream of the treated RMZs served as the downstream response for each harvest unit (Figure 14). Monitoring associated with this experiment was conducted in conjunction with a research project by David Roon (PhD candidate from Oregon State University), whose dissertation research also included studying the riparian thinning restoration that was conducted along Middle Fork Lost Man Creek in Redwood Nation Park.

Objectives

The objectives of the study are to 1) determine how changes in canopy cover and light associated with riparian thinning will affect thermal regimes within the stream network, 2) determine how stream food web structure shifts to changing riparian canopy conditions associated with the experimental thinning treatments, 3) determine if thermal or trophic pathways are responsible for driving potential changes in growth, production, and bioenergetics for cutthroat trout, and 4) evaluate cumulative watershed effects associated with riparian thinning for aquatic ecosystems using a food web system dynamics model. David Roon's research proposal was provided in Appendix D of the 5th Biennial Report (GDRCo 2017).

Project Status

Pre-treatment data collection for the project began in 2015 and 2016. Felling and yarding activities of the harvest units were completed during 2017. Post-harvest data collection began during late summer 2017 and was completed during the fall of 2018. Current activities are focused on data analysis and writing.

Data are currently being processed and analyzed. Dave Roon's dissertation on the Tectah Creek riparian experiment is expected to be completed in spring of 2021. The dissertation will include four chapters:

- Chapter 1: Shade, light, and stream temperature responses to riparian thinning in second-growth redwood forests of northern California.

  This chapter evaluates the reach-scale responses of riparian shade, light, and stream temperature to riparian thinning. Stream thermal responses were characterized seasonally and across multiple components of the thermal regime.

  This chapter was recently published in PLoS ONE: Roon et al. 2021

- Chapter 2: Thermal responses to riparian thinning in forested streams at multiple spatiotemporal scales

  This chapter evaluates the watershed-scale patterns in stream temperature in response to riparian thinning. It evaluates the temporal duration and spatial extent of local and downstream temperature responses to riparian thinning across multiple spatial and temporal scales.

This chapter has been written and is under review. It is expected to be submitted to a journal for peer-review in March 2021.

- Chapter 3: Effects of riparian thinning on trophic pathways supporting stream food webs

  This chapter evaluates the effects of riparian thinning on the trophic pathways supporting stream food webs. It evaluates how increases in light associated with thinning influences stream food webs and combines data on stream periphyton, macroinvertebrates in the diets of coastal cutthroat trout and coastal giant salamander, and stable isotopes.

  Data analysis and writing for this chapter is ongoing. This chapter is expected to be submitted to a journal for peer-review late spring 2021.

- Chapter 4: Growth and bioenergetic responses of coastal cutthroat trout to riparian thinning

  This chapter evaluates whether changes in temperature or prey resources associated with thinning influenced growth and bioenergetic responses by coastal cutthroat trout. This chapter will combine results from the previous chapters with growth data and bioenergetics modeling.

  Data analysis and writing for this chapter is ongoing. This chapter is expected to be submitted to a journal for peer-review late spring or summer 2021.

David Roon has presented this research at a variety of scientific meetings and symposiums in 2019 and 2020:

- Thermal responses to riparian thinning in redwood headwater streams at multiple spatial scales:
  - Headwater Stream Symposium; Corvallis, OR; 1/15/2019.
  - Society for Freshwater Science, Salt Lake City, UT 05/20/2019
  - American Fisheries Society national meeting, Reno, NV 10/04/2019
  - Pacific Northwest Chapter of Society for Freshwater Science, Newport, OR 11/7/2019
  - BLM OR/WA Annual Aquatics Meeting, Bend, OR 03/02/2020

- Aquatic food web responses to riparian thinning in redwood headwater streams:
  - Pacific Northwest Chapter of Society for Freshwater Science, Newport, OR 11/6/2019

- Oregon chapter of American Fisheries Society meeting, Bend, OR 03/04/2020

- Stream food web responses to riparian thinning in second-growth redwood forests:

Pacific Northwest Chapter of Society for Freshwater Science, virtual presentation 11/19/2020.

4. Forest Growth Modeling of Tectah Creek Experimental Riparian Thinning Treatments

The original study design of the Tectah Creek Riparian Canopy Experiment did not include provisions to evaluate the effects of riparian thinning on the promotion of late seral habitat for terrestrial wildlife species. To fulfill this objective California Department of Fish and Wildlife proposed and initiated a project in conjunction with the Tectah Creek Riparian Canopy Experiment to evaluate how the riparian thinning treatments associated with this study might affect the long-term development of large-diameter live trees, snags, and dead wood. Stand plots (60-foot radial) were established randomly within one of each riparian thinning treatment for each harvest unit. The plots were surveyed during the late summer of 2016 (pre-harvest) and again post-harvest during the summer of 2017. The survey protocols used were based on US Forest Service (USFS) Forest Inventory and Analysis Program Manual (USDA 2016). The plot inventory data were analyzed using the USFS Forest Vegetation Simulator (FVS) (Keyser 2016) to simulate the forest stand development of the treatments for standing, snag and downed wood diameter distributions over a 200-year time period. There were a total of 8 plots modeled using FVS; four plots received standard AHCP Class I prescriptions which included 85% overstory canopy cover within the inner 50-70 foot zone and 70% canopy covers within the remaining outer zone (AHCP Sections 6.2.1.1 and 6.2.1.2) and four plots received the experimental thinning treatment of 50% overstory canopy cover.

<u>Project Status</u>

CDFW has provided a draft report to GDRCo for review. GDRCo has provided comments to CDFW for consideration. A final version of the report is anticipated to be available at the beginning of the 2nd quarter of 2021.

5. Effectiveness of Class II Riparian Prescriptions

Green Diamond agreed to host a study, which was conceived, initiated and principally funded by the Effectiveness Monitoring Committee (EMC) of the California Board of Forestry (Board), to assess the effectiveness of the Board's recently enacted California Forest Practice Rules for Class II-L watercourses (14 CCR § Section 916.9). In their biological and geological attributes, State Class II-L watercourses are similar to Class II-2 watercourses outlined in AHCP Section

6.2.1.3. The experiment is being conducted on GDRCo property within tributaries of the Lower Klamath River watershed.

The proposed study reaches and the proposed treatments were reviewed with the Services on August 27, 2019. A letter was submitted to the Services on September 3, 2019 requesting concurrence to conduct the project under AHCP Section 6.2.54 of the Experimental Watersheds Program. On October 24, 2019, the Services provided written concurrence for the study design related to the number and location of study sites, the experimental treatments allocated to each site, including untreated controls, and the grouping of study sites for replication. The majority (12 of 18) of the proposed study sites are located within the designated Experimental Watersheds established in AHCP Section 6.2.5.4. Due to difficulties in obtaining adequate sample sizes and replication, 6 of the 18 study sites were located outside of the Experimental Watersheds; however, the treatments associated with these 6 study sites provide protections that are greater than or equal to the protections of Class II-2 watercourses provided for in AHCP Section 6.2.1.3. The full study proposal for this experiment is included in Appendix E.

Objectives

The objectives of this experiment are to evaluate if the current Class II riparian requirements/regulations are effective at maintaining, protecting, and restoring (a) canopy closure, (b) stream water temperature, and (c) primary productivity. It is also to examine what stream and riparian forest characteristics are important for determining effectiveness of the RMZs. A Before-After Control-Impact (BACI) study design is being utilized. Multiple Class II-2 (Class II-L) stream reaches are instrumented to evaluate RMZ stand structure, canopy closure, upstream/downstream water temperature, and primary productivity response under varying riparian prescriptions.

Project Status

Below is an excerpt of the status of this project from the 2020 Effectiveness Monitoring Committee Annual Report and Workplan (EMC 2020, draft). The Annual Report and Workplan summarizes the EMC's yearly accomplishments, details funding actions, provides updates on EMC membership and staffing as well as includes summary status updates on active and completed projects. The final version of the Annual Report and Workplan has not made available however the draft version is available on the EMC website (https://bof.fire.ca.gov/board-committees/effectiveness-monitoring-committee/). The EMC project number assigned to this study is EMC-2018-006:

"EMC-2018-006: Class II Watercourse and Lake Protection Zone: Drs. Kevin Bladon and Catalina Segura launched this four-year project in collaboration with Green Diamond Resource Company during the summer of 2019. There are 18 watersheds included in the study—six reference watersheds and four of each of

the three riparian treatments. Treatment watersheds were all harvested in 2020 with one of the three treatments: (a) Coastal Anadromy Salmonid Protection Zone Class II-L Prescription (30-ft core zone, 70-ft inner zone with 80% overstory canopy cover), (b) Green Diamond Resource Company Habitat Conservation Plan Prescription (30-ft inner zone with 85% overstory canopy, 70-ft outer zone with 70% overstory canopy cover), or (c) an alternative prescription resembling pre-ASP (100-ft zone with 50% overstory canopy). In 2020, we finished our pre-treatment data collection phase and initiated the postharvest data collection. We have six circular fixed-area plots in the riparian area of each watershed to quantify pre- and post-harvest tree condition, species, diameter at breast height, basal area, and canopy closure (from hemispherical photographs). At the outlet of each of the 18 streams is a pressure transducer (measures stream elevation to calculate continuous discharge), a dissolved oxygen sensor, and a photosynthetically active radiation sensor. Longitudinally, along each of the 18 streams are four air temperature sensors and 12 stream temperature sensors (288 total sensors). We also maintain two centrally located meteorological stations to quantify precipitation, air temperature, wind speed, radiation, soil moisture, and relative humidity across the region. All automated sensors have been set up to collect data at 15-minute intervals. These data will provide key knowledge on the comparative response of streamflow, physical water quality, and whole stream metabolism to the three riparian treatments. PhD student Austin Wissler has been working on the project since August 2019. Austin has completed QA/QC of the 2019 data and has begun QA/QC of the remaining pre-harvest data. He has also begun preliminary QA/QC of post-harvest data for sites that were harvested early in 2020. We also recruited a Master's student, Jonah Nicholas, to the project in fall 2020 to focus on the analysis of streamflow. Despite the challenges that the COVID-19 pandemic has presented, Austin and Jonah have continued to make several trips to Northern California to maintain the data collection effort during the 2020 treatment year and coordinate closely with the timber harvest operations. Drs. Kevin Bladon and Catalina Segura plan to provide an update to the EMC committee in early 2021 on the progress of the research project, including a virtual field tour of the study sites."

E. Protocol Updates

As allowed under the AHCP Program Flexibility (AHCP Section 6.3.5.1.1), monitoring techniques and related technology are expected to change significantly through the life of this Plan. Some monitoring approaches may be retired or replaced by more efficient and/or accurate techniques to address the same issue, and entirely new approaches may be implemented to address currently unforeseen issues. Since implementation of the Plan, modifications to some of the effectiveness monitoring field protocols have occurred. To help track the field protocol changes that have occurred to date and in the future, a summary was compiled (Table 55) and will be updated biennially.

Table 55. Summary of effectiveness monitoring protocol updates (Y = yes, N = no; field protocol modified) since AHCP implementation.

Monitoring Project Type	Project Type	Years Field Protocol Updated													
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rapid Response Monitoring	Headwaters Monitoring - Tailed Frog	N	N	N	N	N	N	Y[1]	N	Y[2]	N	N	N	N	N
	Headwaters Monitoring - Torrent Salamander	N	N	N	Y[3]	N	N	N	N	Y[2]	N	N	N	Y[4]	N
	Spawning Substrate Permeability	N	N	N	N	Y[5]									
	Road-related Surface Erosion Turbidity Monitoring	N	N	N	N	Y[6]									
Response Monitoring	Class I Channel Monitoring	N	N	N	N	N	N	N	N	Y[7]	N	N	N	N	N
	Class III Sediment Monitoring	N	N	N	N	Y[8]	N	N	Y[5]						
Long-term Trend Monitoring/Research	Out-migrant Trapping	N	N	N	N	N	N	N	N	Y[9]	N	N	N	N	N
	10 Year Tailed Frog Occupancy Survey	N	N	N	N	N	N	N	N	N	N	N	N	Y[10]	N
	10 Year Torrent Salamander Occupancy Survey	N	N	N	N	N	N	N	N	N	N	N	N	Y[2]	N
	Road-related Mass Wasting Monitoring	N	N	N	N	Y[6]									
	Road Treatment Implementation and Effectiveness Monitoring						N[11]	N	N	N	N	N	N	N	N

[1] = A pilot project using eDNA was implemented. [2] = Switched from abundance to occupancy survey. [3] = Switched from every other year to every year sampling frequency. [4] = Switched back to sampling sites every other year. [5] = Project retired until alternative is identified. [6] = Replaced with Road Treatment Implementation and Effectiveness Monitoring. [7] = Discontinued cross section and roughness coefficient surveys. [8] = New group of sites sampled. [9] = Discontinued sampling in Ryan Creek and Railroad Creek. Also, initiated sampling in mainstem Little River. [10] = Switched from abundance to occupancy survey and added eDNA sampling. [11] = Project started in 2010 as part of the MATO and Road Management WDR. Was used to replace Road-related Surface Erosion Turbidity Monitoring and Road-related Mass Wasting Monitoring projects starting in 2012.

IX. Adaptive Management Account

The AHCP was designed to be adapted over time as GDRCo learns new information through triggering of a yellow or red light condition determined through on-going monitoring, slope stability monitoring, or through the outcome of a designed experiment in one or more of the Experimental Watersheds. As described in AHCP Section 6.2.6, adaptive management changes will be subject to the availability of the Adaptive Management Reserve Account (AMRA) and limited to changes in RMZs, SMZs and specific road management plan prescriptions. The opening balance of the AMRA was set to 1,550 Fully Stocked Acres. There were no debits or credits made to the AMRA balance during this reporting period. The balance of the AMRA, as of December 31, 2020, is 1,550 Fully Stocked Acres. Any debits and credits will be tracked on an on-going basis and the account will be summarized and updated in each biennial report.

X. Changed Circumstances

The AHCP Conservation Program was designed within the context of the forestland ecosystems in the Plan Area. These ecosystems are dynamic rather than static; they are regularly impacted by various natural physical processes that shape and reshape the habitat for the affected species that occupy those areas. The aquatic species for whose conservation the AHCP was crafted evolved in close association with this ever-changing mosaic of natural physical elements.

The natural physical processes that affect the biodiversity and landscape ecology are usually of moderate intensity and relatively confined in geographic extent and magnitude of impact. Nonetheless, natural physical processes have on occasion been of catastrophic intensity, particularly from the standpoint of impact to individual plants and animals. That these natural physical processes can significantly alter aquatic and riparian habitat has been a substantive consideration in the development of the AHCP, and this Plan was designed to minimize and mitigate management-related disturbances and create conditions that enable natural disturbances to create productive habitat.

GDRCo recognizes that the temporal and spatial configurations of future natural disturbances (and their specific related effects on the aquatic species covered under the Plan) are inherently unpredictable. The fact that certain types of natural disturbances will occur at some time during the term of the AHCP and at some location in the Plan Area is, however, reasonably foreseeable. The operating conservation program was designed, in large part, to be responsive to historical disturbance patterns. The prescriptions were intended to develop a landscape capable of delivering valuable functions in response to such natural disturbances. Therefore, the occurrence of most natural disturbances will not create conditions that should require the implementation of revised prescriptions.

Certain reasonably foreseeable disturbances, however, may be of such magnitude, occur with such frequency or impact particular portions of the Plan Area as to require the application of supplemental prescriptions for the protection of the Covered Species. These supplemental prescriptions are provided in AHCP Section 6.2.9.

There were five types of changes identified in the AHCP as potential “changed circumstances” as defined in applicable federal regulations and policies:

1. Fire covering more than 1,000 acres within the Plan Area or more than 500 acres within a single watershed within the Plan Area, but covering 10,000 acres or less;
2. Complete blow-down of more than 150 feet of previously standing timber within an RMZ, measured along the length of the stream; but less than 900 feet of trees within an RMZ, due to a windstorm;
3. Loss of 51% or more of the pre-harvest total tree basal area within any SSS, headwall swale, or Tier B Class III watercourses as a result of Sudden Oak Death (SOD) or stand treatment to control SOD;
4. Landslides that deliver more than 20,000 cubic yards and less than 100,000 cubic yards of sediment to a channel; and
5. Listing of a species that is not a Covered Species but is affected by the Covered Activities.

GDRCo did not discover nor was GDRCo made aware of any type of conditions that constitute Changed Circumstances as defined above during this reporting period.

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XII. Glossary

A. Abbreviations

AHCP	Aquatic Habitat Conservation Plan
AMRA	Adaptive Management Reserve Account
BACI	Before-After-Control-Impact
CalFire	California Department of Forestry and Fire Protection
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEG	Certified Engineering Geologist
CMZ	Channel Migration Zone
DARR	Darroch Analysis with Rank Reduction
DEM	Digital Elevation Model
DBH	diameter at breast height
DSL	Deep-Seated Landslide
EEZ	Equipment Exclusion Zone
EMC	Effectiveness Monitoring Committee
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESP	Enhancement of Survival Permit
FPRs	Forest Practice Rules
FRIS	Forest Resources Information System
FVS	Forest Vegetation Simulator
GDP	Gross Domestic Product
GDRCo	Green Diamond Resource Company
GIS	Geographic Information System
HCP	Habitat Conservation Plan
HPA	Hydrographic Planning Area
HRA	Habitat Retention Area
HWS	Headwall Swale
IA	Implementation Agreement
IFM	Intensive Forest Management
ITP	Incidental Take Permit
LiDAR	Light Detection And Ranging
LTO	Licensed Timber Operator
LWD	Large Woody Debris
MATO	Master Agreement for Timber Operations
MWA	Mass Wasting Assessment
MWPZ	Mass Wasting Prescription Zones
NCRWQCB	North Coast Regional Water Quality Control Board
NMFS	National Marine Fisheries Service
NSO	Northern Spotted Owl
PHI	Pre-Harvest Inspection
PI	Prediction Interval
PIT	Passive Integrated Transponder

PG	Professional Geologist
RMA	Routine Maintenance Area
RMWDR	Road Management Waste Discharge Requirements
RMZ	Riparian Management Zone
RPF	Registered Professional Forester
RSMZ	Riparian Slope Stability Management Zone
RWU	Road Work Unit
SMZ	Slope Stability Management Zone
SOD	Sudden Oak Death
SRL	Shallow Rapid Landslide
SSC	Suspended Sediment Concentration
SSS	Steep Streamside Slope
SSSMU	Steep Streamside Slope Morphologic Unit
THP	Timber Harvesting Plan
TMIS	Timberlands Management Information Systems
TTS	Turbidity Threshold Sampling
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
WEST Inc.	Western EcoSystems Technology Inc.
WDRs	Waste Discharge Requirements
WSFPB	State of Washington's Forest Practice Board
WY	Water Year
YOY	Young of the year
7DMAVG	highest 7-day moving mean of water temperature
7DMMX	highest 7-day moving mean of the maximum daily temperature

B. Definitions

Adaptive Management: As defined by the Services for purposes of their HCP program, a method for examining alternative strategies for meeting measurable biological goals and objectives, and then, if necessary, adjusting future conservation management actions according to what is learned (65 Federal Register 106, 36245).

Aerial logging: Movement of logs to a landing by use of helicopters, or balloons, often used where roads cannot be constructed to provide access to a harvesting unit.

Age class: One of the intervals into which the age range of trees is divided for classification or use in management.

Aggradation: Deposition in one place of material eroded from another. Aggradation raises the elevation of streambeds, floodplains, and the bottoms of other water bodies.

Alternative Geologic Prescription: Any prescription applied to a mass wasting prescription zone that deviates from the default prescriptions defined in GDRCo's AHCP.

Alternative Prescription: Excerpt from the 2013 Forest Practice Act; "(a) An alternative prescription shall be included in a THP when, in the judgment of the RPF, an alternative regeneration method or intermediate treatment offers a more effective or more feasible way of achieving the objectives of Section 913 [933, 953] than any of the standard silvicultural methods provided in this Article."

Approved Plan: All AHCP THPs with an approval date that falls within the reporting period. These THPs are queried and provide data for the THP summary tables in the AHCP Biennial Report.

Bankfull channel width: Channel width between the tops of the most pronounced bank on either side of a stream reach where water would just begin to flow out onto the floodplain.

Basal area: The cross sectional area of a single stem, including the bark, measured at breast height (4.5 feet above the ground).

Before-After-Control-Impact (BACI): An experimental approach that utilizes a paired design with treatment and control sites. Data are collected from both experimental sites before and after the treatment and an analysis is done to determine if the relationship of the response variable(s) between the treatment and control sites differs following the treatment.

Biomass harvesting: A hazard abatement process that involves the removal of logging debris that typically is piled during active harvesting operations. The debris is removed from the harvesting area and is used as hog fuel rather than being burned on site.

Break-in-slope: See Qualifying Slope Break.

Broadcast burn: A prescribed fire allowed to burn throughout a site preparation area to prepare it for regeneration. It does not include burning of organic matter which is piled during mechanical site preparation or for hazard reduction."

Buffer: A vegetation strip or management zone of varying size, shape, and character maintained along a stream, lake, road, or different vegetation zone to minimize the impacts of actions on sensitive resources.

Cable yarding (logging): Taking logs from the stump area to a landing using an overhead system of winch-driven cables to which logs are attached with chokers.

California Forest Practice Rules (CFPRs): Rules promulgated by the California Board of Forestry and administered by the California Department of Forestry and Fire Protection governing the conduct of commercial timber operations on state and private land in California.

Candidate Conservation Agreement with Assurances (CCAA): An agreement between a non-federal property owner and the Service(s), in which the property owner commits to implement conservation measures for a proposed or candidate species or a species likely to become a candidate or proposed in the near future. The property owner also receives assurances from the Service(s) that additional conservation measures will not be required and additional land, water, or resource use restrictions will not be imposed should the currently unlisted species become listed in the future (64 Federal Register 116, 32727). The agreement accompanying with an enhancement of survival permit issued under section 10(a)(1)(A) of the ESA.

Changed Circumstances: Changes in circumstances affecting a species or geographic area covered by a conservation plan that can reasonably be anticipated by plan developers and the Services and that can be planned for (e.g., the listing of a new species, or a fire or other natural catastrophic event in areas prone to such events.). 50 CFR §§ 17.3, 222.102. Changes that will constitute Changed Circumstances, and the responses to those circumstances, are described in Plan Section 6.2. Changed Circumstances are not Unforeseen Circumstances.

Channel: Natural or artificial waterway of perceptible extent that periodically or continuously contains moving water.

Channel Migration Zones (CMZs): Current boundaries of bankfull channel along the portion of the floodplain that is likely to become part of the active channel in the next 50 years. The area of the channel defined by a boundary that generally corresponds to the modern floodplain, but may also include terraces that are subject to significant bank erosion.

Class I watercourses: All current or historical fish-bearing watercourses and/or domestic water supplies that are on site and/or within 100 feet downstream of the intake.

Class II watercourses: As used in the Plan, watercourses containing no fish, but support or provides habitat for aquatic vertebrates. Seeps and springs that support or provide habitat for aquatic vertebrates are also considered Class II watercourses with respect to the conservation measures.

Class II-1 watercourse: A subset of Class II watercourses, as illustrated in Figure 6-2 of the AHCP.

Class II-2 watercourse: A subset of Class II watercourses, as illustrated in Figure 6-2 of the AHCP.

Class III watercourses: Small seasonal channels which do not support aquatic species, but have the potential to transport sediment to Class I or II watercourses.

Clearcutting: Even-aged regeneration method where all the merchantable trees in the stand are removed in one harvest. Regeneration is accomplished by natural or artificial means.

Cobble: Substrate particles 64-256 mm in diameter. Often subclassified as small (64-128 mm) and large (128-256 mm).

Colluvial hollow: A low tract of land surrounded by steep slopes and continually filled with colluvial material, may be "U" or "V" shaped, is a source for debris flow initiation, typically found above or near the head of a watercourse and generally does not flow water annually.

Commercial harvest: Removal of merchantable trees from a stand.

Commercial thinning: Any type of thinning producing merchantable material at least equal to the value of the direct costs of harvesting and to achieve optimum diameter growth and increase the eventual product value of the remaining trees.

Completed THPs: Completed THPs for the biennial report include AHCP THPs where all units have been depleted (i.e., the felling, logging, loading, & hauling have been completed) for all the units in the timber harvest plan during the reporting period. Note: Only the last unit to be depleted needs to fall within the reporting period.

Covered Activities: Certain activities carried out by Green Diamond in the Plan Area that may result in incidental take of Covered Species and all those activities necessary to carry out the commitments reflected in the Plan's Operating Conservation Program and IA.

Covered Species: The species identified in Table 1-4 of the AHCP, which the Plan addresses in a manner sufficient to meet all of the criteria for issuing an incidental take permit under ESA Section 10(a)(1)(B) and all of the criteria for issuing an enhancement of survival permit under ESA Section 10(a)(1)(A), as applicable.

Culvert: Buried pipe structure that allows streamflow or road drainage to pass under a road.

Debris slide: A landslide of mixed particle size, predominantly dry unconsolidated material. May move fast or slow.

Deep-seated landslide: Landslides that have a basal slip plane that is relatively deep and commonly extends into bedrock. These are typically vegetated with trees and/or grass and typically move incrementally.

Degradation (streambed): Erosional removal of materials from one place to another. Degradation lowers the elevation of streambeds and floodplains.

Diameter at breast height (DBH): The diameter of a tree 4.5 feet above the ground on the uphill side of the tree.

Dissolved oxygen: Oxygen found in solution with water in streams and lakes. Solubility is generally measured in mg/l and varies with temperature, salinity, and atmospheric pressure.

Drainage: An area (basin) mostly bounded by ridges or other similar topographic features, encompassing part, most, or all of a watershed.

Drainage area: Total land area draining to any point in a stream, as measured on a map, aerial photo, or other horizontal, two-dimensional projection.

Effective date: The date(s) upon which the ITP and ESP are issued by the Services.

Enhancement of Survival Permit (ESP): A permit issued by the Service(s) pursuant to ESA Section 10(a)(1)(A) for any act that enhances the propagation or survival of a listed species that would otherwise be prohibited by ESA Section 9. The permit that authorizes incidental take of species covered by a CCAA.

Equipment Exclusion Zone (EEZ): An area where use of heavy equipment is not allowed.

Even-aged stand: A stand of trees composed of a single age class in which the range of tree ages is usually +/- 20 percent of rotation.

Even-aged harvest: The application of a combination of actions that results in the creation of even-aged stands. Clearcut, shelterwood, or seed tree cutting methods produce even-aged stands.

Feasible: Capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, operational, and technological factors, and considering what is allowable under the law.

Felling (timber): Physically cutting a tree from its stump including cutting of the felled tree into predetermined log lengths.

Fine sediment: Sediment with particle size of 2 mm and less, including sand, silt, and clay.

Floodplain: The area adjacent to the stream constructed by the river in the present climate and inundated during periods of high flow.

Forest management: The practical application of biological, physical, quantitative, managerial, economic, social, and policy principles to the regeneration, management, utilization, and conservation of forests to meet specified goals and objectives while maintaining the productivity of the forest.

Geomorphic features: Mass wasting features defined within the AHCP that include; deep-seated landslides (DSL), headwall swales (HWS), riparian slope stability management zones (RSMZ), slope stability management zones (SMZ), and shallow rapid landslides (SRL).

Gradient: Average change in vertical elevation per unit of horizontal distance.

Green Diamond's ownership: Commercial timberlands that Green Diamond owns in fee and lands owned by others subject to Green Diamond harvesting rights.

Ground-based yarding (logging): Movement of logs to a landing by use of tractors, either tracked or rubber tired (rubber-tired skidders) or shovels (hydraulic boom log loaders).

Habitat: The place, natural or otherwise, (including climate, food, cover, and water) where an animal, plant, or population naturally or normally lives and develops.

Habitat Conservation Plan (HCP). As defined in the Services' HCP Handbook, a planning document that is a mandatory component of an application for an incidental take permit under ESA Section 10(a)(1)(B); also known as a conservation plan. The document that, among other things, identifies the operating conservation program that will be implemented to minimize, mitigate, and monitor the effects of incidental take on the species covered by a Section 10(a)(1)(B) permit.

Harvesting: All activities necessary to cut, remove, and transport timber products from the Plan Area.

Harvesting Rights: The rights to conduct timber operations on lands owned in fee by another. Short-term harvesting rights generally expire upon the conclusion of timber operations, upon a date certain, or a combination of the two. Perpetual harvesting rights pertain to existing and subsequent crops of timber and continue without expiration.

Hazard Abatement: The process in which the woody debris that remains after harvesting a stand of timber is removed in order to reduce fire hazard.

Headwall swales: Areas of narrow, steep, convergent topography (swales or hollows) located at the heads of Class III watercourses that have been sculpted over geologic time by repeated debris slide and debris flow events.

HPA Group: HPAs that have been grouped together based on their geologic and geomorphic characteristics for purposes applying slope stability measures.

Hydrographic Planning Area (HPA): The hydrographic areas and hydrologic units mapped in the AHCP/CCAA which encompass the Eligible Plan Area and surrounding lands in common watersheds.

Hydrological disconnection: Isolation of the road network such that drainage will not directly enter into watercourses.

Implementation Agreement (IA): An agreement between the Service(s) and the incidental take permittee(s) that identifies the obligations of the parties, identifies remedies if parties fail to meet their obligations, provides assurances to the Service(s) that the conservation plan will be implemented, and provides assurances to the permittee(s) that implementation of the plan satisfies ESA requirements for the species and activities covered by the plan and permit.

Incidental take: The taking of a federally listed species, if such taking is incidental to, and not the purpose of, carrying out otherwise lawful activities.

Incidental Take Permit (ITP): A permit issued by the Services pursuant to ESA Section 10(a)(1)(B) authorizing incidental take of federally listed species named on the permit.

Initial Plan Area: Green Diamond's ownership within the 11 HPAs as of the effective date of the Permits, as depicted in Figure 1-1 of the AHCP.

Inner Gorge: A geomorphic feature formed by coalescing scars originating by coalescing scars originating from landsliding and erosional processes caused by historically active stream erosion. The feature is identified as that area beginning immediately adjacent to the stream channel below extending up slope to the first break in the slope. Inner gorge is a subset of Steep Streamside Slopes.

Landings: The areas where harvested trees are gathered (through skidding or yarding) for subsequent transport out of the forest.

Large woody debris (LWD): Larger pieces of wood in stream channels or on the ground, including logs, root wads, and large chunks of wood that provide important biological and physical functions.

Mainline roads: Roads that support significant amounts of traffic annually from major tracts of timber or provide the main access into a tract for non-harvest management activities.

Mainstem: Principal stem of channel of a drainage system.

Management roads: Roads that are needed to either support long term management activities in the Plan Area or provide access to timber that will be harvested within the next 20 years.

Manning's roughness coefficient: A variable that represents the resistance of the bed of a stream channel to the flow of water in it.

Mass soil movement (mass wasting): All geologic processes in which masses of earth materials move downslope by gravitational forces. Includes, but is not limited to, landslides, rock falls, and debris avalanches. It does not, however, include surface erosion by running water. It may be caused by natural erosional processes, or by natural disturbances (e.g., earthquakes or fire events) or human disturbances (e.g., mining or road construction).

Mass Wasting Prescription Zones (MWPZs): Steep streamside slopes, deep-seated landslides, and headwall swales where slope stability measures will be applied.

Merchantable: Trees or stands having the size, quality, and condition suitable for marketing under a give economic condition, even if not immediately accessible for logging.

National Marine Fisheries Service (NMFS): A division of the U.S. Department of Commerce that is responsible for the stewardship of the nation's marine resources, the protection and recovery of listed marine species, and the authorization of incidental take of listed marine species.

Operating Conservation Program: As defined in 50 CFR §§ 17.3, 222.102, those conservation management activities which are expressly agreed upon and described in a conservation plan or its implementing agreement, if any, and which are to be undertaken for the affected species when implementing an approved conservation plan, including measures to respond to changed circumstances. In this Plan and the IA, the conservation management activities and specific measures (including provisions for changed circumstances, funding, monitoring, reporting, adaptive management, and dispute resolution) as set forth in Section 6.2.

Orthorectified: The process where the effects of image perspective (tilt) and relief (terrain) effects have been removed for the purpose of creating a planimetrically correct image with a constant scale.

Outmigrant: A juvenile salmonid fish that is moving downstream toward the ocean during which a physiological adaptation termed smoltification occurs thus allowing the young fish to survive in a saline environment.

Overstory: That portion of the trees, in a forest of more than one story, forming the upper or uppermost canopy layer.

Parr: Young salmonid, in the stage between alevin and smolt, that has developed distinctive dark "parr marks" on its sides and is actively feeding in fresh water.

Permanent road decommissioning: Decommissioning of a road that will not be needed for future management activities.

Permit or Permits: The incidental take permit (ITP) issued by NMFS to Green Diamond pursuant to ESA Section 10(a)(1)(B) or the enhancement of survival permit (ESP) issued by USFWS to Green Diamond pursuant to ESA Section 10(a)(1)(A) ("ESP"), or both the ITP and the ESP.

Permeability: The rate of water flow through streambed substrate (e.g., gravels).

Physiographic provinces: Geographical areas that are delineated according to common physical characteristics relating to their geology, and geomorphology.

Plan: The Aquatic Habitat Conservation Plan and Candidate Conservation Agreement with Assurances prepared by Green Diamond, dated October 2006.

Plan Area: All commercial timberland acreage within eleven Hydrographic Planning Areas (HPAs) on the west slopes of the Klamath Mountains and the Coast Range of California where Green Diamond owns fee lands and Harvesting Rights (Green Diamond's ownership), during the period of such ownership within the term of the Permits, subject to the limitations described in AHCP Section 1.3.2.3 and in the IA, and up to 100 miles of roads on lands where Green Diamond owns and exercises Road Access Rights within its approved Timber Harvesting Plan (THP) areas in the Eligible Plan Area during the term of the Plan and Permits. This is the geographic area where incidental take will be authorized, the Covered Activities will occur, and the Operating Conservation Program will be implemented. Except where stated otherwise in the Plan, references to lands, commercial timberlands, and Green Diamond's ownership in the context of the Plan Area include lands owned in fee and lands subject to harvesting rights.

Pond: A body of water smaller than a lake, sometimes artificially formed.

Pools: Pools are impoundments of flowing water in streams which are formed by structures such as bedrock, boulders, or woody debris in or adjacent to the stream channel. Velocity conditions within pools generally result in the deposition of finer sediment types.

Population: A collection of individuals that share a common gene pool.

Prescribed burning: Introduction of fire under controlled conditions to remove unwanted brush, logging slash, and/or woody debris or specified forest elements.

Professional Geologist (PG): A person who holds a valid California license as a professional geologist pursuant to California's Department of Consumer Affairs Geologist and Geophysicist Act.

Qualifying slope break: A decline in slope gradient (below the specified minimum slope gradient for the given HPA) and of sufficient distance that it may be reasonably expected to impede sediment delivery to watercourses from shallow landslides originating above the slope break.

Red light threshold: A threshold triggered by multiple negative monitoring responses (a series of yellow light triggers) indicating a more serious condition than the yellow light threshold.

Regeneration: The renewal of tree cover by natural or artificial means. Also the young tree crop (seedlings and saplings).

Registered Professional Forester (RPF): A person who holds a valid license as a professional forester pursuant to Article 3, Section 2, Division 1 of the California Public Resources Code (as in effect on the date of issuance of the Permits).

Riffle: A stream segment characterized by swiftly flowing water with surface agitation and have bars of deposited sediments. Riffles typically occur in areas of increased channel gradient where hydraulic conditions sort transported sediments (gravel, cobble, and boulders).

Riparian: That portion of the watershed or shoreline influenced by surface or subsurface waters, including stream or lake margins, marshes, drainage courses, springs, and seeps. Riparian areas usually have visible vegetative or physical characteristics reflecting the influence of water. Riversides and lake borders are typical riparian areas.

Riparian Management Zone (RMZ): A riparian buffer zone on each side of Class I or Class II watercourses that receive special treatment to provide temperature control, nutrient inputs, channel stability, sediment control, and LWD recruitment.

Riparian Slope Stability Management Zone (RSMZ): A RMZ below an SMZ or where streamside slopes exceed the minimum Steep Streamside Slope gradients. This is the SSS inner zone.

Salmonids: The taxonomic group of fishes belonging to the family Salmonidae including salmon, trout, char and graylings.

Secondary roads: Roads that support periodic traffic into portions of tracts with the level of use dependent upon location of harvest units.

Sediment: Fragments of rock, soil, and organic material transported and deposited by wind, water, or other natural phenomena.

Sedimentation: Deposition of material suspended in water or air, usually when the velocity of the transporting medium drops below the level at which the material can be supported.

Seep: An area of minor ground water outflow onto the land surface or into a stream channel; flows that are too small to be a spring.

Selection harvest: The removal or trees, individually or in small groups, from the forest.

Services: NMFS and USFWS.

Shallow-rapid landslide (SRL): Rapid landslide event that is confined to the overlying mantle of colluvium and weathered bedrock (in some instances competent bedrock) that commonly leave a bare unvegetated scar after failure. These landslides may include debris slides, debris flows, channel bank failures, and rock falls.

Silviculture: The specific methods by which a forest stand or area is harvested and regenerated over time to achieve the desired management objectives.

Size class: The categorization of trees into one of the following four DBH classes: seedling (< 1”), sapling (1" to 4.9"), pole (5" to 11.9"), sawtimber (12" and larger),

Skid trail: An access cut through the woods for skidding logs with ground-based equipment. It is not a high enough standard for use by highway vehicles, such as a log truck, and is therefore not a road.

Slash: Woody residue left on the ground after trees are felled, or accumulated there as a result of a storm, fire, or silvicultural treatment.

Slope break: See Qualifying Slope Break.

Slope Stability Management Zone (SMZ): The outer zone of an SSS zone.

Smolt: Juvenile salmonid that is undergoing physiological changes to cope with a marine environment.

Species: As defined in ESA Section 3(15), "the term 'species' included any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." Also, a population of individuals that are more or less alike and that are able to breed and produce fertile offspring under natural conditions.

Spring: An area of ground water outflow onto the land surface or into a stream channel; flows are greater than a seep.

Stand: A group of trees that possesses sufficient uniformity in composition, structure, age, spatial arrangement, or condition to distinguish it from adjacent groups.

Steep Streamside Slopes (SSS): Steep slopes located immediately adjacent to a stream channel; defined by: 1) a minimum slope gradient leading to a Class I or Class II watercourse, 2) a maximum distance from a Class I or Class II watercourse, and 3) a reasonable ability for slope failures to deliver sediment to a watercourse.

SSS zone: The area in which default prescriptions for SSS will be applied; consists of an inner zone (the RSMZ) and outer zone (the SMZ).

Stream: A natural watercourse with a well-defined channel with distinguishable bed and bank showing evidence of having contained flowing water indicated by deposit of rock, sand, gravel, or soil.

Substrate: Mineral or organic material that forms the bed of a stream.

Summer period: The period from May 15th through October 15th.

Submitted THPs: Total number of AHCP THPs that have been received by CalFire and new letters of notification have been sent to the services during the reporting period. No summary data for these THPs.

Surface erosion: Movement of soil particles down or across a slope, as a result of gravity and a moving medium such as rain or wind. The transport of sediment depends on the steepness of the slope, the texture and cohesion of the soil particles, the activity of rainsplash, sheetwash, gullying, and dry ravel processes, and the presence of vegetation.

Suspended sediment: Sediment suspended in a fluid by the upward components of turbulent currents or by colloidal suspension. That part of a stream's total sediment load carried in the water column.

Sustained yield: The yield of commercial wood that an area can produce continuously at a given intensity of management consistent with required environmental protection and which is professionally planned to achieve over time a balance between growth and removal.

Take: To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." 16 USCA § 1532(19); 50 CFR § 222.102. "Harm" means an act that actually kills or injures fish or wildlife, which act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including for USFWS species breeding, feeding or sheltering and for NMFS species breeding, spawning, rearing, migrating, feeding or sheltering. 50 CFR §§ 17.3, 222.102.

Tannic water: Water having a high level of dissolved organic compounds from leaf material which give it a dark brown color and reduce water clarity.

Temporary road construction: A road that is built and used only during a timber operation. These roads have a surface adequate for seasonal logging use and have drainage structures, if any, adequate to carry the anticipated flow of water during the period of use. Upon completion of use, all drainage structures are removed.

Temporary road decommissioning: Decommissioning a road that may be used again in the future for management activities but typically not for at least 20 years.

Thalweg: The deepest point of a stream along any channel cross section.

Thinning: A treatment made to reduce stand density of trees primarily to improve growth, enhance forest health, or recover potential mortality.

Timber harvesting: All activities necessary to cut, remove, and transport timber products from an area.

Timber Harvesting Plan (THP): A plan describing a proposed timber harvesting operation pursuant to 14 CCR section 4582 (as in effect on the date of issuance of the Permits).

Turbidity: An indicator of the amount of sediment that is suspended in water. It has been used as an expression of the optical properties of a water sample that causes light rays to be scattered and absorbed, rather than transmitted through the sample.

Watercourse: Any well-defined channel with distinguishable bed and bank showing evidence of having contained flowing water indicated by deposit of rock, sand, gravel, or soil. Watercourse also includes manmade watercourses.

Watercourse transition line: That line closest to the watercourse where perennial vegetation is permanently established.

Water drafting: Direct removal of water from a watercourse or pond into a water truck or for storage in reservoirs or tanks for use in dust abatement or fire suppression.

Watershed: The catchment area of land draining into a river, river system, or body of water; the drainage basin contributing water, organic matter, dissolved nutrients, and sediments to a stream or lake.

Winter period: The period from October 16th through May 14th.

Yarding: (Alternatively: skidding). The movement of forest products from the stump to the landing.

Young of the year (YOY): A juvenile fish that is less than one year old.

Yellow light threshold: An early warning indicator identifying and rapidly addressing a potential problem. This threshold typically can be exceeded by a single negative monitoring result.

XIII. Appendices

A. Post-Harvest Forms of Completed THPs

B. Summary Table of Road Treatment Implementation and Effectiveness Monitoring Results from 2019 and 2020

C. 2020 Summer Juvenile Salmonid Population Sampling Program - Annual Report to NMFS

D. 2020 Juvenile Salmonid Outmigrant Trapping Program, Little River - Annual Report to NMFS

E. Class II Riparian Experiment Proposal: Effectiveness of Class II Watercourse and Lake Protection Zone (WLPZ) Forest Practice Rules (FPRs) and Aquatic Habitat Conservation Plan (AHCP) Riparian Prescriptions at Maintaining or Restoring Canopy Closure, Stream Water Temperature, Primary Productivity, and Terrestrial Habitat

Appendix A

Post-Harvest Forms of Completed THPs

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 141402 **GDRCO No:** 141402

RPF: Mohrmann, Z. **CDF No:** 1-14-119H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	310706	16	13.0	2.8		
B	310707	35	26.5	8.7		
C	310705	17	14.3	1.6		0.9
D	310714	26	23.1	2.8		
E	310717	31	23.7	2.9		2.3
F	310616	35	23.9	10.2		1.3

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A Modified	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
C	SRL	II-1	-
C	SRL	II-2	1.64
F	DSL	II-2	1.00
F	DSL	II-2	4.97

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 141402 **GDRCO No:** 141402

RPF: Mohrmann, Z. **CDF No:** 1-14-119H

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
E	SRL	Alt Geology	MOD3A	0.50	0.00	Yes
	Reason Not Met?	N/A				
	Description	Selection harvesting within the buffer of the shallow-rapid Landslide LS 1.				

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 141701 **GDRCO No:** 141701

RPF: Mohrmann, Z. **CDF No:** 1-17-116H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	300301	29	21.0	7.6		
B	300308	28	10.1	17.7		
C	301222	15	12.6	2.2		
D	301216	20	16.3	3.2		
E	301209	15	13.0	1.7		
F	310724	36	30.0	1.2		4.7

Riparian

Feature	Requirements Met?
Class III Tier A	Yes
Class III Tier A Modified	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	SRL	3A	0.22
A	SRL	II-2	1.00
F	SRL	II-2	0.36

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 141701 **GDRCO No:** 141701

RPF: Mohrmann, Z. **CDF No:** 1-17-116H

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
B	SRL	Alt Geology	II-2	0.81		Yes
	Reason Not Met?	N/A				
	Description	120 ft of Basal Area				
B	DSL	Alt Geology	II-2	1.90		Yes
	Reason Not Met?	N/A				
	Description	ground based selection harvesting on a historically active deep-seated landslide.				
B	DSL	Alt Geology	MOD3A	2.36		Yes
	Reason Not Met?	N/A				
	Description	ground based selection harvesting on a historically active landslide				
B	DSL	Alt Geology	II-1	8.50		Yes
	Reason Not Met?	N/A				
	Description	Selection harvesting on historically active landslides.				
E	DSL	Alt Geology	3A	1.18		Yes
	Reason Not Met?	N/A				
	Description	Cable selection on a historically active landslide.				

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 151801 **GDRCO No:** 151801

RPF: Camper, L. **CDF No:** 1-18-085 HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	511609	31	22.9	7.6		0.4
B	511604	33	24.1	8.7		
C	511512	33	16.8	16.4		
D	511021	28	18.6	9.2		0.1
E	511006	22	13.4	8.9		
F	511004	35	8.1	17.2		9.5

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier A Modified	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
II-FPR: Class II Forest Practice Rules	Yes

Reason Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	CMZ	1F	0.03
A	CMZ	1F	0.02
A	CMZ	1F	0.28
A	RSMZ(SSS)	1F	0.89
B	RSMZ(SSS)	II-1	1.18
B	RSMZ(SSS)	II-1	0.58
B	RSMZ(SSS)	II-2	1.42
B	SMZ(SSS)	II-1	0.07
C	RSMZ(SSS)	1F	4.93
C	RSMZ(SSS)	II-2	0.85
C	RSMZ(SSS)	II-2	0.93
C	SRL	1F	0.10
C	SRL	1F	0.10
C	SRL	1F	0.10
C	SRL	1F	0.10
C	SRL	1F	0.10
C	SRL	1F	0.10
D	RSMZ(SSS)	II-1	0.32
D	RSMZ(SSS)	II-1	2.63
D	SMZ(SSS)	II-1	0.14
D	SMZ(SSS)	II-1	0.35
D	SMZ(SSS)	II-1	0.08
E	RSMZ(SSS)	II-1	0.75
F	SRL	II-1	0.13
F	SRL	II-1	0.10
F	SRL	MOD3A	0.10
F	SRL	MOD3A	0.16

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 151801 **GDRCO No:** 151801

RPF: Camper, L. **CDF No:** 1-18-085 HUM

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
C		par log suspension RMZ				Yes
	Reason Not Met?	N/A				
	Description	Within Unit C, an area has been identified where parital log suspension through the Class II RMZ is proposed.				
E		par log suspension RMZ				Yes
	Reason Not Met?	N/A				
	Description	Within Unit E, an area has been identified where partial log suspension through the Class II RMZ is proposed.				

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 171502 **GDRCO No:** 171502

RPF: Mohrmann, Z. **CDF No:** 1-15-141H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	431801	30	12.8	2.9		14.4
B	431701	16	11.3	1.1		3.8
C	430812	23	19.9	2.8		
D	431713	36	29.9	6.4		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
B	CMZ	1F	1.93
B	RSMZ(SSS)	1F	2.21
D	RSMZ(SSS)	II-2	1.25

Reason Retention Requirements Not Met:

***** N/A *****

B	CMZ	1F		
Reason Not Met:				

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 171502 **GDRCO No:** 171502

RPF: Mohrmann, Z. **CDF No:** 1-15-141H

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
C		Class III skid crossing				Yes
	Reason Not Met?	N/A				
	Description	Install a skid trail crossing on a Class III watercourse.				

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 171601

GDRCO No: 171601

RPF: Mohrmann, Z.

CDF No: 1-16-107-HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	431411	35	25.8	6.8		2.0
B	431404	33	29.7			3.5
C	432223	91				16.0
D	432219	39	26.7	11.9		0.6
E	432316	27	24.8	0.2		2.3
F	432706	24	17.9	1.9		4.1

Riparian

Feature	Requirements Met?
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 171601 **GDRCO No:** 171601

RPF: Mohrmann, Z. **CDF No:** 1-16-107-HUM

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	RSMZ(SSS)	II-1	1.13
A	RSMZ(SSS)	II-1	0.64
C	DSL	3A	0.19
C	RSMZ(SSS)	II-1	1.21
C	RSMZ(SSS)	II-2	0.58
C	SRL	II-2	0.17
D	RSMZ(SSS)	II-1	0.51
F	RSMZ(SSS)	II-2	3.00
F	SRL	II-2	0.28
F	SRL	II-2	0.13

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 171901 **GDRCO No:** 171901

RPF: Mohrmann, Z. **CDF No:** 1-19-00140-HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	430314	69	27.1	11.3		22.3
B	430418	22	19.1	1.6		0.8
C	430318	29	11.6	0.4		9.6
D	431018	5				0.9
E	431001	21	13.3	2.3		5.2
F	431016	38	29.5	8.5		
G	430917	31	27.4	2.5		0.9

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier B	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
II-FPR: Class II Forest Practice Rules	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	DSL	1F	1.19

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 171901 **GDRCO No:** 171901

RPF: Mohrmann, Z. **CDF No:** 1-19-00140-HUM

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
A	DSL	Alt Geology	1F	1.85		Yes
	Reason Not Met?	N/A				
	Description	An alternative to the default buffers and retention of a deep seated landslide.				
A	DSL	Alt Geology	1F	6.46		Yes
	Reason Not Met?	N/A				
	Description	An alternative to the default buffers and retention of a deep seated landslide.				
A	DSL	Alt Geology	1F	5.98		Yes
	Reason Not Met?	N/A				
	Description	No harvesting within Deep-Seated Landslide				
C	DSL	Alt Geology	1F	7.78		Yes
	Reason Not Met?	N/A				
	Description	An alternative to the default buffers and retention of a deep seated landslide.				
C		Class III skid crossing				Yes
	Reason Not Met?	N/A				
	Description	A Class III skid trail crossing. See RP 16 for description.				

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 181601

RPF: Smith, S.

GDRCO No: 181601

CDF No: 1-17-013H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	440618	10	8.5			1.6
B	440620	35	30.6	4.4		
C	440737	21	18.6			2.3
D	440520	19	12.6	6.0		
E	440527	15	13.3	1.2		0.3

Riparian

Feature	Requirements Met?
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
E	RSMZ(SSS)	II-1	0.45

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 261604 **GDRCO No:** 261604

RPF: Drakeford, J. **CDF No:** 1-17-002H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	620129	31	11.8	8.2		2.7
B	621219	42	16.7	10.6		3.5
C	620128	39			27.9	5.8
D	620112	32	18.0	9.3		4.9
E	620102	29	13.8			14.9
F	723620	44	17.1	4.5		

Riparian

Feature	Requirements Met?
Class I	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
II-FPR: Class II Forest Practice Rules	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	RSMZ(SSS)	1F	0.64
A	RSMZ(SSS)	1F	0.96
A	RSMZ(SSS)	1F	0.94
A	RSMZ(SSS)	II-2	2.06
A	SRL	1F	0.05
A	SRL	1F	0.24
A	SRL	1F	0.74
A	SRL	1F	0.50

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

Geology

Unit	Feature	Watercourse	Acres of Retent.	Retent. Req. Met?
A	SRL	3A	0.02	Yes
A	SRL	3A	0.09	Yes
A	SRL	II-1	0.10	Yes
A	SRL	II-2	0.13	Yes
A	SRL	II-2	0.11	Yes
A	SRL	II-2	0.41	Yes
A	SRL	II-2	0.44	Yes
B	DSL	3B	2.99	Yes
B	RSMZ(SSS)	II-2	0.94	Yes
B	SRL	1F	0.28	Yes
B	SRL	1F	0.92	Yes
B	SRL	1F	0.56	Yes
B	SRL	1F	0.24	Yes
D	RSMZ(SSS)	II-2	1.07	Yes
D	SRL	3A	0.45	Yes
D	SRL	3A	0.33	Yes
D	SRL	II-2	3.32	Yes
D	SRL	II-2	0.32	Yes
D	SRL	II-2	2.97	Yes
E	DSL	3A	3.33	Yes
E	DSL	II-2	10.65	Yes
E	DSL	II-2	0.63	Yes

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 261604 **GDRCO No:** 261604

RPF: Drakeford, J. **CDF No:** 1-17-002H

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
A		par log suspension RMZ				Yes
	Reason Not Met?	N/A				
	Description	Partial Suspension of logs through the RMZ is anticipated in THP Unit A. It is anticipated that partial suspension through the RMZ may occur as a result of yarding through the WLPZ/RMZ to access a small isolated clearcut area that is surrounded by an adjacent ownership (Caltrans Highway 299 Right of Way) and cut off by a Class II Watercourse. Full suspension will occur over the watercourse channel. Due to the complex topography exhibited in this unit it is inevitable partial suspension may occur within the outer edges of the WLPZ/RMZ. 2 designated cable corridors are proposed through the WLPZ/RMZ in Unit A where partial suspension is likely to occur. See Unit A Detail Map in Section II. Also see discussion in Item 16 above.				
C		Class III skid intrusion				Yes
	Reason Not Met?	N/A				
	Description	Class III Tractor Crossing X1. This is an existing temporary tractor crossing on a class III watercourse. Refer to THP Detail MAP and Road Points Table. This crossing was used during previous operations to access a portion of the THP, which has limited access. The crossing has diverted multiple times from two skid trails that cross the watercourse at this location. This crossing will be used for yarding and prior to the Winter period, the watercourse crossing will be repaired by eliminating diversion potential and putting the watercourse back to into the natural channel that drains to Road Point 12				
F		Class III skid crossing				Yes
	Reason Not Met?	N/A				
	Description	Class III Tractor Crossing X2. This is a proposed temporary shovel crossing on a class III watercourse. This crossing is necessary to access a portion of the THP, which has limited access.				

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 271403 **GDRCO No:** 271403

RPF: Smith, S. **CDF No:** 1-14-131H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	632201	37	30.4			6.9
B	632708	47	28.3	18.2		
C	632603	37	32.0	1.6		3.6
D	632607	41	32.1	8.2		0.5

Riparian

Feature	Requirements Met?
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
C	DSL	3A	3.55
C	DSL	3A	0.04
D	RSMZ(SSS)	II-1	0.42
D	RSMZ(SSS)	II-2	0.52
D	RSMZ(SSS)	II-2	0.58
D	RSMZ(SSS)	II-2	0.35
D	SRL	II-2	0.55
D	SRL	II-2	0.97

Reason Retention Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name:	271403	**GDRCO No:**	271403
RPF:	Smith, S.	**CDF No:**	1-14-131H

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 271702

RPF: Smith, S.

GDRCO No: 271702

CDF No: 1-17-118HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	632717	32	29.6	1.5		1.3
B	632715	36	32.8	3.3		
C	632601	33	29.8			3.1
D	633425	67			59.7	2.2
E	632618	42			34.5	1.8
F	632615	37	32.6	4.7		0.1
G	633603	41	26.2	14.5		
H	633417	33	28.4	4.3		
I	633527	47			34.3	4.8
J	633507	33	21.8	10.7		
K	633608	31	27.9	3.1		

Riparian

Feature	Requirements Met?
Class I	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Ponds	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 271702 **GDRCO No:** 271702

RPF: Smith, S. **CDF No:** 1-17-118HUM

Geology

Unit	Feature	Watercourse	Acres of Retent.
F	RSMZ(SSS)	1F	1.00
F	SRL	1F	0.10
F	SRL	1F	0.10
F	SRL	1F	0.10
F	SRL	1F	0.10
F	SRL	1F	0.54
F	SRL	1F	0.13
G	RSMZ(SSS)	1F	4.22

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 271901 **GDRCO No:** 271901

RPF: East, R. **CDF No:** 1-20-00012HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	531002	40			29.4	3.9
B	530221	58			43.3	7.3
C	530208	25	22.1			2.6
D	530220	19			17.1	

Riparian

Feature	Requirements Met?
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
II-FPR: Class II Forest Practice Rules	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

***** None *****

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 351701 **GDRCO No:** 351701

RPF: Camper, L. **CDF No:** 1-17-121HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	711622	28	24.8	3.1		
B	712211	21	3.8	16.9		0.2
C	712227	29	25.6	3.1		
D	712305	32	28.2	3.5		
E	712212	29	25.3	3.3		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier A Modified	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Ponds	Yes
Wet areas	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
B	CMZ	1F	0.26

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 351701 **GDRCO No:** 351701

RPF: Camper, L. **CDF No:** 1-17-121HUM

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
B		Class III skid intrusion				Yes
	Reason Not Met?	N/A				
	Description	Approximately 150 feet of a designated skid trail is proposed for use within the outer edge of a Class III ELZ.				
B		Use of landings within an RMZ				Yes
	Reason Not Met?	N/A				
	Description	Use of landings on roads within RMZs. In Unit B, labeled In-Lieu #1 on THP map.				

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 401701 **GDRCO No:** 401701

RPF: Camper, L. **CDF No:** 1-18-003HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	723322	13	10.1			2.8
B	723319	27	20.9	1.5		5.0
C	723323	12	10.0	1.0		0.6
D	620424	22	20.1			2.3
E	620316	17	14.3			2.2
F	620906	18	7.7	10.2		0.1
G	621419	14	1.5	12.3		
H	621506	33	20.0	8.4		4.7
I	621421	25	19.5			4.3

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier B	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 401701 **GDRCO No:** 401701

RPF: Camper, L. **CDF No:** 1-18-003HUM

Geology

Unit	Feature	Watercourse	Acres of Retent.
B	RSMZ(SSS)	1F	1.00
B	SRL	1F	0.54
B	SRL	1F	0.72
B	SRL	1F	1.46
B	SRL	1F	0.69
B	SRL	1F	0.08
F	SRL	1F	0.10
F	SRL	1F	0.01
F	SRL	II-2	0.01
F	SRL	II-2	0.01
F	SRL	II-2	0.01
F	SRL	II-2	0.01
F	SRL	II-2	0.01
F	SRL	II-2	0.01
F	SRL	II-2	0.01
F	SRL	II-2	0.01
H	RSMZ(SSS)	II-1	0.50
H	RSMZ(SSS)	II-1	1.89
H	RSMZ(SSS)	II-2	2.54
H	RSMZ(SSS)	II-2	0.22
H	SRL	II-2	0.01

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 401701

GDRCO No: 401701

RPF: Camper, L.

CDF No: 1-18-003HUM

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
B	SRL	Alt Geology	II-2	0.10		Yes
	Reason Not Met?	N/A				
	Description	This is a small landslide located in the center of Unit B where an alternative to the default prescription is proposed . This feature is a shallow rapid landslides that is located on a steep pitch in the center of the unit on approximately 65-70% slopes. It is proposed to clearcut this area.				
B	SRL	Alt Geology	II-2	0.10		Yes
	Reason Not Met?	N/A				
	Description	This is a small landslide located in the center of Unit B where an alternative to the default prescription is proposed . This feature is a shallow rapid landslides that is located on a steep pitch in the center of the unit on approximately 65-70% slopes. We propose to clearcut the slopes in this area.				

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 421602

GDRCO No: 421602

RPF: Mohrmann, Z.

CDF No: 1-16-108H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	720916	17	14.7	0.9		0.9
B	721608	31	16.2	14.6		0.3
C	721707	35	30.8	2.9		1.0
D	722109	26	23.3	0.9		1.6
E	722119	22	15.1	7.2		
F	722821	48	34.5	13.3		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 421602   **GDRCO No:** 421602

RPF: Mohrmann, Z.   **CDF No:** 1-16-108H

Geology

Unit	Feature	Watercourse	Acres of Retent.
B	RSMZ(SSS)	1F	0.07
B	RSMZ(SSS)	1F	0.20
B	RSMZ(SSS)	II-1	0.53
B	RSMZ(SSS)	II-2	0.07
B	RSMZ(SSS)	II-2	0.18
B	RSMZ(SSS)	II-2	0.22
C	RSMZ(SSS)	II-1	0.89
E	RSMZ(SSS)	II-1	0.20
E	RSMZ(SSS)	II-2	0.29
E	RSMZ(SSS)	II-2	0.55
F	RSMZ(SSS)	II-1	0.71

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 421603 **GDRCO No:** 421603

RPF: Camper, L. **CDF No:** 1-16-105H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	723513	34	30.6	2.9		
B	722620	26	22.8	3.1		
C	722612	34	26.9	7.5		
D	722622	31	27.4	3.8		
E	722327	30	21.9	8.1		
F	722320	27	22.5	4.5		
G	722204	56	25.7	26.9		3.4

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 421603

GDRCO No: 421603

RPF: Camper, L.

CDF No: 1-16-105H

Geology

Unit	Feature	Watercourse	Acres of Retent.
G	DSL	1F	0.10
G	DSL	II-2	0.22
G	DSL	II-2	1.28
G	SRL	II-2	0.16
G	SRL	II-2	0.93
G	SRL	II-2	0.28
G	SRL	II-2	1.12

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 421701

RPF: Kegerreis,J

GDRCO No: 421701

CDF No: 1-18-039H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	721716	26	20.3	6.1		0.1
B	721603	29	26.4	3.0		
C	721518	22	19.3	2.6		
D	721533	22	20.2	0.3		2.0
E	721512	30	26.8	3.4		
F	721511	23	2.8	20.4		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	CMZ	1F	0.07
F	DSL	II-1	7.34

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name:	421701	**GDRCO No:**	421701
RPF:	Kegerreis,J	**CDF No:**	1-18-039H

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 421702 **GDRCO No:** 421702

RPF: Camper, L. **CDF No:** 1-18-002HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	722717	43	27.2	14.1		1.4
B	722707	29	20.5	7.5		0.9
C	722709	39	22.6	16.3		0.3
D	723416	38	31.6	6.0		
E	723403	32	27.1	5.0		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier B	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes

Reason Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 421702 **GDRCO No:** 421702

RPF: Camper, L. **CDF No:** 1-18-002HUM

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	RSMZ(SSS)	1F	1.01
A	RSMZ(SSS)	II-2	0.64
A	RSMZ(SSS)	II-2	1.56
A	SRL	1F	0.10
A	SRL	1F	0.10
A	SRL	II-2	0.10
B	RSMZ(SSS)	II-2	2.08
B	SRL	II-2	0.62
B	SRL	II-2	0.06
B	SRL	II-2	0.78
B	SRL	II-2	0.13
B	SRL	II-2	0.37
C	RSMZ(SSS)	1F	2.88
C	RSMZ(SSS)	1F	0.63
C	SRL	1F	0.32
C	SRL	1F	0.10
D	RSMZ(SSS)	1F	4.49
D	SRL	3A	0.10
D	SRL	II-1	0.10
E	RSMZ(SSS)	II-2	2.86
E	SRL	II-2	0.10

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 421702 **GDRCO No:** 421702

RPF: Camper, L. **CDF No:** 1-18-002HUM

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
A	SRL	Alt Geology	1F	0.16		Yes
	Reason Not Met?	N/A				
	Description	There has been a reduction in the AHCP default landslide buffer due to a significant break in slope.				
A	SRL	Alt Geology	II-2	0.15		Yes
	Reason Not Met?	N/A				
	Description	There has been a reduction in the AHCP default landslide buffer due to a significant break in slope.				
A	SRL	Alt Geology	II-2	0.24		Yes
	Reason Not Met?	N/A				
	Description	There has been a reduction in the AHCP default landslide buffer due to a significant break in slope.				
A	SRL	Alt Geology	II-2	0.44		Yes
	Reason Not Met?	N/A				
	Description	There has been a reduction in the AHCP default landslide buffer due to a significant break in slope.				
A	SRL	Alt Geology	II-2	0.47		Yes
	Reason Not Met?	N/A				
	Description	There has been a reduction in the AHCP default landslide buffer due to a significant break in slope.				

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 421801 **GDRCO No:** 421801

RPF: Vanderhorst, B. **CDF No:** 1-18-00194-HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	720913	34	29.4			4.2
B	721705	33	29.2	2.2		1.8
C	721734	37	30.4	6.3		0.7
D	722113	42	29.8	12.4		
E	722021	38	30.8	6.8		0.6
F	722023	37	27.4	10.0		
G	722819	48	33.1	12.5		2.8

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Ponds	Yes
Seeps/Springs	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
C	RSMZ(SSS)	1F	0.35
C	RSMZ(SSS)	II-1	1.47
C	RSMZ(SSS)	II-2	2.17
C	RSMZ(SSS)	II-2	0.30
C	SRL	II-2	0.63
D	CMZ	1F	0.10

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

Geology

Unit	Feature	Watercourse	Acres of Retent.	Retent. Req. Met?
D	CMZ	1F	0.04	No
D	CMZ	1F	0.10	No
E	CMZ	1F	0.04	No
E	CMZ	1F	0.22	No
F	CMZ	1F	0.08	No
G	CMZ	1F	0.08	No
G	CMZ	1F	0.15	No
G	DSL	1F	1.35	Yes
G	RSMZ(SSS)	1F	0.80	Yes

Reason Retention Requirements Not Met:

***** N/A *****

D	CMZ	1F		
	Reason Not Met:			
D	CMZ	1F		
	Reason Not Met:			
D	CMZ	1F		
	Reason Not Met:			
E	CMZ	1F		
	Reason Not Met:			
E	CMZ	1F		
	Reason Not Met:			
F	CMZ	1F		
	Reason Not Met:			
G	CMZ	1F		
	Reason Not Met:			
G	CMZ	1F		
	Reason Not Met:			

AHCP Exceptions:

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 421801 | **GDRCO No:** 421801

RPF: Vanderhorst, B. | **CDF No:** 1-18-00194-HUM

Additional Comments

***** None *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 431601 **GDRCO No:** 431601

RPF: Mohrmann, Z. **CDF No:** 1-16-068H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	710112	126				2.7
B	720516	43				1.9
C	720322	29				0.6
D	711310	44	32.0	10.9		1.5
E	721916	19	17.4	2.0		

Riparian

Feature	Requirements Met?
Class III Tier A	Yes
Class III Tier A Modified	Yes
Class III Tier B	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
D	DSL	1F	1.40
D	SRL	II-1	0.01

Reason Retention Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 431601 **GDRCO No:** 431601

RPF: Mohrmann, Z. **CDF No:** 1-16-068H

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
A		Class III skid crossing				Yes
	Reason Not Met?	N/A				
	Description	Unit A is an alternative prescription which resembles a commercial thin. This unit was previously tractor yarded in the early 1980's and will be tractor thinned in this entry. This exception is to re-use 3 tractor crossings on Class III watercourses that currently are properly dipped.				
B		Class III skid intrusion				Yes
	Reason Not Met?	N/A				
	Description	Unit B is an alternative prescription which resembles a commercial thin. This unit was previously tractor yarded in the early 1980's and will be tractor thinned in this entry. This exception is to consturct a tractor crossings on Class III watercourses.				
D						Yes
	Reason Not Met?	N/A				
	Description	In Unit D, an wet area was identified in a historic through cut skid trail. The wet area is approximatley 50 ft (L) X 8 ft (W) X 10 in. deep. GDRCo aquatic biologists surveyed this wet area and identiied it as a Forest Practice Rules Class II wet area. Northwestern Salamander larvae was identifed, no other species were identified. This wet area is approximately ten feet within the adjacent Class II-1 watercourse. In Lieu #2 is proposing to reduce WLPZ protection from 50-feet to ten feet. Canopy restrictions shall meet AHCP guidelines for the adjaent watercourse, including the ten feet buffer of the wet area. Cable corridors are not permitted through the wet area.				

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 431701

GDRCO No: 431701

RPF: Camper, L.

CDF No: 1-17-089H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	822728	18	16.3	1.3		0.3
B	823306	35	21.0	13.3		0.9
C	720307	29	24.9	1.0		2.7
D	823414	21	19.3	1.9		
E	720232	31	28.3	3.0		
F	720210	27	25.0	2.4		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier B	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 431701 **GDRCO No:** 431701

RPF: Camper, L. **CDF No:** 1-17-089H

Geology

Unit	Feature	Watercourse	Acres of Retent.
B	RSMZ(SSS)	1R	4.71
B	RSMZ(SSS)	1R	7.01
B	SRL	1R	0.97
B	SRL	1R	0.15
B	SRL	1R	0.40
E	RSMZ(SSS)	II-1	0.14
E	RSMZ(SSS)	II-1	0.17
F	RSMZ(SSS)	II-1	0.18
F	RSMZ(SSS)	II-1	1.07
F	RSMZ(SSS)	II-2	0.69
F	SMZ(SSS)	II-1	0.09

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
F		Class II skid intrusion				Yes
	Reason Not Met?	N/A				
	Description	Use of 75 feet of existing skid trail within a Class II RMZ. In Unit F labeled "In-Lieu" on Unit F Detail THP map.				

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 431702 **GDRCO No:** 431702

RPF: Mohrmann, Z. **CDF No:** 1-17-148HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	813520	63				11.6
B	710215	46				16.5
C	710113	36				8.3
D	710216	65				10.3

Riparian

Feature	Requirements Met?
Class I	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
B	DSL	1F	1.50

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 441802 **GDRCO No:** 441802

RPF: Camper, L. **CDF No:** 1-19-00068-HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	722513	26	22.7	1.8		1.3
B	723610	43	18.0	18.6		6.0
C	733008	32	28.9			3.4
D	733009	24	21.0	2.1		0.5
E	733007	36	28.7	7.7		
F	733036	35	27.7	5.7		1.7

Riparian

Feature	Requirements Met?
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Wet areas	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
B	RSMZ(SSS)	II-2	0.24
B	RSMZ(SSS)	II-2	0.57
B	RSMZ(SSS)	II-2	0.23
B	RSMZ(SSS)	II-2	0.30
B	RSMZ(SSS)	II-2	0.26
F	RSMZ(SSS)	II-1	0.32

Reason Retention Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 441802 **GDRCO No:** 441802

RPF: Camper, L. **CDF No:** 1-19-00068-HUM

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
B		Class II skid intrusion				Yes
	Reason Not Met?	N/A				
	Description	The use of two segments of existing skid trails in the Class II RMZ in Unit B. These are labeled DST1 and DST2 on the Unit B Detail Map. DST1 uses approximately 20 feet of skid trail in the RMZ and DST2 uses approximately 35 feet of skid trail in the RMZ.				
B		Use of landings within an RMZ				Yes
	Reason Not Met?	N/A				
	Description	Use of landings on roads within RMZs. In Unit B, labeled "IN-LIEU1" and "Item 24(d1)" on Unit B Detail Map.				
F		Road constr. In RSMZ or SMZ				Yes
	Reason Not Met?	N/A				
	Description	Road construction in the Class II RMZ in Unit F.				

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 471407 **GDRCO No:** 471407

RPF: Crocker, K. **CDF No:** 1-14-113H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	810120	22	15.0	7.2		
B	811114	37	14.3	0.5		22.8
C	820730	43				13.1
D	820709	31	27.6	1.4		2.0
E	820729	41				
F	820723	24	17.4	6.7		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier B	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 471407 **GDRCO No:** 471407

RPF: Crocker, K. **CDF No:** 1-14-113H

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	CMZ	1F	0.20
A	CMZ	1F	0.04
A	RSMZ(SSS)	1F	1.10
A	RSMZ(SSS)	II-2	2.29
A	RSMZ(SSS)	II-2	0.46
A	SMZ(SSS)	II-2	1.25
A	SMZ(SSS)	II-2	0.17
B	FLOOD	1F	1.64

Reason Retention Requirements Not Met:

***** N/A *****

A	CMZ	1F		
	Reason Not Met:			
A	CMZ	1F		
	Reason Not Met:			
B	FLOOD	1F		
	Reason Not Met:			

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 471503 **GDRCO No:** 471503

RPF: Vanderhorst, B. **CDF No:** 1-15-101H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	911916	22	14.8	3.5		3.8
B	912904	29	16.8	1.8		9.9
C	913205	40	33.8	1.7		4.8
D	913321	20	15.0	4.6		
E	913320	18	9.6	0.3		8.6

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 471503 **GDRCO No:** 471503

RPF: Vanderhorst, B. **CDF No:** 1-15-101H

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	RSMZ(SSS)	II-1	0.46
A	RSMZ(SSS)	II-1	0.73
B	DSL	3A	7.65
E	DSL	1F	1.92
E	RSMZ(SSS)	1F	2.03
E	RSMZ(SSS)	1F	2.28
E	SRL	1F	1.32
E	SRL	1F	0.17

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 471704 **GDRCO No:** 471704

RPF: East, R. **CDF No:** 1-18-015HU&M

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	800105	26	22.1	3.8		
B	801216	24	21.3			2.5
C	801220	28	18.4	9.5		
D	810720	50	30.7	19.5		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

***** None *****

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 471706 **GDRCO No:** 471706

RPF: East, R. **CDF No:** 1-17-135HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	911732	173				44.2

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier A Modified	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Ponds	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	SRL	1R	0.19
A	SRL	3A	0.20
A	SRL	II-1	0.27
A	SRL	II-2	0.21

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 471708 **GDRCO No:** 471708

RPF: Crocker, K. **CDF No:** 1-18-010HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	912317	33	29.3	3.7		
B	912604	29	23.5	2.1		3.2
C	923103	23	19.8	3.6		
D	810213	17	10.6	6.4		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Ponds	Yes
Wet areas	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
B	RSMZ(SSS)	II-2	1.40
B	RSMZ(SSS)	II-2	1.52

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 471708 **GDRCO No:** 471708

RPF: Crocker, K. **CDF No:** 1-18-010HUM

Additional Comments

***** None *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 471709 **GDRCO No:** 471709

RPF: East, R. **CDF No:** 1-18-042H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	911717	20	17.7	0.8		1.3
B	911603	33	29.1	3.7		
C	800122	41	29.2	12.1		0.1

Riparian

Feature	Requirements Met?
Class III Tier A	Yes
Class III Tier A Modified	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
C	SRL	II-2	0.09
C	SRL	II-2	0.18

Reason Retention Requirements Not Met:

***** N/A *****

C	SRL	II-2		
Reason Not Met:				

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 471803 **GDRCO No:** 471803

RPF: Mohrmann, Z. **CDF No:** 1-18-00186-HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	810711	41	26.7	14.0		
B	810814	58	36.4	11.9		9.6
C	810910	40	23.5	16.5		
D	811018	46	30.2	16.2		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier B	
II-1: Class II 1st Order	No
II-2: Class II 2nd Order	Yes
Wet areas	

Reason Requirements Not Met:

Unit	Feature	Issue Affected	Acres Affected	Reason Not Met
	II-1: Class II 1st Order	OTHER	0.10	A minimum of 6 trees within a WLPZ were felled that were not marked. After consult with the GDRCo operations manager, the timber faller and the LTO it was determined that the faller got turned around and on the wrong side of the flagging, he thought he was falling adjacent to a Class III and not the Class II. Canopy was not brought below AHCP nor CFP requirements, however trees were felled within a WLPZ that were not marked by the RPF. The RPF initiated a site visit with CDF. CDF determined although no detrimental environmental effect occurred, the felling of the trees was in violation of the THP. The LTO recieved a violation from CDF.

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 471803 **GDRCO No:** 471803

RPF: Mohrmann, Z. **CDF No:** 1-18-00186-HUM

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	RSMZ(SSS)	II-1	0.43
A	RSMZ(SSS)	II-2	8.11
A	SMZ(SSS)	II-1	0.38
B	HWS	II-1	0.42
B	HWS	II-1	0.67
B	RSMZ(SSS)	1F	2.35
B	RSMZ(SSS)	II-1	10.08
B	SMZ(SSS)	II-1	2.07
B	SRL	II-1	2.16
C	RSMZ(SSS)	II-1	0.46
C	RSMZ(SSS)	II-2	1.32
D	RSMZ(SSS)	II-2	1.13

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
A		par log suspension RMZ				Yes
	Reason Not Met?	N/A				
	Description	Unit A may require up to two cable yarding corridors through the RMZ. Although full suspension is expected across the watercourse, partial log suspension may be required through the WLPZ (RSMZ).				
C		par log suspension RMZ				Yes
	Reason Not Met?	N/A				
	Description	Multiple cable yarding corridors are expected through a WLPZ (RMZ/RSMZ).				

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 481701 **GDRCO No:** 481701

RPF: Mohrmann, Z. **CDF No:** 1-17-091H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	822625	32	28.6	3.1		
B	822606	33	24.8	7.7		
C	823518	36	22.7	13.1		
D	823524	36	31.7	4.0		
E	823529	36	19.8	16.1		
F	823623	30	26.9	3.5		

Riparian

Feature	Requirements Met?
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 481701 **GDRCO No:** 481701

RPF: Mohrmann, Z. **CDF No:** 1-17-091H

Geology

Unit	Feature	Watercourse	Acres of Retent.
B	RSMZ(SSS)	II-1	0.84
B	RSMZ(SSS)	II-2	0.56
B	RSMZ(SSS)	II-2	0.32
C	RSMZ(SSS)	II-1	1.02
C	RSMZ(SSS)	II-2	0.49
C	RSMZ(SSS)	II-2	9.87
D	RSMZ(SSS)	II-1	0.77
D	RSMZ(SSS)	II-1	0.29
D	RSMZ(SSS)	II-2	1.75
E	RSMZ(SSS)	II-2	12.28

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
E		Use of landings within an RMZ				Yes
	Reason Not Met?	N/A				
	Description	Yarding, decking and loading logs within a WLPZ(RMZ).				

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 481703 **GDRCO No:** 481703

RPF: Crocker, K. **CDF No:** 1-17-119HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	822216	22	17.2	2.9		1.6
B	822415	30	27.1			2.4
C	822419	30	27.2			3.2
D	822526	30	27.2			3.0
E	822517	17	16.1			1.2
F	822513	18	16.4			2.0

Riparian

Feature	Requirements Met?
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	SRL	3A	1.28

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 511506 **GDRCO No:** 511506

RPF: Satterlee, B. **CDF No:** 1-16-041H

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	931702	37	24.0	12.4		0.7
B	931722	43	29.5	9.0		4.7
C	931602	34	27.4	5.6		0.6
D	931625	33	29.7	1.8		1.2
E	931611	35	14.9	19.8		0.8
F	931628	38				3.3
G	931613	37	29.0	7.6		0.8
H	931622	34	30.5	2.3		1.4
I	931811	27	15.3	11.2		0.6
J	931825	73				12.0
K	932034	29	23.3	2.9		2.5

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier B	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	RSMZ(SSS)	1F	7.22
A	RSMZ(SSS)	II-1	0.43
A	SMZ(SSS)	1F	0.46

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

Geology

Unit	Feature	Watercourse	Acres of Retent.	Retent. Req. Met?
A	SRL	1F	0.37	Yes
A	SRL	1F	0.01	Yes
A	SRL	1F	0.10	Yes
A	SRL	3A	0.98	Yes
A	SRL	3A	0.40	Yes
A	SRL	3A	0.10	Yes
A	SRL	II-1	0.23	Yes
A	SRL	II-2	0.35	Yes
B	RSMZ(SSS)	II-2	0.99	Yes
B	SRL	II-1	4.21	Yes
B	SRL	II-1	-	Yes
B	SRL	II-2	0.60	No
B	SRL	II-2	0.95	Yes
B	SRL	II-2	0.84	Yes
B	SRL	II-2	0.59	Yes
C	SRL	1F	-	Yes
C	SRL	3A	0.44	Yes
C	SRL	II-1	0.80	Yes
C	SRL	II-1	-	Yes
E	DSL	1F	-	Yes
E	DSL	II-1	12.44	Yes
E	RSMZ(SSS)	II-1	0.37	Yes
E	RSMZ(SSS)	II-2	2.19	Yes
E	RSMZ(SSS)	II-2	2.15	Yes
E	SRL	1F	-	Yes
E	SRL	II-1	-	Yes
E	SRL	II-1	0.53	Yes
E	SRL	II-1	0.22	Yes
E	SRL	II-2	0.40	Yes
F	SRL	II-2	0.03	Yes
G	RSMZ(SSS)	II-1	0.80	Yes

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

Geology

Unit	Feature	Watercourse	Acres of Retent.	Retent. Req. Met?
G	RSMZ(SSS)	II-1	1.15	Yes
G	RSMZ(SSS)	II-1	1.19	Yes
G	RSMZ(SSS)	II-2	1.01	Yes
G	SRL	II-1	1.58	Yes
G	SRL	II-2	0.01	Yes
I	SRL	1F	0.47	Yes
J	SRL	1F	0.09	Yes
K	RSMZ(SSS)	II-1	0.46	Yes
K	SRL	II-1	3.76	Yes

Reason Retention Requirements Not Met:

***** N/A *****				
B	SRL	II-2		
	Reason Not Met:			

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 511506 **GDRCO No:** 511506

RPF: Satterlee, B. **CDF No:** 1-16-041H

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
A	SRL	Alt Geology	II-1	0.15		Yes
	Reason Not Met?	N/A				
	Description	A-5 is located in the southeast portion of unit A and is comprised of a shallow rapid landslide that initiated along the outboard fill of a legacy skid road and deposited downslope approximately 130 feet. The deposited material terminates approximately 20' outside of the 75 foot class II RMZ to the east on a gentle bench comprised of approximately 15% slope.				
C	SRL	Alt Geology	II-2	0.10		Yes
	Reason Not Met?	N/A				
	Description	C-2 is located in the northwest portion of unit C and is comprised of a shallow outboard road slide and cutbank failure.				
C	SRL	Alt Geology	1F	0.06		Yes
	Reason Not Met?	N/A				
	Description	C-3 is located in the northwest portion of unit C and is comprised of a shallow rapid landslide that initiates approximately 120 feet upslope (south) of the SK-10 road and deposited material onto the road surface, which is approximately 30 feet wide at this location.				
G	SRL	Alt Geology	1F	0.35		Yes
	Reason Not Met?	N/A				
	Description	G-5 is located in the southeast portion of unit G located on a steep cutslope of SK-10 haul road. The feature is comprised of a large cutbank slide that initiates approximately 80 feet upslope (south) of the SK-10 road and deposited material onto the road surface, which is approximately 30 feet wide at this location.				
H	SRL	Alt Geology	II-2	0.17		Yes
	Reason Not Met?	N/A				
	Description	R-7 and R-8 are shallow rapid landslides associated with the outboard road fill.				
C		Class III skid crossing				Yes
	Reason Not Met?	N/A				
	Description	Skid road crossing on Class III watercourse.				
J		Class III skid crossing				Yes
	Reason Not Met?	N/A				
	Description	Skid road crossing on Class III watercourse.				

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 511701 **GDRCO No:** 511701

RPF: Cody,Reid **CDF No:** 1-17-134HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	921108	34	28.8	5.0		
B	921111	24	20.4	3.2		
C	921101	23	16.1	6.9		
D	921410	20	16.4			3.7
E	921205	18	15.9	1.2		0.6

Riparian

Feature	Requirements Met?
II-1: Class II 1st Order	
II-2: Class II 2nd Order	Yes
Ponds	
Seeps/Springs	

Reason Requirements Not Met:

***** N/A *****

Geology

***** None *****

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 511702 **GDRCO No:** 511702

RPF: Kegerreis,J **CDF No:** 1-17-137HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1032213	12	10.3			1.2
B	1032731	30	25.9	2.6		1.3
C	1032727	30	26.0			3.8
D	1032729	25	22.1	0.6		2.3
E	1032816	31	26.8	4.0		

Riparian

Feature	Requirements Met?
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

***** None *****

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 511802 **GDRCO No:** 511802

RPF: Kegerreis,J **CDF No:** 1-18-00166-HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	930729	45	26.1	19.1		
B	930840	56	29.1	23.1		4.1
C	930843	49	34.9	7.2		6.8
D	930832	30	26.7	3.2		
E	930828	46	29.8	14.6		1.2
F	1033327	23	21.3			1.9
G	1032823	27	22.0	4.6		
H	1032817	20	18.3			2.0

Riparian

Feature	Requirements Met?
Class I	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 511802 **GDRCO No:** 511802

RPF: Kegerreis,J **CDF No:** 1-18-00166-HUM

Geology

Unit	Feature	Watercourse	Acres of Retent.
B	DSL	II-1	0.93
B	SRL	II-2	0.24
B	SRL	II-2	0.20
B	SRL	II-2	0.19
B	SRL	II-2	0.10
B	SRL	II-2	0.58
B	SRL	II-2	0.25
B	SRL	II-2	0.14
B	SRL	II-2	2.01
C	DSL	II-1	4.78
C	SRL	3A	1.27
C	SRL	II-1	0.32
C	SRL	II-1	0.56
C	SRL	II-1	1.08
D	RSMZ(SSS)	II-1	0.79
E	SRL	II-1	0.51
E	SRL	II-1	0.38
E	SRL	II-1	0.08
E	SRL	II-1	0.27
E	SRL	II-1	0.15
E	SRL	II-2	0.08
E	SRL	II-2	0.08
E	SRL	II-2	0.11
E	SRL	II-2	0.10

Reason Retention Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name:	511802	**GDRCO No:**	511802
RPF:	Kegerreis,J	**CDF No:**	1-18-00166-HUM

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 511803 **GDRCO No:** 511803

RPF: Hurst, R. **CDF No:** 1-18-178HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1021620	26	23.4	1.9		1.0
B	1021628	26	22.8	3.6		
C	1022124	36	30.4	5.7		
D	1022119	32	24.5	4.8		
E	1022127	24	16.2	7.7		

Riparian

Feature	Requirements Met?
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

***** None *****

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 511804 **GDRCO No:** 511804

RPF: Cody,Reid **CDF No:** 1-18-00190-HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1022308	50	28.4	20.5		1.1
B	1022408	39	28.1	9.5		1.7
C	1022419	32	28.2	3.7		
D	1031910	32	24.5	7.4		
E	1022506	23	21.0			2.2
F	1031907	32	15.4	8.9		7.8

Riparian

Feature	Requirements Met?
Class I	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 511804 **GDRCO No:** 511804

RPF: Cody,Reid **CDF No:** 1-18-00190-HUM

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	RSMZ(SSS)	II-2	10.32
A	SRL	II-1	0.77
A	SRL	II-2	0.27
B	SRL	II-1	0.39
B	SRL	II-1	0.13
B	SRL	II-1	0.07
B	SRL	II-1	0.15
B	SRL	II-1	0.28
B	SRL	II-1	0.25
B	SRL	II-2	0.19
B	SRL	II-2	0.15
B	SRL	II-2	0.33
B	SRL	II-2	0.19
F	DSL	II-1	1.62
F	DSL	II-2	3.92
F	SRL	3A	0.64
F	SRL	3A	0.13
F	SRL	II-1	0.10
F	SRL	II-1	0.05
F	SRL	II-1	0.29
F	SRL	II-1	0.15
F	SRL	II-2	1.65
F	SRL	II-2	0.06

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name:	511804	**GDRCO No:**	511804
RPF:	Cody,Reid	**CDF No:**	1-18-00190-HUM

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 561603 **GDRCO No:** 561603

RPF: Hurst, R. **CDF No:** 1-16-120HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1122109	30	26.8	3.3		
B	1122224	21	12.1	8.3		0.5
C	1122228	28	15.1	5.3		7.9
D	1122718	34	26.6	5.1		2.0
E	1122717	26	23.7	2.2		
F	1122817	40	23.0	15.4		1.3
G	1122811	36	23.7	8.7		3.4
H	1122820	108			89.2	1.6
I	1122244	51		0.6	43.9	2.9

Riparian

Feature	Requirements Met?
Class I	Yes
Class I	Yes
Class III Tier A	Yes
Class III Tier A	Yes
Class III Tier A Modified	Yes
Class III Tier A Modified	Yes
II-1: Class II 1st Order	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes
Seeps/Springs	Yes

Reason Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 561603 **GDRCO No:** 561603

RPF: Hurst, R. **CDF No:** 1-16-120HUM

Geology

Unit	Feature	Watercourse	Acres of Retent.
B	DSL	II-2	0.48
C	DSL	3A	1.18
C	DSL	II-2	1.88
C	RSMZ(SSS)	1F	3.21
C	RSMZ(SSS)	1R	0.40
C	SMZ(SSS)	1F	0.72
C	SRL	1F	0.10
C	SRL	II-2	0.22
C	SRL	II-2	0.72
D	SRL	II-2	0.65
D	SRL	II-2	0.58
D	SRL	II-2	0.06
E	SRL	II-1	0.05
F	DSL	3A	1.96
F	DSL	3A	2.37
F	SRL	1F	0.16
F	SRL	3A	0.17
F	SRL	3A	0.96
G	DSL	1F	1.97
G	DSL	1F	0.99
G	SRL	II-1	0.08
I	SRL	II-1	0.45
I	SRL	II-1	0.64
I	SRL	II-2	0.24
I	SRL	II-2	0.13

Reason Retention Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 561603 | **GDRCO No:** 561603

RPF: Hurst, R. | **CDF No:** 1-16-120HUM

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 561606 **GDRCO No:** 561606

RPF: Satterlee, B. **CDF No:** 1-16-110HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1222213	36			24.3	1.2
B	1222206	32	28.6	1.5		1.5
C	1222724	24			19.6	1.7
D	1222823	33	23.8	8.0		1.4
E	1222706	35	20.6	14.0		0.2
F	1222719	38	31.3	5.7		0.8
G	1222725	39			37.6	1.0

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier A Modified	Yes
Class III Tier B	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes
Wet areas	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 561606

GDRCO No: 561606

RPF: Satterlee, B.

CDF No: 1-16-110HUM

Geology

Unit	Feature	Watercourse	Acres of Retent.
D	RSMZ(SSS)	1F	1.81
D	SRL	1F	1.18
D	SRL	II-1	0.44
E	SRL	II-2	-
F	RSMZ(SSS)	II-2	0.59
F	RSMZ(SSS)	II-2	0.46
F	SRL	II-2	0.16
F	SRL	II-2	0.64
F	SRL	II-2	-
F	SRL	II-2	-

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 561607 **GDRCO No:** 561607

RPF: Satterlee, B. **CDF No:** 1-16-134HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1222028	22		0.3		8.2
B	1222902	47	26.0	19.9		1.2
C	1222827	19	15.8	3.1		
D	1222921	38		0.3	29.4	0.2
E	1222913	33	28.9	3.2		0.6
F	1222814	13	11.1	0.6		0.9
G	1222822	20	15.1	5.2		
H	1222906	35	18.9	15.7		0.7
I	1223227	29	20.5	7.3		1.0
J	1223208	26	23.0	3.2		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes
Wet areas	

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	CMZ	1F	0.50
A	DSL	II-1	1.07
A	DSL	II-2	0.19

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

Geology

Unit	Feature	Watercourse	Acres of Retent.	Retent. Req. Met?
A	SRL	3A	0.14	Yes
A	SRL	3A	0.25	Yes
A	SRL	II-1	0.08	Yes
B	RSMZ(SSS)	1F	0.40	Yes
B	RSMZ(SSS)	II-2	2.65	Yes
B	SMZ(SSS)	II-2	2.05	Yes
B	SRL	1F	0.20	Yes
B	SRL	1F	0.71	Yes
B	SRL	1F	0.28	Yes
B	SRL	1F	0.08	Yes
B	SRL	II-1	0.21	Yes
B	SRL	II-2	0.26	Yes
C	RSMZ(SSS)	II-1	0.74	Yes
C	SMZ(SSS)	II-1	0.21	Yes
D	SRL	II-1	0.24	Yes
D	SRL	II-1	0.28	Yes
E	RSMZ(SSS)	II-1	0.36	Yes
E	SRL	II-1	0.50	Yes
E	SRL	II-1	0.50	Yes
F	HWS	3A	0.15	Yes
H	RSMZ(SSS)	1F	4.77	Yes
H	RSMZ(SSS)	II-1	1.11	Yes
H	RSMZ(SSS)	II-2	5.16	Yes
H	SMZ(SSS)	1F	1.94	Yes
H	SMZ(SSS)	II-2	0.92	No
H	SRL	1F	0.27	Yes
H	SRL	II-2	0.38	Yes
I	DSL	II-1	0.63	Yes
I	DSL	II-1	0.13	Yes
I	RSMZ(SSS)	II-1	0.63	Yes
I	RSMZ(SSS)	II-2	1.17	Yes

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

Geology

Unit	Feature	Watercourse	Acres of Retent.	Retent. Req. Met?
I	SRL	II-2	0.14	Yes
I	SRL	II-2	0.13	Yes
I	SRL	II-2	0.12	Yes
J	SMZ(SSS)	II-2	0.21	Yes

Reason Retention Requirements Not Met:

***** N/A *****

A	CMZ	1F		
	Reason Not Met:			
H	SMZ(SSS)	II-2		
	Reason Not Met:			

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 561608

GDRCO No: 561608

RPF: Dols, T.

CDF No: 1-17-047HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1021737	193			162.0	7.5
B	1021716	33	29.0	4.0		
C	1022103	21	18.3	2.4		
D	1022130	108		0.1	99.2	3.6
E	1022104	32	28.6	2.7		0.8
F	1022115	30	26.5	1.8		1.4
G	1022131	37			33.6	0.8
H	1022825	28	24.9	1.1		2.2
I	1022909	44	32.2	9.7		1.8
J	1022805	39	29.7	8.4		0.4
K	1022226	38	26.4	7.1		2.1

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 561608 **GDRCO No:** 561608

RPF: Dols, T. **CDF No:** 1-17-047HUM

Geology

Unit	Feature	Watercourse	Acres of Retent.
D	SRL	II-2	0.10
D	SRL	II-2	0.05
E	DSL	II-1	0.56
I	RSMZ(SSS)	II-1	0.55
I	RSMZ(SSS)	II-2	0.92
J	SRL	II-2	0.35
J	SRL	II-2	0.43

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
A		Class III skid crossing				A
	Reason Not Met?	Tractor Crossings not Used in Unit A				
	Description	Within Units A and D, use of temporary tractor road crossings are proposed within Class III EEZs. These locations are identified on the THP detail map with a specific symbol, and identified in the . The existing skid trail crossing is a fill crossing on a Class III Tier A watercourse with side slopes less than 30%. Use of the tractor road crossing will allow equipment to access an otherwise isolated and un-accessible area of the unit. Other proposed tractor crossings are located at legacy skid trail crossings on Class III Tier A watercourses where a channel has established through the crossing location. Use of the skid trail crossing will allow equipment to use existing skid trails to access narrow areas between EEZs/RMZs.				
D		Class III skid crossing				Yes
	Reason Not Met?	N/A				
	Description	Within Units A and D, use of temporary tractor road crossings are proposed within Class III EEZs. These locations are identified on the THP detail map with a specific symbol, and identified in the . The existing skid trail crossing is a fill crossing on a Class III Tier A watercourse with side slopes less than 30%. Use of the tractor road crossing will allow equipment to access an otherwise isolated and un-accessible area of the unit. Other proposed tractor crossings are located at legacy skid trail crossings on Class III Tier A watercourses where a channel has established through the crossing location. Use of the skid trail crossing will allow equipment to use existing skid trails to access narrow areas between EEZs/RMZs.				

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 561610 **GDRCO No:** 561610

RPF: Smith, S. **CDF No:** 1-17-053HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1223222	35	27.1	7.4		
B	1223210	26	21.7	1.3		3.4
C	1223217	23	20.3	1.1		1.8
D	1223220	33	29.4			3.3
E	1120413	25	17.7	2.1		5.4
F	1120417	34	31.9	2.6		
G	1120416	47	33.0	13.0		1.4
H	1120423	43	29.6	3.7		9.7
I	1120803	41	30.8	10.5		
J	1120817	54	30.8	22.0		1.0

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier A Modified	Yes
Class III Tier B	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Wet areas	Yes

Reason Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	RSMZ(SSS)	II-2	0.62
B	RSMZ(SSS)	II-1	0.74
B	RSMZ(SSS)	II-1	1.15
B	SMZ(SSS)	II-1	0.70
B	SMZ(SSS)	II-1	1.20
E	RSMZ(SSS)	II-2	3.73
G	RSMZ(SSS)	II-2	6.64
G	SRL	II-1	0.30
G	SRL	II-2	0.15
G	SRL	II-2	0.21
G	SRL	II-2	0.11
G	SRL	II-2	0.11
G	SRL	II-2	0.22
H	RSMZ(SSS)	1F	6.29
H	SMZ(SSS)	1F	2.68
H	SRL	1F	0.22
H	SRL	1F	0.50
H	SRL	1F	0.54
H	SRL	1F	0.65
H	SRL	1F	1.53
J	RSMZ(SSS)	1F	0.60
J	RSMZ(SSS)	II-2	0.46
J	RSMZ(SSS)	II-2	1.02
J	SRL	1F	0.51
J	SRL	1F	0.44
J	SRL	1F	0.28
J	SRL	II-2	0.11

Reason Retention Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name:	561610	**GDRCO No:**	561610
RPF:	Smith, S.	**CDF No:**	1-17-053HUM

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 561701 **GDRCO No:** 561701

RPF: Hurst, R. **CDF No:** 1-17-065HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1221818	26	23.6			2.7
B	1222015	36	24.9	10.3		1.1
C	1221724	17	11.2	4.2		1.3
D	1222006	28	24.0	4.3		
E	1222002	32	27.7	2.9		1.6
F	1221923	29	24.1	3.5		1.5

Riparian

Feature	Requirements Met?
Class I	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 561701 **GDRCO No:** 561701

RPF: Hurst, R. **CDF No:** 1-17-065HUM

Geology

Unit	Feature	Watercourse	Acres of Retent.
B	SRL	1F	0.32
B	SRL	1F	0.20
B	SRL	1F	0.15
B	SRL	1F	0.23
B	SRL	1F	0.06
C	RSMZ(SSS)	1F	3.35
C	SMZ(SSS)	1F	2.34
C	SRL	1F	0.78
C	SRL	1F	0.79
C	SRL	1F	0.47
C	SRL	3B	0.69
C	SRL	3B	1.55
E	RSMZ(SSS)	II-1	1.54
E	RSMZ(SSS)	II-2	1.74
E	SMZ(SSS)	II-1	0.74
F	RSMZ(SSS)	II-1	0.69
F	SMZ(SSS)	II-1	0.32
F	SRL	II-1	0.13
F	SRL	II-1	0.19
F	SRL	II-1	0.59
F	SRL	II-1	0.40

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name:	561701	**GDRCO No:**	561701
RPF:	Hurst, R.	**CDF No:**	1-17-065HUM

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 561801 **GDRCO No:** 561801

RPF: Vanderhorst, B. **CDF No:** 1-18-091HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1022008	33	28.1	0.9		4.5
B	1022812	37	29.0	7.6		
C	1022814	25	19.1	4.6		1.6

Riparian

Feature	Requirements Met?
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

***** None *****

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 611601 **GDRCO No:** 611601

RPF: Cody,Reid **CDF No:** 1-17-120HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1220715	38	32.6	4.7		0.4
B	1220815	35	31.6	3.4		
C	1220818	26	22.8	2.8		0.3
D	1220805	29	23.3	2.5		2.9
E	1220931	31	15.1	15.3		0.3
F	1221722	37	32.1			5.0
G	1220820	22	15.2	2.5		4.7

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier B	
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 611601 **GDRCO No:** 611601

RPF: Cody,Reid **CDF No:** 1-17-120HUM

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	RSMZ(SSS)	II-1	0.31
D	RSMZ(SSS)	II-1	0.44
D	SMZ(SSS)	II-1	0.49
D	SMZ(SSS)	II-1	0.26
D	SRL	II-2	0.15
E	SRL	1F	0.23

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 611702 **GDRCO No:** 611702

RPF: Cody,Reid **CDF No:** 1-18-059HUM

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1211103	56	30.3	25.3		0.3
B	1211204	26	18.1	6.0		1.4
C	1211225	34	28.5	2.7		2.8
D	1211221	31	27.9	3.4		
E	1221808	44	26.9	16.1		0.9
F	1221826	37	24.7	12.4		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 611702 **GDRCO No:** 611702

RPF: Cody,Reid **CDF No:** 1-18-059HUM

Geology

Unit	Feature	Watercourse	Acres of Retent.
B	RSMZ(SSS)	II-2	1.07
B	SRL	1F	0.21
C	SRL	3A	0.20
C	SRL	3A	0.25
E	SRL	1F	0.78
E	SRL	1F	0.04
E	SRL	1F	0.12

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 661801 **GDRCO No:** 661801

RPF: Dols, T. **CDF No:** 1-18-00114DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1313517	48	33.0	11.2		3.6
B	1313417	42	28.3	8.3		5.5
C	1313521	44	19.0	20.1		4.6
D	1313423	22				4.6
E	1313424	13				3.4
F	1313419	36	24.5	11.5		
G	1313532	26	22.8	1.2		1.7
H	1313525	24	18.6	3.8		1.1
I	1210221	31	28.0	1.5		2.0

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier B	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
II-FPR: Class II Forest Practice Rules	Yes
Seeps/Springs	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 661801

RPF: Dols, T.

GDRCO No: 661801

CDF No: 1-18-00114DEL

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	SRL	II-2	0.29
A	SRL	II-2	0.13
B	DSL	1F	0.71
B	SRL	1F	0.27
B	SRL	1F	0.38
B	SRL	1F	0.27
C	SRL	II-2	0.11
H	RSMZ(SSS)	II-2	0.78
H	SRL	II-2	0.15
H	SRL	II-2	0.15

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 711701 **GDRCO No:** 711701

RPF: Kegerreis,J **CDF No:** 1-17-084DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1512918	20	16.0	3.8		
B	1512913	29	18.4	10.8		
C	1512819	28	20.9	6.0		0.8

Riparian

Feature	Requirements Met?
Class I	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 711701 **GDRCO No:** 711701

RPF: Kegerreis,J **CDF No:** 1-17-084DEL

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	SRL	II-2	0.50
C	RSMZ(SSS)	1F	0.22
C	RSMZ(SSS)	II-2	0.32
C	RSMZ(SSS)	II-2	1.08
C	RSMZ(SSS)	II-2	0.18
C	SRL	1F	0.13
C	SRL	1F	0.22
C	SRL	1F	0.19
C	SRL	1F	0.13
C	SRL	1F	0.36
C	SRL	1F	0.07
C	SRL	1F	0.08
C	SRL	1F	0.03
C	SRL	II-2	0.03
C	SRL	II-2	0.02

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 711803 **GDRCO No:** 711803

RPF: Cody,Reid **CDF No:** 1-19-00003-DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1512821	35	29.9	5.3		
B	1512917	32	28.8	0.3		2.8
C	1512825	31	27.3	3.3		
D	1513319	34	24.0	10.1		0.3
E	1513439	27	21.3	5.8		0.3
F	1513440	31	28.7	0.6		1.8
G	1513321	34	29.5	3.7		0.4
H	1513320	42	24.8	16.8		
I	1513325	38	30.6	7.1		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
G	SRL	II-1	0.24
G	SRL	II-1	0.44
G	SRL	II-1	0.08

Reason Retention Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name:	711803	**GDRCO No:**	711803
RPF:	Cody,Reid	**CDF No:**	1-19-00003-DEL

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 731701 **GDRCO No:** 731701

RPF: Satterlee, B. **CDF No:** 1-18-080DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1413637	43				7.5
B	1413627	38	29.0	7.3		1.4
C	1310224	36				2.8
D	1310113	30	25.8	2.9		1.4
E	1310107	14	5.3	5.4		3.8
F	1310226	25				0.7
G	1310122	47				5.3
H	1310124	15				1.0

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 731701 **GDRCO No:** 731701

RPF: Satterlee, B. **CDF No:** 1-18-080DEL

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	SRL	II-1	0.05
D	SRL	II-2	0.37
D	SRL	II-2	0.31
E	CMZ	1F	0.17
E	CMZ	1F	0.04
E	CMZ	1F	0.48
E	RSMZ(SSS)	1F	1.40
E	RSMZ(SSS)	II-2	0.77
E	SMZ(SSS)	1F	0.16
E	SRL	1F	0.16
E	SRL	3A	0.14
E	SRL	II-2	0.18
G	SRL	3A	0.32

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 731702

GDRCO No: 731702

RPF: Satterlee, B.

CDF No: 1-18-081 DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1412332	30	20.2	7.7		2.0
B	1412320	23	19.3	3.1		0.8
C	1412404	35	27.7	7.0		
D	1412524	31	26.8	2.0		1.9
E	1412533	18	13.1	1.9		3.1
F	1423020	15	12.8			2.5
G	1413608	35	27.4	7.1		
H	1423021	23	19.5	1.6		1.5
I	1413631	38	16.7	8.4		12.5

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 731702 **GDRCO No:** 731702

RPF: Satterlee, B. **CDF No:** 1-18-081 DEL

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	SRL	II-1	1.08
A	SRL	II-1	1.79
B	SRL	II-1	0.39
B	SRL	II-1	0.25
E	HWS	II-2	0.86
E	RSMZ(SSS)	II-2	2.06
I	DSL	1F	1.54
I	DSL	1F	9.74
I	SRL	II-1	0.22
I	SRL	II-1	0.77

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 851401 **GDRCO No:** 851401

RPF: Dobosh, B. **CDF No:** 1-14-152D

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1423319	33	19.9	5.5		7.4
B	1423329	23	20.2			2.8
C	1423325	53	24.3	22.4		6.7
D	1423312	39	28.0	0.8		3.8
E	1320418	23	19.8	1.1		2.5
F	1320427	21	18.8			2.2
G	1423337	35				1.7
H	1423338	25				4.0
I	1320433	31				0.5
J	1320434	26		0.0		6.2
K	1320929	36				

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier B	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 851401 **GDRCO No:** 851401

RPF: Dobosh, B. **CDF No:** 1-14-152D

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	SRL	II-1	-
A	SRL	II-1	-
A	SRL	II-1	0.20
A	SRL	II-1	0.16
A	SRL	II-1	0.46
C	SRL	II-1	0.04
C	SRL	II-1	2.25
C	SRL	II-1	-
C	SRL	II-1	-
C	SRL	II-1	-
C	SRL	II-1	-
C	SRL	II-1	-
C	SRL	II-2	-
C	SRL	II-2	0.13
J	DSL	II-1	1.46

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 851601 **GDRCO No:** 851601

RPF: Dobosh, B. **CDF No:** 1-17-004DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1422940	71				1.9
B	1423345	54				7.3
C	1320909	29	15.1	7.4		6.8
D	1320405	31	24.9	2.0		4.0
E	1020937	24				0.5
F	1320922	37	30.8	0.9		5.5

Riparian

Feature	Requirements Met?
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

Geology

Unit	Feature	Watercourse	Acres of Retent.
C	DSL	II-2	1.14
C	DSL	II-2	1.10
C	DSL	II-2	0.76
C	DSL	II-2	0.81
C	RSMZ(SSS)	II-2	0.85
C	SMZ(SSS)	II-2	0.09
C	SRL	II-2	0.05
D	SRL	3B	0.31
D	SRL	3B	0.53
D	SRL	II-1	0.41
D	SRL	II-1	0.30
D	SRL	II-1	0.14
D	SRL	II-1	0.36
F	DSL	II-2	5.14
F	SRL	II-2	0.85

Reason Retention Requirements Not Met:

***** N/A *****

C	DSL	II-2		
	Reason Not Met:			
C	DSL	II-2		
	Reason Not Met:			
D	SRL	3B		
	Reason Not Met:			
D	SRL	II-1		
	Reason Not Met:			
F	DSL	II-2		
	Reason Not Met:			
F	SRL	II-2		
	Reason Not Met:			

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 851601 **GDRCO No:** 851601

RPF: Dobosh, B. **CDF No:** 1-17-004DEL

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 901701 **GDRCO No:** 901701

RPF: Freeman,C **CDF No:** 1-17-131DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1802512	73			66.2	6.5
B	1803616	36	25.3	10.1		0.9
C	1813121	39	22.2	15.3		2.0
D	1813108	21	17.1	2.9		0.7

Riparian

Feature	Requirements Met?
Class I	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 901701 **GDRCO No:** 901701

RPF: Freeman,C **CDF No:** 1-17-131DEL

Geology

Unit	Feature	Watercourse	Acres of Retent.
B	RSMZ(SSS)	1F	0.53
B	SRL	1F	0.12
B	SRL	1F	0.16
B	SRL	1F	0.08
C	RSMZ(SSS)	II-1	0.20
C	RSMZ(SSS)	II-1	0.37
C	RSMZ(SSS)	II-1	0.17
C	RSMZ(SSS)	II-2	0.41
C	SRL	1F	0.43
C	SRL	1F	0.14
C	SRL	II-2	0.07
C	SRL	II-2	0.11
D	SRL	II-2	0.14
D	SRL	II-2	0.37
D	SRL	II-2	0.12

Reason Retention Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 901701 **GDRCO No:** 901701

RPF: Freeman,C **CDF No:** 1-17-131DEL

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
C	SRL	Alt Geology	1F	0.12		Yes
	Reason Not Met?	N/A				
	Description	Custom Exception: Clearcut within body of UA-2				
C	SRL	Alt Geology	1F	0.29		Yes
	Reason Not Met?	N/A				
	Description	Custom Exception: This plan proposes to use an alternative to the default prescription by flagging the slide buffers for UA1 at the break in slope (the road prism) rather than using the default of 50' off the head.				
C	SRL	Alt Geology	1F	0.15		Yes
	Reason Not Met?	N/A				
	Description	Custom Exception: This plan proposes to use an alternative to the default prescription by flagging the slide buffers for UA3 at the break in slope (the road prism) rather than using the default of 50' off the head.				

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 931604 **GDRCO No:** 931604

RPF: Freeman,C **CDF No:** 1-16-096DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1810817	44	37.0	5.8		1.3
B	1811704	33	29.9	2.1		1.1
C	1811716	42	21.8	13.3		7.2
D	1811913	39	23.6	14.5		0.7
E	1811817	22	13.1	4.4		4.6
F	1811815	50	29.2	18.2		2.2
G	1810730	81		0.3	56.9	24.0
H	1811808	23	19.0	4.2		0.3

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 931604

GDRCO No: 931604

RPF: Freeman,C

CDF No: 1-16-096DEL

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	SRL	II-2	-
C	SRL	II-2	-
C	SRL	II-2	-
C	SRL	II-2	-
C	SRL	II-2	0.23
C	SRL	II-2	0.35
D	RSMZ(SSS)		1.38
D	RSMZ(SSS)	1F	1.06
D	SRL	1F	-
E	SRL	II-2	-
F	SRL	II-1	-
F	SRL	II-1	0.11
G	SRL	II-2	0.29
H	SRL	II-2	-
H	SRL	II-2	-

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 931606 **GDRCO No:** 931606

RPF: Freeman,C **CDF No:** 1-17-043DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1913120	31	18.8	6.4		6.2
B	1913205	38	19.4	16.2		2.7
C	1913207	45	21.0	21.8		2.5
D	1913203	49	33.1	8.8		7.4
E	1810520	8	7.2			1.2
F	1810528	24	14.5	9.4		0.1
G	1810407	39	23.6	10.5		4.7
H	1913213	32		0.5	25.1	4.8
I	1913122	132		0.3	116.4	8.0
J	1810529	32		0.2	15.9	13.5
K	1810530	15			11.6	1.7

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	HWS	3A	0.34
A	SRL	II-1	0.07
B	RSMZ(SSS)	II-1	0.59

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

Geology

Unit	Feature	Watercourse	Acres of Retent.	Retent. Req. Met?
B	RSMZ(SSS)	II-2	0.98	Yes
B	RSMZ(SSS)	II-2	0.75	Yes
B	RSMZ(SSS)	II-2	0.84	Yes
B	RSMZ(SSS)	II-2	0.67	Yes
B	RSMZ(SSS)	II-2	0.53	Yes
B	SRL	II-1	0.21	Yes
B	SRL	II-1	0.14	Yes
B	SRL	II-1	0.29	Yes
B	SRL	II-2	0.04	Yes
C	RSMZ(SSS)	1F	0.24	Yes
C	RSMZ(SSS)	1F	0.07	Yes
C	RSMZ(SSS)	1F	0.09	Yes
C	RSMZ(SSS)	II-2	0.23	Yes
C	RSMZ(SSS)	II-2	0.28	Yes
C	SRL	II-2	1.92	Yes
D	RSMZ(SSS)	1F	1.29	Yes
D	RSMZ(SSS)	1F	0.61	Yes
D	SRL	II-1	0.06	Yes
D	SRL	II-2	0.06	Yes
F	SRL	II-2	0.09	Yes
F	SRL	II-2	0.19	Yes
G	DSL	II-2	0.22	Yes
G	RSMZ(SSS)	1F	0.90	Yes
G	RSMZ(SSS)	1F	0.37	Yes
G	RSMZ(SSS)	1F	0.47	Yes
G	RSMZ(SSS)	1F	0.22	Yes
G	RSMZ(SSS)	1F	1.01	Yes
G	RSMZ(SSS)	1F	0.54	Yes
G	RSMZ(SSS)	II-2	0.33	Yes
G	RSMZ(SSS)	II-2	0.11	Yes
G	RSMZ(SSS)	II-2	0.13	Yes

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

Geology

Unit	Feature	Watercourse	Acres of Retent.	Retent. Req. Met?
G	SMZ(SSS)	II-2	0.28	Yes
G	SRL	1F	0.16	Yes
G	SRL	1F	0.10	Yes
G	SRL	1F	0.26	Yes
G	SRL	II-1	0.05	Yes
H	DSL	II-1	0.58	Yes
H	DSL	II-1	0.24	Yes
H	SRL	II-1	0.52	Yes
H	SRL	II-1	0.24	Yes
H	SRL	II-1	0.03	Yes
H	SRL	II-1	0.21	Yes
I	SRL	II-1	0.66	Yes
I	SRL	II-1	0.80	Yes
J	RSMZ(SSS)	II-2	0.91	Yes
J	RSMZ(SSS)	II-2	2.20	Yes
J	SRL	1F	0.09	Yes
J	SRL	II-2	0.25	Yes
J	SRL	II-2	0.29	Yes
J	SRL	II-2	0.16	Yes
J	SRL	II-2	0.08	Yes
J	SRL	II-2	0.16	Yes
J	SRL	II-2	0.18	Yes

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 931701

RPF: Freeman,C

GDRCO No: 931701

CDF No: 1-17-108DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1811918	47	22.5	12.4		11.9
B	1812038	14	6.5	5.4		1.7
C	1812042	23	9.0	14.3		
D	1812118	13	8.5	4.3		
E	1812037	57	31.3	15.4		10.3
F	1812040	24	6.6	1.8		15.2
G	1812041	33	28.9	0.8		3.7
H	1813005	30	23.2	7.0		
I	1812923	33	29.9	3.5		

Riparian

Feature	Requirements Met?
Class I	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND
RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 931701 **GDRCO No:** 931701

RPF: Freeman,C **CDF No:** 1-17-108DEL

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	CMZ	1F	2.42
B	DSL	II-1	1.48
C	HWS	II-1	0.40
C	SRL	II-2	0.40
E	RSMZ(SSS)	II-2	3.28
E	SRL	1F	0.68
E	SRL	1F	0.44
E	SRL	II-2	0.09
F	RSMZ(SSS)	II-2	1.80
F	SRL	II-2	0.86
F	SRL	II-2	0.03
G	SRL	II-2	0.62

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 931703 **GDRCO No:** 931703

RPF: Freeman,C **CDF No:** 1-18-044DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1812911	46	27.0	4.1		15.0
B	1812907	36	16.6	13.0		6.1
C	1813217	24	18.4	5.1		0.4
D	1813219	41	22.9	16.7		1.3
E	1813227	28	11.4	0.8		15.9
F	1813229	50	20.5	5.7		23.5
G	1813118	44	26.9	17.0		
H	1813109	38	28.0	8.0		1.6
I	1813103	16	14.4			1.6
J	1803621	24	17.3	6.4		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
II-FPR: Class II Forest Practice Rules	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	RSMZ(SSS)	1F	4.61
A	SRL	1F	0.28
A	SRL	1F	1.34

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

Geology

Unit	Feature	Watercourse	Acres of Retent.	Retent. Req. Met?
A	SRL	1F	0.10	Yes
A	SRL	1F	0.56	Yes
A	SRL	1F	0.60	Yes
A	SRL	II-2	0.01	Yes
B	RSMZ(SSS)	1F	4.35	Yes
B	SRL	1F	0.59	Yes
B	SRL	1F	0.12	Yes
B	SRL	II-1	0.12	Yes
B	SRL	II-1	0.04	Yes
B	SRL	II-2	0.17	Yes
C	SRL	II-1	0.01	Yes
C	SRL	II-2	0.39	Yes
C	SRL	II-2	0.20	Yes
D	HWS	II-1	0.10	Yes
D	RSMZ(SSS)	II-2	0.33	Yes
D	SRL	1F	0.82	Yes
D	SRL	1F	0.42	Yes
D	SRL	II-1	0.08	Yes
E	CMZ	1F	0.29	Yes
E	RSMZ(SSS)	1F	2.52	Yes
E	SRL	1F	0.53	Yes
E	SRL	1F	-	Yes
E	SRL	1F	1.89	Yes
E	SRL	1F	0.10	Yes
E	SRL	II-2	0.08	Yes
E	SRL	II-2	0.11	Yes
F	DSL	II-2	0.06	Yes
F	SRL	II-1	0.09	Yes
F	SRL	II-2	0.87	Yes
F	SRL	II-2	7.11	Yes
H	CMZ	1F	0.68	Yes

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

Geology

Unit	Feature	Watercourse	Acres of Retent.	Retent. Req. Met?
H	SRL	1F	0.24	Yes
H	SRL	1F	0.52	Yes
H	SRL	II-1	0.05	Yes

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
E	SRL	Alt Geology	1F	0.36		Yes
	Reason Not Met?	N/A				
	Description	Custom Exception: This plan proposes to use an alternative to the default prescription by flagging the slide buffers for UA1 at the break in slope (the road prism) rather than using the default of 50' off the head.				
E	SRL	Alt Geology	1F	0.28		Yes
	Reason Not Met?	N/A				
	Description	Custom Exception:This plan proposes to use an alternative to the default prescription by flagging the slide buffers for UA2 at the break in slope (the road prism) rather than using the default of 50' off the head.				

Additional Comments

***** None *****

AHCP Post Harvest Report

GREEN DIAMOND RESOURCE COMPANY

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 931803

GDRCO No: 931803

RPF: Freeman,C

CDF No: 1-19-00100-DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1810918	24	20.1	3.4		0.2
B	1810804	37	29.6	7.0		0.9
C	1810813	49	25.4	20.1		3.7
D	1811707	21	19.2	2.2		
E	1811920	73		0.9	51.7	20.2
F	1813026	67			56.6	10.9

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes
Wet areas	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 931803 **GDRCO No:** 931803

RPF: Freeman,C **CDF No:** 1-19-00100-DEL

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	SRL	II-2	0.06
A	SRL	II-2	0.02
A	SRL	II-2	0.02
B	RSMZ(SSS)	II-1	0.75
C	RSMZ(SSS)	II-2	0.54
C	RSMZ(SSS)	II-2	1.45
C	SRL	II-1	0.08
C	SRL	II-1	0.02
C	SRL	II-2	0.19
C	SRL	II-2	0.28
C	SRL	II-2	0.56
C	SRL	II-2	0.39
C	SRL	II-2	0.06
C	SRL	II-2	0.14
C	SRL	II-2	0.05
C	SRL	II-2	0.25
E	RSMZ(SSS)	II-2	0.21
E	RSMZ(SSS)	II-2	1.27
E	RSMZ(SSS)	II-2	0.47
E	SRL	II-1	0.03
E	SRL	II-2	0.13
E	SRL	II-2	0.28

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name:	931803	**GDRCO No:**	931803
RPF:	Freeman,C	**CDF No:**	1-19-00100-DEL

Additional Comments

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 941701 **GDRCO No:** 941701

RPF: Dols, T. **CDF No:** 1-18-008DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1711806	36	26.7	9.5		0.1
B	1711832	29				3.7
C	1711804	40	22.3	14.2		3.4

Riparian

Feature	Requirements Met?
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
No Riparian Features	Yes
Seeps/Springs	Yes
Wet areas	Yes

Reason Requirements Not Met:

***** N/A *****

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	SRL	II-1	0.04

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
B	SRL	Alt Geology	3A	0.52		Yes
	Reason Not Met?	N/A				
	Description	Custom Exception				

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 941701 **GDRCO No:** 941701

RPF: Dols, T. **CDF No:** 1-18-008DEL

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 941702 **GDRCO No:** 941702

RPF: Dols, T. **CDF No:** 1-18-071-DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1710614	29	26.6			2.7
B	1710825	9	5.6			3.8
C	1710818	13	10.5			3.0
D	1710723	27	16.2	10.0		0.5
E	1710704	32	29.0	1.0		2.2
F	1710717	28	18.5	9.4		0.3
G	1710709	40	24.3	14.1		1.2
H	1710809	20	15.2	4.1		0.8
I	1710834	6	5.5	0.8		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 941702 **GDRCO No:** 941702

RPF: Dols, T. **CDF No:** 1-18-071-DEL

Geology

Unit	Feature	Watercourse	Acres of Retent.
D	RSMZ(SSS)	II-2	1.43
G	RSMZ(SSS)	II-2	0.51
G	SRL	II-1	0.12
G	SRL	II-1	0.05
G	SRL	II-2	0.19
G	SRL	II-2	0.15
G	SRL	II-2	0.05
G	SRL	II-2	0.10
G	SRL	II-2	0.06
G	SRL	II-2	0.58
G	SRL	II-2	0.20

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

Unit	Feature	Exception	Watercourse	Acres of Retention	Clearcut Acres	Exception Met?
G		par log suspension RMZ				A
	Reason Not Met?	Area shovel yarded. Partial suspension not necessary.				
	Description	A small area of clearcut between two Class II RMZs may not provide enough area for shovel loaders to swing logs. Additionally a large cutbank downslope makes access for equipment difficult in this narrow area.				

Additional Comments

***** None *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 941801

RPF: Freeman,C

GDRCO No: 941801

CDF No: 1-18-00158-DEL

Units

Unit	TTRRSSLL	Gross Acres	Clear Cut Acres	Selection Acres	Commercial Thin Acres	No Harvest Acres
A	1711821	41	23.2	12.5		5.7
B	1711816	25	22.6	2.0		0.6
C	1711815	36	25.3	9.7		0.9
D	1710830	28	6.8	19.5		2.0
E	1711908	43	29.1	13.5		0.2
F	1711902	29	18.2	10.4		
G	1712006	41	28.9	10.5		1.9
H	1711926	16	13.0	3.4		
I	1712014	32	28.1	2.9		0.6
J	1711919	31	26.9	0.8		3.4
K	1711917	29	24.0	4.5		0.4
L	1711930	23	17.8	5.4		0.2
M	1712914	22	17.7	3.8		

Riparian

Feature	Requirements Met?
Class I	Yes
Class III Tier A	Yes
Class III Tier B	Yes
II-1: Class II 1st Order	Yes
II-2: Class II 2nd Order	Yes
Seeps/Springs	Yes

Reason Requirements Not Met:

***** N/A *****

GREEN DIAMOND RESOURCE COMPANY

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name: 941801 **GDRCO No:** 941801

RPF: Freeman,C **CDF No:** 1-18-00158-DEL

Geology

Unit	Feature	Watercourse	Acres of Retent.
A	RSMZ(SSS)	1F	1.12
A	SRL	1F	0.06
A	SRL	II-1	0.46
A	SRL	II-1	0.72
A	SRL	II-2	0.10
A	SRL	II-2	0.22
D	DSL	1F	12.55
D	DSL	1F	4.49
D	SRL	1F	0.17
D	SRL	II-2	0.57
D	SRL	II-2	0.71
F	SRL	1F	0.11
G	RSMZ(SSS)	II-2	1.34
G	SRL	II-1	0.05
G	SRL	II-1	0.05
G	SRL	II-2	0.12
G	SRL	II-2	0.05
G	SRL	II-2	0.11
K	SRL	II-1	0.03
L	SRL	II-1	0.16
L	SRL	II-1	0.06

Reason Retention Requirements Not Met:

***** N/A *****

AHCP Exceptions:

***** None *****

AHCP Post Harvest Report

Begin Date: 1/1/2019, End Date: 12/31/2020, Status: Completed

THP Name:	941801	**GDRCO No:**	941801
RPF:	Freeman,C	**CDF No:**	1-18-00158-DEL

Additional Comments

***** None *****

Appendix B

Summary Table of Road Treatment Implementation and Effectiveness Monitoring Results from 2019 and 2020

GDRCO #	State #	Road Point	Pre-Winter Inspection Date	RPF Pre-Inspection	Post-winter Inspection Date	RPF Post-Inspection	Issues Identified	Functional Status	Notes
091501	1-15-068H	01	Sep 25 2018	J. Larrabee	Jul 12 2019	N. Ludington	No	Functional	
091501	1-15-068H	02	Sep 25 2018	J. Larrabee	Jul 12 2019	N. Ludington	No	Functional	
091501	1-15-068H	03	Sep 25 2018	J. Larrabee	Jul 12 2019	N. Ludington	No	Functional	
091501	1-15-068H	04	Sep 25 2018	J. Larrabee	Jul 12 2019	N. Ludington	No	Functional	
140901	1-09-080H	307	Sep 25 2018	J. Larrabee	Oct 8 2019	M. Cameron	No	Functional	Cutslope appears to have slid again somewhat recently.
141402	1-14-119H	PWA 135	Sep 18 2020	J. Wright			No	Functional	
141701	1-17-116H	01	Sep 25 2018	J. Larrabee	Oct 8 2019	M. Cameron	No	Functional	Cutslope appears to have slid again somewhat recently.
141701	1-17-116H	02	Sep 25 2018	J. Larrabee	Oct 8 2019	M. Cameron	No	Functional	
141701	1-17-116H	03	Sep 25 2018	J. Larrabee	Oct 8 2019	M. Cameron	No	Functional	
141701	1-17-116H	06	Sep 25 2018	J. Larrabee	Oct 8 2019	M. Cameron	No	Functional	
141701	1-17-116H	15	Sep 25 2018	J. Larrabee	Oct 8 2019	M. Cameron	No	Functional	
151601	1-16-093H	07	Oct 23 2019	L. McCullough	Oct 29 2020	N. Ludington	No	Functional	
151601	1-16-093H	09	Oct 5 2018	N. Ludington	Oct 11 2019	N. Ludington	No	Functional	
151601	1-16-093H	10	Oct 5 2018	N. Ludington	Oct 11 2019	N. Ludington	No	Functional	
151601	1-16-093H	11	Oct 2 2018	L. McCullough	Oct 8 2019	N. Ludington	No	Functional	
151801	1-18-085 HUM	03	Oct 29 2020	N. Ludington			No	Functional	
151802	1-18-161HUM	03	Aug 28 2019	Tyler Brown	Nov 19 2020	M. Lewis	No	Functional	
171601	1-16-107-HUM	3	Oct 2 2018	N. Ludington	Aug 2 2019	N. Ludington	No	Functional	
171601	1-16-107-HUM	3.1	Oct 2 2018	N. Ludington	Jul 25 2019	N. Ludington	No	Functional	
171601	1-16-107-HUM	4	Oct 2 2018	N. Ludington	Aug 2 2019	N. Ludington	No	Functional	
171601	1-16-107-HUM	5	Oct 2 2018	N. Ludington	Oct 8 2019	S. Felder	No	Functional	CMP is installed properly. Could be lower in the fill. Rock armoring is adequate. Inboard channel is seeded and strawed.
171602	1-16-138H	10	Sep 30 2020	J. Wright			No	Functional	
171602	1-16-138H	13	Sep 30 2020	J. Wright			No	Functional	
171602	1-16-138H	14	Sep 30 2020	J. Wright			No	Functional	
171602	1-16-138H	17	Sep 30 2020	J. Wright			No	Functional	
171602	1-16-138H	18	Sep 30 2020	J. Wright			No	Functional	
171602	1-16-138H	19	Sep 30 2020	J. Wright			No	Functional	

GDRCO #	State #	Road Point	Pre-Winter Inspection Date	RPF Pre-Inspection	Post-winter Inspection Date	RPF Post-Inspection	Issues Identified	Functional Status	Notes
171602	1-16-138H	21	Sep 30 2020	J. Wright			No	Functional	
171602	1-16-138H	30	Sep 9 2018	J. Wright	Aug 6 2019	Tyler Brown	No	Functional	A 24" CMP installed to standards.
171602	1-16-138H	31	Sep 9 2018	J. Wright	Aug 6 2019	Tyler Brown	No	Functional	A 48" CMP installed to standards.
171602	1-16-138H	33	Oct 1 2018	J. Wright	Aug 6 2019	Tyler Brown	No	Functional	A crossing has been removed to AHCP standards.
171801	1-18-00141-HUM	01	Sep 5 2019	Others	Sep 16 2020	M. Cameron	No	Functional	Large pond still present.
171801	1-18-00141-HUM	02	Sep 5 2019	Others	Sep 16 2020	M. Cameron	No	Functional	
171801	1-18-00141-HUM	03	Sep 10 2019	Others	Sep 16 2020	M. Cameron	No	Functional	
171801	1-18-00141-HUM	04	Sep 10 2019	Others	Sep 16 2020	M. Cameron	No	Functional	
171801	1-18-00141-HUM	05	Sep 10 2019	M. Cameron	Sep 16 2020	M. Cameron	No	Functional	
171801	1-18-00141-HUM	06	Sep 9 2019	Others	Sep 16 2020	M. Cameron	No	Functional	
171801	1-18-00141-HUM	07	Sep 9 2019	Others	Sep 16 2020	M. Cameron	No	Functional	Rock ford
171801	1-18-00141-HUM	08	Aug 29 2019	L. McCullough	Sep 16 2020	M. Cameron	No	Functional	A new culvert was installed at this location to standards. No Issues.
171801	1-18-00141-HUM	09	Aug 29 2019	L. McCullough	Sep 16 2020	M. Cameron	No	Functional	A new culvert was installed at this location to standards. No Issues.
171801	1-18-00141-HUM	10	Aug 29 2019	L. McCullough	Sep 16 2020	M. Cameron	No	Functional	This temporary crossing was removed to standards. No Issues.
171801	1-18-00141-HUM	11	Aug 29 2019	L. McCullough	Sep 16 2020	M. Cameron	No	Functional	This temporary crossing was removed to standards. No Issues.
171801	1-18-00141-HUM	12	Sep 9 2019	Others	Sep 17 2020	M. Cameron	No	Functional	
171802	1-18-00176-HUM	05	Sep 10 2019	Others	Sep 17 2020	M. Cameron	No	Functional	
171802	1-18-00176-HUM	06	Sep 10 2019	Others	Sep 17 2020	M. Cameron	No	Functional	Excavated sides on downstream side extremely steep.
171802	1-18-00176-HUM	07	Sep 10 2019	Others	Sep 17 2020	M. Cameron	No	Functional	
171802	1-18-00176-HUM	08	Sep 10 2019	Others	Sep 17 2020	M. Cameron	No	Functional	

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171802	1-18-00176-HUM	16	Sep 12 2019	Others	Sep 30 2020	N. Ludington	No	Functional	
171901	1-19-00140-HUM	03	Nov 19 2020	M. Cameron			No	Functional	
171901	1-19-00140-HUM	04	Nov 19 2020	M. Cameron			No	Functional	
171901	1-19-00140-HUM	05	Sep 30 2020	J. Wright			No	Functional	
171901	1-19-00140-HUM	06	Sep 30 2020	J. Wright			No	Functional	
171901	1-19-00140-HUM	07	Nov 19 2020	M. Cameron			No	Functional	
171901	1-19-00140-HUM	08	Nov 19 2020	M. Cameron			No	Functional	
171901	1-19-00140-HUM	12	Nov 19 2020	M. Cameron			No	Functional	
171901	1-19-00140-HUM	13	Nov 19 2020	M. Cameron			No	Functional	
171901	1-19-00140-HUM	14	Nov 19 2020	M. Cameron			No	Functional	
171901	1-19-00140-HUM	15	Nov 19 2020	M. Cameron			No	Functional	
181601	1-17-013H	01	Aug 6 2019	Tyler Brown	Jul 7 2020	N. Ludington	No	Functional	24" CMP installed to standards.
181601	1-17-013H	02	Oct 17 2019	M. Cameron	Jul 7 2020	N. Ludington	No	Functional	
181601	1-17-013H	03	Aug 6 2019	Tyler Brown	Jul 7 2020	N. Ludington	No	Functional	A 24" CMP installed to standards.
181601	1-17-013H	05	Aug 6 2019	Tyler Brown	Jul 7 2020	N. Ludington	No	Functional	A 24" CMP installed to standards.
181601	1-17-013H	06	Sep 26 2018	J. Wright	Aug 1 2019	N. Ludington	No	Functional	
181601	1-17-013H	07	Oct 1 2018	J. Wright	Aug 1 2019	N. Ludington	No	Functional	
181601	1-17-013H	08	Oct 1 2018	J. Wright	Aug 1 2019	N. Ludington	No	Functional	
181601	1-17-013H	12	Oct 17 2019	M. Cameron	Jul 7 2020	N. Ludington	No	Functional	
181601	1-17-013H	13	Oct 17 2019	M. Cameron	Jul 7 2020	N. Ludington	No	Functional	
181601	1-17-013H	14	Oct 17 2019	M. Cameron	Jul 7 2020	N. Ludington	No	Functional	
181801	1-19-00013-HUM	03	Oct 17 2019	M. Cameron	Jul 7 2020	N. Ludington	No	Functional	
181801	1-19-00013-HUM	04	Oct 17 2019	M. Cameron	Jul 7 2020	N. Ludington	No	Functional	

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181801	1-19-00013-HUM	16	Oct 17 2019	M. Cameron	Jul 7 2020	N. Ludington	No	Functional	
191601	1-16-140H	01	Oct 2 2018	Tyler Brown	Oct 8 2019	Tyler Brown	No	Functional	
191601	1-16-140H	02	Oct 2 2018	Tyler Brown	Jul 12 2019	N. Ludington	No	Functional	
191601	1-16-140H	03	Oct 1 2018	Tyler Brown	Oct 8 2019	Tyler Brown	No	Functional	
191601	1-16-140H	04.1	Oct 2 2018	Tyler Brown	Oct 8 2019	Tyler Brown	No	Functional	
191601	1-16-140H	06	Jul 12 2019	N. Ludington	Jul 7 2020	N. Ludington	No	Functional	
191601	1-16-140H	07	Jul 18 2018	J. Wright	Jul 12 2019	N. Ludington	No	Functional	
191601	1-16-140H	08	Jul 16 2018	J. Wright	Jul 12 2019	N. Ludington	No	Functional	
191601	1-16-140H	09	Jul 12 2018	J. Wright	Jul 12 2019	N. Ludington	No	Functional	
191601	1-16-140H	11	Jul 7 2018	J. Wright	Jul 12 2019	N. Ludington	No	Functional	
191602	1-17-033HUM	01	Sep 28 2018	J. Wright	Oct 8 2019	Tyler Brown	No	Functional	
191602	1-17-033HUM	02	Sep 28 2018	J. Wright	Oct 8 2019	Tyler Brown	No	Functional	
191602	1-17-033HUM	03	Sep 28 2018	J. Wright	Jul 12 2019	N. Ludington	No	Functional	
191602	1-17-033HUM	04	Jul 12 2018	J. Wright	Jul 7 2019	N. Ludington	No	Functional	
191602	1-17-033HUM	05	Sep 28 2018	J. Wright	Jul 7 2019	N. Ludington	No	Functional	
191602	1-17-033HUM	06	Sep 28 2018	J. Wright	Jul 12 2019	N. Ludington	No	Functional	
221901	1-19-00164HUM	05	Oct 23 2020	M. Cameron			No	Functional	
221901	1-19-00164HUM	06	Oct 23 2020	M. Cameron			No	Functional	
221901	1-19-00164HUM	07	Oct 23 2020	M. Cameron			No	Functional	
221901	1-19-00164HUM	10	Oct 29 2020	M. Cameron			No	Functional	
221901	1-19-00164HUM	11	Oct 23 2020	M. Cameron			No	Functional	
241701	1-17-048H	04	Jun 15 2018	N. Ludington	Jul 11 2019	N. Ludington	No	Functional	
241701	1-17-048H	06	Jun 15 2018	N. Ludington	Oct 11 2019	N. Ludington	No	Functional	
241701	1-17-048H	07	Jun 15 2018	N. Ludington	Oct 11 2019	N. Ludington	No	Functional	
241701	1-17-048H	08	Jun 15 2018	N. Ludington	Oct 11 2019	N. Ludington	No	Functional	
241701	1-17-048H	09	Oct 17 2018	N. Ludington	Jul 11 2019	N. Ludington	No	Functional	
241701	1-17-048H	13	Oct 9 2018	N. Ludington	Jul 11 2019	N. Ludington	No	Functional	
241901	1-20-00019HUM	02	Oct 5 2020	M. Lewis			No	Functional	
241901	1-20-00019HUM	04	Oct 5 2020	M. Lewis			No	Functional	

GDRCO #	State #	Road Point	Pre-Winter Inspection Date	RPF Pre-Inspection	Post-winter Inspection Date	RPF Post-Inspection	Issues Identified	Functional Status	Notes
241901	1-20-00019HUM	05	Oct 5 2020	M. Lewis			No	Functional	
241901	1-20-00019HUM	06	Oct 5 2020	M. Lewis			No	Functional	OG stump not removed from upstream channel 18' from inlet. Inlet appears <1' high in fill.
241901	1-20-00019HUM	07	Oct 5 2020	M. Lewis			No	Functional	
241901	1-20-00019HUM	08	Oct 5 2020	M. Lewis			No	Functional	R inlet bank could have 2 cyd removed. Inlet is slightly high in fill but material has been added to level stream flow.
241901	1-20-00019HUM	09	Oct 5 2020	M. Lewis			No	Functional	Inlet appears 6" high in fill.
241901	1-20-00019HUM	10	Oct 5 2020	M. Lewis			No	Functional	Left bank could have been laid back 2-1.
241901	1-20-00019HUM	11	Oct 5 2020	M. Lewis			No	Functional	Appears misaligned 1' L. Inlet 6" high in fill. Defined inlet basin established.
241901	1-20-00019HUM	13	Nov 3 2020	M. Lewis			No	Functional	
241901	1-20-00019HUM	14	Sep 24 2020	M. Cameron			No	Functional	
241901	1-20-00019HUM	15	Sep 24 2020	M. Cameron			No	Functional	
241901	1-20-00019HUM	18	Sep 24 2020	M. Cameron			No	Functional	Bridge
261303	1-14-057H	10	Oct 23 2019	N. Ludington	Sep 8 2020	M. Cameron	No	Functional	
261303	1-14-057H	11	Oct 23 2019	N. Ludington	Sep 8 2020	M. Cameron	No	Functional	
261401	1-14-060H	1	Sep 28 2018	L. McCullough	Jul 25 2019	N. Ludington	No	Functional	Removed to standards
261401	1-14-060H	2	Sep 28 2018	L. McCullough	Jul 25 2019	N. Ludington	No	Functional	Removed to standards
261401	1-14-060H	3	Sep 28 2018	L. McCullough	Jul 25 2019	N. Ludington	No	Functional	Removed to standards
261602	1-16-083H	04	Oct 5 2018	N. Ludington	Oct 8 2019	S. Felder	No	Functional	
261602	1-16-083H	05	Oct 5 2018	N. Ludington	Jul 25 2019	N. Ludington	No	Functional	
261603	1-16-128H	01	Sep 26 2018	N. Ludington	Aug 12 2019	Tyler Brown	No	Functional	A 24" CMP installed to standards.
261603	1-16-128H	02	Sep 26 2018	N. Ludington	Oct 7 2019	S. Felder	No	Functional	
261603	1-16-128H	03	Sep 26 2018	N. Ludington	Oct 7 2019	S. Felder	No	Functional	

GDRCO #	State #	Road Point	Pre-Winter Inspection Date	RPF Pre-Inspection	Post-winter Inspection Date	RPF Post-Inspection	Issues Identified	Functional Status	Notes
261603	1-16-128H	08	Jun 15 2018	N. Ludington	Aug 12 2019	Tyler Brown	No	Functional	30" CMP installed to standards.
261603	1-16-128H	09	Sep 26 2018	N. Ludington	Aug 12 2019	Tyler Brown	No	Functional	48" CMP installed to standards.
261603	1-16-128H	10	Sep 26 2018	N. Ludington	Aug 12 2019	Tyler Brown	No	Functional	A 54" CMP installed to standards.
261603	1-16-128H	11	Sep 26 2018	N. Ludington	Aug 12 2019	Tyler Brown	No	Functional	24" CMP installed to standards.
261603	1-16-128H	13	Sep 26 2018	N. Ludington	Aug 12 2019	Tyler Brown	No	Functional	
261603	1-16-128H	14	Sep 26 2018	N. Ludington	Aug 12 2019	Tyler Brown	No	Functional	
261603	1-16-128H	15	Sep 26 2018	N. Ludington	Aug 12 2019	Others	No	Functional	
261603	1-16-128H	17	Sep 26 2018	N. Ludington	Oct 7 2019	S. Felder	No	Functional	
261604	1-17-002H	02	Oct 20 2020	M. Lewis			No	Functional	
261604	1-17-002H	03	Sep 27 2019	S. Felder	Jul 13 2020	M. Lewis	No	Functional	
261604	1-17-002H	04	Sep 27 2019	S. Felder	Jul 13 2020	M. Lewis	No	Functional	
261604	1-17-002H	05	Sep 27 2019	S. Felder	Jul 13 2020	M. Lewis	No	Functional	
261604	1-17-002H	06	Sep 27 2019	S. Felder	Jul 13 2020	M. Lewis	No	Functional	
261604	1-17-002H	08	Sep 27 2019	S. Felder	Jul 13 2020	M. Lewis	No	Functional	
261604	1-17-002H	10	Sep 27 2019	S. Felder	Jul 13 2020	M. Lewis	No	Functional	
261604	1-17-002H	12	Sep 27 2019	S. Felder	Jul 13 2020	M. Lewis	No	Functional	
261604	1-17-002H	13	Sep 27 2019	S. Felder	Jul 13 2020	M. Lewis	No	Functional	
261604	1-17-002H	14	Sep 27 2019	S. Felder	Jul 13 2020	M. Lewis	No	Functional	
261604	1-17-002H	15	Sep 27 2019	S. Felder	Jul 13 2020	M. Lewis	No	Functional	
261604	1-17-002H	16	Sep 27 2019	S. Felder	Jul 13 2020	M. Lewis	No	Functional	
261604	1-17-002H	17	Sep 27 2019	S. Felder	Jul 14 2020	M. Lewis	No	Functional	
261604	1-17-002H	18	Sep 27 2019	S. Felder	Jul 14 2020	M. Lewis	No	Functional	
261604	1-17-002H	28	Oct 15 2019	S. Felder	Jul 23 2020	M. Lewis	No	Functional	
261604	1-17-002H	31	Oct 15 2019	S. Felder	Jul 23 2020	M. Lewis	No	Functional	

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261901	1-19-00161 HUM	02	Oct 2 2020	M. Lewis			No	Functional	
271702	1-17-118HUM	01	Sep 28 2018	J. Larrabee	Oct 17 2019	N. Ludington	No	Functional	
271702	1-17-118HUM	02	Sep 28 2018	J. Larrabee	Jul 29 2019	N. Ludington	No	Functional	
271702	1-17-118HUM	03	Sep 28 2018	J. Larrabee	Jul 29 2019	N. Ludington	No	Functional	
271702	1-17-118HUM	04	Sep 28 2018	J. Larrabee	Oct 7 2019	S. Felder	No	Functional	
271702	1-17-118HUM	05	Sep 28 2018	J. Larrabee	Jul 29 2019	N. Ludington	No	Functional	
271702	1-17-118HUM	06	Sep 28 2018	J. Larrabee	Jul 29 2019	N. Ludington	No	Functional	
271702	1-17-118HUM	07	Sep 28 2018	J. Larrabee	Oct 7 2019	S. Felder	No	Functional	
271702	1-17-118HUM	08	Sep 28 2018	J. Larrabee	Oct 7 2019	S. Felder	No	Functional	
271702	1-17-118HUM	09	Sep 28 2018	J. Larrabee	Oct 8 2019	S. Felder	No	Functional	
271702	1-17-118HUM	10	Sep 28 2018	J. Larrabee	Jul 29 2019	N. Ludington	No	Functional	
271702	1-17-118HUM	11	Sep 28 2018	J. Larrabee	Jul 29 2019	N. Ludington	No	Functional	
271702	1-17-118HUM	12	Sep 28 2018	J. Larrabee	Jul 29 2019	N. Ludington	No	Functional	
271702	1-17-118HUM	13	Sep 28 2018	J. Larrabee	Jul 29 2019	N. Ludington	No	Functional	
271801	1-18-084HUM	02	Oct 16 2019	N. Ludington	Jul 28 2020	M. Lewis	No	Functional	
271801	1-18-084HUM	04	Oct 16 2019	N. Ludington	Jul 28 2020	M. Lewis	No	Functional	
271801	1-18-084HUM	08	Oct 16 2019	N. Ludington	Jul 28 2020	M. Lewis	No	Functional	
271901	1-20-00012HUM	1	Oct 5 2020	M. Lewis			No	Functional	
271901	1-20-00012HUM	2	Oct 5 2020	M. Lewis			No	Functional	
401701	1-18-003HUM	04	Sep 26 2018	N. Ludington	Oct 7 2019	S. Felder	No	Functional	
401701	1-18-003HUM	05	Sep 26 2018	N. Ludington	Oct 7 2019	S. Felder	No	Functional	
401701	1-18-003HUM	06	Oct 9 2018	N. Ludington	Aug 8 2019	Tyler Brown	No	Functional	
401901	1-20-00005HUM	1	Oct 5 2020	M. Lewis			No	Functional	
421602	1-16-108H	08	Oct 18 2019	M. Cameron	Aug 24 2020	M. Lewis	No	Functional	
421602	1-16-108H	09	Oct 18 2019	M. Cameron	Aug 24 2020	M. Lewis	No	Functional	
421602	1-16-108H	10	Oct 18 2019	M. Cameron	Aug 24 2020	M. Lewis	No	Functional	

GDRCO #	State #	Road Point	Pre-Winter Inspection Date	RPF Pre-Inspection	Post-winter Inspection Date	RPF Post-Inspection	Issues Identified	Functional Status	Notes
421603	1-16-105H	02	Oct 22 2018	J. Wright	Jul 26 2019	N. Ludington	No	Functional	
421603	1-16-105H	03	Oct 15 2018	J. Wright	Jul 26 2019	N. Ludington	No	Functional	
421603	1-16-105H	04	Oct 15 2018	J. Wright	Jul 26 2019	N. Ludington	No	Functional	
421603	1-16-105H	05	Oct 15 2018	J. Wright	Jul 26 2019	N. Ludington	No	Functional	
421701	1-18-039H	01	Oct 15 2019	S. Felder	Aug 14 2020	M. Lewis	No	Functional	Small boulders obstructing inlet resulting in sediment accumulation. Boulders were removed.
421801	1-18-00194-HUM	07	Oct 2 2020	M. Lewis			No	Functional	
422001	1-20-00067 Hum	5	Oct 13 2020	M. Lewis			No	Functional	
422001	1-20-00067 Hum	6	Oct 2 2020	M. Lewis			No	Functional	
430201	1-02-036H	46	Sep 28 2018	N. Ludington	Oct 7 2019	S. Felder	No	Functional	Rolling dip installed properly.
431702	1-17-148HUM	1	Sep 28 2018	N. Ludington	Jul 11 2019	N. Ludington	No	Functional	
431702	1-17-148HUM	2	Sep 28 2018	N. Ludington	Jul 11 2019	N. Ludington	No	Functional	Some erosion of the of the inboard fill. Rip rap intact, road width ok.
431702	1-17-148HUM	3	Sep 28 2018	N. Ludington	Jul 11 2019	N. Ludington	No	Functional	
431702	1-17-148HUM	4	Sep 28 2018	N. Ludington	Jul 11 2019	N. Ludington	No	Functional	
431702	1-17-148HUM	5	Sep 28 2018	N. Ludington	Jul 11 2019	N. Ludington	No	Functional	Some cracking of the outboard fill. About 1.5 cubic feet of erosion on the obf.
431801	1-18-00145-HUM	02	Oct 2 2020	N. Ludington			No	Functional	
431801	1-18-00145-HUM	03	Oct 2 2020	N. Ludington			No	Functional	
431801	1-18-00145-HUM	04	Oct 2 2020	N. Ludington			No	Functional	
431801	1-18-00145-HUM	05	Oct 2 2020	N. Ludington			No	Functional	
431801	1-18-00145-HUM	11	Oct 23 2019	N. Ludington	Jul 31 2020	M. Lewis	No	Functional	Bot flag was not hung far enough downstream. Flow goes subsurface after exiting outlet and emerges 20' below. A cluster of 4 redwoods originating from a nurse log type feature may have prevented further excavation to appropriate bot.
431801	1-18-00145-HUM	13	Jul 30 2019	S. Felder	Jul 24 2020	M. Lewis	No	Functional	No hydrological disconnect.
431801	1-18-00145-HUM	14	Oct 23 2019	N. Ludington	Jul 24 2020	M. Lewis	No	Functional	Minor 12'x4' 'blue goo' sediment plane above inlet. 6"-1' Rocky channel created in center of plane.
431801	1-18-00145-HUM	15	Oct 23 2019	N. Ludington	Jul 24 2020	M. Lewis	No	Functional	

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431901	1-19-00167-HUM	01	Oct 20 2020	M. Lewis			No	Functional	
431901	1-19-00167-HUM	02	Oct 20 2020	M. Lewis			No	Functional	
431901	1-19-00167-HUM	07	Oct 2 2020	N. Ludington			No	Functional	
431901	1-19-00167-HUM	08	Oct 2 2020	N. Ludington			No	Functional	
431901	1-19-00167-HUM	09	Oct 2 2020	N. Ludington			No	Functional	Culvert offset to the left 3 feet of natural channel, some minor ponding at inlet.
431901	1-19-00167-HUM	10	Oct 2 2020	N. Ludington			No	Functional	
431901	1-19-00167-HUM	11	Oct 2 2020	N. Ludington			No	Functional	
431901	1-19-00167-HUM	12	Oct 2 2020	N. Ludington			No	Functional	
431901	1-19-00167-HUM	13	Oct 2 2020	N. Ludington			No	Functional	
431901	1-19-00167-HUM	14	Oct 2 2020	N. Ludington			No	Functional	
431901	1-19-00167-HUM	G	Oct 2 2020	N. Ludington			No	Functional	
441802	1-19-00068-HUM	01	Oct 8 2020	M. Lewis			No	Functional	
441802	1-19-00068-HUM	04	Oct 2 2020	M. Lewis			No	Functional	
471802	1-18-00140 HUM	02	Oct 18 2019	N. Ludington	Aug 13 2020	M. Lewis	No	Functional	
471802	1-18-00140 HUM	03	Oct 18 2019	N. Ludington	Aug 13 2020	M. Lewis	No	Functional	
471802	1-18-00140 HUM	07	Oct 18 2019	N. Ludington	Aug 13 2020	M. Lewis	No	Functional	
471802	1-18-00140 HUM	08	Oct 18 2019	N. Ludington	Aug 13 2020	M. Lewis	No	Functional	
471904	1-19-00209HUM	08	Oct 22 2020	N. Ludington			No	Functional	
471904	1-19-00209HUM	08	Oct 27 2020	M. Lewis			No	Functional	
471904	1-19-00209HUM	09	Oct 21 2020	N. Ludington			No	Functional	
471904	1-19-00209HUM	09	Oct 27 2020	M. Lewis			No	Functional	
471904	1-19-00209HUM	10	Oct 22 2020	N. Ludington			No	Functional	
471904	1-19-00209HUM	10	Oct 27 2020	M. Lewis			No	Functional	
471904	1-19-00209HUM	11	Oct 5 2020	N. Ludington			No	Functional	
481701	1-17-091H	01	Sep 28 2018	N. Ludington	Jul 31 2019	S. Felder	No	Functional	
481701	1-17-091H	02	Sep 28 2018	N. Ludington	Jul 31 2019	S. Felder	No	Functional	
481701	1-17-091H	04	Sep 28 2018	N. Ludington	Jul 31 2019	S. Felder	No	Functional	
481701	1-17-091H	05	Sep 28 2018	N. Ludington	Jul 31 2019	S. Felder	No	Functional	
481701	1-17-091H	07	Sep 28 2018	N. Ludington	Jul 31 2019	S. Felder	No	Functional	

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481701	1-17-091H	08	Sep 28 2018	N. Ludington	Jul 31 2019	S. Felder	No	Functional	
481701	1-17-091H	09	Sep 28 2018	N. Ludington	Jul 31 2019	S. Felder	No	Functional	
481702	1-17-149HUM	13	Aug 12 2019	N. Ludington	Aug 20 2020	N. Ludington	No	Functional	
481702	1-17-149HUM	14	Aug 12 2019	N. Ludington	Aug 20 2020	N. Ludington	No	Functional	
481702	1-17-149HUM	15	Aug 12 2019	N. Ludington	Aug 20 2020	N. Ludington	No	Functional	
481901	1-20-00026 Hum	01	Oct 6 2020	M. Lewis			No	Functional	
481901	1-20-00026 Hum	02	Oct 6 2020	M. Lewis			No	Functional	
481901	1-20-00026 Hum	06	Oct 7 2020	M. Lewis			No	Functional	
481901	1-20-00026 Hum	08	Oct 6 2020	M. Lewis			No	Functional	
511506	1-16-041H	02	Oct 17 2019	S. Felder	Sep 14 2020	M. Cameron	No	Functional	
511506	1-16-041H	02	Oct 17 2019	S. Felder	Sep 14 2020	M. Cameron	No	Functional	
511506	1-16-041H	03	Oct 17 2019	S. Felder	Sep 14 2020	M. Cameron	No	Functional	
511506	1-16-041H	04	Oct 22 2019	N. Ludington	Sep 14 2020	M. Cameron	No	Functional	
511506	1-16-041H	05	Oct 17 2019	S. Felder	Sep 14 2020	M. Cameron	No	Functional	
511506	1-16-041H	07	Aug 13 2019	N. Ludington	Sep 14 2020	M. Cameron	No	Functional	
511506	1-16-041H	07	Aug 13 2019	N. Ludington	Sep 14 2020	M. Cameron	No	Functional	Rock ford
511506	1-16-041H	08	Oct 21 2020	N. Ludington			No	Functional	
511506	1-16-041H	30	Oct 21 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	
511506	1-16-041H	35	Aug 13 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	
511506	1-16-041H	40	Oct 15 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	
511506	1-16-041H	41	Aug 13 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	
511506	1-16-041H	42	Oct 21 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	
511506	1-16-041H	43	Aug 13 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	
511506	1-16-041H	44	Aug 13 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	

GDRCO #	State #	Road Point	Pre-Winter Inspection Date	RPF Pre-Inspection	Post-winter Inspection Date	RPF Post-Inspection	Issues Identified	Functional Status	Notes
511506	1-16-041H	46	Aug 13 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	
511506	1-16-041H	48	Aug 13 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	
511506	1-16-041H	51	Aug 13 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	
511506	1-16-041H	52	Aug 13 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	
511506	1-16-041H	53	Aug 13 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	
511506	1-16-041H	54	Aug 13 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	
511506	1-16-041H	56	Aug 13 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	
511506	1-16-041H	57	Oct 21 2019	N. Ludington	Sep 15 2020	M. Cameron	No	Functional	
511506	1-16-041H	64	Aug 13 2019	N. Ludington	Sep 14 2020	M. Cameron	No	Functional	
511506	1-16-041H	65	Aug 13 2019	N. Ludington	Sep 14 2020	M. Cameron	No	Functional	Reshaped road/cut bank
511705	1-18-016H	05	Oct 23 2020	M. Lewis			No	Functional	Material accumulation at inlet.
511705	1-18-016H	06	Oct 23 2020	M. Lewis			No	Functional	
511705	1-18-016H	07	Oct 23 2020	M. Lewis			No	Functional	Pipe is several feet long causing 1' perch. Rip rap present below outlet.
511705	1-18-016H	08	Oct 23 2020	M. Lewis			No	Functional	Sluffing bed load is accumulating in the inlet.
511705	1-18-016H	09	Oct 23 2020	M. Lewis			No	Functional	
511705	1-18-016H	11	Oct 23 2020	M. Lewis			No	Functional	
511705	1-18-016H	12	Oct 23 2020	M. Lewis			No	Functional	
511705	1-18-016H	13	Oct 23 2020	M. Lewis			No	Functional	Pipe few feet long 1' perch outlet.
511705	1-18-016H	14	Oct 23 2020	M. Lewis			No	Functional	
511705	1-18-016H	15	Oct 23 2020	M. Lewis			No	Functional	
511705	1-18-016H	16	Oct 23 2020	M. Lewis			No	Functional	
511802	1-18-00166-HUM	01	Oct 30 2020	N. Ludington			No	Functional	
511802	1-18-00166-HUM	06	Oct 2 2020	M. Cameron			No	Functional	
511802	1-18-00166-HUM	08	Oct 2 2020	M. Cameron			No	Functional	

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511802	1-18-00166-HUM	10	Oct 2 2020	M. Cameron			No	Functional	
511802	1-18-00166-HUM	13	Oct 2 2020	M. Cameron			No	Functional	
511802	1-18-00166-HUM	19	Oct 2 2020	M. Cameron			No	Functional	
511803	1-18-178HUM	01	Oct 19 2020	M. Lewis			No	Functional	
511803	1-18-178HUM	02	Oct 19 2020	M. Lewis			No	Functional	
511803	1-18-178HUM	03	Oct 19 2020	M. Lewis			No	Functional	
511803	1-18-178HUM	04	Oct 19 2020	M. Lewis			No	Functional	
511803	1-18-178HUM	05	Oct 19 2020	M. Lewis			No	Functional	
511803	1-18-178HUM	06	Oct 19 2020	M. Lewis			No	Functional	
511803	1-18-178HUM	07	Oct 19 2020	M. Lewis			No	Functional	
511803	1-18-178HUM	08	Oct 19 2020	M. Lewis			No	Functional	
511803	1-18-178HUM	09	Oct 19 2020	M. Lewis			No	Functional	
511803	1-18-178HUM	10	Oct 19 2020	M. Lewis			No	Functional	
511803	1-18-178HUM	11	Oct 19 2020	M. Lewis			No	Functional	
511803	1-18-178HUM	12	Oct 19 2020	M. Lewis			No	Functional	
511803	1-18-178HUM	19	Oct 19 2020	M. Lewis			No	Functional	
511803	1-18-178HUM	20	Oct 19 2020	M. Lewis			No	Functional	
511803	1-18-178HUM	21	Oct 19 2020	M. Lewis			No	Functional	
511804	1-18-00190-HUM	07	Oct 20 2020	M. Lewis			No	Functional	
511804	1-18-00190-HUM	09	Sep 28 2020	N. Ludington			No	Functional	
511804	1-18-00190-HUM	10	Oct 20 2020	M. Lewis			No	Functional	
511804	1-18-00190-HUM	11	Sep 28 2020	N. Ludington			No	Functional	
511804	1-18-00190-HUM	12	Sep 28 2020	N. Ludington			No	Functional	
512001	1-20-00085 Hum	1	Oct 21 2020	N. Ludington			No	Functional	
512001	1-20-00085 Hum	2	Oct 21 2020	N. Ludington			No	Functional	
512001	1-20-00085 Hum	3	Oct 21 2020	N. Ludington			No	Functional	
512001	1-20-00085 Hum	5	Oct 21 2020	N. Ludington			No	Functional	
561603	1-16-120HUM	01.2	Nov 2 2020	M. Lewis			No	Functional	
561605	1-16-139H	19	Nov 5 2018	N. Ludington	Sep 19 2019	N. Ludington	No	Functional	
561611	1-17-057 HUM	02	Sep 25 2018	N. Ludington	Aug 14 2019	Tyler Brown	No	Functional	30" CMP installed to standards.
561611	1-17-057 HUM	03	Sep 25 2018	N. Ludington	Aug 14 2019	Tyler Brown	No	Functional	

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561611	1-17-057 HUM	04	Sep 25 2018	N. Ludington	Aug 14 2019	Tyler Brown	No	Functional	
561611	1-17-057 HUM	05	Sep 25 2018	N. Ludington	Aug 14 2019	Tyler Brown	No	Functional	
561611	1-17-057 HUM	06	Sep 25 2018	N. Ludington	Aug 14 2019	Tyler Brown	No	Functional	72" CMP installed to standards.
561611	1-17-057 HUM	07	Sep 25 2018	N. Ludington	Aug 14 2019	Tyler Brown	No	Functional	42" CMP installed to standards.
561611	1-17-057 HUM	09	Aug 5 2018	N. Ludington	Sep 10 2019	S. Felder	No	Functional	
561611	1-17-057 HUM	10	Sep 25 2018	N. Ludington	Aug 5 2019	N. Ludington	No	Functional	
561611	1-17-057 HUM	11	Sep 25 2018	N. Ludington	Oct 17 2019	S. Felder	No	Functional	
561611	1-17-057 HUM	12	Sep 25 2018	N. Ludington	Oct 17 2019	S. Felder	No	Functional	
561611	1-17-057 HUM	13	Aug 5 2018	N. Ludington	Oct 17 2019	S. Felder	No	Functional	
561611	1-17-057 HUM	14	Sep 25 2018	N. Ludington	Oct 17 2019	S. Felder	No	Functional	
561611	1-17-057 HUM	15	Sep 25 2018	N. Ludington	Oct 17 2019	S. Felder	No	Functional	
561611	1-17-057 HUM	16	Sep 25 2018	N. Ludington	Aug 14 2019	Tyler Brown	No	Functional	Rocked ford installed to standards.
561611	1-17-057 HUM	17	Sep 25 2018	N. Ludington	Oct 8 2019	N. Ludington	No	Functional	
561611	1-17-057 HUM	21	Sep 25 2018	N. Ludington	Aug 13 2019	Tyler Brown	No	Functional	
561802	1-19-00002-HUM	01	Sep 23 2020	M. Cameron			No	Functional	
561802	1-19-00002-HUM	03	Sep 23 2020	M. Cameron			No	Functional	
561802	1-19-00002-HUM	06	Nov 2 2020	M. Lewis			No	Functional	
561802	1-19-00002-HUM	07	Sep 23 2020	M. Cameron			No	Functional	
561802	1-19-00002-HUM	08	Sep 23 2020	M. Cameron			No	Functional	Sediment extending into pipe
561802	1-19-00002-HUM	09	Sep 23 2020	M. Cameron			No	Functional	
561802	1-19-00002-HUM	10	Sep 23 2020	M. Cameron			No	Functional	
561803	1-18-00141HUM	05	Sep 28 2020	N. Ludington			No	Functional	
561803	1-18-00141HUM	08	Sep 28 2020	N. Ludington			No	Functional	
561803	1-18-00141HUM	09	Sep 28 2020	N. Ludington			No	Functional	
561803	1-18-00141HUM	10	Sep 28 2020	N. Ludington			No	Functional	

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561804	1-18-00173-HUM	08	Sep 23 2020	M. Cameron			No	Functional	
561804	1-18-00173-HUM	09	Sep 23 2020	M. Cameron			No	Functional	
561804	1-18-00173-HUM	10	Sep 23 2020	M. Cameron			No	Functional	
561806	1-19-00094HUM	01	Nov 2 2020	M. Lewis			No	Functional	
561901	1-19-00156HUM	01	Nov 2 2020	M. Lewis			No	Functional	
561901	1-19-00156HUM	02	Nov 2 2020	M. Lewis			No	Functional	
561901	1-19-00156HUM	03	Nov 2 2020	M. Lewis			No	Functional	
611701	1-17-079HUM-DEL	01	Oct 24 2018	N. Ludington	Jul 31 2019	L. McCullough	No	Functional	A new culvert was installed at this location to standards. No Issues.
611701	1-17-079HUM-DEL	02	Oct 24 2018	N. Ludington	Jul 31 2019	L. McCullough	No	Functional	A new culvert was installed at this location to standards. No Issues.
611701	1-17-079HUM-DEL	112	Sep 24 2018	N. Ludington	Oct 7 2019	N. Ludington	No	Functional	DRC drains directly into watercourse below.
611701	1-17-079HUM-DEL	113	Sep 24 2018	N. Ludington	Oct 7 2019	N. Ludington	No	Functional	
611701	1-17-079HUM-DEL	114	Sep 24 2018	N. Ludington	Oct 7 2019	N. Ludington	No	Functional	
611701	1-17-079HUM-DEL	12	Sep 24 2018	N. Ludington	Oct 7 2019	N. Ludington	No	Functional	
611701	1-17-079HUM-DEL	13	Sep 24 2018	N. Ludington	Aug 13 2019	Tyler Brown	No	Functional	CMP installed to standards.
611701	1-17-079HUM-DEL	14	Sep 24 2018	N. Ludington	Aug 13 2019	Tyler Brown	No	Functional	48" CMP installed to standards.
611701	1-17-079HUM-DEL	15	Sep 24 2018	N. Ludington	Aug 13 2019	Tyler Brown	No	Functional	
611701	1-17-079HUM-DEL	16	Sep 24 2018	N. Ludington	Aug 13 2019	Tyler Brown	No	Functional	
661605	1-17-001DEL	05	Sep 24 2018	N. Ludington	Oct 7 2019	M. Cameron	No	Functional	
661605	1-17-001DEL	06	Sep 24 2018	N. Ludington	Jul 31 2019	L. McCullough	No	Functional	A 24 inch CMP installed to AHCP standards. No issues
661605	1-17-001DEL	10	Sep 24 2018	N. Ludington	Oct 7 2019	M. Cameron	No	Functional	Removed piece of riprap from pipe

GDRCO #	State #	Road Point	Pre-Winter Inspection Date	RPF Pre-Inspection	Post-winter Inspection Date	RPF Post-Inspection	Issues Identified	Functional Status	Notes
661605	1-17-001DEL	10.1	Sep 24 2018	N. Ludington	Oct 7 2019	M. Cameron	No	Functional	Outlet rocking is sparse.
661605	1-17-001DEL	10.2	Sep 24 2018	N. Ludington	Oct 7 2019	M. Cameron	No	Functional	
661801	1-18-00114DEL	01	Oct 23 2019	S. Felder	Jul 10 2020	N. Ludington	No	Functional	
661801	1-18-00114DEL	02	Oct 23 2019	S. Felder	Jul 10 2020	N. Ludington	No	Functional	
661801	1-18-00114DEL	03	Oct 23 2019	S. Felder	Jul 13 2020	N. Ludington	No	Functional	
661801	1-18-00114DEL	04	Oct 23 2019	S. Felder	Jul 10 2020	N. Ludington	No	Functional	
661801	1-18-00114DEL	09	Oct 17 2019	N. Ludington	Jul 13 2020	N. Ludington	No	Functional	
711702	1-17-073	03	Oct 24 2018	N. Ludington	Aug 12 2019	L. McCullough	No	Functional	A new culvert was installed at this location to standards. No Issues.
711802	1-19-00005-DEL	15	Oct 23 2019	Tyler Brown	Aug 11 2020	M. Lewis	No	Functional	24" CMP installed to standards. Minor outboard fill erosion.
711802	1-19-00005-DEL	23	Oct 23 2019	Tyler Brown	Aug 11 2020	M. Lewis	No	Functional	24" CMP installed to standards.
711803	1-19-00003-DEL	14	Oct 11 2019	RPF	Aug 11 2020	M. Lewis	No	Functional	
711902	1-20-00007DEL	02	Sep 25 2020	M. Cameron			No	Functional	
711902	1-20-00007DEL	03	Sep 25 2020	M. Cameron			No	Functional	sides could be laid back a bit more, but otherwise good.
711902	1-20-00007DEL	04	Sep 25 2020	M. Cameron			No	Functional	
711902	1-20-00007DEL	05	Sep 25 2020	M. Cameron			No	Functional	
711902	1-20-00007DEL	09	Sep 25 2020	M. Cameron			No	Functional	
711902	1-20-00007DEL	13	Sep 25 2020	M. Cameron			No	Functional	
711902	1-20-00007DEL	17	Sep 25 2020	M. Cameron			No	Functional	
711902	1-20-00007DEL	17	Sep 25 2020	M. Cameron			No	Functional	Armored with wood, not rock
711902	1-20-00007DEL	18	Sep 25 2020	M. Cameron			No	Functional	
711902	1-20-00007DEL	18	Sep 25 2020	M. Cameron			No	Functional	Outlet armored with wood not rock
711902	1-20-00007DEL	24	Sep 25 2020	M. Cameron			No	Functional	

GDRCO #	State #	Road Point	Pre-Winter Inspection Date	RPF Pre-Inspection	Post-winter Inspection Date	RPF Post-Inspection	Issues Identified	Functional Status	Notes
711902	1-20-00007DEL	26	Sep 25 2020	M. Cameron			No	Functional	
711902	1-20-00007DEL	27	Sep 25 2020	M. Cameron			No	Functional	
711902	1-20-00007DEL	29	Oct 5 2020	M. Cameron			No	Functional	
711902	1-20-00007DEL	30	Oct 5 2020	M. Cameron			No	Functional	
711903	1-19-00220DEL	01	Nov 3 2020	M. Lewis			No	Functional	
711903	1-19-00220DEL	02	Nov 3 2020	M. Lewis			No	Functional	
711903	1-19-00220DEL	04	Nov 3 2020	M. Lewis			Yes	Functional	Headwall sluffing obstructs inlet 95%
711903	1-19-00220DEL	08	Sep 28 2020	M. Cameron			No	Functional	
711903	1-19-00220DEL	09	Sep 28 2020	M. Cameron			No	Functional	
711903	1-19-00220DEL	10	Sep 28 2020	M. Cameron			No	Functional	
711903	1-19-00220DEL	11	Sep 28 2020	M. Cameron			No	Functional	
731602	1-17-062 DEL	01	Sep 29 2020	M. Cameron			No	Functional	
731701	1-18-080DEL	01	Oct 17 2019	N. Ludington	Aug 10 2020	M. Lewis	No	Functional	
731701	1-18-080DEL	02	Oct 17 2019	N. Ludington	Aug 10 2020	M. Lewis	No	Functional	
731701	1-18-080DEL	03	Oct 17 2019	N. Ludington	Aug 10 2020	M. Lewis	No	Functional	
731701	1-18-080DEL	04	Oct 17 2019	N. Ludington	Aug 10 2020	M. Lewis	No	Functional	
731701	1-18-080DEL	05	Oct 17 2019	N. Ludington	Aug 10 2020	M. Lewis	No	Functional	
731701	1-18-080DEL	07	Oct 17 2019	N. Ludington	Aug 10 2020	M. Lewis	No	Functional	
731701	1-18-080DEL	08	Oct 17 2019	N. Ludington	Aug 10 2020	M. Lewis	No	Functional	
731701	1-18-080DEL	11	Oct 17 2019	N. Ludington	Aug 13 2020	M. Lewis	No	Functional	
731701	1-18-080DEL	12	Oct 17 2019	N. Ludington	Aug 13 2020	M. Lewis	No	Functional	
731701	1-18-080DEL	14	Oct 17 2019	N. Ludington	Aug 10 2020	M. Lewis	No	Functional	
731802	1-19-00097-DEL	1	Sep 29 2020	M. Cameron			No	Functional	
731802	1-19-00097-DEL	2	Sep 29 2020	M. Cameron			No	Functional	
731901	1-19-00221DEL	01	Nov 3 2020	M. Lewis			No	Functional	
731901	1-19-00221DEL	02	Nov 3 2020	M. Lewis			No	Functional	

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731901	1-19-00221DEL	03	Nov 3 2020	M. Lewis			No	Functional	
731901	1-19-00221DEL	04	Nov 3 2020	M. Lewis			No	Functional	
731901	1-19-00221DEL	04	Nov 3 2020	M. Lewis			No	Functional	Minimal inlet armoring.
851803	1-20-00013 Del	15	Sep 29 2020	M. Cameron			No	Functional	
851803	1-20-00013 Del	16	Sep 29 2020	M. Cameron			No	Functional	
851803	1-20-00013 Del	17	Sep 29 2020	M. Cameron			No	Functional	
851803	1-20-00013 Del	18	Sep 29 2020	M. Cameron			No	Functional	
851803	1-20-00013 Del	19	Sep 28 2020	M. Cameron			No	Functional	
851803	1-20-00013 Del	20	Sep 29 2020	M. Cameron			No	Functional	
851803	1-20-00013 Del	22	Sep 29 2020	M. Cameron			No	Functional	
851803	1-20-00013 Del	23	Sep 29 2020	M. Cameron			No	Functional	
851803	1-20-00013 Del	24	Sep 29 2020	M. Cameron			No	Functional	
901701	1-17-131DEL	02	Nov 2 2020	M. Cameron			No	Functional	
901701	1-17-131DEL	07	Oct 24 2019	M. Cameron	Nov 2 2020	M. Cameron	No	Functional	
901901	1-19-00212DEL	2	Nov 4 2020	M. Cameron			No	Functional	
931602	1-16-115DEL	4	Dec 30 2020	N. Ludington			No	Functional	
931701	1-17-108DEL	12	Oct 9 2018	RPF - B Dobosh	Aug 1 2019	Tyler Brown	No	Functional	
931702	1-18-106 DEL	01	Jul 31 2019	Tyler Brown	Oct 27 2020	M. Cameron	No	Functional	
931702	1-18-106 DEL	02	Jul 31 2019	Tyler Brown	Oct 27 2020	M. Cameron	No	Functional	A crossing has been removed to AHCP standards.
931702	1-18-106 DEL	02.1	Oct 23 2019	M. Cameron	Oct 27 2020	M. Cameron	No	Functional	
931702	1-18-106 DEL	03	Jul 31 2019	Tyler Brown	Oct 27 2020	M. Cameron	No	Functional	A crossing has been removed to AHCP standards.
931702	1-18-106 DEL	05	Oct 21 2019	M. Cameron	Oct 21 2020	M. Cameron	No	Functional	
931702	1-18-106 DEL	07	Oct 21 2019	M. Cameron	Oct 21 2020	M. Cameron	No	Functional	

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931702	1-18-106 DEL	10	Jul 3 2019	M. Cameron	Oct 21 2020	M. Cameron	No	Functional	
931702	1-18-106 DEL	11	Jul 31 2019	M. Cameron	Oct 21 2020	M. Cameron	No	Functional	
931702	1-18-106 DEL	12	Jul 31 2019	M. Cameron	Oct 21 2020	M. Cameron	No	Functional	
931702	1-18-106 DEL	14	Oct 23 2019	M. Cameron	Oct 27 2020	M. Cameron	No	Functional	
931702	1-18-106 DEL	15	Oct 23 2019	M. Cameron	Oct 27 2020	M. Cameron	No	Functional	
931702	1-18-106 DEL	17 Wi-1000	Oct 21 2019	M. Cameron	Oct 21 2020	M. Cameron	No	Functional	
931703	1-18-044DEL	11	Oct 24 2019	M. Cameron	Nov 2 2020	M. Cameron	No	Functional	
931703	1-18-044DEL	17	Sep 4 2019	L. McCullough	Nov 18 2020	M. Cameron	No	Functional	
931703	1-18-044DEL	18	Sep 4 2019	L. McCullough	Oct 28 2020	M. Cameron	No	Functional	
931703	1-18-044DEL	19	Sep 4 2019	S. Felder	Oct 28 2020	M. Cameron	No	Functional	Steep cut bank on right side, potential unstable area
931703	1-18-044DEL	20	Sep 4 2019	S. Felder	Oct 28 2020	M. Cameron	No	Functional	Headwall is slightly steep not quite too grade, steep slopes on both sides greater than 45, channel is wider than natural stream channel
931703	1-18-044DEL	23	Oct 28 2020	M. Cameron			No	Functional	
931703	1-18-044DEL	26	Sep 4 2019	L. McCullough	Oct 28 2020	M. Cameron	No	Functional	
931703	1-18-044DEL	27	Oct 25 2019	M. Cameron	Oct 28 2020	M. Cameron	No	Functional	
931703	1-18-044DEL	28	Oct 25 2019	M. Cameron	Oct 28 2020	M. Cameron	No	Functional	
931703	1-18-044DEL	29	Sep 4 2019	S. Felder	Oct 28 2020	M. Cameron	No	Functional	
931703	1-18-044DEL	30	Sep 4 2019	L. McCullough	Oct 28 2020	M. Cameron	No	Functional	Steep rough sides.
931703	1-18-044DEL	31	Sep 4 2019	L. McCullough	Oct 28 2020	M. Cameron	No	Functional	Grade change throughout crossing. Rough sides.
931703	1-18-044DEL	33	Sep 4 2019	L. McCullough	Oct 28 2020	M. Cameron	No	Functional	
931703	1-18-044DEL	41	Oct 24 2019	M. Cameron	Nov 4 2020	M. Cameron	No	Functional	

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931703	1-18-044DEL	42	Oct 28 2020	M. Cameron			No	Functional	
931802	1-18-00187-DEL	02	Oct 30 2020	M. Cameron			No	Functional	
931803	1-19-00100-DEL	01	Oct 27 2020	M. Cameron			No	Functional	
931803	1-19-00100-DEL	05	Oct 27 2020	M. Cameron			No	Functional	
931803	1-19-00100-DEL	10	Dec 30 2020	N. Ludington			No	Functional	
931803	1-19-00100-DEL	15	Nov 2 2020	M. Cameron			No	Functional	
931803	1-19-00100-DEL	16	Nov 2 2020	M. Cameron			No	Functional	
931902	1-19-00158DEL	09	Oct 30 2020	M. Cameron			No	Functional	
931902	1-19-00158DEL	10	Oct 30 2020	M. Cameron			No	Functional	
931902	1-19-00158DEL	11	Oct 30 2020	M. Cameron			No	Functional	
931902	1-19-00158DEL	12	Oct 30 2020	M. Cameron			No	Functional	
941502	1-16-006 DEL	34	Nov 11 2020	M. Cameron			No	Functional	
941702	1-18-071-DEL	03	Oct 31 2019	M. Cameron	Nov 4 2020	M. Cameron	No	Functional	
941702	1-18-071-DEL	04	Nov 4 2020	M. Cameron			No	Functional	
941702	1-18-071-DEL	06	Nov 4 2020	M. Cameron			No	Functional	
941702	1-18-071-DEL	07	Nov 4 2020	M. Cameron			No	Functional	
941702	1-18-071-DEL	08	Nov 4 2020	M. Cameron			No	Functional	
941702	1-18-071-DEL	09	Nov 4 2020	M. Cameron			No	Functional	
941702	1-18-071-DEL	11	Oct 24 2019	S. Felder	Nov 4 2020	M. Cameron	No	Functional	
941702	1-18-071-DEL	12	Oct 24 2019	S. Felder	Nov 4 2020	M. Cameron	No	Functional	
941801	1-18-00158-DEL	05	Oct 24 2019	S. Felder	Nov 11 2020	M. Cameron	No	Functional	
941801	1-18-00158-DEL	06	Nov 11 2020	M. Cameron			No	Functional	

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941801	1-18-00158-DEL	15	Nov 12 2020	M. Cameron			No	Functional	
941801	1-18-00158-DEL	18	Nov 11 2020	M. Cameron			No	Functional	
941801	1-18-00158-DEL	19	Nov 11 2020	M. Cameron			No	Functional	
941801	1-18-00158-DEL	20	Nov 11 2020	M. Cameron			No	Functional	
941801	1-18-00158-DEL	21	Oct 31 2019	M. Cameron	Nov 11 2020	M. Cameron	No	Functional	
941801	1-18-00158-DEL	23	Oct 24 2019	S. Felder	Nov 5 2020	M. Cameron	No	Functional	
941801	1-18-00158-DEL	24	Oct 24 2019	S. Felder	Nov 5 2020	M. Cameron	No	Functional	
941801	1-18-00158-DEL	28	Oct 24 2019	S. Felder	Nov 5 2020	M. Cameron	No	Functional	
941801	1-18-00158-DEL	34	Oct 31 2020	M. Cameron			No	Functional	
941801	1-18-00158-DEL	Aa	Nov 4 2020	M. Cameron			No	Functional	
951701	1-18-107DEL	01	Nov 11 2020	M. Cameron			No	Functional	
951701	1-18-107DEL	10	Nov 18 2020	M. Cameron			No	Functional	
951701	1-18-107DEL	11	Nov 18 2020	M. Cameron			No	Functional	
N/A	N/A	CR1800-01	Oct 22 2018	N. Ludington	Jul 30 2019	S. Felder	No	Functional	
N/A	N/A	CR1800-04	Oct 19 2018	N. Ludington	Oct 7 2019	N. Ludington	No	Functional	
N/A	N/A	CR1800-05	Oct 19 2018	N. Ludington	Jul 30 2019	S. Felder	No	Functional	
N/A	N/A	CR1800-06	Oct 19 2018	N. Ludington	Jul 30 2019	S. Felder	No	Functional	
N/A	N/A	CR1800-08	Oct 19 2018	N. Ludington	Jul 30 2019	S. Felder	No	Functional	
N/A	N/A	CR2270-01	Oct 18 2019	M. Cameron	Jul 29 2020	N. Ludington	No	Functional	
N/A	N/A	CR2270-02	Oct 18 2019	M. Cameron	Jul 29 2020	N. Ludington	No	Functional	
N/A	N/A	CR2270-03	Oct 18 2019	M. Cameron	Jul 29 2020	N. Ludington	No	Functional	
N/A	N/A	KM-800-01	Oct 23 2019	S. Felder	Aug 10 2020	M. Lewis	No	Functional	

GDRCO #	State #	Road Point	Pre-Winter Inspection Date	RPF Pre-Inspection	Post-winter Inspection Date	RPF Post-Inspection	Issues Identified	Functional Status	Notes
N/A	N/A	T-500-01	Nov 3 2020	M. Lewis			No	Functional	
N/A	N/A	T-500-05	Nov 3 2020	M. Lewis			No	Functional	
N/A	N/A	T-500-06	Nov 3 2020	M. Lewis			No	Functional	
N/A	N/A	T-500-07	Nov 3 2020	M. Lewis			No	Functional	
N/A	N/A	WI 700-501	Jul 31 2019	Tyler Brown	Oct 21 2020	M. Cameron	No	Functional	
N/A	N/A	WI700-502	Jul 31 2019	Tyler Brown	Oct 21 2020	M. Cameron	No	Functional	
N/A	N/A	WI-700-503	Jul 31 2019	Tyler Brown	Oct 21 2020	M. Cameron	No	Functional	
N/A	N/A	WM 1830-01	Oct 26 2018	N. Ludington	Aug 7 2019	N. Ludington	No	Functional	
N/A	N/A	WM 1830-02	Oct 26 2018	N. Ludington	Aug 7 2019	N. Ludington	No	Functional	
N/A	N/A	WM 1830-04	Oct 26 2018	N. Ludington	Oct 8 2019	N. Ludington	No	Functional	
N/A	N/A	WM 1830-05	Oct 26 2018	N. Ludington	Aug 7 2019	N. Ludington	No	Functional	
N/A	N/A	WM 1830-07	Oct 26 2018	N. Ludington	Aug 7 2019	N. Ludington	No	Functional	
N/A	N/A	WM 2400-01	Oct 26 2018	N. Ludington	Aug 7 2019	N. Ludington	No	Functional	

Appendix C

2020 Summer Juvenile Salmonid Population Sampling Program - Annual Report to NMFS

Green Diamond Resource Company's Annual Report

To

National Marine Fisheries Service

For

Permit 17351

Summer Juvenile Salmonid Population Sampling Program

2020

Prepared by:

Michael Zontos
Green Diamond Resource Company
P.O. Box 68
Korbel, CA 95550

INTRODUCTION

In 2020, Green Diamond Resource Company (GDRCo) conducted its twenty-sixth year of summer juvenile salmonid population monitoring, under a National Marine Fisheries Service (NMFS) Section 10 Permit (17351). This permit is required to cover take of Endangered Species Act (ESA) listed salmonids that may result from monitoring activities. The covered species include the Southern Oregon/North Coastal California (SONCC) coho salmon (*Oncorhyncus kisutch*) evolutionarily significant unit (ESU), the California Coastal (CC) Chinook Salmon (*Oncorhyncus tshawytscha*) ESU, and the Northern California (NC) steelhead trout (*Oncorhyncus mykiss*) distinct population segment (DPS). A Scientific Collection Permit (SCP) and a Memorandum of Understanding (MOU) for coho salmon from the California Department of Fish and Wildlife (CDFW) were also obtained to allow for the implementation of this project.

Single stream summer juvenile salmonid population monitoring is a component of the Effectiveness Monitoring Program under the GDRCo Aquatic Habitat Conservation Plan (AHCP; GDRCo, 2006). This monitoring program allows GDRCo to obtain annual estimates on juvenile salmonids (coho salmon, Chinook salmon, steelhead trout and coastal cutthroat trout). Where possible, the summer estimates for juvenile coho can be compared with coho smolt production estimates from an outmigrant trapping program to yield an apparent over-winter survival rate for juvenile coho populations. The apparent over-winter survival rates are provided in the 2020 outmigrant trapping report (GDRCo 2020). The summer population estimates help to establish baseline and long-term trend data on the abundance of juvenile salmonid populations.

Eleven creeks were sampled in 2020 and are distributed among five hydrographic planning areas (HPAs) as defined in the GDRCo Aquatic Habitat Conservation Plan (GDRCo 2006). The sample design and protocol employed was that described by Hankin and Mohr (2001), and is based primarily on diver observations, with repeat passes and electrofishing used to calibrate the probability of detection. Counts of juvenile coho salmon, 1+ steelhead trout and coastal cutthroat trout were conducted in 2020 and population sizes were estimated.

This report presents the results from the 2020 summer juvenile population monitoring effort and makes select comparisons to past monitoring dating as far back as 1995 in some of these streams. In addition to population estimates, this report summarizes the number of ESA listed salmonids observed, handled, and incidentally taken during each part of project implementation.

METHODS

Study Sites

Eleven monitoring sites were sampled in 2020. The streams surveyed were Ah Pah Creek, Cañon Creek, Hunter Creek, Little Surpur Creek, Lower South Fork Little River, South Fork Ah Pah Creek, South Fork Rowdy Creek / Savoy Creek, South Fork Winchuck River, Sullivan Gulch, Upper South Fork Little River and Wilson Creek. Collectively, these sites represent five HPAs along north coastal California; Smith River, Coastal Klamath, Little River, North Fork Mad River, and Mad River (Appendix 1). These monitoring sites are restricted to anadromous coho salmon habitats located in sub-basins within lands predominantly owned by GDRCo. Each site consists of a linear segment(s) of stream and the extent of each reach was determined by evidence of coho anadromy and can vary in length from year to year.

Sampling Design

The sampling methodologies used by GDRCo for estimating summer juvenile salmonid populations have evolved over the years with advances in fisheries population monitoring techniques. The sampling design described by Hankin and Reeves (1988) was used from 1995 to 2000. From 2001 to the present, the two phase sampling design described by Hankin and Mohr (2001) was employed. This new sampling design increased the use of diver counts and reduced the amount of electrofishing and the associated deleterious effects on listed species and other stream biota. Using this technique, sampling varies based on stream habitat type. The sampling rate for deep pools is 50% for Phase I and 100% for Phase II dives. For shallow units the sampling rate is 50% for both Phase I and Phase II dives. Riffles are sampled systematically at 8.5% (1 in 12) with a random start. The electrofishing protocol is a minimum of 3 passes and depletion. Detailed GDRCo field protocols are maintained and available upon request. In 2020, at Lower South Fork Little River (LSFLR), the sampling rate for Phase II shallow pools was reduced from 50% to 33% in an effort to decrease our electrofishing in this particular reach. LSFLR consistently produces high densities of coho juveniles and this modification to the sampling design was implemented in an effort to reduce our electrofishing footprint while still obtaining a reliable population estimate. Details on the electrofishing equipment used are provided in Appendix 2. The NMFS guidelines were followed when operating an electrofisher (Schaeffer and Logan 2000).

In addition to adopting the improved sampling design, there have been other modifications to the protocol over the years. Prior to 1999, the difference between a deep pool and a shallow pool was subjective and based on the surveyors' opinion on electrofishing effectiveness for the particular unit. Beginning in the 1999 field season, the decision between deep or shallow pools was based solely on depth. A pool less than 3.4 feet was a shallow pool. This provided better consistency between personnel, improving the validity of comparisons of population estimates between different streams, surveyors, and organizations or agencies. Additionally, starting in 2001, run habitat was grouped with the shallow pool habitat stratum because small sample sizes for runs prohibited treating them separately. This change was adopted to improve the estimates because of the increased number of calibrated shallow pools.

Population Estimates

Estimates and confidence intervals were generated using the updated estimators of abundance and variance described by Mohr and Hankin (2005). The estimators were written in R code by Mike Mohr and Western EcoSystems Technology Inc. (WEST-Inc.). The primary improvements in these estimators are the addition of bias adjustments associated with diver count and electrofishing probabilities of detection, to reduce the bias of the bounded counts and jackknife estimators, respectively. This improved estimator was applied to the earlier (pre-2005) data as well. Where the application of these estimators was not possible, due to either protocol variance or small sample size, hard counts or bounded counts, were used. These were usually limited to a single habitat stratum (e.g., runs) and could not be extrapolated to the entire stream for that year.

During the diving component of the surveys, counts were recorded for coho, Chinook, cutthroat (≥1+), and steelhead (≥1+). No attempts were made to count 0+ trout, though they are enumerated during electrofishing. Estimates were generated for coho, steelhead and cutthroat only. Each stream was surveyed to the upper extent of coho anadromy. Surveyed extents for each stream are depicted on maps provided in Appendix 1.

For estimates presented in this report, the shallow unit (SU) habitat stratum includes runs (1995-2000), riffles, and shallow pools (which included runs after 2000). When combined, the estimates of abundance and variances of each stratum were summed for the combined category estimate (Zar, 1999). The product of the variance for SU was then used to calculate the confidence interval (CI). In cases where the sample size for a shallow habitat type was one, an estimate could not be calculated, and thus, the hard count or bounded count for this habitat type was summed with the estimates for the other SU habitat types. Confidence intervals were then calculated as described above using the sum of available variances.

While all data have been audited for accuracy and consistency as of this report, GDRCo maintains a data quality routine that occasionally detects previously unidentified errors. Any historical estimates presented in this report that may differ from previously reported figures, should be considered the most accurate.

RESULTS

Survey Effort and Habitat Composition

Stream habitat composition and sampling rates were summarized for each stream surveyed in 2020 (Table 1). Overall, the desired sampling rate for the different habitat stratum was achieved. The habitat stratum “other” was not surveyed for summer juvenile salmonids. Other habitats included: dry stream sections, isolated side-channel pools obviously not holding fish, or units where LWD, SWD or undercut banks were abundant enough to prevent effective observation or safe electrofishing. No take of ESA listed SONCC coho salmon, CC Chinook salmon, or NC steelhead occurred during the habitat typing process.

Dive Counts

A summary of the fish counts from the dive portion of the stream sampling was compiled for all sites monitored (Table 2). A total of 4,190 juvenile salmonids were observed in 2020. Four salmonid species were observed but coho and steelhead were the two dominant species, accounting for 59% and 32% respectively, of the total salmonid observations. No take of ESA listed SONCC coho salmon, CC Chinook salmon, or NC steelhead occurred during the dive component.

Electrofishing

The eleven monitoring sites were electroshocked from July 27th through October 20th 2020. A summary of sampling dates, habitat units sampled, maximum water temperature, electrofishing effort, maximum conductivity and maximum voltage used for the electrofishing portion of the survey are provided below for each site (Table 3). The water temperatures and conductivities at all sites were within the acceptable ranges.

The total number of individuals captured during the electrofishing portions of the surveys and associated mortality by stream and species were summarized (Table 4). A total of

3,491 salmonids were captured. The majority (71.9%) of captures were trout, followed by coho (22.8%), steelhead (3.8%) and cutthroat (1.4%). There were six steelhead 0+ mortalities observed during the 2020 summer juvenile population estimate survey. A summary of the possible ESA listed salmonid mortalities resulting from the 2020 electrofishing effort was compiled (Table 5).

Summer Juvenile Population Estimates

The 2020 population estimates and corresponding confidence intervals were summarized for the sites sampled (Table 6). Bar graphs were used to summarize the full history of estimates for coho (Figures 1-4) and steelhead (Figures 5-8) by stream for the 11 creeks sampled. The data used to create these figures are presented in Appendix 3. When possible, population estimates were generated using the most recent estimators of abundance and variance including the bias adjustments described in Mohr and Hankin (2005). In some cases, there were no units available, only one unit available or not enough units were sampled of a certain habitat type to use the standard estimation procedure. In those cases, either hard counts or single unit estimates with no variance are displayed. In other cases, the protocol was still being developed so the data was not available to use the standard estimation procedure. In those cases, the hard count numbers were used or the hard count numbers were added to the estimated numbers to give a value with no variance. Footnotes are included in Appendix 3 to indicate the estimation method used to calculate the values.

The results presented in this section are only for those sites monitored during the 2020 sampling period. However, the sites monitored over the history of this project have changed over time and some results from sampling at discontinued sites (N = 6) have been provided in Appendix 3. Justification for discontinuing sites has been provided in past annual monitoring reports or AHCP biennial reports (e.g., GDRCo 2015).

Table 1. Summary of stream habitat composition and sampling effort at sites monitored by GDRCo in 2020.

Creek Name	Criteria	Habitat Type: Deep Pool	Shallow Pool	Riffle	Other	Total
Ah Pah Creek	# Units	7	117	105	27	256
	Surveyed Units	3	58	9	0	70
	Percent Surveyed	42.9%	49.6%	8.6%	0.0%	27.3%
Cañon Creek	# Units	29	94	105	42	270
	Surveyed Units	14	42	8	0	64
	Percent Surveyed	48.3%	44.7%	7.6%	0.0%	23.7%
Hunter Creek	# Units	22	96	97	18	233
	Surveyed Units	11	47	8	0	66
	Percent Surveyed	50.0%	49.0%	8.2%	0.0%	28.3%
Little Surpur Creek	# Units	0	14	9	6	29
	Surveyed Units	0	7	3	0	10
	Percent Surveyed	N/A	50.0%	33.3%	0.0%	34.5%
Lower South Fork Little River	# Units	12	126	108	45	291
	Surveyed Units	6	41	9	0	56
	Percent Surveyed	50.0%	32.5%	8.3%	0.0%	19.2%
SF Ah Pah Creek	# Units	1	62	61	17	141
	Surveyed Units	0	29	5	0	34
	Percent Surveyed	0.0%	46.8%	8.2%	0.0%	24.1%
SF Rowdy and Savoy Creeks	# Units	1	120	126	33	280
	Surveyed Units	0	60	10	0	70
	Percent Surveyed	0.0%	50.0%	7.9%	0.0%	25.0%
SF Winchuck River	# Units	24	130	144	43	341
	Surveyed Units	12	65	12	0	89
	Percent Surveyed	50.0%	50.0%	8.3%	0.0%	26.1%
Sullivan Gulch	# Units	2	33	27	6	68
	Surveyed Units	2	16	3	0	21
	Percent Surveyed	100.0%	48.5%	11.1%	0.0%	30.9%
Upper South Fork Little River	# Units	11	93	84	27	215
	Surveyed Units	5	46	7	0	58
	Percent Surveyed	45.5%	49.5%	8.3%	0.0%	27.0%
Wilson Creek	# Units	19	79	83	45	226
	Surveyed Units	10	38	7	0	55
	Percent Surveyed	52.6%	48.1%	8.4%	0.0%	24.3%
Total	# Units	128	964	949	309	2,350
	Surveyed Units	63	449	81	0	593
	Percent Surveyed	49.2%	46.6%	8.5%	0.0%	25.2%

Table 2. Summary of salmonids observed during dive counts at each monitoring site sampled by GDRCo in 2020.

Creek Name	0+ Chinook	0+ Coho	1+ Cutthroat	1+ Steelhead
Ah Pah Creek	0	1	99	109
Cañon Creek	66	78	0	109
Hunter Creek	0	0	27	319
Little Surpur Creek	0	0	11	3
Lower South Fork Little River	0	1,639	7	69
SF Ah Pah Creek	0	0	15	25
SF Rowdy and Savoy	0	0	1	115
SF Winchuck River	3	118	105	346
Sullivan Gulch	0	84	0	9
Upper South Fork Little River	2	391	15	58
Wilson Creek	0	175	13	183
Total	71	2,485	292	1,343

Table 3. Summary of electroshocking sampling effort, maximum water temperature (MWT), maximum water conductivity (MC), maximum voltage (MV) and total time spent electrofishing for each monitoring site sampled by GDRCo in 2020.

Creek Name	Start Date	End Date	Sample Days	# Units Sampled * Riffle	# Units Sampled * Shallow Pool	MWT (°C)	MC (µS/cm)	MV (v)	Electrofishing Effort (sec.)
Ah Pah Creek	25-Aug	25-Aug	1	9	0	15.1	84	200	2,430
Cañon Creek	27-Jul	30-Jul	2	8	0	17.5	265	200	6,324
Hunter Creek	31-Aug	2-Sep	2	8	1	15.5	71	250	4,397
Little Surpur Creek	20-Oct	20-Oct	1	3	0	10.6	85	200	13,505
Lower South Fork Little River	6-Aug	13-Aug	3	9	9	89.1	86	250	506
SF Ah Pah Creek	20-Aug	20-Aug	1	5	0	14.2	108	200	1,700
SF Rowdy and Savoy	21-Sep	23-Sep	2	10	0	16.0	121	250	3,678
SF Winchuck River	30-Sep	1-Oct	2	12	0	14.7	89	200	6,272
Sullivan Gulch	27-Jul	29-Jul	2	3	0	15.1	149	200	881
Upper South Fork Little River	4-Aug	6-Aug	3	7	2	63.2	65	200	8,599
Wilson Creek	16-Sep	21-Sep	2	7	2	15.0	68	250	6,249
Total:			21	81	14				54,541

** Units sampled by electroshocking.*

Table 4. Summary of salmonid captures and mortalities associated with electroshocking conducted at monitoring sites sampled by GDRCo in 2020.

Creek Name	Criteria	0+ Coho	1+ Steelhead	1+ Cutthroat	0+ Trout	0+ Chinook
Ah Pah Creek	# Captured	-	15	10	100	-
	# of Mortalities	-	0	0	0	-
	Percent Mortalities	-	0.0%	0.0%	0.0%	-
Cañon Creek	# Captured	-	9	-	440	-
	# of Mortalities	-	0	-	3	-
	Percent Mortalities	-	0.0%	-	0.7%	-
Hunter Creek	# Captured	-	24	14	171	-
	# of Mortalities	-	0	0	0	-
	Percent Mortalities	-	0.0%	0.0%	0.0%	-
Little Surpur Creek	# Captured	-	-	4	24	-
	# of Mortalities	-	-	0	0	-
	Percent Mortalities	-	-	0.0%	0.0%	-
Lower South Fork Little River	# Captured	655	13	2	500	-
	# of Mortalities	0	0	0	1	-
	Percent Mortalities	0.0%	0.0%	0.0%	0.2%	-
SF Ah Pah Creek	# Captured	-	-	8	93	-
	# of Mortalities	-	-	0	0	-
	Percent Mortalities	-	-	0.0%	0.0%	-
SF Rowdy and Savoy Creeks	# Captured	-	11	-	250	-
	# of Mortalities	-	0	-	0	-
	Percent Mortalities	-	0.0%	-	0.0%	-
SF Winchuck River	# Captured	-	13	9	438	-
	# of Mortalities	-	0	0	0	-
	Percent Mortalities	-	0.0%	0.0%	0.0%	-
Sullivan Gulch	# Captured	-	-	-	23	-
	# of Mortalities	-	-	-	1	-
	Percent Mortalities		-	-	4.3%	-
Upper South Fork Little River	# Captured	61	14	2	167	-
	# of Mortalities	0	0	0	1	-
	Percent Mortalities	0.0%	0.0%	0.0%	0.6%	-
Wilson Creek	# Captured	82	35	-	304	-
	# of Mortalities	0	0	-	0	-
	Percent Mortalities	0.0%	0.0%	-	0.0%	-
Total	# Captured	798	134	49	2,510	-
	# of Mortalities	0	0	0	6	-
	Percent Mortalities	0.0%	0.0%	0.0%	0.24%	-

"-" represents no capture of species.

Table 5. Summary of captures and possible mortalities for Federal Endangered Species Act (ESA) listed salmonids associated with electroshocking conducted at monitoring sites sampled by GDRCo in 2020.

Species	ESU / DPS	ESA Status	Age Class	Captured^	Mortalities #	Mortalities %
Coho	SONCC	Threatened	0+	791	0	0.0%
Chinook	CC	Threatened	0+	0	0	0.0%
Steelhead	NC	Threatened	0+	1,094	6	0.5%
Steelhead	NC	Threatened	1+	72	0	0.0%

^ Captured by electroshocking

Table 6. Summer juvenile population estimates and confidence intervals (CI) for three salmonid species at monitoring sites sampled by GDRCo in 2020.

		Deep Pool		Shallow Pool		Riffle		Total
Creek Name	**Species**	**Estimate**	**95% CI**	**Estimate**	**95% CI**	**Estimate**	**95% CI**	**Estimate**
Ah Pah Creek	Coho	2	4	0	0	0	0	2
	Cutthroat	113	130	162	52	117	97	391
	Steelhead	63	56	237	63	175	142	475
Cañon Creek	Coho	201	156	62	107	0	0	263
	Cutthroat	0	0	0	0	0	0	0
	Steelhead	212	53	139	52	118	135	469
Hunter Creek	Coho	0	0	0	0	0	0	0
	Cutthroat	27	10	58	45	97	140	182
	Steelhead	266	103	562	178	97	186	925
Little Surpur Creek	Coho	-	-	0	0	0	0	0
	Cutthroat	-	-	21	0	12	13	33
	Steelhead	-	-	6	0	0	0	6
Lower SF Little River	Coho	1,389	712	4,978	1,223	1,392	1,615	7,759
	Cutthroat	24	18	15	19	0	0	39
	Steelhead	90	32	201	61	0	0	291
SF Ah Pah Creek	Coho	-	-	0	0	0	0	0
	Cutthroat	-	-	46	36	98	79	144
	Steelhead	-	-	82	38	0	0	82
SF Rowdy - Savoy Creek	Coho	-	-	0	0	0	0	0
	Cutthroat	-	-	2	4	0	0	2
	Steelhead	-	-	255	72	139	137	394
SF Winchuck River	Coho	88	50	220	100	0	0	308
	Cutthroat	67	24	173	40	110	112	350
	Steelhead	199	51	674	108	156	157	1,029
Sullivan Gulch	Coho	29	4	133	42	0	0	161
	Cutthroat	0	0	0	0	0	0	0
	Steelhead	7	3	12	5	0	0	20
Upper SF Little River	Coho	241	141	695	180	60	76	996
	Cutthroat	21	9	21	11	0	0	42
	Steelhead	47	22	114	32	60	58	221
Wilson Creek	Coho	169	82	349	267	0	0	518
	Cutthroat	40	23	8	9	0	0	49
	Steelhead	300	124	220	112	119	180	638
Total	Coho	2,119	-	6,436	-	1,452	-	10,008
	Cutthroat	293	-	506	-	433	-	1,232
	Steelhead	1,186	-	2,501	-	863	-	4,550

- not applicable

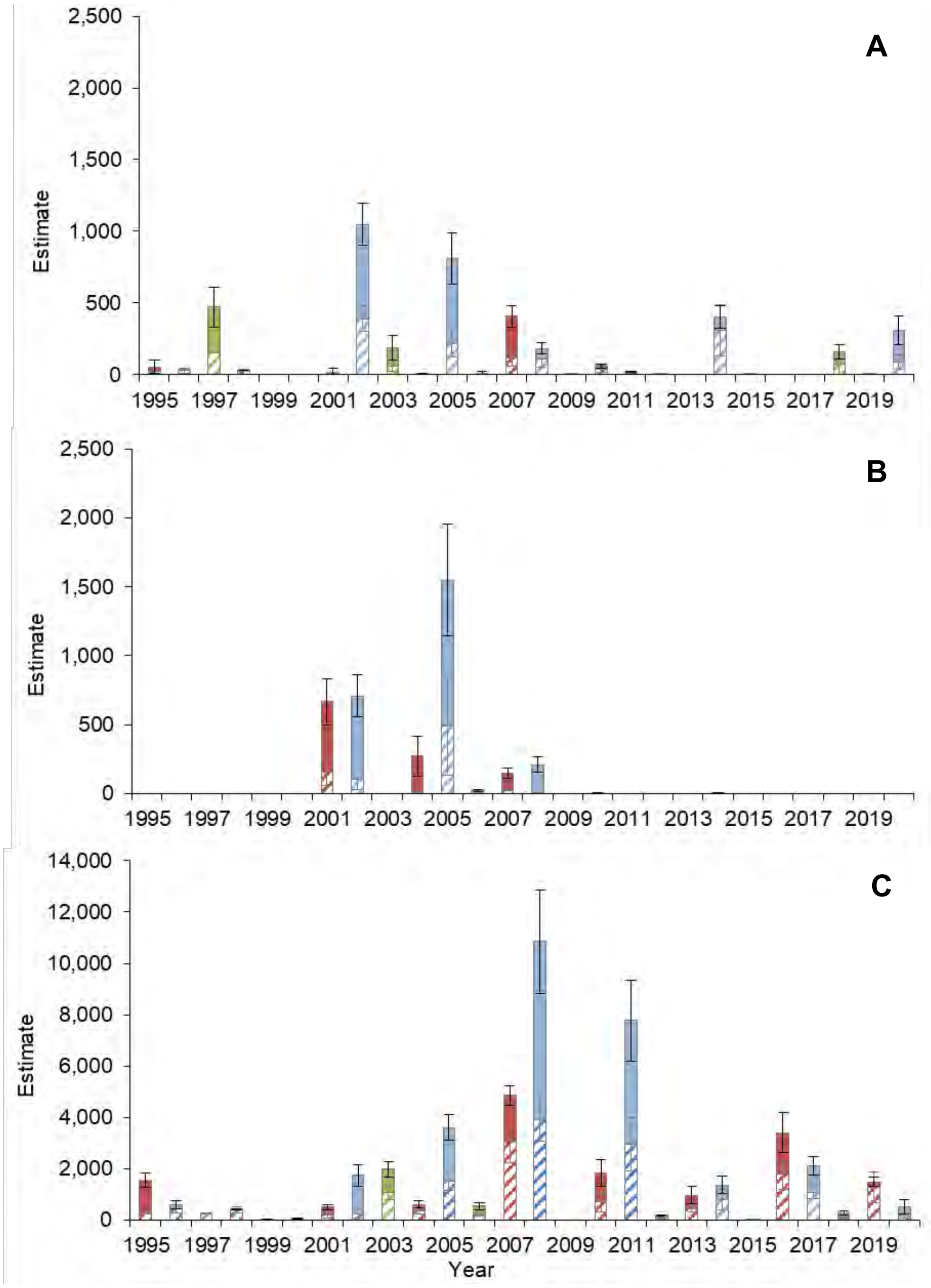

Figure 1. Histograms of Smith River HPA summer juvenile coho population estimates with confidence intervals for deep pools (diagonal striped bars) and shallow units (solid bars) at SF Winchuck River (A), SF Rowdy/Savoy Creeks (B), and Wilson Creek (C) sampled by GDRCo. Colors indicate three distinct cohorts of coho and an asterisk (*) indicates year(s) when sampling was not conducted. Scale on y-axes vary among histograms.

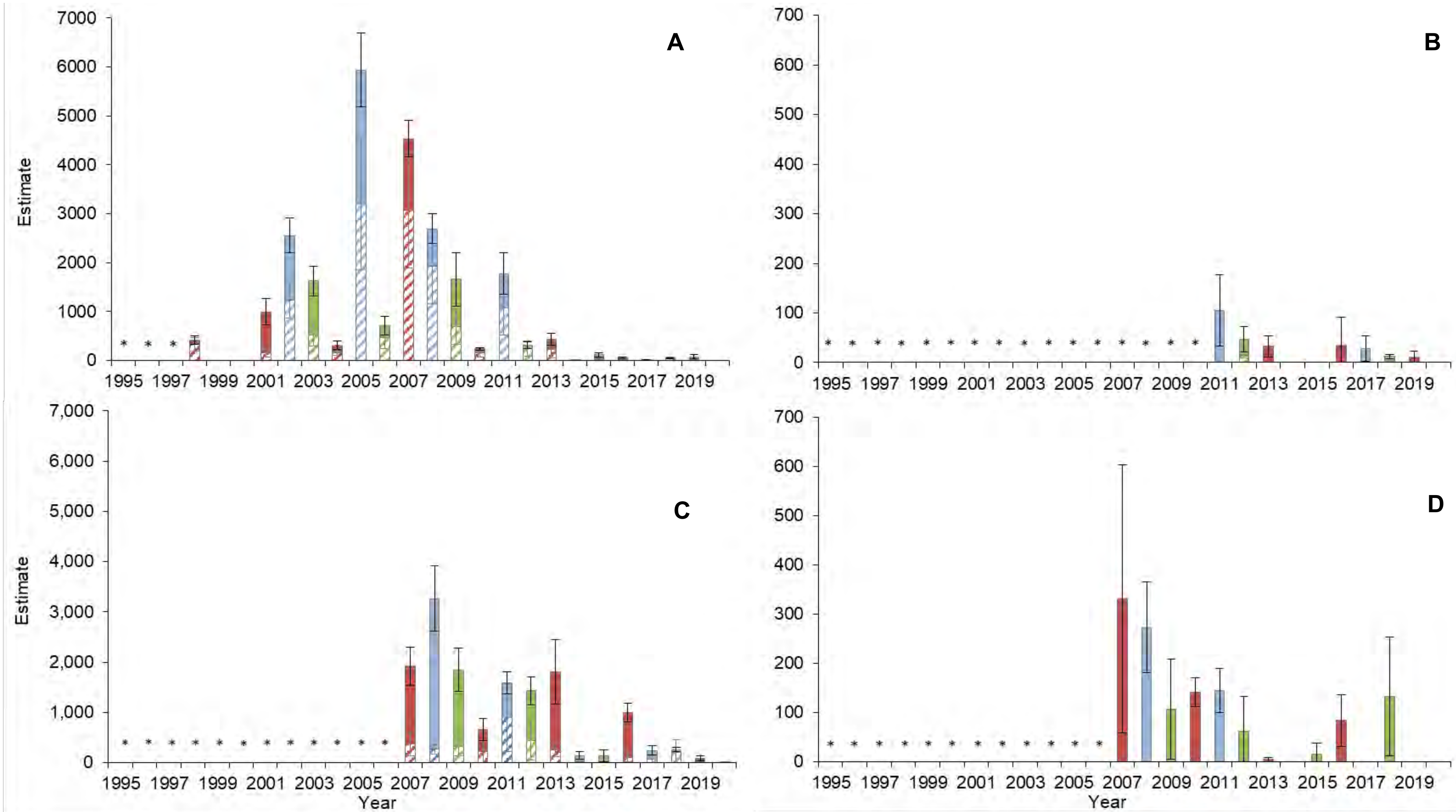

Figure 2. Histograms of Coastal Klamath HPA summer juvenile coho population estimates with confidence intervals for deep pools (diagonal striped bars) and shallow units (solid bars) at Hunter Creek (A), Little Surpur Creek (B), Ah Pah Creek (C), and SF Ah Pah Creek (D) sampled by GDRCo. Colors indicate three distinct cohorts of coho and an asterisk (*) indicates year(s) when sampling was not conducted. Scale on y-axes vary among histograms.

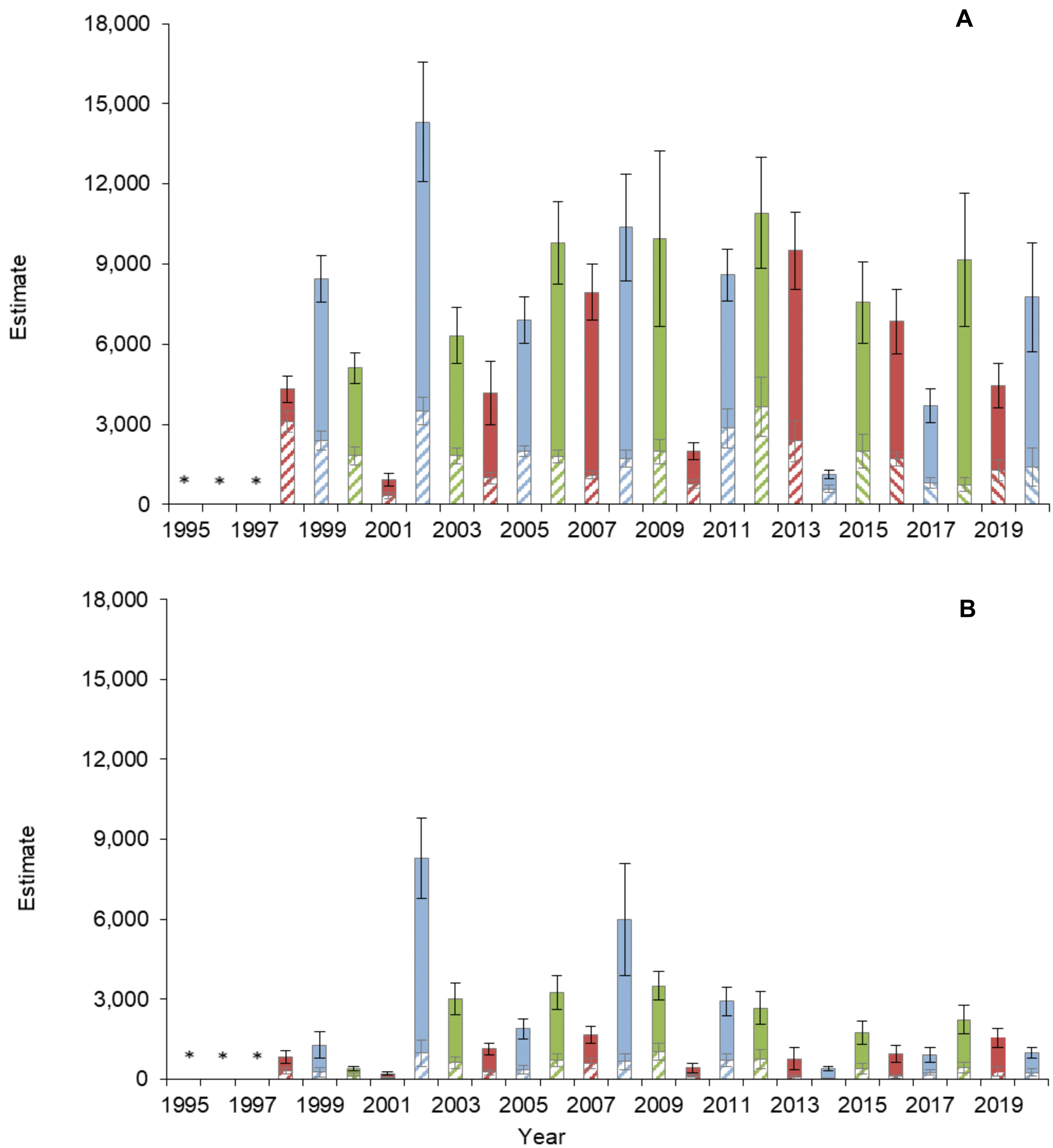

Figure 3. Histograms of Little River HPA summer juvenile coho population estimates with confidence intervals for deep pools (diagonal striped bars) and shallow units (solid bars) at Lower SF Little River (A), and Upper SF Little River (B) sampled by GDRCo. Colors indicate three distinct cohorts of coho and an asterisk (*) indicates year(s) when sampling was not conducted.

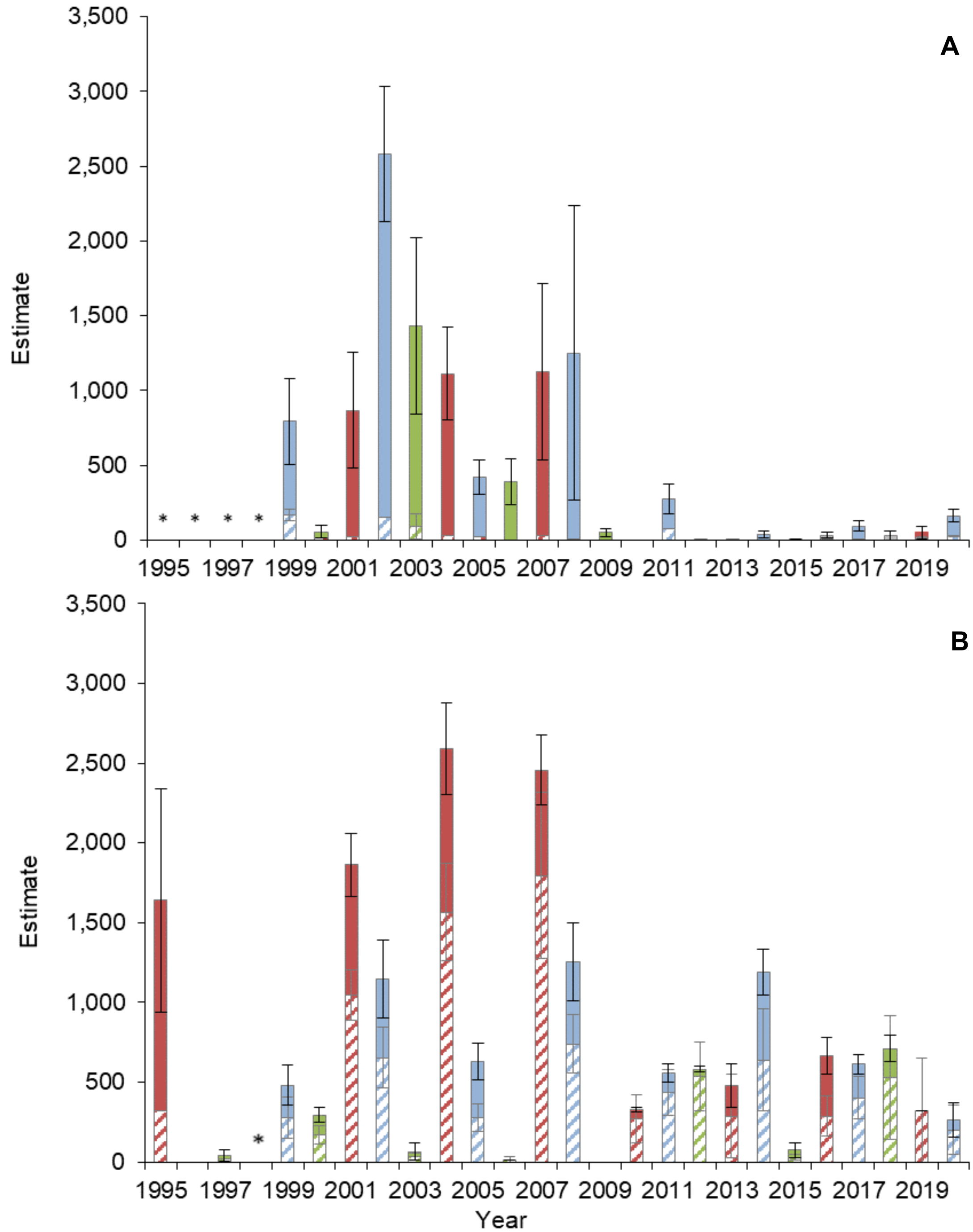

Figure 4. Histograms of Mad River and North Fork Mad River HPAs summer juvenile coho population estimates with confidence intervals for deep pools (diagonal striped bars) and shallow units (solid bars) at Sullivan Gulch (A) and Cañon Creek (B) sampled by GDRCo. Colors indicate three distinct cohorts of coho and an asterisk (*) indicates year(s) when sampling was not conducted.

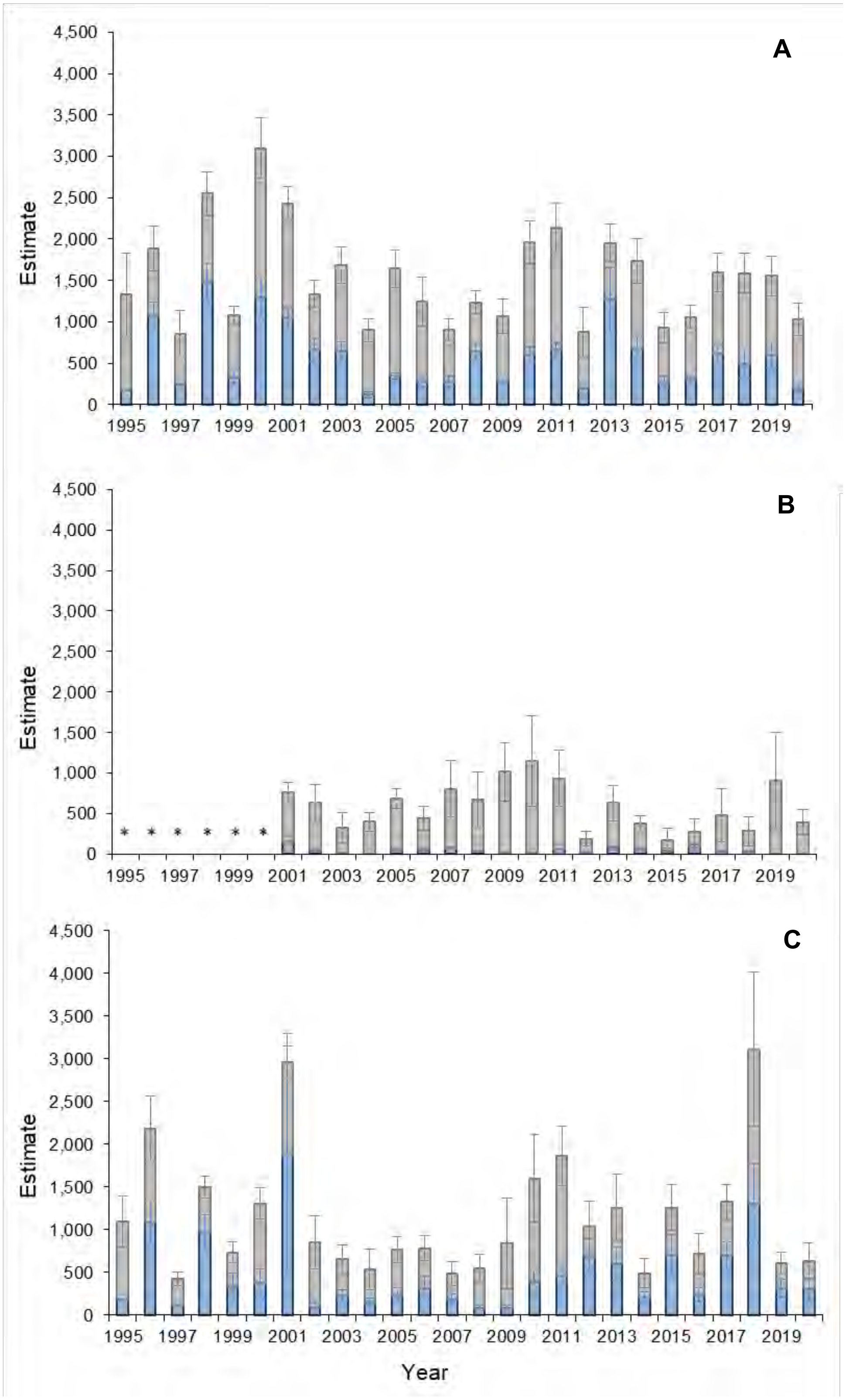

Figure 5. Histograms of Smith River HPA summer juvenile steelhead population estimates with confidence intervals for deep pools (blue) and shallow units (gray) at SF Winchuck River (A), SF Rowdy/Savoy Creeks (B), and Wilson Creek (C) sampled by GDRCo. An asterisk (*) indicates year(s) when sampling was not conducted.

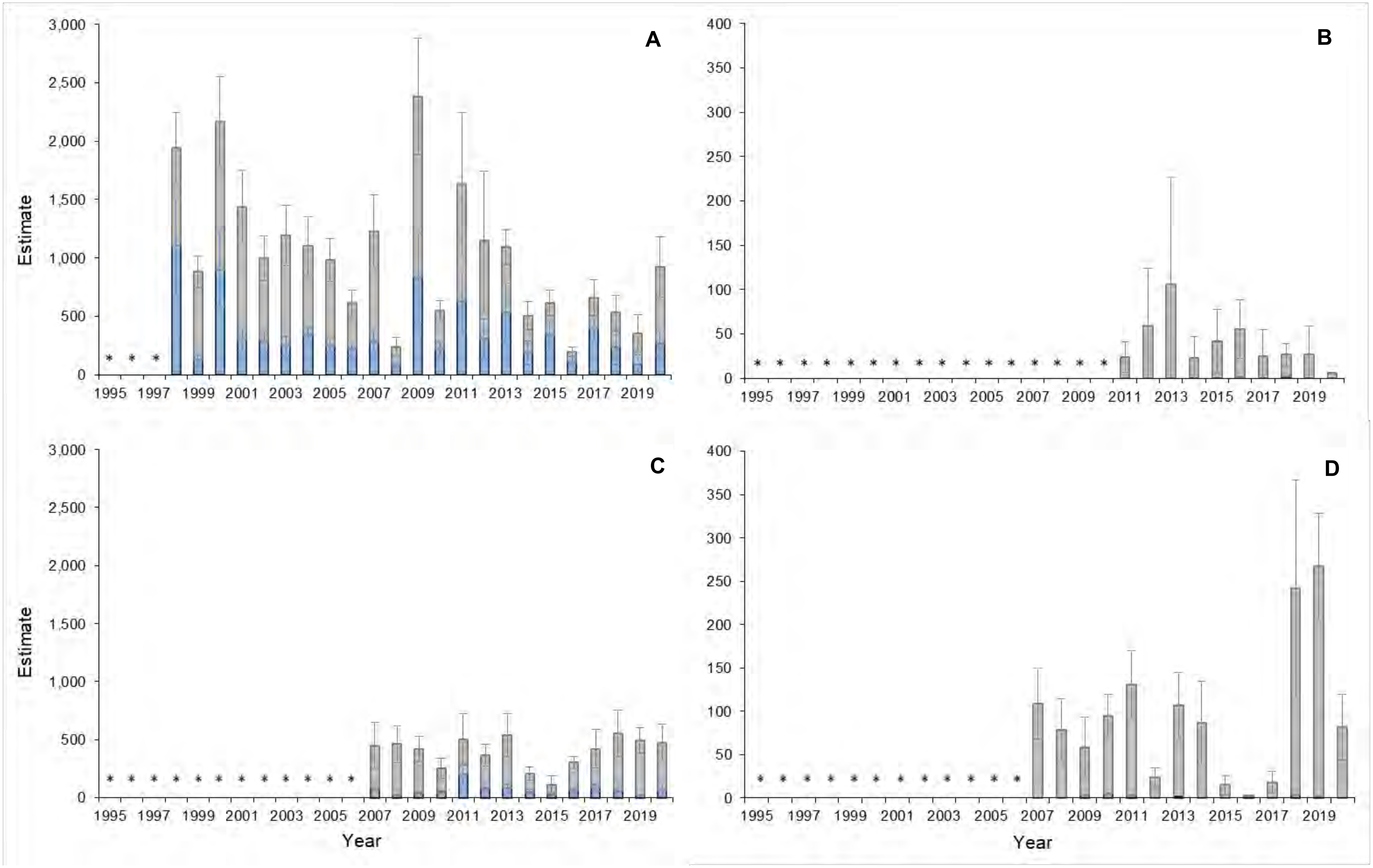

Figure 6. Histograms of Coastal Klamath HPA summer juvenile steelhead population estimates with confidence intervals for deep pool units (blue) shallow units (gray) at Hunter Creek (A), Little Surpur Creek (B), Ah Pah Creek (C), and SF Ah Pah Creek (D) sampled by GDRCo. An asterisk (*) indicates year(s) when sampling was not conducted. Scale on y-axes vary among histograms.

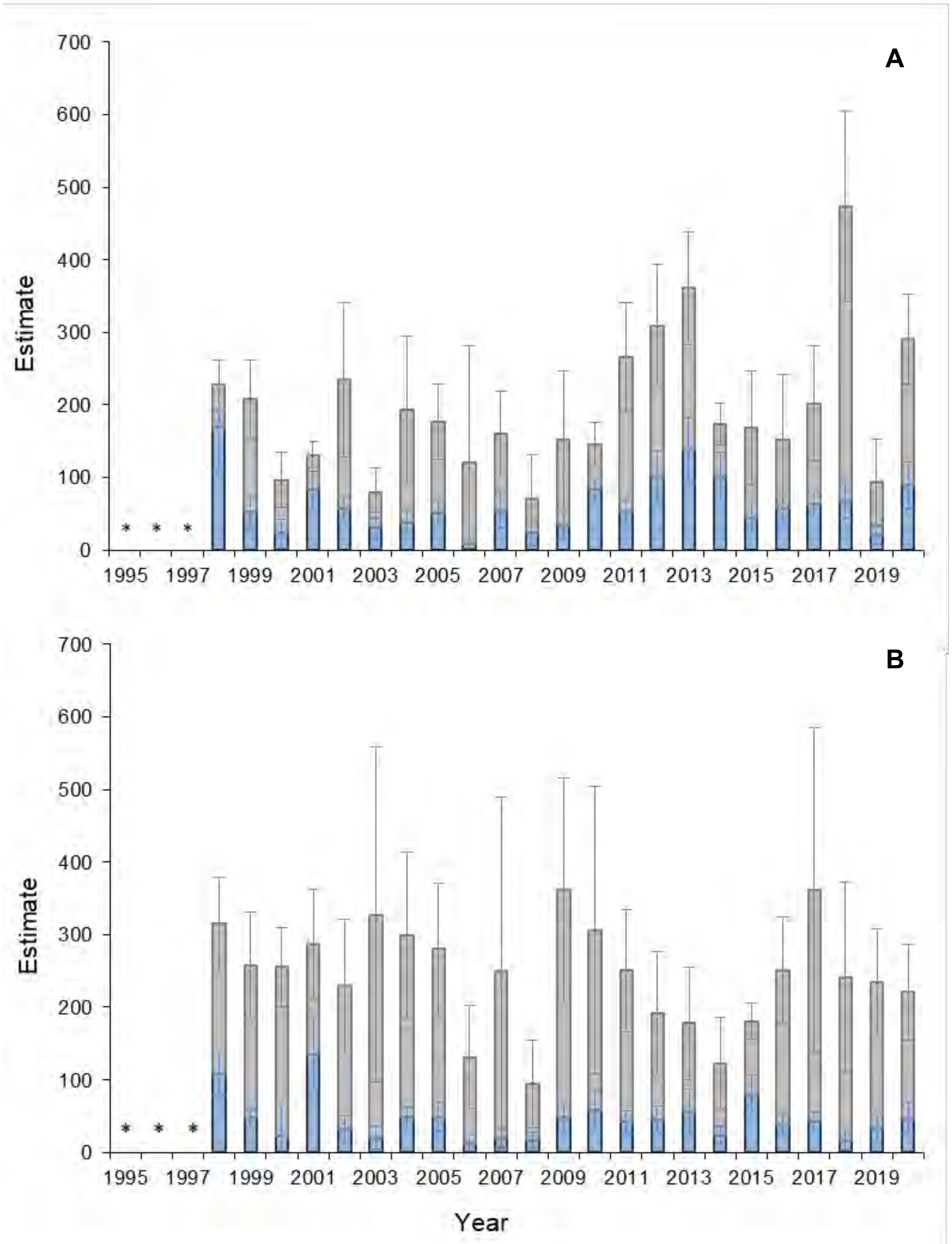

Figure 7. Histograms of Little River HPA summer juvenile steelhead population estimates with confidence intervals for deep pool units (blue) and shallow units (gray) at Lower SF Little River (A), and Upper SF Little River (B) sampled by GDRCo. An asterisk (*) indicates year(s) when sampling was not conducted.

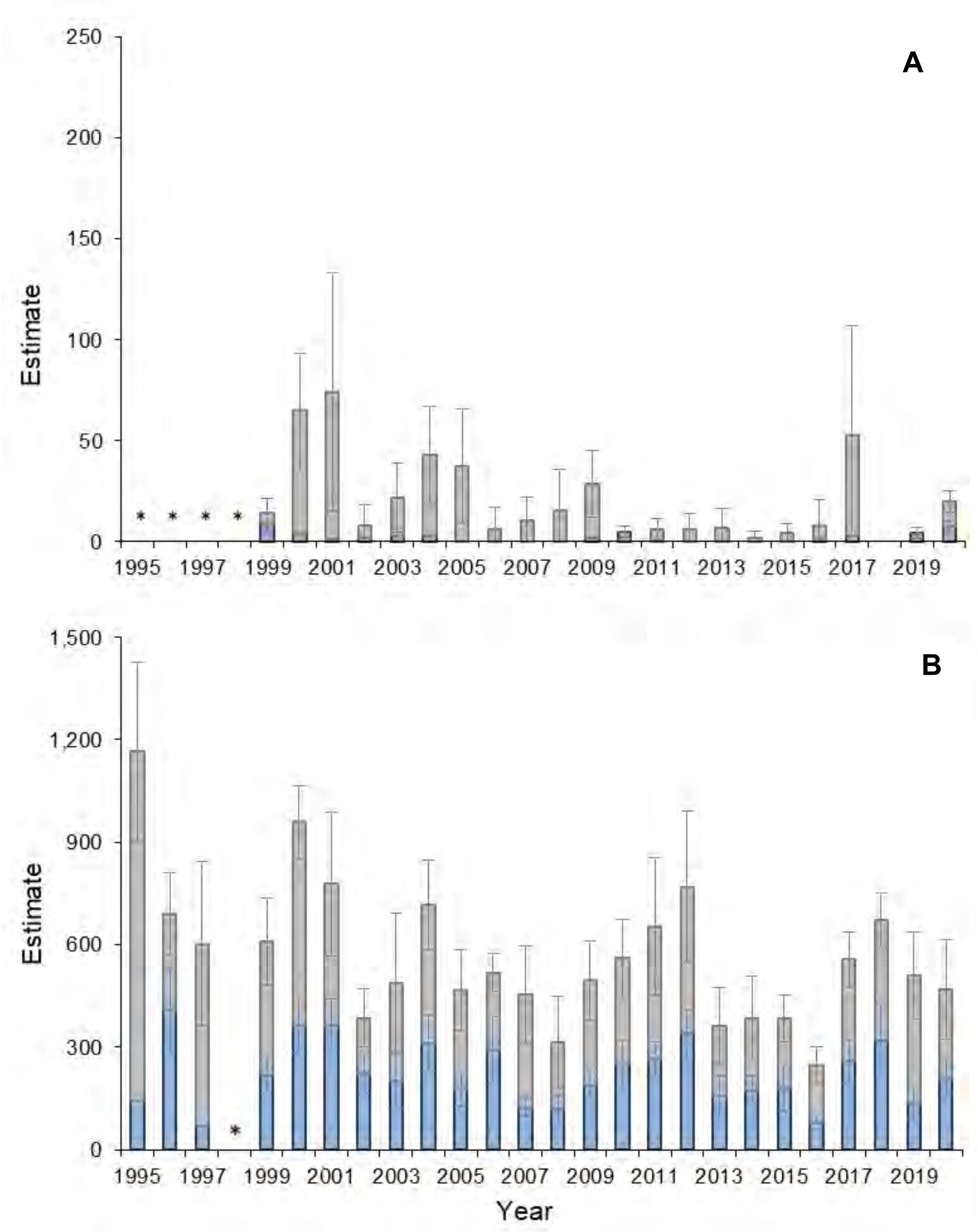

Figure 8. Histograms of Mad River and North Fork Mad River HPAs summer juvenile steelhead population estimates with confidence intervals for deep pool units (blue) and shallow units (gray) at Sullivan Gulch (A) and Cañon Creek (B) sampled by GDRCo. An asterisk (*) indicates year(s) when sampling was not conducted. Scale on y-axes vary among histograms.

DISCUSSION

Population Estimates

There was a lot of variability from north to south in summer juvenile population estimates for coho among the sites monitored in 2020. In the Smith River HPA, the SF Winchuck had an increase in coho detections (308) compared to the last time the cohort was estimated in 2017 (0). For the sixth straight year coho were not detected at SF Rowdy/Savoy creeks. Estimates at these two most northern sites over the last 10 years have been low or not detected. GDRCo has operated a turbidity threshold sampling station in lower SF Winchuck since 2008 and the watershed has consistently produced some of the lowest suspended sediment values observed across our California timberlands. The reason for the lack of coho in the basin is unclear but water quality does not appear to be a major contributing factor. Wilson Creek is our most southern watershed in the Smith River HPA. The 2020 cohort (blue bars) in Wilson Creek produces the largest estimates of the three cohorts on record with its peak in 2008 (10,846), but has since been in a steady decline. Population estimates calculated in the Coastal Klamath HPA continued to be low or undetected for 2020. Hunter Creek estimates over the last 10 years have been low and in 2020 there were no coho detections. There has been extensive habitat restoration projects implemented in Hunter Creek over the last few years and there has yet to be an apparent response in the population estimates. Little Surpur Creek had no coho detections in 2020 but was surveyed later than previous years (October 20th, 2020).The Ah Pah Creek coho estimates significantly decreased in 2020 (2) compared to 2017 (996), and are well below the long term average for the site. Coho were not observed in SF Ah Pah Creek in 2020 for the second year in a row. Population estimates for coho in the Mad River and North Fork Mad River HPAs were low for 2020. Since the late 1990's, this year's cohort (blue bars) has been responsible for producing the largest estimates in Sullivan Gulch and relatively stable estimates in Cañon Creek. In 2020, Sullivan Gulch estimates remained relatively low; however, the population estimate for coho increased (161) from the last time the cohort was estimated in 2017 (33). In 2020, Cañon Creek estimate was low and remains on a downward trend. The Little River HPA continues to be the most stable producer of coho juveniles on GDRCo ownership. In 2020, estimates increased at both Lower SF Little River and Upper SF Little River.

The cause(s) of the observed coho juvenile population dynamics is unclear but they are presumably a result of multiple factors, including climate, ocean conditions, predator-prey dynamics, spawning and rearing habitat availability, and anthropogenic disturbances, acting synergistically. A detailed analysis is planned for the future and will possibly explain which of these factors are associated with the observed changes and confirm the existence of a pattern in summer juvenile coho salmon population estimates.

Steelhead juvenile estimates for 2020 were also variable among sites monitored. However, comparing the 2020 estimates to the long term averages shows that 10 out of the 11 sites were above long term averages. Sites with the most consistent and largest population estimates over time continue to be in the northernmost HPA's. There is no clear explanation for the observed changes in 2020 or the dynamics in steelhead juveniles documented over the term of this monitoring project. The cause(s) are likely the result of similar factors as mentioned above for coho salmon. Again, a detailed analysis is planned which should explore if some of these factors are associated with the observed changes in summer juvenile steelhead trout population estimates.

Mortalities

The efforts by GDRCo fisheries staff to minimize take of Federal ESA listed species were effective in 2020. Of the 1,957 salmonids captured during over 15 hours (54,541 seconds) of electrofishing, there were only 6 steelhead 0+ mortalities. These fish were likely overexposed to electrical shock which resulted in direct mortality. This exceptionally low mortality is believed to be a direct result of the dedicated efforts from a consistent staff of well trained and experienced fisheries professionals employed at Green Diamond Resource Company.

Electrofishing is a valuable sampling technique but poses the greatest risk to fish health (Snyder, 2003). Green Diamond Resource Company followed strict protocol and ensured proper training of field crews to alleviate this potential risk. The crew monitored stream temperature and conductivity prior to and during electrofishing to confirm that temperatures were less than or equal to 18°C and/or water conductivity was less than or equal to 350 μS/cm. Finally, efforts were made to keep holding time of fish to a minimum, and when necessary, in-stream mesh holding pens were used to ensure that fish were retained in cold, well-oxygenated water.

Coordinating Research Efforts

Green Diamond Resource Company maintains an open dialogue with various federal, state, and tribal agencies to avoid sampling redundancy whenever possible.

Acknowledgments

Several people contributed to the implementation and continued success of this monitoring project and are worthy of acknowledgement and recognition. First, thank you to the following individuals for their hard work, long hours and dedicated efforts conducting the field work: Jonathan Pini, Matthew Nannizzi, Matthew Kluber, William Devenport and Audrey Gomes. Thank you to Neil Cheatum for his continued efforts and technical support maintaining and enhancing our data management system. Last but not least, thank you to both Matthew House and Pat Righter for their technical expertise, thoughtful input, and guidance during project implementation and review of this report.

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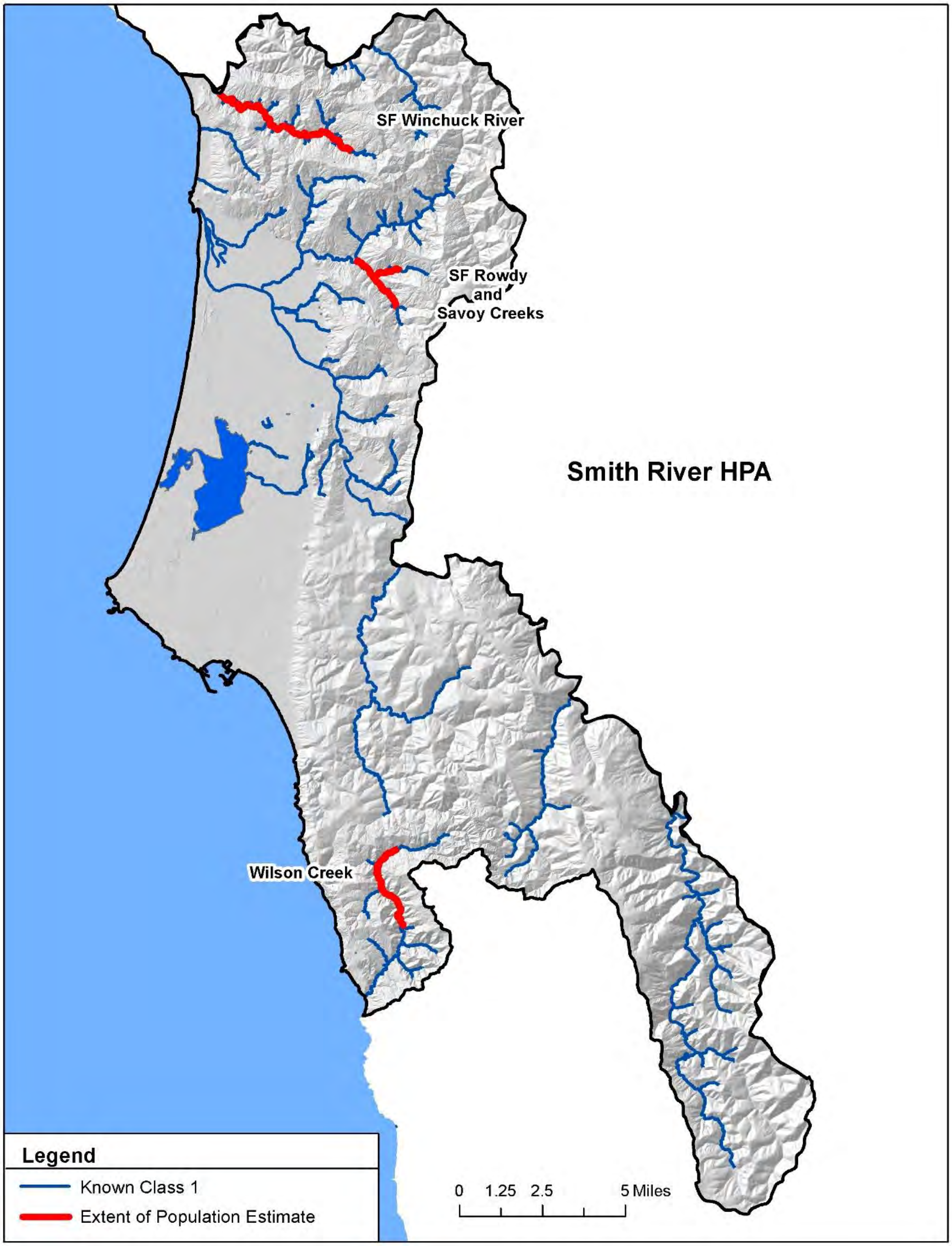
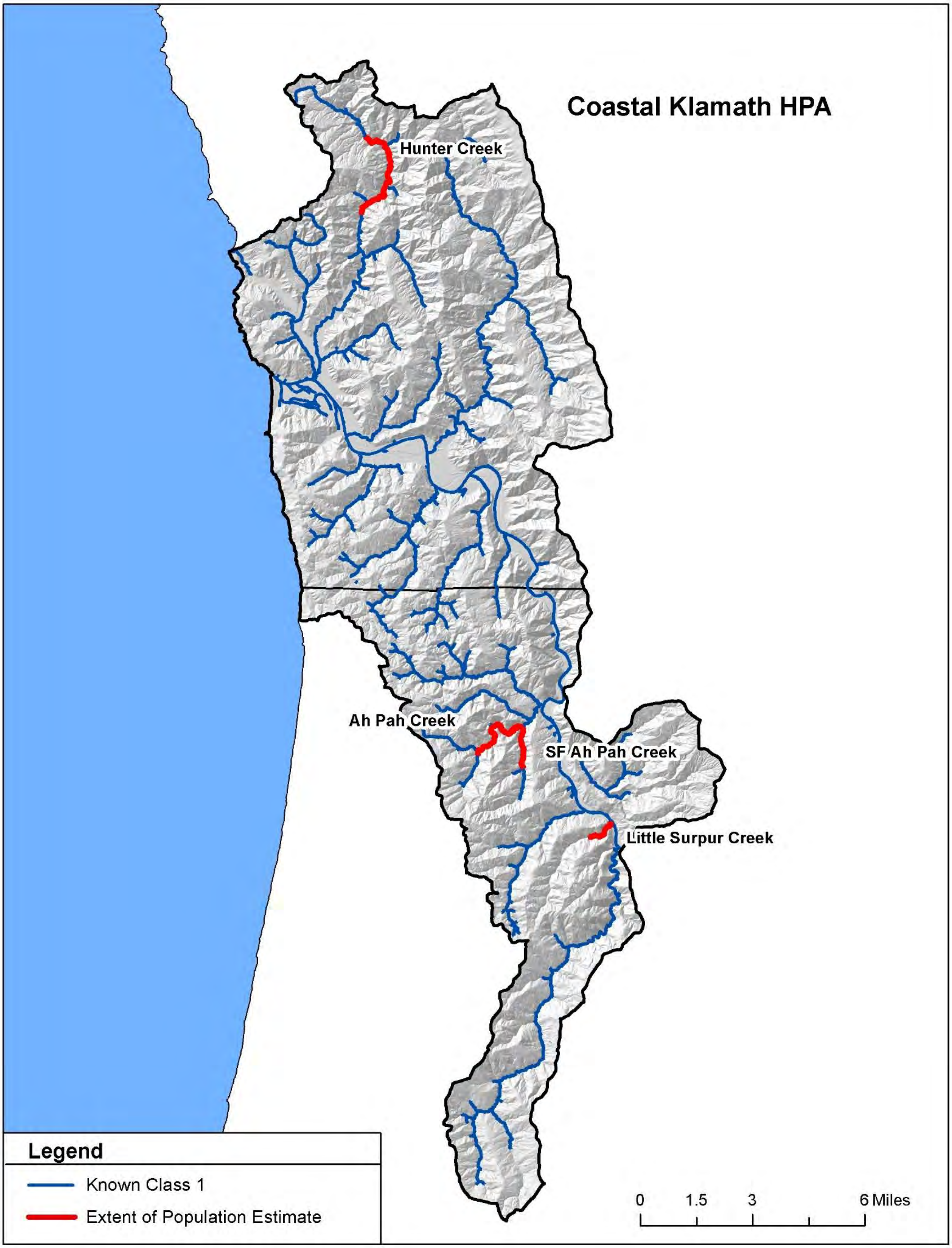
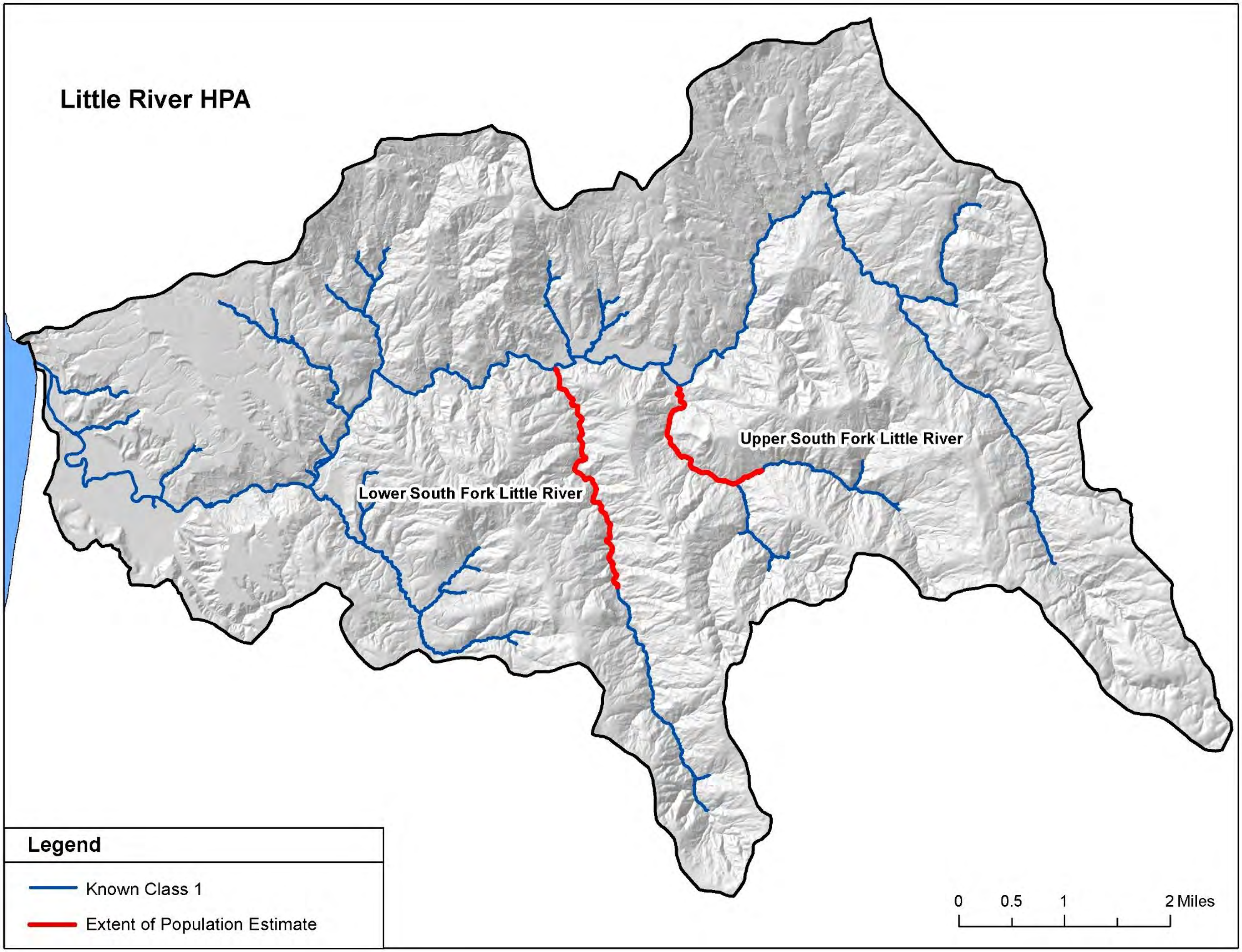
Appendices

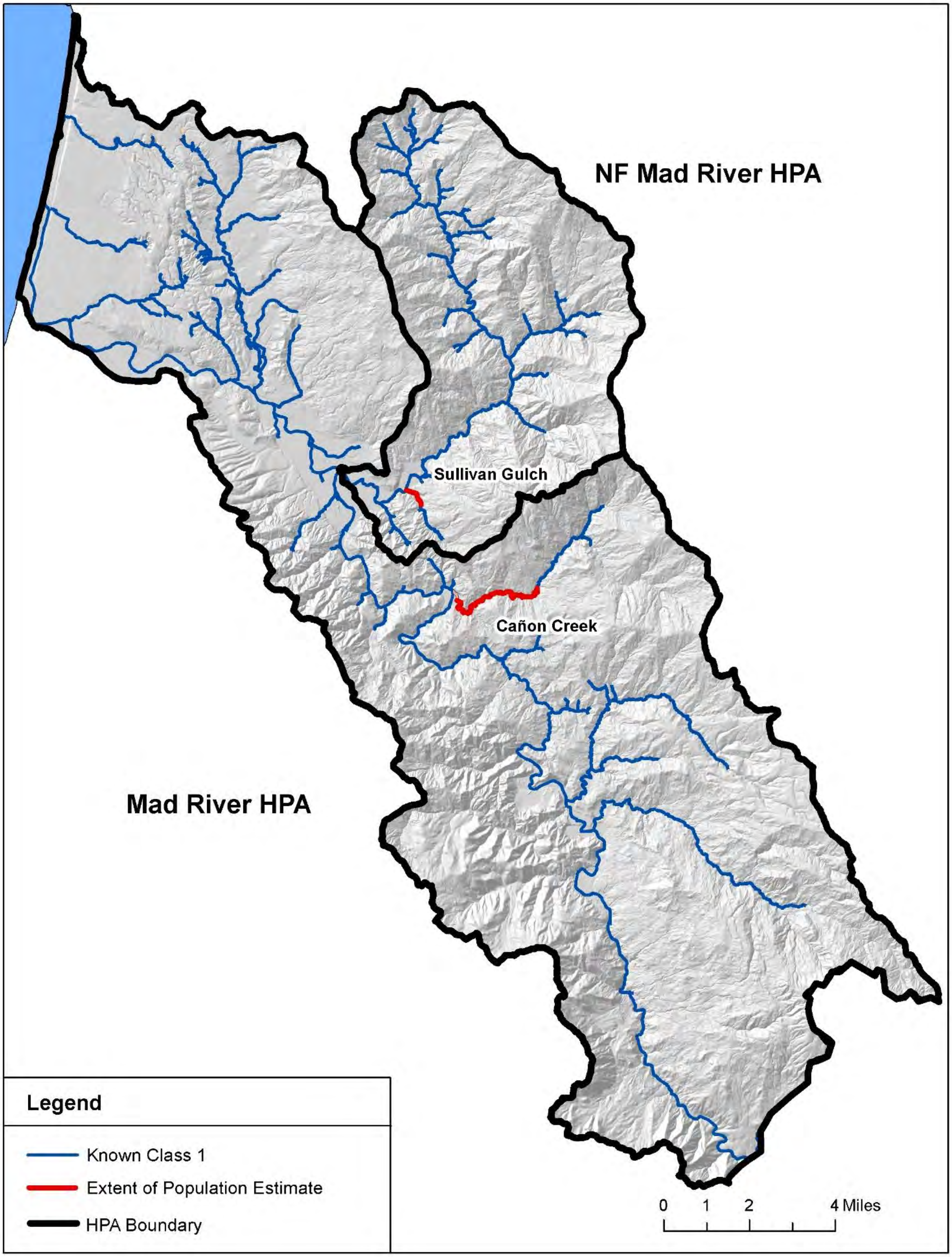
Appendix 1. Maps showing the locations and extents of the sites monitored in 2020 to calculate summer juvenile salmonid population estimates. Sites were grouped by hydrographic planning area (HPA) and were ordered from north to south. The extent of each site was determined by evidence of coho anadromy and can vary in length from year to year.




Coastal Klamath HPA
Hunter Creek
Ah Pah Creek
SF Ah Pah Creek
Little Surpur Creek
Legend
Known Class 1
Extent of Population Estimate
0
1.5
3
6 Miles



Little River HPA
Upper South Fork Little River
Lower South Fork Little River
Legend
Known Class 1
Extent of Population Estimate
0
0.5
1
2 Miles


NF Mad River HPA
Sullivan Gulch
Cañon Creek
Mad River HPA
Legend
Known Class 1
Extent of Population Estimate
HPA Boundary
0
1
2
4 Miles

Appendix 2. Electrofishing equipment used by GDRCo fisheries staff during the 2020 summer juvenile population monitoring surveys.

During 2020, the GDRCo fisheries staff used two electrofishing units. Both electrofishers used were Smith-Root (Smith-Root Inc., Vancouver, WA) model LR-20B (serial #s: B24947 and B671241). The electrical input and output of these units as operated by GDRCo were as follows:

The Model LR-20B is a 400 watt electrofisher. It is capable of an output voltage of 50 to 990 volts. It was operated using DC current and 200 volts. The input from the 24-volt sealed lead acid battery or lithium ion battery system at up to 5 amps is capable of an output of up to 200 watts. Electrofishing with this model is conducted to keep the wattage output at approximately 100 watts or less. This was accomplished by monitoring the audible output voltage indicator (beeper). The rate of beeping is scaled to the wattage output, and if the rate increased indicating the 100-watt threshold was being broken, steps were taken to eliminate this from happening.

As mentioned above, sampling occurred with the use of straight DC current. The switch from pulsed DC to straight DC follows the NMFS recommended “decision tree”. This method of sampling coupled with our experienced fisheries staff reduced the chances of causing fish mortality. GDRCo has adopted the Hankin and Mohr (2001) salmonid population estimate sample design as a means of estimating coho populations and minimizes the use of electrofishing equipment. This protocol relies heavily on making multiple dive passes on Phase II shallow pools with low density population (≤20 target species) rather than electrofishing every Phase II shallow pool. Only selected riffles and Phase II shallow pools with high density population (>20 target species) are sampled by electrofishing.

Appendix 3. Summary of summer juvenile salmonid population estimates and confidence intervals (CI) separated by habitat type for each monitoring site sampled from 1995-2020.

		Coho Salmon				Cutthroat Trout				Steelhead Trout			
		Deep Pools		Shallow Units		Deep Pools		Shallow Units		Deep Pools		Shallow Units	
Site Name	Year	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Ah Pah Creek	2007	378	238	1,542	380	22	6	217	106	80	22	367	201
	2008	265	90	3,001	642	5	4	212	111	17	15	443	157
	2009	323	186	1,525	433	5	5	501	310	40	8	380	112
	2010	218	210	440	212	43	27	645	409	49	14	202	87
	2011	890	675	696	223	50	28	371	275	200	85	302	220
	2012	447	393	983	274	64	40	292	122	80	14	284	94
	2013	250	139	1,557	634	66	16	583	217	77	38	462	188
	2014	14	13	125	74	135	77	571	249	53	15	158	57
	2015	0	0	135	126	8	0	436	148	22	8	91	76
	2016	107	94	889	186	41	13	285	121	61	33	245	53
	2017	76	72	168	99	9	9	100	86	84	30	338	165
	2018	204	244	54	46	18	22	222	100	56	53	500	198
	2019	6	8	81	51	4	3	151	57	20	6	475	111
	2020	2	4	0	0	113	130	279	110	63	56	412	155

* Hard count, not estimate.

^ Combination of estimates and hard count.

- Data unavailable.

† Calculated from the product of available variances.

Appendix 3. Continued.

		Coho Salmon				Cutthroat Trout				Steelhead Trout			
		Deep Pools		Shallow Units		Deep Pools		Shallow Units		Deep Pools		Shallow Units	
Site Name	Year	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Cañon Creek	1995	319*	-	1,322	699	0	-	0	0	146*	-	1,019	263
	1996	0	0	0	0	12	12	0	0	409	123	281^	119†
	1997	23*	0	21	35	0	-	0	0	72*	-	531^	239†
	1999	279	129	203	122	0	0	0	0	219	53	392	128
	2000	170	55	126	45	16	12	13	21	361	79	598	106
	2001	1,046	161	816	195	0	0	0	0	362	79	416	209
	2002	655	187	490	246	4	6	0	0	222	58	163	84
	2003	34	23	31	51	0	0	0	0	199	80	289	204
	2004	1,567	308	1,025	289	0	0	0	0	312	80	405	131
	2005	277	88	354	117	0	0	0	0	177	50	289	117
	2006	15	16	0	0	0	0	0	0	291	97	227	54
	2007	1,796	521	660	219	0	0	0	0	124	27	330	140
	2008	740	180	515	245	3	3	0	0	119	40	194	135
	2009	0	0	0	0	0	0	0	0	191	38	305	115
	2010	271	151	58	12	0	0	0	0	252	69	309	114
	2011	436	142	121	57	0	0	0	0	265	49	387	202
	2012	538	214	45	19	21	17	22	11	340	67	430	221
	2013	286	262	195	135	0	0	0	0	155	61	207	111
	2014	640	319	551	144	0	0	0	0	175	41	210	122
	2015	30	16	44	43	0	0	0	0	182	69	201	69
	2016	288	128	379	114	0	0	0	0	80	24	167	55
	2017	403	134	210	63	0	0	0	0	258	62	298	82
	2018	529	386	183	80	0	0	0	0	320	107	352	80
	2019	324	326	0	0	0	0	0	0	136	49	375	128
	2020	201	156	62	107	0	0	0	0	212	53	257	144

* Hard count, not estimate.

^ Combination of estimates and hard count.

- Data unavailable.

† Calculated from the product of available variances.

Appendix 3. Continued.

		Coho Salmon				Cutthroat Trout				Steelhead Trout			
		Deep Pools		Shallow Units		Deep Pools		Shallow Units		Deep Pools		Shallow Units	
Site Name	Year	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
EF Hunter Creek	2003	-	-	0	0	-	-	41	45	-	-	171	66
	2004	0	0	0	0	0	0	9	8	17	4	79	37
	2005	59	6	375	181	3	2	89	59	12	2	198	92
	2006	0	0	0	0	10	4	4	6	3	4	19	16
	2007	158	113	197	106	0	0	0	0	21	15	86	51
	2008	310	240	416	201	5	7	49	51	23	21	47	26
	2009	0	0	0	0	4	4	65	62	55	45	156	47
	2010	0	0	0	0	10	6	120	121	20	17	79	54
	2011	0	0	0	0	8	8	154	155	34	26	147	54
	2012	0	0	0	0	0	0	76	36	11	4	114	47
	2013	0	0	0	0	7	2	43	34	42	6	132	50
	2014	0	0	0	0	6	0	34	29	4	2	10	9
Heightman Creek	2005	-	-	908	349	-	-	4	7	-	-	19	10
	2007	-	-	361^	64	-	-	0	0	-	-	140	103
	2008	-	-	1,067	310	-	-	29	33	-	-	8	8
	2009	50	-	962	392	1	-	27	28	0	-	4	4
	2010	-	-	29	26	-	-	4	4	-	-	12	6
	2011	-	-	268	165	-	-	24	41	-	-	12	9
	2012	11	-	691	218	1	-	81	61	3	-	11	10
	2013	-	-	639	215	-	-	16	28	-	-	0	0
	2014	-	-	8	15	-	-	31	48	-	-	0	0

* Hard count, not estimate.
^ Combination of estimates and hard count.
- Data unavailable.
† Calculated from the product of available variances.

Appendix 3. Continued.

		Coho Salmon				Cutthroat Trout				Steelhead Trout			
		Deep Pools		Shallow Units		Deep Pools		Shallow Units		Deep Pools		Shallow Units	
Site Name	Year	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Hunter Creek	1998	331	134	82	88	0	0	18	30	1,101	421	839	303
	1999	0	0	0	0	0	0	0	0	128	44	754	134
	2000	0	0	0	0	35	26	10	15	902	319	1,268	382
	2001	148	84	847	264	0	0	29	34	302	95	1,138	313
	2002	1,231	362	1,327	355	4	6	137	101	286	90	712	193
	2003	518	224	1,104	298	8	9	83	101	248	82	948	258
	2004	150	40	163	94	12	8	232	124	338	62	764^	248†
	2005	3,196	1,346	2,743	750	9	6	117	94	249	54	734	187
	2006	466	217	239	191	218	54	5	3	218	54	395	114
	2007	3,075	1,181	1,457	376	4	6	0	0	289	86	945	306
	2008	1,918	763	779	304	2	3	18	16	80	31	163	80
	2009	694	360	963	543	85	47	312	168	830	385	1,555	496
	2010	152	86	84	22	23	14	54	46	223	63	327	89
	2011	1,074	556	702	431	154	96	218	102	628	249	1,006	611
	2012	243	156	67	68	12	7	75	51	306	172	839	602
	2013	218	161	213	121	20	13	159	81	533	255	561	149
	2014	2	3	0	0	6	6	23	13	189	98	316	119
	2015	35	22	79	38	23	12	42	20	337	127	281	110
	2016	24	18	26	24	10	8	8	9	106	50	94	41
	2017	11	9	0	0	26	18	8	10	402	109	256	160
	2018	34	38	8	10	85	40	110	57	233	143	298	149
	2019	29	16	41	43	25	26	78	53	93	74	262	158
	2020	0	0	0	0	27	10	155	148	266	103	659	257

* Hard count, not estimate.
^ Combination of estimates and hard count.
- Data unavailable.
† Calculated from the product of available variances.

Appendix 3. Continued.

		Coho Salmon				Cutthroat Trout				Steelhead Trout			
		Deep Pools		Shallow Units		Deep Pools		Shallow Units		Deep Pools		Shallow Units	
Site Name	Year	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Lower SF Little River	1998	3,086	395	1,224	502	0	0	0	0	169	59	58	35
	1999	2,390	356	6,066	880	0	0	74	63	54	21	154	54
	2000	1,819	325	3,284	591	4	7	21	18	23	20	74	38
	2001	339	123	589	239	6	7	0	0	83	25	48	19
	2002	3,484	511	10,838	2,234	10	9	132	89	57	17	177	106
	2003	1,816	309	4,504	1,060	0	0	74	46	32	20	47	34
	2004	986	213	3,186	1,171	14	9	11	19	38	15	155	101
	2005	1,996	211	4,916	866	13	11	57	44	51	15	125	51
	2006	1,796	245	7,989	1,546	0	0	47	27	8	6	113	160
	2007	1,097	139	6,846	1,043	0	0	42	28	55	25	104	59
	2008	1,720	317	8,650	1,993	0	0	31	21	23	17	48	60
	2009	1,983	452	7,954	3,292	8	9	96	94	36	20	116	96
	2010	766	169	1,244	319	31	10	43	33	82	17	64	30
	2011	2,851	726	5,741	979	47	20	190	71	53	15	213	75
	2012	3,656	1,108	7,260	2,086	37	18	177	99	101	36	208	85
	2013	2,378	765	7,118	1,462	65	28	151	69	138	45	223	78
	2014	575	138	557	165	69	26	226	150	102	33	72	28
	2015	2,002	639	5,560	1,532	18	13	95	59	46	20	123	79
	2016	1,715	257	5,128	1,189	28	12	110	65	57	19	95	89
	2017	805	205	2,901	625	26	8	94	52	63	17	139	79
	2018	747	248	8,417	2,488	26	19	103	55	68	24	406	132
	2019	1,276	409	3,176	842	26	17	95	53	21	12	73	59
	2020	1,389	712	6,370	2,026	24	18	15	19	90	32	201	61
Little Surpur Creek	2011	-	-	105	72	-	-	136	45	-	-	24	17
	2012	13	4	34	26	0	0	87	86	0	0	60	64
	2013	0	-	33	21	0	0	66	45	0	-	106	121
	2014	0	0	0	0	2	0	162	100	0	0	23	25
	2015	-	-	0	0	-	-	104	116	-	-	42	36
	2016	0	0	35	56	3	2	19	35	1	0	54	33
	2017	0	0	28	26	2	0	129	30	0	0	25	30
	2018	0	0	12	4	1	0	231	403	2	0	25	13
	2019	0	-	11	11	3	-	118	100	0	-	26	32
	2020	-	-	0	0	-	-	33	13	-	-	6	0
Moon Creek	2007	0	0	0	0	0	0	83	81	0	0	107	44
	2008	0	0	0	0	5	2	93	51	9	8	68	36
	2009	0	0	0	0	7	0	114	51	3	0	51	20
NF Ah Pah Creek	2007	-	-	139	103	-	-	11	19	-	-	12	12
	2008	-	-	809*	-	-	-	45*	-	-	-	42	35

* Hard count, not estimate.
^ Combination of estimates and hard count.
- Data unavailable.
† Calculated from the product of available variances.

Appendix 3. Continued.

		Coho Salmon				Cutthroat Trout				Steelhead Trout			
		Deep Pools		Shallow Units		Deep Pools		Shallow Units		Deep Pools		Shallow Units	
Site Name	Year	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Railroad Creek	1998	85	48	165	98	0	0	9	13	90	55	88	52
	1999	0	0	391^	130†	0	0	2	5	12	9	63	23
	2000	40	62	155	86	3	4	0	0	19	8	80	40
	2001	0	0	7	17	2	3	0	0	10	8	60	31
	2002	67	104	1,472	517	0	0	25	47	27	5	66	68
	2003	28	40	251	106	0	0	4	7	8	3	28	32
	2004	0	0	0	0	0	0	0	0	19	8	45	28
	2005	147	37	514	189	17	13	16	19	25	24	31	23
	2006	0	0	153	83	0	0	4	6	3	5	23	20
	2007	18	25	144	63	0	0	0	0	18	5	44	50
	2008	0	0	95	79	0	0	10	19	34	26	22	11
	2009	0	0	24	20	4	4	3	5	17	10	51	35
	2010	0	0	0	0	0	0	12	23	6	3	11	4
	2011	0	-	0	0	4	-	9	13	4	-	37	13
	2012	0	-	0	0	1	-	48	46	3	-	91	79
	2013	0	-	0	0	3	-	17	10	2	-	10	6
	2014	0	0	0	0	14	2	0	0	5	2	2	4
SF Ah Pah Creek	2007	-	-	331	272	-	-	39	31	-	-	109	41
	2008	0	-	273	93	6	-	39	17	0	-	79	36
	2009	0	-	106	102	0	-	178	142	3	-	56	34
	2010	0	-	141	29	0	-	134	98	5	-	90	24
	2011	0	-	145	45	2	-	125	177	6	-	128	38
	2012	0	-	61	71	1	-	290	234	0	-	24	11
	2013	0	-	4	4	1	-	159	91	2	-	105	38
	2014	-	-	0	-	-	-	148	205	-	-	86	49
	2015	-	-	15^	23†	-	-	120	81	-	-	15	11
	2016	0	-	84	53	0	-	67	72	1	-	2*	-
	2017	0	-	0	0	2	-	175	77	0	-	18	13
	2018	0	-	133	121	0	-	107	97	4	-	238	125
	2019	0	-	0	0	1	-	105	200	2	-	266	61
	2020	-	-	0	0	-	-	144	87	-	-	82	38

* Hard count, not estimate.
^ Combination of estimates and hard count.
- Data unavailable.
† Calculated from the product of available variances.

Appendix 3. Continued.

		Coho Salmon				Cutthroat Trout				Steelhead Trout			
		Deep Pools		Shallow Units		Deep Pools		Shallow Units		Deep Pools		Shallow Units	
Site Name	Year	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
SF Rowdy / Savoy Creeks	2001	156	95	510	166	13	10	110	68	163	51	598	129
	2002	105	79	603	153	12	11	245	117	43	17	593	226
	2003	0	0	0	0	0	0	52	50	7	11	323	187
	2004	4	-	267	147	4	-	143	83	10	-	393	121
	2005	492	363	1,058	408	11	11	108	51	41	21	645	125
	2006	0	0	18	8	13	13	75	45	52	14	387	144
	2007	30	9	120	37	22	9	41	45	73	17	732	344
	2008	3	4	205	55	10	0	136	101	31	4	640	348
	2009	0	-	0	0	2	-	330	150	25	-	1,004	365
	2010	0	-	2	4	4	-	105	75	24	-	1,138	560
	2011	0	0	0	0	15	9	121	73	59	55	875	351
	2012	0	0	0	0	12	10	103	59	9	15	177	89
	2013	0	0	0	0	23	8	98	76	79	25	549	215
	2014	3	4	0	0	12	7	100	76	67	14	304	107
	2015	0	0	0	0	7	6	0	0	38	39	135	150
	2016	0	0	0	0	5	3	4	4	84	42	194	163
	2017	0	0	0	0	0	0	34	54	35	19	445	327
	2018	0	0	0	0	8	6	46	23	21	16	261	176
	2019	-	-	0	0	-	-	64	69	0	0	908	595
	2020	-	-	0	0	-	-	2	4	-	-	394	155

* Hard count, not estimate.

^ Combination of estimates and hard count.

- Data unavailable.

† Calculated from the product of available variances.

Appendix 3. Continued.

		Coho Salmon				Cutthroat Trout				Steelhead Trout			
		Deep Pools		Shallow Units		Deep Pools		Shallow Units		Deep Pools		Shallow Units	
Site Name	Year	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
SF Winchuck River	1995	23*	-	32	47	29*	-	188	115	178*	-	1,149	501
	1996	28	21	4*	-	276	54	184	102	1,085	156	803	266
	1997	156*	-	317	140	56*	-	133	92	237*	-	619	280
	1998	33	7	0	0	261	71	191	92	1,480	224	1,067	260
	1999	0	0	0	0	110	32	255	65	325	76	756	102
	2000	0	0	0	0	154	50	479	214	1,291	232	1,809	361
	2001	7	8	13	23	257	50	378	90	1,041	135	1,392	200
	2002	392	87	656	148	136	39	328	142	660	136	677	160
	2003	62	38	126	87	208	36	435	91	637	115	1,042	222
	2004	2	3	8	4	62	21	309	74	121	39	777	136
	2005	220	95	589	181	123	50	597	163	344	42	1,300	229
	2006	2	2	8	14	171	41	474	180	272	58	976	298
	2007	115	54	294	76	149	38	284	77	280	60	622	135
	2008	107	51	77	38	212	35	395	182	636	95	600	142
	2009	2	3	0	0	195	48	388	183	292	42	776	206
	2010	41	26	22	15	251	47	624	176	603	95	1,363	259
	2011	13	14	5	3	195	24	673	273	664	88	1,476	298
	2012	2	3	0	0	189	31	314	156	199	61	676	303
	2013	0	0	0	0	307	106	288	213	1,263	386	687	227
	2014	311	179	92	81	297	47	460	192	680	148	1,051	272
	2015	2	2	0	0	84	21	292	100	264	78	663	185
	2016	0	0	0	0	83	34	186	98	311	35	748	142
	2017	0	0	0	0	156	29	308	80	611	104	983	230
	2018	76	72	84	52	151	45	368	107	490	169	1,099	242
	2019	2	2	0	0	67	20	170	98	602	161	951	240
	2020	88	50	220	100	67	24	283	119	199	51	830	191

* Hard count, not estimate.

^ Combination of estimates and hard count.

- Data unavailable.

† Calculated from the product of available variances.

Appendix 3. Continued.

		Coho Salmon				Cutthroat Trout				Steelhead Trout			
		Deep Pools		Shallow Units		Deep Pools		Shallow Units		Deep Pools		Shallow Units	
Site Name	Year	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Sullivan Gulch	1999	168	37	627	287	0	0	0	0	9	4	5	7
	2000	13	-	42	40	0	-	0	0	4	-	60	29
	2001	23	-	843	387	0	-	0	0	2	-	73	59
	2002	151	-	2,429	454	0	-	0	0	4	-	6	10
	2003	88	84	1,343	590	0	0	0	0	3	3	19	17
	2004	28	-	1,084	309	0	-	0	0	3	-	40	24
	2005	26	-	394	114	0	-	0	0	0	-	37	29
	2006	-	-	393	154	-	-	0	0	-	-	6	11
	2007	27	-	1,100	587	0	-	0	0	0	-	10	12
	2008	6	-	1,246	985	0	-	0	0	0	-	16	20
	2009	0	-	50	29	0	-	0	0	2	-	27	17
	2010	0	0	0	0	0	0	0	0	5	3	0	0
	2011	77	-	198	98	0	-	0	0	0	-	6	5
	2012	2	-	0	0	0	-	0	0	0	-	6	8
	2013	2	-	0	0	0	-	0	0	0	-	7	10
	2014	0	-	39	22	0	-	0	0	0	-	2	3
	2015	0	-	4	4	0	-	0	0	0	-	4	5
	2016	12	2	21	20	0	0	0	0	1	0	7	13
	2017	5	-	89	32	0	-	0	0	3	-	50	54
	2018	2	-	27	29	0	-	0	0	0	-	0	0
	2019	22	4	28	43	0	0	0	0	4	3	0	0
	2020	29	4	133	42	0	0	0	0	7	3	12	5
Tarup Creek	2012	0	-	362	265	8	-	193	134	0	-	15	5
	2013	52	8	31	20	38	4	107	70	12	4	85	127
	2014	0	-	5	10	11	-	401	225	0	-	82	68

* Hard count, not estimate.
^ Combination of estimates and hard count.
- Data unavailable.
† Calculated from the product of available variances.

Appendix 3. Continued.

		Coho Salmon				Cutthroat Trout				Steelhead Trout			
		Deep Pools		Shallow Units		Deep Pools		Shallow Units		Deep Pools		Shallow Units	
Site Name	Year	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Upper SF Little River	1998	303	117	517	230	21	29	4	5	108	30	208	64
	1999	257	193	1022^	489†	0	0	91	74	47	12	210^	73†
	2000	106	134	283	86	0	0	13	13	24	43	232	54
	2001	40	42	157	59	2	2	0	0	136	50	150	76
	2002	973	498	7,302	1,510	0	0	37	37	31	18	198	92
	2003	613	230	2,405	592	4	6	92	79	20	15	308	230
	2004	257	107	881	218	0	0	24	33	48	14	251	115
	2005	359	157	1,523	370	10	4	52	35	49	19	231	91
	2006	711	222	2,534	640	8	7	54	49	12	12	119	72
	2007	574	197	1,086	308	0	0	4	8	20	13	229	241
	2008	657	290	5,330	2,101	0	0	54	53	17	12	78	61
	2009	1,019	311	2,482	541	2	2	68	103	48	19	312	155
	2010	128	72	289	191	53	15	168	87	59	26	247	198
	2011	720	241	2,194	546	20	9	185	99	42	16	209	83
	2012	748	362	1,925	605	47	23	221	75	44	19	147	86
	2013	73	86	695	422	42	19	205	74	57	29	121	77
	2014	19	21	356	79	45	27	155	54	24	12	99	64
	2015	402	195	1,328	432	18	12	66	69	79	27	102	25
	2016	103	61	854	308	42	21	185	138	38	14	213	73
	2017	245	97	660	274	30	12	126	103	43	12	318	223
	2018	433	186	1,803	531	13	11	143	88	17	15	224	131
	2019	291	176	1,250	340	23	32	118	53	34	19	201	73
	2020	241	141	755	195	21	9	21	11	47	22	174	66

* Hard count, not estimate.
^ Combination of estimates and hard count.
- Data unavailable.
† Calculated from the product of available variances.

Appendix 3. Continued.

		Coho Salmon				Cutthroat Trout				Steelhead Trout			
		Deep Pools		Shallow Units		Deep Pools		Shallow Units		Deep Pools		Shallow Units	
Site Name	Year	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Wilson Creek	1995	237*	-	1,310	288	0	-	0	0	187*	-	908	302
	1996	442	159	173	158	136	57	6	19	1,086	247	1,093	383
	1997	248*	-	27*	-	0	-	0	0	125*	-	300^	76†
	1998	404	133	28	26	52	80	3	4	971	207	530	128
	1999	0	0	21	34	0	0	0	0	337	160	399	121
	2000	21	18	21	22	15	15	0	0	380	164	927	180
	2001	188	117	315	111	2	2	12	17	1,882	1,419	1,086	189
	2002	247	170	1,489	408	17	16	17	23	96	44	758	312
	2003	1,077	287	904	292	15	13	0	0	228	68	426	173
	2004	359	122	253	130	0	0	0	0	147	48	390	242
	2005	1,524	369	2,077	492	0	0	2*	-	230	86	535	152
	2006	204	55	347	136	4	6	0	0	318	136	465	148
	2007	3,023	783	1,836	385	5	4	0	0	184	63	306	140
	2008	3,928	851	6,918	2,008	0	0	4	7	85	27	463	163
	2009	0	0	0	0	13	7	17	19	82	30	758	533
	2010	705	389	1,138	516	11	10	0	0	390	141	1,210	512
	2011	2,938	1,035	4,835	1,565	30	15	31	16	465	75	1,397	347
	2012	72	32	108	24	50	22	26	11	678	222	358	303
	2013	457	156	519	329	31	15	40	28	600	194	660	395
	2014	797	396	571	338	15	16	15	21	202	69	288	173
	2015	17	17	0	0	11	13	0	0	708	238	552	270
	2016	1,792	582	1,616	785	7	7	0	0	239	77	474	237
	2017	1,075	225	1,042	364	36	17	4*	-	689	169	634	210
	2018	82	45	191	74	43	19	11	12	1,306	461	1,808	908
	2019	1,288	597	198	182	14	12	10	11	314	99	294	123
	2020	169	82	349	267	40	23	8	9	300	124	338	211

* Hard count, not estimate.
^ Combination of estimates and hard count.
- Data unavailable.
† Calculated from the product of available variances.

Appendix D

2020 Juvenile Salmonid Outmigrant Trapping Program, Little River - Annual Report to NMFS

Green Diamond Resource Company's Annual Report

To

National Marine Fisheries Service

For

Permit 17351

Juvenile Salmonid Outmigrant Trapping Program

Little River

2020

Prepared by:

Matt Nannizzi

Green Diamond Resource Company
P.O. Box 68
Korbel, CA 95550

Introduction

In 2020, Green Diamond Resource Company (GDRCo) conducted its twenty-second year of outmigrant trap monitoring in Little River, under a National Marine Fisheries Service (NMFS) Section 10 Permit (17351). This monitoring project has been conducted in Little River since 1999 and in 2007 became part of the Effectiveness Monitoring Program under an approved Aquatic Habitat Conservation Plan (AHCP, (GDRCo 2006)). The purpose of the Effectiveness Monitoring Program is to track the success of the AHCP conservation program in relation to the biological goals and objectives and provide a basis for adaptive management.

The Little River watershed is in Humboldt County and provides habitat for ESA listed salmonids from the Southern Oregon/North Coastal California (SONCC) coho salmon evolutionarily significant unit (ESU), California Coastal Chinook salmon ESU, and Northern California steelhead distinct population segment (DPS). The objectives of the outmigrant trapping project in the Little River watershed are to monitor the abundance, size and timing of emigrating salmonid smolts for these species and coastal cutthroat trout. Over time, the results of this monitoring effort will provide information on long-term trends in any of these variables. Comparisons of the outmigrant population estimate to a summer population estimate (where available) can also be made to yield an apparent overwinter survival rate for the juvenile coho population. Juvenile outmigrant trapping helps to identify factors affecting outmigration timing, and establish baseline and long-term trend data on the abundance of juvenile salmonid populations.

Outmigrant trapping was conducted in Little River from February 28th through June 26th, 2020. This document reports findings for the 2020 season and makes comparisons to past monitoring in Little River.

Methods

Study Site

Outmigrant trapping was conducted at four sites in the Little River watershed (Figure 1). Traps were operated on Lower South Fork Little River (LSFLR, drainage area ≈ 5.31 mi^2), Upper South Fork Little River (USFLR, ≈ 5.70 mi^2), Carson Creek (CC, ≈ 3.81 mi^2) and Mainstem Little River (MSLR, ≈ 40.35 mi^2). There is approximately 3.0, 2.0, 3.5, and 21.4 miles of known coho habitat above these sites, respectively. However, the amount of habitat above each monitoring site varies from year to year, as a result of dynamic stream processes. All tributary trap sites are located near the confluence of each creek with mainstem Little River. The mainstem site (MSLR) was established in 2015 and is located at approximately river mile three and is downstream of the tributary sites. These creeks are all located within the Little River hydrographic planning area (HPA, (GDRCo 2006)) and lands within each monitored sub-basin are entirely or predominantly owned by GDRCo.

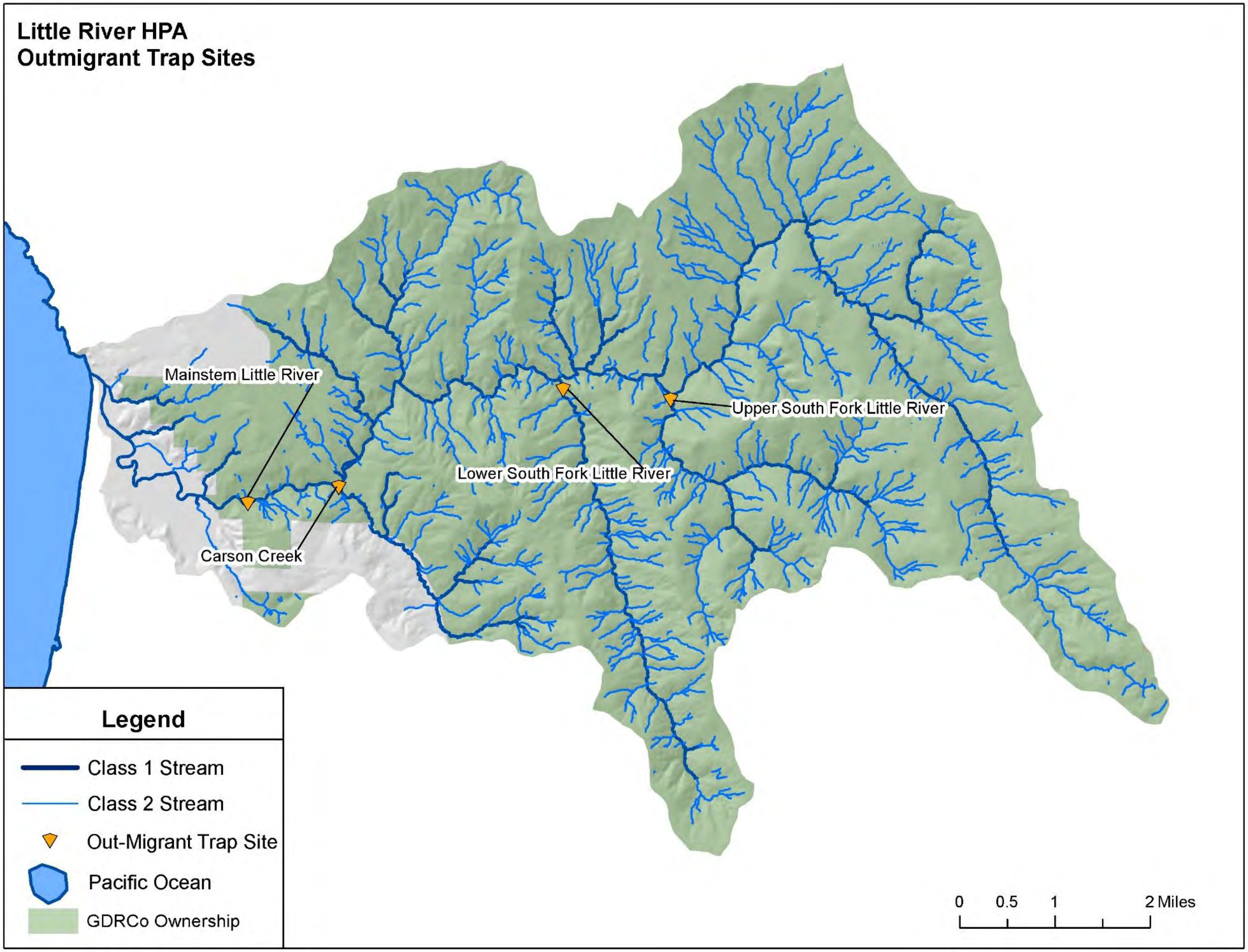


Figure 1. Location of the four outmigrant trap sites within the Little River Hydrographic Planning Area, Humboldt County, California.

Outmigrant Trapping

Two types of outmigrant traps were used for monitoring in Little River. V-notch weir/pipe traps (Figure 2A) are utilized at the tributary sites and a rotary screw trap (RST; Figure 2B) at the mainstem site. Two methods were used because stream habitat conditions are different between mainstem and tributary sites and each method is the best available technique where it was used. Details on each of these trapping methods are below.

The RST (cone diameter = 1.5 m) is made up of seven general components; a screened cone, two pontoons, cross members, two live-boxes, A-frame, rails and weir(s). The trap was positioned in the creek with the opening of the cone facing upstream and was located at the head of a pool utilizing the upstream riffle to spin the cone. Under low flows, weir(s) were installed upstream from the trap opening to help guide out-migrating fish into the trap and capture more water to increase cone rotation. Rotations per minute (RPM) were counted during site visits. The weir(s) was constructed of sandbags and rocks which are removed after the trapping season. Fish entering the cone were guided by an auger inside the cone into a live-box (dimensions = 56" L X 40" W X 20" D) at the rear of the trap. An additional back box was added to increase the capacity of the trap. Screened openings (mesh opening size =1/2", set diagonally) were provided in the sides or back of the live-boxes to minimize the predation potential by allowing smaller fish to exit the live-boxes. Exclusion tubes were placed in both live-boxes to help minimize predation potential of YOY fish. These tubes (1/2" sq. plastic coated wire mesh, set diagonally, dimensions = 12" L X 9.5" W) were positioned vertically in the water and used to provide refuge for juveniles.

The V-notch weir/pipe trap method uses a combination of a weir, pipe, McBane's ramp, and live-box. The weirs were constructed with fence posts and wooden pallets and buttressed with large substrates (e.g., cobbles and boulders). A weir overflow was constructed to provide passage for adult migrants moving upstream to spawn. The pipe runs from the center of the “V” in the weir and empties out onto a McBain’s ramp that dissipates water velocity of the outflow and guides fish into the trap box. Inside the trap, a V-shaped panel creates a large slack water area in the box. The slack water area provides a place where fish are protected from the current of the stream. Mesh screen (mesh size opening = ½”) at the back of the live box allowed YOY fish to escape the trap. To prevent predation, cobbles and a circular mesh enclosure (mesh size = ½”) was provided to serve as refuge for YOY fish.

Outmigrant traps were operated 24 hours a day, 7 days a week during suitable flow condition and checked at least daily. During large storm events, trapping was suspended to prevent fish mortality and equipment damage. During periods when significant numbers of outmigrants were captured or when accumulations of debris were likely (e.g. during moderate-high winds), the traps were checked more than once per day, as necessary. The reason being that juvenile salmonid mortality has been associated with large capture numbers and debris loading in the trap-box during periods of high winds and high flows (GDRCo 2011).

Figure 2. Photos showing the trapping methods, V-notch weir/pipe trap (A) and RST (B), used for outmigrant trapping in Little River, Humboldt County, California.

The data collecting and handling procedures for captured fish varied depending on species and age class. Each day, all captured fish were at least identified, aged, and counted. Due to the similarities between YOY steelhead and YOY cutthroat trout, proper identification is problematic (Baumsteiger et al. 2005, Voight et al. 2008), therefore, these species were categorized as "trout". All "trout" were YOY fish. Steelhead and cutthroat trout in the 1+ or older age classes are more readily distinguishable and were categorized to species. Adult cutthroat were defined as fish >200 mm with little to no signs of smoltification. Among YOY salmonids captured each day, the first 20 fish of each species at each site were measured (fork length [FL], ± 1 mm). Weights (± 0.1 gram) were also collected for the measured fish one day per week at each site. Among 1+ fish and adult cutthroat captured each day, the first 20 fish of each species were measured and weighed at each site. All adult steelhead were measured but not weighed. Unmarked fish were released downstream from the trap site after processing and handling. Among smolts, a sub-sample were marked and released upstream of the trap to estimate trapping efficiency (see below for details). Prior to marking, fish were anesthetized with Alka-Seltzer Gold®, identified, weighed, and measured. After recovery, marked fish were released upstream of the weir to quantify trap efficiency.

Trap Efficiency

Trap efficiency was calculated only for species that were actively leaving the watershed on their seaward migration (i.e., smolts). Smolts were identified using distinct morphological characteristics including; fading parr marks, scale color transition towards silver, and fins turning clear with dark tips. At MSLR, four different caudal fin clips were used as marks throughout the trapping effort on a seven-day rotating period: upper horizontal, upper vertical, lower vertical, and lower horizontal. After the first twenty-eight days, the same sequence of clips was repeated. At the tributary trap sites, PIT tags were implanted in the abdomen, posterior to the pectoral fin. This allowed for unique identification among individuals and tracking recaptures between sites to avoid pseudoreplication in the data. Fish that were captured at MSLR with a PIT tag were tallied as unmarked fish for the MSLR site. Up to 20 smolts of each species were marked every day for trap efficiency tests.

Marked fish were allowed to recover in a perforated live-box that was located at least three pool habitats upstream of each trap site. The live-box has an automatic release device which was programmed to release fish 10 hours following capture. This delayed release allowed fish ample recovery time and provided cover (i.e., darkness) during their release to minimize predation. Recaptured fish were released downstream from the trap site to avoid pseudoreplication in calculations of capture probabilities.

Population Estimates

All outmigrant salmonid smolt population estimates were calculated using the Darroch Analysis with Rank Reduction (DARR 2.0.1 software) for analysis of stratified mark-recapture data (Bjorkstedt 2005) where possible. Due to low capture or recapture numbers, or other circumstances, it was not possible to generate population estimates for all species and years. In these cases, only counts are shown and these data are labeled in tables and depicted without error bars in figures.

While all historical data have been audited for accuracy and consistency as for this report, GDRCo maintains and periodically updates a data quality routine that may detect previously unidentified errors. Estimates presented in this report that differ from previously reported figures should be considered the most accurate.

Coho Overwinter Survival

The apparent overwinter survival of coho salmon was calculated by dividing the smolt population estimate by the prior summer’s juvenile population estimate. Summer juvenile population estimates were conducted using the GDRCo Single Stream Population Estimate protocol (GDRCo 2018). Summer coho population estimates presented here are for use in estimating apparent overwinter survival and were generated using the Mohr and Hankin (2005) estimators of abundance and variance with bias adjustments to reduce the bias of the bounded counts and jackknife estimators.

One assumption for this method of calculation is that the monitored population is closed. However, recent work in Freshwater Creek, a nearby coastal watershed, quantified the probability of early emigration of coho smolts and found that 2-25% of them emigrate during late fall and winter (Rebenack et al. 2015). This finding must be considered when interpreting the overwinter survival estimated for Little River.

An overwinter survival estimate could not be calculated for Carson Creek or Mainstem Little River because site conditions prohibit use of the standard GDRCo Juvenile Summer Abundance survey protocol. Carson Creek has dark tannic water and an abundance of complex deep pools with large woody debris that are very difficult to dive or electrofish effectively and Mainstem Little River is too large and extensive to effectively sample.

Stream Temperature

Water temperature was monitored at each site during the 2020 trapping season and these data were used to document the water temperatures trapped fish were exposed to during the trapping season. Water temperatures were measured using HOBO® Water Temp Pro v^2 data loggers (Onset Computer Corporation, Bourne, MA). At the tributary traps data loggers were attached to the bottom of a t-post installed adjacent to the trap box. At the mainstem trap, the data logger was attached directly to the frame of the live box. Loggers recorded water temperature (ºC) on a 72 minute interval.

Results

Trapping Effort

The 2020 trapping effort was summarized and compiled with all other years to allow for comparison over the history of outmigrant trapping in the Little River watershed (Table 1). In 2020, outmigrant traps were in operation for 97% of the trapping season. The overall mean of operable days across all years and sites is 94.4%. For the mainstem RST, the initiation of trapping on February 28th was thirty-three days earlier than the mean initiation date of March 31st. At the tributary traps, the 2020 trap initiation date was March 21st, three days earlier than their mean initiation date. A histogram with combined tributary estimates (primary y-axis) and average tributary trap installation date (secondary y-axis) illustrates the increasingly later trap installation trend in recent years (Figure 3). In 2020, tributary traps were installed early and this year's estimate was the largest combined tributary estimate observed for this cohort since the beginning of the project. At MSLR, cone revolutions (rpm) were counted for 95% of trapping days (average = 5.9 rpm, range = 3.0-12.0).

Table 1. Summary of the 1999 – 2020 outmigrant trapping (OMT) seasons conducted by GDRCo in the Little River watershed, Humboldt County, California.

		Year																							
Site	**OMT parameter**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Mean**	**Total**
MSLR	Initiation date	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28-Mar	2-Apr	22-Apr	31-Mar	14-Mar	28-Feb	31-Mar	-
	Completion date	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19-Jun	24-Jun	30-Jun	29-Jun	5-Jul	26-Jun	27-Jun	-
	Season days	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	84	84	70	91	114	120	88.6	443
	Operable days	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82	84	69	80	106	114	84.2	421
	Operable %	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	98%	100%	99%	88%	93%	95%	95.4%	-
	Inoperable days	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0	1	11	8	9	4.4	22
	Inoperable %	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2%	0%	1%	12%	7%	8%	4.6%	-
CC	Initiation date	-	31-Mar	19-Feb	19-Feb	3-Mar	11-Mar	25-Feb	6-Apr	15-Mar	12-Mar	26-Mar	29-Mar	9-Apr	14-Apr	23-Mar	22-Mar	28-Mar	2-Apr	5-May	27-Apr	27-Apr	21-Mar	25-Mar	-
	Completion date	-	16-Jun	5-Jun	5-Jun	11-Jun	28-May	3-Jun	14-Jun	21-Jun	26-Jun	19-Jun	29-Jun	18-Jun	29-Jun	28-Jun	14-Jun	12-Jun	17-Jun	22-Jun	11-Jun	24-Jun	19-Jun	16-Jun	-
	Season days	-	78	107	107	101	79	99	70	99	107	86	93	71	77	98	85	77	77	49	46	62	91	83.4	1668
	Operable days	-	78	107	107	87	75	86	68	98	107	84	86	67	77	98	83	76	77	49	46	59	89	80.8	1615
	Operable %	-	100%	100%	100%	86%	95%	87%	97%	99%	100%	98%	92%	94%	100%	100%	98%	99%	100%	100%	100%	95%	98%	97.0%	-
	Inoperable days	-	0	0	0	14	4	13	2	1	0	2	7	4	0	0	2	1	0	0	0	4	1	2.7	54
	Inoperable %	-	0%	0%	0%	14%	5%	13%	3%	1%	0%	2%	8%	6%	0%	0%	2%	1%	0%	0%	0%	6%	1%	3.1%	-
LSFLR	Initiation date	17-Mar	7-Mar	21-Feb	19-Feb	3-Mar	11-Mar	25-Feb	7-Apr	15-Mar	12-Mar	2-Apr	29-Mar	9-Apr	14-Apr	23-Mar	22-Mar	28-Mar	2-Apr	5-May	27-Apr	27-Apr	21-Mar	24-Mar	-
	Completion date	7-Jul	16-Jun	4-Jun	5-Jun	11-Jun	28-May	3-Jun	14-Jun	21-Jun	19-Jun	19-Jun	29-Jun	18-Jun	15-Jun	21-Jun	14-Jun	5-Jun	17-Jun	22-Jun	21-Jun	17-Jun	19-Jun	15-Jun	-
	Season days	113	102	104	107	101	79	99	69	99	100	79	93	71	63	91	85	70	77	49	56	52	91	84.1	1850
	Operable days	105	102	100	107	77	78	43	69	97	100	76	82	67	63	91	82	69	77	49	56	49	89	78.5	1728
	Operable %	93%	100%	96%	100%	76%	99%	43%	100%	98%	100%	96%	88%	94%	100%	100%	96%	99%	100%	100%	100%	94%	98%	94.1%	-
	Inoperable days	8	0	4	0	24	1	56	0	2	0	3	11	4	0	0	3	1	0	0	0	4	2	5.6	123
	Inoperable %	7%	0%	4%	0%	24%	1%	57%	0%	2%	0%	4%	12%	6%	0%	0%	4%	1%	0%	0%	0%	8%	2%	5.9%	-
USFLR	Initiation date	16-Mar	4-Mar	28-Feb	19-Feb	3-Mar	11-Mar	25-Feb	11-Apr	15-Mar	12-Mar	2-Apr	29-Mar	9-Apr	14-Apr	23-Mar	22-Mar	28-Mar	2-Apr	5-May	27-Apr	27-Apr	21-Mar	24-Mar	-
	Completion date	7-Jul	14-Jun	4-Jun	31-May	11-Jun	28-May	3-Jun	7-Jun	14-Jun	12-Jun	19-Jun	8-Jun	11-Jun	29-Jun	21-Jun	7-Jun	5-Jun	10-Jun	15-Jun	11-Jun	17-Jun	19-Jun	12-Jun	-
	Season days	114	103	97	102	101	79	99	58	92	93	79	72	64	77	91	78	70	70	42	46	52	91	80.5	1770
	Operable days	108	103	97	102	76	78	39	57	91	93	76	66	60	77	91	76	69	70	42	46	48	89	75.2	1654
	Operable %	95%	100%	100%	100%	75%	99%	39%	98%	99%	100%	96%	92%	94%	100%	100%	97%	99%	100%	100%	100%	92%	98%	94.2%	-
	Inoperable days	6	0	0	0	25	1	60	1	1	0	3	6	4	0	0	2	1	0	0	0	5	2	5.3	117
	Inoperable %	5%	0%	0%	0%	25%	1%	61%	2%	1%	0%	4%	8%	6%	0%	0%	3%	1%	0%	0%	0%	10%	2%	5.9%	-
Total	Average install date	16-Mar	14-Mar	22-Feb	19-Feb	3-Mar	11-Mar	25-Feb	8-Apr	15-Mar	12-Mar	30-Mar	29-Mar	9-Apr	14-Apr	23-Mar	22-Mar	28-Mar	2-Apr	5-May	27-Apr	27-Apr	21-Mar	24-Mar	
Total	Season days	227	283	308	316	303	237	297	197	290	300	244	258	206	217	280	248	301	308	210	239	280	393	337	5731
Total	Operable days	213	283	304	316	240	231	168	194	286	300	236	234	194	217	280	241	296	308	209	228	262	381	319	5418
Total	Inoperable days	14	0	4	0	63	6	129	3	4	0	8	24	12	0	0	7	5	0	1	11	21	14	18	316
Mean	Season days	114	94	103	105	101	79	99	66	97	100	81	86	69	72	93	83	75	77	53	60	70	98	84	1433
Mean	Operable days	107	94	101	105	80	77	56	65	95	100	79	78	65	72	93	80	74	77	52	57	66	95	80	1355
Mean	Inoperable days	7	0	1.33333	0	21	2	43	1	1.33333	0	2.66667	8	4	0	0	2	1	0	0	3	5	4	4.5	79
Mean	Operable %	93.83%	100.00%	98.70%	100.00%	79.21%	97.47%	56.57%	98.48%	98.62%	100.00%	96.72%	90.70%	94.17%	100.00%	100.00%	97.18%	98.34%	100.00%	99.52%	95.40%	93.57%	96.95%	94.69%	94.54%
Mean	Inoperable %	6.17%	0.00%	1.30%	0.00%	20.79%	2.53%	43.43%	1.52%	1.38%	0.00%	3.28%	9.30%	5.83%	0.00%	0.00%	2.82%	1.66%	0.00%	0.48%	4.60%	7.50%	3.56%	5.35%	5.51%

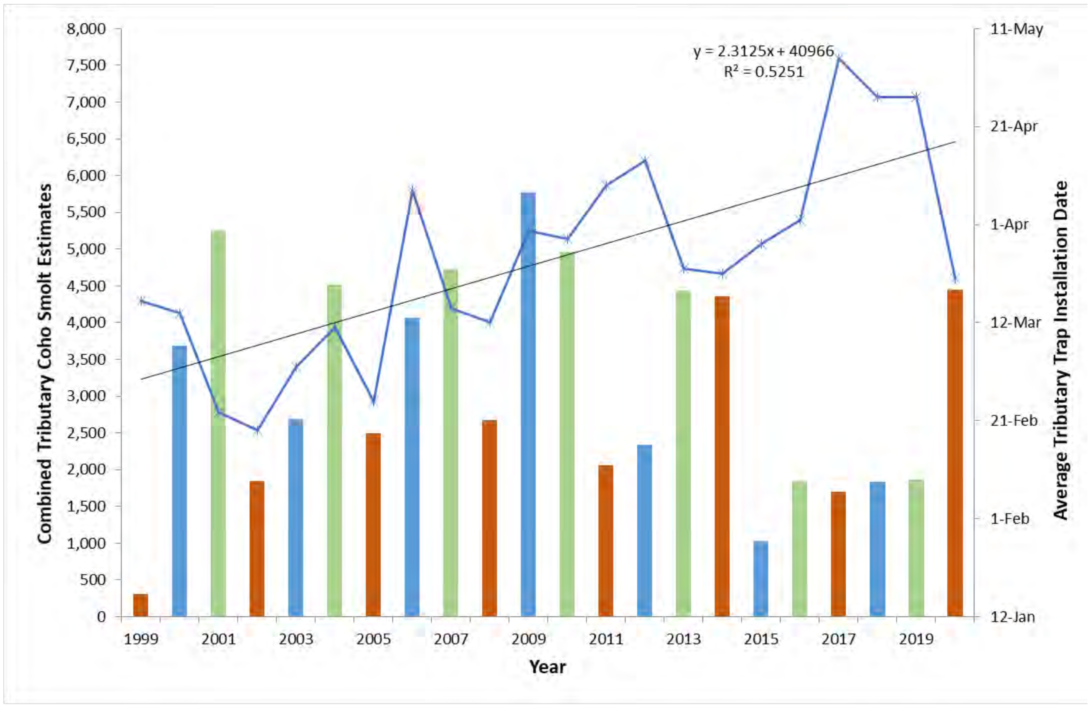


Figure 3. Frequency histrogram of combined tributary coho estimates (colored bars, y-axis) and average tributary trap installation date (blue line, secondary y-axis).

Trap Efficiency

Trapping efficiencies (i.e., capture probability) were calculated for coho smolts at each of the four trap sites. Efficiencies were also calculated for steelhead and cutthroat smolts at MSLR. When efficiencies were not calculated it was due to insufficient captures or recaptures. The change in trapping efficiency varied both among sites and during the season (Figure 4). The overall mean trap efficiency for coho smolts during the 2020 trapping season was 50% (Range = 22− 77%). Compared to past years, average trap efficiency in 2020 was within the range previously documented (42 − 76%) in Little River.

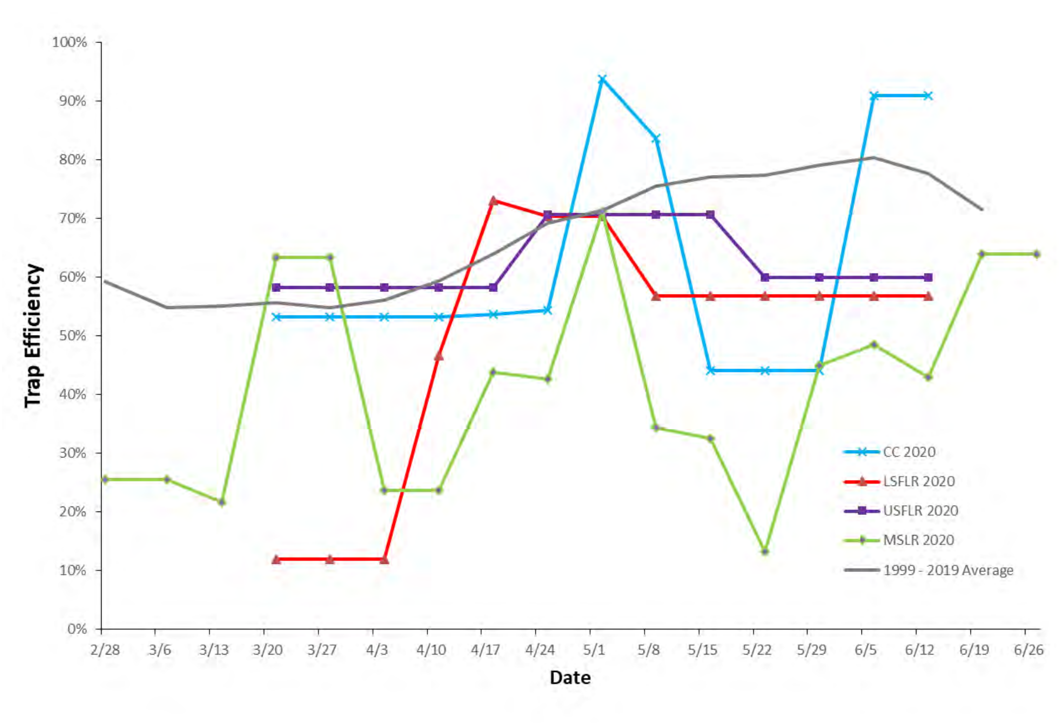


Figure 4. Summary of trap efficiencies for coho smolts during 2020 outmigrant trapping and the average of all four trapping sites for 1999-2020 in Little River, Humboldt County, California.

Population Estimates

During the 2020 outmigrant trapping season, a total of 7,863 salmonid smolts were captured. The number of captures (i.e., marked and unmarked fish), marked, and recaptured fish for each species were summarized (Table 2). Coho accounted for most (96.9%) of the smolt captures. Among the salmonid smolts captured, 41% were marked. The proportion of marked smolts by species at all trapping sites was; 40% for coho, 96% for steelhead, and 100% for cutthroat. The relatively high proportion of marked steelhead and cutthroat resulted from small sample sizes. In 2020, smolt population estimates were calculated for all salmonids at each monitoring site where possible (Table 3) and compared to the past twenty years (Figures 5-7).

Smolt estimates for coho, steelhead and cutthroat were variable among sites and there has not been a consistent pattern over time. Coho smolt estimates were highest at MSLR followed by LSFLR, CC and USFLR (Figure 5). Compared to 2019, coho estimates increased at all four Little River outmigrant trap sites.

The 2020 estimate at MSLR was the second time this cohort (i.e., Figure 5, red bar) was estimated. Compared to 2017, coho smolt estimates increased by approximately 65%. The 2020 estimates were all above average at the tributary sites; CC (mean = 1,233), LSFLR (mean = 1,770), and USFLR (mean=245),.

For the tributary traps, steelhead smolt numbers were similarly low among sites in 2020 but increased compared to recent years where this species were absent or extremely low

(Figure 6). Cutthroat smolts were absent at the tributary traps in 2020 (Figure 7). Estimates for cutthroat and steelhead smolts at MSLR decreased from 2019.

Excluding smolts, a total of 6,648 salmonids were captured at the four sites in Little River during the 2020 trapping season. These captures were summarized by site for each species and age class (Table 4). The numbers in this table are counts and not estimates. A majority (91.4%) of the captures were 1+ fish, followed by 0+ fish (6.7%), and adults (1.9%).

Counts of juvenile Chinook moving through the outmigrant traps from 1999-2020 are presented below (Figure 8). Trap efficiencies were not calculated for Chinook so the numbers presented in this report are counts only. During the 2020 season, a total of 165 Chinook were captured. Since 2015, permit requirements limiting the capture of Chinook YOY required modifications of traps (e.g. back boxes were not used and anything that could fit through 1/2" mesh, set diagonally, was allowed to escape). This change in trapping method explains the relatively low number of Chinook captures over the last five seasons.

Counts of cutthroat 1+ and steelhead 1+ moving through the outmigrant traps from 1999-2020 are presented below (Figure 9). Trap efficiencies were not calculated for cutthroat 1+ and steelhead 1+. During the 2020 trapping season a total of 1,700 cutthroat 1+ and 4,366 steelhead 1+ were captured at the 4 trapping sites in Little River. Total captures for steelhead 1+ increased significantly beginning in 2015 with the initiation of the MSLR site.

Table 2. Summary of the 2020 smolt captures and recaptures during the outmigrant trapping season in the Little River watershed, Humboldt County, California.

	Captured Smolts			Marked Smolts			Recaptured Smolts		
Site	**Coho**	**Steelhead**	**Cutthroat**	**Coho**	**Steelhead**	**Cutthroat**	**Coho**	**Steelhead**	**Cutthroat**
MSLR	5,146	215	4	1,538	206	4	627	50	2
CC	947	5	0	548	5	0	332	5	0
LSFLR	990	11	0	547	11	0	328	3	0
USFLR	542	3	0	388	3	0	259	1	0
Total	7,625	234	4	3,021	225	4	1,546	59	2

Table 3. Smolt population estimates and confidence intervals (UCI = upper and LCI = lower) from outmigrant trapping 1999-2020 in the Little River watershed, Humboldt County, California.

		MSLR			CC			LSFLR			USFLR		
Species	Year	Estimate	95% UCI	95% LCI	Estimate	95% UCI	95% LCI	Estimate	95% UCI	95% LCI	Estimate	95% UCI	95% LCI
Coho	1999	-	-	-	-	-	-	287	39	39	25	8	8
	2000	-	-	-	1,832	64	64	1,718	121	121	137	13	13
	2001	-	-	-	2,331	42	42	2,832	568	568	89	16	16
	2002	-	-	-	1,264	153	153	549	60	60	30	8	7
	2003	-	-	-	1,112	104	104	950	483	466	621	157	157
	2004	-	-	-	2,181	155	155	1,411	109	109	927	904	793
	2005	-	-	-	1,519	126	126	873	138	138	100	8	8
	2006	-	-	-	2,625	430	430	1,039	57	57	404	39	39
	2007	-	-	-	2,293	200	200	1,721	223	223	719	282	282
	2008	-	-	-	1,164	22	22	1,156	43	43	354	45	45
	2009	-	-	-	2,118	43	43	2,372	128	128	1,282	219	219
	2010	-	-	-	2,241	318	318	1,283	308	308	1,439	502	502
	2011	-	-	-	729	127	127	1,130	149	149	198	96	96
	2012	-	-	-	1,002	155	155	998	277	277	338	73	73
	2013	-	-	-	1,806	28	28	1,966	228	228	670	105	105
	2014	-	-	-	1,718	78	78	2,405	366	366	240	14	14
	2015	2,557	90	90	427	5	5	454	168	168	146	30	30
	2016	5,036	266	266	876	62	62	691	37	37	283	118	118
	2017	8,195	859	859	583	50	50	934	102	102	185	102	88
	2018	5,056	692	692	319	89	89	1,253	567	567	267	187	187
	2019	9,609	1,161	1,161	635	18	18	794	30	30	442	71	71
	2020	13,441	1,456	1,456	1582	126	126	2,030	425	425	831	61	61
Steelhead	1999	-	-	-	-	-	-	101	52	52	50	14	14
	2000	-	-	-	12	6	5	61	15	15	76	8	8
	2001	-	-	-	23	2	2	36	16	16	51	11	11
	2002	-	-	-	93	23	23	41	21	21	53	9	9
	2003	-	-	-	61	59	47	50	38	34	40	37	29
	2004	-	-	-	14*	-	-	39	21	13	73	51	29
	2005	-	-	-	39	27	18	48	33	32	60	52	42
	2006	-	-	-	2*	-	-	11	5	4	16	26	12
	2007	-	-	-	30	12	12	53	41	37	82	149	72
	2008	-	-	-	15	2	2	24	14	14	61	27	27
	2009	-	-	-	2*	-	-	7	2	1	12	2	1
	2010	-	-	-	0	-	-	0	-	-	9	14	6
	2011	-	-	-	0	-	-	10	6	4	0	-	-
	2012	-	-	-	2	0	0	0	-	-	1	0	0
	2013	-	-	-	2	0	0	57	27	27	17	8	5
	2014	-	-	-	0	-	-	21	23	14	24	14	13
	2015	1,129	123	123	0	-	-	20	11	10	26	13	13
	2016	723	183	183	5	2	1	9	4	3	81	149	72
	2017	338	249	249	0	-	-	1*	-	-	0	-	-
	2018	868	202	202	0	-	-	1*	-	-	1*	-	-
	2019	1,249	396	396	0	-	-	1*	-	-	1*	-	-
	2020	1,065	357	357	5	0	0	40	37	29	9	14	6
Cutthroat	1999	-	-	-	-	-	-	101	46	46	37	15	15
	2000	-	-	-	57	9	9	20	3	3	10	3	3
	2001	-	-	-	111	6	6	5	-	-	18	4	4
	2002	-	-	-	81	23	23	36	22	17	22	2	2
	2003	-	-	-	20	8	8	36	42	27	17	26	12
	2004	-	-	-	22	7	7	21	7	6	27	18	15
	2005	-	-	-	49	7	7	9	1	1	7	3	2
	2006	-	-	-	31	4	4	4	0	0	25	43	20
	2007	-	-	-	4	0	0	1*	-	-	1*	-	-
	2008	-	-	-	5	2	1	1*	-	-	5	2	1
	2009	-	-	-	3*	-	-	0	-	-	2*	-	-
	2010	-	-	-	32	37	24	17	25	12	3*	-	-
	2011	-	-	-	1	0	0	1	0	0	18	20	12
	2012	-	-	-	0	-	-	1	0	0	1*	-	-
	2013	-	-	-	5	0	0	4	0	0	0	-	-
	2014	-	-	-	1*	-	-	0	-	-	0	-	-
	2015	46	35	35	1	0	0	1*	-	-	0	-	-
	2016	65	30	30	5*	-	-	32	37	24	25	43	20
	2017	20	33	15	0	-	-	0	-	-	0	-	-
	2018	52	49	39	0	-	-	0	-	-	0	-	-
	2019	93	55	55	1*	-	-	0	-	-	1*	-	-
	2020	8	7	4	0	-	-	0	-	-	0	-	-

Note: * indicates value is count, not estimate.

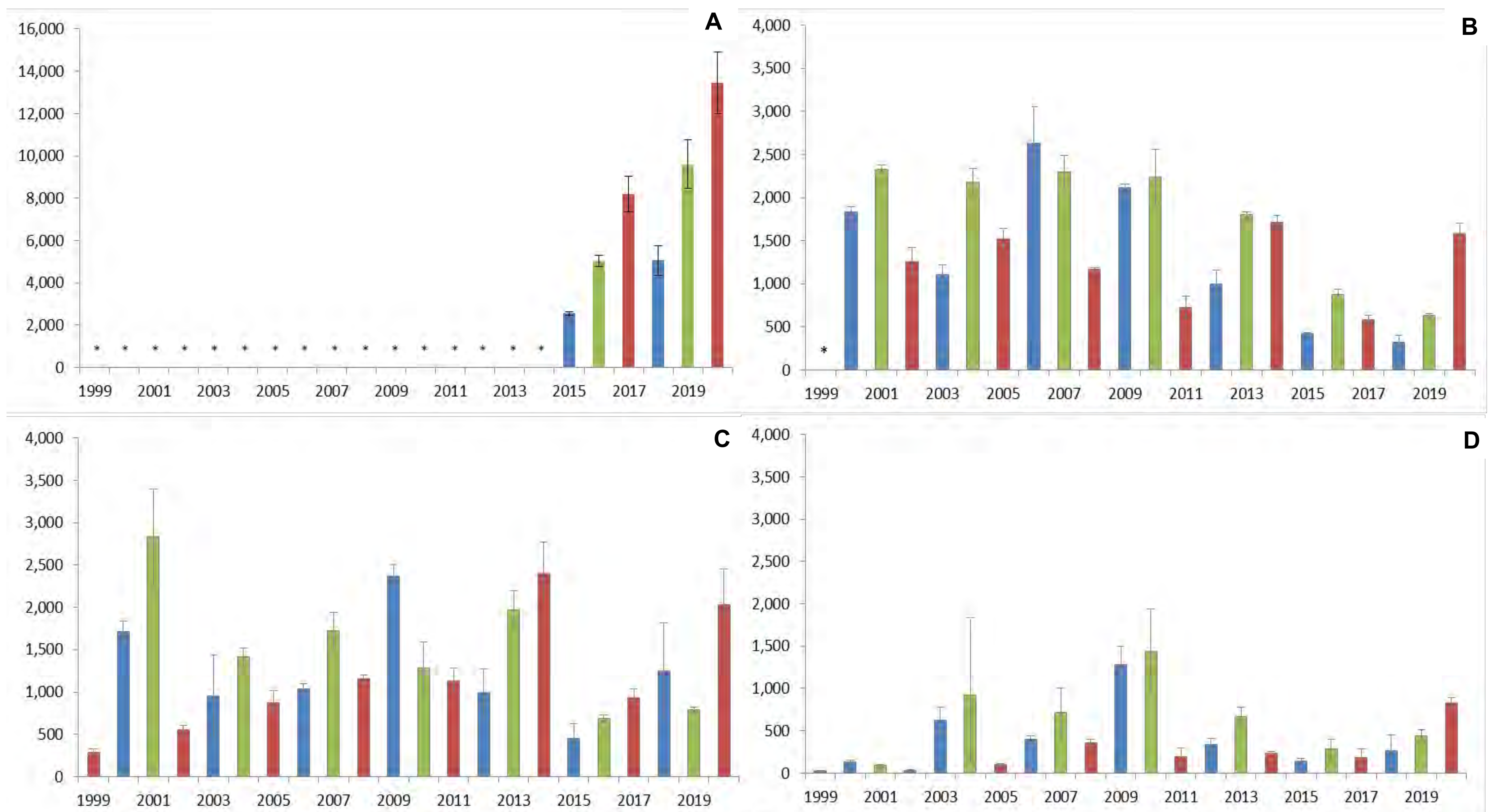


Figure 5. Outmigrant smolt estimates (with 95% CI) for coho salmon at Mainstem Little River (A), Carson Creek (B), Lower South Fork Little River (C), and Upper South Fork Little River (D), 1999-2020. Colors indicate three distinct cohorts of coho and an asterisk (*) indicates year when sampling was not conducted.

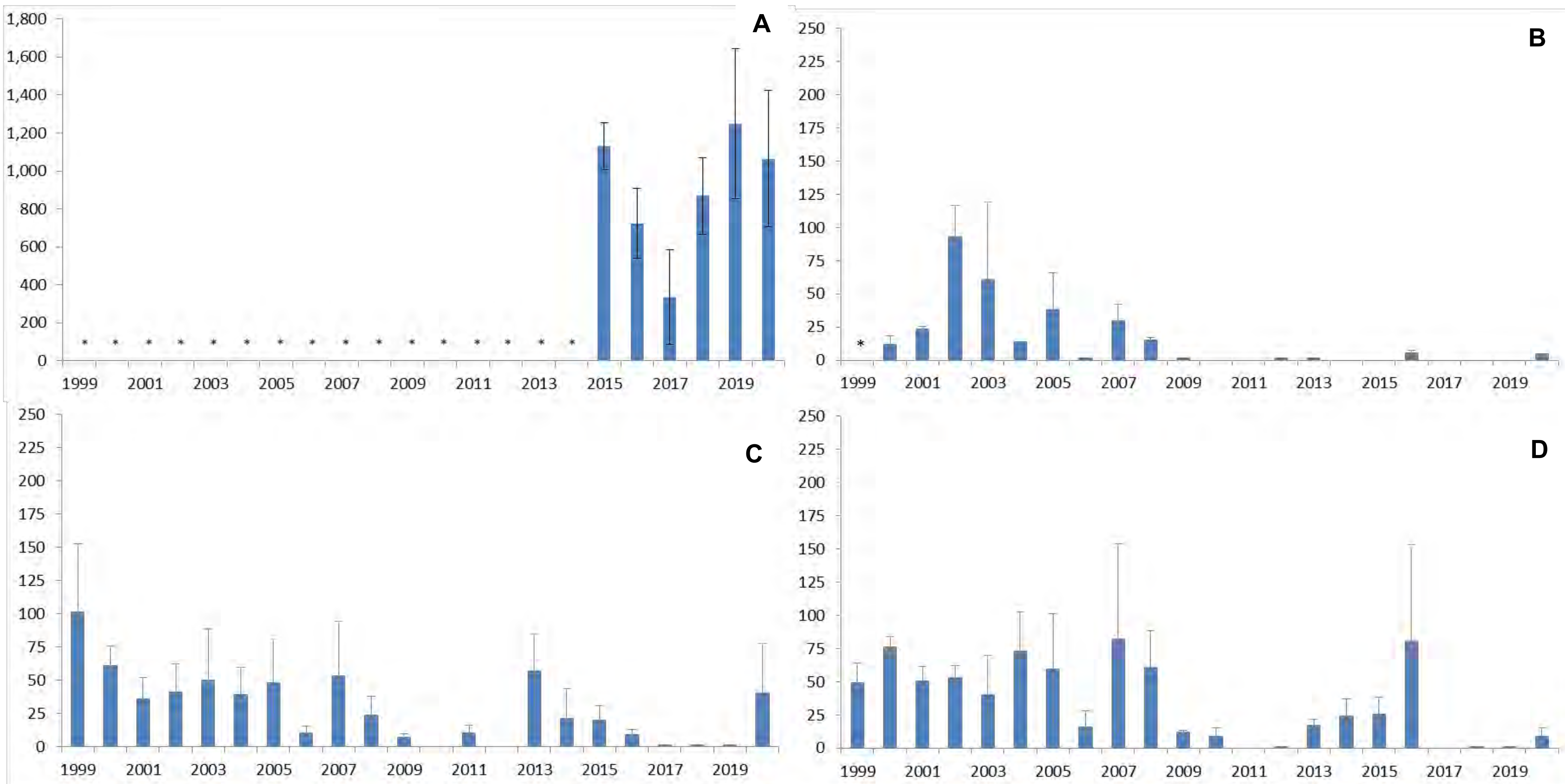


Figure 6. Outmigrant smolt estimates (with 95% CI) and counts (without error bars) for steelhead trout at Mainstem Little River (A) Carson Creek (B), Lower South Fork Little River (C), and Upper South Fork Little River (D), 1999-2020. Asterisk (*) indicates year when sampling was not conducted.

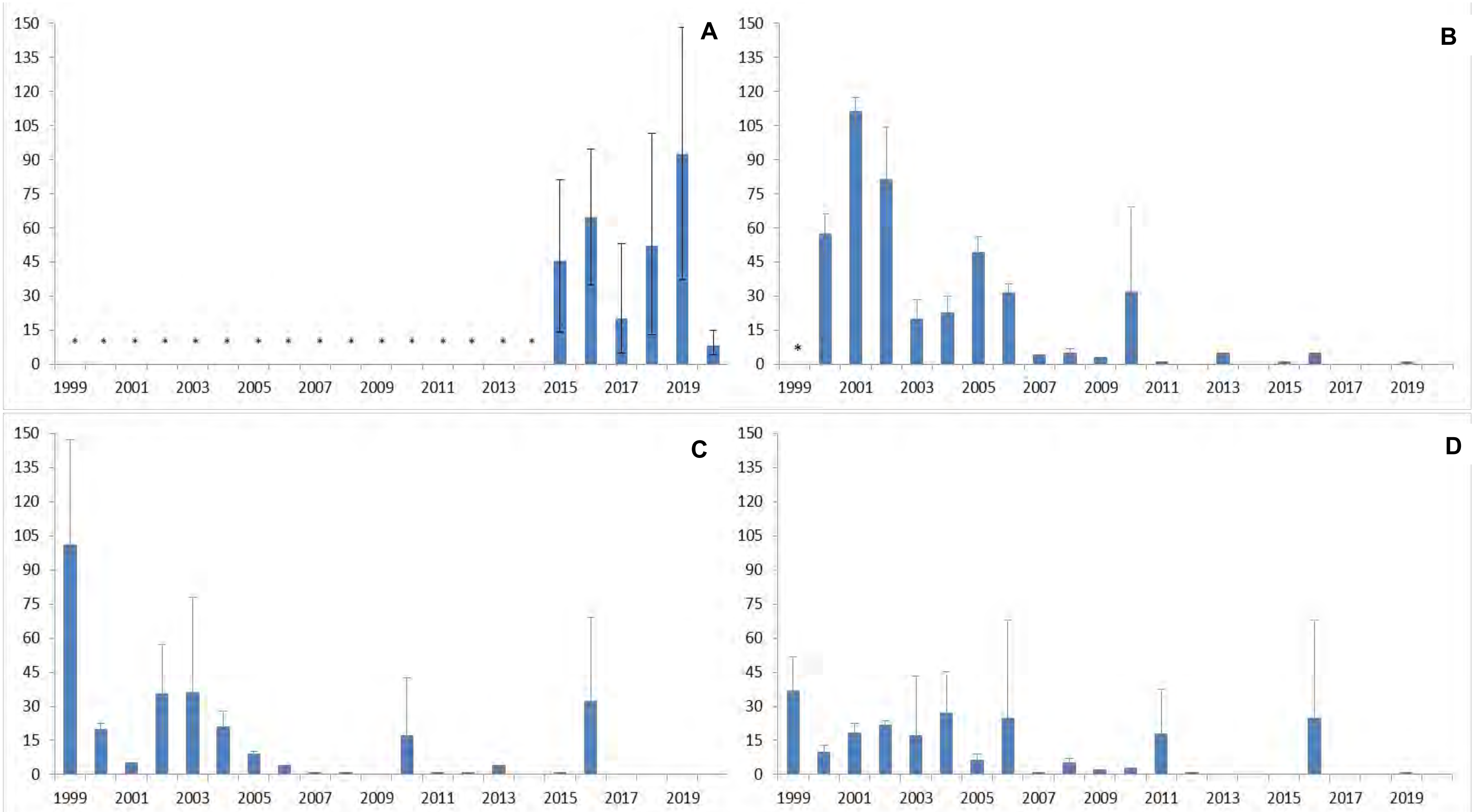


Figure 7. Outmigrant smolt estimates (with 95% CI) and counts (without error bars) for cutthroat trout at Mainstem Little River (A), Carson Creek (B), Lower South Fork Little River (C), and Upper South Fork Little River (D), 1999-2020. Asterisk (*) indicates year when sampling was not conducted.

Table 4. Summary of unmarked salmonids captured during the 2020 trapping season in the Little River watershed, Humboldt County, California.

	Adult		YOY			1+		
Site	**Steelhead**	**Cutthroat**	**Coho**	**Chinook**	**Trout**	**Chinook**	**Steelhead**	**Cutthroat**
MSLR	24	43	0	82	4	10	3,616	1,023
CC	6	18	108	0	0	0	82	321
LSFLR	16	5	99	0	14	0	381	187
USFLR	3	13	43	73	21	0	287	169
Total	49	79	250	155	39	10	4,366	1,700

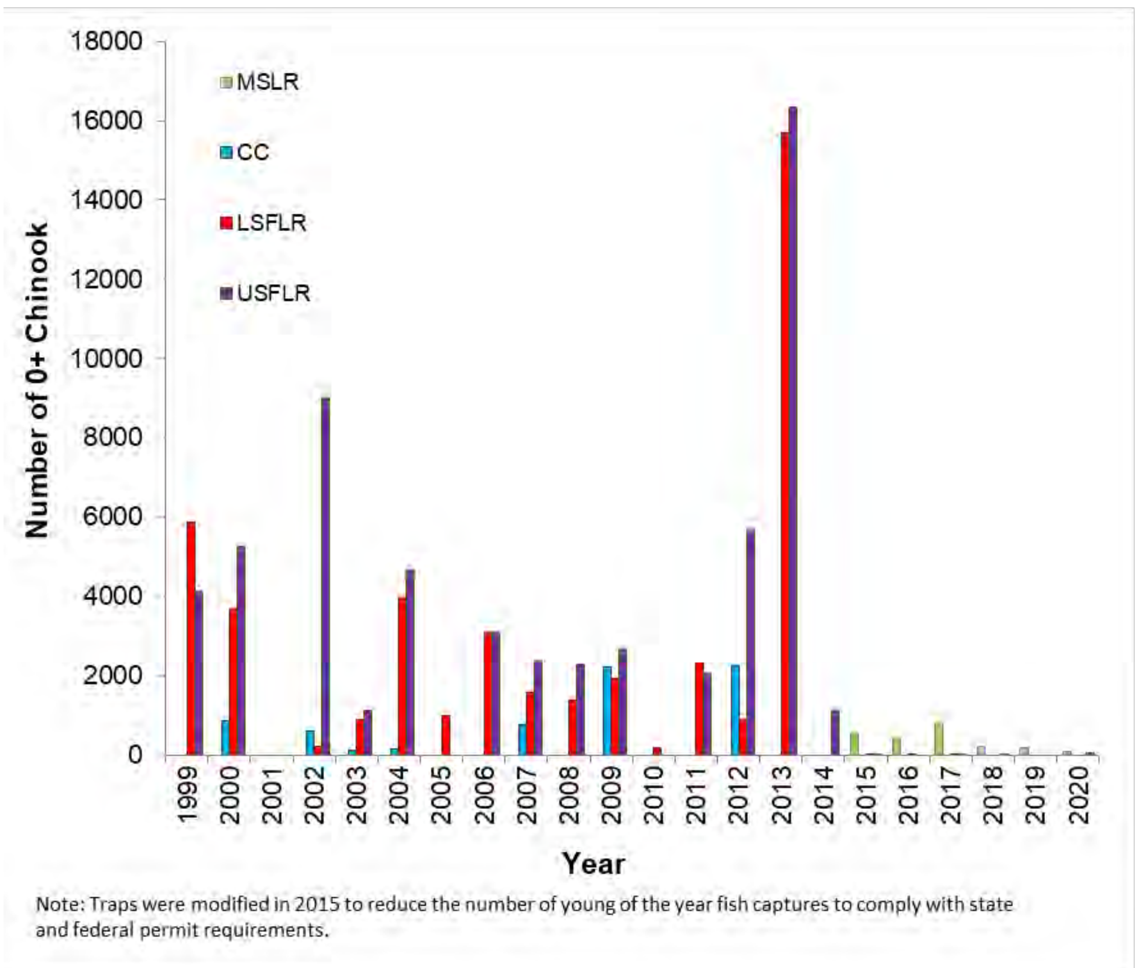


Figure 8. Frequency histogram of age 0+ Chinook salmon counted during outmigrant trapping from 1999-2020 in Little River, Humboldt County, California.

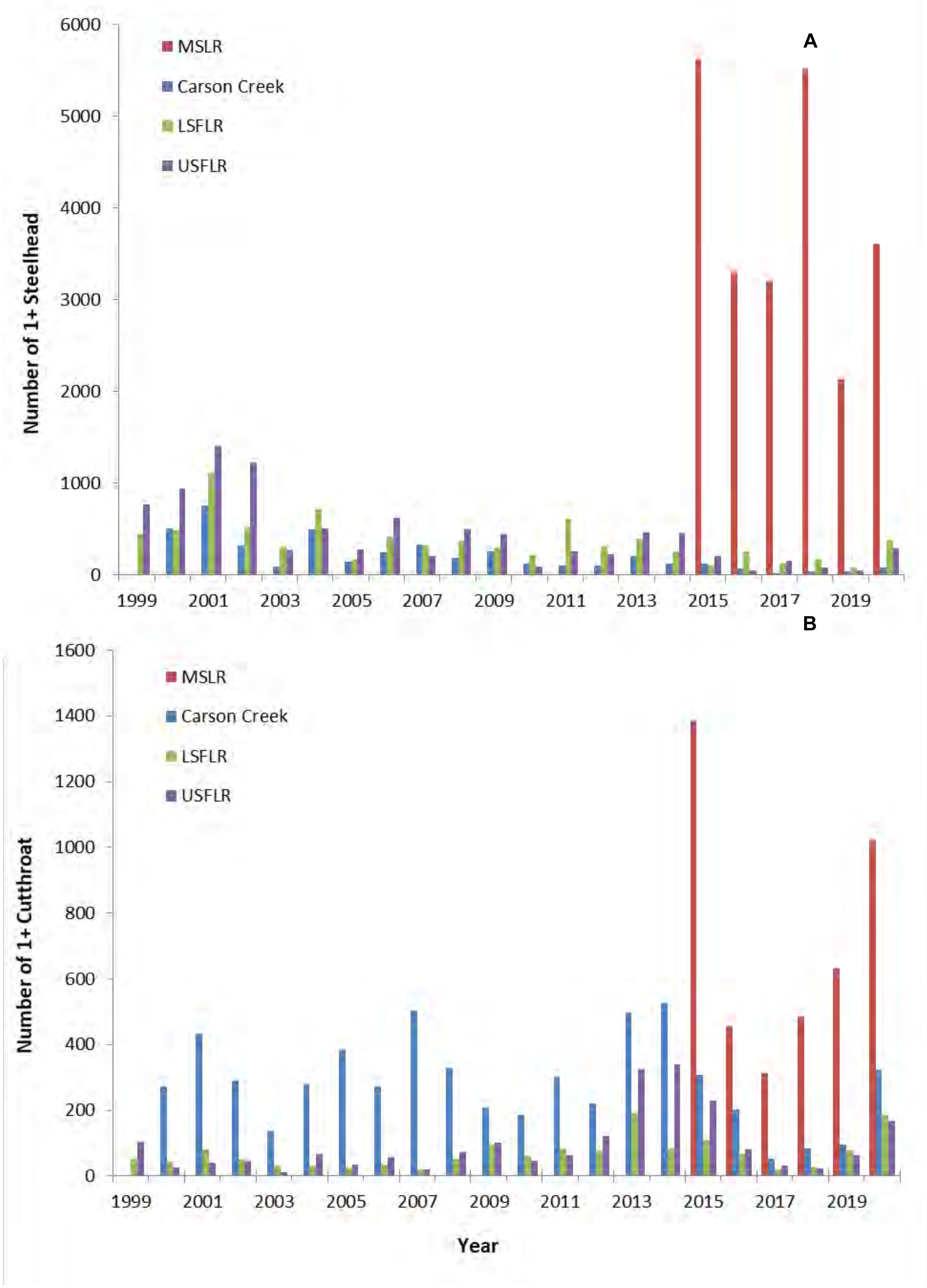


Figure 9. Frequency histogram of cutthroat 1+ (A) and steelhead 1+ (B) counted during outmigrant trapping from 1999-2020 in Little River, Humboldt County, California.

Size and Condition

A total of 4,699 fish were measured and weighed during the 2020 outmigrant trapping season. A summary of the measurements collected were compiled and statistics were calculated for each salmonid species and life history stages at each site (Table 5).

Based on a visual assessment of the 16,118 salmonids handled, the majority (99.9%) appeared to be in good condition and health. Twenty fish were recorded as injured or unhealthy. Among these fish, 8 had injuries (e.g., bruised, scraped, damaged tail or fins, bite marks), 3 had fungal infections and 9 were affected by exothalmia (e.g. protruding eyes).

Table 5. Summary of length and weight for salmonids captured (N = sample size) during the 2020 outmigrant trapping season in Little River, Humboldt County, California.

				Fork Length (mm)		Weight (g)	
Site Name	**Species**	**Age Class**	**N**	**Range**	**Mean**	**Range**	**Mean**
MSLR	Coho	Smolt	1455	70-175	103	3.7-58.3	12.5
	Steelhead	Smolt	189	140-234	172	24.0-129.8	52.2
	Steelhead	1+	406	67-181	99	3.8-65.5	12.2
	Steelhead	YOY	3	88-105	96	8.4-13.1	10.6
	Cutthroat	Adult	31	200-296	258	81.4-301.2	180.8
	Cutthroat	Smolt	4	199-243	220	78.8-137.5	105.8
	Cutthroat	1+	278	91-198	146	8.7-89.2	35.4
	Chinook	1+	1	76	-	5.2	-
CC	Coho	Smolt	487	78-132	100	5.1-25.3	11.6
	Steelhead	Smolt	4	157-181	167	40.9-60.3	48.6
	Steelhead	1+	54	72-163	94	4.4-45.2	10.6
	Cutthroat	Adult	11	222-310	261	110.2-246.7	184.1
	Cutthroat	1+	166	90-195	143	8.2-199.2	34.4
LSFLR	Coho	Smolt	567	73-133	99	4.9-24.6	11.1
	Steelhead	Smolt	11	143-196	173	32.7-66.7	50.9
	Steelhead	1+	195	65-170	97	3.3-90.0	11.5
	Steelhead	YOY	1	92	-	8.8	-
	Cutthroat	Adult	5	225-295	263	130.6-285.6	196.9
	Cutthroat	1+	120	106-198	147	14.0-81.2	34.6
USFLR	Coho	Smolt	393	75-133	99	4.7-24.2	10.8
	Steelhead	Smolt	3	152-162	156	33.0-40.7	36.3
	Steelhead	1+	163	74-168	101	4.6-117.6	14.1
	Cutthroat	Adult	11	210-295	261	119.9-295.0	184.9
	Cutthroat	1+	141	105-197	144	13.1-84.3	32.5

Mortality

Overall, of the 14,511 salmonids captured, the mortality rate was 0.22%. A total of 32 dead fish were documented during the 2020 outmigrant trapping season in Little River (Table 6). Those resulting from unknown causes or monitoring activities (n = 19) were reported as mortalities and those clearly from predation (n = 13) were reported separately. Mortalities were observed for coho, Chinook and steelhead. Predation was observed for coho, Chinook and steelhead. More details on the cause(s) of the observed mortalities and efforts to minimize them are described in the discussion section.

Migration Timing

A frequency histogram was created using daily smolt captures (i.e., not estimates) to summarize the timing of coho smolt migration at the four monitored sites in Little River (Figure 10). The outmigrant traps were installed before the peak of the coho smolt migration. For the first time in 5 years, spring rains did not prevent installation of the traps. The tributary traps all seem to have peaked around the end of April but had similar pulses during the first and third weeks in May. MSLR coho smolt migration peaked on May 13th.

Table 6. Summary of salmonid mortality during 2020 outmigrant trapping in Little River, Humboldt County, California.

				Mortality							
				Handling		Unknown*		Predation		Total	
Site	Species	Age Class	Captured (#)	#	%	#	%	#	%	#	%
MSLR	Coho	Smolt	5,146	0	0.00%	7	0.14%	1	0.02%	0	0.00%
	Coho	YOY	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Chinook	1+	10	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Chinook	YOY	82	0	0.00%	2	0.00%	0	0.00%	0	0.00%
	Cutthroat	Adult	43	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Cutthroat	Smolt	4	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Cutthroat	1+	1,023	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Steelhead	Adult	24	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Steelhead	Smolt	215	0	0.00%	2	0.93%	0	0.00%	0	0.00%
	Steelhead	1+	3,616	0	0.00%	4	0.11%	0	0.00%	0	0.00%
	Trout	0+	4	0	0.00%	1	25.00%	0	0.00%	0	0.00%
CC	Coho	Smolt	947	0	0.00%	0	0.00%	5	0.53%	0	0.00%
	Coho	YOY	108	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Chinook	1+	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Chinook	YOY	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Cutthroat	Adult	18	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Cutthroat	Smolt	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Cutthroat	1+	321	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Steelhead	Adult	6	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Steelhead	Smolt	5	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Steelhead	1+	82	0	0.00%	1	1.22%	0	0.00%	0	0.00%
	Trout	0+	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
LSFLR	Coho	Smolt	990	0	0.00%	1	0.10%	4	0.40%	0	0.00%
	Coho	YOY	99	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Chinook	1+	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Chinook	YOY	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Cutthroat	Adult	5	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Cutthroat	Smolt	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Cutthroat	1+	187	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Steelhead	Adult	16	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Steelhead	Smolt	11	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Steelhead	1+	381	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Trout	0+	14	0	0.00%	0	0.00%	0	0.00%	0	0.00%
USFLR	Coho	Smolt	542	0	0.00%	1	0.18%	3	0.55%	0	0.00%
	Coho	YOY	43	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Chinook	1+	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Chinook	YOY	73	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Cutthroat	Adult	13	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Cutthroat	Smolt	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Cutthroat	1+	169	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Steelhead	Adult	3	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Steelhead	Smolt	3	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Steelhead	1+	287	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Trout	0+	21	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Total	Coho	Smolt	7,625	0	0.00%	9	0.12%	13	0.17%	0	0.00%
	Coho	YOY	250	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Chinook	1+	10	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Chinook	YOY	155	0	0.00%	2	1.29%	0	0.00%	0	0.00%
	Cutthroat	Adult	79	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Cutthroat	Smolt	4	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Cutthroat	1+	1,700	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Steelhead	Adult	49	0	0.00%	0	0.00%	0	0.00%	0	0.00%
	Steelhead	Smolt	234	0	0.00%	2	0.85%	0	0.00%	0	0.00%
	Steelhead	1+	4,366	0	0.00%	5	0.11%	0	0.00%	0	0.00%
	Trout	0+	39	0	0.00%	1	2.56%	0	0.00%	0	0.00%

* mortality resulting from unknown causes (i.e., not predation)

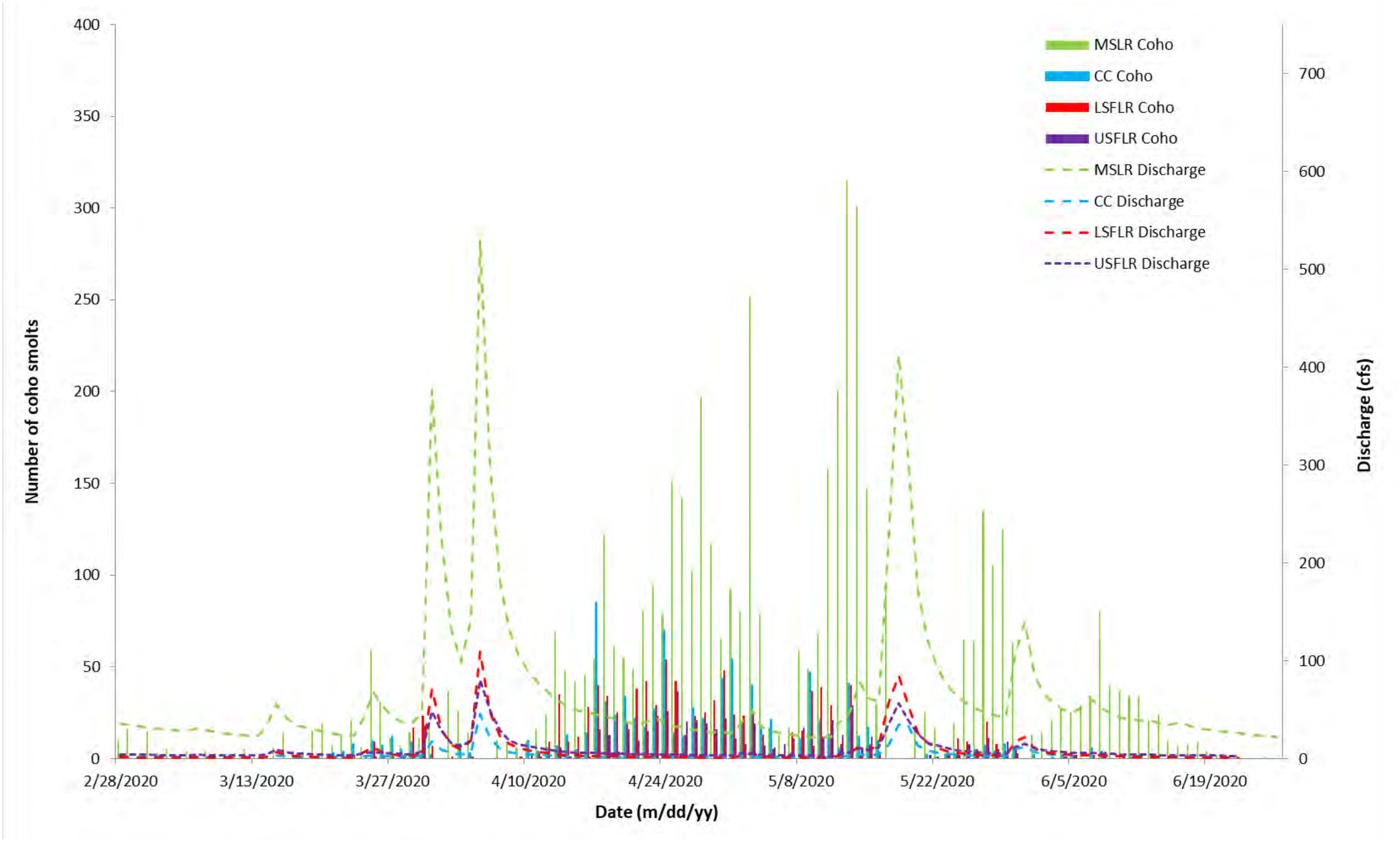


Figure 10. Histogram of coho smolt captures (vertical bars) and stream discharge (dashed lines) during the 2020 trapping season in Little River, Humboldt County, California.

Coho Overwinter Survival

Apparent overwinter survival, which does not account for early emigration, was calculated for LSFLR and USFLR based on 2019 summer juvenile population estimates and 2020 smolt estimates (Table 7). LSFLR had an apparent overwinter survival of 46% which is above average (24%) for this site. USFLR had an apparent overwinter survival of 54% which is also above average (24%) for this site. Overwinter survival could not be calculated for CC and MSLR (see Methods for justification).

Table 7. Summary of apparent overwinter survival estimates for coho from 1999-2020 in the Little River watershed, Humboldt County, California.

Site	Smolt Year	Coho (YOY) Summer Population	Coho Smolt Winter Population	Apparent Over-winter Survival Estimate	Drainage Area (Miles^2)	Length of Habitat (Miles)	Summer Population (Fish/Mile)	Winter Population (Fish/Mile)
LSFLR	1999	4,310	287	7%	5.3	2.2	1,959	130
	2000	8,456	1,718	20%	5.3	2.2	3,844	781
	2001	5,103	2,832	55%	5.3	2.2	2,320	1,287
	2002	928	549	59%	5.3	2.2	422	250
	2003	14,322	950	7%	5.3	2.2	6,510	432
	2004	6,320	1,411	22%	5.3	2.2	2,873	642
	2005	4,172	873	21%	5.3	2.2	1,896	397
	2006	6,912	1,039	15%	5.3	2.2	3,142	472
	2007	9,785	1,721	18%	5.3	2.2	4,448	782
	2008	7,943	1,156	15%	5.3	2.2	3,610	525
	2009	10,371	2,372	23%	5.3	2.2	4,714	1,078
	2010	9,937	1,283	13%	5.3	2.2	4,517	583
	2011	2,010	1,130	56%	5.3	2.2	914	514
	2012	8,592	998	12%	5.3	3.0	2,864	333
	2013	10,916	1,966	18%	5.3	3.0	3,639	655
	2014	9,495	2,405	25%	5.3	3.0	3,165	802
	2015	1,131	454	40%	5.3	3.0	377	151
	2016	7,562	691	9%	5.3	3.0	2,521	230
	2017	6,843	934	14%	5.3	3.0	2,281	311
	2018	3,706	1,253	34%	5.3	3.0	1,235	418
	2019	9,164	794	9%	5.3	3.0	3,055	265
	2020	4,452	2,030	46%	5.3	3.0	1,484	677
USFLR	1999	820	25	3%	5.7	1.6	513	16
	2000	1,279	137	11%	5.7	1.6	799	86
	2001	389	89	23%	5.7	1.6	243	56
	2002	197	30	15%	5.7	1.6	123	19
	2003	8,275	621	8%	5.7	2.0	4,138	310
	2004	3,018	927	31%	5.7	2.0	1,509	464
	2005	1,137	100	9%	5.7	2.0	569	50
	2006	1,881	404	21%	5.7	2.0	941	202
	2007	3,245	719	22%	5.7	2.0	1,623	360
	2008	1,660	354	21%	5.7	2.0	830	177
	2009	5,987	1,282	21%	5.7	2.0	2,994	641
	2010	3,501	1,439	41%	5.7	2.0	1,751	720
	2011	417	198	47%	5.7	2.0	209	99
	2012	2,914	338	12%	5.7	2.0	1,457	169
	2013	2,673	670	25%	5.7	2.0	1,337	335
	2014	769	240	31%	5.7	2.0	385	120
	2015	376	146	39%	5.7	2.0	188	73
	2016	1,730	283	16%	5.7	2.0	865	142
	2017	957	185	19%	5.7	2.0	479	93
	2018	906	267	29%	5.7	2.0	453	134
	2019	2,236	442	20%	5.7	2.0	1,118	221
	2020	1,542	831	54%	5.7	2.0	771	416

Species Composition and Abundance

Ten species (8 fish and 2 amphibian) were captured in the outmigrant traps during the 2020 season in the Little River watershed (Table 8). Fifty-seven percent of the fish species (95% of all captures) were in the genus *Oncorhynchus*. The remainder of species were incidental captures of non-target species, primarily sculpin, three spined stickleback, lamprey and amphibians. Five eulachon (*Thaleichthys pacificus*) were captured at the MSLR site in 2020 between March 7th and April 23rd. These are the first Eulachon captured in Little River since the beginning of the project in 1999. Only one eulachon was measured (fork length = 171 mm and weight = 46.3 g). However, the other four eulachons were noted to be of similar size. A fin clip for genetic analysis was collected from the measured eulachon and will be sent to the NOAA Fisheries Southwest Fisheries Science Center with all the other genetic samples collected during this project. Also, three northwestern salamanders (*Ambystoma gracile*) were captured at the MLSR site in 2020, this is the first time this species has been observed during this project. These were captured on March 14th and March 15th.

Table 8. Summary of species captured during 1999-2020 outmigrant trapping in the Little River, Humboldt County, California.

		Year																					
Common Name	**Scientific Name**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Coho Salmon	*Oncorhynchus kisutch*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Chinook Salmon	*Oncorhynchus tshawytscha*	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Steelhead	*Oncorhynchus mykiss*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Coastal Cutthroat Trout	*Oncorhynchus clarki clarki*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eulachon	*Thaleichthys pacificus*	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
Pacific Lamprey	*Entosphenus tridentatus*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Western Brook Lamprey	*Lampetra richardsoni*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	N	N	N
Pacific Giant Salamander	*Dicamptodon tenebrosus*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Tailed Frog	*Ascaphus truei*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	N
Red-legged Frog	*Rana aurora*	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	Y	Y	N
Rough-skinned Newt	*Taricha granulosa*	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	N	N	N	N	N	N
Northwestern Salamander	*Ambystoma gracile*	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
Prickly Sculpin	*Cottus asper*	N	Y	Y	N	N	N	Y	N	Y	N	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Humboldt Sucker	*Catostomus occidentalis humboldtianus*	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N
Three-Spined Stickleback	*Gasterosteus aculeatus*	N	Y	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y

Stream Temperature

Water temperature was monitored for 120 days (February 28 – June 26) at the MSLR trap site, during which a total of 2,400 measurements were collected. Water temperature was monitored for 88 days (March 24 – June 19) at the CC, LSFLR and USFLR trap sites, during which, a total of 1,752 measurements were collected. These monitoring periods accounted for 97.7% of the 2020 outmigrant trapping season at all four sites. Mean daily water temperatures were calculated from these data and temperature profiles were created (Figure 11). Water temperatures were similar among sites, all increased throughout the season as expected, and temperatures stayed within the thermal tolerances for captured species.

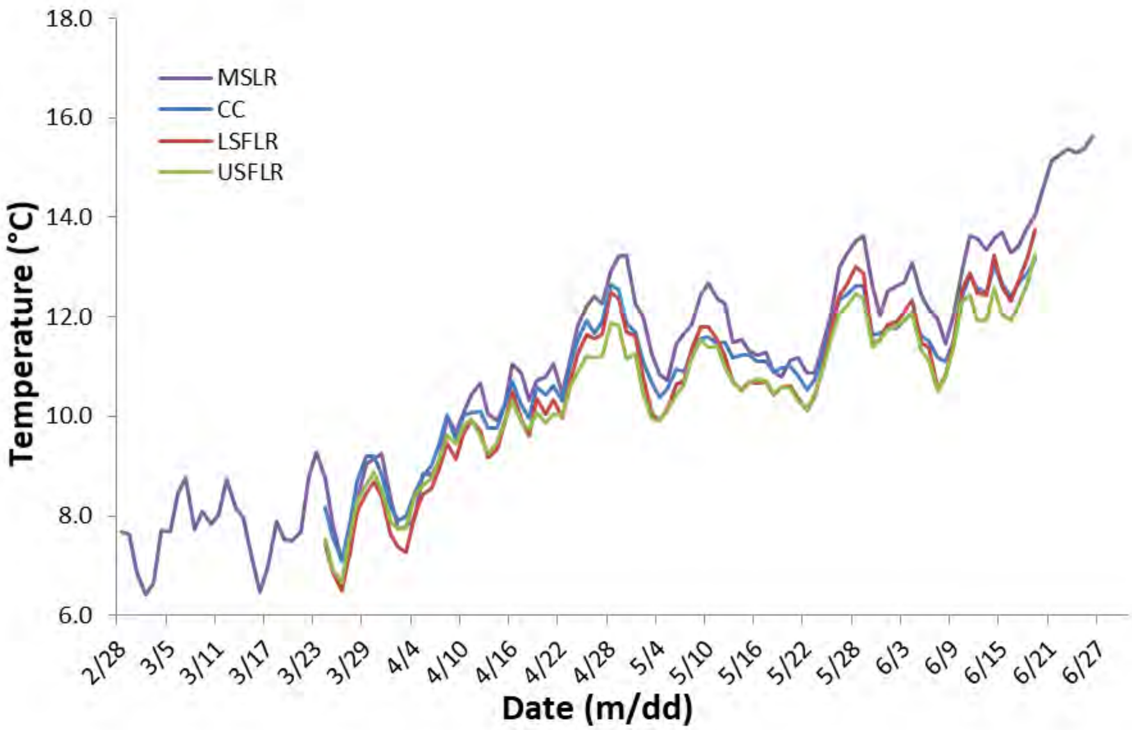


Figure 11. Profiles of average-daily water temperatures recorded at the four trapping sites during the 2020 season in the Little River watershed, Humboldt County, California.

Discussion

Population Estimates

Based on the three year life history of coho (Murphy and Meehan 1991), the 2020 population estimates in Little River tributaries was the eighth time this cohort was estimated (Figure 5). The outmigrating coho smolts documented this year in the Little River tributaries suggests that this moderate strength cohort more than doubled, compared to the last time (2017) they were monitored. USFLR experienced the largest estimate for this particular cohort since the start of the project in 1999. Light spring rains in March allowed for early trap installation for the first time in the last five years and based on the migration timing it appears we were able to capture a representative sample of the outmigrating coho smolts leaving the tributaries.

2020 was the sixth year of outmigrant trapping on the mainstem of Little River which has now allowed us to observe two full cohort cycles. The 2020 estimate, which was the largest estimate (13,441) to date for this site, suggests that this cohort experienced a significant increase in the quantity of coho smolts compared to the 2017 estimate (8,195). The mainstem estimate incorporates coho smolts from the tributaries and should be interpreted as a basin estimate for Little River. Prior to 2015 the largest basin estimate (sum of tributary estimates) for Little River observed was 5,796. The MSLR rotary screw trap is easier to install while spring flows are still elevated and allows for the capture of early emigrants that have potentially begun their downstream migration out of the tributaries. The RST estimate includes the progeny of adult fish that may have spawned in the mainstem, nonnatal fish that were born in the tributaries that reared in the mainstem and natal tributary fish that emigrated to the mainstem during early spring. Increasing evidence indicates that up to 25% of coho smolts in a north coastal California stream can move downstream in fall and winter (Rebenack et al. 2015). Having the RST located in the lower river has allowed GDRCo monitoring efforts to better capture the overall annual production in Little River. However, undoubtedly, some coho smolts are emigrating downstream below our mainstem monitoring site during winter and early spring prior to the installation of the mainstem trap. The 2020 migration phenology at MSLR was similar to past years where the largest peak in migration occurred during the second week in May (GDRCo 2015 and 2016). A pair of storms that occurred in late May caused brief interruptions in trapping, but did not appear to significantly affect the estimate.

The observed dynamics of coho smolt production both within and between cohorts at the monitored locations in Little River is interesting and presumably a result of multiple factors, including climate, ocean conditions, predator-prey dynamics, spawning and rearing habitat availability, and anthropogenic disturbances, acting synergistically. A comprehensive analysis is needed to better understand what is truly associated with the observed dynamics of coho smolt populations in Little River.

After being very low or not detected in the last three years, steelhead smolts were observed at all three of the Little River tributaries. Although this an improvement compared to recent years, the 2020 steelhead smolt estimates at Carson Creek and USFLR were still low. LSFLR experienced the 8th largest estimate over the last 22 years of monitoring at the site (Figures 6). Cutthroat smolts were not detected in the tributaries during 2020 (Figure 7). Both cutthroat and steelhead smolt estimates at the mainstem site decreased compared to 2019. The overall long term trends in the tributaries suggests these species may be declining; however, interpreting the population estimates for these species is likely confounded for several reasons. First, for steelhead, the average low numbers observed may be at least partially an artifact from the timing of the trapping seasons. In Blue Creek, tributary to the Klamath River, peak steelhead smolt emigration occurred from mid-March through mid-April (Gale 2003); earlier than the initiation date for several of the later outmigrant trapping seasons in Little River. This explanation seems plausible considering the largest estimates GDRCo calculated occurred during years with the earliest initiation dates (e.g., 1999-2005). Furthermore, our finding that mainstem steelhead smolt estimates have been an order of magnitude greater than any tributary suggests that smolts are moving out of Little River tributaries and rearing in mainstem habitats before smoltification. Second, low sample sizes produced low confidence in population estimates or did not allow for estimating, limiting the ability to assess population trends. Third, both species are iteroparous and have variable fresh water rearing times (steelhead = 1-3 years and cutthroat = 2-5 years) and ocean rearing times (steelhead = 1-4 years and cutthroat = 1-2 years) (Moyle 2002), making it difficult to assess population trends using juvenile estimates alone. Lastly, the morphologic criteria used to categorize steelhead and cutthroat as smolts is subjective and may have varied over time among the different crew members. In general categorizing fish as smolts (as compared to 1+ or greater steelhead or cutthroat) has become more conservative over time which may partially explain the observed numbers for these species. Due to the above reasons, the tributary smolt estimates for steelhead and cutthroat trout from this monitoring effort should be used judiciously.

Unlike recent years, the beginning of the 2020 trapping season at MSLR was not affected by high flows and the trap was installed in late February for the first time since the mainstem site was established in 2015. During high flow events, the traps are typically removed or modified to prevent equipment damage or loss, and during these inoperable times fish can’t be captured. In 2020, there were three storm events during the trapping season that resulted in four non-operational trapping days at MSLR, one at CC and two at LSFLR and USFLR. Some coho smolts were likely missed at the tributaries and the mainstem during this time.

The low number of Chinook YOY captured in 2020 resulted from a change in the trapping method that occurred prior to the 2015 trapping season. To comply with a reduction in authorized take for this age class and species the capture of YOY fish were intentionally avoided. Over the last six trapping seasons, this was achieved by using larger mesh openings (mesh opening size = 1/2“, diagonally set) on the live-box(s) of all traps. Therefore, most YOY fish that entered a trap could freely escape. Those that were captured either chose to enter or stay in the live-box because it provides flow refugia or were too large to exit upon entry towards the end of the trapping season. Our efforts to reduce the number of Chinook handled was successful in 2020 and the number of YOY we captured for this and other species should not be used to assess population trends.

Coho Overwinter Survival

The results from 2020 for apparent overwinter survival of coho should be interpreted cautiously. The apparent overwinter survival estimates are based on the assumption of no immigration or emigration of juveniles between the time of the summer estimate survey and the installation of the outmigrant traps the subsequent spring. Increasing evidence indicates that up to 25% of coho smolts in a north coastal California stream can move downstream in fall and winter (Rebenack et al. 2015). Coho smolts that migrated out of LSFLR and USFLR during this time decrease the overwinter survival statistics. These findings suggest that the closed population assumption is violated and should be considered when interpreting coho overwinter survival results. The proportion of fish emigrating from the sites monitored in Little River is unknown, and is likely influenced by factors including population density, winter flows (e.g., frequency and intensity), temperature, food availability, and the amount of suitable winter rearing habitat. Therefore, a detailed analysis is needed to understand what factor(s) likely influence coho overwinter survival in Little River so that these data can be interpreted correctly.

In Little River, evidence continues to suggest that peak discharge has at least some association with apparent overwinter survival. There is a seemingly inverse relationship from 1999-2010 between discharge and apparent overwinter survival (GDRCo 2011), which seems to be further supported by results from 2020. The lowest average apparent overwinter survivals occurred during the 1999 and 2003 smolt cohorts when the Little River peak flow events exceeded 9,400 and 8,500 cfs, respectively. Presumably, high flow events increase mortality and/or force juveniles downstream before the trapping season and during the OMT season when the traps are not operational (i.e., peak flow events). Therefore, the true overwinter survival in the Little River watershed is likely higher than that reported here, assuming that fish are utilizing other portions of the Little River watershed (i.e. the mainstem or estuary). Conversely, the highest average apparent overwinter survival was for the 2001 smolt cohort when the peak event (788 cfs) was the lowest since the inception of outmigrant trapping by GDRCo in Little River. Flows during the 2019-2020 winter were very mild with only two significant storms events that produced peak flows of 1,270 cfs and 1,190 cfs respectively. A winter of low level flows may have encouraged tributary use and contributed to the 4th highest overwinter survival observed at LSFLR and the highest overwinter survival observed at USFLR since the beginning of the project.

Size and Condition

The sizes and weights documented for salmonids in Little River during the 2020 outmigrant trapping season were similar to those reported in years past. The lack of any obvious change in fish size and condition suggests that there have been no significant changes to the available rearing habitat in Little River. Salmonid growth increases at varying rates depending on the abundance of aquatic insects and plant life during critical rearing periods (Murphy and Meehan 1991). Size can also be influenced by density related competition (Imre et al. 2005). The seemingly consistent size and length among salmonids captured at the trap sites suggests that these factors are relatively constant in the Little River watershed.

Migration Timing

The 2020 migration timing for coho salmon in Little River was variable at our tributary and mainstem traps. Storms during the trapping season seemed to have the largest influence on outmigration. The mainstem, as well as, the tributary traps all had reductions in daily smolt captures following each storm. MSLR peaked on May 13th with 315 coho smolt captures. A light storm and trap adjustment were the suspected reasons for the steep decrease in captures during the first week in May. CC appears to have peaked in mid-April. LSFLR and USFLR both peaked around the last week in April although at USFLR the peak in migration was more subtle. One storm in late March and two storms in mid-May and late-May caused brief interruptions in trapping where the MSLR and tributary traps were non-operational. During this time it is likely we missed some of the smolts emigrating from both the tributaries and the mainstem. The exact reasoning for the observed migration timing is likely due to a number of factors including the size of the fish, flow conditions, water temperature, dissolved oxygen levels, day length, and availability of food (Shapovalov and Taft 1954). These factors presumably contributed to the 2020 outmigrant phenology observed in Little River.

Mortalities

The overall mortality rate observed during the 2020 trapping season was 0.22%. Several factors may have contributed to the mortalities observed related to the trapping process during the 2020 outmigrant season in Little River. Predation is clearly one factor. Some of the other potential reasons for fish mortality while operating the outmigrant traps may include improper handling, trapping injury, debris loading in the trap box, and employee inexperience. Below we considered the potential role of each of these factors in the observed mortality in 2020.

It is unlikely that employee training and experience negatively contributed to the observed mortality in 2020. In fact, the low mortality rates in 2020 is partly attributable to the focused effort of our experienced field crew. All crew members involved in conducting outmigrant trapping in Little River received sufficient training and most had multiple years of direct experience using the trapping equipment and following the field protocols. This factor is easiest to control with proper training and supervision of field crews in fish handling techniques, and the company’s emphasis on the importance of this issue.

One high flow event during the 2020 trapping season resulted in 13 mortalities. Seven coho smolts , 2 steelhead smolts and 4 steelhead 1+ were killed when the cone on the RST became jammed with debris overnight during a storm. Mortality associated with heavy debris loading in the trap-box in Little River can occur during periods of high winds and high flows (GDRCo, 2011). Young-of-year fish are especially susceptible to this source of mortality. During periods of heavy rain or wind, the traps are checked a second or third time in the later afternoons and evenings to clear accumulated debris from the live-box in an attempt to minimize mortalities associated with debris loading. These debris cleaning checks were conducted on four different days in 2020, including the day before theses 13 animals were found in the cone. As flows dropped at the mainstem RST site, a debris fence was installed to decrease surface material caused by wind events from entering the cone of the screw trap. The unlikely association of debris loading and the condition of the observed mortalities suggests an alternate cause.

Six undetermined mortalities, 2 coho smolts, 2 steelhead 1+ and 2 Chinook 0+, were observed during the 2020 trapping season. These undetermined mortalities occurred throughout the season and field observations did not attribute routine or excessive debris accumulation in the trap boxes as the cause. These six individuals were found inside the trap box upon checking the trap and did not have obvious signs of predation wounds.

Predation in the trap box is difficult to prevent and caused some of the observed mortality in 2020, despite efforts to minimize predation once fish had been trapped. To comply with a reduction in authorized take for Chinook YOY, capture of this age class for all salmonids was intentionally minimized. This was achieved by using larger mesh openings (mesh size opening = 1/2“, diagonally set) on the live-box(s) of all traps. Therefore, most YOY fish that entered a trap could freely escape. During the 2020 trapping season we continued to implement three tactics to minimize predation in the trap. First, we used a small screen cylinder to create a refuge, within the forward trap-box, such that only smaller fish can enter and seek shelter from larger fish which are excluded. Second, cover (i.e., cobbles) was also provided in trap-box. This cover was intended to allow smaller fish an alternative means to hide from larger fish in the trap-box. Lastly, a second live box was added to the screw trap to increase space and allow smaller fish an increased chance of avoiding predation by larger fish. Despite these efforts we did observe thirteen predation mortalities during the 2020 trapping season. Predation mortalities were observed for only coho smolts. While scanning unmarked fish during the workup process, 7 coho smolts were found to be located inside the stomach of a cutthroat trout. The other 6 predation mortalities were either regurgitated during the work-up process or found in the box with clear predation wounds. It is not certain when these predations occurred, but assumed to have happened while in the live box of the outmigrant trap.

While the mortalities observed in 2020 were low, both in percent of fish handled and relative to the take limits provided in our Section 10(a)(1)(A) permit, GDRCo continues to make efforts to further reduce mortality associated with the monitoring efforts. For example, the trapping equipment will be inspected for potential fish hazards and repaired as needed prior to deployment in 2021. Furthermore, we will continue to develop and implement new improvements in the trap design and handling procedures as part of our ongoing efforts. GDRCo will continue to strive towards low mortality associated with future trapping efforts.

Potential Research Improvements

GDRCo continues to research and explore options that would improve our methods and data. One way to improve the methodology is by constructing permanent weirs in these sub-basins. This would improve the confidence of the smolt estimates by providing a flexible initiation date and efficient trapping under all but the highest flows. Correlating this to our summer population estimates would lead to reliable overwinter survival estimates, giving us better insight into the quality of the winter habitat in the Little River watershed.

Now that GDRCo is applying PIT tags to fish in the tributaries during the trapping season, placing fixed PIT tag antennae near the mouths of the tributaries and in mainstem upstream and downstream of those tributaries and perhaps in other tributaries could be beneficial. This would allow for a better understanding of migration patterns that occur within and outside of the trapping season.

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Appendix E

Class II Riparian Experiment Proposal:

Effectiveness of Class II Watercourse and Lake Protection Zone (WLPZ) Forest Practice Rules (FPRs) and Aquatic Habitat Conservation Plan (AHCP) Riparian Prescriptions at Maintaining or Restoring Canopy Closure, Stream Water Temperature, Primary Productivity, and Terrestrial Habitat

Project #: EMC-2018-006

Project title: Effectiveness of Class II Watercourse and Lake Protection Zone (WLPZ) Forest Practice Rules (FPRs) and Aquatic Habitat Conservation Plan (AHCP) Riparian Prescriptions at Maintaining or Restoring Canopy Closure, Stream Water Temperature, Primary Productivity, and Terrestrial Habitat

PIs: Kevin Bladon, Catalina Segura, Matt House, Drew Coe, Nicholas Simpson

Collaborators: Oregon State University, Green Diamond Resource Company, CAL FIRE, California Department of Fish and Wildlife

Critical Question Themes and Rules or Regulations being Tested: Theme 1: WLPZ Riparian Function

Timeline: The duration of the project will be 4 years starting June 1, 2019 and continuing until May 31, 2023 (Table 1). The timeline presented in Table 1 indicates the core activities associated with each of the main data collection components of the research.

1. Background and justification

Estimating the thermal response of headwater streams and rivers to forest management activities is increasingly important given current and projected climate change (Luce *et al.*, 2014; Pyne and Poff, 2017) and increasing land use activities (Hester and Doyle, 2011). Historical forest management activities, such as harvesting near streams, often resulted in increased summertime stream temperatures because of reduced shade and increased solar radiation reaching the stream surface (Moore and Wondzell, 2005; Studinski *et al.*, 2012). Changes in stream temperature regimes are principally a concern when resulting temperatures are outside the range of thermal tolerances for aquatic ecosystem biota (Dunham *et al.*, 2003; Bear *et al.*, 2007). Elevated stream temperatures can affect primary productivity (D'Angelo *et al.*, 1997; Morin *et al.*, 1999), benthic invertebrates (Hogg and Williams, 1996; Hawkins *et al.*, 1997; Caruso, 2002), fish habitat (Eaton and Scheller, 1996; Beitinger *et al.*, 2000; Waite and Carpenter, 2000; Ice, 2008), as well as the rates of in-stream chemical processes (Demars *et al.*, 2011).

To address and mitigate negative impacts from forest harvesting activities in and around riparian zones, best management practices (BMPs) have been developed and implemented (Cristan *et al.*, 2016). In particular, BMPs aimed at maintenance or reestablishment of streamside forests have been effective at improving many of the functions of riparian zones. For example, there is strong evidence that riparian forests have been effective at providing shade, limiting direct solar radiation to the stream, and mitigating changes in stream temperature after contemporary forest harvesting (McGurk, 1989; Ledwith, 1996; Bladon *et al.*, 2016; Bladon *et al.*, 2018). Maintenance of shade has been found to be an effective strategy to mitigate stream temperature changes following forest harvesting as direct solar radiation and atmospheric conditions are often the primary driver for summer stream temperatures (Cafferata, 1990; Sinokrot and Stefan, 1993; James, 2003; Johnson, 2004; Wick, 2016). There is recent evidence, though, that too much shade from riparian forests may reduce in-stream photosynthesis (primary productivity) with associated declines in aquatic insects, fish, and/or amphibian productivity (Wilzbach *et al.*, 2005; Newton and Ice, 2016). Additionally, there is some evidence that other factors, such as stream orientation (Gomi *et al.*, 2006), steepness of channel slopes (Kasahara and Wondzell, 2003), and the contributions to streamflow from groundwater or hyporheic exchange (Moore and Wondzell, 2005) could all influence the effectiveness of riparian zones. However, the relative importance of these different factors and the possible tradeoffs in riparian function haven't been adequately or holistically examined.

The California Forest Practice Rules (FPRs) specify regulations for operations within Watercourse Lake and Protection Zones (WLPZs), the strips of retained trees and/or vegetation, along both sides of a watercourse. As an alternative to the ASP FPRs, private landowners may also develop tailored riparian prescriptions within an Aquatic Habitat Conservation Plan (AHCP), as part of the application for an Incidental Take Permit (ITP). For example, Green Diamond Resource Company (GDRC) has had an approved AHCP since 2007, which includes specific requirements for Class II watercourses. The AHCP also includes monitoring and a process to iteratively adjust management practices in response to findings from monitoring and experiments (i.e., adaptive management). In either case, these forest management practices are designed to ensure that "timber operations do not potentially cause significant adverse site-specific and cumulative impacts to the beneficial uses of water, native aquatic and riparian-associated species, and the beneficial functions of riparian zones" (CAL FIRE, 2017). As such, both the ASP FPRs and GDRC AHCP Class II riparian requirements for the WLPZ have the potential to contribute toward the objectives of key policies, such as the federal Endangered Species Act, California Endangered Species Act, Clean Water Action Section 303(d), Salmon Policy, Water Policy, and Joint Pacific Salmon and Anadromous Trout Policies (CAL FIRE, 2017). However, again, the effectiveness of current WLPZ regulations have not been thoroughly examined.

The effectiveness of current WLPZ regulations at mitigating adverse site-specific and cumulative impacts are particularly important in Class II-L (Large) watercourses. In California, the Forest Practice Rules (FPRs) afford the most protection to Class I (fish bearing) relative to Class II (aquatic life other than fish) and Class III streams (not supporting aquatic life). However, it has been recognized that headwater systems can be critically important to the water quality in downstream sites (MacDonald and Coe, 2007). This has led to the establishment of stricter provisions for Class II Large (Class II-L) watercourses compared to other Class II Standard (Class II-S) streams, according to the "Anadromous Salmonid Protection Rules, 2009" (ASP), and modified by the "Class II-L Identification and Protection Amendments, 2013" rule package approved by the California State Board of Forestry and Fire Protection in October, 2013. At present, the regulations require a 30 foot core zone and a 70 foot inner zone within watersheds of the coastal anadromy zone (Table 1), unless a site-specific riparian prescription is approved under CCR § 916.9(v). One of the objectives of these rules is to protect anadromous salmonid habitat by minimizing potential increases in water temperature and sediment from Class II and Class III watercourses draining into Class I systems. In addition, all watercourse and lake protection rules are designed to maintain, protect, and/or restore riparian-associated species, including amphibians and terrestrial wildlife species.

2. Objectives and scope

The broad objectives of the proposed research are to address critical questions associated with the high priority thematic area (EMC Strategic Plan Theme 1-WLPZ Riparian Function (Effectiveness Monitoring Committee, 2018) related to watercourse and lake protection zones (WLPZ) of Class II-L watercourses in the Coast District (See 14 CCR § 916.9 [936.9,956.9] (c) (4)):

a) How do the current FPRs and GDRCs AHCP Class II riparian requirements influence important controls on water quality and stream metabolism, including canopy closure, solar radiation, and near-stream air temperature during the summer low flow period?

b) What is the relative importance of the different drivers (objective a) in influencing the variability in stream temperature dynamics (e.g., maximum, minimum, diurnal variations), dissolved oxygen, and primary productivity during summer low flow across different Class II WLPZ prescriptions?

c) Integrate the data from objectives (a) and (b) to develop a model to improve understanding of the effectiveness of different Class II WLPZ prescriptions at mitigating undesirable changes in stream temperature and primary productivity following forest harvesting activities across a range of scenarios.

3. Critical questions and Relevant Forest Practice Regulations (Please address the critical question, scientific uncertainty, geographic application, and collaboration & feasibility. See the EMC Strategic Plan Appendix F for more info)

Critical Questions: The proposed project will directly contribute knowledge to the following EMC Strategic Plan Themes and Critical Questions:

- Theme 1: WLPZ Riparian Function. Specifically, the proposed research will address critical questions within this theme regarding, 'Are the FPRs and associated regulations effective in:
  (a) maintaining and restoring canopy closure?
  (b) maintaining and restoring stream water temperature?
  (d) retaining conifer and deciduous species to maintain or restore riparian shade, water temperature, and primary productivity?
  (f) maintaining and restoring riparian function of Class II-L watercourses in the Coast District?

Please see section 4. ‘Research Methods’ of this proposal for details on the study design and methods we plan to use to adequately address the proposed critical questions.

While the proposed project will not directly address the following, it is important to note that the data from the proposed project could be used to indirectly support and/or provide base data for future research on the following EMC Strategic Plan Themes and Critical Questions:

- Theme 1: WLPZ Riparian Function. (c) Are the FPRs and associated regulations effective in retaining predominant conifers in WLPZs (Implementation and Compliance) and large woody debris input to watercourse channels?
- Theme 5: Fish Habitat. (b) Are the FPRs and associated regulations effective in maintaining and restoring the distribution of foraging, rearing and spawning habitat for anadromous salmonids?
- Theme 8: Wildlife Habitat Seral Stages. (a) Are the FPRs and associated regulations effective in retaining and recruiting late and diverse seral stage habitat components in WLPZs for wildlife?

Scientific Uncertainty: The effectiveness of current WLPZ regulations at mitigating adverse site-specific and cumulative impacts are particularly important in Class II-L (Large) watercourses. Moreover, interactions between riparian conditions, light levels reaching streams, physical and chemical water quality, and primary productivity are critical knowledge gaps needed to manage riparian zones effectively. However, WLPZ regulations in the state have evolved rapidly. As such, there remains large gaps in our knowledge about the critical functions of WLPZ (additional details in section 1 ‘Background and justification’ of this proposal) necessary to maintain or enhance water quality, aquatic habitat, and wildlife habitat.

Geographic Application: Research results will be directly relevant and applicable to the Coast Forest District within the Coastal Anadromy Zone (CAZ), which is a sub-region covered by the Anadromous Salmonid Protection (ASP) Rules. Increased process-based understanding may also inform current knowledge gaps and future research needs in the North Forest District of the CAZ, Southern Subdistrict of the CAZ, the Current Listed Salmonid Range outside of the CAZ, and more broadly to WLPZs outside of the ASP.

Collaboration: The proposed project will be a multidisciplinary (e.g., foresters, hydrologists, geomorphologists, fish and wildlife ecologists) effort, involving individuals from academic, state agencies, and private industry. Base data (e.g., riparian stand structure) will be made available to collaborators to facilitate related research (e.g., large wood, terrestrial habitat), which has been discussed but is not part of this proposal.

4. Describe Research Methods

To fulfill the objectives of this study we will implement a Before-After Control-Impact (BACI) study design on GDRC holdings in the coastal anadromy zone (CAZ). We have identified 26 potential Class II-L stream reaches on GDRC holdings, which could be used for this study (Figures 1 and 2). Specifically, we have identified 17 potential stream reaches to be harvested and 6–9 potential reference stream reaches that will remain unharvested through the duration of the study. Our target, is to instrument 18 stream reaches, which would include 4 replicates of 3 WLPZ prescriptions (12 harvested stream reaches), plus 6 references streams. Specifically, the WLPZ prescriptions would include, but are not limited to: (a) ASP Coastal Anadromy Zone Class II-L Prescription – 30 foot core zone; 70 foot inner zone with 80 percent overstory canopy cover, (b) GDRC Habitat Conservation Plan (HCP) Prescription – 30 foot inner zone with 85 percent overstory canopy; 70 foot outer zone with 70 percent overstory canopy cover, and (c) alternative prescription resembling pre-ASP prescription – 100 foot zone with 50 percent overstory canopy. In the following sub-sections, we provide additional details about the methods we plan to use to adequately address the proposed critical questions.

4.1 WLPZ stand structure and canopy closure

We will collect pre- and post-treatment data on WLPZ stand structure from ~5–7 fixed area plots along each of the 12 prescription and 6 reference stream reaches (~90–126 plots total). Fixed area plots will be approximately 1/10 acre (~400 m^2). Data will be collected on all standing live and dead trees with diameters ≥ 4 inches (>10 cm) at breast height [4.5 ft (1.37 m) above ground] that are within the WLPZ. We will record the following data for each tree: condition (live or dead), species, diameter at breast height (DBH), distance and azimuth from plot center. The canopy class (overstory, understory, or open) will be recorded for all live trees. Data recorded for dead trees includes decay class and mortality agent (e.g., wind, erosion, suppression, fire, insects, disease, and physical damage) when it is possible to determine. This foundational data is necessary to determine characteristics of the WLPZ likely to control its effectiveness and to interpret other data from this study.

The WLPZ prescriptions will be implemented to meet the specified retention requirements for canopy cover. We will use hemispherical photography to relate canopy cover requirements to canopy closure, and assess effectiveness of the WLPZ at influencing solar radiation transmission to the stream. Hemispherical photographs will be taken over the center of the stream along all reaches in the study to adequately characterize the entire WLPZ in all stream reaches (~5–7 per stream reach; ~90–126 total). All photographs will be taken vertically up into the canopy from directly over the stream with a Nikon D7100 equipped with a Sigma 45 mm f2.8 circular fisheye lens. Photographs will be taken following the recommended standard protocols for exposure, leveling, and image processing (Beckschäfer *et al.*, 2013; Glatthorn and Beckschäfer, 2014; Origo *et al.*, 2017). The resulting photographs record the sky visible through gaps in the forest canopy, as well as the structure of the canopy (e.g., LAI). We will use these features of the photographs to estimate solar radiation transmitted through (or intercepted by) the WLPZ, which would then be received at the stream surface (Gonsamo *et al.*, 2011).

Plot inventory information will be entered into the United States Forest Service's (USFS) Forest Vegetation Simulator (FVS). FVS is a distance-independent, individual tree forest growth model developed by the USFS that has been used to project forest stand development in the Pacific Northwest (Pollock and Beechie, 2014). Extensive information regarding FVS can be found at www.fs.fed.us/fmsc/fvs/. The Pacific Northwest variant will be used. Metrics which will be evaluated through the model over a 200 year period will be average tree diameter, stand density, height, and deadwood density.

4.2. Stream temperature measurements

Stream temperature is a critical physical water quality parameter that governs in-stream processes such as metabolism, gas solubility (e.g., DO), organic matter decomposition, with potentially related effects on stream biota (Johnson, 2004). As such, we will measure stream temperature (T_s) along each stream reach using thermistors (Onset TidbiT v2 Water Temperature Data Logger) programmed to collect data at 30-minute intervals. We will pair stream temperature (T_s) loggers with air temperature (T_a) data loggers to develop direct, local relationships between T_s and T_a. All in-stream loggers will be placed along the thalweg in riffle sections (avoiding stagnant pools) of each of the 12 streams in the treated watersheds and 6 reference watersheds (~8–12 loggers per stream) (Figure 3). Analytically, we will test for differences in stream temperature dynamics (e.g., maximum, minimum, mean, diurnal variations) across the different WLPZ prescriptions, which will provide critical insights into WLPZ effectiveness. Moreover, we will investigate variations in longitudinal stream temperature in all study reaches. This aspect of the study may be leveraged to provide broader insights beyond the Coast District. This will be achieved by comparing and contrasting the data we will collect with data currently being collected at the Jackson and LaTour Demonstration State Forests (since 2017) as part of a previously funded EMC project ("Multiscale investigation of perennial flow and thermal influence of headwater streams into fish bearing systems").

4.3. Primary productivity

Primary productivity is a critical component of aquatic ecosystems, providing food for invertebrates, thus supporting salmonid production. Primary productivity is influenced by stream temperature, light levels reaching streams, and nutrient availability (Morin *et al.*, 1999; Kiffney and Bull, 2000). However, it remains uncertain how riparian conditions influence these potential drivers and, therefore, in-stream primary productivity.

To address critical questions related to this uncertainty, we with quantify summer stream periphyton. Specifically, we will measure benthic algal biomass with a BenthoTorch (BBE Moldaenke; http://www.bbe-moldaenke.de) at each of the stream temperature locations. The Benthotorch is a hand-held, fluorimeter that estimates *in situ* chlorophyll-*a* (chl-*a*) concentrations from the stream substrate based on absorbance of fluorescent light (Kahlert and McKie, 2014). Chl-*a* is the dominant photosynthetic pigment of benthic algae in streams, so it provides an approximate estimate of primary productivity (Gregory, 1980). We will collect measurements at 3–5 replicate locations randomly selected around each stream temperature sensor (~648–1080 total).

Field measurements with the Benthotorch will be compared against the standard brush sampling/ethanol extraction/spectrophotometric analysis method to assess the accuracy and comparability of the different measurement techniques (Marker *et al.*, 1980; Nusch, 1980). Locations near the BenthoTorch sites will be selected randomly; sample rocks will be covered with a cap of similar diameter to the measurement surface of the BenthoTorch (3 cm vs 1 cm for the cap and BenthoTorch respectively). The cap will remain in place while the remainder of the rock will be scrubbed with a nylon brush and rinsed. Following the rinsing procedure, the cap will be removed and the area below will be scrubbed vigorously with a nylon brush. This procedure will be repeated two additional times to collected a composite sample. The removed material from the small diameter sampling surface will be placed into a 250 mL bottle and topped off to 250 mL with stream water. The samples will be kept cold prior to transport to the laboratory. In the laboratory, the samples will be filtered in the dark (0.7 μm glass fiber filters). Filters will be stored in centrifuge tubes at -20°C for 18 days prior to extraction using sonication and hot 95% ethanol. Chl-*a* concentrations of the extractant will measured using a spectrophotometer and not corrected for phaeophytin as the BenthoTorch cannot distinguish between photoactive pigments.

While the *in situ* Chl *a* provides a surrogate for primary productivity at explicit spatial locations, it does not account for the energy usage during respiration by benthic primary producers. Comparatively, estimates of whole stream metabolism can account for it, providing a better estimate of energy availability to upper trophic levels. More specifically, whole-stream metabolism quantifies carbon cycling in streams and is an empirical measure of carbon fixed and respired in the ecosystem, providing an estimate of gross primary productivity (GPP) and ecosystem respiration (ER). As such, we will measure whole stream metabolism for 4–6 weeks on each study stream during summer low flows. To accomplish this we will incorporate measurements of stream temperature with additional measures of DO, PAR, oxygen reaeration rates, and stream discharge.

Specifically, we will deploy MiniDOT dissolved oxygen (DO) and temperature loggers (Precision Measurement Engineering, Inc.) for continuous measurement (30-min intervals). We will clean DO meters weekly during deployment, as readings on optical DO meters can be impacted by periphyton growth on the surface of the sensor. We will also install photosynthetically active radiation (PAR) sensors (Odyssey PAR Light) along each stream reach to provide high resolution data (30-min interval) on the spectral range (400–700 nm) of solar radiation used by photosynthetic organisms. We will distribute the DO and PAR sensor installations along each of the stream reaches at locations most likely to be representative of reach average values. We will measure oxygen reaeration rates using a gas tracer (i.e., sulfur hexafluoride or SF_6) in all stream reaches (Wanninkhof *et al.*, 1990).

As the stream metabolism model we will use also requires information about the volume of water in the stream, we will install a level logger and barometer (Solinst Canada Ltd.) in each stream reach/watershed (Figures 1 and 2). Stage measurements from the level loggers will be converted to volumetric discharge measurements by developing stage-discharge relationships for each stream using the salt dilution gauging procedure (Moore, 2005). In this protocol, electrical conductivity (EC) measurements will be collected at one-second intervals using a YSI proDSS sensor Sonde (YSI Incorporated, Yellow Springs, OH). A salt slug (1 kg of salt, 6 L of water) will be prepared and dumped ~50 meters upstream of the EC sensor. We will then use the diel temperature, DO, PAR, reaeration, barometric pressure, and discharge data to calculate whole-stream metabolism using the one-station open-water exchange method (Kosinski and Merkle, 1984; Atkinson *et al.*, 2008; Grace *et al.*, 2015). We will determine two ecosystem metrics from these data using an inverse modeling approach based upon the diel oxygen curves (Atkinson *et al.*, 2008; Grace *et al.*, 2015).

Finally, riparian conditions and in-stream temperature and DO can also influence nutrient dynamics and primary productivity. Thus, we will also collect stream water samples monthly during the summer for nutrient analysis (nitrogen, phosphorus, dissolved organic carbon). We will collect three replicates of manual depth-integrated water samples at the downstream outlet of each of the study reaches. Water samples will be filtered on site using Whatman GFF filters and then placed on ice in a cooler until frozen within 6 hrs of collection. Samples will be analyzed at OSU's Institute for Water and Watersheds (IWW) Collaboratory.

5. Describe Project Deliverables

As outcomes of the proposed research project, the deliverables will include:

- Conduct all planned research and monitoring, data collection and recording, data analysis, and data interpretation.
- Digital archives of all raw data, digitally scanned field notes, processed data, and other products produced as a result of this research to facilitate future use of the data for other projects.
- Development of a PhD thesis and associated manuscripts for publication in refereed journals.
- A technical project report of the final results for the Department of Forestry and Fire Protection.
- Presentations at meetings with stakeholders, funding agencies, and professional workshops and conferences.

6. Anticipated Project Timeline

The duration of the project will be 4 years starting June 1, 2019 and continuing until May 31, 2023 (Table 2). The timeline presented in Table 2 indicates the core activities associated with each of the main data collection components of the research.

7. **Requested Funding:** $694,371 (see budget and budget justification below)

Category	Description	Year 1	Year 2	Year 3	Year 4	Total
Personnel	PI Bladon	9,756	10,049	10,350	10,661	40,816
	PI Segura	9,781	10,074	10,377	10,688	40,920
	PhD student	25,520	26,031	26,551	27,081	105,183
	Undergarduate	7,800	7,800	7,800	7,800	31,200
Personnel Benefits	PI Bladon	5,366	5,627	5,900	6,183	23,076
	PI Segura	5,380	5,641	5,915	6,199	23,135
	PhD student	7,401	8,069	8,762	9,479	33,711
	Undergarduate	624	624	624	624	2,496
Fees & Services		9,610	9,610	10,610	10,610	40,440
Materials & Supplies		108,459	10,960	10,960	10,960	141,339
Travel		17,849	17,849	22,377	22,377	80,452
Tuition	PhD student	14,976	15,651	16,353	17,091	64,071
Indirect Costs	OSU Overhead	24,906	13,480	14,427	14,719	67,532
Leveraged Costs (GDRC)†						130,000
EMC Funding Request		247,428	141,465	151,006	154,472	694,371

† Note: These are estimated costs that will be incurred by Green Diamond Resource Company (GDRC) over the duration of the study to facilitate its completion. These costs may include, but are not limited to, site selection, site verification, THP amendment, field crew assistance, and an approximate $30K cash contribution for equipment and supplies.

8. **Principal Investigator(s) and Collaborator(s) (Include a contact person with email address, phone number, and mailing address)**

PI: Kevin Bladon, 280 Peavy Hall, Department of Forest Engineering, Resources, and Management, Oregon State University, Corvallis, OR, 97331, email: bladonk@oregonstate.edu, Tel: 541-737-5482, Cell: 541-243-2588

Co-PI: Catalina Segura, 280 Peavy Hall, Department of Forest Engineering, Resources, and Management, Oregon State University, Corvallis, OR, 97331, email: segurac@oregonstate.edu, Tel: 541-737-6568

Collaborators: Matt House, Drew Coe, Nicholas Simpson

Attach figures, tables, or photos as needed.

Table 1. Core zone and inner zone width requirements for WLPZ associated with Class II-S and Class II-L streams within and outside of the coastal anadromy zone (CAL FIRE, 2017).

Water Class	**Class II-S (feet)**				**Class II-L (feet)**			
Geographic location	**Watersheds in the coastal anadromy zone**		**Watersheds outside the coastal anadromy zone**		**Watersheds in the coastal anadromy zone**		**Watersheds outside the coastal anadromy zone**	
Slope class	Core Zone (feet)	Inner Zone (feet)	Core Zone (feet)	Inner Zone (feet)	Core Zone (feet)	Inner Zone (feet)	Core Zone (feet)	Inner Zone (feet)
≤30%	15	35	10	40	30	70	20	80
30-50%	15	60	10	65	30	70	20	80
>50%	15	85	10	90	30	70	20	80

Table 2. Anticipated project timeline for main activities necessary to complete the project.

Activity	Pre-harvest (Before)				Post-harvest (After)											
	Year 1				Year 2				Year 3				Year 4			
	Su19	Fa19	Wi20	Sp20	Su20	Fa20	Wi21	Sp21	Su21	Fa21	Wi22	Sp22	Su22	Fa22	Wi23	Sp23
Finalize site selection	■															
Start of PhD student		■														
Instrumentation of field sites	■	■														
Mensuration data on WLPZ stand structure	■	■			■				■				■			■
Hemispherical photos for canopy closure	■	■		■	■			■	■			■	■			■
Field data collection of primary productivity	■	■		■	■			■	■			■		■	■	
Water sample collection for nutrients	■	■		■	■			■	■			■		■	■	
Laboratory analysis of algal samples		■	■			■	■			■	■		■	■	■	■
Temperature, DO and PAR data collection	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Stream metabolims modelling						■	■	■	■	■	■	■	■	■	■	
Finalize riparian prescription and lay out cutblocks					■											
Laboratory analysis of nutrients		■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Data analysis					■	■	■	■	■	■	■	■				
Presentation of results at international conference											■				■	
PhD Thesis defense																■
Submit final report and data to CalFire																■
Peer reviewed manuscripts submitted													■			■

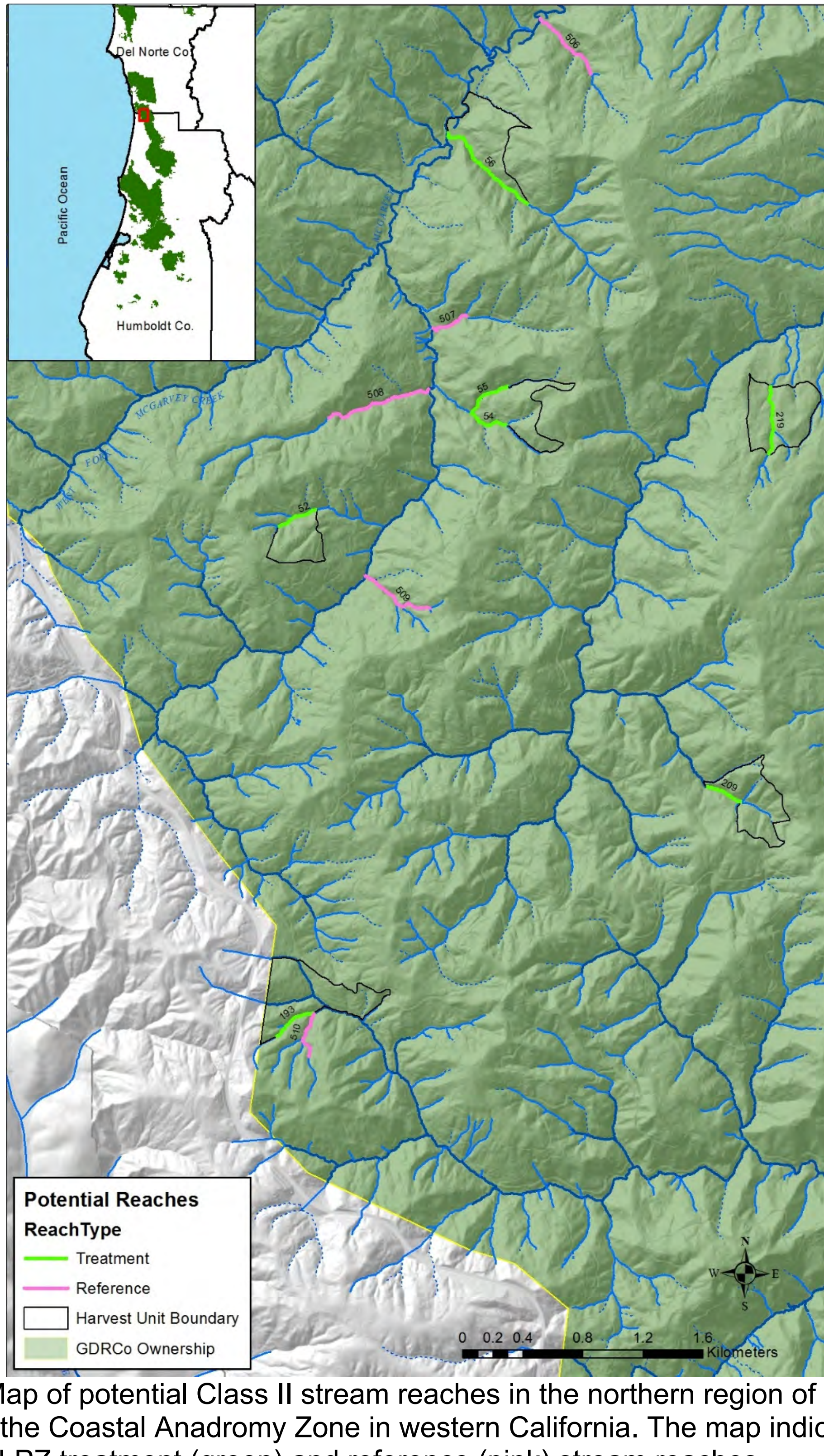

Figure 1: Map of potential Class II stream reaches in the northern region of GDRC holdings in the Coastal Anadromy Zone in western California. The map indicates potential WLPZ treatment (green) and reference (pink) stream reaches.

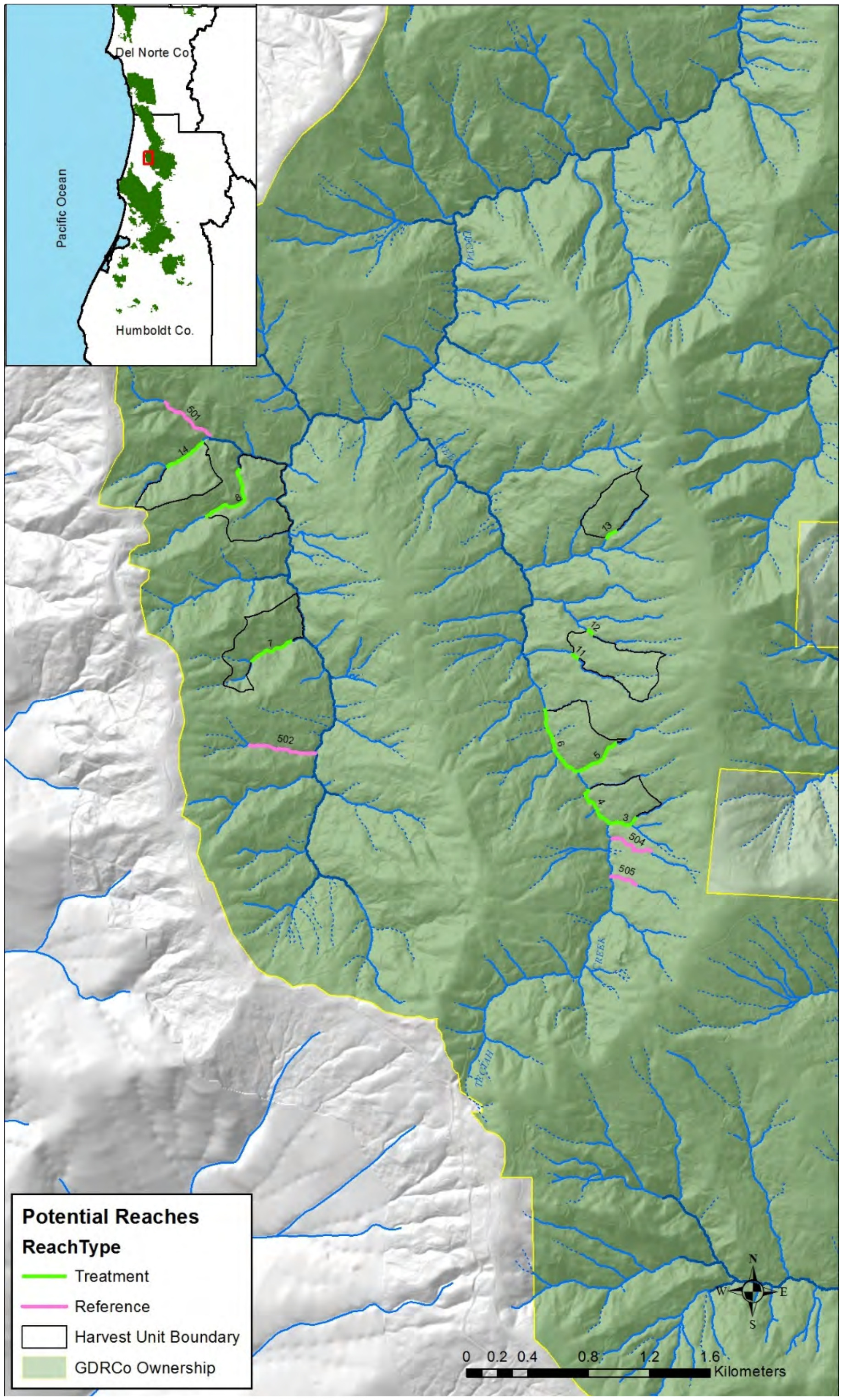

Figure 2: Map of potential Class II stream reaches in the southern region of GDRC holdings in the Coastal Anadromy Zone in western California. The map indicates potential WLPZ treatment (green) and reference (pink) stream reaches.

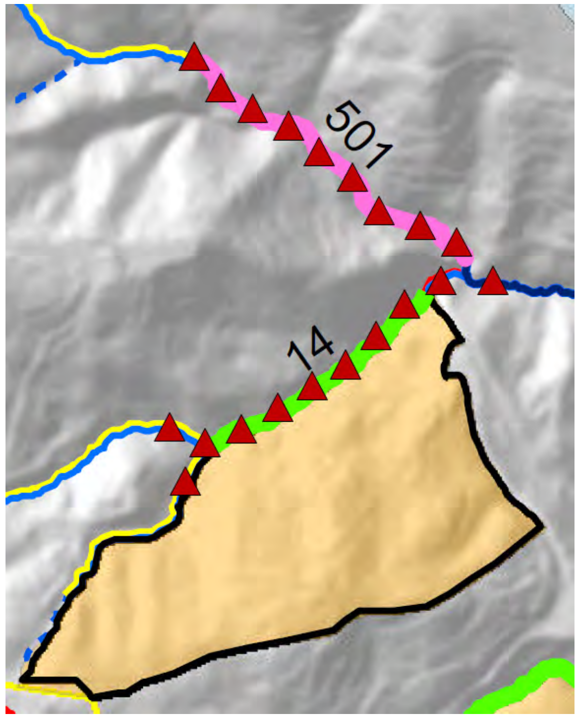

Figure 3: The inset shows an example of stream temperature sensor locations (red triangles) in a stream (14, green line) adjacent to a planned cutblock (beige polygon) and in a reference stream (501, pink line), which will be paired with measurements of air temperature, photosynthetically active radiation, dissolved oxygen, primary productivity, and WLPZ structure.

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Appendix A. Budget Justification.

A. Personnel - $218,119

Bladon is requesting 1 month per year for 4 years using a base monthly salary of $9,472 for a total of $40,816. Bladon will be responsible for (1) coordination of field and laboratory research, (2) oversight of data QA/QC and analysis, (3) overall project management, (4) advisement of the graduate students, and (5) communication of the research results in reports, peer-reviewed publications, and at conferences, workshops, and meetings. A 3% annual escalation was applied.

Segura is requesting 1 month per year for 4 years using a base monthly salary of $9,496 for a total of $40,920. Segura will also be responsible for (1) coordination of field and laboratory research, (2) oversight of data QA/QC and analysis, (3) overall project management, (4) advisement of the graduate students, and (5) communication of the research results in reports, peer-reviewed publications, and at conferences, workshops, and meetings. A 3% annual escalation was applied.

Funds are requested for a graduate student (PhD) for 4 academic year terms and 4 summer terms using a base monthly salary of $4,255 for a total of $105,183. The student will be responsible for data collection, data analysis, and communication of the research results in reports, peer-reviewed publications, and at conferences, workshops, and meetings. A 2% annual escalation was applied beginning in year 1.

Additional funds are requested for an undergraduate student for 4 summers (3 months) at $15/hour for a total of $31,200 ($7,800 per summer). The undergraduate student will assist with field and laboratory data collection.

B. Fringe Benefits - $82,418

Fringe benefits for Bladon follow institutionally approved guidelines and start at 55% for a total of $23,076.

Fringe benefits for Segura follow institutionally approved guidelines and start at 55% for a total of $23,135.

Fringe benefits for graduate student follow institutionally approved guidelines and start at 29% for a total of $33,711.

Fringe benefits for the undergraduate student follow institutionally approved guidelines and start at 8% for a total of $2,496.

C. Travel - $80,452

Domestic - $80,452

Funds are requested in each of Years 1 to 4 for the PIs, graduate student, and undergraduate assistant to travel to Arcata, CA and the field sites in the region for instrumentation of the field sites, data collection, and maintenance of field equipment. Costs for the trip are calculated as follows:

- per diem $57/day x 11 days + $134/night x 10 nights = $1967;
- vehicle $390/month x 4 months + $0.3/mi x 8400 miles = $4080;
- per trip total = $1967 x 7 trips plus monthly vehicle costs $4080 = $17849 x 4 years = $71,396

Funds are requested for 2 people to travel to AGU (San Francisco, CA) to present the research results in Year 3 and 4. Costs for the trip are calculated as follows:

- airfare $300, per diem $68/day, lodging $216/night for 5 nights for 2 people = $3,576.
- additional costs, include ground transportation $87, PI registration $480, student registration $255, abstract submissions $130;
- per trip total = $4,528 x 2 years = $9,056

D. Major equipment - none requested

E. Materials & Supplies - $141,339

Funds are requested for materials and supplies to support the project fieldwork and laboratory analysis of samples including: stream temperature loggers and housing (297 at $138 each = $40,986), photosynthetic active radiation sensors (54 at $250 each = $13,500), MiniDot dissolved oxygen sensors (20 at $1,188 each = $23,760), level loggers and barometric pressure loggers (20 at $639 and 2 at $350 respectively = $13,482), and additional field supplies to support the project (HOBO Shuttle, GPS, waders, field camera, SPOT unit, hemispherical lens, water sample bottles, filtering device = $5,771). Sub-total = 97,499 (Year 1)

Additionally, funds are requested for each of Years 1–4 for supplies used in the field and lab, which are not reusable. Specifically, funds will be used to purchase 25 mm GFF filters (178 at $17/each = $3,089), 4.7 cm glass filters (198 at $2/each = $376), SF6 gas release (832 at $3/each = $2,495), and additional miscellaneous annual supplies (ethanol, centrifuge tubes, butyl stoppers, gas sampling bags, hand crimpers, aluminum crimp seals, serum vials, equipment parts, lab safety items = $5,000).

F. Other Direct Costs - $104,511

Fees and Services - $35,640

Funds are requested in each of Years 1–4 ($8,910/year) for analytical services at the Oregon State University Cooperative Chemical Analytical Laboratory (CCAL), as follows:

Water Quality Parameter	Cost per sample		# samples	Total cost	
Nitrogen (NO_3^-)	$	18	162	$	2,916
Phosphorus (ortho-phosphate)	$	18	162	$	2,916
DOC	$	19	162	$	3,078
				$	8,910

Computer Services - $2,800

Funds are requested for costs ($700/yr) associated with housing and backing up of data on network servers.

Publication Costs/Page Charges - $2,000

Funds are requested in Year 3 and 4 ($1,000 each year) for publication of research results in peer-reviewed journals.

Tuition and Fees - $64,071

Graduate student tuition and fees are included in the budget for a total of 12 academic terms. Per term cost is $4,992 with an annual budgeted increase of 4.5% as projected by OSU's office of sponsored programs.

G. Total Direct Costs - $626,839

H. Indirect Charges - $67,532

The maximum permissible indirect cost rate from the funding agency (CalFire) is 12% of modified total direct costs (tuition is excluded).

I. Total - $694,371