



2023 Amphibian and Reptile Summary Report

June 1, 2023



Cover photo: Adult male southern torrent salamander, HRC Forest Sciences. In memorial, Michael Dunkelberger.

Humboldt Redwood Company (HRC) Project Description

Title: Amphibian and Reptile Monitoring

Purpose: Habitat Conservation Plan Monitoring

Date Initiated: March 1999

Projected End Date: Ongoing

Project Manager: Sal Chinnici, Director, Forest Sciences

Executive Summary:

The HRC HCP includes four covered amphibians (southern torrent salamander, tailed frog, yellow-legged frog, and red-legged frog) and one covered reptile (northwestern pond turtle). The HCP's strategy for conserving and monitoring the covered amphibian and reptile species is a landscape approach to protecting habitat, assessment of habitat conditions through watershed analysis, and species surveys and population monitoring.

With this summary report covering the 2022-2023 monitoring period there was an emphasis on watershed analysis revisitation work for the Lower Eel – Eel Delta (LEED) Watershed Analysis Unit (WAU), and in this report we also summarize cumulative monitoring efforts in the WAU to date. For tailed frogs, site occupancy and habitat conditions were monitored at six sites from 2013 to 2022. For southern torrent salamanders, site occupancy and habitat conditions were monitored at four sites from 2013 to 2022. For foothill yellow-legged frogs, site occupancy and habitat conditions were monitored at 12 sites over the years 2011 - 2013, 2017, and 2022. Surveys for northwestern pond turtles have been occurred at three sites from 2020-2022. No northern red-legged frog surveys were conducted in the LEED WAU during the 2022-2023 reporting period. Results of monitoring efforts are discussed below.

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Introduction

Four amphibian and one reptile species are covered under the HRC HCP: the southern torrent salamander (*Rhyacotriton variegatus*, RHVA); tailed frog (*Ascaphus truei*, ASTR); northern red-legged frog (*Rana aurora aurora*, RAAU); foothill yellow-legged frog (*Rana boylei*, RABO); and northwestern pond turtle (*Emys marmorata marmorata*, EMMA). None of these species local populations are currently listed under the federal or state endangered species acts, but all are listed as California Species of Special Concern (Thomsen, et al., 2016).

Surveys and habitat assessments for the covered species have been ongoing through implementation of HCP monitoring strategies. Sections of the HCP addressing amphibians and reptiles include: 6.3.2.1, 6.3.5.2.4, and 6.10. These HCP sections discuss the process by which both WA and effectiveness monitoring address the covered species' habitat needs.

The initial WA for the Lower Eel River and Eel River Delta (LEED) WAU, completed in 2004, included an Amphibian and Reptile Module (Appendix G, Hart Crowser 2004) which described the life history and habitat requirements of the covered species. Further discussion has subsequently been provided in HRC Amphibian and Reptile HCP Annual Reports.

The initial LEED WA (Hart Crowser 2004) followed the typical WA process, including development of critical questions, use of Channel Geomorphic Units (CGU) for analysis of habitat types, field investigations to collect data on habitat condition and species occurrence, and identified potential areas of concern. The Properly Functioning Conditions (PFC) matrix was used to rank habitat for the covered species.

Key findings of the 2004 LEED WAU Amphibian and Reptile Module included:

- All covered species have been documented in the LEED WAU in surveys conducted for the analysis, in surveys previously conducted, or incidentally. (For example, tailed frogs and northwestern pond turtles were not observed during field investigations for the 2004 LEED WAU but were known from previous or related PALCO surveys).
- Habitat and occurrences were identified for the southern torrent salamander and tailed frog in both consolidated geologies and higher gradient streams.
- Foothill yellow-legged frogs were the most frequently observed species, followed by northern red-legged frogs and southern torrent salamanders.
- Habitat for the northwestern pond turtle is generally limited to the Eel River floodplain. Shallower water and lack of adjacent nesting habitat are limiting factors for pond turtle habitat in tributaries of the Eel River in the LEED WAU.
- Areas of concern for the covered species' habitat in the WAU relative to sediment regime, peak flow, canopy cover, and LWD were examined:
 - According to the life history requirements of the amphibian and reptile species of concern, the southern torrent salamander and the tailed frog are the only species that are

sensitive to inputs of fine sediment. Because this parameter does not meet properly functioning conditions for amphibians and reptiles within all CGU classes surveyed (due to high percent fines and/or high embeddedness), all potential habitat for the southern torrent salamander and tailed frog was considered an area of concern.

- Of the amphibian species that would potentially occur in this WAU, the only species that is sensitive to the input of coarse sediment (i.e., boulders and cobbles) is the tailed frog. An increase in input of coarse sediments, however, would be beneficial for this species due to their preference for streambed compositions of greater than 50 percent boulders and cobbles, according to their life history requirements.
- Of the amphibian and reptile species that occur in this WAU, only the tailed frog and foothill yellow-legged frog have been documented to be sensitive to increases in peak flow. For example, stream velocities greater than 20 cm/sec sustained for more than a few days have been documented to cause mortality in foothill yellow-legged frog embryos (Kupferberg 1996). Therefore, a change in peak flow is an area of concern for these species.
- Of the amphibian and reptile species that could potentially occur in this WAU, the southern torrent salamander, tailed frog, and northwestern pond turtle are the only species that has been documented to be sensitive to canopy closure.
- Of the amphibian and reptile species that potentially occur in streams in this WAU, the southern torrent salamander, tailed frog, and western pond turtle are the only species that have been documented to be sensitive to the quantity of large woody debris (LWD) in the stream. For example, LWD is important as basking sites and refugia for pond turtles (Reese 1996). Because LWD amounts (number of pieces/channel width) ranked as good, LWD is not of concern for the northwestern pond turtle. Based on the habitat diagnostic for LWD (pieces/channel width) for the tailed frog and southern torrent salamander, LWD is not an area of concern in these species.
- Long-term temperature monitoring data were limited, both spatially and temporally. The long-term temperature data available were collected during the summer months in low-gradient streams when water temperatures would be at their highest, and thus when they would most likely pose a threat to the species of concern. No long-term temperature data were available for high-gradient streams located in the upper watershed. Long-term temperature data for the low-gradient streams were within the temperature ranges preferred by the foothill yellow-legged frog, the northern red-legged frog, and the northwestern pond turtle. From the data available, it does not appear that temperature stress would be an issue for these species in the areas that were monitored, as canopy closure was high.

No specific monitoring requirements for the amphibians and reptile covered species were recommended as a result of the 2004 LEED WA or through riparian prescription development.

For HCP monitoring and watershed analysis revisit purposes, the field investigations for the 2004 LEED WA were subsequently used as baseline surveys from which to establish future monitoring sites. In addition, more records of covered species occurrence in the WAU were gathered over time from incidental observations recorded during THP surveys, and from wildlife monitoring surveys, including protocol surveys of Class I and Class II waters (streams, watercourses, seeps, springs, lakes, ponds, and wetlands), and through the Aquatic Trends Monitoring (ATM) program. Where applicable, additional records have been used to establish new monitoring sites since the initial baseline surveys. See Figure 1, LEED WAU Covered Species Surveys and Distribution.

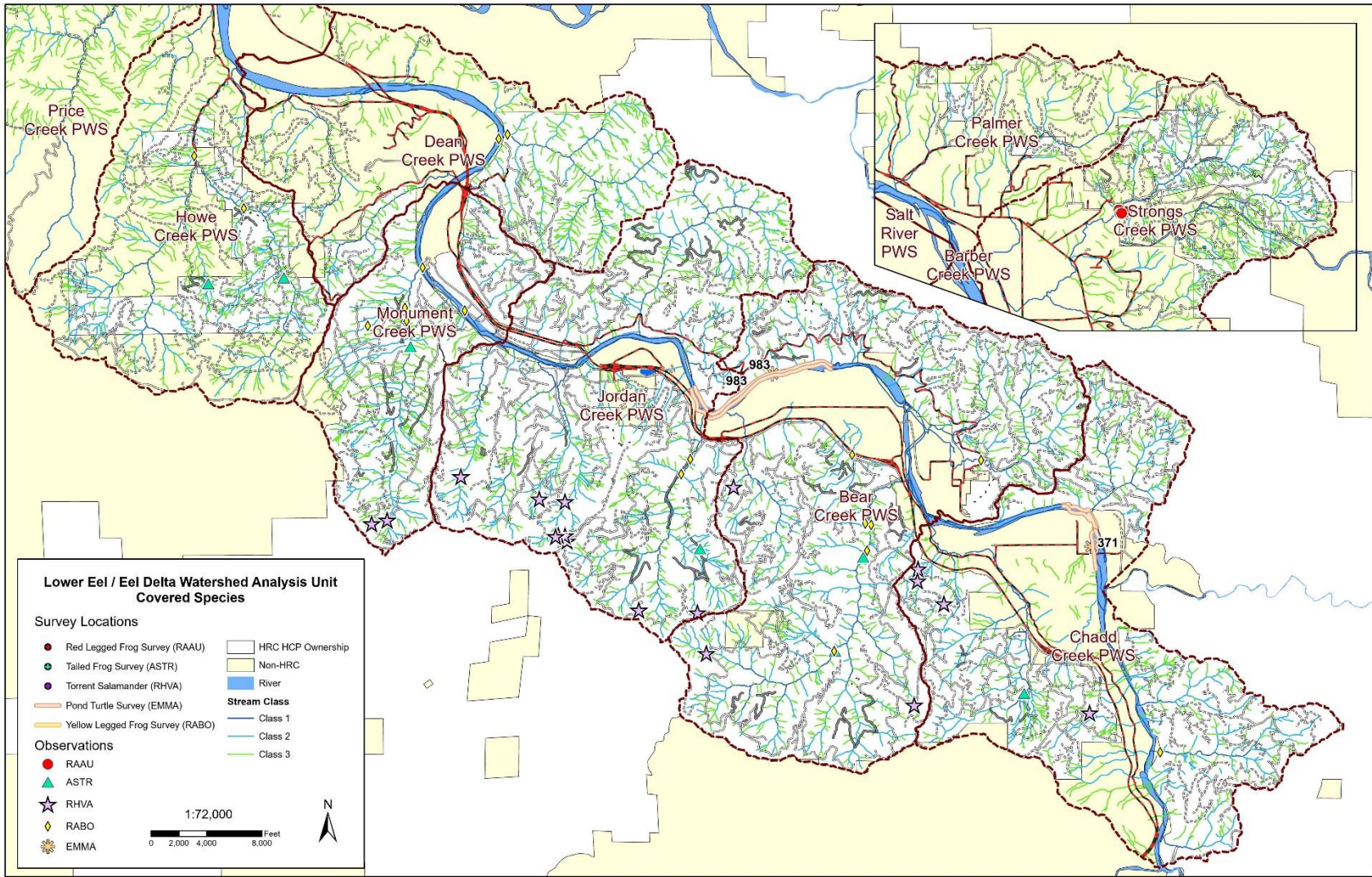


Figure 1. LEED WAU Covered amphibian and reptile species surveys and distribution.

For northern red-legged frogs, known breeding sites are inspected for evidence of adults, juveniles, and egg masses. In addition to site occupancy, water source and formation are recorded. Northern red-legged frogs prefer a variety of slow-moving waters or ponds for breeding, including lakes, ponds, stream backwaters, sloughs, and roadside ditches (Nussbaum et al. 1983). Habitats of this type are limited on HRC lands in the LEED WAU. Site occupancy and habitat conditions have been monitored at three sites over the years 2005, 2006, 2015, and 2017. A total of nine individual surveys were conducted during this time (Table 4).

Foothill yellow-legged frog survey and monitoring techniques are also area-constrained searches, concentrating on surveying river and stream reaches for eggs, tadpoles, and adults. As with the surveys for the headwater species, an occupancy level survey has been implemented for foothill yellow-legged frogs, using similar techniques but terminating the survey once the target species has been found. The survey continues until specimens are found or the entire reach is surveyed.

Survey sites are visually searched for the presence or absence of foothill yellow-legged frogs, using a 400-meter reach as the survey site. Surveys are concentrated during a period when the larger tadpoles, recent metamorphs, and adults are relatively easy to locate by searching the slow water edges of the wetted channel, typically June through September. Occupancy is established when an adult, juvenile, tadpole, or eggs are found at the survey site.

The foothill yellow-legged frog is widely distributed along the Lower Eel River and its floodplain tributaries, as noted in the initial WA. Site occupancy and habitat conditions have been monitored at five sites over the years 2011, 2012, 2013, and 2017. A total of 20 individual surveys were conducted during this time. Seven additional sites, consisting of ATM locations, were added in 2022. A total of 17 surveys were conducted in 2022 (Table 5).

Although no northwestern pond turtles were located during surveys for the initial LEED WA, turtles were observed near the mouth of Bridge Creek, thus establishing their presence in the Eel River floodplain. Since that time, we have found them to be common in suitable habitat on the mainstem Eel River (i.e., deep pools with suitable basking structure). We selected three monitoring locations to observe over time and have checked for occupancy for the last three years (2020-2022). The sampling season for pond turtles is the summer period, or specifically June through September. We have noted that turtles can be observed both earlier and later in the season here on the north coast of California when flow conditions permit.

Methods include using visual searches (i.e., walking surveys), snorkel-surveys, and floating surveys of suitable watercourses looking for basking adults. Turtles can often be seen using the same basking structures over multiple years. Since the survey techniques for pond turtles are not invasive or destructive, no changes to methods were necessary to transition to occupancy level surveys.

Results

Tailed Frog

In the initial LEED WA, no tailed frogs were observed during the field investigations. As a result of subsequent surveys and incidental observations we established six monitoring locations (site numbers 17,

18, 735, 798, 1174, and 1548) since the initial WA. Locations are in Bear Creek, Chadd Creek, Jordan Creek, Howe Creek and Atwell Creek. Complete survey results for tailed frog are shown in

Table 2.

These sites have been visited a total of 18 times (58 belt surveys) since the initial LEED WA, spread out over the years 2013, 2015, 2016, 2021 and 2022. Tailed frog adults and tadpoles were observed on eight of the surveys. Coastal giant salamander larvae (*Dicamptodon tenebrosus*), as well as adult and juvenile foothill yellow-legged frogs were also observed.

Table 2. Complete results for tailed frog (ASTR) surveys.

Site #	Date	Belt #	Belt Habitat Type	Belt Gradient (%)	Belt Substrate	Belt Embed	Belt Canopy	Species ID	Age ID	Count
18	14-Jun-13	1	LGR	1	C	2	61.0%	NA	NA	NA
18	14-Jun-13	2	LGR	1	C	2	62.5%	NA	NA	NA
18	14-Jun-13	1	LGR	2	I	1	53.0%	NA	NA	NA
18	14-Jun-13	2	LGR	2	C	1	50.0%	NA	NA	NA
798	01-Jul-13	1	LGR	3	C	2	82.0%	ASTR	T	6
1548	10-Jul-13	1	HGR	13	C	2	86.5%	NA	NA	NA
1548	10-Jul-13	2	HGR	8	C	2	80.5%	ASTR	T	1
798	27-Jul-15	1	LGR	3	C	2	89.5%	DITE	T	2
798	27-Jul-15	1	LGR	3	C	2	89.5%	ASTR	T	1
1548	15-Jun-16	1	HGR	18	C	1	89.5%	NA	NA	NA
1548	15-Jun-16	2	LGR	7	C	1	82.0%	ASTR	T	2
798	06-Jul-16	1	LGR	10	C	1	83.5%	ASTR	T	8
1548	20-Apr-21	1	LGR	2	C	2	100.0%	NA	NA	NA
1548	20-Apr-21	2	LGR	2	C	2	100.0%	DITE	T	1
735	19-May-21	1	HGR	5	C	3	100.0%	NA	NA	NA
735	19-May-21	2	SP	15	C	3	100.0%	NA	NA	NA
735	19-May-21	1	SP	15	C	3	100.0%	NA	NA	NA
735	19-May-21	2	SP	15	C	3	100.0%	NA	NA	NA
798	19-May-21	1	LGR	4	C	2	91.0%	NA	NA	NA
798	19-May-21	2	C/F	30	C	3	91.0%	NA	NA	NA
798	19-May-21	1	LGR	4	C	2	100.0%	DITE	T	1
798	19-May-21	2	LGR	5	C	2	100.0%	ASTR	T	1
17	20-May-21	1	LGR	3	C	2	100.0%	NA	NA	NA
17	20-May-21	2	LGR	4	C	2	100.0%	NA	NA	NA
17	20-May-21	1	LGR	2	C	2	100.0%	NA	NA	NA
17	20-May-21	2	LGR	2	C	2	100.0%	NA	NA	NA
18	20-May-21	1	LGR	2	C	2	100.0%	NA	NA	NA
18	20-May-21	2	LGR	2	C	2	100.0%	NA	NA	NA
18	20-May-21	1	LGR	2	C	2	100.0%	NA	NA	NA
18	20-May-21	2	LGR	2	C	2	100.0%	NA	NA	NA

Site #	Date	Belt #	Belt Habitat Type	Belt Gradient (%)	Belt Substrate	Belt Embed	Belt Canopy	Species ID	Age ID	Count
1174	24-May-21	1	SP	5	C	3	100.0%	NA	NA	NA
1174	24-May-21	2	SP	5	C	3	100.0%	NA	NA	NA
1174	24-May-21	1	HGR	3	C	2	100.0%	NA	NA	NA
1174	24-May-21	2	HGR	5	C	2	100.0%	ASTR	A	2
18	09-Jun-22	1	LGR	2	C	3	80.0%	RABO	J	2
18	09-Jun-22	2	LGR	2	C	3	80.0%	RABO	A	1
18	09-Jun-22	1	LGR	2	C	3	30.0%	DITE	L	1
18	09-Jun-22	2	LGR	2	C	3	30.0%	RABO	J	2
17	09-Jun-22	1	LGR	2	C	3	98.0%	DITE	L	1
17	09-Jun-22	2	LGR	2	C	2	98.0%	RABO	J	1
17	09-Jun-22	1	LGR	1	C	3	98.0%	DITE	L	2
17	09-Jun-22	2	LGR	1	C	3	98.0%	RABO	A	1
1548	02-Jun-22	1	LGR	3	C	2	100.0%	DITE	L	2
1548	03-Jun-22	2	LGR	3	C	3	100.0%	DITE	L	1
1548	04-Jun-22	1	LGR	3	C	3	100.0%			
1548	05-Jun-22	2	LGR	3	C	3	100.0%	DITE	L	1
1174	06-Jun-22	1	HGR	6	C	3	90.0%			
1174	06-Jun-22	2	HGR	6	C	3	90.0%	DITE	L	1
1174	06-Jun-22	1	HGR	10	C	2	100.0%	DITE	L	2
1174	06-Jun-22	2	HGR	10	C	2	100.0%			
735	07-Jun-22	1	HGR	8	C	3	95.0%			
735	07-Jun-22	2	C/F	10	C	2	95.0%	DITE	L	1
735	07-Jun-22	1	HGR	7	C	3	100.0%			
735	07-Jun-22	2	HGR	7	C	3	100.0%	DITE	L	2
798	07-Jun-22	1	LGR	2	C	2	100.0%			
798	07-Jun-22	2	LGR	2	C	2	100.0%	DITE	L	1
798	07-Jun-22	1	LGR	3	C	2	100.0%	ASTR	L	1
798	07-Jun-22	2	LGR	3	C	2	100.0%	RABO	A	1

A = adult, L = larvae, T = tadpole, NA = not available. LGR = low gradient riffle, C/F = cascade/falls, HGR = high gradient riffle, P = pool, SP = step pool. ASTR = *Ascaphus truei* (tailed frog), DITE = *Dicamptodon tenebrosus* (coastal giant salamander), RABO = *Rana boylei* (foothill yellow-legged frog), RAAU = *Rana aurora aurora* (northern red-legged frog).

Tailed frog detections included both adults and tadpoles. Observing tailed frog tadpoles, with their distinctive tail marking and habit of using the suction-like mouthparts to attach on stream cobble (**Figure 2**) can be the easiest method of detecting the species, especially later in the survey period (typically March through June). The majority of surveys were conducted during that survey period, although some July surveys also had positive results.



Figure 2. Tailed frog tadpole attached to substrate, Atwell Creek, LEED WAU.

Sample sizes are relatively small, but some patterns emerge from analysis. Belt habitat type was primarily low gradient riffle (LGR) and high gradient riffle (HGR) at 66% and 22%, respectively (Figure 3). Observing tailed frogs, in particular tadpoles, in riffles is consistent with the tailed frog literature (e.g., Nussbaum et al. 1983).

Belt gradient ranged from 1 to 30%, with a mean of 5.6%. For belt substrate, all sites were of competent rock, except for one belt surveyed at site 18 in 2013. This result is consistent with all monitoring sites being located within the Franciscan Melange formation.

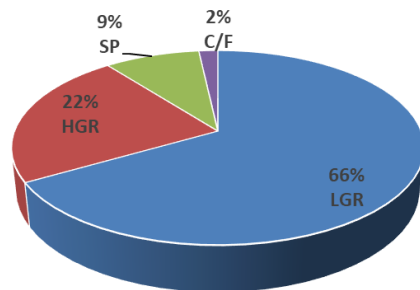


Figure 3. Belt habitat types at LEED WAU tailed frog monitoring sites, 2013-2022.

Belt embeddedness calls ranged from 1-3 with a mean of 2.3 (0 to 50% embeddedness, mean in the 26-50% range). When compared to the PFC Matrix used for habitat condition evaluation in the initial WA, embeddedness code 2 would fall within the Poor (i.e., > 40%) category. Comparison of three monitoring sites that have been visited multiple times since the initial WA (18, 798, and 1548) suggests an increase in embeddedness over time (**Figure 4**), but again these are very small sample sizes and the location of survey and subjectivity of surveyor in assigning codes should be considered.

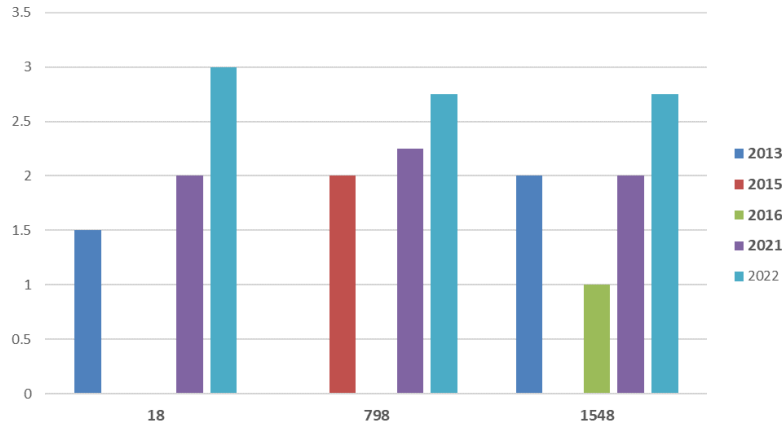


Figure 4. Belt embeddedness at survey sites 18, 798, and 1548: 2013-2022.

Belt canopy cover had a range of 30% to 100%, with a mean of 90%. The PFC target for canopy cover considered beneficial for tailed frog is > 85%. The most recent tailed frog observations (2022) were of both tailed frog adults and tadpoles, indicating that the species is currently breeding in the WAU.

Southern Torrent Salamander

In the initial watershed analysis for the LEED WAU, southern torrent salamanders were observed in Class II streams only, and were associated with both consolidated geologies, and in any geology with a gradient greater than 20 percent. We have continued to monitor the sites investigated during the initial WA and have added additional sites over time. Additional sites were among the areas identified for surveys or as potential habitat during the initial WA. Complete survey results southern torrent salamander are shown in **Table 3**. Complete results for southern torrent salamander (RHVA) surveys, 2003-2019, LEED WAU.

Table 3. Complete results for southern torrent salamander (RHVA) surveys, 2003-2019, LEED WAU.

Site #	Date	Belt #	Belt Habitat Type	Belt Gradient (%)	Belt Substrate	Belt Embed	Belt Canopy	Species ID	Age ID	Count
998	01-Feb-13	1	C/F	60	C	2	94.00%	RHVA	L	1
18	14-Jun-13	1	LGR	1	C	2	61.00%	NA	NA	NA
18	14-Jun-13	2	LGR	1	C	2	62.50%	NA	NA	NA
18	14-Jun-13	1	LGR	2	I	1	53.00%	NA	NA	NA
18	14-Jun-13	2	LGR	2	C	1	50.00%	NA	NA	NA
798	01-Jul-13	1	LGR	3	C	2	82.00%	ASTR	T	6
1548	10-Jul-13	1	HGR	13	C	2	86.50%	NA	NA	NA
1548	10-Jul-13	2	HGR	8	C	2	80.50%	ASTR	T	1
998	14-Feb-14	1	C/F	60	C	2	94.00%	RHVA	A	1
798	27-Jul-15	1	LGR	3	C	2	89.50%	DITE	L	2
798	27-Jul-15	1	LGR	3	C	2	89.50%	ASTR	T	1
998	25-Sep-15	1	C/F	75	C	2	95.50%	RHVA	M	1
998	25-Sep-15	1	C/F	75	C	2	95.50%	RHVA	L	1
1548	15-Jun-16	1	HGR	18	C	1	89.50%	NA	NA	NA

Site #	Date	Belt #	Belt Habitat Type	Belt Gradient (%)	Belt Substrate	Belt Embed	Belt Canopy	Species ID	Age ID	Count
1548	15-Jun-16	2	LGR	7	C	1	82.00%	ASTR	T	2
798	06-Jul-16	1	LGR	10	C	1	83.50%	ASTR	T	8
1548	20-Apr-21	1	LGR	2	C	2	100.00%	NA	NA	NA
1548	20-Apr-21	2	LGR	2	C	2	100.00%	DITE	L	1
798	19-May-21	1	LGR	4	C	2	91.00%	NA	NA	NA
798	19-May-21	2	C/F	30	C	3	91.00%	NA	NA	NA
798	19-May-21	1	LGR	4	C	2	100.00%	DITE	L	1
798	19-May-21	2	LGR	5	C	2	100.00%	ASTR	L	1
18	20-May-21	1	LGR	2	C	2	100.00%	NA	NA	NA
18	20-May-21	2	LGR	2	C	2	100.00%	NA	NA	NA
18	20-May-21	1	LGR	2	C	2	100.00%	NA	NA	NA
18	20-May-21	2	LGR	2	C	2	100.00%	NA	NA	NA
998	28-May-21	1	C/F	10	C	3	91.00%	RHVA	L	2
998	15-Dec-22	1	C/F	30	C	3	100.00%	DITE	L	1
998	15-Dec-22	2	C/F	30	C	3	100.00%	DITE	L	1
998	15-Dec-22	1	HGR	5	C	3	100.00%	DITE	L	4
998	15-Dec-22	2	HGR	10	C	2	100.00%	DITE	L	3
798	15-Dec-22	1	LGR	5	C	2	90.00%	NA	NA	NA
798	15-Dec-22	2	C/F	30	C	3	100.00%	NA	NA	NA
798	15-Dec-22	1	LGR	5	C	3	100.00%	DITE	L	1
798	15-Dec-22	2	LGR	5	C	3	100.00%	NA	NA	NA
18	09-Jun-22	1	LGR	2	C	3	80.00%	RABO	J	2
18	09-Jun-22	2	LGR	2	C	3	80.00%	RABO	A	1
18	09-Jun-22	1	LGR	2	C	3	30.00%	DITE	L	1
18	09-Jun-22	2	LGR	2	C	3	30.00%	RABO	J	2
1548	02-Jun-22	1	LGR	3	C	2	100.00%	DITE	L	2
1548	02-Jun-22	2	LGR	3	C	3	100.00%	DITE	L	1
1548	02-Jun-22	1	LGR	3	C	3	100.00%			
1548	02-Jun-22	2	LGR	3	C	3	100.00%	DITE	L	1
798	07-Jun-22	1	LGR	2	C	2	100.00%			
798	07-Jun-22	2	LGR	2	C	2	100.00%	DITE	L	1
798	07-Jun-22	1	LGR	3	C	2	100.00%	ASTR	L	1
798	07-Jun-22	2	LGR	3	C	2	100.00%	RABO	A	1

A = adult, L = larvae, T = tadpole, J = juvenile, NA = not available. LGR = low gradient riffle, C/F = cascade/falls, HGR = high gradient riffle, SP = step pool. ASTR = *Ascaphus truei* (tailed frog), DITE = *Dicamptodon tenebrosus* (coastal giant salamander), RHVA = *Rhyacotriton variegatus* (southern torrent salamander).

There has been a total of 18 visits to the monitoring sites during the years 2013-2022. Surveys consisted of 47 individual belt surveys. Southern torrent salamanders have been observed at only one of the monitoring sites during the survey period (998) but were observed consistently over four survey years from 2013-2021. Other species observed at these sites include tailed frog, and coastal giant salamander.



Figure 5. Larval southern torrent salamander, Bear Creek, LEED WAU.

Overall, belt gradient ranged from 1% to 75%, with a mean of 16%. However, at site 998 where RHVA was present, the range was 5% to 75%, with a mean of 40%. This result is consistent with the literature regarding the habitat of the southern torrent salamander (e.g., Diller and Wallace 1996). The substrate at all belts consisted of competent rock, except for reach 2, belt 1 at site 18 on 14 June 2013. Low gradient riffle (LGR) habitat was the primary type (60%) overall but consisted of cascade/falls (C/F) habitat at site 998.

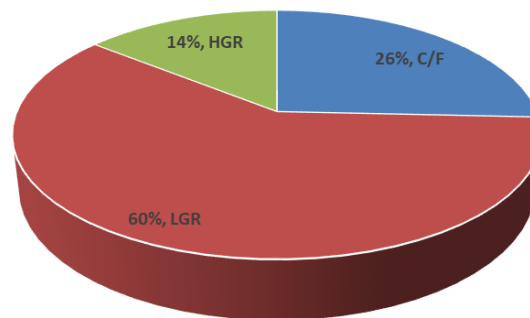


Figure 6. Belt habitat types at LEED WAU southern torrent salamander monitoring sites, 2013-2022.



Figure 7. Example of occupied southern torrent salamander habitat, Bear Creek, LEED WAU.

Belt embeddedness ranged from 1 to 3 calls (0 to 75% embeddedness), with an average of 2.1. When compared to the PFC Matrix used for habitat condition evaluation in the initial WA, this result would fall within the Poor (i.e., > 40%) category. Comparison of monitoring sites that have been visited multiple times since the initial WA in 2013, 2021 and 2022 suggests that there may have been an increase in embeddedness over time (Figure 8. Belt embeddedness at survey sites 18, 998, and 1548: 2013, 2021 and 2022.), but again these are very small sample sizes, and the location of survey and subjectivity of surveyor should be considered.

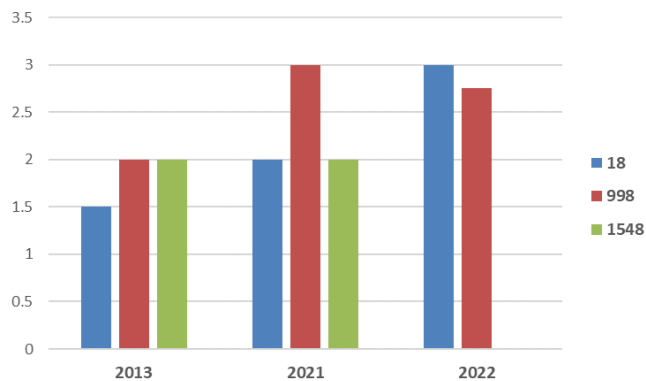


Figure 8. Belt embeddedness at survey sites 18, 998, and 1548: 2013, 2021 and 2022.

Belt canopy cover had a range of 50% to 100%, with a mean of 89%, above the PFC target for canopy cover considered beneficial for southern torrent salamanders (> 85%). Both larvae and adult southern torrent salamanders have been observed at site 998 over time, indicating that the species is continuing to inhabit and breed in the WAU.

Northern Red-legged Frog

During the initial LEED WA visual encounter surveys were conducted for northern red-legged frogs. There were only three sightings of northern red-legged frogs in the LEED survey, which occurred in areas of consolidated geology. Two of these were in stream reaches of 3 to 6.5 percent gradient (Greenlaw and Kiler Creeks) and one with a gradient of 6.5 to 20 percent (Chadd Creek).

Although habitat appears limited and ephemeral in this WAU, we have continued to visit the original three WA sites since the baseline surveys to monitor northern red-legged frog occupancy from 2005 through 2017. The level of effort for monitoring has not been consistent from year to year during this period. Monitoring sites consist of potential northern red-legged frog habitat with water sourced from rain pooling, road runoff, and from streams. Complete survey results are shown in **Table 4**.

Table 4. Complete results for northern red-legged frog (RAAU) surveys, 2005-2017.

Site ID	Date	Water Source	Formation	Species ID	Age ID	Count
42	1/20/2005	Road Runoff	Basin	NA	NA	NA
42	12/8/2006	Road Runoff	Basin	NA	NA	NA
89	1/20/2005	Rain Pooling	Equipment	NA	NA	NA
89	12/8/2006	Road Runoff	Ditch	NA	NA	NA
91	1/20/2005	Stream	Other	RAAU	Juvenile	1
91	12/4/2015	Stream	Basin	NA	NA	NA
91	11/27/2017	Stream	Basin	AMGR	Adult	1
91	11/27/2017	Stream	Basin	HYRE	Adult	1
91	11/27/2017	Stream	Basin	RAAU	Adult	6

NA = not available, RAAU = *Rana aurora aurora* (northern red-legged frog), HYRE = *Hyla regilla* (Pacific treefrog), AMGR = *Ambystoma gracile* (northwestern salamander).

No northern red-legged frog surveys were conducted in the LEED WAU during the 2022-2023 reporting period.

Foothill Yellow-legged Frog

The foothill yellow-legged frog is widely distributed along the Lower Eel River and its floodplain tributaries and was noted in the initial WA as being the most frequently observed species. For monitoring purposes, we have focused on some of the tributaries (e.g., Bear, Bridge, Howe, and Shively Creeks) that had been identified as potential habitat in the initial WA. Seven monitoring sites were added in 2022. Surveys have been conducted during the seasons of 2011, 2012, 2013, 2017, and 2022. A total of 14 surveys were conducted at the 12 sites during this time, consisting of 41 stream segments. Foothill yellow-legged frogs were observed at all sites with the exception of sites 69 and 107 on Bear Creek (

Table 5). Coastal giant salamanders were also observed.

Table 5. Results of foothill yellow-legged frog (RABO) in the LEED WAU 2011-2022.

Site #	Date	Tributary	Habitat Type	Gradient	Substrate	Canopy	Species ID	Count	Age ID
386	14-Oct-11	BRIDGE CR	HGR	3-6.5	Boulder	61-80%	RABO	1	A
386	14-Oct-11	BRIDGE CR	HGR	3-6.5	Boulder	61-80%	NA	NA	NA
386	14-Oct-11	BRIDGE CR	HGR	3-6.5	Boulder	61-80%	NA	NA	NA
386	14-Oct-11	BRIDGE CR	HGR	3-6.5	Boulder	61-80%	NA	NA	NA
386	28-Sep-12	BRIDGE CR	LGR	3-6.5	Boulder	61-80%	RABO	4	Juvenile
386	14-Aug-13	BRIDGE CR	LGR	3-6.5	Boulder	21-40%	NA	NA	NA
386	14-Aug-13	BRIDGE CR	LGR	3-6.5	Boulder	41-60%	RABO	1	Juvenile
69	10-Oct-17	BEAR CR	LGR	0-3	Boulder	61-80%	DITE	1	A
69	10-Oct-17	BEAR CR	LGR	0-3	Boulder	41-60%	NA	NA	NA
69	10-Oct-17	BEAR CR	P	0-3	Boulder	41-60%	NA	NA	NA
69	10-Oct-17	BEAR CR	P	0-3	Boulder	61-80%	NA	NA	NA
72	23-Oct-17	HOWE CR	LGR	0-3	Cobble	21-40%	RABO	1	Juvenile
72	23-Oct-17	HOWE CR	R	0-3	Cobble	41-60%	NA	NA	NA
72	23-Oct-17	HOWE CR	LGR	0-3	Cobble	41-60%	NA	NA	NA
73	25-Oct-17	SHIVELY CR	R	0-3	Gravel	81-100%	RABO	1	A
73	25-Oct-17	SHIVELY CR	LGR	0-3	Cobble	41-60%	NA	NA	NA
73	25-Oct-17	SHIVELY CR	R	0-3	Gravel	81-100%	NA	NA	NA
190	27-Oct-17	BEAR CR	HGR	0-3	Cobble	41-60%	NA	NA	NA
190	27-Oct-17	BEAR CR	HGR	0-3	Boulder	61-80%	RABO	1	Juvenile
190	27-Oct-17	BEAR CR	HGR	0-3	Boulder	21-40%	RABO	1	Juvenile
171	09-Sep-22	STITZ CREEK	R	0-3	Gravel	41-60%			
171	09-Sep-22	STITZ CREEK	R	0-3	Gravel	41-60%	RABO	2	Juveniles
174	09-Sep-22	JORDAN CREEK	R	0-3	Cobble	61-80%			
174	09-Sep-22	JORDAN CREEK	R	0-3	Cobble	61-80%	RABO	2	Juveniles
121	12-Sep-22	HOWE CR	R	0-3	Gravel	41-60%	RABO	1	Adult
121	12-Sep-22	HOWE CR	R	0-3	Gravel	41-60%	RABO	1	Juveniles
121	12-Sep-22	HOWE CR	R	0-3	Cobble	41-60%	RABO	1	Juveniles
242	12-Sep-22	ATWELL CR	R	0-3	Boulder	81-100%	RABO	1	Juveniles
242	12-Sep-22	ATWELL CR	R	0-3	Boulder	81-100%	RABO	1	Adult
203	08-Sep-22	BEAR CR	R	0-3	Gravel	81-100%			
203	08-Sep-22	BEAR CR	R	0-3	Gravel	81-100%	RABO	1	Adult
107	14-Sep-22	BEAR CR	R	0-3	Cobble	61-80%			
107	14-Sep-22	BEAR CR	R	0-3	Boulder	81-100%			
107	14-Sep-22	BEAR CR	R	0-3	Gravel	61-80%			
107	14-Sep-22	BEAR CR	R	0-3	Gravel	61-80%			
204	14-Sep-22	BEAR CR	R	0-3	Gravel	41-60%			
204	14-Sep-22	BEAR CR	R	0-3	Gravel	61-80%	RABO	1	Adult

A = adult, L = larvae, T = tadpole, J = juvenile, NA = not available. LGR = low gradient riffle, C/F = cascade/falls, HGR = high gradient riffle, P = pool, R = run. DITE = *Dicamptodon tenebrosus* (coastal giant salamander).

Habitat and substrate conditions on these surveys are consistent with known foothill yellow-legged frog habitats and the existing literature on the species. Stream segment habitats consisted primarily of runs (54%) (**Figure 9**). Boulder and gravel comprised 75% of the substrate types encountered (43% and 32% respectively). Canopy cover at the stream segments was generally in the moderate to high range, with 73% of the segments in the 41-80% canopy range.

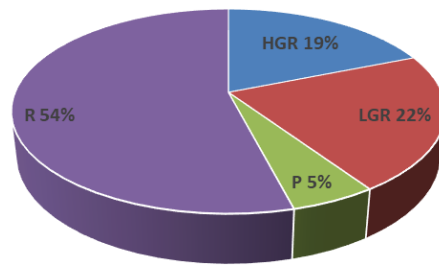


Figure 9. Stream segment habitat types at LEED WAU foothill yellow-legged frog monitoring sites, 2011-2022.

Northwestern Pond Turtle

For the initial LEED WA no surveys were conducted along the mainstem Eel River. However, pond turtles had been previously observed near the mouth of Bridge Creek in the Eel River floodplain. It was also stated in the initial WA that *“because the Eel River has a broad floodplain with abandoned channels or oxbows, there are likely to be ponds and backwater areas with suitable habitat for turtles. These off-channel habitats could have deep water, accumulations of LWD that were abandoned by the river, and high canopy closure levels from young riparian vegetation. The mainstem channel itself, however, is probably not suitable habitat because canopy closure will always be below 50 percent in the wide channel, LWD levels are low, and the high current velocity may prohibit habitat access”* (Hart Crowser 2004).

Using our knowledge of locations of suitable habitat within the WAU we have subsequently surveyed and documented at least three northwestern pond turtle sites on HRC lands (**Figure 1**). These include the Bridge Creek/Holmes Bar and Elinor Bar sites. Habitat is characterized by deep pools, abundant LWD and boulders for basking, and adjacent sandy banks that can be used for nesting.

For monitoring purposes, we have used three reaches on the Lower Eel River: site 371.1 that encompasses a reach of the Eel River above and below Bridge Creek, site 371.2 that is just upstream from 371.1 near the mouth of Larabee Creek, and site 982 near the Elinor Bar (**Figure 1**). We have surveyed these sites during the summers of 2020-2022. Northwestern pond turtles were observed occupying 371.1 and 983 in both years but were not observed at 371.2 (**Table 6**. Results of northwestern pond turtle monitoring in the LEED WAU 2020-2022.).

Table 6. Results of northwestern pond turtle monitoring in the LEED WAU 2020-2022.

Site ID	Date	EMMA Observed
371.1	8/14/2020	Y
371.2	8/14/2020	N
983	8/14/2020	Y
371.1	7/15/2021	Y
371.2	7/15/2021	N
983	7/16/2021	Y
983	7/18/2022	Y
371.2	7/18/2022	N
371.1	7/18/2022	Y

Relative to pond turtle habitat conditions, pool frequency, pool quality, LWD, and canopy cover do not appear to be limiting factors on the Lower Eel River. Northwestern pond turtles seem to be locally abundant in the monitoring reaches, as well as in similar habitat elsewhere on the river. Based on our observations of pond turtles basking on LWD, boulders, and river bars, the habitat concern expressed in the initial WA over the lack of canopy closure on the mainstem may have been overstated.



Figure 10. Northwestern pond turtles basking on logs at Elinor Bar, LEED WAU.

Discussion

All HCP covered amphibian and reptile species continue to be observed in the LEED WAU either on periodic monitoring surveys, surveys conducted for this WA revisit, or incidental to other surveys and monitoring. There have been no indications that any of the covered species have disappeared from monitoring locations over time due to habitat degradation caused by anthropogenic or natural conditions (e.g., riparian harvest or mass wasting events).

There have been no changes in RMZ prescriptions since watershed-specific prescriptions were established by HRC and the Wildlife Agencies following the initial 2004 WA. In an attempt to address species distribution and habitat concerns, we have continued to conduct species monitoring at the locations discussed above. In addition, monitoring of habitat conditions including LWD, substrate, pool dimensions, water temperature, and canopy cover is ongoing at eight ATM stations distributed within the LEED WAU.

As discussed in the Introduction, the initial WA amphibian/reptile module pointed out some areas of concern for the covered species' habitat in the WAU relative to sediment regime, peak flow, canopy cover, and LWD. Here we revisit those areas of concern with data collected since the initial WA on covered species' habitat and distribution.

For example, habitat for the southern torrent salamander and the tailed frog are sensitive to inputs of fine sediment. The initial WA found that this parameter did not meet PFC targets for amphibians and reptiles within all CGU classes surveyed (due to high percent fines and/or high embeddedness). Amphibian habitat monitoring over time suggests that there could be an increase or no change in embeddedness since sampling began. Mean measurements from ATM stations over the entire monitoring period (2003 through 2020) indicate that D_{50} values in the LEED WAU were still not within the target range of 65-95 mm. However, most stations showed improvements towards the target range from 2015 through the most recent sampling year in 2020. Data from Bear Creek suggests that all streams appear to be coarsening favorably over time.

Of the amphibian species that occur in the LEED WAU, the only species that is sensitive to the input of coarse sediment (i.e., boulders and cobbles) is the tailed frog. An increase in input of coarse sediments would be beneficial for this species due to their preference for streambed compositions of greater than 50 percent boulders and cobbles, according to their life history requirements.

The tailed frog and foothill yellow-legged frog have been documented to be sensitive to increases in peak flow. Therefore, changes in peak flow are an area of concern for these species. However, representative studies were in systems where changes in flow are regulated by dam releases and can cause eggs and/or tadpoles to be washed away or destroyed (e.g., Kupferberg 1996). In the tributaries of the LEED WAU where these species occur, peak flows are a result of above average precipitation and are within the range of natural weather variability.

The initial WA stated that, of the amphibian and reptile species that occur in this WAU, the southern torrent salamander, tailed frog, and western pond turtle are the only species that have been documented to be sensitive to canopy closure and therefore canopy closure has been an area of concern for these species. Based on ATM monitoring data, all ATM stations consistently meet or are trending towards the PFC overstream canopy target ($\geq 90\%$ canopy) most important to stream shade, water temperature regulation, insect fall, and LWD recruitment. All ATM stations met or exceeded the PFC riparian canopy targets ($\geq 85\%$) the last time they were surveyed between 2013 and 2016. Thus, lack of canopy closure does not appear to be a factor for southern torrent salamander and tailed frog habitat, while observations of pond turtle habitat indicates that canopy cover is not a concern.

The southern torrent salamander, tailed frog, and northwestern pond turtle are the only species that have been documented to be sensitive to the quantity of LWD in the stream. Because LWD amounts (number

of pieces/channel width) ranked as good in the initial WA, LWD was not of concern for the northwestern pond turtle. In addition, based on the habitat diagnostic for LWD (pieces/channel width) for the tailed frog and southern torrent salamander, LWD was not considered an area of concern for these species.

From ATM monitoring, the results of LWD data collected at LEED WAU ATM stations from 2003 through 2020 shows that six of the eight ATM stations met or exceeded wood loading targets in most years surveyed. Atwell Creek only met the target one of five monitoring years and Shively Creek did not meet the PFC target any of the six monitoring years surveyed. Thus, it is important to continue monitoring LWD recruitment in the LEED tributaries and attempt to assess how it is affecting covered species habitat.

The initial LEED WA found that long-term temperature monitoring data were limited, both spatially and temporally. The long-term temperature data available were collected during the summer months in low-gradient streams when water temperatures would be at their highest, and thus when they would most likely pose a threat to the species of concern. No long-term temperature data were available for high-gradient streams located in the upper watershed. Long-term temperature data for the low-gradient streams were within the temperature ranges preferred by the foothill yellow-legged frog, the northern red-legged frog, and the northwestern pond turtle. From the data available, it does not appear that temperature stress would be an issue for these species in the areas that were monitored, as canopy closure was high.

As part of the HCP ATM program, stream temperatures are measured at nine monitoring stations annually throughout the watershed. Riparian and over-stream mid-channel canopy cover is also measured at eight of these locations at three-year intervals, and annually at Bear Creek.

Most streams on HRC's ownership regularly meet the PFC target for MWAT. Only the lower-most station in Bear Creek has experienced slightly elevated stream temperatures in recent years. Since the ATM stations are located downstream of most of the HCP harvest area, the monitored stream temperatures suggest the HCP riparian prescriptions are effective in maintaining sufficient canopy cover for achieving PFC temperature targets.

Amphibian and reptile monitoring has occurred on a periodic basis and has not had consistent effort over the years since the initial WA. Although species occupancy at monitoring sites has been relatively consistent over the years, surveying long stream reaches for cryptic species, very small seep features, and confined stream reaches with low flow and abundant LWD, for example, can possibly lead to false negatives.

Species occupancy can "blink on and off" over the years. Although all sites monitored have been occupied in some years of the survey period, data indicate that sites may not be occupied again while habitat conditions remain virtually unchanged. Survey intensity, for example the level of effort used in searching small habitat areas, can vary by surveyor. In addition, belt habitat and belt gradient calls can be slightly different between years and may indicate differences in observers rather than actual changes in habitat.

Maintenance of good habitat and recovery of degraded habitat is dependent upon the appropriate application of riparian management prescriptions and proper implementation of riparian management zones during timber harvesting operations and road construction and maintenance. Thus, continued

identification and mapping of watercourses, seeps, and springs with potential habitat for these species during the THP process is important for their conservation. In addition to proper implementation of riparian prescriptions, ongoing monitoring of sediment conditions continues to be important in this WAU relative to habitat conditions for the covered species.

SUMMARY AND RECOMMENDATIONS

For the 2022-2023 survey period efforts were focused on occupancy level surveys in the LEED WAU to support the watershed analysis revisit, site-specific watershed analysis questions, and on classification of waters for THPs. During the 2023-2024 survey period our efforts will be focused on LEED, Upper Eel, and Bear River WAUs.

Distribution of covered species continues to be widespread in suitable habitat. Watershed analysis has aided in finding areas of good habitat to be maintained, as well as areas of habitat that can be improved or restored. No changes in the monitoring strategy are recommended at this time.

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