

SECTION G AMPHIBIAN DISTRIBUTION

INTRODUCTION

The Greenwood Creek WAU was surveyed to determine the distribution of tailed frogs (*Ascaphus truei*), red-legged frogs (*Rana aurora* spp.), and southern torrent salamanders (*Rhyacotriton variegatus*) during 2003 and 2004. This information is being collected throughout Mendocino Redwood Company's (MRC) ownership. Comprehensive amphibian distribution sampling was conducted in the Greenwood Creek WAU in conjunction with this watershed analysis. The distribution of foothill yellow-legged frogs (*Rana boylei*) is well documented by MRC's salmonid distribution surveys. The foothill yellow-legged frog is widely distributed throughout Class I watercourses in the Greenwood WAU.

The amphibian assemblages of the Greenwood WAU are diverse and may indicate preferable stream habitat conditions in lower order (headwater) watercourses. Southern torrent salamanders (*Rhyacotriton variegatus*) and tailed frogs (*Ascaphus truei*) are known to be good indicators of cold, sediment free stream habitats in the Pacific Northwest (Welsh and Ollivier 1998, Corn and Bury 1989). The Greenwood WAU has several meta-populations of *A. truei* and at least one meta-population of *R. variegatus* residing in the watershed, implying that several lower order watercourses in the Greenwood WAU provide cold, sediment free habitat.

Amphibian distribution surveys conducted in the Greenwood WAU have also detected other 'Species of Special Concern' in the State of California: red-legged frogs (*Rana aurora* spp.) and foothill yellow-legged frogs (*Rana boylei*). These species are known to be struggling in most portions of their respective ranges in California. Other amphibian species detected during amphibian distribution surveys include: Pacific giant salamanders (*Dicamptodon tenebrosus*), California slender salamanders (*Batrachoseps attenuatus*), black salamanders (*Aneides flavipunctatus*), northwestern salamanders (*Ambystoma gracile*), rough-skinned newts (*Taricha granulosa*), California newts (*Taricha torosa*), Pacific tree frogs (*Hyla regilla*), and bullfrogs¹ (*Rana catesbiana*).

METHODS

Tailed Frogs (*Ascaphus truei*)

Surveys were conducted during the most appropriate season, when larval life forms are known to be present (May-August). Sites or streams selected to be surveyed were chosen based on the following criteria: site should have at least 750-meters of flowing water present (observer judgment); preferably a 2nd or 3rd order watercourse; stream should be high gradient (greater than 3% average gradient); and approximately 70% of sites have northerly or easterly aspects (landscape level).

Occasionally some sites were selected which did not meet the criteria outlined above. Most often, if site selection criteria were not met, surveys were conducted in larger main-stem watercourses due to a lack of flowing water in lower order tributaries. Lower order (2nd and 3rd) tributaries which did not have flowing water were noted as "Dry".

¹ Bullfrogs are not a native species in this area.

Upon arrival to the selected survey site, the site was flagged and labeled with a Site ID. The Site ID is the 2-letter planning watershed abbreviation plus a number, in order of survey completion starting with 1001². For example, the first survey in Lower Greenwood Creek (code CG) planning watershed was CG-1001. Water temperature, pH, (EC) electrical conductivity and (TDS) total dissolved solids were measured at the time of the survey using a Hanna® HI 98129 water quality meter. If the water quality meter was not calibrated properly, or if low on batteries, the results were not included and denoted with “N/A”.

The selected stream was surveyed in an upstream direction, searching all potential habitats with the greatest effort expended in the “best” habitats. Surveys consist of looking for larvae attached to rocks on the stream bottom, using a glass bottomed viewing box to examine interstices, and turning over movable rocks while holding a dip-net downstream to catch dislodged larvae. The survey was considered complete after larval *A. truei* were observed, or after 30-minutes of search time elapsed (time constrained search, TCS). Several surveys were terminated due to a lack of habitat or flowing water upstream of the starting point. If the observer deemed the habitat to be suitable for *A. truei*, additional search time was spent.

Stream gradient was measured with a hand-held clinometer to the nearest 1%, from a section of the stream representative of the reach surveyed. Stream gradient measurements were then broken into classes as follows: 0-3%, 3-7%, 7-10%, 10-15%, 15-20%, 20-25%, 25-30%, 30-40%, and 40-50%. An embeddedness rating of streambed substrates was assessed within a representative riffle (observer judgment) by measuring the percentage of a stone lodged/cemented into the streambed. The overall rating of streambed substrate embeddedness was estimated as 0-25%, 25-50%, 50-75%, and 75-100% for each stream surveyed. Often the observer deemed the embeddedness rating to be variable throughout the watercourse surveyed. For example, low gradient riffles were highly embedded, while embeddedness in high gradient riffles was low. In these cases a greater range of ratings was presented (ie: 50-100% or 25-75%).

The aspect of the stream was recorded from a map, and rounded to the nearest cardinal direction (N, S, W, and E). The percent of canopy cover shading the watercourse, or percentage of wetted channel covered by overhead canopy, was estimated for each of the survey sites. The percent of canopy cover was a visual estimate performed by the observer in increments of 5%. Survey sites which were dry may or may not have had aspect and canopy cover estimates taken.

Red-Legged Frogs (*Rana aurora aurora* and *Rana aurora draytonii*)

The entire Greenwood WAU was surveyed to determine the distribution of *R. aurora* potential breeding habitats, and to determine which breeding habitats were being utilized by the species at the time of the study. Potential breeding habitat was considered to be “pond” type habitat with sufficient water present to facilitate larval development of *R. aurora*.

Surveys for *R. aurora* were conducted in the late winter or early spring (from January 1 – May 1), when the species are known to be congregating at breeding sites to reproduce (B. Shaffer pers. comm.). Potential breeding sites were located via communications with MRC forestry staff, driving and walking roads, and examining aerial photographs. Several potential breeding sites were found by carefully listening to the calls of Pacific tree frogs (*Hyla regilla*) at night, and following the sounds of the calls to the water source.

² Number started with 1001 to ensure that the survey sites were not given the same identifier as stream segments identified in the Greenwood WAU.

Searches were performed at potential breeding sites using techniques aimed at detecting evidence of reproduction (tadpole or egg mass presence). The perimeter of the potential breeding site was walked, turning over movable objects and looking into the water for conspicuous *R. aurora* egg masses. Dip nets and seines were used to capture larval *R. aurora* and other amphibian species from the potential breeding site. Small vessels (kayaks, rafts, etc) were used to survey the entire wetted area of the potential breeding site. Vegetation growing on the bank which was hanging into the water was lifted out of the water to potentially reveal attached egg masses. Upon the first visit to a potential breeding site, branches and vegetation were placed along a portion of the pond's wetted perimeter to provide easily searchable attachment media for oviposition. Upon returning to the potential breeding site to perform another survey, the branches were lifted out of the water and examined for egg masses.

Potential Breeding Site Re-visits

When potential *R. aurora* breeding habitat was located, but no evidence of reproduction was present, the site was considered a "potential breeding site". Potential breeding sites were re-visited at least once every two weeks to account for variation in the timing of oviposition, and to increase the likelihood of detecting *R. aurora*. The amount of time spent searching a potential breeding site (seining, dip-netting, etc) was variable dependent upon the observer's discretion. Large potential breeding sites typically required more search time than smaller "puddle-like" sites. Potential breeding sites were also re-visited during dark hours (night) once every month. Nocturnal surveys utilized primarily "eyeshine" techniques to detect post-metamorphic red-legged frogs congregating around the site. Nocturnal surveys performed at potential breeding sites did not utilize seines as a sampling method, nor was water quality measured due to the safety hazard of working at night around deep ponds.

Water temperature, pH, total dissolved solids, and electrical conductivity were measured using a Hanna® HI 98129 water quality meter at the time of the survey. If the water quality meter was not calibrated properly, or if low on batteries, the results were not included and denoted with "N/A". The percent of canopy cover shading the site, or percentage of the water's surface covered by overhead canopy, was estimated at each site location. The percent of canopy cover was a subjective visual estimate performed by the observer in increments of 5%. The area of the potential breeding site was estimated by multiplying the length by the mean width of the site. Site elevations were determined by plotting UTM coordinates onto a map, where elevation was recorded in increments of 40 feet from topographic map contour lines.

Each site identified was given a Site ID, and a "pond name" was determined. The Site ID is the 2-letter planning watershed abbreviation plus a number over 1100. For example, sites surveyed in the Lower Greenwood Creek planning watershed (code CG) were denoted as CG-1100, CG-1101, and so on. Site ID numbers began at 1100 to distinguish *R. aurora* potential breeding habitats from other amphibian survey sites sampled and from stream segment numbers identified in this watershed analysis. The pond name assigned to each potential breeding site was indicative of the geographical area, or of the characteristics of the site. Pond names were assigned to facilitate data interactions, improve communications regarding these sites, and to help promote the importance of these features.

If evidence of *R. aurora* reproduction was present (tadpoles or egg masses), then the site was considered a documented breeding site. Documented breeding sites were not re-visited.

Southern Torrent Salamanders (*Rhyacotriton variegatus*)

Each site surveyed was flagged and labeled with a Site ID. The Site ID is the 2-letter planning

watershed abbreviation plus a number over 1200, in order of survey completion. For example, the first survey in the Lower Greenwood Creek (code CG) planning watershed was CG-1200. Water temperature and pH was measured using a Hanna® HI 98129 water quality meter (when possible) at the time of the survey. Due to the shallow seeping nature of water flows in these habitats, often pH was difficult to measure without altering the streambed and was denoted as “NA” when not measured.

Survey sites were selected according to the following criteria: site must retain water perennially and have interstitial spaces that provides for inter-gravel water flow (not mud, sand, or silt dominated channels). The selected stream or seep was surveyed in an upstream direction, searching all potential habitats with the greatest effort expended in the “best” habitats. Best habitats are considered riffles dominated by cobble substrates, splash zones near waterfalls or plunge pools; and any higher gradient movable substrates within the wetted width. Surveys consist of turning over movable rocks and examining interstitial spaces for organisms. During high flows a dip-net was also used to catch dislodged organisms after turning over rocks. The survey was considered complete after the first individual was observed, or after 30-minutes of search time elapsed (time constrained search, TCS). Several surveys were terminated due to a lack of habitat or flowing water upstream of the starting point. Species detected were classified by life stage (larval ‘L’, sub-adult ‘SA’, and adult ‘A’).

Stream gradient was measured with a hand-held clinometer to the nearest 1%, from a stream segment deemed to be representative of the reach surveyed. Stream gradient measurements were then broken into classes as follows: 0-3%, 3-7%, 7-10%, 10-15%, 15-20%, 20-25%, 25-30%, 30-40%, and 40-50%. An embeddedness rating of streambed substrates was assessed within a representative riffle (observer judgment) by measuring the percentage of a stone lodged/cemented into the streambed. The overall streambed substrate embeddedness was estimated as 0-25%, 25-50%, 50-75%, and 75-100% for each site surveyed. Often the observer deemed the embeddedness rating to be variable throughout the watercourse surveyed. For example, low gradient riffles were highly embedded, while embeddedness in high gradient riffles was low. In these cases a greater range of ratings was presented (ie: 50-100% or 25-75%).

The aspect of the stream was recorded from a map, and rounded to the nearest cardinal direction (N, S, W, and E). The percent of canopy cover shading the watercourse, or percentage of wetted channel covered by overhead canopy, was estimated for the reach of watercourse surveyed. The percent of canopy cover was a visual estimate performed by the observer in increments of 5%. Survey sites which were dry may or may not have had aspect and canopy cover estimates taken.

Foothill Yellow-Legged Frogs (*Rana boylei*)

Foothill yellow-legged frogs prefer larger watercourses, and often are found co-existing with fish. Surveys conducted to determine the distribution of salmonids have documented the distribution of foothill yellow-legged frogs quite well in the Greenwood WAU.

A hierarchical framework was used to select the initial locations of salmonid distribution survey sites in each stream. Major streams were broken into lower, middle and upper reaches. Smaller streams were divided into lower and upper reaches. One site is surveyed in each reach, resulting in 3 sites in larger streams, and 2 sites in smaller streams. Additional sites are added directly downstream and upstream of potential migration barriers to determine which species these barriers are impacting.

A survey site contains a minimum of two consecutive habitat sequences (pool-riffle sequences) and has a minimum length of ninety feet. The survey method used to determine the aquatic

species present is single pass electrofishing or snorkeling. The effort put forth at each survey site is not sufficient to delineate the absence of a species. If future research develops reasonable methods to determine the probability that a species is absent, these methods will be incorporated into future distribution surveys.

Prior to initiating surveys water quality is measured using a Horiba™ U-10 Water Quality Checker. Measurements taken are water temperature (°C), conductivity (microS/cc), dissolved oxygen (mg/L), and pH. Air temperature is measured with a pocket thermometer and water visibility is estimated. Stream discharge is estimated or measured with a Swiffer™ Model 2100 flow meter. The actual physical parameters measured at each site vary depending on equipment availability. Horiba™ U-10 Water Quality Checkers were not used prior to the surveys in 2000.

Diving (snorkeling) is used to assess species presence when stream conditions are considered adequate or when elevated stream temperatures have the potential to adversely impact the health of the animals being electrofished. The basic survey unit for diving consists of a minimum of two pools, however if riffles are deep enough to allow underwater observation these units are sampled.

AMPHIBIAN DISTRIBUTION RESULTS and DISCUSSION

The results of amphibian distribution surveys are discussed for each planning watershed in the Greenwood WAU (Lower Greenwood Creek and Upper Greenwood Creek). Maps G-1 and G-2 illustrate the documented distribution of foothill yellow-legged frogs and locations of amphibian sampling sites in the Greenwood Creek WAU.

The species encountered while performing amphibian distribution surveys were recorded. These species are listed in Table G-1. While conducting surveys certain animals may escape from the observer, or may be difficult or impossible to identify in the field. In these cases, an abbreviation reflecting a broad family or genus of species is used to classify an animal to lowest taxonomic level possible. Tarichid newts were especially difficult to identify in the field and thus were often categorized as “NEW”, an unidentified tarichid newt.

Table G-1: Scientific and common names for species observed, including abbreviation.

Abbreviation	Common Name	Scientific Name
BLF	Bullfrog	<i>Rana catesbiana</i>
BLK	Black Salamander	<i>Aneides flavipunctatus</i>
CAUD	Unidentified Salamander	unidentified caudate
CNT	California Newt	<i>Taricha torosa</i>
CSS	California Slender Salamander	<i>Batrachoseps attenuatus</i>
FISH	Unidentified Fish	unidentified fish species
NEW	Unidentified Newt	<i>Tarichid spp.</i>
NWS	Northwestern Salamander	<i>Ambystoma gracile</i>
PGS	Pacific Giant Salamander	<i>Dicamptodon tenebrosus</i>
PTF	Pacific Tree Frog	<i>Hyla regilla</i>
RLF	Red-Legged Frog	<i>Rana aurora spp.</i>
RSN	Rough-Skinned Newt	<i>Taricha granulosa</i>
STH	Steelhead/Rainbow Trout	<i>Oncorhynchus mykiss</i>
STS	Southern Torrent Salamander	<i>Rhyacotriton variegatus</i>
TLF	Tailed Frog	<i>Ascaphus truei</i>
YLF	Yellow-Legged Frog	<i>Rana boylei</i>

Lower Greenwood Creek Planning Watershed

Tailed Frogs (Ascaphus truei)

Surveys were conducted at 14 sites throughout the planning watershed (Table G-2); *A. truei* were observed at 4 of 14 sites.

Table G-2: Results from 2003 *A. truei* surveys conducted in the Lower Greenwood Creek planning watershed (113.61011), Mendocino County, CA.

Site ID	Date	Aspect	% Canopy	% Embedded	Stream Gradient	Water Temp °C	pH	EC / TDS	TLF Present	Other Species Present	Search Time (minutes)
CG 1001	25-Jul-03	N	85	50-75	7-10%	12.8	7.33	128/76		PGS	30
CG 1002	25-Jul-03	E	85	25-50	7-10%	12.9	7.48	191/89	X	PGS	10
CG 1003	25-Jul-03	E	90	25-50	7-10%	13.1	7.25	199/100	X	PGS	5
CG 1004	28-Jul-03	S	75	50-75	7-10%	14.2	7.45	128/97		PGS, YLF	30
CG 1005	28-Jul-03	W	80	25-50	3-7%	14.7	7.38	199/90		PGS, CRS, YLF	30
CG 1006	28-Jul-03	S	80	50-75	7-10%	13.8	7.33	178/87		PGS	30
CG 1007	28-Jul-03	N	85	50-75	7-10%	13.3	7.27	181/72		PGS	30
CG 1008	29-Jul-03	N	70	25-50	7-10%	12.7	7.88	198/99	X	PGS	5
CG 1009	29-Jul-03	N	70	50-75	40-50%	13.3	7.38	197/98		PGS	10
CG 1010	29-Jul-03	E	80	25-50	7-10%	13.6	7.35	214/107		PGS	40
CG 1011	30-Jul-03	W	80	25-50	3-7%	14.2	7.25	199/87		PGS	40
CG 1012	30-Jul-03	W	75	25-50	3-7%	13.9	7.43	200/103		PGS	45
CG 1013	5-Aug-03	N	60	25-50	10-15%	14.5	8.23	213/108	X	PGS	30
CG 1014	1-Aug-03	N	75	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY

Red-Legged Frogs (Rana aurora aurora and Rana aurora draytonii)

Four documented breeding sites were identified; CG-1101 (West Morrison Pond); CG-1102 (South Morrison Pond); CG-1103 (Cow Water Hole); and CG-1104 (Morrison Pond). Potential breeding habitat was fairly abundant (1 site per 1,502 acres). *R. aurora* was detected at all of the sites identified (Table G-3).

All of the documented breeding sites identified were manmade ponds. These manmade features may have played a major role in sustaining *R. aurora* in the Lower Greenwood Creek planning watershed. The presence of numerous breeding sites throughout the landscape is thought to be the most important component of the long-term viability of *R. aurora* meta-populations (Welsh et al. 1998).

Larval tissue samples were collected from Sites CG-1101, CG-1102, CG-1103, and CG-1104. Dr. Bradley Shaffer at UC Davis analyzed both mitochondrial and nuclear DNA present in the tissue samples collected from these sites to determine which sub-species were/are present. The results from these sites indicate that hybrid frogs (*Rana aurora aurora* X *Rana aurora draytonii*) were present at all 4 of the sites analyzed.

Table G-3: Results of *R. aurora* surveys conducted in 2003 within the Lower Greenwood Creek Planning Watershed, Mendocino County, California.

Site ID	Date	Temp (°C)	pH	uS/ppm	VIS (ft)	Species Present	Surface Area (sq. ft)	Max Depth (ft)	Canopy (%)	Elevation
CG 1101	11-Feb-03	8.3	7.06	150/75	1.5	RLF, BLF	75,000	7	5	440
CG 1102	11-Feb-03	14.5	7.54	50/26	0.5	RLF, PTF	360	3	10	1,000
CG 1103	11-Feb-03	9.2	6.78	57/28	2	RLF, PTF, CNT	1,000	2	0	1,140
CG 1104	11-Feb-03	8.8	6.98	115/58	3	RLF, PTF	2,025	5	0	1,180

Southern Torrent Salamanders (Rhyacotriton variegatus)

Surveys were conducted at 10 sites and *R. variegatus* was detected within one site CG-1204 (Table G-4).

Table G-4: Results from 2003 *R. variegatus* surveys conducted in the Lower Greenwood Creek planning watershed (113.61011), Mendocino County, CA.

Site ID	Date	Aspect	% Canopy	% Embedded	Stream Gradient	Habitat Type	Water Temp(°C)	pH	STS Present	Other Species Present
CG 1200	26-Jan-04	S	50	50-75	50	W	8.9	8.05		PGS(L)
CG 1201	26-Jan-04	S	50	25-50	70	S	11.9	7.57		PGS(L),YLF(SA)
CG 1202	26-Jan-04	S	70	50-75	40	W	9.7	8.04		PGS(L)
CG 1203	27-Jan-04	NW	50	50-75	65	W	10.5	7.57		YLF(SA)
CG 1204	27-Jan-04	N	70	25-50	30	P	10.5	7.54	X (A)	PGS(L)
CG 1205	27-Jan-04	N	85	50-75	55	W	10.2	7.86		PGS(L)
CG 1206	27-Jan-04	N	90	25-50	35	W	10.1	7.81		
CG 1207	27-Jan-04	N	95	25-50	50	W	9.8	7.78		
CG 1208	27-Jan-04	N	60	25-50	40	S	10.6	7.50		BLK(SA)
CG 1209	27-Jan-04	N	95	50-75	40	W	9.7	7.49		

Key to Habitat Types: (W) = Watercourse (S) = Seep or Spring (P) = Soil Pipe
Key to Life Stages: (L) = Larval (SA) = Sub-Adult (A) = Adult

Foothill Yellow-Legged Frogs (Rana boylei)

Foothill yellow-legged frogs have been documented to occur throughout the entirety of the main-stem of Greenwood Creek in the Lower Greenwood Creek planning watershed. Foothill yellow-legged frogs have also been documented in Barn Gulch and Corrals Gulch (Map G-1).

During the spring of 2001, MRC operated a juvenile salmonid out-migrant trap approximately one mile upstream of the mouth of Greenwood Creek. On several occasions, amplexing (actively breeding) adult foothill yellow-legged frogs were captured in the trap. The presence of amplexing adults implies that this reach of Greenwood Creek is being utilized as a breeding area for the species. Future surveys focused towards estimating the abundance of foothill yellow-legged frog egg masses in the Greenwood WAU will determine the spatial extent of the species breeding grounds.

Upper Greenwood Creek Planning Watershed

Tailed Frogs (*Ascaphus truei*)

Surveys were conducted at 13 sites throughout the planning watershed (Table G-5) and *A. truei* were observed at 2 of 13 sites. This planning watershed contained appropriately sized substrate (boulders, large cobbles, bedrock). However, there were few watercourses present with sufficient flows.

Table G-5: Results from 2003 *A. truei* surveys conducted in the Upper Greenwood Creek planning watershed (113.61010), Mendocino County, CA.

Site ID	Date	Aspect	% Canopy	% Embedded	Stream Gradient	Water Temp °C	pH	EC / TDS	TLF Present	Other Species Present	Search Time (minutes)
CU 1001	14-Jul-03	S	75	25-50	3-7%	15.3	7.89	203/108		PGS	30
CU 1002	15-Jul-03	N	75	25-50	10-15%	13.8	7.72	180/101		PGS	30
CU 1003	15-Jul-03	N	70	25-50	10-15%	13.9	7.75	199/87	X	STH, PGS	5
CU 1004	15-Jul-03	N	80	50-75	10-15%	13.7	7.32	181/103		PGS	30
CU 1005	16-Jul-03	N	74	25-50	10-15%	13.2	7.87	203/105	X	STH, PGS	5
CU 1006	16-Jul-03	N	75	50-75	15-20%	12.8	7.65	199/82		PGS, BKS	30
CU 1007	16-Jul-03	N	75	25-50	7-10%	13	7.78	196/99		PGS	30
CU 1008	17-Jul-03	N	75	50-75	15-20%	N/A	N/A	N/A		PGS	60
CU 1009	16-Jul-03	N	70	50-75	7-10%	14	7.98	210/99		PGS	30
CU 1010	15-Jul-03	W	60	25-50	7-10%	17.1	N/A	N/A		PGS, STH, YLF, CNT	30
CU 1011	15-Jul-03	W	60	25-50	7-10%	17.2	N/A	N/A		PGS, STH, YLF	30
CU 1012	17-Jul-03	S	70	50-75	10-15%	N/A	N/A	N/A			30
CU 1013	17-Jul-03	S	80	50-75	3-7%	17.3	8.23	215/105		STH, PGS	30

Red-Legged Frogs (*Rana aurora aurora* and *Rana aurora draytonii*)

Two potential breeding sites were located; CU-1101 (Lower Cliff Ridge Pond) and CU-1102 (Upper Cliff Ridge Pond). Potential breeding habitat was fairly abundant (1 site per 1,837 acres). Tarichid newts, Pacific tree frogs, and Northwestern salamanders were found at 100% of the sites surveyed in this planning watershed. *R. aurora* was not detected at any of the sites identified, and there have not been any incidental observations of *R. aurora* in this planning watershed during previous studies.

Site CU-1101 “Lower Cliff Ridge Pond”

Site CU-1101 is a large pond with surface area of approximately 40,000 ft² with a maximum depth of over 5 feet at high water. Canopy cover was 15%, and the elevation was approximately 1,400 feet above sea level. Results from surveys conducted at this site are located in Table G-6.

Table G-6: Results of surveys conducted at Site CU-1101 (Lower Cliff Ridge Pond) within the Upper Greenwood Planning Watershed, Mendocino County, California (UTM 449351 4325301).

Date	Day or Night	Temp (°C)	pH	uS/ppm	VIS (ft)	Species Present	Search Time
13-Feb-03	Day	10.1	7.53	218/108	1.5	PTF, RSN, NEW	1.5 hrs
3-Mar-03	Day	15.1	7.39	198/100	1.5	NWS, CNT, CAUD	1.5 hrs
12-Mar-03	Night	13.8	7.2	190/94		PTF	20 min
18-Mar-03	Day	14.1	7.36	189/92	3	PTF, CNT, NWS	1.5 hrs
31-Mar-03	Day	19.3	8.1	172/86	2	PTF, NWS, CNT, NEW	1 hr
7-Apr-03	Night	12.8	7.28	126/52		PTF	30 min
15-Apr-03	Day	12.6	7.35	160/60	3	NWS, NEW	30 min
25-Apr-03	Day	12.5	7.28	160/63	2	NWS, NEW	30 min

Site CU-1102 “Upper Cliff Ridge Pond”

Site CU-1102 is a large pond with surface area of approximately 40,000 ft² with a maximum depth of over 7 feet at high water. Canopy cover was 20%, and the elevation was approximately feet above sea level. Several steelhead/rainbow trout were observed at this site outside of the surveys conducted. Results from surveys conducted at this site are located in Table G-7.

Table G-7: Results of surveys conducted at Site CU-1102 (Upper Cliff Ridge Pond) within the Upper Greenwood Planning Watershed, Mendocino County, California (UTM 449393 4325066).

Date	Day or Night	Temp (°C)	pH	uS/ppm	VIS (ft)	Species Present	Search Time
13-Feb-03	Day	9.8	7.48	218/96	4		1 hr
3-Mar-03	Day	13.6	7.5	216/109	4	NWS, NEW, FISH	1.5 hrs
12-Mar-03	Night	13.5	7.43	195/90	3	PTF, NWS	30 min
18-Mar-03	Day	13.9	7.4	195/97	3	PTF, CNT, RSN	1.5 hrs
31-Mar-03	Day	20.4	8.3	186/93	2	PTF, FISH	1 hr
7-Apr-03	Night	12.4	7.28	159/63		PTF	30 min
15-Apr-03	Day	12.2	7.26	110/60	2	PTF, CNT, NEW	30 min
25-Apr-03	Day	12.3	7.33	123/68	2	PTF, NWS	30 min

Southern Torrent Salamanders (Rhyacotriton variegatus)

Surveys were conducted at 10 sites and *R. variegatus* was not observed (Table G-8). The majority of the habitat present appeared to be suitable.

Table G-8: Results from 2003 *R. variegatus* surveys conducted in the Upper Greenwood Creek planning watershed (113.61010), Mendocino County, CA.

Site ID	Date	Aspect	% Canopy	% Embedded	Stream Gradient	Habitat Type	Water Temp(°C)	pH	STS Present	Other Species Present
CU 1200	20-Jan-04	E	70	50-75	30	W	9.2	7.84		PGS(L)
CU 1201	20-Jan-04	SE	70	75-100	45	S	11.0	7.48		PGS(L)
CU 1202	20-Jan-04	NE	70	50-75	25	W	10.0	7.90		PGS(L)
CU 1203	20-Jan-04	N	90	25-50	10	S	11.5	6.94		
CU 1204	20-Jan-04	NE	70	50-75	35	W	9.4	8.00		
CU 1205	20-Jan-04	NW	75	50-75	15	W	9.2	7.89		PGS(L)
CU 1206	20-Jan-04	N	95	75-100	10	W	10.8	7.01		
CU 1207	20-Jan-04	N	80	50-75	10	W	9.4	8.02		PGS(L,A)
CU 1208	20-Jan-04	N	70	50-75	40	W	9.4	8.06		PGS(L)
CU 1209	20-Jan-04	NE	100	50-75	20	W				PGS(L),CSS(A)

Key to Habitat Types: (W) = Watercourse (S) = Seep or Spring (P) = Soil Pipe
Key to Life Stages: (L) = Larval (SA) = Sub-Adult (A) = Adult

Foothill Yellow-Legged Frogs (Rana boylei)

Foothill yellow-legged frogs have been documented to occur throughout the entirety of the mainstem of Greenwood Creek in the Upper Greenwood Creek planning watershed. Foothill yellow-legged frogs have also been detected within two tributaries to Greenwood Creek, Big Tree Creek (a fish bearing watercourse) and a small unnamed tributary (Map G-2). Future surveys focused towards estimating the abundance of foothill yellow-legged frog egg masses in the Greenwood Creek WAU will determine the spatial extent of the species breeding grounds.

CONCLUSIONS

Amphibian Assemblages in Greenwood WAU

The amphibian species detected in the Greenwood WAU represent most every species having geographical ranges in the area. Four amphibious 'Species of Special Concern' (as designated by the State of California) were detected within the Greenwood WAU: red-legged frogs, tailed frogs, foothill yellow-legged frogs and southern torrent salamanders. To date, the results of MRC's amphibian distribution studies have only detected one other watershed within MRC's ownership where all four 'concern species' were present (Albion River). Aquatic habitat types in the Greenwood WAU have remained functional to support many species which have been extirpated both locally and regionally.

Bullfrogs in Greenwood WAU

Although the Greenwood WAU supports amphibian species known to be indicators of good stream habitat, sound management practices may improve meta-population status, dispersal capabilities, and other factors relevant to the long-term viability of these meta-populations. One of the most significant problems pertaining to aquatic amphibians in the Greenwood Creek WAU is the presence of non-native bullfrogs.

Non-native bullfrogs are major predators of red-legged frogs. In laboratory studies, the presence of bullfrog adults and tadpoles was found to significantly reduce mass at metamorphosis, increase time to metamorphosis, and decrease survival to metamorphosis of red-legged frog tadpoles (Kiesecker and Blaustein 1998). Adult bullfrogs also significantly decreased the survival of red-legged frog post-metamorphosis, and the presence of both bullfrog tadpoles and smallmouth bass appeared to contribute to negative developmental effects on larval red-legged frogs (Kiesecker and Blaustein 1998). Bullfrogs were found co-existing with red-legged frogs at one amphibian sampling site (CG-1104 'West Morrison Pond').

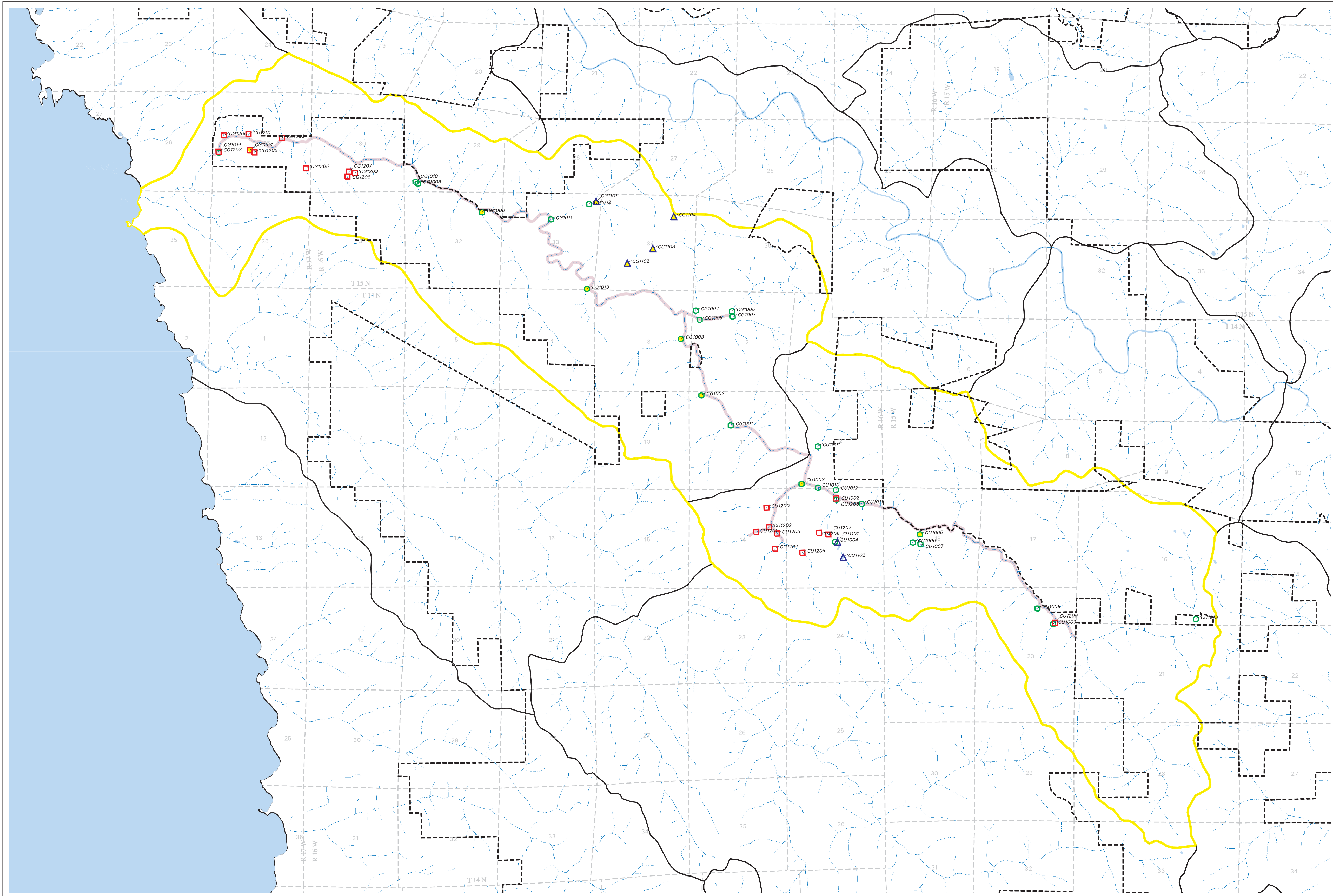
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**Greenwood Creek
Watershed Analysis
Unit**

**Map G-1
Amphibian Distribution**

This map illustrates the documented distribution of foothill yellow-legged frogs, locations of potential red-legged frog breeding sites, and the locations of surveys conducted for tailed frogs and southern torrent salamanders in the Greenwood WAU. Sites were surveyed by MRC in 2002-2003 in conjunction with this watershed analysis. Foothill yellow-legged frog distribution is based upon information from both amphibian distribution surveys and salmonid distribution surveys.



- Yellow-legged Frog Distribution
- Amphibian Distribution Survey Sites
 - Tailed Frog
 - △ Red-legged Frog
 - Southern Torrent Salamander
 - Yellow highlight denotes species presence at survey site
- MRC Ownership
- Planning Watershed Boundary
- Greenwood Creek Watershed Boundary
- Flow Class
 - Class I
 - Class II
 - Class III

