SECTION G
AMPHIBIAN DISTRIBUTION

INTRODUCTION

The Elk Creek WAU was surveyed to determine the distribution of tailed frogs (*Ascaphus truei*), red-legged frogs (*Rana aurora*), and southern torrent salamanders (*Rhyacotriton variegatus*) during 2005. This information is being collected throughout Mendocino Redwood Company's (MRC) ownership. The distribution of foothill yellow-legged frogs (*Rana boylii*) is well documented by MRC's salmonid distribution surveys.

The amphibian assemblages of the Elk Creek 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 Elk Creek WAU has several populations of *A. truei* and *R. variegatus* residing in the watershed, implying that several lower order watercourses in the Elk Creek WAU provide cold, sediment free habitat.

Amphibian distribution surveys conducted in the Elk Creek WAU have detected other 'Species of Special Concern' in the State of California: red-legged frogs (*Rana aurora* spp.) and foothill yellow-legged frogs (*Rana boylii*). 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: black salamanders (*Aneides flavipunctatus*), Coastal giant salamanders (*Dicamptodon tenebrosus*), and northwestern salamanders (*Ambystoma gracile*).

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 meet, 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".

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 1001[1]. For example, the first *A. truei* survey in Cottaneva Creek (code RC) planning watershed was RC-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

[1] Number started with 1001 to ensure that the survey sites were not given the same identifier as stream segments identified in the Cottaneva WAU.

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*)

The entire Elk Creek 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. Potential breeding sites can be 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.

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, the first *R. aurora* survey in Lower Elk Creek (code CL) planning watershed was CL-1101. Site ID numbers began at 1101 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 starting at 1200, in order of survey completion. For example, the first *R. variegatus* survey in the Elk Creek (code CL) planning watershed was CL-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 boylii*)
Foothill yellow-legged frogs prefer larger watercourses, and often are found co-existing with fish. Surveys conducted to determine the distribution of salmonids have confirmed the presence of foothill yellow-legged frogs in the Elk Creek 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 Swoffer™ 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 species in the Elk Creek WAU. Maps G-1 illustrates the locations of amphibian sampling sites in the Elk Creek WAU. The species encountered while performing amphibian distribution surveys were recorded. These species are listed in Table G-1.

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

Abbreviation	Common Name	Scientific Name
BLK	Black Salamander	*Aneides flavipunctatus*
CGS	Coastal Giant Salamander	*Dicamptodon tenebrosus*
NWS	Northwestern Salamander	*Ambystoma gracile*
RLF	Red-Legged Frog	*Rana aurora spp.*
STH	Steelhead/Rainbow Trout	*Oncorhynchus mykiss*
STS	Southern Torrent Salamander	*Rhyacotriton variegatus*
TLF	Tailed Frog	*Ascaphus truei*
WAGS	Western Aquatic Garter Snake	*Thamnophis couchii*
YLF	Yellow-Legged Frog	*Rana boylii*

Foothill Yellow-Legged Frogs (Rana boylii)

Foothill yellow-legged frogs have been documented to occur throughout the entirety of the main-stem of Elk Creek in both the Upper and Lower Elk Creek Planning Watersheds. They have also been documented in all of the major tributaries to Elk Creek (Three Springs Creek, Soda Creek, Sulphur Creek, and South Fork of Elk Creek). It is expected that this species could be encountered in virtually any of the watercourses within the WAU while foraging. However, the breeding habitat for foothill yellow-legged frogs is likely restricted to only the larger watercourses.

Lower Elk Creek Planning Watershed

Tailed Frogs (Ascaphus truei)

Surveys were conducted at 10 sites throughout the planning watershed, of which 6 sites had *A. truei* detections (Table G-2).

Table G-2: Results from *A. truei* surveys conducted in the Lower Elk Creek planning watershed

Site ID	Aspect	% Canopy	% Embedded	Stream Gradient	Water Temp °C	pH	EC / TDS	Drainage Acres	TLF Present	Other Species Present
CL1001	W	95	25-50	7-10	13.3	7.45	226/114	152		CGS
CL1002	S	95	25-50	3-7	13.6	7.52	240/119	292		CGS, WAGS
CL1003	N	90	0-25	7-10	13.2	7.51	136/68	443	**X**	CGS
CL1004	W	80	50-75	10-20	15.2	7.13	228/114	217		CGS
CL1005	N	90	0-25	0-3	13.2	7.80	214/108	825	**X**	CGS, STH
CL1006	W	90	0-25	3-7	12.5	7.72	177/88	717	**X**	CGS
CL1007	W	90	50-75	0-3	13.9	7.46	268/134	646		CGS
CL1008	S	85	25-50	3-7	14.2	7.85	260/130	378	**X**	CGS, STH
CL1009	S	90	25-50	3-7	14.3	7.82	213/106	354	**X**	CGS
CL1010	S	95	25-50	15-20	14.2	7.69	303/152	241	**X**	CGS

Southern Torrent Salamanders (*Rhyacotriton variegatus*)

Surveys were conducted at 10 sites throughout the planning watershed, of which 3 sites had *R. variegatus* detections (Table G-3). The majority of sites sampled had optimal habitat for this species.

Table G-3: Results from *R. variegatus* surveys conducted in the Lower Elk Creek planning watershed

Site ID	Aspect	% Canopy	% Embedded	Stream Gradient	Habitat Type	Water Temp °C	pH	STS Present	Other Species Present
CL1200	N	70	25-50	60-70%	W	10.7	6.67	**X**	CGS
CL1201	N	70	25-75	50-60%	W	11.1	6.55		CGS
CL1202	N	75	50-100	60-70%	W	10.9	7.99		CGS
CL1203	E	85	25-50	50-60%	W	11.8	7.75		CGS
CL1204	N	50	50-100	50-60%	W	10.4	7.11		CGS
CL1205	N	75	25-50	40-50%	S	10.1	7.11	**X**	CGS,TLF
CL1206	E	60	0-50	50-60%	S	11.3	5.94		CGS
CL1207	N	95	0-25	10-15%	S	10.9	6.06	**X**	
CL1208	N	85	25-50	70-80%	W	10.5	6.69		CGS
CL1209	N	60	25-75	60-70%	W	11.3	7.73		CGS

Key to Habitat Types: (W) = Watercourse (S) = Seep or Spring (P) = Soil Pipe

Red-Legged Frogs (*Rana aurora)*

One potential breeding site was identified in the planning watershed and *R. aurora* was detected at the site (Table G-4). The site identified is an in-stream marsh formed by a large historical landslide. The slide blocked the watercourse (South Fork Elk) and created slow-water habitat. During the heavy rainfall events in 2006, a large portion of the earthen dam was scoured away thus reducing the size of the feature. This feature will continue to be monitored over time to assess its utility as a red-legged frog breeding site.

Table G-4: Results of *R. aurora* surveys conducted in the Lower Elk Creek planning watershed

RLF Management Unit	Site ID	Surface area (ft²)	Maximum Depth (ft)	% Canopy	RLF Present	Other Species Present
CL1	CL1101	15,000	4.0	60	**X**	NWS(EM)

Key to Life Stages: (EM) = Egg Mass (L) = Larval (SA) = Sub-Adult (A) = Adult

Upper Elk Creek

Tailed Frogs (Ascaphus truei)

Surveys were conducted at 10 sites throughout the planning watershed, of which 9 sites had *A. truei* detections (Table G-5).

Table G-5: Results from *A. truei* surveys conducted in the Upper Elk Creek planning watershed

Site ID	Aspect	% Canopy	% Embedded	Stream Gradient	Water Temp °C	pH	EC / TDS	Drainage Acres	TLF Present	Other Species Present
CE1001	N	100	0-25	3-7	11.4	7.66	128/64	822	**X**	CGS
CE1002	E	95	0-25	0-3	14.2	7.32	167/83	439	**X**	CGS
CE1003	S	75	50-75	7-10	15.6	7.70	237/119	199		CGS
CE1004	W	85	50-75	10-20	14.9	7.68	246/123	319	**X**	CGS
CE1005	S	85	25-50	20-25	16.0	7.60	229/115	578	**X**	CGS
CE1006	W	90	25-50	3-7	14.8	7.45	228/114	305	**X**	CGS, YLF, BLK, STH
CE1007	W	85	25-50	0-3	15.9	7.75	218/109	1535	**X**	CGS, YLF, STH
CE1008	E	95	25-50	3-7	14.6	7.37	130/65	363	**X**	CGS
CE1009	W	85	25-50	0-3	17.0	7.74	239/119	896	**X**	CGS, STH
CE1010	N	90	25-50	3-7	14.6	7.70	180/90	968	**X**	CGS

Southern Torrent Salamanders (Rhyacotriton variegatus)

Surveys were conducted at 10 sites throughout the planning watershed, of which 2 sites had *R. variegatus* detections (Table G-6). The majority of sites sampled had optimal habitat for this species.

Table G-6: Results from *R. variegatus* surveys conducted in the Upper Elk Creek planning watershed

Site ID	Aspect	% Canopy	% Embedded	Stream Gradient	Habitat Type	Water Temp °C	pH	STS Present	Other Species Present
CE1200	N	75	0-50	3-7%	W	9.8	7.74	**X**	CGS,BLK
CE1201	N	90	50-75	30-40%	W	9.4	7.67		CGS
CE1202	N	80	0-25	50-60%	S	9.7	7.62	**X**	CGS,TLF
CE1203	N	95	25-50	80-100%	W	10.7	7.78		CGS,BLK
CE1204	E	65	25-50	90-100%	W	9.8	7.60		CGS
CE1205	E	55	25-50	50-60%	W	10.4	7.71		CGS
CE1206	E	90	25-75	70-80%	S	10.3	6.96		CGS,TLF
CE1207	N	100	25-50	3-7%	S	10.2	7.16		
CE1208	N	80	25-75	30-60%	S	10.9	7.15		CGS,TLF
CE1209	N	100	50-75	50-60%	W	10.4	6.83		

Key to Habitat Types: (W) = Watercourse (S) = Seep or Spring (P) = Soil Pipe

CONCLUSIONS

The amphibian species detected in the Elk Creek WAU include all four of the 'Species of Special Concern' as designated by the State of California. Aquatic habitat types have remained functional in the Elk Creek WAU to support these species which have been extirpated both locally and regionally. Tailed frogs were detected within 15 sites in the WAU and southern torrent salamanders were observed in 5 sites. The number of sites occupied by these two species is rather impressive within the Elk Creek WAU and probably represents one of the most prolific watersheds in the MRC ownership.

During fish habitat analyses in the Elk Creek WAU, a tailed frog nest was encountered. This was the first account of a tailed frog nest site ever discovered in Mendocino County. The nest site was also the first nest site ever encountered within a seep habitat. The utility of seeps as breeding habitat is not documented and may be an important component for the success of the species. During surveys for southern torrent salamanders, tailed frog adults were observed within seeps at four sampling locations. Based upon this evidence it appears as if seeps adjacent to larger watercourses may be an important habitat for tailed frogs- whether for foraging habitat or reproductive habitat.

LITERATURE CITED

Corn, P. S., and R. B. Bury. 1989. Logging in western Oregon: responses of headwater habitats and stream amphibians. Forest Ecology and Management 29: 35-57.

Kiesecker, J. M., and A. R. Blaustein. 1998. Effects of introduced bullfrogs and smallmouth bass on microhabitat use, growth, and survival of native red-legged frogs (*Rana aurora*). Conservation Biology 12: 776-787.

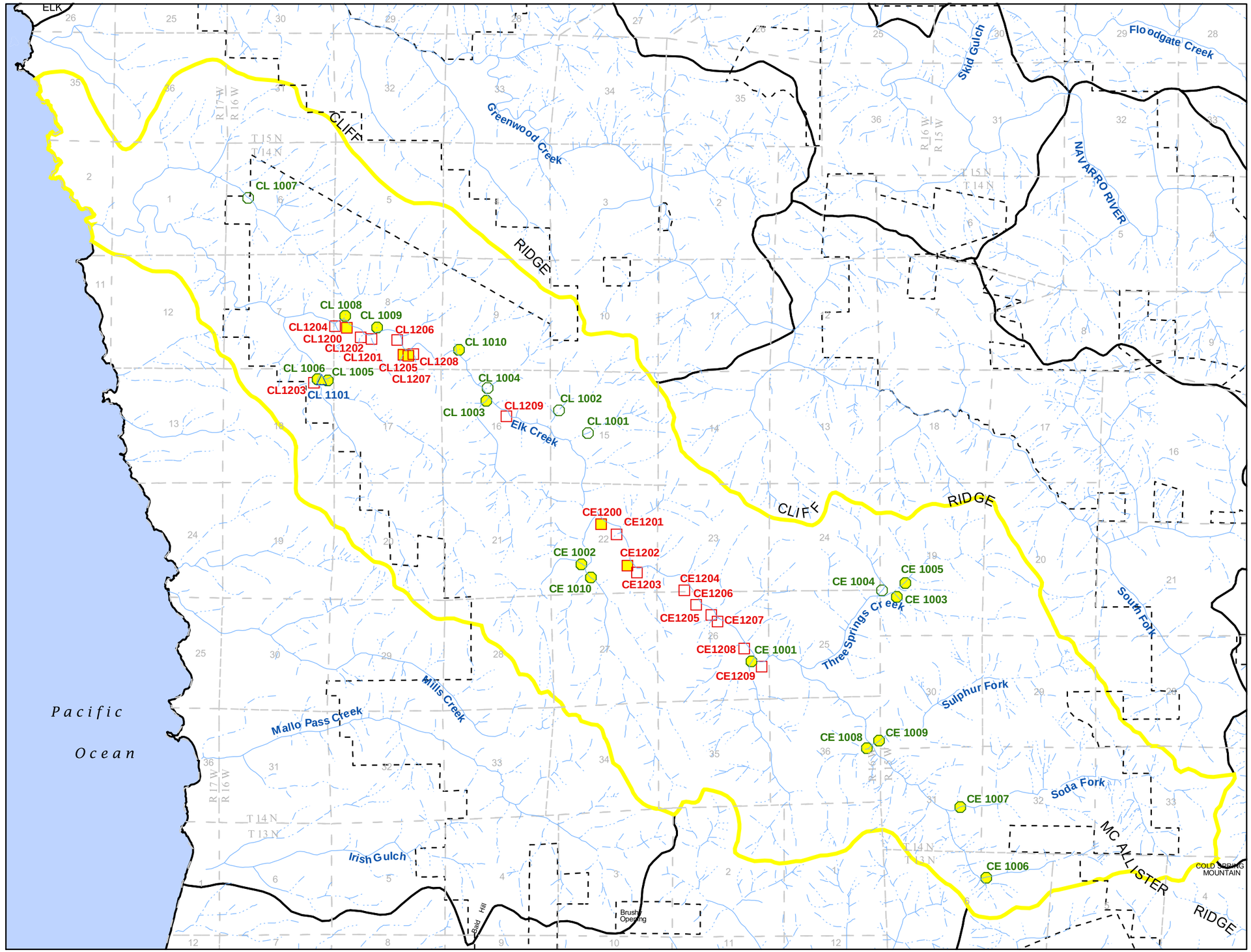
Welsh, H. H. and L.M. Ollivier. 1998. Stream amphibians as indicators of ecosystem stress: a case study from California's redwoods. Ecological Applications 8(4): 1118-1132.

Welsh, H. H., Jr., A. J. Lind, L. M. Ollivier, G. R. Hodgson, and N. E. Karraker. 1998. Comments on the PALCO HCP/SYP and EIS/EIR with regard to the maintenance of riparian, aquatic, and late seral ecosystems and their associated amphibian and reptile species.

Elk Creek Watershed Analysis Unit

Map G-1
Amphibian Distribution

This map illustrates the documented locations of potential red-legged frog breeding sites, and the locations of surveys conducted for coast tailed frogs and southern torrent salamanders in the Elk Crek WAU. Sites were surveyed by MRC in 2002-2008 in conjunction with this watershed analysis.



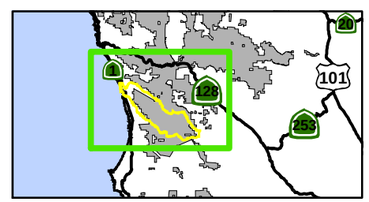
Amphibian Distribution Survey Sites

	Detected	Not Detected
Coast Tailed Frog	⬢	⬡
Red-legged Frog	△	△
Southern Torrent Salamander	▢	▢

- MRC Ownership
- Planning Watershed Boundary
- Elk Creek Watershed Analysis Unit Boundary

Flow Class

- Class I
- Class II
- Class III



0 0.5 1 Miles

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