SECTION F
FISH HABITAT CONDITION AND AQUATIC SPECIES DISTRIBUTION

INTRODUCTION

The anadromous fish species inhabiting the Hollow Tree WAU are steelhead trout (*Oncorhynchus mykiss)*, coho salmon (*O. kisutch*), fall run chinook salmon (*O. tshawytscha*) and Pacific lamprey (*Lampetra tridentata).* The anadromous fish species inhabiting the Hollow Tree WAU are steelhead trout (*Oncorhynchus mykiss)*, coho salmon (*O. kisutch*), fall run chinook salmon (*O. tshawytscha*) and Pacific lamprey (*Lampetra tridentata).* Other fish species include Sacramento sucker (*Castomus occidentalis),* California roach (*Lavinia symmetricus*), and three-spine stickleback (*Gasterosteus aculeatus*). A fish habitat assessment was conducted in the Hollow Tree WAU to identify the current habitat conditions and areas of special concern regarding the three freshwater life stages of salmonids: spawning, summer rearing, and over-wintering.

Field surveys conducted to evaluate the quality and quantity of fish habitat in the Hollow Tree WAU included fish habitat typing and assessment, aquatic species distribution surveys, stream gravel permeability measurements and bulk gravel samples. The fish habitat assessment evaluated spawning, rearing and over-wintering habitats based on targets derived from scientific literature (Bilby and Ward, 1989; Bisson et al., 1987; Bjornn and Reiser, 1991; CDFG, 1998; Montgomery et al., 1995; Washington Forest Practices Board, 1995) and professional judgment. The habitat data are combined into indices of habitat quality for the different life history stages.

Aquatic species distribution surveys were conducted by the previous landowners (Louisiana-Pacific Corp.) from 1994-1996, and were repeated by MRC from 2000-2002 (MRC 2002). The study consisted of single pass electro-fishing or snorkeling surveys in the summer months to assess aquatic species distribution and composition in the Hollow Tree WAU. All organisms observed were identified to the lowest possible taxonomic level.

Permeability and bulk gravel samples were taken in select fish bearing reaches of the Hollow Tree WAU to determine an index of spawning gravel quality. Permeability and gravel particle size distributions are stream substrate parameters, which affect survival of incubating salmonid embryos. Salmonid eggs buried under as much as a foot of gravel depend on sufficient intra-gravel water flow for their survival and development. Fine sediment within spawning gravel can impede intra-gravel water flow, reducing the delivery of dissolved oxygen to eggs, which can increase mortality in the egg to emergence stage. Forest management practices may increase the delivery of fine sediment to the stream channel, potentially impacting spawning gravel. The assessment of substrate permeability and composition are useful in monitoring the effects of increased sediment delivery on salmonid incubation conditions and spawning survival success.

Other activities in the watershed include three index stations (multi-pass electro-fishing surveys) that have been conducted for juvenile salmonids since 1986 by California Department of Fish and Game (CDFG). CDFG has also performed adult salmonid spawning surveys since the 1980's in Hollow Tree Creek. Additionally, MRC operated a juvenile salmonid out-migrant trap in Hollow Tree Creek between 2000 and 2002 (MRC 2003). CDFG and the California Conservation Corp (CCC) have been actively involved in instream restoration efforts since the 1980's. The Salmon

Restoration Association (SRA) has maintained a hatchery operation for chinook salmon on Hollow Tree Creek since 1979.

METHODS

Fish Habitat Assessment

The habitat inventory used to evaluate the habitat condition of the Hollow Tree WAU was conducted during low flow conditions using methods modified from the California Salmonid Stream Restoration Manual (Flosi et al., 1998). Stream segments were created based on stream gradient and channel confinement (see section E "Stream Channel Condition"). Fish habitat conditions were determined by sampling representative stream segments throughout the watershed. Factors that determined fish habitat assessment locations included fish presence, accessibility and stream channel type (response, transport or source reach). Since high gradient streams were likely to be non-fish bearing, survey efforts were concentrated on low gradient reaches of the stream network.

A distance of 20-30 bankfull widths determined the survey length to ensure that approximately two meander bends of the stream channel were observed. Data collected during the fish habitat and stream channel surveys provided information on pool, riffle and flatwater frequency; pool spacing; spawning gravel quantity and quality; over-wintering substrate; shelter complexity and large woody debris (LWD) frequency, condition and future recruitment.

The fish habitat observations were evaluated for quality for each salmonid life stage: spawning, summer rearing and over-wintering. Table F-1 displays the targets used for rating measured habitat parameters. These indices are based on scientific literature (Bilby and Ward, 1989; Bisson et al., 1987; Bjornn and Reiser, 1991; CDFG 1998; Montgomery et al., 1995; Washington Forest Practices Board, 1995) and professional judgment. Spawning habitat conditions are evaluated on the basis of gravel availability and quality (gravel sizes, subsurface fines, embeddedness), and are evaluated for preferred salmonid spawning areas located at the tail-outs of pools. Summer rearing habitat conditions for salmonids are evaluated on the size, depth and availability of pools and the complexity and quantity of cover (particularly large woody debris). Over-wintering habitat is evaluated on the size, depth and availability of pools, the proportion of habitat units with cobble or boulder-dominated substrate and the quantity of cover.

TableF-1. Fish Habitat Condition Indices for Measured Parameters

		Fish Habitat Quality		
Fish Habitat Parameter	**Feature**	**Poor**	**Fair**	**Good**
Percent Pool (By length) **(A)**	Anadromous Salmonid Streams	<25%	25-50%	>50%
Pool Spacing (Reach length/Bankfull/#pools) **(B)**	Anadromous Salmonid Streams	≥ 6.0	3.0 - 5.9	≤ 2.9
Shelter Rating (Shelter value x % of habitat covered) **(C)**	Pools	<60	60-120	>120
% Of Pools that are ≥3 ft. residual depth **(D)**	Pools	<25%	25-50%	>50%
Spawning Gravel Quantity (% of Surface Area) **(E)**	Pool Tail-outs	<1.5%	1.5-3%	>3%
Percent Embeddedness **(F)**	Pool Tail-outs	>50%	25-50%	<25%
Subsurface Fines (L-P watershed analysis manual) **(G)**	Pool Tail-outs	2.31-3.0	1.61-2.3	1.0-1.6
Gravel Quality Rating (L-P watershed analysis manual) **(H)**	Pool Tail-outs	2.31-3.0	1.61-2.3	1.0-1.6
Key LWD +root wads / 328 ft of stream. **(I)**	Streams < 40 ft. BFW	<4.0	4.0-6.5	>6.6
	Streams ≥ 40 ft. BFW	<3.0	3.0-3.8	>3.9
Substrate for Over-wintering **(J)**	All Habitat Types	<20% of Units Cobble or Boulder Dominated	20-40% of Units Cobble or Boulder Dominated	>40% of Units Cobble or Boulder Dominated

The habitat data are combined into indices of habitat quality for the different salmonid life stages. Measured fish habitat parameters were weighted and given a numeric scale to develop a quality rating for individual life history stages. Parameters were divided into subsets that correspond with individual life history stages (spawning, summer rearing, and over-wintering habitat). Parameters were scored as follows: 1 (poor), 2 (fair), and 3 (good). Parameter weights were applied to the total score calculated as shown below. The parameter codes (see Table F-1) are in bold and the weights in parentheses.

Spawning Habitat
E (0.25) + **F** (0.25) + **G** (0.25) + **H** (0.25)

Summer Rearing Habitat
A (0.20) + **B** (0.15) + **C** (0.15) + **D** (0.15) + **F** (0.15) + **I** (0.20)

Over-wintering Habitat
A (0.20) + **B** (0.15) + **C** (0.15) + **D** (0.10) + **I** (0.20) + **J** (0.20)

The overall score is rated as follows:
1.00 - 1.66 = Poor
1.67 - 2.33 = Fair
2.34 - 3.00 = Good

Aquatic Species Distribution

A hierarchical framework was used to select the initial locations of 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 salmonid 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 electro-fishing or snorkeling. The effort put forth at each survey site is not sufficient to delineate the absence of a species.

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.

The primary survey method is electro-fishing using a Smith-Root™ Model 12 (Smith-Root Inc., Vancouver, WA) backpack electro-fisher. One person operates the backpack electro-fisher while one or two other individuals use dip nets to capture the stunned species. The captured specimens are placed into a five-gallon bucket containing stream water. The aquatic species are enumerated, measured to fork length (fish) or snout-vent length (amphibians) and released back into the units from which they were captured. All vertebrate species are identified to the lowest possible taxonomic level.

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 if electro-fish techniques were used. 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. Depending on the channel width, one to four divers are used for the field surveys. The diver(s) enters the survey unit from the downstream end and waits approximately one-minute before proceeding upstream to observe species. If the water velocity is too fast for divers to proceed upstream, the unit is surveyed by floating downstream. Dive slates are used to

record data underwater. During the survey, salmonid species are enumerated by size class according to pre-determined size class categories (<70mm, 70–130mm, >130mm). All other vertebrate species observed during the field surveys are identified to the lowest possible taxonomic level.

Permeability and Bulk Gravel Samples

Steam gravel permeability and bulk gravel samples were collected on five stream monitoring segments in the Hollow Tree WAU in 1999. In 2001, four stream monitoring segments were surveyed for permeability and with no bulk gravel samples collected. The stream gravel permeability was measured using a 1-inch diameter standpipe similar to the standpipe discussed in Terhune (1958) and Barnard and McBain (1994) with the exception that our standpipe is smaller in diameter. We used the smaller diameter standpipe because we hypothesize that it creates fewer disturbances to the stream gravel when inserted. Bulk stream gravel samples were taken with a 12-inch diameter sampler as described in Platts, Megahan and Minshall (1983).

An electric pump was used to create the water suction in the standpipe for the permeability measurements. The permeability measurements were taken at a depth of 25 centimeters, near the maximum depth of coho and steelhead spawning. In 1999 the permeability measurements were taken in 4 randomly selected pool tail-out sections along the monitoring segment. At each pool tail-out sampled permeability measurements were taken at 3 sites; the ¼, ½ and ¾ mark of the wetted channel. This gave a total of 12 permeability sites along each monitoring segment in 1999.

A recent analysis of MRC permeability data has shown that more samples should be taken to more accurately predict the survival to emergence percentage calculated from the permeability data. From a power analysis it was determined that 26 measurements per segment are needed to predict within 20 percent accuracy the survival of emerging fry (Stillwater Science, 2000). In the observations in 2001, a total of 26 permeability measurements were taken in each selected monitoring segment. The measurements were evenly distributed among all pool tail-outs in the segments, with any additional measurements taken in tail-outs behind the deepest pools. The measurement location in each tail-out was randomly selected from an evenly selected 12-point grid in the tail-out. At each measurement location permeability repetitions were taken until the permeability readings no longer were increasing. Bulk gravel samples were not collected in 2001.

The median permeability measurement for each permeability site in the monitoring segment was used as representative of the site. To characterize the entire monitoring segment the natural log of the geometric mean of the median permeability measurements was determined. The natural log of the permeability is used because of a relationship developed from data from Tagart (1976) and McCuddin (1977) (Stillwater Sciences, 2000) to estimate survival to emergence from permeability data. This relationship equates the natural log of permeability to fry survival (r^2 = 0.85, $p<10^{-7}$). This index needs further improvements, but is currently all we have for interpreting permeability information and biological implications. This relationship is:

$$\text{Survival} = -0.82530 + 0.14882 * \ln \text{permeability}$$

It is important to understand that the use of this survival relationship is only an index of spawning gravel quality in the segment. The permeability measurements were taken in randomly selected pool tail-outs and are not indicative of where a salmon may select to spawn. Furthermore, spawning salmon have been shown to improve permeability in gravel where redds are developed

(MRC, 2000). Therefore the survival percentage developed is only indicative of the quality of potential spawning habitat and not as an absolute number.

Bulk gravel samples were taken in 1999 in each of the 4 randomly selected pool tail-outs, except for Bear Creek and Bond Creek which only had 1 and 2 samples taken respectively. The gravel sample was taken directly over the permeability site that is closest to the thalweg of the channel. After the bulk gravel samples were collected the gravel was dried and sieved through 7 different size-class screens (50.8, 25.4, 12.5, 6.3, 4.75, 2.36, 0.85 mm). The weight of each gravel size class was determined for each of the bulk gravel samples using a commercial quality scale.

From the sieved bulk gravel samples the percent fine particles less than 0.85 mm sieve size class was determined. The survival index for steelhead trout and chinook was calculated from the bulk gravel samples using the method described in Tappel and Bjorn (1983). The chinook and steelhead indices are both used because these are both fisheries in the Hollow Tree WAU.

RESULTS AND DISCUSSION

Fish Habitat Condition and Aquatic Species Distribution

There are two taxonomic uncertainties that are important to note. 1) Juvenile steelhead and resident rainbow trout cannot be distinguished between in the field. For the purpose of this report, *Oncorhynchus mykiss* juveniles are referred to as "steelhead" if there is not a known migration barrier downstream. If there is a migration barrier downstream the juveniles are referred to as "resident rainbow trout". 2) The Hollow Tree River watershed is known to contain signal crayfish (*Pacifastacus leniusculus*). Other species of crayfish may also be present. Crayfish are not identified to the species level in this report.

Tables F-2 and F-3 summarize the 1999 fish habitat assessment data. A total of 24 segments were evaluated. The habitat parameters used to evaluate individual stream segments can be found in Table F-2. The 'rating' is the quality value for calculation of weighted habitat indices (see Table F-1). The ratings were used to calculate habitat quality for each life history stage. A summary of the habitat ratings corresponding to each life history stage can be found in Table F-3.

The Hollow Tree River WAU is comprised of seven planning watersheds of which three were surveyed for fish habitat and aquatic species distribution. The discussion of results is separated into planning watersheds and stream names of the Hollow Tree WAU. Some streams lack fish habitat or aquatic species distribution information. Additionally, fish distribution is not always discussed for the mainstem of Hollow Tree Creek; it may be assumed that coho and steelhead utilize the mainstem at some point of their life cycle. Available information for each stream is summarized in the discussion below. Data from six years of aquatic species distribution surveys (MRC 2002) are located in Appendix F. The Site ID's presented below are from these surveys and are depicted on Map F-1. Physical data collected during these surveys is omitted from this report but may be obtained from MRC.

Lower Hollow Tree Planning Watershed

Hollow Tree Creek (Habitat segments RL3 and RL4)

Spawning habitat rated good for segment RL3 due to low embeddedness and abundant high quality spawning gravels. Segment RL4 rated fair for spawning habitat due to moderately embedded substrates. Summer rearing habitat was rated fair for both segments due to low levels of large woody debris, shallow pools and low quantities of instream cover. Over-wintering habitat ratings were fair for both segments due to high quantities of over-wintering substrate. These segments did not receive good ratings for rearing habitat due to shallow pools, low levels of large woody debris and low amounts of instream cover. The shallow pools and low quantities of cover available to fish suggest a need for large woody debris. Large woody debris was removed from this planning watershed in the 1980's.

South Fork Creek and Mule Creek

Habitat data has not been collected for these creeks. There is a waterfall in South Fork Creek that is a complete barrier to upstream salmonid migration (see map F-1). Downstream of the waterfall juvenile coho and steelhead have been detected. Upstream of the waterfall resident rainbow trout are present in South Fork Creek and in Mule Creek.

Middle Hollow Tree Planning Watershed

Hollow Tree Creek (Habitat segments RM3, RM5 and RM6)
Habitat
Spawning habitat rated fair to good. Summer rearing and over-wintering habitat rated poor to fair. The segments were lacking in large woody debris and over-wintering substrate. This results in poor cover for rearing juvenile salmonids.
Other Species
Other species found within this stream reach have included Pacific lamprey, Pacific giant salamander and rough skinned newt.

Walters Creek (Habitat segment RM43)
Habitat
Spawning habitat rated fair. Summer rearing and over-wintering habitat rated poor, primarily due to minimal shelter and shallow pools.
Steelhead
Steelhead have been found as far upstream as Site 41-12. Upstream of Site 41-12 there is a road crossing (a culvert) that is a barrier to upstream migration of salmonids. MRC is currently making plans to remove this barrier.
Coho Salmon
Coho have not been found in Walters Creek.
Other Species
Other species found in Walters Creek include Pacific giant salamander, California newt and foothill yellow-legged frog.

Lost Pipe Creek (Habitat segment RM48)
Habitat
Spawning habitat rated fair. Summer rearing and over-wintering habitat rated poor, primarily due to minimal cover and shallow pools.
Steelhead
Steelhead have been found at Site 41-13. Surveys have not been conducted further upstream.
Coho Salmon
Coho have not been found in Lost Pipe Creek
Other Species
Pacific giant salamanders have been found in Lost Pipe Creek.

Bear Creek (Habitat segment RM54)
Habitat
Spawning and summer rearing habitat rated fair. Over-wintering habitat rated good.
Steelhead
Steelhead have been found as far upstream as Site 41-15.
Coho
Coho have not been found in Bear Creek. There is a 6 foot waterfall near the mouth of Bear Creek that may be an upstream migration barrier to adult coho.
Other Species
Other species found in Bear Creek include foothill yellow legged frog, rough skinned newt and Pacific giant salamander.

Redwood Creek (Habitat segment RM68 and RM69)
Habitat
Spawning habitat rated poor to fair. Summer rearing and over-wintering habitat rated fair. The segments lacked shelter and deep pools.
Steelhead and coho salmon
Steelhead and coho have been found as far upstream as Site 41-18.
Other Species
Pacific giant salamanders have been found in Redwood Creek.

South Fork Redwood Creek (Habitat segment RM88)
Habitat
Spawning, summer rearing and over-wintering habitat rated fair.
Steelhead
Steelhead have been found as far upstream as Site 41-22.
Coho Salmon
Coho have been found as far upstream as Site 41-20.
Other Species
Other species found in SF Redwood Creek include Pacific giant salamander and unidentified tarichid newt.

Bond Creek (Habitat segments RM109 and RM110)
Habitat
Spawning habitat rated fair to good. Summer rearing and over-wintering habitat rated fair. Bond Creek has had many wooden structures placed in the channel to improve habitat conditions.
Steelhead
Steelhead have been found as far upstream as Site 41-27.
Coho Salmon
Coho have been found as far upstream as Site 41-26.
Other Species
Other species found in Bond Creek include Pacific giant salamander, crayfish, foothill yellow-legged frog and Pacific lamprey.

Upper Hollow Tree Planning Watershed

Hollow Tree Creek (Habitat segments RU2, RU4 and RU5)
Habitat
Spawning, summer rearing and over-wintering habitat ranged from fair to good. Woody debris was abundant, however pool depths were poor.
Other Species
Pacific giant salamander, California newt, rough skinned newt, foothill yellow-legged frog and Pacific lamprey have been found in this stream reach.

Michaels Creek (Habitat segment RU8)
Habitat
Spawning habitat rated good. Summer rearing and over-wintering habitat rated fair. The segment was deficient in deep pools and substrate suitable for over-wintering.
Steelhead and Coho Salmon
Steelhead and coho have been found as far upstream as Site 41-31.
Other Species
Other species found in Michaels Creek include Pacific giant salamander, unidentified tarichid newt, crayfish, Pacific lamprey and foothill yellow-legged frog.

Lynch Creek (Habitat segment RU9)
Habitat
Spawning, summer rearing and over-wintering habitat rated fair. The segment was deficient in shelter and deep pools.
Steelhead
Steelhead are found upstream as far as Site 41-34. Upstream of this site there is a waterfall that is believed to be a barrier to upstream salmonid migration.
Coho
Coho have not been found in Lynch Creek.
Other Species
Pacific giant salamanders have been found in Lynch Creek.

Doctors Creek (Habitat segment RU12)
Habitat
Spawning, summer rearing and over-wintering habitat rated fair. The segment was deficient in deep pools and substrate suitable for over-wintering.
Steelhead
Steelhead have been found as far upstream as Site 41-33,
Coho
Coho have been found as far upstream as Site 41-32.
Other Species
Pacific giant salamanders have been found in Doctors Creek.

Waldron Creek (Habitat segment RU25)
Habitat
Spawning habitat rated good. Summer rearing and over-wintering habitat rated fair. The segment was deficient in shelter and deep pools.
Steelhead
Steelhead have been found as far upstream as Site 41-38.
Coho
There is a high gradient bedrock reach of stream in the lower portion of Waldron Creek. This reach has been modified to better allow upstream passage of salmonids. In 2002, juvenile coho were found above this reach at Site 41-36.
Other Species
Other species found in Waldron Creek include Pacific lamprey, Pacific giant salamander and crayfish.

Butler Creek (Habitat segment RU6)
Habitat
Spawning habitat was rated good. Summer rearing and over-wintering habitat were rated fair. The segment lacked substrate suitable for over-wintering and pool depths were poor.
Steelhead and coho salmon
Steelhead and coho have been found as far upstream as Site 41-47.
Other Species
Other species found in Butler Creek include Pacific lamprey, Pacific giant salamander, California newt and rough skinned newt.

Bear Wallow Creek (Habitat segment RU57)
Habitat
Spawning, summer rearing and over-wintering habitat were rated fair. The segment was deficient in shelter and deep pools.
Steelhead and coho salmon
Steelhead and coho have been found as far upstream as Site 41-43.
Other Species
Pacific giant salamanders have been found in Bear Wallow Creek.

Little Bear Wallow Creek (Habitat segment RU65)
Habitat
Spawning, summer rearing and over-wintering habitat rated fair. Pool depths were poor, and the substrate was highly embedded.
Steelhead and Coho Salmon
Steelhead and coho have been found at Site 41-44.
Other Species
Pacific giant salamanders have been found in Little Bear Wallow Creek.

Huckleberry Creek (Habitat segment RU7)
Habitat
Spawning habitat rated good. Summer rearing and over-wintering habitat rated fair. The segment lacked shelter and deep pools.
Steelhead and Coho Salmon
Steelhead and coho have been found as far upstream as Site 41-45.
Other Species
Other species found in Huckleberry Creek include Pacific giant salamander and Pacific lamprey.

Table F-2. Summary of Fish Habitat Parameters, with Scores and Corresponding Ratings. Hollow Tree Watershed Analysis Unit.

Segment	**A.** % Pool:Riffle: Flatwater by stream length		**B.** Pool Spacing		**C.** Shelter rating		**D.** % of all pools with residual depth ≥3 ft.		**E.** Spawning gravel quantity(%)		**F.**% Embed-dedness		**G.** Sub-surface fines		**H.** Gravel Quality		**I.** Key LWD + rootwads / 328 ft. with Debris Jams		**J.** % Over-wintering substrate	
	%	Rating	Spacing	Rating	Score	Rating	%	Rating	%	Rating	%	Rating	Score	Rating	Score	Rating	Score	Rating	%	Rating
RL3	48:8:44	Fair	2.6	Good	30	Poor	0	Poor	>3	Good	<25	Good	2	Fair	3	Good	2.6	Poor	>40	Good
RL4	78:22:0	Good	3.1	Fair	34	Poor	29	Fair	>3	Good	25-50	Fair	2	Fair	2	Fair	0	Poor	>40	Good
RM3	38:24:38	Fair	3.5	Fair	54	Poor	50	Fair	>3	Good	25-50	Fair	2	Fair	2	Fair	2.8	Poor	<20	Poor
RM5	85:15:0	Good	1.6	Good	93	Fair	83	Good	1.5-3	Fair	25-50	Fair	2	Fair	2	Fair	0.7	Poor	<20	Poor
RM6	34:26:40	Fair	2.7	Good	58	Poor	66	Good	>3	Good	25-50	Fair	3	Good	3	Good	2.2	Poor	<20	Poor
RM43	38:51:13	Fair	4.7	Fair	51	Poor	0	Poor	>3	Good	>50	Poor	2	Fair	2	Fair	4.5	Fair	<20	Poor
RM48	50:21:29	Good	8.1	Poor	72	Fair	20	Poor	>3	Good	>50	Poor	3	Good	2	Fair	3.4	Poor	<20	Poor
RM54	55:34:11	Good	1.8	Good	61	Fair	0	Poor	1.5-3	Fair	>50	Poor	2	Fair	2	Fair	7.5	Good	>40	Good
RM68	79:21:0	Good	1.4	Good	50	Poor	16	Poor	1.5-3	Fair	>50	Poor	1	Poor	2	Fair	2.6	Poor	<20	Poor
RM69	83:17:0	Good	2.8	Good	43	Poor	17	Poor	1.5-3	Fair	>50	Poor	2	Fair	2	Fair	18.4	Good	<20	Poor
RM88	59:36:5	Good	1.7	Good	108	Fair	0	Poor	1.5-3	Fair	>50	Poor	2	Fair	2	Fair	7.3	Good	<20	Poor
RM109	63:37:0	Good	4.0	Fair	75	Fair	0	Poor	1.5-3	Fair	>50	Poor	3	Good	2	Fair	9.0	Good	20-40	Fair
RM110	40:60:0	Fair	2.8	Good	53	Poor	0	Poor	>3	Good	25-50	Fair	3	Good	3	Good	14.5	Good	>40	Good
RU2	71:29:0	Good	5.3	Fair	67	Fair	0	Poor	>3	Good	>50	Poor	3	Good	3	Good	4.9	Good	>40	Good
RU4	71:29:0	Good	1.5	Good	63	Fair	0	Poor	>3	Good	25-50	Fair	1	Poor	2	Fair	18.5	Good	<20	Poor
RU5	73:27:0	Good	3.0	Fair	57	Poor	22	Poor	1.5-3	Fair	25-50	Fair	2	Fair	2	Fair	12.5	Good	20-40	Fair
RU6	55:45:0	Good	3.1	Fair	64	Fair	13	Poor	>3	Good	25-50	Fair	3	Good	3	Good	12.9	Good	<20	Poor
RU7	50:37:13	Good	3.3	Fair	51	Poor	0	Poor	>3	Good	25-50	Fair	3	Good	2	Fair	7.4	Good	<20	Poor
RU8	37:43:20	Fair	4.8	Fair	62	Fair	14	Poor	>3	Good	<25	Good	3	Good	3	Good	6.7	Good	<20	Poor
RU9	53:47:0	Good	0.8	Good	54	Poor	0	Poor	1.5-3	Fair	25-50	Fair	2	Fair	2	Fair	30.5	Good	<20	Poor
RU12	71:29:0	Good	3.5	Fair	73	Fair	0	Poor	>3	Good	25-50	Fair	2	Fair	2	Fair	12.0	Good	<20	Poor
RU25	45:55:0	Fair	3.4	Fair	47	Poor	11	Poor	1.5-3	Fair	25-50	Fair	3	Good	3	Good	10.9	Good	<20	Poor
RU57	60:40:0	Good	3.1	Fair	32	Poor	0	Poor	>3	Good	25-50	Fair	2	Fair	2	Fair	6.9	Good	<20	Poor
RU64	53:36:11	Good	2.2	Good	43	Poor	7	Poor	>3	Good	>50	Poor	2	Fair	2	Fair	19.8	Good	<20	Poor
RU65	38:24:38	Fair	5.7	Fair	66	Fair	0	Poor	>3	Good	>50	Poor	2	Fair	2	Fair	20.0	Good	<20	Poor

Table F-3. Summary of Fish Habitat Ratings for Three Life History Stages. Hollow Tree WAU.

Segment	Slope gradient class (percent)	Spawning habitat score	Spawning habitat rating	Rearing habitat score	Rearing habitat rating	Over-wintering habitat score	Over-wintering habitat rating
RL3	0-1	2.75	Good	1.80	Fair	1.90	Fair
RL4	0-1	2.25	Fair	1.85	Fair	2.05	Fair
RM3	0-1	2.25	Fair	1.65	Poor	1.45	Poor
RM5	0-1	2.00	Fair	2.30	Fair	2.05	Fair
RM6	0-1	2.75	Good	1.95	Fair	1.70	Fair
RM43	4-8	2.00	Fair	1.55	Poor	1.55	Poor
RM48	4-8	2.25	Fair	1.55	Poor	1.55	Poor
RM54	2-4	1.75	Fair	2.25	Fair	2.65	Good
RM68	1-2	1.50	Poor	1.70	Fair	1.70	Fair
RM69	1-2	1.75	Fair	2.10	Fair	2.10	Fair
RM88	1-2	1.75	Fair	2.25	Fair	2.25	Fair
RM109	1-2	2.00	Fair	2.10	Fair	2.30	Fair
RM110	2-4	2.75	Good	2.05	Fair	2.30	Fair
RU2	0-1	2.50	Good	2.10	Fair	2.50	Good
RU4	1-2	2.00	Fair	2.40	Good	2.25	Fair
RU5	1-2	2.00	Fair	2.10	Fair	2.15	Fair
RU6	1-2	2.75	Good	2.25	Fair	2.10	Fair
RU7	1-2	2.50	Good	2.10	Fair	1.95	Fair
RU8	1-2	3.00	Good	2.20	Fair	1.90	Fair
RU9	4-8	2.00	Fair	2.25	Fair	2.10	Fair
RU12	2-4	2.25	Fair	2.25	Fair	2.10	Fair
RU25	2-4	2.50	Good	1.90	Fair	1.75	Fair
RU57	2-4	2.25	Fair	2.10	Fair	1.95	Fair
RU64	2-4	2.00	Fair	2.10	Fair	2.10	Fair
RU65	4-8	2.00	Fair	1.90	Fair	1.90	Fair

Map F-1 was generated using data collected during the aquatic distribution surveys. Some additional field work was conducted to investigate the location of migration barriers. The upper extent of salmonid (steelhead, chinook and coho) distribution is mapped as far upstream as juveniles have been found. In most circumstances this is close to the actual extent of salmonid distribution. The potential distribution represents our interpretation of where these salmonid species potentially are located upstream of our observations. However, this interpretation of potential distribution was only performed on the larger watercourses and cannot be concluded to be the only potential distribution locations.

Chinook have migrated downstream from Hollow Tree Creek prior to initiation of the distribution surveys discussed in this report. However, data regarding chinook has become available through two types of research: spawning ground surveys and juvenile out-migrant trapping. During spawning surveys conducted by MRC and the California Department of Fish and Game adult Chinook have been identified in the mainstem of Hollow Tree Creek as far upstream as Huckleberry Creek, as well as in Redwood Creek and Bear Creek. Table F-5 presents data collected by MRC while operating an out-migrant trap in Hollow Tree Creek between 2000 and 2002 (See map F1). Information on out-migrating coho, steelhead and chinook is presented. It is important to note that the chinook numbers do not represent population estimates because the trap did not capture all out-migrating fish. Population estimates are presented for age 1+ coho and steelhead based upon a mark recapture program that accounted for the capture efficiency of the trap. The complete report (MRC 2003) should be consulted regarding additional data and the data limitations.

Table F-4. Summary of Coho and Steelhead Population Estimates and Chinook Captures from Out-migrant Trap on Hollow Tree Creek (2000-2002).

Dates	Steelhead Population Estimate	Coho Population Estimate	Number of Chinook Captured
3/18/00-6/9/00	11758 ± 5344	35178 ± 3996	2128
3/2/01-5/31/01	24818 ± 2177	35976 ± 4498	46
3/5/02-6/7/02	8251 ± 1439	9785 ± 935	4261

Permeability and Bulk Gravel Samples

Results from permeability and percent fine particles <0.85 mm for the Hollow Tree WAU are presented in Table F-6. MRC uses the following criteria for evaluating permeability: 0-3000 cm/hr is deficient, 3000-10,000 cm/hr is marginal, and >10,000 cm/hr is on target. The geometric mean permeability observations for the 5 stream segments observed (4 are long term channel monitoring segments) in the Hollow Tree WAU are deficient. These observations are something that will have to be watched over time. Particularly due to the fact that the trend observed is toward decreasing permeability from 1999-2003. A mean observation, as presented for the segments, provides an index of the segment's condition, however, even with the low mean observations all of the segments have permeability observations in the range of the marginal and on target criteria. This suggests that though the mean observations are low, and of concern, there are areas of good quality spawning gravels within the segments sampled.

Generally, the percentage of fine sediment (<0.85 mm) was marginal in the Hollow Tree WAU. Many observations of >10 percent fine particles >0.85 mm were observed throughout the watershed. The estimated percent survival of emerging steelhead and chinook, as calculated from Tappel and Bjorn equations (1983), varied from 32% to 92% and 15% to 86% respectively (Table F-5). The lowest survival ratings calculated were found in the mainstem Hollow Tree.

Percent survival index from permeability was found to be low throughout the Hollow Tree WAU. The survival-to-emergence index calculated for the permeability data showed survival rates that ranged from 0% to 30% (Table F-5). These survival indices reflect conditions at pool tail-outs where a spawning fish has not worked the gravel into a redd. Therefore they reflect the relative quality of stream gravel that a spawning fish encounters upon entering the stream. Areas of stream gravel with a high survival percentage would likely be preferred by spawning fish and likely have better survival success for emerging fish. Areas of stream gravel with a low survival index percentage may not be of completely poor quality; particularly because the permeability and gravel quality will be improved following redd development.

Table F-5. Permeability and Percent Fine Sediment <0.85 mm and Associated Survival Indices for Long Term Monitoring Segments of the Hollow Tree WAU, 1999, 2001, and 2003.

Stream Name	Year	Geometric Mean Permeability for Segment (cm/hr)	Standard Error Permeability (cm/hr)	Range of Permeability Observations (cm/hr)	Survival Index (Taggart/ McCuddin)	Tappel/ Bjorn Chinook Survival Index	Tappel/ Bjorn Steelhead Survival Index	Range Percent Particles <0.85mm
Hollow Tree (Lower)	1999	1076	267	246-6,557	21%	32-54%	15-47%	10-13%
	2001	707	270	1-77,875	15%	-	-	-
	2003	249	3116	1-82,920	0%	-	-	-
Hollow Tree (Upper)	1999	1217	752	1-17,570	23%	54-82%	14-75%	5-9%
	2001	481	369	1-6,975	9%	-	-	-
	2003	368	193	1-13,328	5%	-	-	-
Bear Wallow	1999	304	1169	1-25,940	3%	37-80%	32-74%	6-13%
	2001	53	217	1-4,285	0%	-	-	-
	2003	46	405	1-6,966	0%	-	-	-
Bear Creek	1999*	585	1127	1-15,092	12%	76-92%	64-70%	4-6%
Bond Creek	1999	1909	762	611-6,484	30%	94%	86%	3%
	2001	1130	2364	1-36,329	22%	-	-	-
	2003	394	338	1-5,779	6%	-	-	-

* - Not a long term channel monitoring segment, only one year of data collected.

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Appendix F

Hollow Tree Creek Watershed Analysis Unit

Map F-1
Salmonid Distribution

This map illustrates the documented and potential distribution of coho salmon, chinook salmon, and steelhead trout in the Hollow Tree WAU. Documented distribution is based on distribution surveys conducted by MRC in 2000-2002 and the previous landowner Louisiana-Pacific Corporation in 1994-1996. Documented distribution only shows presence of fish up to the observation site. Potential distribution represents an interpretation of where coho salmon, chinook salmon and steelhead trout potentially use. The potential distribution is only interpreted for the larger watercourses and cannot be considered complete. The potential distribution is our interpretation at this point in time for larger streams, it is highly likely the actual potential distribution is larger.

Potential Salmonid Distribution
- Chinook Salmon Distribution
- Coho Salmon Distribution
- Potential Coho Salmon Distribution
- Steelhead Distribution
- Potential Steelhead Distribution
- Resident Rainbow Trout Distribution

Habitat Survey Segments

Fish Distribution Sampling Locations

Barriers to Adult Salmonid Upstream Migration
- Gradient
- Waterfall
- Culvert

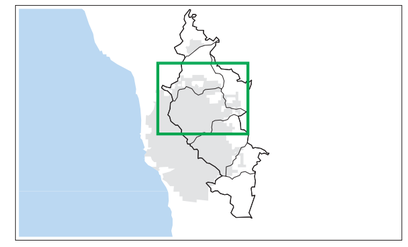
MRC Ownership

Planning Watershed Boundary

Hollow Tree Creek Watershed Analysis Unit Boundary

Flow Class
- Class I
- Class II
- Class III

Sheet 1



0 1/2 1 Mile

December 2003

Hollow Tree Creek Watershed Analysis Unit

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- Potential Steelhead Distribution
- Resident Rainbow Trout Distribution

Habitat Survey Segments

Fish Distribution Sampling Locations

Barriers to Adult Salmonid Upstream Migration
- Gradient
- Waterfall
- Culvert

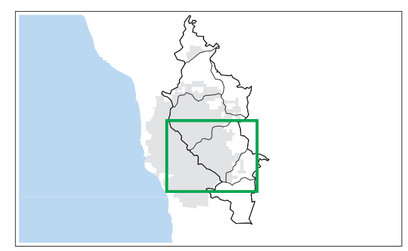
MRC Ownership

Planning Watershed Boundary

Hollow Tree Creek Watershed Analysis Unit Boundary

Flow Class
- Class I
- Class II
- Class III

Sheet 2



0 1/2 1 Mile

December 2003

Hollow Tree Creek Watershed Analysis Unit

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Potential Salmonid Distribution
- Chinook Salmon Distribution
- Coho Salmon Distribution
- Potential Coho Salmon Distribution
- Steelhead Distribution
- Potential Steelhead Distribution
- Resident Rainbow Trout Distribution

Habitat Survey Segments

Fish Distribution Sampling Locations

Barriers to Adult Salmonid Upstream Migration
- Gradient
- Waterfall
- Culvert

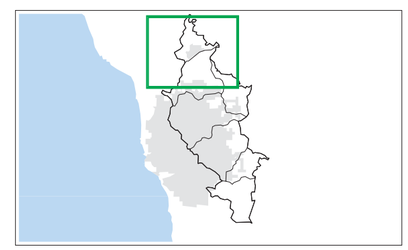
MRC Ownership

Planning Watershed Boundary

Hollow Tree Creek Watershed Analysis Unit Boundary

Flow Class
- Class I
- Class II
- Class III

Sheet 3



0 1/2 1 Mile

December 2003

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
MULE CREEK	41-04	8/11/1994	6	2				PGS
MULE CREEK	41-04	7/10/1995		PRESENT				PGS
MULE CREEK	41-04	8/8/1996	PRESENT	PRESENT				PGS
MULE CREEK	41-04	6/19/2000	1	1	1			PGS
MULE CREEK	41-04	9/25/2001	1	4				
MULE CREEK	41-04	7/16/2002	1	1				PGS YLF
MULE CREEK	41-05	7/10/1995		PRESENT				PGS
MULE CREEK	41-05	8/8/1996	PRESENT	PRESENT	PRESENT			PGS YLF
MULE CREEK	41-05	6/19/2000	3	3				PGS
MULE CREEK	41-05	7/16/2002	5	1				CNT PGS
SOUTH FORK CREEK	41-51	6/19/2000	21				1	PGS
SOUTH FORK CREEK	41-51	9/25/2001		1		8		PGS
SOUTH FORK CREEK	41-51	7/16/2002	11			3	1	PGS
MIDDLE CREEK	41-50	6/19/2000						PGS YLF
MIDDLE CREEK	41-50	9/25/2001	5					CNT

* Species Abbreviations; AMM=Pacific Lamprey Larvae; CDS=Clouded Salamander; CNT=California Newt; COH=Coho Salmon; CRY=Crayfish; LAM=Pacific Lamprey; NEW=Newt (Unidentified Species); PGS=Pacific Giant Salamander; RSN=Rough Skinned Newt; STH=Steelhead Trout; YLF=Foothill Yellow Legged Frog.

* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
MIDDLE CREEK	41-50	7/16/2002	17	3				PGS YLF
MIDDLE CREEK	41-06	7/10/1995						CNT PGS YLF
MIDDLE CREEK	41-06	8/7/1996						PGS YLF
MIDDLE CREEK	41-06	6/19/2000						PGS
MIDDLE CREEK	41-06	9/25/2001						PGS
MIDDLE CREEK	41-06	7/16/2002						PGS
ISLAM JOHN CREEK	41-07	7/8/1995						PGS
ISLAM JOHN CREEK	41-07	8/6/1996						NEW PGS
ISLAM JOHN CREEK	41-07	6/19/2000						PGS
ISLAM JOHN CREEK	41-07	9/28/2001						PGS
LOST MAN CREEK	41-08	7/19/1994						PGS YLF
LOST MAN CREEK	41-08	7/8/1995						PGS
LOST MAN CREEK	41-08	8/6/1996						PGS YLF
LOST MAN CREEK	41-08	6/19/2000						PGS YLF
LOST MAN CREEK	41-08	9/28/2001						

* Species Abbreviations; AMM=Pacific Lamprey Larvae; CDS=Clouded Salamander; CNT=California Newt; COH=Coho Salmon; CRY=Crayfish; LAM=Pacific Lamprey; NEW=Newt (Unidentified Species); PGS=Pacific Giant Salamander; RSN=Rough Skinned Newt; STH=Steelhead Trout; YLF=Foothill Yellow Legged Frog.

* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
LOST MAN CREEK	41-09	8/6/1996						PGS
LOST MAN CREEK	41-09	6/19/2000						CNT PGS YLF
TRIB TO WALTERS CREEK #1	41-10	8/6/1996						PGS
TRIB TO WALTERS CREEK #1	41-10	7/24/2002						PGS
WALTERS CREEK	41-11	7/19/1994	10		2			
WALTERS CREEK	41-11	7/8/1995	PRESENT					
WALTERS CREEK	41-11	8/6/1996	PRESENT	PRESENT	PRESENT			PGS YLF
WALTERS CREEK	41-11	9/28/2001	1					PGS
WALTERS CREEK	41-11	7/24/2002	3		1			CNT PGS
WALTERS CREEK	41-12	7/19/1994						PGS
WALTERS CREEK	41-12	7/8/1995	PRESENT					
WALTERS CREEK	41-12	8/6/1996	PRESENT	PRESENT				PGS
WALTERS CREEK	41-12	6/19/2000		1				CNT PGS
WALTERS CREEK	41-12	7/24/2002						PGS
LOST PIPE CREEK	41-13	7/8/1995	PRESENT					

* Species Abbreviations; AMM=Pacific Lamprey Larvae; CDS=Clouded Salamander; CNT=California Newt; COH=Coho Salmon; CRY=Crayfish; LAM=Pacific Lamprey; NEW=Newt (Unidentified Species); PGS=Pacific Giant Salamander; RSN=Rough Skinned Newt; STH=Steelhead Trout; YLF=Foothill Yellow Legged Frog.

* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
LOST PIPE CREEK	41-13	8/6/1996	PRESENT	PRESENT	PRESENT			
LOST PIPE CREEK	41-13	6/19/2000		4				PGS
LOST PIPE CREEK	41-13	9/28/2001		1				
LOST PIPE CREEK	41-13	7/24/2002						PGS
BEAR CREEK	41-14	7/19/1994	1					PGS
BEAR CREEK	41-14	7/8/1995	PRESENT					RSN
BEAR CREEK	41-14	8/7/1996	PRESENT	PRESENT				
BEAR CREEK	41-14	6/19/2000		1				PGS
BEAR CREEK	41-14	9/27/2001	2					PGS
BEAR CREEK	41-14	7/24/2002		2	1			PGS
BEAR CREEK	41-15	7/19/1994	2	2				NEW PGS
BEAR CREEK	41-15	7/8/1995		PRESENT				PGS
BEAR CREEK	41-15	8/7/1996	PRESENT	PRESENT	PRESENT			PGS
BEAR CREEK	41-15	6/19/2000	2					PGS
BEAR CREEK	41-15	7/24/2002			2			PGS YLF

* Species Abbreviations; AMM=Pacific Lamprey Larvae; CDS=Clouded Salamander; CNT=California Newt; COH=Coho Salmon; CRY=Crayfish; LAM=Pacific Lamprey; NEW=Newt (Unidentified Species); PGS=Pacific Giant Salamander; RSN=Rough Skinned Newt; STH=Steelhead Trout; YLF=Foothill Yellow Legged Frog.

* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
REDWOOD CREEK	41-16	7/18/1994	6			18		PGS
REDWOOD CREEK	41-16	7/10/1995	PRESENT	PRESENT		PRESENT	PRESENT	
REDWOOD CREEK	41-16	8/7/1996	PRESENT			PRESENT		
REDWOOD CREEK	41-16	6/16/2000	7			7		PGS
REDWOOD CREEK	41-16	9/27/2001	7			13		PGS
REDWOOD CREEK	41-16	7/23/2002	3	1		14		PGS
REDWOOD CREEK	41-17	7/18/1994	1	1			4	
REDWOOD CREEK	41-17	7/10/1995	PRESENT	PRESENT		PRESENT	PRESENT	
REDWOOD CREEK	41-17	8/6/1996	PRESENT	PRESENT		PRESENT	PRESENT	
REDWOOD CREEK	41-17	6/15/2000	34	6	1	8		PGS
REDWOOD CREEK	41-17	10/10/2001	10	3	1			PGS
REDWOOD CREEK	41-17	7/23/2002				20		PGS
TRIB TO REDWOOD CREEK #1	41-49	6/15/2000						PGS
TRIB TO REDWOOD CREEK #1	41-49	7/23/2002						PGS
REDWOOD CREEK	41-18	7/18/1994	2	3				PGS

* Species Abbreviations; AMM=Pacific Lamprey Larvae; CDS=Clouded Salamander; CNT=California Newt; COH=Coho Salmon; CRY=Crayfish; LAM=Pacific Lamprey; NEW=Newt (Unidentified Species); PGS=Pacific Giant Salamander; RSN=Rough Skinned Newt; STH=Steelhead Trout; YLF=Foothill Yellow Legged Frog.

* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
REDWOOD CREEK	41-18	7/10/1995						PGS
REDWOOD CREEK	41-18	8/6/1996	PRESENT	PRESENT	PRESENT			PGS
REDWOOD CREEK	41-18	6/15/2000	3	3				
REDWOOD CREEK	41-18	10/10/2001		2				
REDWOOD CREEK	41-18	7/23/2002		1		7		
SF REDWOOD CREEK	41-19	7/19/1994				21		NEW PGS
SF REDWOOD CREEK	41-19	7/10/1995				PRESENT		
SF REDWOOD CREEK	41-19	8/6/1996	PRESENT	PRESENT		PRESENT		
SF REDWOOD CREEK	41-19	6/16/2000	17			19		
SF REDWOOD CREEK	41-19	7/23/2002				18		PGS
SF REDWOOD CREEK	41-20	7/19/1994		4				PGS
SF REDWOOD CREEK	41-20	7/10/1995	PRESENT					PGS
SF REDWOOD CREEK	41-20	8/7/1996	PRESENT	PRESENT		PRESENT	PRESENT	PGS
SF REDWOOD CREEK	41-20	6/16/2000	1	6				PGS
SF REDWOOD CREEK	41-20	10/10/2001		1				

* Species Abbreviations; AMM=Pacific Lamprey Larvae; CDS=Clouded Salamander; CNT=California Newt; COH=Coho Salmon; CRY=Crayfish; LAM=Pacific Lamprey; NEW=Newt (Unidentified Species); PGS=Pacific Giant Salamander; RSN=Rough Skinned Newt; STH=Steelhead Trout; YLF=Foothill Yellow Legged Frog.

* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
SF REDWOOD CREEK	41-20	7/23/2002	10					
TRIB TO SF REDWOOD CREEK #1	41-21	7/10/1995	PRESENT	PRESENT				PGS
TRIB TO SF REDWOOD CREEK #1	41-21	8/7/1996	PRESENT	PRESENT				
TRIB TO SF REDWOOD CREEK #1	41-21	6/16/2000		1	1			
TRIB TO SF REDWOOD CREEK #1	41-21	7/23/2002						PGS
SF REDWOOD CREEK	41-22	7/10/1995	PRESENT					
SF REDWOOD CREEK	41-22	8/7/1996						PGS
SF REDWOOD CREEK	41-22	6/16/2000						PGS
SF REDWOOD CREEK	41-22	10/10/2001	3	2				PGS
SF REDWOOD CREEK	41-22	7/23/2002		1				
HOLLOW TREE CREEK	41-23	7/18/1994	11	1		11		AMM PGS
HOLLOW TREE CREEK	41-23	7/10/1995	PRESENT	PRESENT		PRESENT		RSN
HOLLOW TREE CREEK	41-23	8/7/1996	PRESENT	PRESENT		PRESENT		AMM LAM PGS
HOLLOW TREE CREEK	41-23	6/16/2000	29			5		AMM PGS
HOLLOW TREE CREEK	41-23	10/10/2001	12			6	1	

* Species Abbreviations; AMM=Pacific Lamprey Larvae; CDS=Clouded Salamander; CNT=California Newt; COH=Coho Salmon; CRY=Crayfish; LAM=Pacific Lamprey; NEW=Newt (Unidentified Species); PGS=Pacific Giant Salamander; RSN=Rough Skinned Newt; STH=Steelhead Trout; YLF=Foothill Yellow Legged Frog.

* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
HOLLOW TREE CREEK	41-23	7/23/2002	5	2		4		AMM PGS
BOND CREEK	41-24	7/18/1994	10	2		10		AMM PGS
BOND CREEK	41-24	7/8/1995	PRESENT			PRESENT		PGS
BOND CREEK	41-24	8/6/1996	PRESENT	PRESENT		PRESENT		PGS YLF
BOND CREEK	41-24	6/15/2000	13			2		
BOND CREEK	41-24	10/9/2001	2			4		AMM
BOND CREEK	41-24	7/19/2002	5	2		7		PGS YLF
BOND CREEK	41-25	7/18/1994	18	2		3		PGS
BOND CREEK	41-25	7/10/1995	PRESENT	PRESENT				PGS
BOND CREEK	41-25	8/6/1996	PRESENT	PRESENT		PRESENT		PGS
BOND CREEK	41-25	6/15/2000	14	2	1			PGS
BOND CREEK	41-25	10/9/2001		1				PGS
BOND CREEK	41-25	7/19/2002	3	2				PGS
BOND CREEK	41-26	8/5/1996	PRESENT	PRESENT	PRESENT	PRESENT		PGS
BOND CREEK	41-26	6/15/2000	8	3				PGS

* Species Abbreviations; AMM=Pacific Lamprey Larvae; CDS=Clouded Salamander; CNT=California Newt; COH=Coho Salmon; CRY=Crayfish; LAM=Pacific Lamprey; NEW=Newt (Unidentified Species); PGS=Pacific Giant Salamander; RSN=Rough Skinned Newt; STH=Steelhead Trout; YLF=Foothill Yellow Legged Frog.

* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
BOND CREEK	41-27	8/5/1996	PRESENT	PRESENT		PRESENT		YLF
BOND CREEK	41-27	6/15/2000	6	1	1			CRY PGS
BOND CREEK	41-27	10/9/2001	3		1			PGS
BOND CREEK	41-27	7/19/2002	7	2	1			
MICHAELS CREEK	41-28	7/21/1994	20	3		2		AMM PGS
MICHAELS CREEK	41-28	7/18/1995	PRESENT	PRESENT		PRESENT		NEW
MICHAELS CREEK	41-28	8/6/1996	PRESENT	PRESENT	PRESENT	PRESENT		PGS
MICHAELS CREEK	41-28	6/14/2000	28			3		PGS
MICHAELS CREEK	41-28	10/12/2001	3	1		3		
MICHAELS CREEK	41-28	7/30/2002	3			19		
MICHAELS CREEK	41-29	7/21/1994	16	5		11		PGS
MICHAELS CREEK	41-29	7/8/1995	PRESENT	PRESENT		PRESENT		NEW PGS
MICHAELS CREEK	41-29	8/6/1996	PRESENT	PRESENT		PRESENT		CRY PGS
MICHAELS CREEK	41-29	6/14/2000	15	3		11		CNT PGS
MICHAELS CREEK	41-29	10/12/2001	8	1		10		

* Species Abbreviations; AMM=Pacific Lamprey Larvae; CDS=Clouded Salamander; CNT=California Newt; COH=Coho Salmon; CRY=Crayfish; LAM=Pacific Lamprey; NEW=Newt (Unidentified Species); PGS=Pacific Giant Salamander; RSN=Rough Skinned Newt; STH=Steelhead Trout; YLF=Foothill Yellow Legged Frog.

* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
MICHAELS CREEK	41-29	7/30/2002	3	1		18	2	PGS
TRIB TO MICHAELS CREEK #1	41-30	8/15/1996						PGS
TRIB TO MICHAELS CREEK #1	41-30	6/14/2000	18	1		8		PGS
TRIB TO MICHAELS CREEK #1	41-30	7/30/2002	3	1		17		PGS
MICHAELS CREEK	41-31	8/15/1996	PRESENT	PRESENT	PRESENT			PGS RSN YLF
MICHAELS CREEK	41-31	6/14/2000	17					PGS
MICHAELS CREEK	41-31	7/30/2002				13		PGS
DOCTORS CREEK	41-32	7/19/1994	3	1				PGS
DOCTORS CREEK	41-32	7/8/1995	PRESENT	PRESENT		PRESENT		
DOCTORS CREEK	41-32	8/6/1996	PRESENT	PRESENT		PRESENT	PRESENT	PGS
DOCTORS CREEK	41-32	6/14/2000	15			3	1	PGS
DOCTORS CREEK	41-32	10/12/2001	5	1				PGS
DOCTORS CREEK	41-32	7/30/2002	9	2				PGS
DOCTORS CREEK	41-33	8/6/1996		PRESENT				PGS
DOCTORS CREEK	41-33	6/14/2000		1				PGS

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* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
DOCTORS CREEK	41-33	10/12/2001	6					
DOCTORS CREEK	41-33	7/30/2002		3				PGS
LYNCH CREEK	41-34	8/15/1996	PRESENT	PRESENT				PGS
LYNCH CREEK	41-34	6/14/2000						PGS
LYNCH CREEK	41-34	10/11/2001						PGS
LYNCH CREEK	41-34	7/30/2002						PGS
HOLLOW TREE CREEK	41-35	7/18/1994	30	2				
HOLLOW TREE CREEK	41-35	7/7/1995	PRESENT			PRESENT		CNT
HOLLOW TREE CREEK	41-35	8/5/1996	PRESENT	PRESENT				AMM LAM PGS RSN
HOLLOW TREE CREEK	41-35	6/13/2000	40	1		1		AMM PGS
HOLLOW TREE CREEK	41-35	9/27/2001	5	1		7		
WALDRON CREEK	41-36	7/18/1994	12	2				AMM PGS
WALDRON CREEK	41-36	7/8/1995	PRESENT	PRESENT				PGS
WALDRON CREEK	41-36	8/5/1996	PRESENT	PRESENT				PGS
WALDRON CREEK	41-36	6/14/2000	21	8				PGS

* Species Abbreviations; AMM=Pacific Lamprey Larvae; CDS=Clouded Salamander; CNT=California Newt; COH=Coho Salmon; CRY=Crayfish; LAM=Pacific Lamprey; NEW=Newt (Unidentified Species); PGS=Pacific Giant Salamander; RSN=Rough Skinned Newt; STH=Steelhead Trout; YLF=Foothill Yellow Legged Frog.

* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
WALDRON CREEK	41-36	9/27/2001	4		1			PGS
WALDRON CREEK	41-36	7/17/2002	4			10		PGS
WALDRON CREEK	41-37	7/18/1994	13	1				PGS
WALDRON CREEK	41-37	7/8/1995	PRESENT					PGS
WALDRON CREEK	41-37	8/5/1996	PRESENT	PRESENT				PGS
WALDRON CREEK	41-37	6/14/2000	11	3				PGS
WALDRON CREEK	41-37	9/27/2001	2					PGS
WALDRON CREEK	41-37	7/16/2002	1					PGS
WALDRON CREEK	41-38	7/18/1994						PGS
WALDRON CREEK	41-38	7/8/1995	PRESENT					PGS
WALDRON CREEK	41-38	8/5/1996	PRESENT	PRESENT	PRESENT			PGS
WALDRON CREEK	41-38	6/14/2000		2	1			CRY PGS
WALDRON CREEK	41-38	9/27/2001	1					PGS
WALDRON CREEK	41-38	7/16/2002			1			PGS
BEAR PEN CREEK	41-39	7/21/1994						PGS

* Species Abbreviations; AMM=Pacific Lamprey Larvae; CDS=Clouded Salamander; CNT=California Newt; COH=Coho Salmon; CRY=Crayfish; LAM=Pacific Lamprey; NEW=Newt (Unidentified Species); PGS=Pacific Giant Salamander; RSN=Rough Skinned Newt; STH=Steelhead Trout; YLF=Foothill Yellow Legged Frog.

* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
BEAR PEN CREEK	41-39	7/7/1995						PGS
BEAR PEN CREEK	41-39	8/6/1996						PGS
BEAR PEN CREEK	41-39	6/12/2000						PGS
BEAR PEN CREEK	41-39	9/24/2001						PGS
BEAR PEN CREEK	41-39	7/16/2002						PGS
HUCKLEBERRY CREEK	41-40	7/21/1994	10	2		10		AMM PGS
HUCKLEBERRY CREEK	41-40	7/7/1995	PRESENT			PRESENT		PGS
HUCKLEBERRY CREEK	41-40	8/5/1996	PRESENT			PRESENT		PGS
HUCKLEBERRY CREEK	41-40	6/12/2000	23	1	2	10	1	PGS
HUCKLEBERRY CREEK	41-40	9/24/2001	1	1	1	7	1	
HUCKLEBERRY CREEK	41-40	7/17/2002	2			10	1	PGS
BEAR WALLOW CREEK	41-41	7/21/1994	11	5		6		PGS
BEAR WALLOW CREEK	41-41	7/7/1995	PRESENT	PRESENT		PRESENT		PGS
BEAR WALLOW CREEK	41-41	8/5/1996	PRESENT			PRESENT		PGS
BEAR WALLOW CREEK	41-41	6/12/2000	32	1	1	27		PGS

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* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
BEAR WALLOW CREEK	41-41	9/13/2001	11	1				
BEAR WALLOW CREEK	41-41	7/17/2002	2	1		11		PGS
BEAR WALLOW CREEK	41-42	7/21/1994	17	2		14		PGS
BEAR WALLOW CREEK	41-42	7/7/1995	PRESENT	PRESENT		PRESENT		PGS
BEAR WALLOW CREEK	41-42	8/5/1996	PRESENT	PRESENT	PRESENT	PRESENT	PRESENT	PGS
BEAR WALLOW CREEK	41-42	6/12/2000	13	1		27		PGS
BEAR WALLOW CREEK	41-42	9/13/2001	4	1				PGS
BEAR WALLOW CREEK	41-43	7/7/1995	PRESENT	PRESENT		PRESENT		PGS
BEAR WALLOW CREEK	41-43	8/5/1996	PRESENT	PRESENT		PRESENT	PRESENT	PGS
BEAR WALLOW CREEK	41-43	6/12/2000	8	1				PGS
BEAR WALLOW CREEK	41-43	9/13/2001	6	3			1	PGS
BEAR WALLOW CREEK	41-43	7/17/2002		1	1	23		PGS
LITTLE BEAR WALLOW CREEK	41-44	7/21/1994		4			8	PGS
LITTLE BEAR WALLOW CREEK	41-44	7/7/1995						PGS
LITTLE BEAR WALLOW CREEK	41-44	8/5/1996	PRESENT			PRESENT		PGS

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* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
LITTLE BEAR WALLOW CREEK	41-44	6/12/2000	4			6	1	PGS
LITTLE BEAR WALLOW CREEK	41-44	9/13/2001	1					
LITTLE BEAR WALLOW CREEK	41-44	7/17/2002				13		PGS
HUCKLEBERRY CREEK	41-45	7/21/1994	3	3		18	6	
HUCKLEBERRY CREEK	41-45	7/7/1995	PRESENT	PRESENT		PRESENT		PGS
HUCKLEBERRY CREEK	41-45	8/5/1996	PRESENT	PRESENT	PRESENT	PRESENT	PRESENT	PGS
HUCKLEBERRY CREEK	41-45	6/12/2000				5	1	PGS
HUCKLEBERRY CREEK	41-45	9/13/2001	1				1	
HUCKLEBERRY CREEK	41-45	7/17/2002				13		PGS
BUTLER CREEK	41-46	7/22/1994	3	6		20		AMM PGS
BUTLER CREEK	41-46	7/7/1995	PRESENT			PRESENT		PGS RSN
BUTLER CREEK	41-46	8/6/1996	PRESENT	PRESENT		PRESENT	PRESENT	PGS
BUTLER CREEK	41-46	6/13/2000	36	1		16		AMM PGS RSN
BUTLER CREEK	41-46	9/24/2001	4		1	2	1	PGS
BUTLER CREEK	41-46	7/17/2002	1	1	1	11		CNT PGS

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* Blank spaces indicate that no organisms were observed.

Appendix F. Summary of results for aquatic species surveys within the Hollow Tree watershed. Refer to Map F-1.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
BUTLER CREEK	41-47	7/22/1994	14	3		17		PGS
BUTLER CREEK	41-47	7/7/1995	PRESENT	PRESENT	PRESENT	PRESENT		PGS
BUTLER CREEK	41-47	8/6/1996	PRESENT	PRESENT	PRESENT	PRESENT		PGS RSN
BUTLER CREEK	41-47	6/13/2000	59	4		22		PGS
BUTLER CREEK	41-47	9/24/2001	12	1			1	PGS
BUTLER CREEK	41-47	7/17/2002	6			15		
HOLLOW TREE CREEK	41-48	7/22/1994	3	1		26		CDS PGS
HOLLOW TREE CREEK	41-48	7/7/1995	PRESENT			PRESENT		LAM
HOLLOW TREE CREEK	41-48	8/6/1996	PRESENT			PRESENT	PRESENT	PGS
HOLLOW TREE CREEK	41-48	6/13/2000	13			6		PGS YLF
HOLLOW TREE CREEK	41-48	9/24/2001	1			10	4	
HOLLOW TREE CREEK	41-48	7/19/2002				18		CNT PGS
HOLLOW TREE CREEK	41-52	6/13/2000	33	4		3		PGS RSN
HOLLOW TREE CREEK	41-52	7/17/2002	7			6		PGS

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