CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT

Pena Creek

Report Revised April 14, 2006
Report Completed 2000
Assessment Completed 1998

INTRODUCTION

A stream inventory was conducted during the summer of 1998 on Pena Creek. The inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the amount and condition of available habitat to fish, and other aquatic species with an emphasis on anadromous salmonids in Pena Creek. The objective of the biological inventory was to document the salmonid and other aquatic species present and their distribution.

The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of habitat for Chinook salmon, coho salmon and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Pena Creek is a tributary to Dry Creek which flows into the Russian River, located in Sonoma County, California (see Pena Creek map, page 2). The legal description at the confluence with Dry Creek is T10N, R10W, S22. Its location is 38°42'07" N. latitude and 122°57'44" W. longitude. Year round vehicle access exists from Highway 101 near Healdsburg, via Westside Road, via West Dry Creek Road.

Pena Creek and its tributaries drain a basin of approximately 22.3 square miles. Pena Creek is a second order stream and has approximately 11.2 miles of blue line stream, according to the USGS Geyserville and Warm Springs Dam 7.5 minute quadrangles. Major tributaries include Pechaco Creek and Woods Creek and each are described in separate stream reports. Other major tributaries include Chapman Branch, Sweetwater Creek, and Redwood Log Creek and each are included in this report. An Unnamed Tributary to Sweetwater Creek was also habitat typed and is included in this report. Summer flow was measured as approximately 0.90 cfs at habitat unit #029 on September 8, 1998. Another flow was measured as approximately 1.08 cfs at approximately 100 feet downstream of the confluence with Chapman Branch on November 5, 1998. Elevations range from about 110 feet at the mouth of the creek to 1600 feet in the headwaters. Conifer forest dominates the upper watershed, but there are zones of grassland and oak-woodland in the lower watershed. The watershed is entirely owned privately and is managed for timber production, grazing, vineyard development and rural/residential development.

METHODS

The habitat inventory conducted in Pena Creek follows the methodology presented in the California

Salmonid Stream Habitat Restoration Manual (Flosi et al. 1998). The AmeriCorps Volunteers that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two person team and was supervised by Bob Coey, Russian River Basin Planner (DFG).

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the California Salmonid Stream Habitat Restoration Manual. This form was used in Pena Creek to record measurements and observations. There are nine components to the inventory form: flow, channel type, temperatures, habitat type, embeddedness, shelter rating, substrate composition, canopy, and bank composition.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated. Flows were also measured or estimated at major tributary confluences.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 1994). This methodology is described in the California Salmonid Stream Habitat Restoration Manual. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity.

3. Temperatures:

Water and air temperatures, and time, are measured by crew members with hand held thermometers and recorded at each tenth unit typed. Temperatures are measured in Fahrenheit at the middle of the habitat unit and within one foot of the water surface. Temperatures are also recorded using remote Temperature recorders which log temperature every two hours, 24 hours/day.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1988). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "DRY". Pena Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All unit lengths were measured, additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were completely sampled (length, mean width, mean depth, maximum depth

and pool tail crest depth). All measurements were in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Pena Creek, embeddedness was visually estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3), 76 - 100% (value 4) or "not suitable" (value 5) was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, having a bedrock tail-out, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All shelter is then classified according to a list of nine shelter types. In Pena Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the shelter. The shelter rating is calculated for each habitat unit by multiplying shelter value and percent covered. Thus, shelter ratings can range from 0-300, and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully measured habitat units, dominant and sub-dominant substrate elements were visually estimated using a list of seven size classes.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the California Salmonid Stream Habitat Restoration Manual, 1998. Canopy density relates to the amount of stream shaded from the sun. In Pena Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated visually into percentages of evergreen or deciduous trees.

9. Bank Composition:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Pena Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully measured unit were selected from the habitat inventory

form. Additionally, the percent of each bank covered by vegetation was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, 3) electrofishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE IV data entry program developed CDFG. This program processes and summarizes the data, and produces the following tables and appendices:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Shelter by habitat types
- Dominant substrates by habitat types
- Vegetative cover and dominant bank composition
- Fish habitat elements by stream reach

Graphics are produced from the tables using Lotus 1,2,3. Graphics developed for Pena Creek include:

- Level II Habitat Types by % Occurrence and % Total Length
- Level IV Habitat Types by % Occurrence
- Pool Habitat Types by % Occurrence
- Maximum Depth in Pools
- Pool Shelter Types by % Area
- Substrate Composition in Low Gradient Riffles
- Percent Cobble Embeddedness by Reach
- Mean Percent Canopy
- Mean Percent Canopy by Reach
- Percent Bank Composition and Bank Vegetation

HISTORICAL STREAM SURVEYS:

On July 26, 1944 the Department of Fish and Game inspected Pena Creek and found the creek particularly dry. It was noted that the creek drys from the mouth to the foothills early and consequently many fish perish. Pena Creek was observed to be a fine spawning stream and a good creek for rescue work.

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of Pena Creek was conducted from August 24 to September 30, 1998 by Dez Mikkelsen, Marc Miller, Simone Watts (AmeriCorps), and Stephanie Carey (DFG) with supervision and analysis by CDFG. The survey began at the confluence with Dry Creek and extended up Pena Creek to the end of landowner access permission. The total length of the stream surveyed was 50413 feet, with an additional 364 feet of side channel.

A flow of 0.90 cfs was measured September 8, 1998 at habitat unit #029 (above West Dry Creek Rd.) with a Marsh-McBirney Model 2000 flowmeter. Another flow was measured as 1.08 cfs on November 5, 1998 approximately 100 feet downstream of the confluence with Chapman Creek.

This section of Pena Creek has three channel types: from the mouth to 13618 feet an F4; next 672 feet an F1 and the upper 36123 feet an F4.

F4 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly gravel substrate. F1 channel types are similar with a predominantly bedrock substrate.

Water temperatures ranged from 56°F to 78°F. Air temperatures ranged from 45°F to 96°F. Summer temperatures were also measured using remote temperature recorders placed in pools (see Temperature Summary graphs at end of report). A recorder placed at West Dry Creek Road Bridge in Reach 1 logged temperatures every 2 hours from July 13 - September 3, 1998. The highest temperature recorded was 80°F in July and the lowest was 59°F at the end of August. This reach dried up in September 1998. Another recorder placed near habitat unit #300 in Reach 3 logged temperatures from July 15 - September 24, 1998. The highest temperature recorded was 84°F in July and the lowest was 62°F in September.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 39% pool units, 37% flatwater units, 23% riffle units, and 1% dry streambed units. Based on total **length** there were 39% flatwater units, 29% pool units, 20% riffle units, and 13% dry streambed units (Graph 1).

Four hundred eighty-two habitat units were measured and 17% were completely sampled. Fourteen Level IV habitat types were identified. The data is summarized in Table 2. The most frequent habitat types by percent **occurrence** were low gradient riffles at 23%, runs 20%, glides 15% and bedrock scour pools 14% (Graph 2). By percent total **length**, runs made up 20%, low gradient riffles 20%, glides 17%, and dry streambed 13%.

One hundred eighty-nine pools were identified (Table 3). Scour pools were most often encountered at 72%, and comprised 72% of the total length of pools (Graph 3).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. One hundred forty two of the 189 pools (75%) had a depth of two feet or greater (Graph 4). These deeper pools comprised 23% of the total length of stream habitat.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Pool types had the highest shelter rating at 24. Riffle had the lowest rating with 4 and flatwater rated 18 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 60, scour pools rated 25, and main channel pools rated 20 (Table 3).

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were boulders at 37%, terrestrial vegetation 18%, root masses 13%, and undercut banks 8%. Graph 5 describes the pool shelter in Pena Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in ten of the fourteen low gradient riffles measured. Small cobble was dominant in two of the low gradient riffles (Graph 6).

No mechanical gravel sampling was conducted in 1998 surveys due to inadequate staffing levels.

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 188 pool tail-outs measured, 26 had a value of 1 (14%); 62 had a value of 2 (33%); 51 had a value of 3 (27%); and 39 had a value of 4 (21%). Ten (5%) pool tail-outs rated a 5 (unsuitable substrate type for spawning). On this scale, a value of one is best for fisheries. Sand and gravel was the dominant substrate observed at pool tail-outs.

The mean percent canopy density for the stream reach surveyed was 49%. The mean percentages of deciduous and evergreen trees were 66% and 33%, respectively. Graph 8 describes the canopy for the entire survey.

For the entire stream reach surveyed, the mean percent right bank vegetated was 54% and the mean percent left bank vegetated was 49%. For the habitat units measured, the dominant vegetation types for the stream banks were: 48% deciduous trees, 22% brush, 16% evergreen trees, 13% grass and 1% bare soil. The dominant substrate for the stream banks were: 42% silt/clay/sand, 33% bedrock, 19% cobble/gravel and 6% boulder (Graph 10).

HABITAT INVENTORY RESULTS FOR CHAPMAN BRANCH

The habitat inventory of Chapman Branch was conducted on October 15, 1998 by Dez Mikkelsen (AmeriCorps) and Stephanie Carey (DFG) with supervision and analysis by CDFG. The survey began at the confluence with Pena Creek and extended up Chapman Branch to a log jam. The total length of the stream surveyed was 1717 feet, with an additional 11 feet of side channel.

Flows were not measured on Chapman Branch.

This section of Chapman Branch has one channel type: from the mouth to 1717 feet a G3. G3 channel types are characterized as well entrenched "gully" step-pool channels with a low width/depth ratio, a moderate gradient (2-4%) and a predominantly cobble substrate.

Water temperatures and air temperatures were not taken during the habitat typing survey. However, during the general survey that was conducted on November 5, 1998 above the log jam, the water temperature was 51 ℉ and the air temperature was 58 ℉.

*Based on frequency of **occurrence** there were 39% pool units, 33% flatwater units, and 28% riffle units. Based on total **length** there were 44% flatwater units, 29% riffle units, and 27% pool units.*

*The most frequent habitat types by percent **occurrence** were low gradient riffles at 28%, step runs 20%, mid-channel pools 11%, and runs 9%. By percent total **length**, step runs made up 33%, low gradient riffles 29%, step pools 10%, and runs 9%. Scour pools were most often encountered at 52%, and comprised 40% of the total length of pools.*

Three of the 21 pools (14%) had a depth of two feet or greater. These deeper pools comprised 3% of the total length of stream habitat.

Pool types had the highest shelter rating at 26. Riffles had the lowest rating with 0 and flatwater rated 6. Of the pool types, the scour pools had the highest mean shelter rating at 34 and main channel pools rated 17. By percent area, the dominant pool shelter types were undercut banks at 42%, boulders 22%, small woody debris 13%, and large woody debris 9%.

Of the 20 pool tail-outs measured, two had a value of 1 (10%); four had a value of 2 (20%); five had a value of 3 (25%); and zero had a value of 4 (0%). Nine (45%) pool tail-outs rated a 5 (unsuitable substrate type for spawning). Cobble was the dominant substrate observed at pool tail-outs.

The mean percent canopy density for the stream reach surveyed was 95%. The mean percentages of deciduous and evergreen trees were 58% and 43%, respectively.

The mean percent right bank vegetated was 45% and the mean percent left bank vegetated was 44%. (the dominant vegetation types for the stream banks were: 48% deciduous trees, 33% evergreen trees, 11% brush, and 7% bare soil; dominant substrate for the stream banks were: 79% silt/clay/sand, 11% bedrock, and 11% cobble/gravel).

A general survey of Chapman Branch was conducted on November 5, 1998 starting upstream of the log jam, which is a complete barrier, in habitat unit #053 and ending approximately 4000 feet upstream. The purpose was to establish conditions upstream of the barrier. Three log jams and a natural cascade were observed above the log jam at habitat unit #053. Two of the log jams and the cascade were noted to be possible fish barriers. A wet tributary was observed entering on the right

bank with a water temperature of 52 ℉. Between log jams and their associated gravel bars, pool and riffle habitat was good. Many 2'+ deep pools were observed with good cover. In a few areas sediment, mostly silt, was deep and difficult to walk through. The sediment source appears to be from old, unused logging roads. Canopy is good, but not as good as the habitat typed section of creek. No fish were observed during the general survey, but one pacific giant salamander and one unidentified frog was observed.

HABITAT INVENTORY RESULTS FOR SWEETWATER CREEK

The habitat inventory of Sweetwater Creek was conducted on November 4, 1998 by Paul Retherford and Chris Ramsey (AmeriCorps) with supervision and analysis by CDFG. The survey began at the confluence with Pena Creek and extended up Sweetwater Creek to a log jam. The total length of the stream surveyed was 2316 feet, with an additional 109 feet of side channel.

A flow of 0.06 cfs was measured November 4, 1998 at habitat unit #001, approximately twenty-four feet upstream of the confluence with Pena Creek with a Marsh-McBirney Model 2000 flowmeter. This section of Sweetwater Creek has 1 channel type: from the mouth to 2316 feet a B3. B3 channel types are moderately entrenched, moderate gradient (2-4%), riffle dominated channels, with infrequently spaced pools, a very stable plan and profile, stable banks and have a predominantly cobble substrate.

Water temperatures ranged from 52 ℉ to 54 ℉. Air temperatures ranged from 54 ℉ to 60 ℉.

Based on frequency of ***occurrence*** *there were 48% flatwater units, 31% pool units, and 19% riffle units. Based on total* ***length*** *there were 74% flatwater units, 15% pool units, and 10% riffle units. The most frequent habitat types by percent* ***occurrence*** *were step runs at 34%, low gradient riffles 19%, runs 15% and mid-channel pools 11%. By percent total* ***length****, step runs made up 63%, runs 12%, low gradient riffles 10%, and mid-channel pools 5%.*

Scour pools were most often encountered at 63%, and comprised 64% of the total length of pools. Four of the 19 pools (21%) had a depth of two feet or greater. These deeper pools comprised 3% of the total length of stream habitat.

Pool types had the highest shelter rating at 40. Riffle had the lowest rating with 5 and flatwater rated 8. Of the pool types, the scour pools had the highest mean shelter rating at 46 and main channel pools rated 10. By percent area, the dominant pool shelter types were undercut banks at 49%, large woody debris 21%, bedrock ledges 16%, and boulders 10%.

Of the 19 pool tail-outs, four had a value of 3 (21%) and fifteen (79%) pool tail-outs rated a 5 (unsuitable substrate type for spawning). Cobble was the dominant substrate observed at pool tail-outs.

The mean percent canopy density for the stream reach surveyed was 89%. The mean percentages of deciduous and evergreen trees were 70% and 30%, respectively.

The mean percent right bank vegetated was 56% and the mean percent left bank vegetated was 53% (dominant vegetation types for the stream banks were: 38% deciduous trees, 25% bare soil, 17% brush, 13% evergreen trees and 8% grass; dominant substrate for the stream banks were: 71% silt/clay/sand, 17% bedrock, 8% boulder and 4% cobble/gravel).

HABITAT INVENTORY RESULTS FOR THE UNNAMED TRIBUTARY TO SWEETWATER CREEK

The survey began at the confluence with Sweetwater Creek and extended up the unnamed tributary to a rock falls (1062 feet).

Flow was estimated to be <0.01 cfs during the survey period on the unnamed tributary of Sweetwater Creek.

This section of the Unnamed Tributary of Sweetwater Creek has one channel type: from the mouth to 1062 feet an A3. A3 channel types are steep (4-10%), narrow, cascading, step-pool streams with a high energy/debris transport associated with depositional soils and a predominantly cobble substrate.

Water temperatures ranged from 54 ℉ to 64 ℉. Air temperatures ranged from 66 ℉ to 68 ℉.

*Based on total **length** there were 40% dry streambed units, 35% flatwater units, 19% riffle units, and 5% pool units.*

Pool types had the highest shelter rating at 8. Riffle had the lowest rating with 0 and flatwater rated 3. By percent area, the dominant pool shelter types were bedrock ledges at 59%, boulders 37%, and small woody debris 4%.

Of the four pool tail-outs, one had a value of 4 (25%), three (75%) pool tail-outs rated a 5 (unsuitable substrate type for spawning). Cobble was the dominant substrate observed at pool tail-outs.

The mean percent canopy density for the stream reach surveyed was 86%. The canopy was comprised entirely (100%) of deciduous trees.

HABITAT INVENTORY RESULTS FOR Redwood Log Creek

The survey began at the confluence with Pena Creek and extended up Redwood Canyon to the end of survey (3094 feet).

Flow was estimated to be <0.01 cfs during the survey period on Redwood Log Creek.

This section of Redwood Canyon has one channel type: from the mouth to 3094 feet a G3. G3 channel types are characterized as well entrenched "gully" step-pool channels with a low

width/depth ratio, a moderate gradient (2-4%) and a predominantly cobble substrate.

Water temperatures ranged from 55°F to 57°F. Air temperatures ranged from 60°F to 64°F.

Based on frequency of occurrence there were 43% dry streambed units, 30% flatwater units, and 26% pool units. Based on total length there were 69% dry streambed units, 28% flatwater units, and 3% pool units.

The most frequent habitat types by percent occurrence were dry streambed at 43%, step runs 30%, mid-channel pools 22% and plunge pools 4%. By percent total length, dry streambed made up 69%, step runs 28%, and mid-channel pools 2%.

One of the six pools (17%) had a depth of two feet or greater.

Pool types had the highest shelter rating at 12 and flatwater rated 0. Of the pool types, the main channel pools had the highest mean shelter rating at 13 and scour pools rated 10. By percent area, the dominant pool shelter types were large woody debris at 51%, boulders 43%, and bedrock ledges 6%.

Of the six pool tail-outs measured, five had a value of 2 (83%) and one had a value of 3 (17%). Gravel was the dominant substrate observed at pool tail-outs.

The mean percent canopy density for the stream reach surveyed was 95% (deciduous and evergreen trees were 51% and 50%). The mean percent right bank vegetated was 33% and the mean percent left bank vegetated was 52% (dominant vegetation types for the stream banks were: 60% bare soil, 30% brush, and 10% evergreen trees; dominant substrate for the stream banks were: 50% boulder and 50% silt/clay/sand).

BIOLOGICAL INVENTORY

JUVENILE SURVEYS: (Pena Creek)

During the July 1944 survey, a few pools with fish were observed around the foothills, but most of the fish were dead. It was noted that these fish were the finest fish seen during the season, ranging from three to four inches in length.

In July 6, 1960 rotenone sampling with use of potassium permanganate was conducted in Pena Creek. The object of conducting rotenone sampling with the use of potassium permanganate as a neutralizer was to perfect a method of treatment that could be used in the rough fish sampling of the Russian River basin. The flow was estimated to be 2.5 cfs. The air temperature was 84.6°F and the water temperature was 76°F. The approximate number of fishes present were 400 steelhead fish of the year, 6 juvenile steelhead, 20 roach 2-4 inches in length and 10 suckers 3-7 inches in length. After the survey, it was recommended that further studies be conducted before rotenone with potassium permanganate as a neutralizer is used as the basic method of fish sampling due to the fact

that the potassium permanganate did not neutralize the rotenone and young of the year steelhead were affected and/or killed by the rotenone.

In September 1963 a biological inventory was conducted by using chemical treatment in order to document fish species distribution. One hundred eighty-four steelhead were observed along with 148 roach, 83 suckers, 21 pike minnow, and 32 sculpin.

On May 2, 1964 a brief reconnaissance was conducted in the upper section of Pena Creek. The flow was estimated at 5 cfs. The air temperature was 56°F and the water temperature was 55°F. A tremendous amount of newly emerged steelhead were observed along with a few pockets of adult size roach. There were not any pike minnow observed.

On October 18-20, 1965 a biological inventory was conducted by using chemical treatment and/or visual estimates to document fish species distribution in six sections of Pena Creek. At the first station, starting at the headwaters and ending at the small dam approximately 300 yards downstream, 380 rainbow trout/steelhead were observed along with 3750 roach and 41 suckers. At the second station, starting at the small dam approximately 300 yards below the headwaters, 1890 rainbow trout/steelhead were observed along with 11,110 roach, 23 sculpin, and 87 suckers. In the third station, 64 rainbow trout/steelhead were observed along with 606 roach, 5 suckers, and one sculpin. In the fourth station, 97,332 rainbow trout/steelhead were observed along with 22,855 roach, 1238 suckers, 318 sculpin, 2350 stickleback, 50 pike minnow, and 45 green sunfish. In the fifth station, 176 rainbow trout/steelhead were observed along with 76 roach, 70 suckers, 34 sculpin, and 136 stickleback. In the sixth station, which ended at the mouth of Pena Creek, 1056 rainbow trout/steelhead were observed along with 1936 roach, 497 stickleback, 466 suckers, 70 sculpin, and 13 green sunfish.

On June 20, 1968 Pena Creek was checked for the presence of juvenile silver salmon. Steelhead, roach, and suckers were observed, however, no silver salmon were observed during the survey.

On October 20 and 26, 1998 a recent biological inventory was conducted in three sites of Pena Creek to document the fish species composition and distribution at several locations. Each site was single pass electrofished using one Smith Root Model 12 electrofisher. Fish from each site were counted by species, and returned to the stream. The air temperature ranged from 62°F to 74°F and the water temperatures ranged from 51°F to 52°F. The observers were Dez Mikkelsen, Marc Miller (AmeriCorps), and Bob Coey (DFG).

The inventory of Reach 3 started 850 feet downstream of the Chapman Branch Creek confluence and ended approximately 335 feet upstream. In pool, run, and riffle habitat types 67 0+, 6 1+, and 2 2+ steelhead were observed along with 30 sculpin, many roach, and 11 yellow-legged frogs.
The inventory of Reach 3 was continued starting at habitat unit #347 and ending approximately 737 feet upstream. In pool, run, and riffle habitat types 121 0+, 4 1+, and 2 2+ steelhead were observed along with many sculpin, many roach, and two unidentified frogs.

The inventory of Reach 3 was continued starting 75 feet downstream of the confluence with

Redwood Log Creek and ending approximately 690 feet upstream. In pool, run, and riffle habitat types 163 0+, 7 1+, and 2 2+ steelhead were observed along with 30 sculpin, many roach, and one unidentified frog.

Juvenile Survey: Chapman Branch

On October 20, 1998 a recent biological inventory was conducted in two sites of Chapman Branch to document the fish species composition and distribution at several locations. Each site was single pass electrofished using one Smith Root Model 12 electrofisher. Fish from each site were counted by species, and returned to the stream. The air temperature was 80°F and the water temperature was 50°F. The observers were Dez Mikkelsen, Simone Watts (AmeriCorps), and Bob Coey (DFG).

The inventory of Reach 1 was started at the road crossing in habitat unit #007 and continued upstream for approximately 392 feet. In riffle, run, and pool habitat types 35 0+ and one 1+ steelhead were observed along with nine sculpin and fifteen yellow-legged frogs. The crew observed that there was good habitat available for 0+ steelhead, but very little habitat available for 1+ steelhead.

The next inventory consisted of spot checking pools upstream of the habitat unit #053 where a log jam impedes further fish passage. Four yellow-legged frogs and two pacific giant salamanders were observed, however, no salmonids or rainbow trout were observed above the log jam.

A biological inventory was not conducted in Redwood Log Creek, Sweetwater Creek, and the tributary to Sweetwater Creek due to inadequate staffing levels. However, during the habitat inventory of Sweetwater Creek, salmonids, crayfish, newts, and frogs were observed. Frogs and salamanders were also observed in Redwood Log Creek and yellow-legged frogs were observed in the unnamed tributary to Sweetwater Creek.

A summary of historical and recent data collected appears in the table below.

Table 1. Species Observed in Historical and Recent Surveys

YEARS	SPECIES	SOURCE	Native/Introduced
1960,1963,1964, 1965,1968, 1998	Steelhead	DFG	N
1963, 1965	Pike Minnow	DFG	N
1963,1965,1998	Sculpin	DFG	N
1960,1963,1964, 1965,1968,1998	Roach	DFG	N

Table 1. Species Observed in Historical and Recent Surveys

YEARS	SPECIES	SOURCE	Native/Introduced
1960,1963,1965, 1968,1998	Sacramento Sucker	DFG	N
1965,1998	Three-spine Stickleback	DFG	N
1998	Pacific Giant Salamander	DFG	N
1998	Crayfish	DFG	N
1998	California Newt	DFG	N
1998	Yellow-legged Frog	DFG	N
1965	Green Sunfish	DFG	I

Historical records reflect that fish rescue/transfer operations occurred from Pena Creek in 1955-1971. Historical records reflect that fish rescue/transfer operations occurred into Pena Creek in 1958, 1960, 1968, 1982, 1983, and 1986.

Table 2. Summary of fish rescue/transfer operations to and from Pena Creek

YEAR	LOCATION	SOURCE	SPECIES	#	SIZE
1955	Russian River	Pena Creek	SH	34702	FING
1955	Russian River	Pena Creek	SH	2	YEAR
1956	Russian River	Pena Creek	SH	37932	FING
1957	Russian River	Pena Creek	SH	54327	FING
1958	Pena Creek	Pena Creek	SH	1442	FING
1958	Warm Springs Creek	Pena Creek	SH	3453	FING
1959	Big Sulphur Creek	Pena Creek	SH	46592	FING
1959	Pena Creek	Pena Creek	SH	12854	FING
1960	Little Sulphur Creek	Pena Creek	SH	27492	FING
1960	Pena Creek	Pena Creek	SH	10833	FING

Table 2. Summary of fish rescue/transfer operations to and from Pena Creek					
1961	Little Sulphur Creek	Pena Creek	SH	13197	FING
1962	Big Sulphur Creek	Pena Creek	SH	5460	FING
1962	Little Sulphur Creek	Pena Creek	SH	26051	FING
1963	Big Sulphur Creek	Pena Creek	SH	5622	FING
1964	Russian River	Pena Creek	SH	37197	FING
1965	Russian River	Pena Creek	SH	35682	FING
1966	Russian River	Pena Creek	SH	61642	FING
1967	Russian River	Pena Creek	SH	10650	FING
1968	Pena Creek	Pena Creek	SH	1680	FING
1968	Russian River	Pena Creek	SH	12120	FING
1969	Russian River	Pena Creek	SH	8511	FING
1970	Russian River	Pena Creek	SH	9340	FING
1971	Russian River	Pena Creek	SH	1232	FING
1982	Pena Creek	Dry Creek	SH	16280	FING
1983	Pena Creek	Dry Creek	SH	9800	FING
1986	Pena Creek	Dry Creek	SH	9200	FING

SH = steelhead

ADULT SURVEYS:

A field note taken on April 29, 1964 discussed a Pena Creek landowners' observation of more than 100 adult steelhead spawning in the section approximately three miles upstream from the confluence with Dry Creek approximately two months prior.

In March 1984 and July 1984, a fish passage project consisting of removing a log jam determined to be a barrier on Pena Creek was sponsored by the California Department of Fish and Game. The jam was located just upstream of the confluence with Redwood Log Creek on the Passalaqua property and was impounding large quantities of gravel. It was noted that adult steelhead were observed below the barrier in the early spring of 1984. Hand labor was utilized in the removal of 385 cubic yards of material. The removal of the log jam opened up 2.5 miles of stream.

No spawning/carcass surveys were conducted in 1998/1999 due to inadequate staffing levels.

DISCUSSION

Pena Creek has two channel types and three reaches: F4 (13618 ft.), F1 (672 ft.) and F4 (36123 ft.).

There are 49741 feet of F4 channel type in Reach 1 and Reach 3. According to the DFG Salmonid Stream Habitat Restoration Manual, F4 channel types are good for bank-placed boulders and fair for low-stage weirs, single and opposing wing-deflectors, channel constrictors and log cover.

There are 672 feet of F1 channel type in Reach 2. According to the DFG Salmonid Stream Habitat Restoration Manual, F1 channel types are good for bank-placed boulders and fair for single wing-deflectors and log cover.

Any work considered will require careful design, placement, and construction that must include protection for any unstable banks.

The water temperatures recorded on the survey days 08/24/98 to 09/30/98 ranged from 56°F to 78°F. Air temperatures ranged from 45°F to 96°F. The warmer water temperatures were recorded in Reach 1. These temperatures, if sustained, are above the threshold stress level (65°F) for salmonids.

Summer temperatures measured using remote temperature recorders placed in pools ranged from 59° to 80°F for Reach 1 and 62° to 84°F for Reach 3. The Temperature Summary graph shows that for much of the summer (July through August) the lower and upper watersheds exhibited temperatures above the optimal for salmonids.

It is unknown if this thermal regime is typical, but our electrofishing samples found steelhead more frequently in the upper, cooler sample sites. To make any further conclusions, temperatures need to be monitored for a longer period of time through the critical summer months, and more extensive biological sampling conducted.

Pools comprised 29% of the total **length** of this survey. In first and second order streams a primary pool is defined to have a maximum depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. In Pena Creek, the pools are relatively deep with 75% having a maximum depth of at least 2 feet. These pools comprised 23% of the total length of stream habitat. In coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat length.

The mean shelter rating for pools was 24. However, a pool shelter rating of approximately 80 is desirable. The relatively small/moderate/large amount of pool shelter that now exists is being provided primarily by boulders (37%), terrestrial vegetation (18%), root masses (13%), and undercut banks (8%).Log and root wad cover in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Log cover provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Twelve of the 14 low gradient riffles measured (86%) had either gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

Forty-eight percent of the pool tail-outs measured had embeddedness ratings of either 3 or 4. Only 14% had a rating of 1. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. In a reach comparison, Reach 1 had the best ratings and Reach 3 had the poorest ratings. Reach 2 is unsuitable for spawning due to the natural geomorphology of the reach.

The higher the percent of fine sediment, the lower the probability that eggs will survive to hatch. This is due to the reduced quantity of oxygenated water able to percolate through the gravel, or because of fine sediment capping the redd and preventing fry emergence. In Pena Creek, although Reach 1 had better ratings than Reach 3, both reaches had poor embeddedness ratings and should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean percent canopy for the survey was 49%. This is a very low percentage of canopy, since 80 percent is generally considered desirable. Cooler water temperatures are desirable in Pena Creek. Elevated water temperatures could be reduced by increasing stream canopy. The large trees required for adequate stream canopy would also eventually provide a long term source of large woody debris needed for instream shelter and bank stability.

The riparian buffer is thin or nearly absent in areas with livestock and agricultural development. Riparian removal/intensive grazing/vineyard development within the riparian corridor all leads to less stream canopy and channel migration causing bank erosion and higher water temperatures.

DISCUSSION OF CHAPMAN BRANCH

Chapman Branch has one channel type: G3 (1717 ft.).

There are 1717 feet of G3 channel type in Reach 1. According to the DFG Salmonid Stream Habitat Restoration Manual, G3 channel types are good for bank-placed boulders and fair for low-stage weirs, opposing wing-deflectors and log cover.

The water temperature recorded during the general survey on November 5, 1998 was 51 °F and the air temperature was 58 °F. This temperature regime is favorable to salmonids.

*Pools comprised 27% of the total **length** of this survey. In first and second order streams a primary pool is defined to have a maximum depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. In Chapman Branch, the pools are relatively shallow with 14% having a maximum depth of at least 2 feet. These pools comprised 3% of the total length of stream habitat.*

The mean shelter rating for pools was 26. However, a pool shelter rating of approximately 80 is

desirable. The relatively small amount of pool shelter that now exists is being provided primarily by undercut banks (42%), boulders (22%), small woody debris (13%), and large woody debris (9%). Log and root wad cover in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Log cover provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

One of the two low gradient riffles measured (50%) had either gravel or small cobble as the dominant substrate. This is generally considered fair for spawning salmonids.

Twenty-five percent of the pool tail-outs measured had embeddedness ratings of either 3 or 4. Only 10% had a rating of 1. Approximately 50% of the pool tail-outs measured rated a 5 which is considered unsuitable for spawning due to the natural geomorphology.

The mean percent canopy for the survey was 95%. This is very good, since 80 percent is generally considered desirable.

DISCUSSION OF SWEETWATER CREEK

Sweetwater Creek has one channel type: B3 (2316 ft.).

There are 2316 feet of B3 channel type in Reach 1. According to the DFG Salmonid Stream Habitat Restoration Manual, B3 channel types are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors and log cover. They are also good for medium-stage plunge weirs.

The water temperatures recorded on the survey day November 4, 1998 ranged from 52°F to 54°F. Air temperatures ranged from 54°F to 60°F. This temperature regime is favorable to salmonids.

*Pools comprised 15% of the total **length** of this survey. In Sweetwater Creek, the pools are relatively shallow with 21% having a maximum depth of at least 2 feet. These pools comprised 3% of the total length of stream habitat.*

The mean shelter rating for pools was 40. However, a pool shelter rating of approximately 80 is desirable. The relatively small amount of pool shelter that now exists is being provided primarily by undercut banks (49%), large woody debris (21%), bedrock ledges (16%), and boulders (10%).

None of the two low gradient riffles measured (0%) had either gravel or small cobble as the dominant substrate. This is generally considered poor for spawning salmonids.

Twenty-one percent of the pool tail-outs measured had embeddedness ratings of either 3 or 4. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. The majority of the reach was determined to be unsuitable for spawning due to the natural geomorphology of the reach.

The mean percent canopy for the survey was 89%. This is very good, since 80 percent is generally considered desirable.

DISCUSSION OF THE UNNAMED TRIBUTARY TO SWEETWATER CREEK

The Unnamed Tributary to Sweetwater Creek has one channel type: A3 (1062 ft.).

There are 1062 feet of A3 channel type in Reach 1. According to the DFG Salmonid Stream Habitat Restoration Manual, A3 channel types are good for bank-placed boulders and fair for low-stage weirs, opposing wing-deflectors and log cover.

The water temperatures recorded on the survey day November 4, 1998 ranged from 54 ℉ to 64 ℉. Air temperatures ranged from 66 ℉ to 68 ℉. This temperature regime is favorable to salmonids.

*Pools comprised 5% of the total **length** of this survey.*

The mean shelter rating for pools was 8. The relatively small amount of pool shelter that now exists is being provided primarily by bedrock ledges (59%), boulders (37%), and small woody debris (4%).

The mean percent canopy for the survey was 86%. This is good, since 80 percent is generally considered desirable.

DISCUSSION OF Redwood Log Creek

Redwood Canyon has one channel type: G3 (3094 ft.).

There are 3094 feet of G3 channel type in Reach 1. According to the DFG Salmonid Stream Habitat Restoration Manual, G3 channel types are good for bank-placed boulders and fair for low-stage weirs, opposing wing-deflectors and log cover.

The water temperatures recorded on the survey day November 3, 1998 ranged from 55 ℉ to 57 ℉. Air temperatures ranged from 60 ℉ to 64 ℉. This temperature regime is favorable to salmonids.

*Pools comprised 3% of the total **length** of this survey. In Redwood Canyon, the pools are relatively shallow with 17% having a maximum depth of at least 2 feet.*

The mean shelter rating for pools was 12. The relatively small amount of pool shelter that now exists is being provided primarily by large woody debris (51%), boulders (43%), and bedrock ledges (6%).

Seventeen percent of the pool tail-outs measured had embeddedness ratings of either 3 or 4.

The mean percent canopy for the survey was 95%. This is very good, since 80 percent is generally

considered desirable.

SUMMARY

The 1998 spring surveys documented many 0+ fish indicating successful spawning in the lower reaches of Pena Creek. However, few 1+ fish were observed indicating good/poor rearing conditions the year before or poor holding-over conditions in general. Habitat conditions upstream of our survey reach are unknown due to uncooperative ownership. Overall, habitat conditions for both steelhead and coho have declined over time.

GENERAL MANAGEMENT RECOMMENDATIONS

Pena Creek should be managed as an anadromous, natural production stream.

Recent winter storms brought down many large trees and other woody debris into the stream, which increased the number and quality of pools since the drought years. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. Signs of recent and historic tree and log removal were evident in the active channel during our survey. Efforts to increase flood protection or improve fish access in the short run, have led to long term problems in the system. Landowners should be sensitive about the natural and positive role woody debris plays in the system, and encouraged not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

PRIORITY FISHERY ENHANCEMENT OPPORTUNITIES

1) Access for migrating salmonids is an ongoing potential problem in Pena Creek tributaries, therefore, fish passage should be improved where possible. There are several log debris accumulations present on Chapman Branch, Sweetwater and Redwood Canyon that have the potential for being barriers. The modification of these debris accumulations is recommended at this time, but it must be done carefully to preserve existing habitat provided by the woody debris.

2) Reach 3 is being impacted from livestock in the riparian zone. Livestock in streams generally inhibit the growth of new trees, exasperate erosion, and reduce summertime survival of juvenile fish by defecating in the water. Alternatives to limit cattle access, control erosion and increase canopy, should be explored with the landowner, and developed if possible.

3) In Pena Creek watershed, active and potential sediment sources related to the road system need to be mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

4) Map sources of upslope landslides and in-channel erosion, and prioritize them according to present and potential sediment yield in Pena Creek and its tributaries. Identified sites should

then be treated to reduce the amount of fine sediments entering the stream. Near-stream riparian planting along any portion of the stream should be encouraged to provide bank stability and a buffering against agricultural, grazing and urban runoff.

5) Increase the canopy on Pena Creek by planting willow, alder, oak and Douglas fir along the stream where shade canopy is not at acceptable levels. The reach above the survey section should be assessed for planting and treated as well, since water temperatures throughout are effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

6) Reaches 1 and 3 would benefit from the utilizing bio-technical vegetative techniques to re-establish floodplain benches and a defined low flow channel. This would discourage lateral migration of the base flow channel and decrease bank erosion.

7) Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream and its tributaries. Most of the existing >shelter is from vegetation and undercut banks. Adding high quality complexity with larger woody cover is desirable. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool locations in the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion (Reach 1).

8) Where feasible, design and engineer pool enhancement structures to increase the number of pools in the upper reaches. This must only be done where the banks are stable (Reaches 2 and 3) or in conjunction with stream bank armor to prevent erosion (Reach 1).

PROBLEM SITES AND LANDMARKS - PENA CREEK SURVEY COMMENTS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

Habitat Unit #	Stream Length(ft)	Comments
1.00	76	Water not flowing at the mouth. Dry Creek is probably backed up into Pena, creating residual pools with many roach and sucker fish. several dead sculpin sighted.
2.00	146	Automobiles at LB-signs of an old attempt at bank stabilization. dead sculpin and crayfish observed in pools.
4.00	294	Nice pool-good for summering fish.
5.00	1160	At 39feet, cement weir goes halfway across channel at the l/b. large clump of *Arundo donax* at RB. Road crossing crosses creek. banks vegetated with mostly willow, also oaks.
6.00	1307	A shallow pool w/ fish. probably roach and suckers. 1 dead 0 + SHD.
8.00	1548	Culvert at RB.

12.00	1798	Stream under thicket of willow.
14.00	7106	Bridge #1. approximately 600 feet up from West Dry Creek bridge is a culvert at RB, three feet up from the bed of creek. road crossing at top of unit. road in stream bed for approx. three hundred feet.
15.00	7195	Vineyards at LB. 2plus SHD observed.
17.00	7374	Tire tracks in creekbed. dead stickleback.
18.00	7498	Steep eroding bank at LB. 60feet H by 40feet long by 50 feet deep. silt above bedrock.
20.00	7660	Dead 0+ SHD-possibly due to high water temps.
31.00	9045	Several 0+ SHD and warm water fish.
37.00	9515	This unit and the next five all have large populations of roach, suckers and a few steelhead. Populations observed in the hundreds.
56.00	10963	Possible dry trib on left bank.
60.00	11078	Dead Sculpin 5"
65.00	11519	Canopy changing to more overhanging trees and large alders. Channel narrowing.
69.00	11915	Turtle seen in area at end of day. Small wet trib at right bank. First redwoods at creek side observed.
78.00	12940	Vegetation is now redwoods, oaks, grass along the banks. Good coho habitat.
80.00	13095	Wet trib RB over bedrock
85.00	13363	Canyon is getting steeper. This section has small alder, oaks, and less canopy.
86.00	13426	Kingfishers seen.
89.00	13516	Major slide left bank (200 ft up bank).
90.00	13618	Dry trib left bank.
91.00	13677	Major slide left bank (200 ft up bank). F1 channel begins.
92.00	13794	Dry trib right bank.
94.00	14049	Dirt road right bank.
98.00	14340	Substrate change to gravel
107.00	15160	Channel change to F4.
108.00	15201	Restoration site needs instream cover.
115.00	15830	Major erosion on right bank from road sediment into stream. Approx. 100 L x 100 H x 40 D.
118.00	16245	Dead sculpin.
122.00	16640	Wet trib right bank 62 F. Road system along right bank. Trib has culvert.
145.00	18860	Dry trib LB
146.00	18912	Dry trib LB
148.00	19386	Dirt road crosses stream @ end of unit
155.00	19915	Warm H20 fish observed
156.00	20059	Dry trib RB
160.00	20455	Dry trib RB
161.00	20498	Dead fox

164.00	20743	Dry trib RB
168.00	21161	Dry trib RB
173.00	21648	Major gravel bar RB- 150'L x 70'W
177.00	21933	Barbed wire fence crossing channel
179.00	22229	Dry trib RB- drains into gravel bar
180.00	22316	Skid road crossing creek @ 87'
184.00	22615	(2) 2+ SHD
204.00	24412	Crayfish
211.00	24861	Dry trib LB
214.00	25347	Ranch Rd. on LB creating erosion and sediment to stream
215.00	25442	Small patch *Arundo* RB
220.00	26008	Lg debris on RB piled behind 2 lg alders - not obstructing main channel
222.00	26220	Dry side channel LB
223.00	26320	Dry trib RB
225.00	26526	Dry trib RB
228.00	26694	0+, 1+ salmonids
230.00	26891	Chapman Branch enters RB; Chapman temp 64F; Pena temp 68F
239.00	27791	Road 40' above LB
242.00	28086	Spring RB
243.00	28111	Eroding RB - 100'Lx20'H'x5'D
248.00	28455	Dry side channel RB
250.00	28569	Cows are grazing in creek
251.00	28628	Wet trib RB; Trib temp 60F; Pena temp 65F; 2+ SHD
258.00	29273	Cow patties in stream; roach
259.00	29402	Wild pigs rooting in stream bank
261.00	29701	LB slumping
263.00	29898	Rd. 40' above LB; dying SHD w/ appearance of wht fungus-like spot
268.00	30249	Warm pool; algae; 200+ roach
269.00	30560	Dry trib RB
270.00	30656	5 0+ salmonids
272.00	31047	60' into unit- barbed wire fence crossing stream
273.00	31133	Green algae on stream bottom; spring LB
274.00	31376	No Canopy, good re-vegetation. site
275.00	31563	Wet trib LB; Dry trib LB
276.00	31719	Dry trib LB; units 275 & 276 have approx. 300' of steep erosive bank 5' adding sediment
277.00	31842	This area and units ahead needs re-vegetation.
279.00	32105	Wet trib LB (no hab)
286.00	33049	Erosion RB, oaks falling in creek 125'Lx40'Hx10'D; 2 0+ SHD
287.00	33072	Cow feces in creek
290.00	33498	Wet x-ng; algae growth
291.00	33562	Riprap RB 75'L; algae
292.00	33600	Lots of silt on creek bottom; old truck RB; sm. patch of *Arundo* RB

293.00	33711	Dry trib RB - culvert form; evidence of cows in creek
297.00	34155	Cow feces
298.00	34232	Slide LB 100'Hx90'Lx10'D; 8 pieces of concrete culvert in creek
303.00	34471	Dry trib RB
305.00	34658	Dry trib RB
309.00	34969	Algae; 2+ SHD (resident?); nice pool- needs shelter- possible restoration site
310.00	35009	2+ SHD (resident?)
311.00	35084	Dry trib LB
312.00	35192	2+ SHD; pool needs shelter
314.00	35405	Evidence of cows in creek
317.00	35602	Erosion RB
319.00	35809	Cow feces
322.00	36158	Dry trib LB
323.00	36299	Dry trib LB
324.00	36325	Chamise Rd RB
327.00	36454	Cow feces
330.00	36749	Pechaco creek RB; heavy accumulation of gravel RB; french broom LB
331.00	36785	Great blue heron
332.00	36903	Dry trib LB
336.00	37205	Barbed wire fence across stream
339.00	37399	Old cars LB; spring RB
340.00	37494	Redwoods above LB
341.00	37639	2 1+ SHD; 1 2+ SHD; road is 15' up bank on RB
342.00	37823	Spring coming out of pipe 15' above stream RB
344.00	37983	RB eroding- bank not vegetated and has underground water; road RB
345.00	38097	Some attempt at seepage stabilization- plastic sheets & pipes; willow wall needed?
350.00	38869	cows in creek
352.00	39154	2+ SHD
353.00	39406	Good spot for restoration of banks w/set back, planting
354.00	39451	Lots of algae clumps
363.00	40289	Wet trib @ 43' (60F water temp)- approx. 5' wetted width @ mouth-habitat typeable; water temp 65F in Pena
370.00	41032	Gully @ LB coming off the road-approx. 10'Wx10'D
373.00	41318	Wet trib @ LB (water temp 61F in trib); Pena water temp 63F; 8'Dx8'W w/cars
377.00	41617	Gully RB- 10'Dx10'W
378.00	42090	Lots of roach; signs of natural springs/seeps @RB for 100'
379.00	42177	Dry trib RB; old road LB
381.00	42504	Old homestead site LB
382.00	42569	Good restoration possibilities (planting)
384.00	42811	Nice pool- needs cover; wet trib RB

385.00	42943	Large landslide RB: 100'Hx70'Wx10-20'D
388.00	43226	Cow patties in creek
389.00	43327	Sudden change in substrate to boulders
391.00	43481	A lot of large boulders in area-not a channel change
392.00	43521	Wet trib LB (not habitat typeable)
393.00	43567	Old road 20' above RB
400.00	44203	Wet trib RB (habitat typeable); cowfeces in stream
403.00	44406	Debris jam RB; large gravel bar 5'Hx40'Wx150'L; great pool
404.00	44493	LB unstable- restoration site
405.00	44526	2+ SHD
407.00	44940	Spring RB; pool needs cover
408.00	45121	Dry trib RB
409.00	45146	Spring RB
410.00	45326	Spring RB
411.00	45369	Dry trib LB
413.00	45688	Old road 70' up LB
414.00	45809	LB- dry trib/gully
416.00	46046	Dry trib LB
417.00	46150	Spring RB; gully LB
418.00	46187	Spring RB
419.00	46271	RB is failing due to old road
422.00	46593	French broom LB
423.00	46727	Gully LB; LB failing due to road
426.00	46911	Redwood Log Creek LB
427.00	47062	Short large boulder section
428.00	47091	Boulders are backing up gravel/cobble up to 3'- gravel bar 40'Wx80'Lx3'H
437.00	47956	Old road 5' up RB
438.00	48026	Old trib LB
439.00	48085	LB coming down w/boulders and trees 100'Hx60'Lx30'D
440.00	48194	Spring LB
446.00	48670	More large gravel bars
447.00	48757	Woods Creek enters RB
448.00	48959	Signs of downcutting
450.00	49028	Old rusty pipe sticking out of bank
451.00	49103	Evidence of downcutting
453.00	49198	Huge slide RB- several 100'Hx150'Lx50'D; spring RB
454.00	49248	Gully/spring RB
458.00	49551	Spring LB
460.00	49703	Old rd. RB; 3 CA newts
463.00	49772	Spring LB
471.00	50066	Wet trib RB (not habitat typeable)
475.00	50310	END OF ACCESS****END OF SURVEY****

PROBLEM SITES AND LANDMARKS - CHAPMAN BRANCH SURVEY COMMENTS

Habitat Unit #	*Stream Length(ft)*	*Comments*
1.00	*39*	*No temperatures were taken during the habitat typing survey, only during the general survey (see notebook)*
7.00	*126*	*Wet road crossing*
14.00	*348*	*Many 0+ SHD; erosion from road LB*
31.00	*950*	*0+ SHD; yellow-legged frog*
32.00	*958*	*0+ SHD*
35.00	*1048*	*Channel typed*
41.00	*1234*	*Dry trib RB*
43.00	*1289*	*0+ SHD; crawdad*
45.00	*1390*	*Slide RB- 100'Hx20'W*
46.00	*1428*	*Slide RB- 120'Hx30'W (starting to heal)*
49.00	*1570*	*0+ SHD*
51.00	*1640*	*Dry trib RB*
53.00	*1717*	*High amount of silt in pool. Huge log jam at end of unit that has changed the gradient of the stream*
		END HABITAT TYPING SURVEY*
	General survey done above log jam	

PROBLEM SITES AND LANDMARKS - SWEETWATER CREEK SURVEY COMMENTS

Habitat Unit #	*Stream Length(ft)*	*Comments*
1.00	*68*	*Begin survey at confluence with Pena Creek.*
2.00	*86*	*Salmonids observed.*
13.00	*496*	*At 17' right bank tributary less than 0.01 cfs, steep not accessible to fish and 52*F.*
23.00	*789*	*Salmonids observed.*
24.00	*928*	*Left bank erosion at 20', 26'L x 8'H.*
25.00	*983*	*Crayfish observed.*
26.00	*1001*	*At 15' left bank steep bedrock tributary not accessible to fish.*
29.00	*1106*	*At 21' large debris accumulation 8'L x 10'W x 4'H.*
31.00	*1171*	*Left bank erosion 50'L x 80'H.*
36.00	*1322*	*At 21' large debris accumulation 18'L x 8'W x 5'H passable.*
44.00	*1516*	*At 30' right bank tributary, steep not accessible to fish.*
46.00	*1608*	*At 22' large debris accumulation passable 5'L x 10'W x 5'H.*
47.00	*1669*	*At 49' large debris accumulation 5'L x 15'W x 7'H passable but retaining 6' of gravel.*
54.00	*2041*	*Frog observed.*
56.00	*2073*	*Newt observed.*

57.00	*2134*	*Left bank typeable tributary at 61'.*
57.10	*2134*	*Old road which used to cross making the side channel into the main channel. The road blew out above the culvert and the stream diverted causing a floating culvert with an island of soil in between.*
57.20	*2134*	*Seven foot jump into culvert with no jump pool.*
59.00	*2258*	*Left bank dry steep bedrock tributary not accessible to fish.*
60.00	*2316*	*At 58' large debris accumulation 5'L x 5'W x 94'H. Nine foot gravel and sand retained. END OF SURVEY. After 7' jump it becomes dry . walked for at least 500', no sign of water.*

PROBLEM SITES AND LANDMARKS - UNNAMED TRIBUTARY TO SWEETWATER CREEK SURVEY COMMENTS

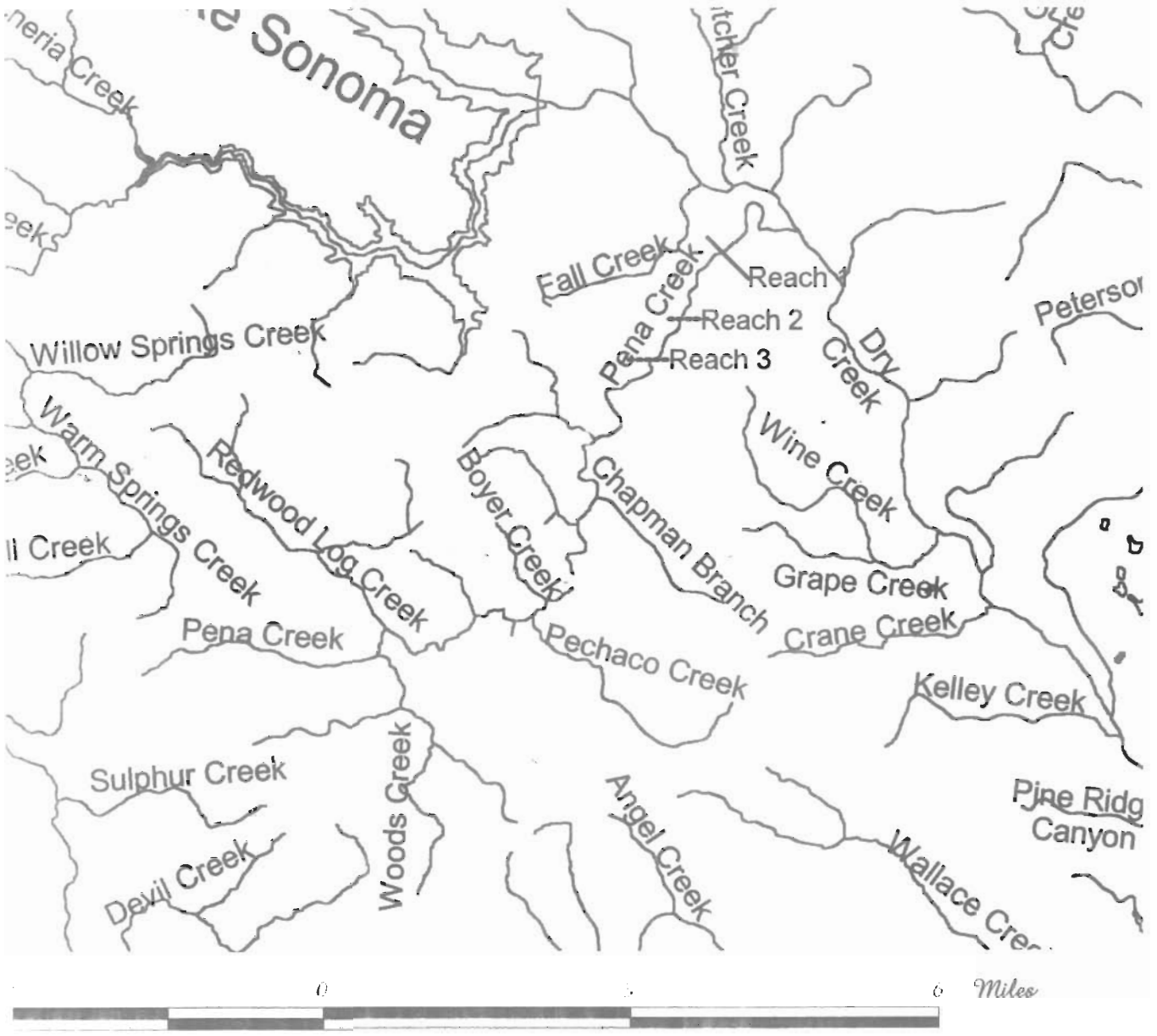
Habitat Unit #	*Stream Length(ft)*	*Comments*
1.00	*57*	*Begin at confluence with Sweetwater Creek, 5'jump.*
2.00	*73*	*No water flowing in or out of pool.*
3.00	*438*	*Great place to plant trees.*
5.00	*560*	*Left bank dry, steep tributary at 63' not accessible to fish.*
7.00	*662*	*At 63' right bank dry tributary, steep, not accessible to fish.*
8.00	*771*	*High bedrock jump.*
9.00	*785*	*Frog observed.*
12.00	*824*	*Yellow legged frog and 8' jump.*
14.00	*947*	*Left bank dry tributary at 26', steep, not accessible to fish.*
15.00	*1062*	*END OF SURVEY. Step run ends with a 9' jump and no jump pool. Extremely steep terrain above with lots of boulders and bedrock. No fish observed entire survey.*

PROBLEM SITES AND LANDMARKS - Redwood Log Creek SURVEY COMMENTS

Habitat Unit #	*Stream Length(ft)*	*Comments*
1.00	*428*	*Begin survey at confluence with Pena Creek. +29' cattle fence crossing creek. +324' four foot jump.*
2.00	*442*	*Frogs, salamanders and aquatic insects observed.*
5.00	*565*	*+48' left bank dry tributary not accessible to fish.*
6.00	*574*	*Five foot jump and frogs observed.*
10.00	*1684*	*+ 105' left bank dry tributary steep, not accessible to fish.*
14.00	*1872*	*At 10', right bank dry steep tributary not accessible to fish.*
16.00	*2061*	*At 15', a ten foot high jump retaining 8' of gravel. At 86' left bank steep dry tributary not accessible to fish.*

18.00	*2160*	*Right bank dry tributary, steep not accessible to fish.*
21.00	*2360*	*At 40' left bank dry steep tributary not accessible to fish enters. Road 40' up left bank begins.*
23.00	*3094*	*At 37' right bank dry steep tributary enters, not accessible to fish; No fish observed for entire survey*
		**** END OF SURVEY ****

Pena Creek Habitat Inventory



Streams

N
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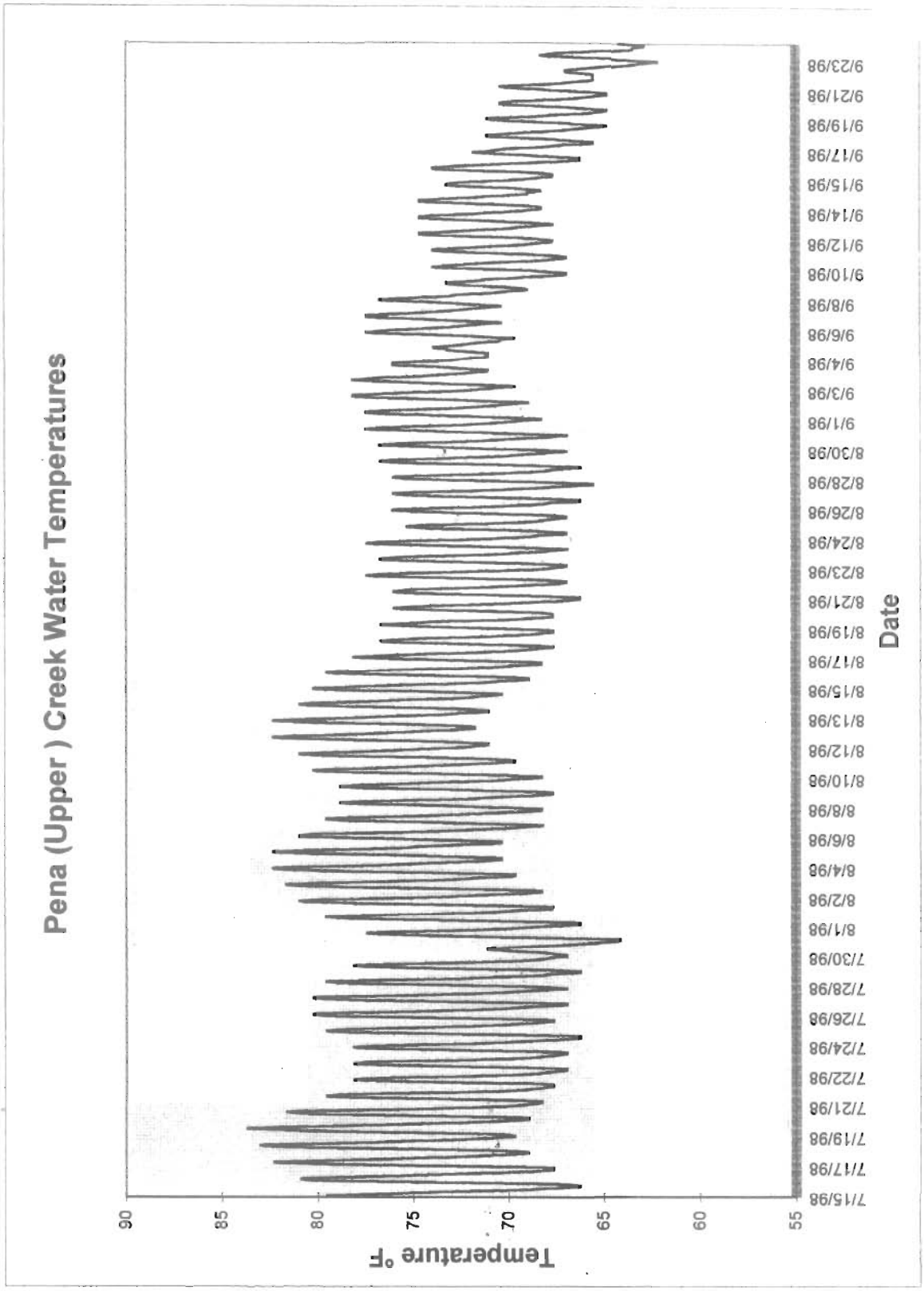
Pena (Upper) Creek Water Temperatures
Temperature °F
90
85
80
75
70
65
60
55
Date
7/15/98
7/17/98
7/19/98
7/21/98
7/22/98
7/24/98
7/26/98
7/28/98
7/30/98
8/1/98
8/2/98
8/4/98
8/6/98
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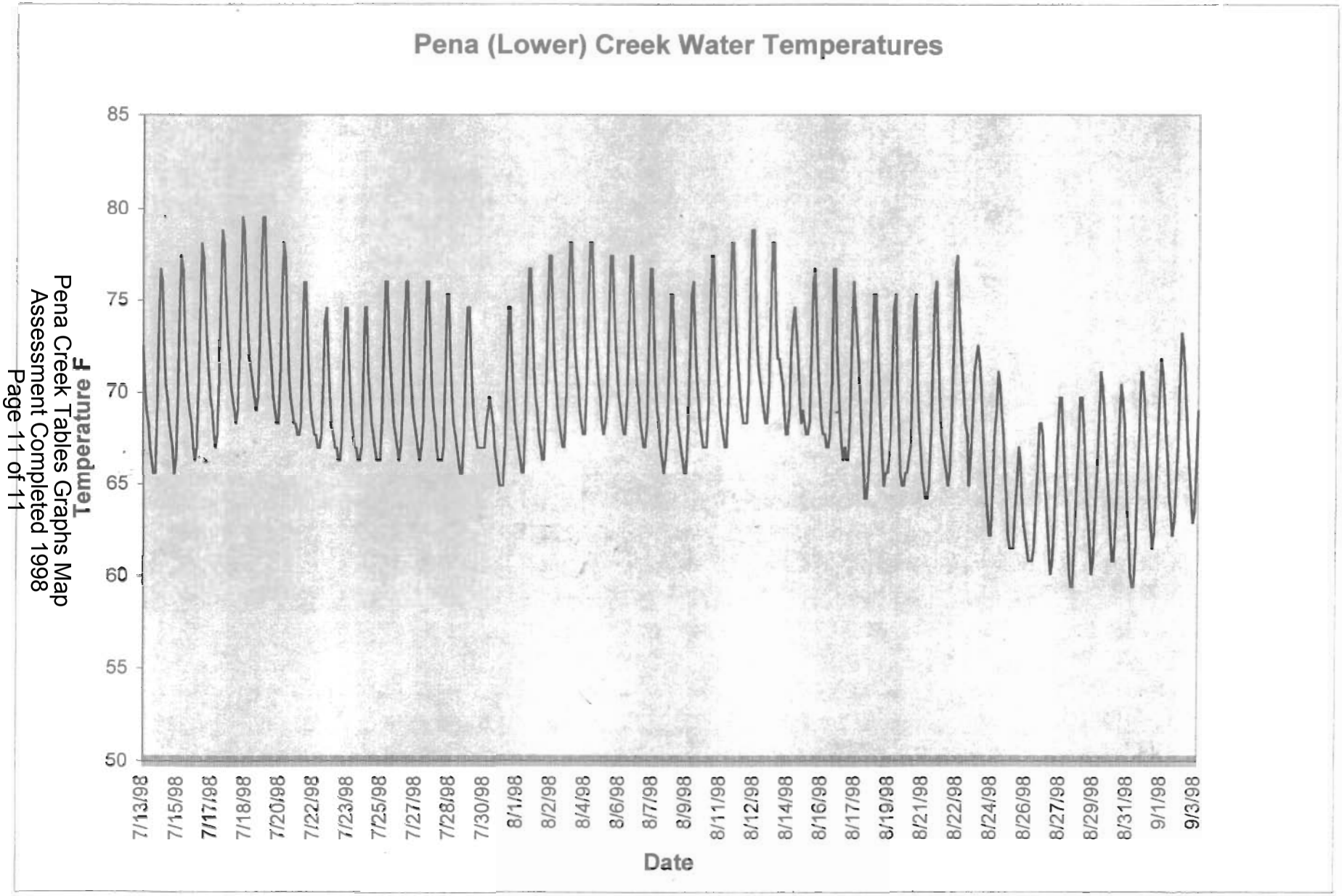
9/23/98


Pena (Lower) Creek Water Temperatures
Temperature F
85
80
75
70
65
60
55
50
7/13/98
7/15/98
7/17/98
7/18/98
7/20/98
7/22/98
7/23/98
7/25/98
7/27/98
7/28/98
7/30/98
8/1/98
8/2/98
8/4/98
8/6/98
8/7/98
8/9/98
8/11/98
8/12/98
8/14/98
8/16/98
8/17/98
8/19/98
8/21/98
8/22/98
8/24/98
8/26/98
8/27/98
8/29/98
8/31/98
9/1/98
9/3/98
Date

Pena Creek — Drainage: Dry Creek, Russian River

Table 1 - SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES — Survey Dates: 08/24/98 to 09/30/98

Confluence Location: QUAD: Geyserville LEGAL DESCRIPTION: T10NR10WS22 LATITUDE: 38°42'7" LONGITUDE: 122°57'44"

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN DEPTH (ft.)	MEAN AREA (sq.ft.)	ESTIMATED TOTAL AREA (sq.ft.)	MEAN VOLUME (cu.ft.)	ESTIMATED TOTAL VOLUME (cu.ft.)	MEAN RESIDUAL POOL VOL (cu.ft.)	MEAN SHELTER RATING
1	0		0	103	103	0	110.0	1.0	11330	11330	11330	11330	0	5
110	13	RIFFLE	23	90	9918	20	18.4	0.3	1314	144529	313	34428	0	4
177	21	FLATWATER	37	111	19687	39	12.4	0.5	1134	200739	535	94607	0	18
189	46	POOL	39	77	14554	29	14.4	1.1	1181	223217	1341	253377	936	24
4	0	DRY	1	1587	6349	13	0.0	0.0	0	0	0	0	0	0
1	0	CULVERT	0	63	63	0	0.0	0.0	0	0	0	0	0	0

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq. ft.)	TOTAL VOL. (cu. ft.)
482	80	50674	579816	393741

Pena Creek

Drainage: Dry Creek, Russian River

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS

Survey Dates: 08/24/98 to 09/30/98

Confluence Location: QUAD: Geyserville LEGAL DESCRIPTION: T10NR10WS22 LATITUDE: 38°42'7" LONGITUDE: 122°57'44"

HABITAT UNITS #	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT OCCURRENCE %	MEAN LENGTH ft.	TOTAL LENGTH ft	TOTAL LENGTH %	MEAN WIDTH ft.	MEAN DEPTH ft.	MAXIMUM DEPTH ft.	MEAN AREA sq.ft.	TOTAL AREA EST. sq.ft.	MEAN VOLUME cu.ft.	TOTAL VOLUME EST. cu.ft.	MEAN RESIDUAL POOL VOL cu.ft.	MEAN SHELTER RATING	MEAN CANOPY %
1	0		0	103	103	0	110	1.0	3.2	11330	11330	11330	11330	0	5	20
110	13	LGR	23	90	9918	20	18	0.3	1.0	1314	144529	313	34428	0	4	45
73	9	GLD	15	115	8390	17	15	0.6	2.2	1300	94921	694	50653	0	26	52
94	9	RUN	20	109	10217	20	11	0.5	1.5	1106	103939	452	42466	0	13	44
10	3	SRN	2	108	1080	2	8	0.5	1.4	684	6843	307	3066	0	10	48
44	12	MCP	9	73	3214	6	13	1.1	4.5	1028	45217	1111	48875	758	17	46
2	0	CCP	0	112	223	0	21	1.2	3.0	2702	5404	4173	8347	3135	3	10
5	2	STP	1	128	639	1	15	0.9	2.8	1457	7283	1263	6313	647	53	49
1	0	CRP	0	74	74	0	9	1.8	4.4	666	666	1199	1199	999	10	0
2	1	LSL	0	32	64	0	12	0.9	2.3	365	730	318	636	146	70	95
35	7	LSR	7	66	2327	5	14	1.0	4.2	984	34426	1055	36908	712	33	68
66	12	LSBk	14	86	5700	11	15	1.1	5.0	1433	94559	1784	117760	1323	13	49
33	11	LSBo	7	69	2268	4	15	0.9	4.8	1031	34014	980	32330	582	37	50
1	1	DPL	0	45	45	0	17	1.6	4.8	765	765	1224	1224	995	60	25
4	0	DRY	1	1587	6349	13	0	0.0	0.0	0	0	0	0	0	0	100
1	0	CUL	0	63	63	0	0	0.0	0.0	0	0	0	0	0	0	100

TOTAL UNITS	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
482	80	50674	584626	395533

Pena Creek — Drainage: Dry Creek, Russian River

Table 3 - SUMMARY OF POOL TYPES — Survey Dates: 08/24/98 to 09/30/98

Confluence Location: QUAD: Geyserville LEGAL DESCRIPTION: T10NR10WS22 LATITUDE: 38°42'7" LONGITUDE: 122°57'44"

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN DEPTH (ft.)	MEAN AREA (sq.ft.)	TOTAL AREA EST. (sq.ft.)	MEAN VOLUME (cu.ft.)	TOTAL VOLUME EST. (cu.ft.)	MEAN RESIDUAL POOL VOL. (cu.ft.)	MEAN SHELTER RATING
1	0		1	103	103	1	110.0	1.0	11330	11330	11330	11330	0	5
51	14	MAIN	27	80	4076	28	13.7	1.1	1138	58014	1248	63672	844	20
137	31	SCOUR	72	76	10433	71	14.6	1.0	1200	164395	1375	188423	969	25
1	1	BACKWATER	1	45	45	0	17.0	1.6	765	765	1224	1224	995	60

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
190	46	14657	234504	264650

Pena Creek Drainage: Dry Creek, Russian River

Table 4 = SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES Survey Dates: 08/24/98 to 09/30/98

Confluence Location: QUAD: Geyserville LEGAL DESCRIPTION: T10NR10WS22 LATITUDE: 38°42'7" LONGITUDE: 122°57'44"

UNITS MAX DPTH MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	<1 FOOT MAXIMUM DEPTH	<1 FOOT PERCENT OCCURRENCE	1-<2 FT. MAXIMUM DEPTH	1-<2 FOOT PERCENT OCCURRENCE	2-<3 FT. MAXIMUM DEPTH	2-<3 FOOT PERCENT OCCURRENCE	3-<4 FT. MAXIMUM DEPTH	3-<4 FOOT PERCENT OCCURRENCE	>=4 FEET MAXIMUM DEPTH	>=4 FEET PERCENT OCCURRENCE
1		1	0	0	0	0	0	0	1	100	0	0
44	MCP	23	0	0	13	30	16	36	13	30	2	5
2	CCP	1	0	0	1	50	0	0	1	50	0	0
5	STP	3	0	0	1	20	4	80	0	0	0	0
1	CRP	1	0	0	0	0	0	0	0	0	1	100
2	LSL	1	0	0	1	50	1	50	0	0	0	0
35	LSR	18	0	0	7	20	22	63	5	14	1	3
65	LSBk	34	0	0	14	22	29	45	18	28	4	6
33	LSBo	17	1	3	8	24	19	58	4	12	1	3
1	DPL	1	0	0	0	0	0	0	0	0	1	100

TOTAL UNITS
189

Pena Creek Drainage: Dry Creek, Russian River

Table 5 - Summary of Shelter by Habitat Type Survey Dates: 08/24/98 to 09/30/98

Confluence Location: QUAD: Geyserville LEGAL DESCRIPTION: T10NR10WS22 LATITUDE: 38°42'7" LONGITUDE: 122°57'44"

UNITS MEASURED	UNITS SHELTER MEASURED	HABITAT TYPE	% TOTAL UNDERCUT BANKS	% TOTAL SWD	% TOTAL LWD	% TOTAL ROOT MASS	% TOTAL TERR. VEGETATION	% TOTAL AQUATIC VEGETATION	% TOTAL WHITE WATER	% TOTAL BOULDERS	% TOTAL BEDROCK LEDGES
1	1		0	0	0	0	0	0	0	0	100
110	14	LGR	0	0	0	0	76	0	0	24	0
73	10	GLD	0	0	2	3	70	12	0	3	8
94	11	RUN	4	20	0	9	32	0	0	32	3
10	3	SRN	0	0	0	15	0	0	0	85	0
44	44	MCP	8	8	2	10	26	2	0	39	5
2	2	CCP	0	0	0	0	0	0	0	100	0
5	5	STP	0	4	1	2	1	0	0	88	4
1	1	CRP	0	0	0	0	100	0	0	0	0
2	2	LSL	30	7	53	6	0	4	0	0	0
35	35	LSR	15	10	14	29	27	1	0	4	0
66	64	LSBk	12	5	2	16	10	2	0	29	24
33	33	LSBo	3	1	3	4	22	14	0	52	0
1	1	DPL	0	30	60	0	0	0	0	10	0
4	0	DRY	0	0	0	0	0	0	0	0	0
1	0	CUL	0	0	0	0	0	0	0	0	0
ALL HABITAT TYPES 482	226		8	6	5	12	21	5	0	35	9
POOLS ONLY 189	187		8	5	5	13	18	5	0	37	7

Pena Creek

Drainage: Dry Creek, Russian River

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE

Survey Dates: 08/24/98 to 09/30/98

Confluence Location: QUAD: Geyserville LEGAL DESCRIPTION: T10NR10WS22 LATITUDE: 38°42'7" LONGITUDE: 122°57'44"

TOTAL HABITAT UNITS	UNITS SUBSTRATE MEASURED	HABITAT TYPE	% TOTAL SILT/CLAY DOMINANT	% TOTAL SAND DOMINANT	% TOTAL GRAVEL DOMINANT	% TOTAL SM COBBLE DOMINANT	% TOTAL LG COBBLE DOMINANT	% TOTAL BOULDER DOMINANT	% TOTAL BEDROCK DOMINANT
1	0		0	0	0	0	0	0	0
110	14	LGR	0	7	71	14	7	0	0
73	10	GLD	0	30	60	10	0	0	0
94	11	RUN	0	0	64	0	9	9	18
10	3	SRN	0	0	67	33	0	0	0
44	15	MCP	0	33	40	0	0	0	27
2	1	CCP	0	100	0	0	0	0	0
5	3	STP	0	33	0	0	0	33	33
1	1	CRP	0	0	100	0	0	0	0
2	1	LSL	0	0	100	0	0	0	0
35	9	LSR	0	44	44	11	0	0	0
66	17	LSBk	0	35	65	0	0	0	0
33	12	LSBo	0	42	58	0	0	0	0
1	1	DPL	0	100	0	0	0	0	0
4	2	DRY	0	0	100	0	0	0	0
1	0	CUL	0	0	0	0	0	0	0

APPENDIX A. Summary of Mean Percent Vegetative Cover for Entire Stream

Mean Percent Canopy	Mean Percent Evergreen	Mean Percent Deciduous	Mean Right bank % Cover	Mean Left Bank % Cover
48.80	32.84	66.43	53.92	48.92

APPENDIX B.

Mean Percentage of Dominant Substrate

Dominant Class of Substrate	Number Units Right Bank	Number Units Left Bank	Percent Total Units
Bedrock	27	37	33.16
Boulder	9	3	6.22
Cobble/Gravel	20	16	18.65
Silt/clay	40	41	41.97

Mean Percentage of Dominant Vegetation

Dominant Class of Vegetation	Number Units Right Bank	Number Units Left Bank	Percent Total Units
Grass	9	16	12.89
Brush	20	22	21.65
Deciduous Trees	49	45	48.45
Evergreen Trees	19	13	16.49
No Vegetation	0	1	0.52

APPENDIX C. FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: Pena Creek
SAMPLE DATES: 08/24/98 to 09/30/98
SURVEY LENGTH:
MAIN CHANNEL: 50413 ft. SIDE CHANNEL: 364 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: Geyserville Latitude: 38°42'7"
Legal Description: T10NR10WS22 Longitude: 122°57'44"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 1 (Units 1-90)

Channel Type: F4	Mean Canopy Density: 50%
Main Channel Length: 13618 ft.	Evergreen Component: 42%
Side Channel Length: 5 ft.	Deciduous Component: 56%
Riffle/Flatwater Mean Width: 10.2 ft.	Pools by Stream Length: 17%
Pool Mean Depth: 1.2 ft.	Pools >=2 ft. Deep: 77%
Base Flow: 0.0 cfs	Pools >=3 ft. Deep: 31%
Water: 64-78°F Air: 66-96°F	Mean Pool Shelter Rtn: 40
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Terrestrial Veg.
Bank Vegetative Cover: 64%	Occurrence of LOD: 33%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 6349 ft.

Embeddness Value: 1. 21% 2. 32% 3. 24% 4. 24% 5. 0%

STREAM REACH 2 (Units 91-97)

Channel Type: F1	Mean Canopy Density: 16%
Main Channel Length: 672 ft.	Evergreen Component: 50%
Side Channel Length: 0 ft.	Deciduous Component: 33%
Riffle/Flatwater Mean Width: 10.8 ft.	Pools by Stream Length: 26%
Pool Mean Depth: 1.1 ft.	Pools >=2 ft. Deep: 100%
Base Flow: 0.0 cfs	Pools >=3 ft. Deep: 0%
Water: 65-66°F Air: 65-66°F	Mean Pool Shelter Rtn: 5
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Bedrock Ledges
Bank Vegetative Cover: 34%	Occurrence of LOD: 0%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 0 ft.

Embeddness Value: 1. 0% 2. 0% 3. 0% 4. 100% 5. 0%

STREAM REACH 3 (Units 98-475)

Channel Type: F4	Mean Canopy Density: 50%
Main Channel Length: 36123 ft.	Evergreen Component: 30%
Side Channel Length: 359 ft.	Deciduous Component: 70%
Riffle/Flatwater Mean Width: 21.9 ft.	Pools by Stream Length: 33%
Pool Mean Depth: 1.0 ft.	Pools >=2 ft. Deep: 74%
Base Flow: 0.0 cfs	Pools >=3 ft. Deep: 26%
Water: 56-76°F Air: 45-84°F	Mean Pool Shelter Rtn: 20
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Boulders
Bank Vegetative Cover: 47%	Occurrence of LOD: 37%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 0 ft.

Embeddness Value: 1. 13% 2. 34% 3. 28% 4. 19% 5. 7%