Ref # 90

SL-20
12/14/04

STREAM INVENTORY REPORT

**SAN VICENTE CREEK**

FS# 2563
LOE#'s 3220, 3209

## INTRODUCTION

A stream inventory was conducted during the summer of 1996 on San Vicente Creek, Santa Cruz County. The inventory consisted of two parts: a habitat inventory and biological inventory. The purpose of the habitat inventory was to document the habitat available to anadromous salmonids in San Vicente Creek. The biological inventory was conducted to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for 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

San Vicente Creek enters the Pacific Ocean approximately 9 miles north of the city of Santa Cruz in Santa Cruz County, California (Map 1). San Vicente Creek's legal description at the confluence with the Pacific Ocean is T11S R03W. Its location is 31°08'04" north latitude and 122°11'35" west longitude. San Vicente Creek is a third order stream and has approximately 9.3 miles of main stem and 11.3 miles of tributary blue line stream according to the USGS Davenport 7.5 minute quadrangle. San Vicente Creek drains a watershed of approximately 11.1 square miles. Elevations range from 0 feet at the mouth of the creek to 2,600 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production, open pit mining, cattle grazing, urbanization and water diversion. Vehicle access exists via private roads off Highway 1.

## METHODS

The habitat inventory conducted in San Vicente Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 1994). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) Members 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.

## SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the flatwater and riffle habitat

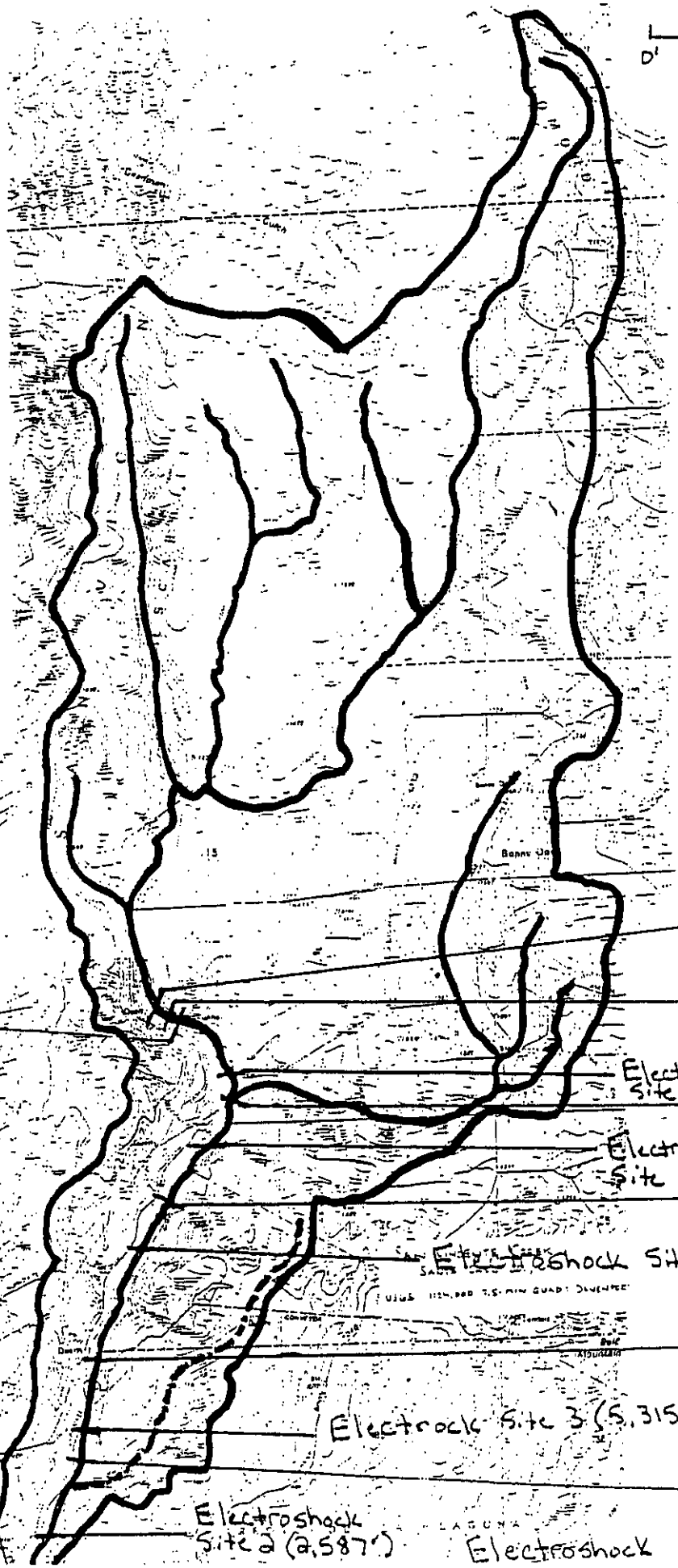
USGS Quad: Davenport (1991)

50% Reduced

0' 3000'

1:24 K

# Map 1



Manmade Bedrock Tunnel

End Survey (17,906')

Old Concrete Building (17,672')

troshock = 7 (17,449')

Electroshock Site 6 (15,485')

Left bank trib, Mill Cree (14,806')

Electroshock Site 5 (13,703')

ert passes eath hway 1 42')

Bridge (11,914

Electroshock Site 4 (10,301')

~ 1996 itat vey (0')

Bridge (7,056')

Electrock Site 3 (5,315')

Culvert diverts water into a left bank pond (4,520')

Electroshock Site 2 (2,587')

Electroshock

units and 47% of the pool habitat within the survey reach (Hopelain, 1994). All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth. Complete measurements are made on 1) habitat unit types encountered for the first time, 2) one randomly selected unit from the ten habitat units on each field form page and 3) every third pool.

## 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 San Vicente Creek to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow was measured in cubic feet per second (cfs) at stream mile 0.86 using a Marsh-McBirney Model 2000 Flowmate.

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 temperature, air temperature and time are measured and recorded at every tenth habitat unit. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

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". San Vicente 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. Channel dimensions were measured using hip chains, tape measures, and stadia rods. All units were measured for length; additionally, the first occurrence of each habitat type, every third pool, and a randomly selected 10% subset of all flatwater and riffle units were

sampled for all features on the sampling form (Hopelain, 1995). Pool tail crest depth at each pool unit was measured in the thalweg. 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 San Vicente Creek, embeddedness was ocularly 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). Additionally, a rating of "not suitable" (NS) was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate size (i.e. silt, large cobble, boulder or bedrock).

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide salmonids protection from predation and high water velocities and allow separation of territorial units to reduce density related competition. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In San Vicente Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. 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-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two respectively.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In San Vicente 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 ocularly into percentages of coniferous or deciduous trees.

9. Bank Composition and Vegetation:

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 San Vicente Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described 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 composition and their distribution throughout the stream. In San Vicente Creek fish presence was observed from the stream banks and seven sites were sampled using a Smith-Root Model 12 backpack electrofishing unit. 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 8.4*, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following six tables:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

Graphics are produced from the tables using Quattro Pro. Graphics developed for San Vicente Creek include:

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence
- Pool types by percent occurrence
- Total pools by maximum depths
- Embeddedness
- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

## HABITAT INVENTORY RESULTS

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

The habitat inventory of July, 09, 10, 11, 13, and 14, 1996 was conducted by Allan Renger (WSP/AmeriCorps) and Dawn Fisher (CCC). The total length of the stream surveyed was 17,930 feet (3.4 miles) with an additional 718 feet (0.14 miles) of side channel.

Flow measured at stream mile 0.86 was 8.0 cfs on July 10, 1995.

San Vicente Creek is a B3 channel type for the entire 17,930 feet of stream reach surveyed. B3 channel types are moderately entrenched, moderate gradient, riffle dominated channels, with infrequently spaced pools, very stable plan and profile, stable banks and a cobble channel.

Water temperatures taken during the survey period ranged from 55 to 57 degrees Fahrenheit. Air temperatures ranged from 54 to 65 degrees Fahrenheit (Table 7).

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 16% riffle units, 40% flatwater units, 43% pool units, and 1% culvert units. (Graph 1). Based on total **length** of Level II habitat types there were 7% riffle units, 76% flatwater units, 15% pool units, and 2% culvert units. (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools (28.0%), step runs (28.0%), and low gradient riffles (12.0%) (Graph 3). Based on percent total **length**, step runs comprised 70%, mid-channel pools 10%, and runs 5%.

A total of 70 pools were identified (Table 3). Main channel pools were most frequently encountered at 64% and comprised 69% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. If instream shelter is present, pool quality for salmonids will increase with depth. Twenty-one of the seventy pools (30%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail crests. Of the 70 pool tail crests measured, 1 had a value of 1 (1.4%); 12 had a value of 2 (17.1%); 51 had a value of 3 (72.8%); 1 had a value of 4 (1.4%); and 5 (7.1%) were unsuitable for spawning (Graph 6). On this scale, a value of 1 indicates low embeddedness or a low percentage of fines at spawning sites.

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 habitat types had a mean shelter rating of 12, and flatwater habitats had a mean shelter rating of 6 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 15. Main channel pools had a mean

shelter rating of 13 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in San Vicente Creek. Large woody debris are lacking in nearly all habitat types (Graph 7).

Table 6 summarizes the dominant substrate by habitat type. Large cobble was the dominant substrate observed in the two low gradient riffles measured. Large cobble was the dominant substrate observed in 4 of the 7 step runs measured (57%). Small cobble was the next most frequently observed dominant substrate type and occurred in 43% of the step runs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 87% of which 86% of the canopy consisted of deciduous trees and 14% were coniferous trees (Graph 9).

For the stream reach surveyed, the mean percent right bank vegetated was 73%. The mean percent left bank vegetated was 75.5%. The dominant elements composing the structure of the stream banks consisted of 20% bedrock, 1% boulder, 15% cobble/gravel, and 60% sand/silt/clay (Graph 10). Deciduous trees are the dominant vegetation type observed in 76% of the units surveyed. Additionally, 11% of the units surveyed had brush as the dominant vegetation type, and 1% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

## BIOLOGICAL INVENTORY RESULTS

Seven sites were sampled on October 16, 17, and 21, 1995 by Jennifer Nelson, T. Laidig and Twyla Anderson (DFG).

The first site sampled was located at stream mile 0.16 and included 2 mid-channel pools and a run. The site yielded 37 steelhead ranging in total length from 62 millimeters to 187 millimeters, 4 sculpin ranging in length from 50 millimeters to 140 millimeters and 1 coho salmon (81 millimeters total length).

The second site sampled was located at stream mile 0.49 and included a lateral scour pool - root wad enhanced, a run and riffle. The site yielded 67 steelhead ranging in total length from 59 to 192 millimeters, 2 sculpin (125 millimeters and 137 millimeters) and 1 coho salmon (90 millimeters).

The third site sampled was located at stream mile 1.01 and included a lateral scour pool - root wad enhanced, a riffle and a mid-channel pool. The site yielded 32 steelhead ranging in total length from 53 to 188 millimeters and 4 sculpin ranging in length from 110 millimeters to 169 millimeters.

The fourth site sampled was located at stream mile 1.95 and included a riffle, a run, and a mid-channel pool. The site yielded 12 steelhead ranging in total length from 55 millimeters to 157

millimeters and 1 sculpin (117 millimeters).

The fifth site sampled was located at stream mile 2.6 and included 2 mid-channel pools and a riffle. The site yielded 25 steelhead ranging in total length from 60 millimeters to 206 millimeters, 1 coho salmon (85 millimeters) and 1 Pacific giant salamander.

The sixth site sampled was located at stream mile 2.93 and included a mid-channel pool, a riffle, and a plunge pool. The site yielded 30 steelhead ranging in total length from 54 millimeters to 269 millimeters.

The seventh site sampled was located at stream mile 3.3 and included 2 plunge pools and a step run. The site yielded 25 steelhead ranging in total length from 57 millimeters to 242 millimeters, 2 Pacific giant salamanders and a red-legged frog.

## DISCUSSION

San Vicente Creek is a B3 channel type for the entire 3.40 miles (17,930 feet) of stream surveyed.

The water temperatures recorded on the survey days July 9, 10, 11, 13, and 14, 1996, ranged from 55 to 57 degrees Fahrenheit. Air temperatures ranged from 54 to 65 degrees Fahrenheit. Optimum temperatures for coho salmon juveniles during the summer months range from 50 to 59 degrees Fahrenheit (McMahan, 1983). Steelhead juveniles can survive in warmer water, but the optimum summer temperature range for steelhead is also 50 to 59 degrees Fahrenheit (Barnhart, 1986). As stream temperatures approach 68 degrees Fahrenheit, growth ceases, swimming is impaired and it becomes increasingly difficult to extract oxygen from the water. The virulence of fish diseases and the toxicity of most chemicals is also exacerbated by higher water temperatures (Barnhart, 1986).

Flatwater habitat types comprised 76% of the total **length** of this survey, riffles 8%, and pools 15%. The pools are relatively shallow, with only 21 of the 70 (30%) pools having a maximum depth greater than 3 feet. In third and fourth order streams, a primary pool is defined to have a maximum depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Fallen trees, log jams, large boulders and other hard substantial elements will allow additional pools to be scoured and in the case of fallen trees and log jams, complex instream cover will also be provided.

Fifty-seven of the 70 pool tail-outs measured had embeddedness ratings of 3, 4, or 5. Only 1 had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, indicates high quality spawning substrate for salmon and steelhead. In San Vicente Creek, sediment sources should be identified mapped and prioritized according to their potential sediment yields, and the appropriate control measures should be taken.

The mean shelter rating for pools was low with a rating of 12. The shelter rating in the flatwater habitats was slightly lower at 6. A pool shelter rating of approximately 100 is desirable. The relatively large amount of cover that now exists is being provided primarily by boulders in all habitat types. Log and root wad cover structure in pool and flatwater habitats are needed to improve both summer and winter salmonid habitat. Complex woody debris (i.e roots, fallen trees) provides rearing fry with protection from predation, refuge from high water velocities, provides a food source and divides territorial units to reduce density related competition.

The two low gradient riffles measured had large cobble as the dominant substrate. Large cobble was also dominant in four of the seven step runs measured. Large cobble (5.0 to 10.0 inch diameter) is considered unsuitable for spawning steelhead and coho salmon.

The mean percent canopy density for the stream was 87%. This is considered adequate canopy cover to provide the necessary shade on the stream and assure cool water for juvenile coho salmon and steelhead.

The percentage of right and left bank covered with vegetation was moderate at 73% and 76%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank revetment, is recommended.

## RECOMMENDATIONS

1) San Vicente Creek should be managed as an anadromous, natural production stream.

2) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding or allowing for the natural recruitment of complex woody debris (i.e. trees and logs) would provide summer and winter habitat in addition to scouring more pools.

3) Active and potential sediment sources need to be identified, mapped, and prioritized according to their potential for sediment yield to the stream and its tributaries.

4) To establish a more complete and meaningful temperature record for stream temperatures, 24-hour monitoring from June through November should be conducted to determine potentially critical temperature periods.

5) Because of the extensive water diversion from the system, future water rights issues should be scrutinized to assure adequate bypass flows throughout the year.

COMMENTS AND LANDMARKS

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

| | |
|---|---|
| 0' | Begin survey at confluence with the Pacific Ocean. Channel type is B3. |
| 230' | San Vicente Creek passes through a 245' long x 12' wide x 16' high bedrock tunnel. |
| 542' | San Vicente Creek passes through a 142' long x 13' wide x 13' high bedrock tunnel. Culvert passes beneath Highway 1. |
| 1,868' | Broken glass and brick debris from right bank glass blowing shop is ending up in the creek. |
| 2,023' | Log debris accumulation (LDA) 12' long x 10' wide x 4' high is retaining sediment 2' deep x 20' long. |
| 2,540 - | Cattle grazing on right and left sides of creek. |
| 3,089' | Unpaved road crossing. |
| 3,574' | Unpaved road crossing. |
| 4,172' | Unpaved road crossing. Old broken down concrete dam. |
| 4,520' | A three foot diameter culvert diverts water into a left bank pond. An 8' screened pipe diverts water up the left bank. |
| 5,253' | Unpaved road crossing. |
| 5,411' | A man made side channel diverts water into a right bank holding pond. A 6" pipe diverts water up the right bank. The diversion pipe fish screen does not appear to be working. |
| 7,041' | One foot concrete dam. |
| 7,056' | Bridge 11' long x 24' wide x 4.2' high. |
| 8,784' | Left bank retaining wall. |
| 9,085' | Left bank tributary drains from left bank culvert. No fish observed above culvert. |

| | |
|---|---|
| 9,480' | Right bank trickling tributary. No fish observed. |
| 11,914' | Bridge 14' long x 35' wide x 9' high. |
| 12,766' | Right bank diversion 2' diameter. |
| 12,884' | Barbed wire fence crosses creek. |
| 13,911' | Left bank broken down dam or retaining pond. |
| 14,806' | Left bank tributary is Mill Creek. |
| 15,189' | Unpaved road crossing. |
| 17,576' | Steep boulder cascade 5' high x 10' long. |
| 17,586' | Right bank concrete retaining wall 86' long x 20' high. |
| 17,672' | Old concrete building on the right bank 153' long x 50' high. |
| 17,906' | End of survey. San Vicente Creek flows through a man made bedrock tunnel 9' high x 27' wide x approximately 0.25 miles long. The tunnel is a barrier to fish passage. |

## References

Barnhart, Roger. 1986. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Pacific Southwest), Steelhead. Biological Report 82 (11.60). U.S. Fish and Wildlife Service. 21 pages.

Flosi, G., and F. Reynolds. 1994. California salmonid stream habitat restoration manual, 2nd edition. California Department of Fish and Game, Sacramento, California.

Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

McMahon, Thomas E. 1983. Habitat Suitability Index Models: Coho Salmon. U.S. Fish and Wildlife Service. 29 pages.

# LEVEL III and LEVEL IV HABITAT TYPE KEY

| HABITAT TYPE | LETTER | NUMBER |
|---|---|---|
| **RIFFLE** | | |
| Low Gradient Riffle | [LGR] | 1.1 |
| High Gradient Riffle | [HGR] | 1.2 |
| **CASCADE** | | |
| Cascade | [CAS] | 2.1 |
| Bedrock Sheet | [BRS] | 2.2 |
| **FLATWATER** | | |
| Pocket Water | [POW] | 3.1 |
| Glide | [GLD] | 3.2 |
| Run | [RUN] | 3.3 |
| Step Run | [SRN] | 3.4 |
| Edgewater | [EDW] | 3.5 |
| **MAIN CHANNEL POOLS** | | |
| Trench Pool | [TRP] | 4.1 |
| Mid-Channel Pool | [MCP] | 4.2 |
| Channel Confluence Pool | [CCP] | 4.3 |
| Step Pool | [STP] | 4.4 |
| **SCOUR POOLS** | | |
| Corner Pool | [CRP] | 5.1 |
| Lateral Scour Pool - Log Enhanced | [LSL] | 5.2 |
| Lateral Scour Pool - Root Wad Enhanced | [LSR] | 5.3 |
| Lateral Scour Pool - Bedrock Formed | [LSBk] | 5.4 |
| Lateral Scour Pool - Boulder Formed | [LSBo] | 5.5 |
| Plunge Pool | [PLP] | 5.6 |
| **BACKWATER POOLS** | | |
| Secondary Channel Pool | [SCP] | 6.1 |
| Backwater Pool - Boulder Formed | [BPB] | 6.2 |
| Backwater Pool - Root Wad Formed | [BPR] | 6.3 |
| Backwater Pool - Log Formed | [BPL] | 6.4 |
| Dammed Pool | [DPL] | 6.5 |

SAN VICENTE Drainage:

Table 1 - SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES Survey Dates: 07/09/96 to 07/14/96

Confluence Location: QUAD: DAVENPORT LEGAL DESCRIPTION: T11SR03WS LATITUDE:37°8'4" LONGITUDE:122°11'35"

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | 5 | RIFFLE | 16 | 54 | 1399 | 8 | 22.8 | 1.7 | 2137 | 55555 | 8853 | 230182 | 0 | 4 |
| 65 | 10 | FLATWATER | 40 | 218 | 14147 | 76 | 12.4 | 1.2 | 2707 | 175946 | 2347 | 152586 | 0 | 6 |
| 70 | 33 | POOL | 43 | 39 | 2715 | 15 | 14.8 | 1.4 | 565 | 39550 | 796 | 55727 | 330 | 12 |
| 2 | 2 | CULVERT | 1 | 194 | 387 | 2 | 4.5 | 1.4 | 1051 | 2102 | 1108 | 2216 | 0 | 3 |

| TOTAL UNITS | TOTAL UNITS | TOTAL LENGTH (ft.) | TOTAL AREA (sq. ft.) | TOTAL VOL. (cu. ft.) |
|---|---|---|---|---|
| 163 | 50 | 18648 | 273153 | 440710 |

SAN VICENTE

Drainage:

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS

Survey Dates: 07/09/96 to 07/14/96

Confluence Location: QUAD: DAVENPORT LEGAL DESCRIPTION: T11SR03WS

LATITUDE:37°8'4" LONGITUDE:122°11'35"

| 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 % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 3 | LGR | 12 | 39 | 787 | 4 | 32 | 2.1 | 5.0 | 3058 | 61165 | 14273 | 285466 | 0 | 3 | 80 |
| 3 | 1 | HGR | 2 | 108 | 323 | 2 | 10 | 1.1 | 1.7 | 440 | 1320 | 484 | 1452 | 0 | 5 | 97 |
| 3 | 1 | BRS | 2 | 96 | 289 | 2 | 9 | 0.9 | 1.3 | 1069 | 3206 | 962 | 2886 | 0 | 5 | 35 |
| 18 | 2 | RUN | 11 | 56 | 1007 | 5 | 8 | 3.1 | 4.0 | 623 | 11210 | 1304 | 23473 | 0 | 5 | 77 |
| 46 | 7 | SRN | 28 | 285 | 13103 | 70 | 14 | 0.8 | 2.1 | 3624 | 166692 | 2942 | 135321 | 0 | 6 | 95 |
| 1 | 1 | EDW | 1 | 37 | 37 | 0 | 13 | 0.6 | 0.8 | 457 | 457 | 274 | 274 | 0 | 5 | 15 |
| 45 | 20 | MCP | 28 | 41 | 1866 | 10 | 14 | 1.4 | 3.4 | 636 | 28610 | 906 | 40776 | 383 | 13 | 86 |
| 1 | 1 | CRP | 1 | 50 | 50 | 0 | 14 | 1.5 | 2.6 | 665 | 665 | 998 | 998 | 333 | 5 | 85 |
| 2 | 1 | LSL | 1 | 38 | 76 | 0 | 17 | 1.1 | 2.2 | 595 | 1190 | 655 | 1309 | 298 | 10 | 100 |
| 5 | 2 | LSR | 3 | 38 | 192 | 1 | 14 | 1.6 | 2.5 | 336 | 1680 | 479 | 2394 | 210 | 10 | 97 |
| 5 | 3 | LSBk | 3 | 39 | 194 | 1 | 13 | 1.6 | 4.1 | 499 | 2496 | 712 | 3558 | 337 | 5 | 96 |
| 9 | 3 | PLP | 6 | 28 | 249 | 1 | 17 | 1.2 | 4.0 | 377 | 3392 | 472 | 4252 | 202 | 13 | 87 |
| 1 | 1 | BPB | 1 | 26 | 26 | 0 | 12 | 1.7 | 2.7 | 296 | 296 | 504 | 504 | 59 | 5 | 80 |
| 2 | 2 | BPL | 1 | 31 | 62 | 0 | 19 | 1.3 | 2.9 | 536 | 1073 | 742 | 1483 | 259 | 20 | 99 |
| 2 | 2 | CUL | 1 | 194 | 387 | 2 | 5 | 1.4 | 2.2 | 1051 | 2102 | 1108 | 2216 | 0 | 3 | 100 |

| TOTAL UNITS | TOTAL UNITS | LENGTH (ft.) | AREA (sq.ft) | TOTAL VOL. (cu.ft) |
|---|---|---|---|---|
| 163 | 50 | 18648 | 285554 | 506361 |

SAN VICENTE

Drainage:

Table 3 - SUMMARY OF POOL TYPES

*Survey Dates: 07/09/96 to 07/14/96*

Confluence Location: QUAD: DAVENPORT LEGAL DESCRIPTION: T11SR03WS LATITUDE:37°8'4" LONGITUDE:122°11'35"

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 45 | 20 | MAIN | 64 | 41 | 1866 | 69 | 14.5 | 1.4 | 636 | 28610 | 906 | 40776 | 383 | 13 |
| 22 | 10 | SCOUR | 31 | 35 | 761 | 28 | 14.8 | 1.4 | 456 | 10032 | 616 | 13555 | 267 | 9 |
| 3 | 3 | BACKWATER | 4 | 29 | 88 | 3 | 16.7 | 1.4 | 456 | 1369 | 662 | 1987 | 192 | 15 |

| TOTAL UNITS | TOTAL UNITS | TOTAL LENGTH (ft.) | TOTAL AREA (sq.ft.) | TOTAL VOL. (cu.ft.) |
|---|---|---|---|---|
| 70 | 33 | 2715 | 40012 | 56318 |

SAN VICENTE

Drainage:

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES

Survey Dates: 07/09/96 to 07/14/96

Confluence Location: QUAD: DAVENPORT LEGAL DESCRIPTION: T11SR03WS

LATITUDE:37°8'4" LONGITUDE:122°11'35"

| UNITS 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 45 | MCP | 64 | 1 | 2 | 7 | 16 | 24 | 53 | 11 | 24 | 2 | 4 |
| 1 | CRP | 1 | 0 | 0 | 0 | 0 | 1 | 100 | 0 | 0 | 0 | 0 |
| 2 | LSL | 3 | 0 | 0 | 0 | 0 | 1 | 50 | 0 | 0 | 1 | 50 |
| 5 | LSR | 7 | 0 | 0 | 0 | 0 | 5 | 100 | 0 | 0 | 0 | 0 |
| 5 | LSBk | 7 | 0 | 0 | 0 | 0 | 1 | 20 | 2 | 40 | 2 | 40 |
| 9 | PLP | 13 | 0 | 0 | 1 | 11 | 5 | 56 | 2 | 22 | 1 | 11 |
| 1 | BPB | 1 | 0 | 0 | 0 | 0 | 1 | 100 | 0 | 0 | 0 | 0 |
| 2 | BPL | 3 | 0 | 0 | 1 | 50 | 1 | 50 | 0 | 0 | 0 | 0 |

TOTAL UNITS

70

SAN VICENTE Drainage:

Table 5 - SUMMARY OF MEAN PERCENT COVER BY HABITAT TYPE Survey Dates: 07/09/96 to 07/14/96

Confluence Location: QUAD: DAVENPORT LEGAL DESCRIPTION: T11SR03WS LATITUDE:37°8'4" LONGITUDE:122°11'35"

| UNITS MEASURED | UNITS FULLY MEASURED | HABITAT TYPE | MEAN % UNDERCUT BANKS | MEAN % SWD | MEAN % LWD | MEAN % ROOT MASS | MEAN % TERR. VEGETATION | MEAN % AQUATIC VEGETATION | MEAN % WHITE WATER | MEAN % BOULDERS | MEAN % BEDROCK LEDGES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 2 | LGR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 0 |
| 3 | 1 | HGR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 0 |
| 3 | 1 | BRS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 50 |
| 18 | 2 | RUN | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| 46 | 6 | SRN | 0 | 17 | 0 | 1 | 23 | 0 | 3 | 56 | 0 |
| 1 | 1 | EDW | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 0 |
| 45 | 19 | MCP | 1 | 26 | 8 | 25 | 21 | 0 | 4 | 11 | 0 |
| 1 | 1 | CRP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 0 |
| 2 | 1 | LSL | 0 | 70 | 30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 2 | LSR | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 |
| 5 | 2 | LSBk | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 25 | 65 |
| 9 | 3 | PLP | 0 | 0 | 0 | 0 | 7 | 0 | 77 | 17 | 0 |
| 1 | 1 | BPB | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 |
| 2 | 2 | BPL | 0 | 25 | 25 | 0 | 0 | 0 | 0 | 25 | 25 |
| 2 | 1 | CUL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 0 |

SAN VICENTE

Drainage:

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE

Survey Dates: 07/09/96 to 07/14/96

Confluence Location: QUAD: DAVENPORT LEGAL DESCRIPTION: T11SR03WS LATITUDE:37°8'4" LONGITUDE:122°11'35"

| TOTAL HABITAT UNITS | UNITS FULLY 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 |
|---|---|---|---|---|---|---|---|---|---|
| 20 | 2 | LGR | 0 | 0 | 0 | 0 | 100 | 0 | 0 |
| 3 | 1 | HGR | 0 | 0 | 0 | 0 | 100 | 0 | 0 |
| 3 | 1 | BRS | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| 18 | 2 | RUN | 0 | 0 | 50 | 0 | 0 | 0 | 50 |
| 46 | 7 | SRN | 0 | 0 | 0 | 43 | 57 | 0 | 0 |
| 1 | 1 | EDW | 0 | 0 | 0 | 0 | 0 | 100 | 0 |
| 45 | 20 | MCP | 0 | 25 | 35 | 25 | 10 | 5 | 0 |
| 1 | 1 | CRP | 0 | 0 | 0 | 100 | 0 | 0 | 0 |
| 2 | 1 | LSL | 0 | 0 | 0 | 100 | 0 | 0 | 0 |
| 5 | 2 | LSR | 0 | 50 | 50 | 0 | 0 | 0 | 0 |
| 5 | 3 | LSBk | 0 | 0 | 100 | 0 | 0 | 0 | 0 |
| 9 | 3 | PLP | 0 | 0 | 67 | 33 | 0 | 0 | 0 |
| 1 | 1 | BPB | 0 | 0 | 100 | 0 | 0 | 0 | 0 |
| 2 | 2 | BPL | 0 | 50 | 0 | 50 | 0 | 0 | 0 |
| 2 | 1 | CUL | 0 | 0 | 0 | 0 | 0 | 0 | 100 |

*Summary of Mean Percent Vegetative Cover for Entire Stream*

| Mean Percent Canopy | Mean Percent Conifer | Mean Percent Deciduous | Mean Percent Open units | Mean Right bank % Cover | Mean Left Bank % Cover |
|---|---|---|---|---|---|
| 87 | 14 | 86 | 4 | 73.0 | 75.5 |

Note: Mean percent conifer and deciduous for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

7/9/96 - 7/14/96

Temperatures

| DATE | LOCATION (ft.) | TIME | AIR (°F) | WATER (°F) |
|---|---|---|---|---|
| 7-9 | 0 | 0845 | 55 | 56 |
| 7-9 | 938 | 1005 | 56 | 56 |
| 7-9 | 2029 | 1110 | 57 | 56 |
| 7-10 | 2320 | 0855 | 54 | 55 |
| 7-10 | 3009 | 0950 | 55 | 55 |
| 7-10 | 3902 | 1100 | 56 | 55 |
| 7-10 | 4963 | 1320 | 58 | 57 |
| 7-11 | 6182 | 1420 | 60 | 57 |
| 7-11 | 8234 | 1145 | 59 | 56 |
| 7-11 | 9556 | 1310 | 63 | 57 |
| 7-11 | 10549 | 1340 | 63 | 57 |
| 7-13 | 13313 | 0920 | 58 | 56 |
| 7-13 | 13831 | 1015 | 57 | 55 |
| 7-13 | 14308 | 1120 | 60 | 56 |
| 7-13 | 14728 | 1215 | 62 | 57 |
| 7-13 | 15851 | 1400 | 65 | 56 |
| 7-14 | 17449 | 0853 | 59 | 56 |

Table 7. Air and water temperatures taken during the habitat typing survey in San Vicente Creek, Santa Cruz County.

TABLE 8. FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: SAN VICENTE
SAMPLE DATES: 07/09/96 to 07/14/96
STREAM LENGTH: 17930 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: DAVENPORT — Latitude: 37°8'4"
Legal Description: T11SR03WS — Longitude: 122°11'35"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 01

| | |
|---|---|
| Channel Type: B3 | Canopy Density: 87% |
| Channel Length: 17930 ft. | Coniferous Component: 14% |
| Riffle/flatwater Mean Width: 17 ft. | Deciduous Component: 86% |
| Total Pool Mean Depth: 1.4 ft. | Pools by Stream Length: 14% |
| Base Flow: 8.0 cfs | Pools >=3 ft.deep: 33% |
| Water: 055- 057°F Air: 054-065°F | Mean Pool Shelter Rtn: 11 |
| Dom. Bank Veg.: Deciduous Trees | Dom. Shelter: Boulders |
| Vegetative Cover: 77% | Occurrence of LOD: 6% |
| Dom. Bank Substrate: Silt/Clay/Sand | Dry Channel: 0 ft. |

Embeddness Value: 1. 1% 2.17% 3. 73% 4. 1% 5. 7%

Mean Percentage of Dominant Substrate

| Dominant Class of Substrate | Number Units Right Bank | Number Units Left Bank | Total Mean Percent |
|---|---|---|---|
| Bedrock | 8 | 12 | 20.83 |
| Boulder | 1 | 0 | 1.04 |
| Cobble/Gravel | 6 | 9 | 15.63 |
| Silt/clay | 33 | 27 | 62.50 |

Mean Percentage of Dominant Vegetation

| Dominant Class of Vegetation | Number Units Right Bank | Number Units Left Bank | Total Mean Percent |
|---|---|---|---|
| Grass | 1 | 0 | 1.04 |
| Brush | 5 | 6 | 11.46 |
| Decid. Trees | 37 | 39 | 79.17 |
| Conif. Trees | 1 | 0 | 1.04 |
| No Vegetation | 4 | 3 | 7.29 |

Total stream average embeddedness value for pool 2.76

TABLE 10. MEAN PERCENT OF SHELTER COVER TYPES FOR ENTIRE STREAM

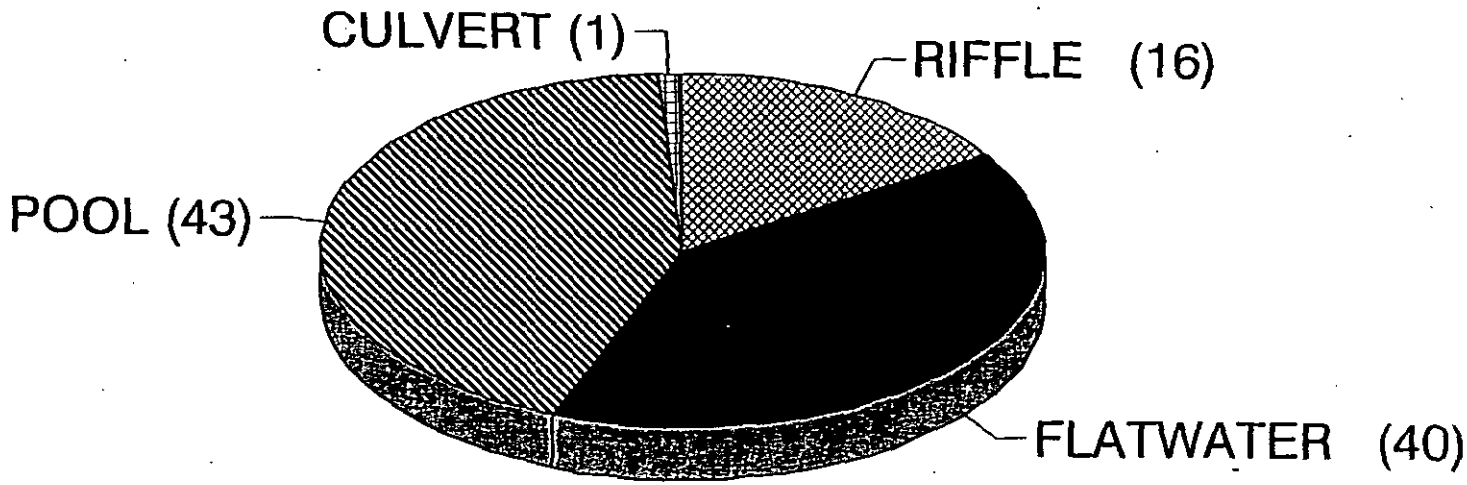
Stream: SAN VICENTE Drainage:

Survey Date: 07/09/96 to 07/14/96

| | RIFFLES | FLATWATER | POOLS |
|---|---|---|---|
| UNDERCUT BANKS | 0.20 | 0 | 0.27 |
| SMALL WOODY DEBRIS | 16.94 | 27.27 | 22.97 |
| LARGE WOODY DEBRIS | 5.10 | 0 | 8.11 |
| ROOTS | 15.41 | 0.45 | 21.08 |
| TERRESTRIAL VEG | 13.27 | 12.73 | 13.78 |
| AQUATIC VEG | 0 | 0 | 0 |
| WHITEWATER | 6.73 | 1.82 | 8.38 |
| BOULDERS | 31.53 | 48.64 | 15.14 |
| BEDROCK LEDGES | 8.78 | 9.09 | 7.57 |

# SAN VICENTE CREEK

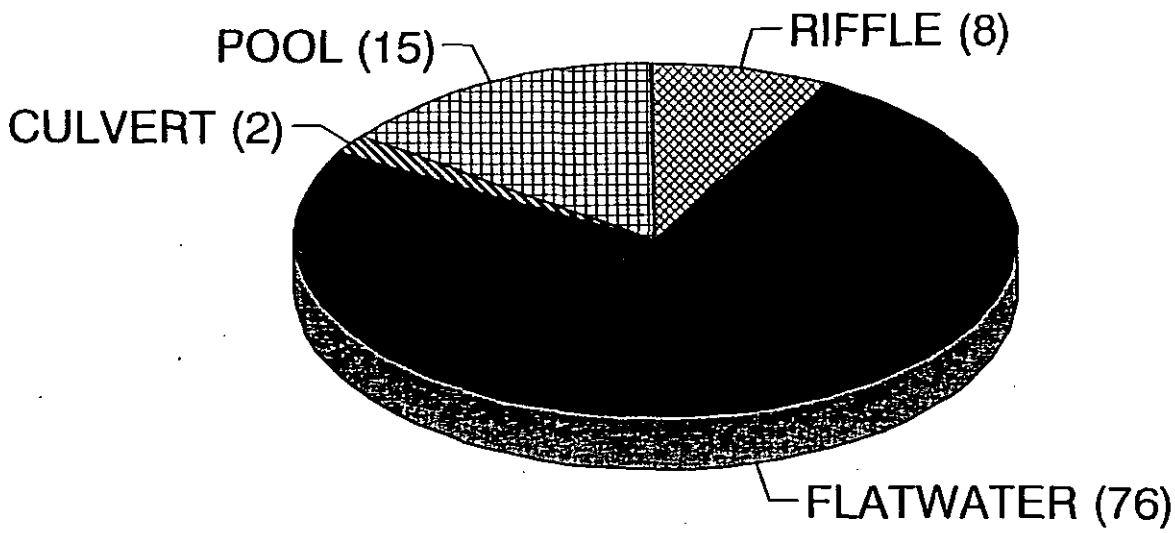
## HABITAT TYPES BY PERCENT OCCURRENCE




GRAPH 1

# SAN VICENTE CREEK

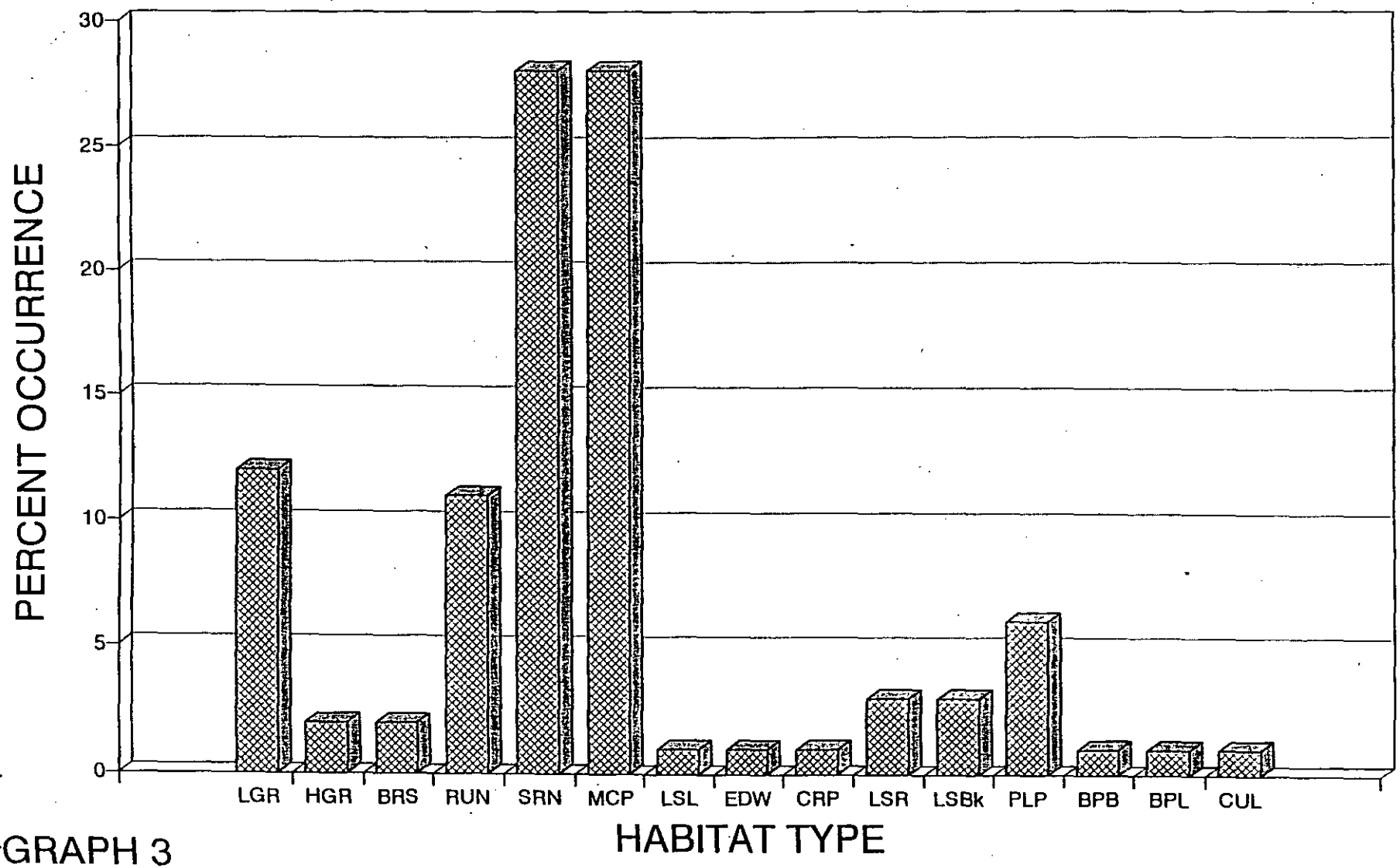
## HABITAT TYPES BY PERCENT TOTAL LENGTH




GRAPH 2

# SAN VICENTE CREEK

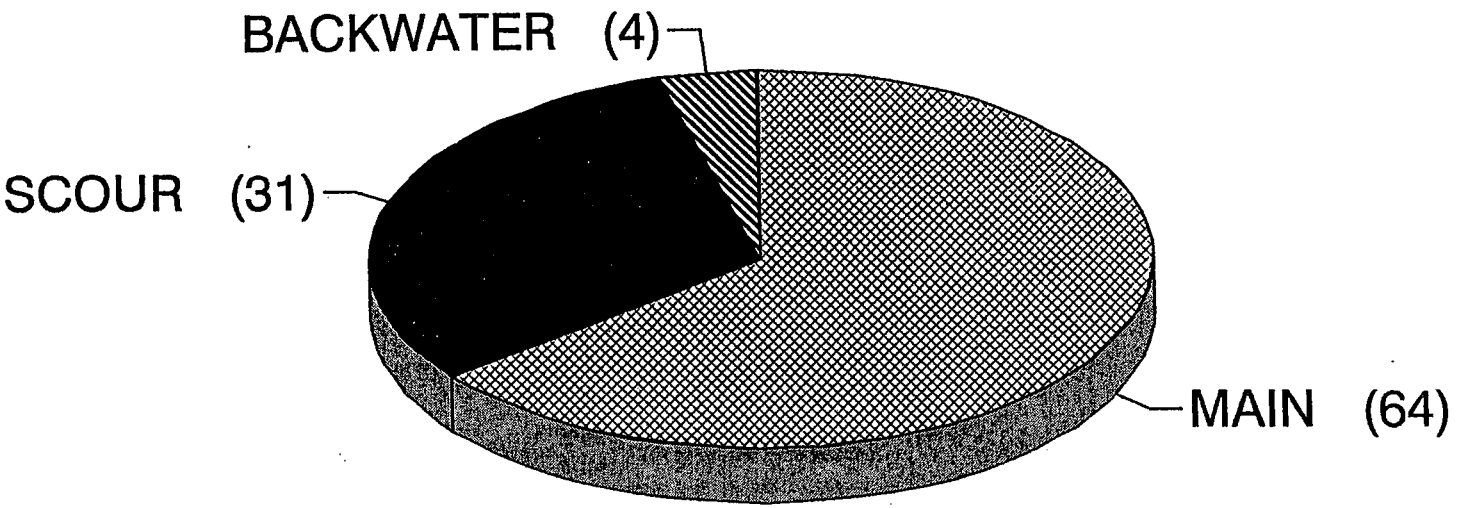
## HABITAT TYPES BY PERCENT OCCURRENCE




GRAPH 3

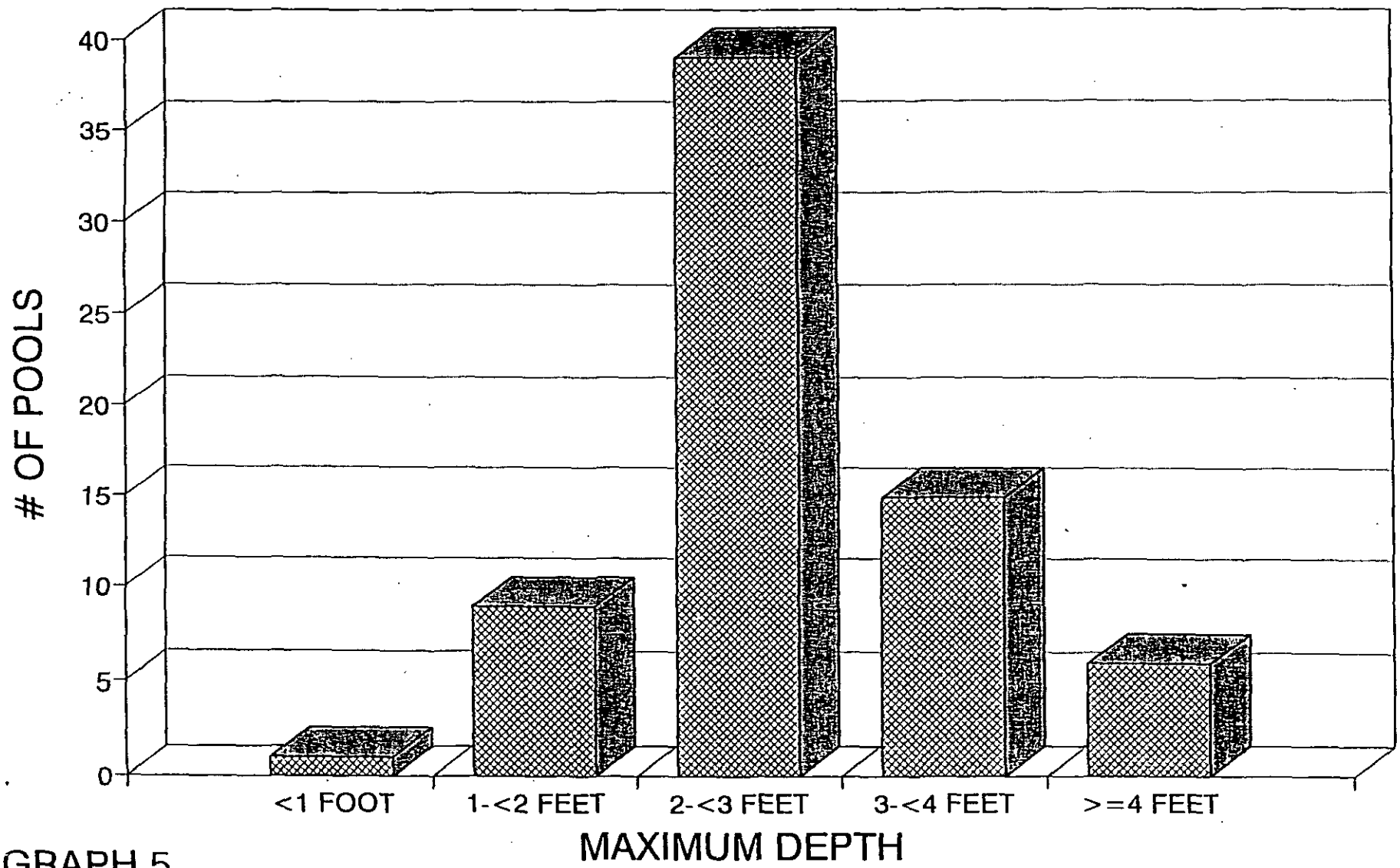
# SAN VICENTE CREEK

## POOL HABITAT TYPES BY PERCENT OCCURRENCE



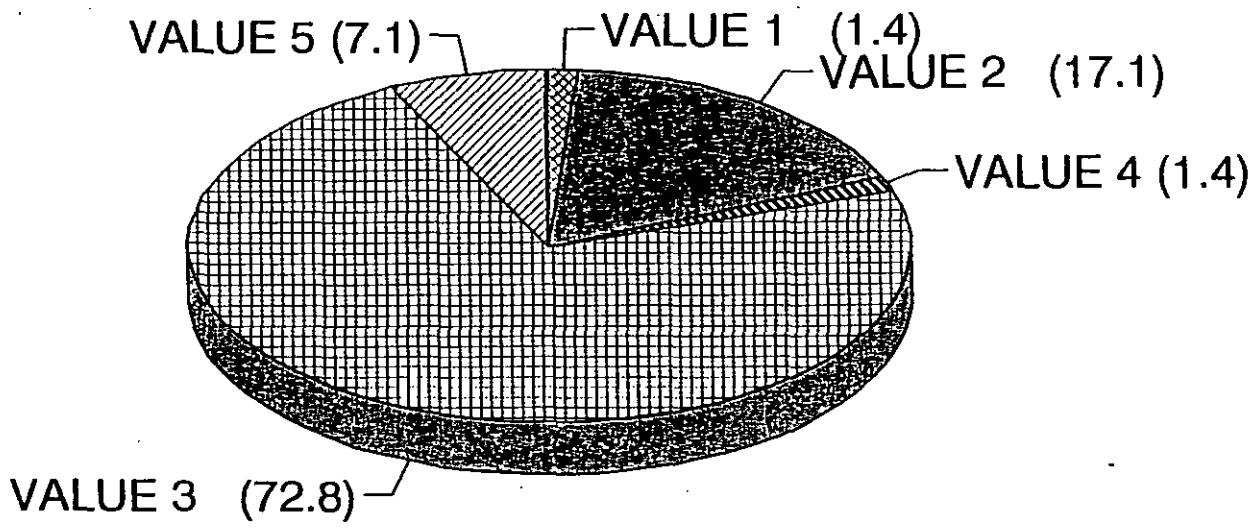

GRAPH 4

# SAN VICENTE CREEK
## MAXIMUM POOL DEPTHS




GRAPH 5

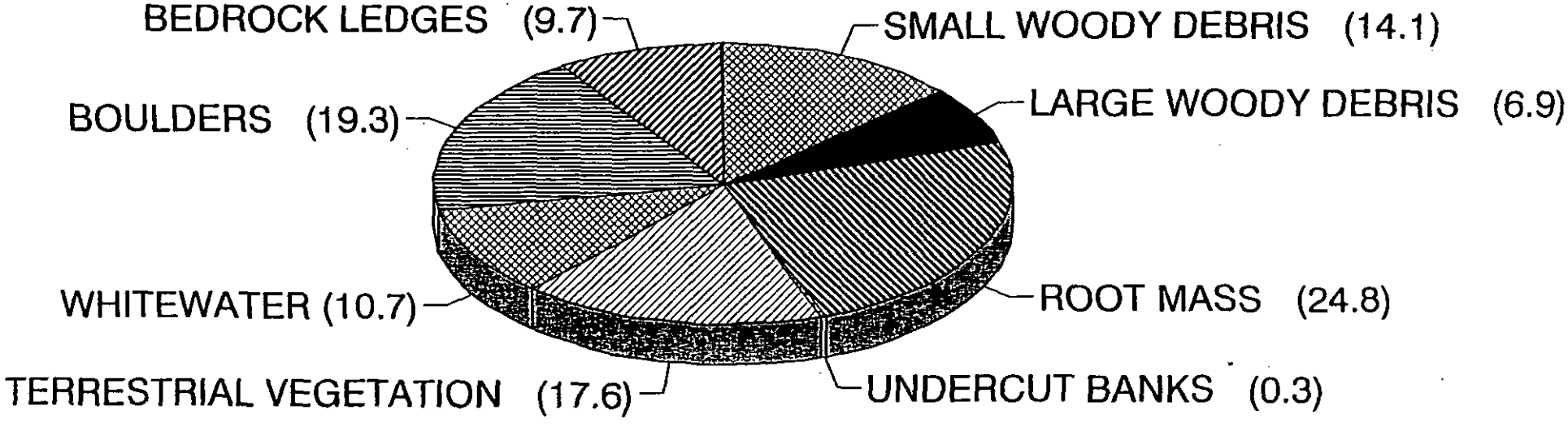
# SAN VICENTE CREEK
## PERCENT EMBEDDEDNESS




GRAPH 6

# SAN VICENTE CREEK

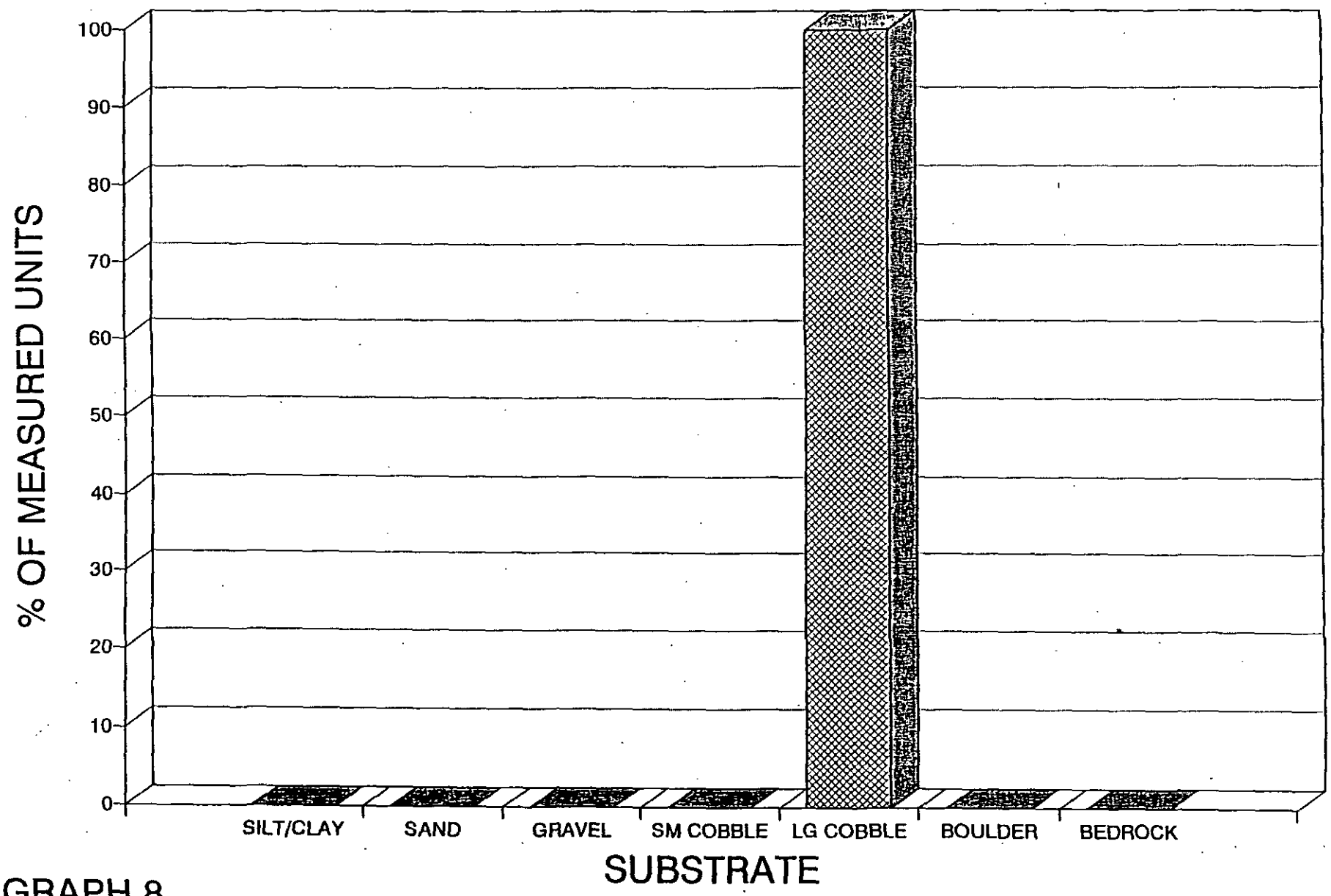
## MEAN PERCENT COVER TYPES IN POOLS




GRAPH 7

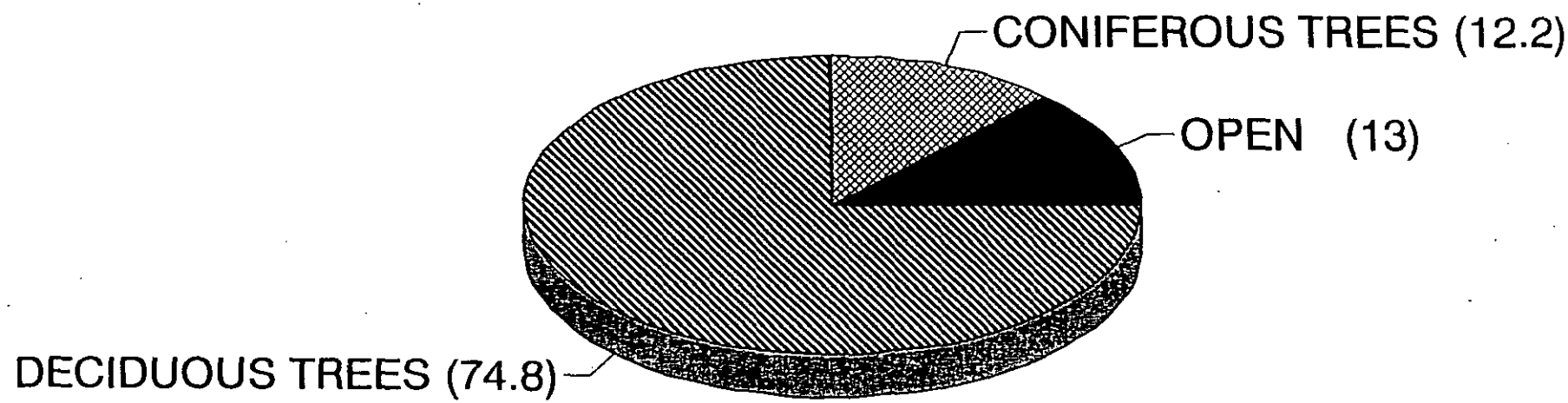
# SAN VICENTE CREEK

## SUBSTRATE COMPOSITION IN LOW GRADIENT RIFFLES




GRAPH 8

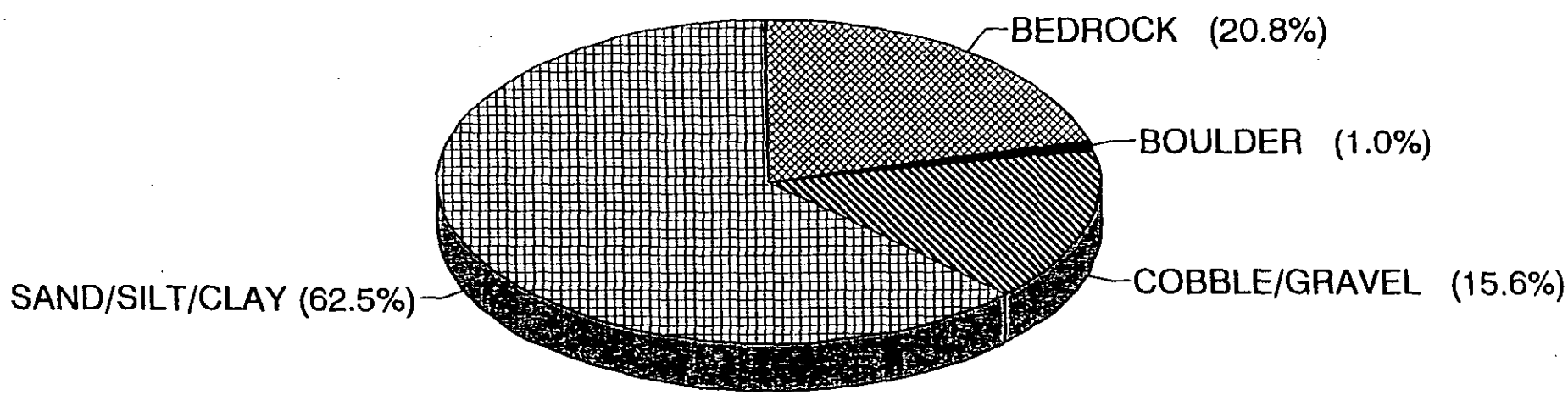
# SAN VICENTE CREEK
## PERCENT CANOPY




GRAPH 9

# SAN VICENTE CREEK

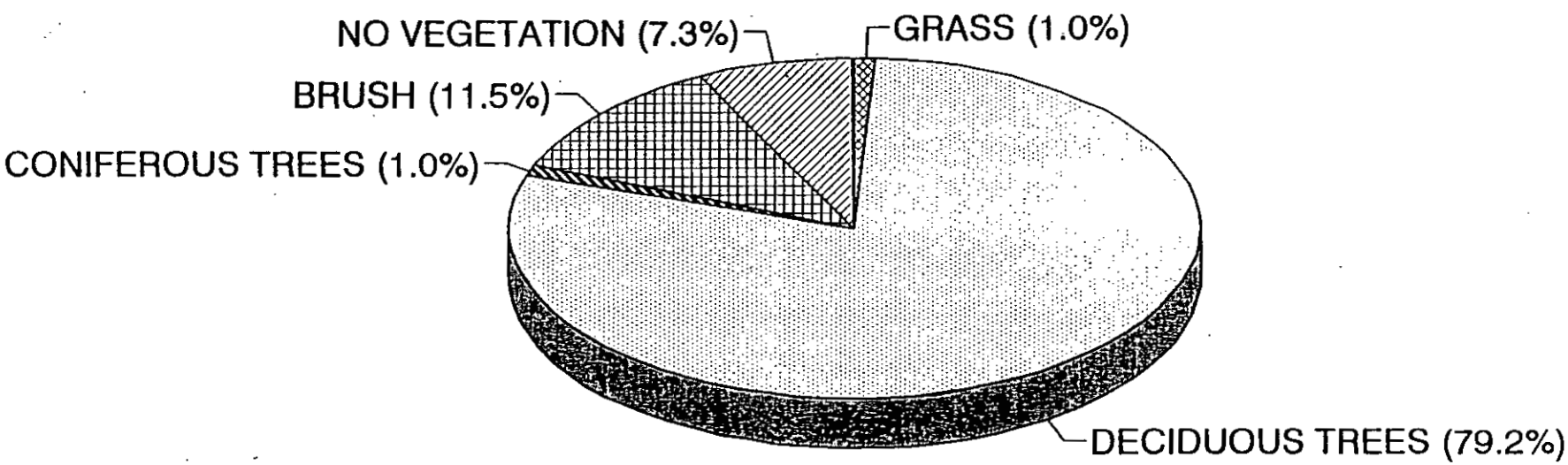
## DOMINANT BANK COMPOSITION IN SURVEY REACH




GRAPH 10

# SAN VICENTE CREEK

## DOMINANT BANK VEGETATION IN SURVEY REACH




GRAPH 11

Ref # 90

SL-20
12/14/04

STREAM INVENTORY REPORT

**SAN VICENTE CREEK**

FS# 2563
LOE#'s 3220, 3209

## INTRODUCTION

A stream inventory was conducted during the summer of 1996 on San Vicente Creek, Santa Cruz County. The inventory consisted of two parts: a habitat inventory and biological inventory. The purpose of the habitat inventory was to document the habitat available to anadromous salmonids in San Vicente Creek. The biological inventory was conducted to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for 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

San Vicente Creek enters the Pacific Ocean approximately 9 miles north of the city of Santa Cruz in Santa Cruz County, California (Map 1). San Vicente Creek's legal description at the confluence with the Pacific Ocean is T11S R03W. Its location is 31°08'04" north latitude and 122°11'35" west longitude. San Vicente Creek is a third order stream and has approximately 9.3 miles of main stem and 11.3 miles of tributary blue line stream according to the USGS Davenport 7.5 minute quadrangle. San Vicente Creek drains a watershed of approximately 11.1 square miles. Elevations range from 0 feet at the mouth of the creek to 2,600 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production, open pit mining, cattle grazing, urbanization and water diversion. Vehicle access exists via private roads off Highway 1.

## METHODS

The habitat inventory conducted in San Vicente Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 1994). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) Members 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.

## SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the flatwater and riffle habitat

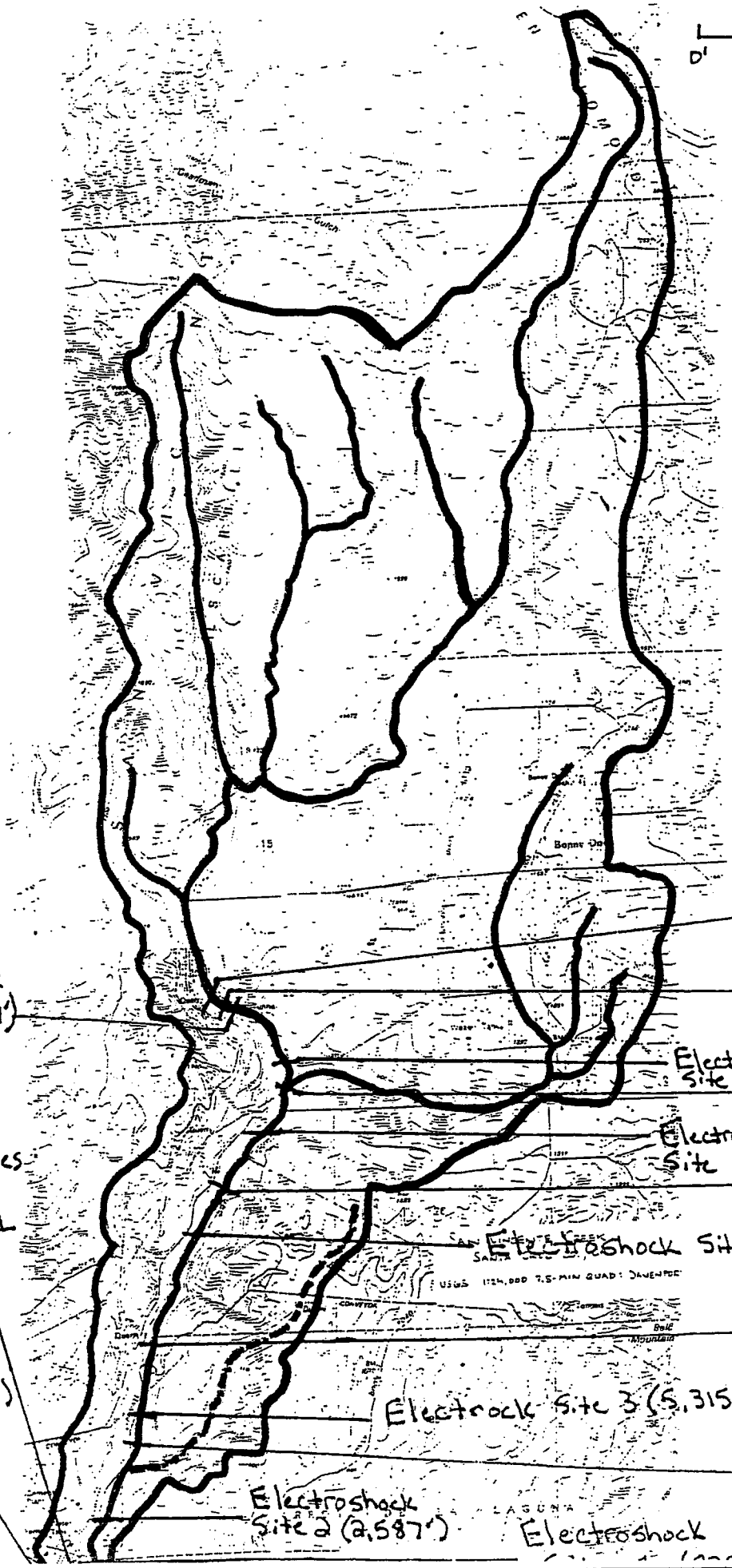
USGS Quad: Davenport (1991)

50% Reduced

0' 3000'

1:24K

# Map 1



units and 47% of the pool habitat within the survey reach (Hopelain, 1994). All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth. Complete measurements are made on 1) habitat unit types encountered for the first time, 2) one randomly selected unit from the ten habitat units on each field form page and 3) every third pool.

## 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 San Vicente Creek to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow was measured in cubic feet per second (cfs) at stream mile 0.86 using a Marsh-McBirney Model 2000 Flowmate.

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 temperature, air temperature and time are measured and recorded at every tenth habitat unit. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

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". San Vicente 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. Channel dimensions were measured using hip chains, tape measures, and stadia rods. All units were measured for length; additionally, the first occurrence of each habitat type, every third pool, and a randomly selected 10% subset of all flatwater and riffle units were

sampled for all features on the sampling form (Hopelain, 1995). Pool tail crest depth at each pool unit was measured in the thalweg. 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 San Vicente Creek, embeddedness was ocularly 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). Additionally, a rating of "not suitable" (NS) was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate size (i.e. silt, large cobble, boulder or bedrock).

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide salmonids protection from predation and high water velocities and allow separation of territorial units to reduce density related competition. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In San Vicente Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. 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-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two respectively.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In San Vicente 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 ocularly into percentages of coniferous or deciduous trees.

9. Bank Composition and Vegetation:

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 San Vicente Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described 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 composition and their distribution throughout the stream. In San Vicente Creek fish presence was observed from the stream banks and seven sites were sampled using a Smith-Root Model 12 backpack electrofishing unit. 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 8.4*, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following six tables:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

Graphics are produced from the tables using Quattro Pro. Graphics developed for San Vicente Creek include:

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence
- Pool types by percent occurrence
- Total pools by maximum depths
- Embeddedness
- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

## HABITAT INVENTORY RESULTS

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

The habitat inventory of July, 09, 10, 11, 13, and 14, 1996 was conducted by Allan Renger (WSP/AmeriCorps) and Dawn Fisher (CCC). The total length of the stream surveyed was 17,930 feet (3.4 miles) with an additional 718 feet (0.14 miles) of side channel.

Flow measured at stream mile 0.86 was 8.0 cfs on July 10, 1995.

San Vicente Creek is a B3 channel type for the entire 17,930 feet of stream reach surveyed. B3 channel types are moderately entrenched, moderate gradient, riffle dominated channels, with infrequently spaced pools, very stable plan and profile, stable banks and a cobble channel.

Water temperatures taken during the survey period ranged from 55 to 57 degrees Fahrenheit. Air temperatures ranged from 54 to 65 degrees Fahrenheit (Table 7).

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types: Based on frequency of **occurrence** there were 16% riffle units, 40% flatwater units, 43% pool units, and 1% culvert units. (Graph 1). Based on total **length** of Level II habitat types there were 7% riffle units, 76% flatwater units, 15% pool units, and 2% culvert units. (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools (28.0%), step runs (28.0%), and low gradient riffles (12.0%) (Graph 3). Based on percent total **length**, step runs comprised 70%, mid-channel pools 10%, and runs 5%.

A total of 70 pools were identified (Table 3). Main channel pools were most frequently encountered at 64% and comprised 69% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. If instream shelter is present, pool quality for salmonids will increase with depth. Twenty-one of the seventy pools (30%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail crests. Of the 70 pool tail crests measured, 1 had a value of 1 (1.4%); 12 had a value of 2 (17.1%); 51 had a value of 3 (72.8%); 1 had a value of 4 (1.4%); and 5 (7.1%) were unsuitable for spawning (Graph 6). On this scale, a value of 1 indicates low embeddedness or a low percentage of fines at spawning sites.

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 habitat types had a mean shelter rating of 12, and flatwater habitats had a mean shelter rating of 6 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 15. Main channel pools had a mean

shelter rating of 13 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in San Vicente Creek. Large woody debris are lacking in nearly all habitat types (Graph 7).

Table 6 summarizes the dominant substrate by habitat type. Large cobble was the dominant substrate observed in the two low gradient riffles measured. Large cobble was the dominant substrate observed in 4 of the 7 step runs measured (57%). Small cobble was the next most frequently observed dominant substrate type and occurred in 43% of the step runs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 87% of which 86% of the canopy consisted of deciduous trees and 14% were coniferous trees (Graph 9).

For the stream reach surveyed, the mean percent right bank vegetated was 73%. The mean percent left bank vegetated was 75.5%. The dominant elements composing the structure of the stream banks consisted of 20% bedrock, 1% boulder, 15% cobble/gravel, and 60% sand/silt/clay (Graph 10). Deciduous trees are the dominant vegetation type observed in 76% of the units surveyed. Additionally, 11% of the units surveyed had brush as the dominant vegetation type, and 1% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Seven sites were sampled on October 16, 17, and 21, 1995 by Jennifer Nelson, T. Laidig and Twyla Anderson (DFG).

The first site sampled was located at stream mile 0.16 and included 2 mid-channel pools and a run. The site yielded 37 steelhead ranging in total length from 62 millimeters to 187 millimeters, 4 sculpin ranging in length from 50 millimeters to 140 millimeters and 1 coho salmon (81 millimeters total length).

The second site sampled was located at stream mile 0.49 and included a lateral scour pool - root wad enhanced, a run and riffle. The site yielded 67 steelhead ranging in total length from 59 to 192 millimeters, 2 sculpin (125 millimeters and 137 millimeters) and 1 coho salmon (90 millimeters).

The third site sampled was located at stream mile 1.01 and included a lateral scour pool - root wad enhanced, a riffle and a mid-channel pool. The site yielded 32 steelhead ranging in total length from 53 to 188 millimeters and 4 sculpin ranging in length from 110 millimeters to 169 millimeters.

The fourth site sampled was located at stream mile 1.95 and included a riffle, a run, and a mid-channel pool. The site yielded 12 steelhead ranging in total length from 55 millimeters to 157

millimeters and 1 sculpin (117 millimeters).

The fifth site sampled was located at stream mile 2.6 and included 2 mid-channel pools and a riffle. The site yielded 25 steelhead ranging in total length from 60 millimeters to 206 millimeters, 1 coho salmon (85 millimeters) and 1 Pacific giant salamander.

The sixth site sampled was located at stream mile 2.93 and included a mid-channel pool, a riffle, and a plunge pool. The site yielded 30 steelhead ranging in total length from 54 millimeters to 269 millimeters.

The seventh site sampled was located at stream mile 3.3 and included 2 plunge pools and a step run. The site yielded 25 steelhead ranging in total length from 57 millimeters to 242 millimeters, 2 Pacific giant salamanders and a red-legged frog.

## DISCUSSION

San Vicente Creek is a B3 channel type for the entire 3.40 miles (17,930 feet) of stream surveyed.

The water temperatures recorded on the survey days July 9, 10, 11, 13, and 14, 1996, ranged from 55 to 57 degrees Fahrenheit. Air temperatures ranged from 54 to 65 degrees Fahrenheit. . Optimum temperatures for coho salmon juveniles during the summer months range from 50 to 59 degrees Fahrenheit (McMahan, 1983). Steelhead juveniles can survive in warmer water, but the optimum summer temperature range for steelhead is also 50 to 59 degrees Fahrenheit (Barnhart, 1986). As stream temperatures approach 68 degrees Fahrenheit, growth ceases, swimming is impaired and it becomes increasingly difficult to extract oxygen from the water. The virulence of fish diseases and the toxicity of most chemicals is also exacerbated by higher water temperatures (Barnhart, 1986).

Flatwater habitat types comprised 76% of the total **length** of this survey, riffles 8%, and pools 15%. The pools are relatively shallow, with only 21 of the 70 (30%) pools having a maximum depth greater than 3 feet. In third and fourth order streams, a primary pool is defined to have a maximum depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Fallen trees, log jams, large boulders and other hard substantial elements will allow additional pools to be scoured and in the case of fallen trees and log jams, complex instream cover will also be provided.

Fifty-seven of the 70 pool tail-outs measured had embeddedness ratings of 3, 4, or 5. Only 1 had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, indicates high quality spawning substrate for salmon and steelhead. In San Vicente Creek, sediment sources should be identified mapped and prioritized according to their potential sediment yields, and the appropriate control measures should be taken.

The mean shelter rating for pools was low with a rating of 12. The shelter rating in the flatwater habitats was slightly lower at 6. A pool shelter rating of approximately 100 is desirable. The relatively large amount of cover that now exists is being provided primarily by boulders in all habitat types. Log and root wad cover structure in pool and flatwater habitats are needed to improve both summer and winter salmonid habitat. Complex woody debris (i.e roots, fallen trees) provides rearing fry with protection from predation, refuge from high water velocities, provides a food source and divides territorial units to reduce density related competition.

The two low gradient riffles measured had large cobble as the dominant substrate. Large cobble was also dominant in four of the seven step runs measured. Large cobble (5.0 to 10.0 inch diameter) is considered unsuitable for spawning steelhead and coho salmon.

The mean percent canopy density for the stream was 87%. This is considered adequate canopy cover to provide the necessary shade on the stream and assure cool water for juvenile coho salmon and steelhead.

The percentage of right and left bank covered with vegetation was moderate at 73% and 76%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank revetment, is recommended.

## RECOMMENDATIONS

1) San Vicente Creek should be managed as an anadromous, natural production stream.

2) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding or allowing for the natural recruitment of complex woody debris (i.e. trees and logs) would provide summer and winter habitat in addition to scouring more pools.

3) Active and potential sediment sources need to be identified, mapped, and prioritized according to their potential for sediment yield to the stream and its tributaries.

4) To establish a more complete and meaningful temperature record for stream temperatures, 24-hour monitoring from June through November should be conducted to determine potentially critical temperature periods.

5) Because of the extensive water diversion from the system, future water rights issues should be scrutinized to assure adequate bypass flows throughout the year.

COMMENTS AND LANDMARKS

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

| | |
|---|---|
| 0' | Begin survey at confluence with the Pacific Ocean. Channel type is B3. |
| 230' | San Vicente Creek passes through a 245' long x 12' wide x 16' high bedrock tunnel. |
| 542' | San Vicente Creek passes through a 142' long x 13' wide x 13' high bedrock tunnel. Culvert passes beneath Highway 1. |
| 1,868' | Broken glass and brick debris from right bank glass blowing shop is ending up in the creek. |
| 2,023' | Log debris accumulation (LDA) 12' long x 10' wide x 4' high is retaining sediment 2' deep x 20' long. |
| 2,540 - | Cattle grazing on right and left sides of creek. |
| 3,089' | Unpaved road crossing. |
| 3,574' | Unpaved road crossing. |
| 4,172' | Unpaved road crossing. Old broken down concrete dam. |
| 4,520' | A three foot diameter culvert diverts water into a left bank pond. An 8' screened pipe diverts water up the left bank. |
| 5,253' | Unpaved road crossing. |
| 5,411' | A man made side channel diverts water into a right bank holding pond. A 6" pipe diverts water up the right bank. The diversion pipe fish screen does not appear to be working. |
| 7,041' | One foot concrete dam. |
| 7,056' | Bridge 11' long x 24' wide x 4.2' high. |
| 8,784' | Left bank retaining wall. |
| 9,085' | Left bank tributary drains from left bank culvert. No fish observed above culvert. |

| | |
|---|---|
| 9,480' | Right bank trickling tributary. No fish observed. |
| 11,914' | Bridge 14' long x 35' wide x 9' high. |
| 12,766' | Right bank diversion 2' diameter. |
| 12,884' | Barbed wire fence crosses creek. |
| 13,911' | Left bank broken down dam or retaining pond. |
| 14,806' | Left bank tributary is Mill Creek. |
| 15,189' | Unpaved road crossing. |
| 17,576' | Steep boulder cascade 5' high x 10' long. |
| 17,586' | Right bank concrete retaining wall 86' long x 20' high. |
| 17,672' | Old concrete building on the right bank 153' long x 50' high. |
| 17,906' | End of survey. San Vicente Creek flows through a man made bedrock tunnel 9' high x 27' wide x approximately 0.25 miles long. The tunnel is a barrier to fish passage. |

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