

STREAM INVENTORY REPORT

Bear Pen Creek

INTRODUCTION

A stream inventory was conducted during July 12, 2007 to August 22, 2007 on Bear Pen Creek. The survey began at the confluence with the South Fork Eel River and extended upstream 2.8 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Bear Pen Creek.

A biological survey of Bear Pen Creek was last conducted in 2001 to document the presence of juvenile salmonid species. Findings from that survey will also be included in this report.

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

Bear Pen Creek is a tributary to the South Fork Eel River, tributary to Eel River which drains to the Pacific Ocean, located in Mendocino County, California (Map 1). Bear Pen Creek's legal description at the confluence with South Fork Eel River is T24N R17W S7. Its location is 39.9358 north latitude and 123.7766 west longitude, LLID number 1237766399359. Bear Pen Creek is a second order stream and has approximately 2.7 miles of blue line stream according to the USGS Piercy 7.5 minute quadrangle. Bear Pen Creek drains a watershed of approximately 5.0 square miles. Elevations range from about 535 feet at the mouth of the creek to 1,300 feet in the headwater areas. Second growth redwood forest dominates the watershed. The watershed is entirely privately owned by the Redwood Forest Foundation, Inc. Vehicle access exists via Highway 101 to Highway 271 south. Exit Highway 271 and turn right and park at the first large pull-out. Follow the dirt road to the locked gate and proceed on foot to the South Fork Eel River. Then walk downstream about 0.25 miles to mouth of Bear Pen Creek.

METHODS

The habitat inventory conducted in Bear Pen Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (WSP) 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.

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SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. 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, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

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 Bear Pen Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (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. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. 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 (1990). 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". Bear Pen 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 measurements are in feet to the nearest tenth. Habitat characteristics are

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measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Bear Pen 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) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile 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 for prey. 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 Bear Pen 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. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

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 Bear Pen 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 hardwood 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 Bear Pen 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

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the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

BIOLOGICAL INVENTORY

Biological sampling is used to determine fish species and their distribution in the stream. Detailed biological sampling was not conducted on Bear Pen Creek during the 2007 survey season. Fish presence was observed from the stream banks during habitat typing in Bear Pen Creek. Data from a 2001 electrofishing survey is listed in the Biological Inventory Results section of this report. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.19, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Game. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream

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- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Bear Pen Creek include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant 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 12, 2007 to August 22, 2007, was conducted by T. Fisher and M. Cavin (WSP). The total length of the stream surveyed was 14,864 feet with an additional 627 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.5 cfs on July 23, 2007.

Bear Pen Creek is a B4 channel type for 1,150 feet of the stream surveyed (Reach 1), a F2 channel type for 2,233 feet of the stream surveyed (Reach 2), and a B4 channel type for 11,481 feet of the stream surveyed (Reach 3)

B4 channels are moderately entrenched riffle-dominated channels with infrequently spaced pools, very stable plan and profile, stable banks on moderate gradients with low width /depth ratios and gravel-dominant substrates. F2 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and boulder-dominant substrates.

Water temperatures taken during the survey period ranged from 56 to 66 degrees Fahrenheit. Air temperatures ranged from 56 to 73 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 44% pool units, 28% flatwater units, 26% riffle units, and 2% dry units

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(Graph 1). Based on total length of Level II habitat types there were 43% pool units, 35% flatwater units, 20% riffle units, and 3% dry units (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 29% mid-channel pool units, 26% run units, and 21% high gradient riffle units (Graph 3). Based on percent total length, run units made up 32%, mid-channel pool units 26%, and high gradient riffle units 17%.

A total of 131 pools were identified (Table 3). Main channel pools were the most frequently encountered at 89% (Graph 4), and comprised 91% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Twenty-eight of the 129 (22%) measured pools had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 129 pool tail-outs measured, 36 had a value of 1 (27.9%); 50 had a value of 2 (38.8%); 28 had a value of 3 (21.7%); 6 had a value of 4 (4.7%); and 9 had a value of 5 (6.9%), (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

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. Riffle habitat types had a mean shelter rating of 42, flatwater habitat types had a mean shelter rating of 17, and pool habitats had a mean shelter rating of 42 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 42, scour pools had a mean shelter rating of 38 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in Bear Pen Creek. Graph 7 describes the pool cover in Bear Pen Creek. Boulders are the dominant pool cover type, followed by large woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was observed in 74% of pool tail-outs, and small cobble was observed in 14% of pool tail-outs.

The mean percent canopy density for the surveyed length of Bear Pen Creek was 80%. Twenty percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 79% and 21%, respectively. Graph 9 describes the mean percent canopy in Bear Pen Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 93%. The mean percent left bank vegetated was 93%. The dominant elements composing the structure of the stream banks consisted of 44% cobble/gravel, 30% boulder, 17% bedrock, and 8% sand/silt/clay (Graph 10). Coniferous trees were the dominant vegetation type observed in 54.3% of the units surveyed. Additionally, 45.7% of the units surveyed had hardwood trees as the dominant

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vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Bear Pen Creek was biologically sampled on September 12, 2001, by the California Department of Fish and Game for fish presence and identification. Using a backpack electrofisher, 11 coho salmon and 42 steelhead trout were captured and identified during. The survey began at the confluence with South Fork Eel River and extended upstream 870 feet.

DISCUSSION

Bear Pen Creek is a B4 channel type for the first 1,150 feet of stream surveyed, an F2 channel type for the next 2,233 feet and a B4 channel type for the remaining 11,481 feet. The suitability of B4 and F2 channel types for fish habitat improvement structures is as follows: B4 channels are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing deflectors, and log cover. F2 channels are fair for plunge weirs, single and opposing wing deflectors, and log cover.

The water temperatures recorded on the survey days July 12, 2007 to August 22, 2007, ranged from 56 to 66 degrees Fahrenheit. Air temperatures ranged from 56 to 73 degrees Fahrenheit. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 28.3% of the total length of this survey, riffles 26.3%, and pools 43.7%. The pools are relatively shallow, with only 28 of the 129 (22%) pools having a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual 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. Installing structure that will deepen pool habitat is recommended.

Eighty-six of the 129 pool tail-outs measured had embeddedness ratings of 1 or 2. Thirty-four of the pool tail-outs had embeddedness ratings of 3 or 4. Nine of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

One hundred thirteen of the 129 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 42. The shelter rating in the flatwater habitats was 17. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Bear Pen Creek. Boulders are the dominant cover type in pools followed by large woody debris. Log and root wad cover structures in the pool and

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flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 80%. Reach 1 had a canopy density of 83.1%, reach 2 had a canopy density of 81.9%, and reach 3 had a canopy density of 78.6%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 93% and 93%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

- 1) Bear Pen 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 in the pools is from boulders. Adding high quality complexity with woody cover in the pools is desirable.
- 3) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.
- 4) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

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.

Position (ft):	Habitat unit #:	Comments:
0	0001.00	Start of survey at the confluence with the South Fork Eel River.
151	0005.00	A young-of-the-year (YOY) salmonid was observed at this unit.
202	0006.00	Bear Pen Creek leaves the influence of the SF Eel at this unit.

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228	0007.00	There was left bank erosion that measured 250' long x 15' high.
731	0014.00	There was left bank erosion that measured 180' long x 15' high.
1026	0019.00	There was left bank erosion that measured 15' high x 115' long.
1150	0021.00	The top of this unit was the beginning of reach #2 which was a F2 channel type.
1408	0031.00	An erosion site measuring 100' long x 300' high was on the right bank.
1596	0033.00	There were 2 rootwads that were wedged together by a large boulder confining the creek. As a result there was a 3.5' plunge with gravel sediment retention measuring 200' long x 4' high x 10' wide.
1650	0035.00	There was a 2.5 foot plunge at the top of this habitat unit.
1767	0038.00	At this unit there was a log debris accumulation (LDA) consisting of 60 pieces of large woody debris. The LDA measured 12' high x 37' wide x 49' long. Water flowed through visible gaps near the left bank. Sediment being retained ranged from sand to large cobble and measured 37' wide, 33' long and 9' high. Fish were seen above the LDA.
2133	0046.00	There was a landslide on the left bank (LB) measured 40' high x 35' long.
2909	0068.00	There was a slide in a gully on the left bank.
3073	0070.00	A slide on the right bank was observed.
3288	0076.00	There was erosion on left bank measuring 15' high x 80' long.
3332	0077.00	There was a channel type change at the bottom of this unit. The channel type was a B4, and it marks the beginning of reach #3.
4028	0090.00	Partially re-vegetated left bank erosion site was observed that measured 80' long x 40' high.
5523	0127.00	Erosion sites were observed on both the left and right banks. LDA #02 was 8' high x 28' wide x 50' long and extended through habitat unit #128. There were roughly 40 pieces of LWD. Water flowed through visible gaps. The sediment that used to be retained has been blown out. This accumulation is not a barrier to fish.
5727	0132.00	The plunge pool height 1.5' high.

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5826	0135.00	Tributary #01 entered the right bank at the top of the habitat unit with a flow estimated less than 1 cubic feet per second (cfs). The tributary's temperature was 57 degrees Fahrenheit; Bear Pen's temperature upstream was 61 degrees Fahrenheit and downstream was 60 degrees Fahrenheit. For the first 100' the slope of the tributary was 21% and no young-of-year were observed.
5862	0136.00	A bedrock seep was observed on the right bank.
5862	0136.00	Left bank erosion measured 26' high x 110' long.
6239	0146.00	Juvenile salmonids observed.
6678	0155.01	The side channel here was being formed by an old growth stump within the wetted width.
6854	0160.00	A dry intermittent tributary entered on the left bank.
6921	0161.00	There was a seep on the left bank.
7289	0168.00	A dry intermittent tributary entered on the left bank.
7289	0168.00	A partially re-vegetated erosion site was observed measuring 159' long x 100' high.
7561	0174.00	A dry intermittent tributary was observed on the left bank.
7561	0174.00	There was an erosion site on the left bank that measured 73' long x 150' high.
7608	0175.00	Erosion on the left bank measured 30' long x 55' high.
7724	0176.00	Tributary #02 entered from the left bank with a flow estimated to be less than 0.1cfs. The temperature of the tributary was 60 degrees Fahrenheit, while Bear Pen's upstream temperature was 63 degrees Fahrenheit and downstream temperature was 64 degrees Fahrenheit. The slope of the tributary was 45% for the 40' explored. No fish were observed in the tributary.
7778	0178.00	Erosion on the left bank measured 72' long x 80' high.
7916	0181.00	There was a slide on the left bank that measured 60' long x 70' high.
8120	0182.00	Partially re-vegetated erosion site observed on the left bank measuring 60' long x 40' high.

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8346	0188.00	LDA #03 was at this unit, it measured 10' high x 35' wide x 26' long. Water was flowing through, there were visible gaps, and sediment was no longer being retained. There was active left bank erosion that was 200' high x 100' long. The right bank was partially re-vegetated measuring 200' high x 150' long.
8415	0190.00	LDA #04 measured 8' high, 42' wide and 35' long. The sediment being retained was 15' wide, 20' long and 3' deep. There were gaps that water flowed through and there was no apparent barrier to fish. YOY were observed above this unit. There was active right bank erosion measuring 80' long x 30' high.
8478	0192.00	Active erosion was observed on the left bank, 87' long x 200' high.
8947	0197.00	There was a dry intermittent tributary on the left bank.
9352	0203.00	There was an old erosion site on the left bank measuring 100' long x 100' high.
9439	0205.00	A dry intermittent tributary entered from the left bank.
9486	0206.00	There was an active slide on the right bank measuring 100' long x 200' high.
9530	0208.00	There was an active right bank slide observed.
9552	0209.00	There were active slides on both banks. The right bank slide measured 200' long x 80' high. The left bank slide measured 200' long x 150' high.
9782	0212.00	There was an active slide on the right bank that measured 68' long x 50' high.
9815	0213.00	A dry intermittent tributary entered from the right bank.
9830	0214.00	There was an active slide on the left bank that measured 60' long x 60' high.
9890	0215.00	There was a partially active and partially re-vegetated slide on the right bank measuring 370' long x 250' high.
10723	0229.00	There was an active slide on the right bank that was 35' long x 300' high.
10846	0232.00	Tributary #03 entered from the right bank. The estimated flow is less than 1 cfs contributing an estimated less than 2% to the flow of Bear Pen. The temperature of the tributary was 55 degrees Fahrenheit, while Bear Pen was 60 degrees Fahrenheit both upstream and downstream of

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the confluence. The slope was 10% for the entirety of the 40' that was visually observed up the tributary. The channel was full of boulders and LWD. No fish were observed in the tributary.

11013	0236.00	There was an active slide on the right bank measuring 25' long x 50' high.
11184	0240.00	Numerous juvenile salmonids have been observed throughout the survey as well as in this habitat unit.
11205	0241.00	There was an active slide on the right bank measuring 85' long x 300' high.
11410	0247.00	There was an active slide on both banks. The left bank slide measured 125' long x 20' high. The right bank slide measured 200' long x 300' high. This is causing the LDA within the next habitat unit.
11422	0248.00	LDA #05 measured 15' high, 45' wide and 330' long. There were over 100 pieces of large woody debris in the accumulation. Water was flowing through the LDA but there were no visible gaps. The sediment being retained was 15' deep, 45' wide and 450' long and ranged in size from sand to cobble. YOY were observed above the LDA.
11718	0249.00	There was active erosion on the left bank that measured 75' long x 30' high.
11718	0249.00	There were juvenile salmonids observed.
12136	0253.00	There was a slide measuring 35' long x 25' high.
12170	0254.00	Tributary #04 entered on the right bank. The flow was estimated to be less than 1 cfs and its contribution to Bear Pen's flow was estimated to be less than 1%. The temperature of the tributary was 55 degrees Fahrenheit, while Bear Pen upstream and downstream was 58 degrees Fahrenheit. The tributary was checked 10' upstream for fish and slope. No fish were observed and the slope was 21% and increasing.
12487	0256.00	Tributary #05 entered from the left bank; flow was estimated to be less than 1 cfs while its contribution to Bear Pen was estimated to be 4%. The water temperature of the tributary was 58 degrees Fahrenheit; the temperature of Bear Pen upstream of the tributary was 58 degrees Fahrenheit, while the downstream temperature was 59 degrees Fahrenheit. It appeared accessible to fish for the 100' explored, although no fish were sighted in the tributary.

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13143	0262.00	A left bank seep was observed.
13332	0264.00	There was an active slide on the left bank measuring 25' high x 60' long.
13332	0264.00	An old growth redwood lodged in the stream created a natural weir with a 5' plunge that was retaining sediment. There were fish observed upstream of the redwood.
13410	0267.00	Erosion was coming in from the right bank measuring 55' long x 10' high and the left bank measuring 55' long x 60' high.
13576	0270.00	Juvenile salmonids were observed in this unit.
13769	0275.00	A dry intermittent tributary entered from the right bank.
14082	0280.00	LDA #06 was 10' high x 30' wide x 25' long; with about 50 pieces of LWD. Water flowed through, but there weren't any visible gaps. No sediment was being retained. It did not present a fish barrier and there were fish seen upstream of the LDA.
14243	0283.00	LDA#07 was 8' high x 56' wide x 20' long with about 50 pieces of LWD. Water was flowing through visible gaps. No sediment was being retained. Fish were seen above it.
14342	0284.00	There was a small drainage/seep on the right bank.
14864	0290.00	The survey ended due to poor access and a long hike in and out of the creek resulting in little to no survey time.

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

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LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE

Low Gradient Riffle	(LGR)	[1.1]	{ 1 }
High Gradient Riffle	(HGR)	[1.2]	{ 2 }

CASCADE

Cascade	(CAS)	[2.1]	{ 3 }
Bedrock Sheet	(BRS)	[2.2]	{24}

FLATWATER

Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}

MAIN CHANNEL POOLS

Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}

SCOUR POOLS

Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }

BACKWATER POOLS

Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}

ADDITIONAL UNIT DESIGNATIONS

Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	

Table 1 - Summary of Riffle, Flatwater, and Pool Habitat Types

Stream Name: Bear Pen Creek

LLID: 1237766399359

Drainage: Eel River - South Fork

Survey Dates: 7/12/2007 to 8/22/2007

Confluence Location: Quad: PIERCY

Legal Description: T24NR17WS07

Latitude: 39:56:09.0N

Longitude: 123:46:36.0

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max 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
5	0	DRY	1.7	83	413	2.7									
85	16	FLATWATER	28.3	63	5345	34.5	12.2	0.5	1.0	489	41543	270	22963		17
131	129	POOL	43.7	51	6616	42.7	13.0	0.5	1.5	609	79763	640	83835	343	42
79	17	RIFFLE	26.3	39	3117	20.1	16.5	0.5	1.0	426	33634	217	17147		42
Total Units 300	Total Units Fully Measured 162				Total Length (ft.) 15491					Total Area (sq.ft.) 154941			Total Volume (cu.ft.) 123945		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Bear Pen Creek

LLID: 1237766399359

Drainage: Eel River - South Fork

Survey Dates: 7/12/2007 to 8/22/2007

Confluence Location: Quad: PIERCY

Legal Description: T24NR17WS07

Latitude: 39:56:09.0N

Longitude: 123:46:36.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Max 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	Mean Canopy (%)
16	5	LGR	5.3	31	496	3.2	10	0.4	1.1	453	7249	188	3014		7	82
62	11	HGR	20.7	42	2588	16.7	18	0.5	1.8	399	24753	208	12869		54	83
1	1	CAS	0.3	33	33	0.2	32	0.8	1.2	581	581	465	465		90	85
1	1	POW	0.3	39	39	0.3	15	0.8	1.3	439	439	351	351		100	85
78	13	RUN	26.0	64	5020	32.4	12	0.5	2	511	39878	277	21624		7	80
6	2	SRN	2.0	48	286	1.8	11	0.5	1.1	367	2204	184	1102		38	82
88	87	MCP	29.3	45	3986	25.7	13	0.5	3.9	575	50558	649	57104	381	41	77
28	27	STP	9.3	72	2028	13.1	13	0.3	2.1	796	22280	710	19889	271	48	83
2	2	LSL	0.7	36	72	0.5	18	0.3	1.8	548	1096	459	918	203	53	85
3	3	LSR	1.0	39	118	0.8	12	0.6	3.3	458	1374	506	1519	267	42	83
3	3	LSBk	1.0	56	167	1.1	10	0.8	3	568	1703	658	1975	388	8	78
4	4	LSBo	1.3	43	172	1.1	12	0.4	1.4	469	1877	383	1532	199	30	87
3	3	PLP	1.0	24	73	0.5	15	0.2	2.3	343	1028	326	979	137	65	82
5	0	DRY	1.7	83	413	2.7										

Total Units
300

Total Units Fully Measured
162

Total Length (ft.)
15491

Total Area (sq.ft.)
155020

Total Volume (cu.ft.)
123340

Table 3 - Summary of Pool Types

Stream Name: Bear Pen Creek

LLID: 1237766399359

Drainage: Eel River - South Fork

Survey Dates: 7/12/2007 to 8/22/2007

Confluence Location: Quad: PIERCY

Legal Description: T24NR17WS07

Latitude: 39:56:09.0N

Longitude: 123:46:36.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Residual Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Residual Pool Vol (cu.ft.)	Estimated Total Resid.Vol. (cu.ft.)	Mean Shelter Rating
116	114	MAIN	89	52	6014	91	13.0	0.5	627	72722	359	37952	42
15	15	SCOUR	11	40	602	9	13.1	0.5	472	7078	238	3574	38
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
131	129				6616					79800		41526	

Table 4 - Summary of Maximum Residual Pool Depths By Pool Habitat Types

Stream Name: Bear Pen Creek

LLID: 1237766399359

Drainage: Eel River - South Fork

Survey Dates: 7/12/2007 to 8/22/2007

Confluence Location: Quad: PIERCY

Legal Description: T24NR17WS07

Latitude: 39:56:09.0N

Longitude: 123:46:36.0W

Habitat Units	Habitat Type	Habitat Occurrence (%)	< 1 Foot Maximum Residual Depth	< 1 Foot Percent Occurrence	1 < 2 Feet Maximum Residual Depth	1 < 2 Feet Percent Occurrence	2 < 3 Feet Maximum Residual Depth	2 < 3 Feet Percent Occurrence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
87	MCP	67	15	17	48	55	21	24	3	3	0	0
27	STP	21	8	30	18	67	1	4	0	0	0	0
2	LSL	2	1	50	1	50	0	0	0	0	0	0
3	LSR	2	1	33	1	33	0	0	1	33	0	0
3	LSBk	2	0	0	2	67	0	0	1	33	0	0
4	LSBo	3	0	0	4	100	0	0	0	0	0	0
3	PLP	2	1	33	1	33	1	33	0	0	0	0
Total Units			Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
129			26	20	75	58	23	18	5	4	0	0

Mean Maximum Residual Pool Depth (ft.): 1.5

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Bear Pen Creek

LLID: 1237766399359

Drainage: Eel River - South Fork

Survey Dates: 7/12/2007 to 8/22/2007

Dry Units: 5

Confluence Location: Quad: PIERCY

Legal Description: T24NR17WS07

Latitude: 39:56:09.0N

Longitude: 123:46:36.0W

Habitat Units	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
16	5	LGR	0	0	0	0	0	0	8	93	0
62	11	HGR	0	1	0	0	1	0	19	79	0
1	1	CAS	0	0	0	0	0	0	35	65	0
79	17	TOTAL RIFFLE	0	1	0	0	0	0	19	80	0
1	1	POW	0	0	0	0	0	0	10	90	0
78	13	RUN	4	0	0	4	0	0	0	92	0
6	2	SRN	0	15	33	0	0	0	5	48	0
85	16	TOTAL FLAT	3	3	7	3	0	0	2	82	0
88	87	MCP	4	12	14	13	1	0	3	48	5
28	27	STP	2	2	9	4	0	0	15	68	0
2	2	LSL	0	10	40	0	0	0	5	45	0
3	3	LSR	20	3	3	62	0	0	10	2	0
3	3	LSBk	0	0	0	0	0	0	0	50	50
4	4	LSBo	0	3	5	0	0	0	6	86	0
3	3	PLP	2	0	2	7	0	0	28	62	0
131	129	TOTAL POOL	4	9	12	11	1	0	7	53	4
300	162	TOTAL	3	8	11	10	1	0	7	57	4

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Bear Pen Creek

LLID: 1237766399359

Drainage: Eel River - South Fork

Survey Dates: 7/12/2007 to 8/22/2007

Dry Units: 5

Confluence Location: Quad: PIERCY

Legal Description: T24NR17WS07

Latitude: 39:56:09.0N

Longitude: 123:46:36.0W

Habitat Units	Units Fully Measured	Habitat Type	% Total Silt/Clay Dominant	% Total Sand Dominant	% Total Gravel Dominant	% Total Small Cobble Dominant	% Total Large Cobble Dominant	% Total Boulder Dominant	% Total Bedrock Dominant
16	5	LGR	0	0	20	20	0	60	0
62	11	HGR	0	0	9	0	0	91	0
1	1	CAS	0	0	0	0	0	100	0
1	1	POW	0	0	0	0	0	100	0
78	13	RUN	0	0	54	15	23	8	0
6	2	SRN	0	0	50	50	0	0	0
88	87	MCP	0	1	67	11	5	15	1
28	27	STP	0	0	44	0	11	44	0
2	2	LSL	0	0	100	0	0	0	0
3	3	LSR	0	0	67	33	0	0	0
3	3	LSBk	0	0	100	0	0	0	0
4	4	LSBo	0	0	75	0	0	25	0
3	3	PLP	0	0	33	0	0	33	33

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Bear Pen Creek

LLID: 1237766399359

Drainage: Eel River - South Fork

Survey Dates: 7/12/2007 to 8/22/2007

Confluence Location: Quad: PIERCY

Legal Description: T24NR17WS07

Latitude: 39:56:09.0N

Longitude: 123:46:36.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
80	21	79	0	93	93

Note: Mean percent conifer and hardwood 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.

Table 8 - Fish Habitat Inventory Data Summary

Stream Name: Bear Pen Creek

LLID: 1237766399359

Drainage: Eel River - South Fork

Survey Dates: 7/12/2007 to 8/22/2007

Survey Length (ft.): 15491

Main Channel (ft.): 14864

Side Channel (ft.): 627

Confluence Location: Quad: PIERCY

Legal Description: T24NR17WS07

Latitude: 39:56:09.0N

Longitude: 123:46:36.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: B4

Reach Length (ft.): 1150

Riffle/Flatwater Mean Width (ft.): 14.4

BFW:

Range (ft.): 18 to 23

Mean (ft.): 22

Std. Dev.: 2

Base Flow (cfs.): 0.5

Water (F): 56 - 58

Air (F): 56 - 59

Dry Channel (ft): 0

Canopy Density (%): 83.5

Coniferous Component (%): 5.8

Hardwood Component (%): 94.2

Dominant Bank Vegetation: Hardwood Trees

Vegetative Cover (%): 99.3

Dominant Shelter: Boulders

Dominant Bank Substrate Type: Boulder

Occurrence of LWD (%): 2

LWD per 100 ft.:

Riffles: 1

Pools: 5

Flat: 1

Pools by Stream Length (%): 29.9

Pool Frequency (%): 34.8

Residual Pool Depth (%):

< 2 Feet Deep: 83

2 to 2.9 Feet Deep: 17

3 to 3.9 Feet Deep: 0

>= 4 Feet Deep: 0

Mean Max Residual Pool Depth (ft.): 0.9

Mean Pool Shelter Rating: 40

Pool Tail Substrate (%): Silt/Clay: 0

Sand: 0

Gravel: 67

Sm Cobble: 17

Lg Cobble: 0

Boulder: 17

Bedrock: 0

Embeddedness Values (%): 1. 50.0

2. 0.0

3. 33.3

4. 0.0

5. 16.7

STREAM REACH: 2

Channel Type: F2

Reach Length (ft.): 2233

Riffle/Flatwater Mean Width (ft.): 13.0

BFW:

Range (ft.): 13 to 34

Mean (ft.): 26

Std. Dev.: 6

Base Flow (cfs.): 0.5

Water (F): 56 - 66

Air (F): 56 - 66

Dry Channel (ft): 177

Canopy Density (%): 81.9

Coniferous Component (%): 9.6

Hardwood Component (%): 90.4

Dominant Bank Vegetation: Coniferous Trees

Vegetative Cover (%): 96.0

Dominant Shelter: Boulders

Dominant Bank Substrate Type: Boulder

Occurrence of LWD (%): 8

LWD per 100 ft.:

Riffles: 8

Pools: 19

Flat: 20

Pools by Stream Length (%): 47.8

Pool Frequency (%): 40.7

Residual Pool Depth (%):

< 2 Feet Deep: 83

2 to 2.9 Feet Deep: 17

3 to 3.9 Feet Deep: 0

>= 4 Feet Deep: 0

Mean Max Residual Pool Depth (ft.): 1.5

Mean Pool Shelter Rating: 54

Pool Tail Substrate (%): Silt/Clay: 0

Sand: 0

Gravel: 67

Sm Cobble: 17

Lg Cobble: 8

Boulder: 8

Bedrock: 0

Embeddedness Values (%): 1. 33.3

2. 33.3

3. 25.0

4. 0.0

5. 8.3

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: B4	Canopy Density (%): 78.7	Pools by Stream Length (%): 43.0
Reach Length (ft.): 11481	Coniferous Component (%): 26.2	Pool Frequency (%): 45.4
Riffle/Flatwater Mean Width (ft.): 15.1	Hardwood Component (%): 73.8	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 77
Range (ft.): 13 to 40	Vegetative Cover (%): 92.0	2 to 2.9 Feet Deep: 18
Mean (ft.): 25	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 5
Std. Dev.: 7	Dominant Bank Substrate Type: Cobble/Gravel	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.5	Occurrence of LWD (%): 11	Mean Max Residual Pool Depth (ft.): 1.5
Water (F): 58 - 64 Air (F): 56 - 73	LWD per 100 ft.:	Mean Pool Shelter Rating: 39
Dry Channel (ft): 236	Riffles: 5	
	Pools: 8	
	Flat: 7	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 1 Gravel: 76 Sm Cobble: 13 Lg Cobble: 5 Boulder: 4 Bedrock: 1		
Embeddedness Values (%): 1. 25.3 2. 42.4 3. 20.2 4. 6.1 5. 6.1		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Bear Pen Creek

LLID: 1237766399359

Drainage: Eel River - South Fork

Survey Dates: 7/12/2007 to 8/22/2007

Confluence Location: Quad: PIERCY

Legal Description: T24NR17WS07

Latitude: 39:56:09.0N

Longitude: 123:46:36.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	26	30	17.4
Boulder	49	49	30.4
Cobble / Gravel	76	67	44.4
Sand / Silt / Clay	10	15	7.8

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	0	0	0.0
Brush	0	0	0.0
Hardwood Trees	66	81	45.7
Coniferous Trees	95	80	54.3
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values:

2

Table 10 - Mean Percent of Shelter Cover Types For Entire Stream

StreamName: Bear Pen Creek

LLID: 1237766399359

Drainage: Eel River - South Fork

Survey Dates: 7/12/2007 to 8/22/2007

Confluence Location: Quad: PIERCY

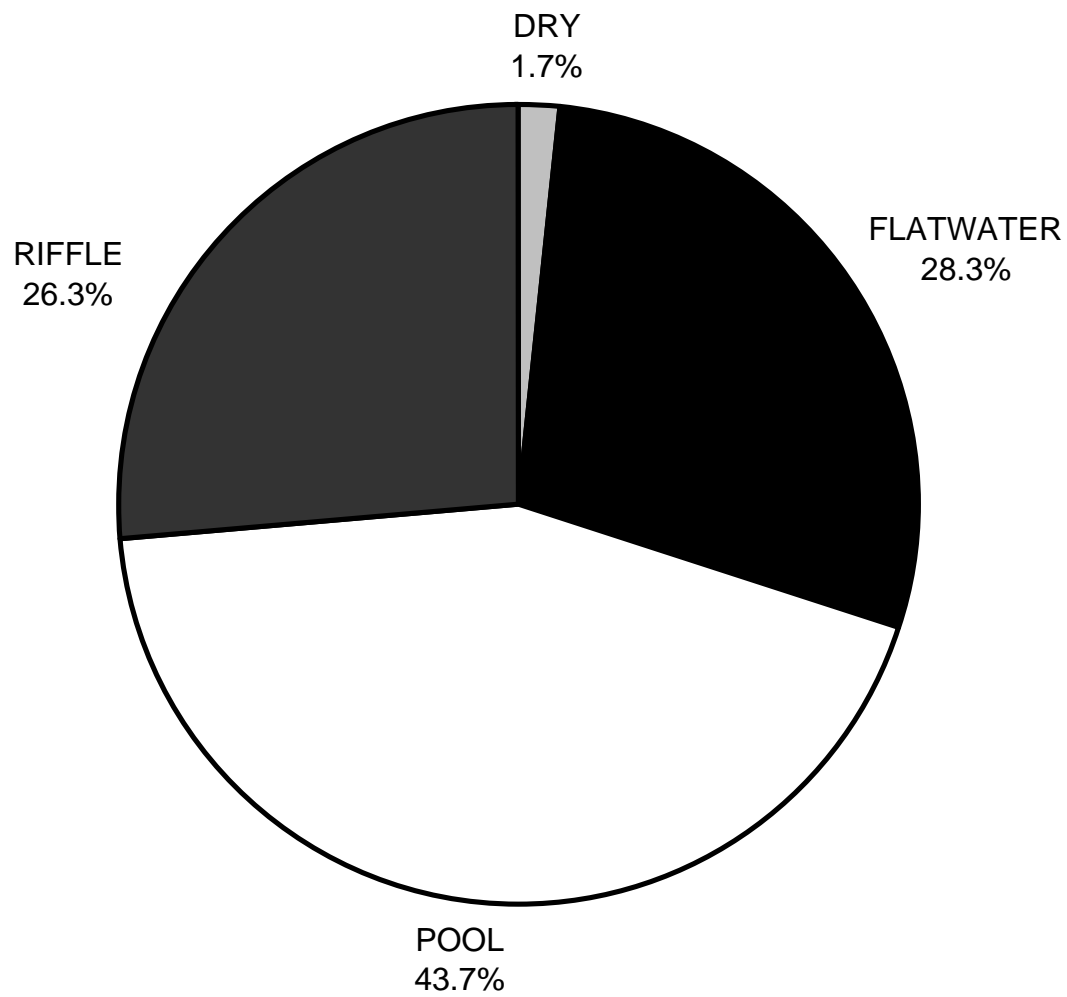
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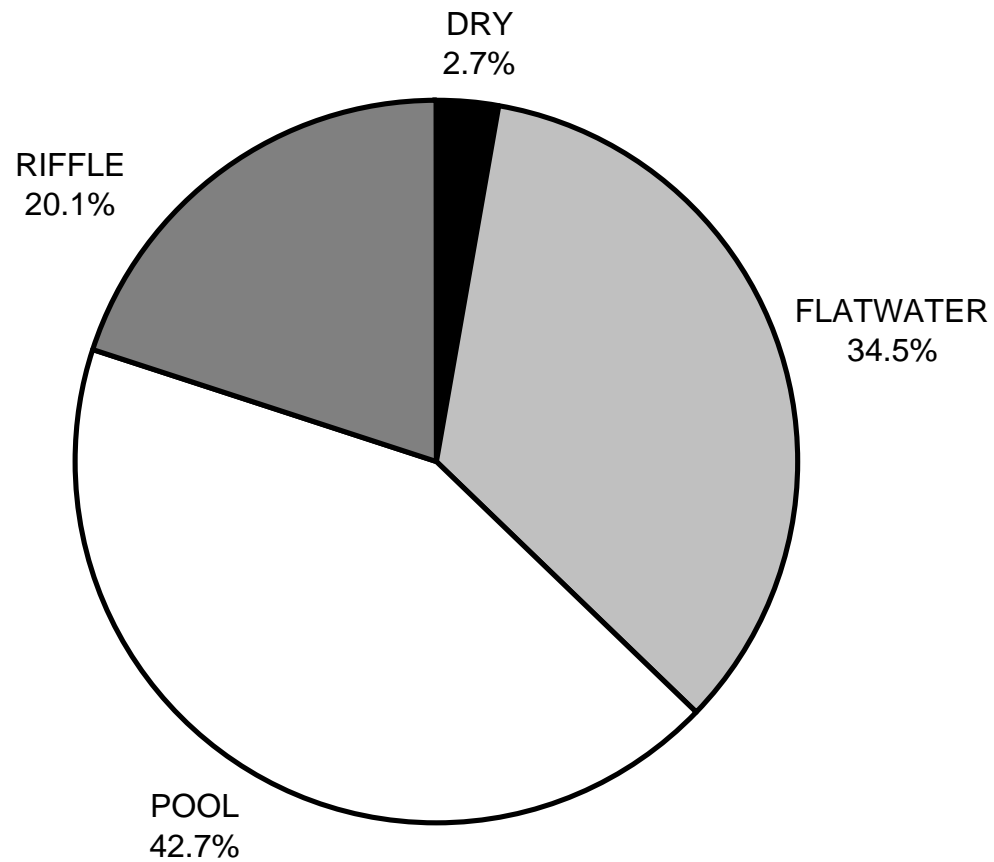
	Riffles	Flatwater	Pools
<hr/>			
UNDERCUT BANKS (%)	0	3	4
SMALL WOODY DEBRIS (%)	1	3	9
LARGE WOODY DEBRIS (%)	0	7	12
ROOT MASS (%)	0	3	11
TERRESTRIAL VEGETATION (%)	0	0	1
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	19	2	7
BOULDERS (%)	80	82	53
BEDROCK LEDGES (%)	0	0	4

BEAR PEN CREEK 2007
HABITAT TYPES BY PERCENT OCCURRENCE



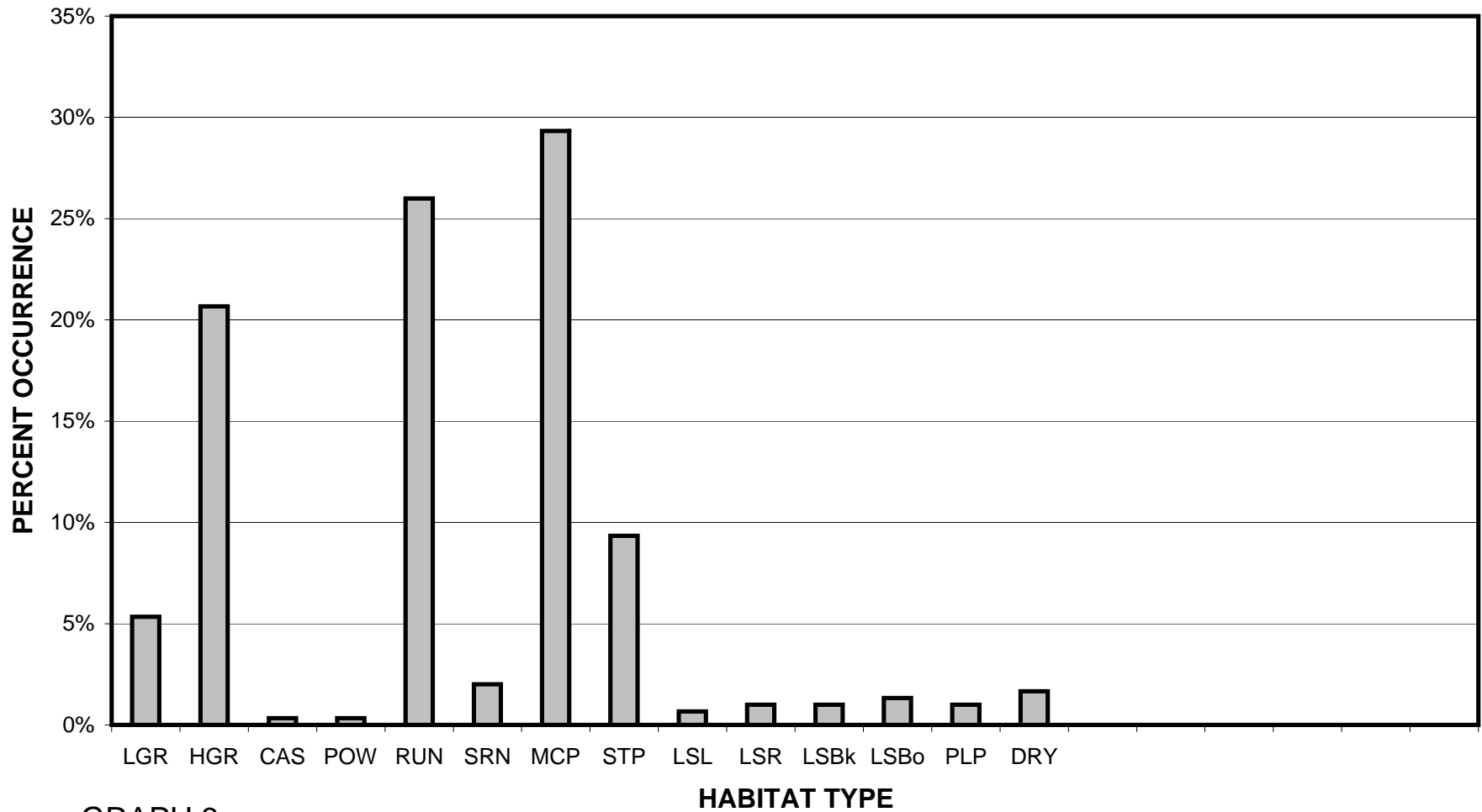
GRAPH 1

BEAR PEN CREEK 2007
HABITAT TYPES BY PERCENT TOTAL LENGTH

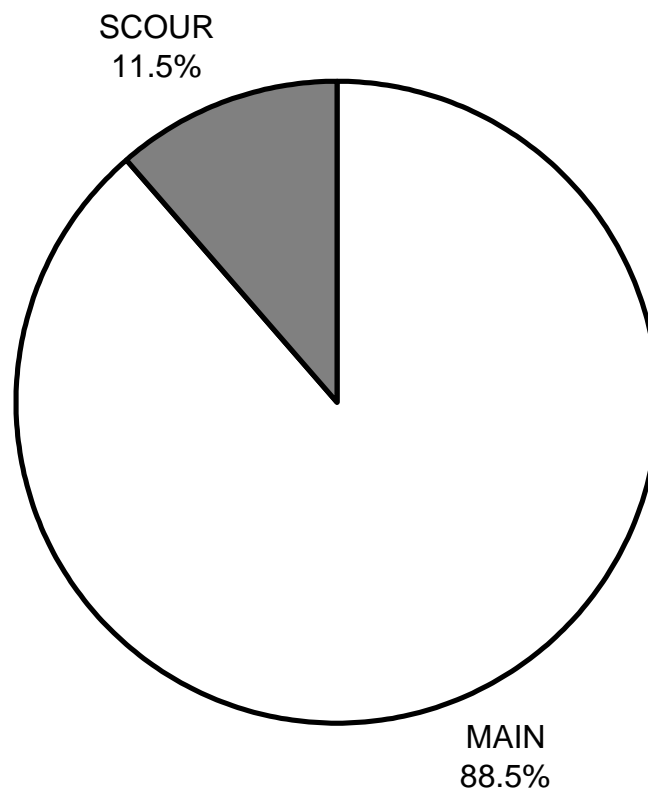


GRAPH 2

GRAPH 3

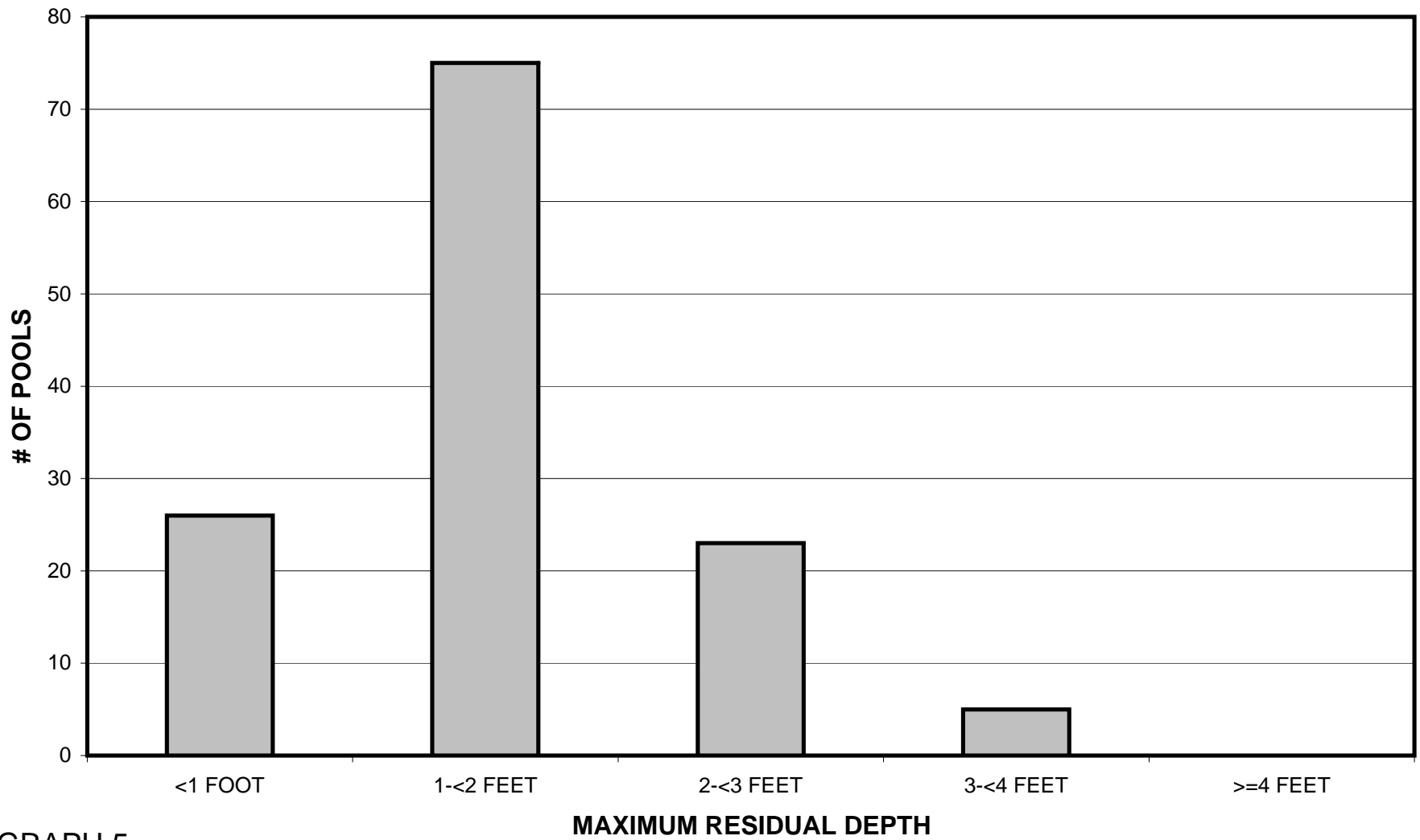


**BEAR PEN CREEK 2007
POOL TYPES BY PERCENT OCCURRENCE**



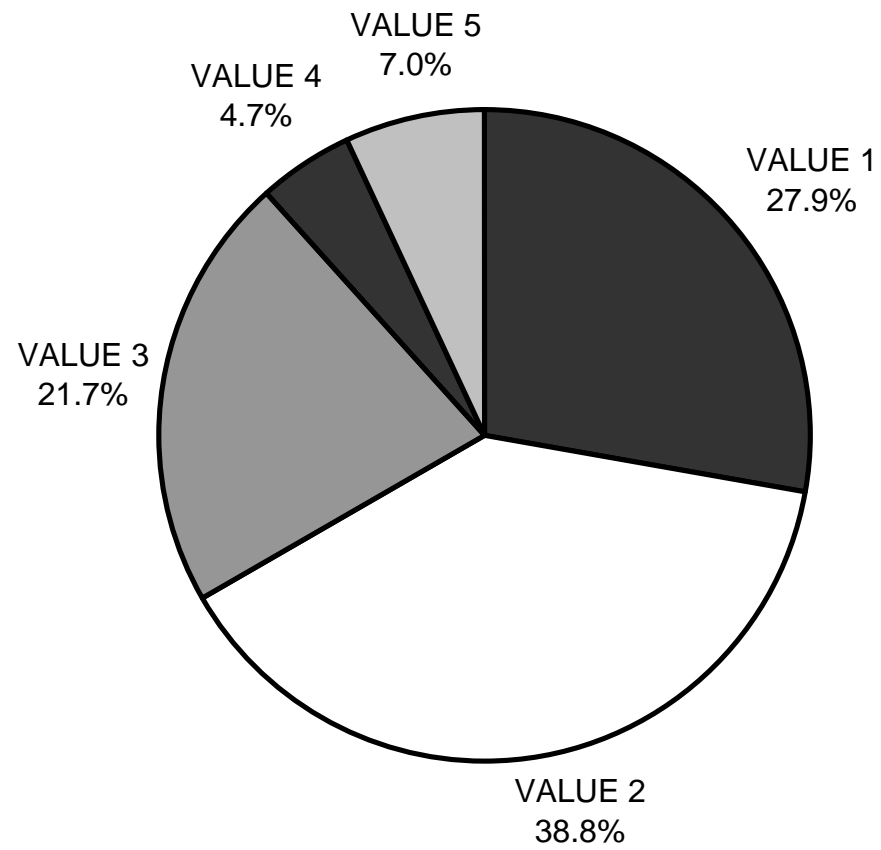
GRAPH 4

BEAR PEN CREEK 2007 MAXIMUM DEPTH IN POOLS



GRAPH 5

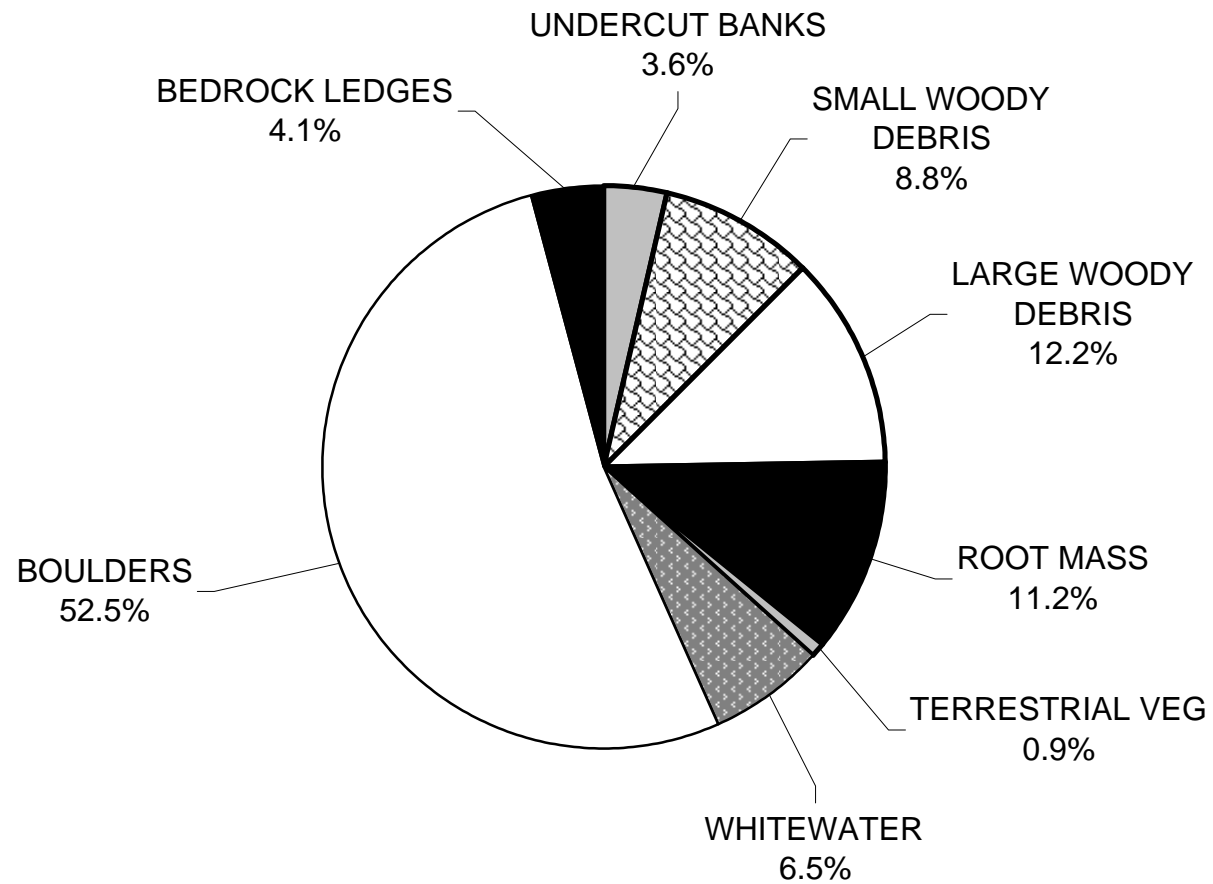
BEAR PEN CREEK 2007 PERCENT EMBEDDEDNESS



GRAPH 6

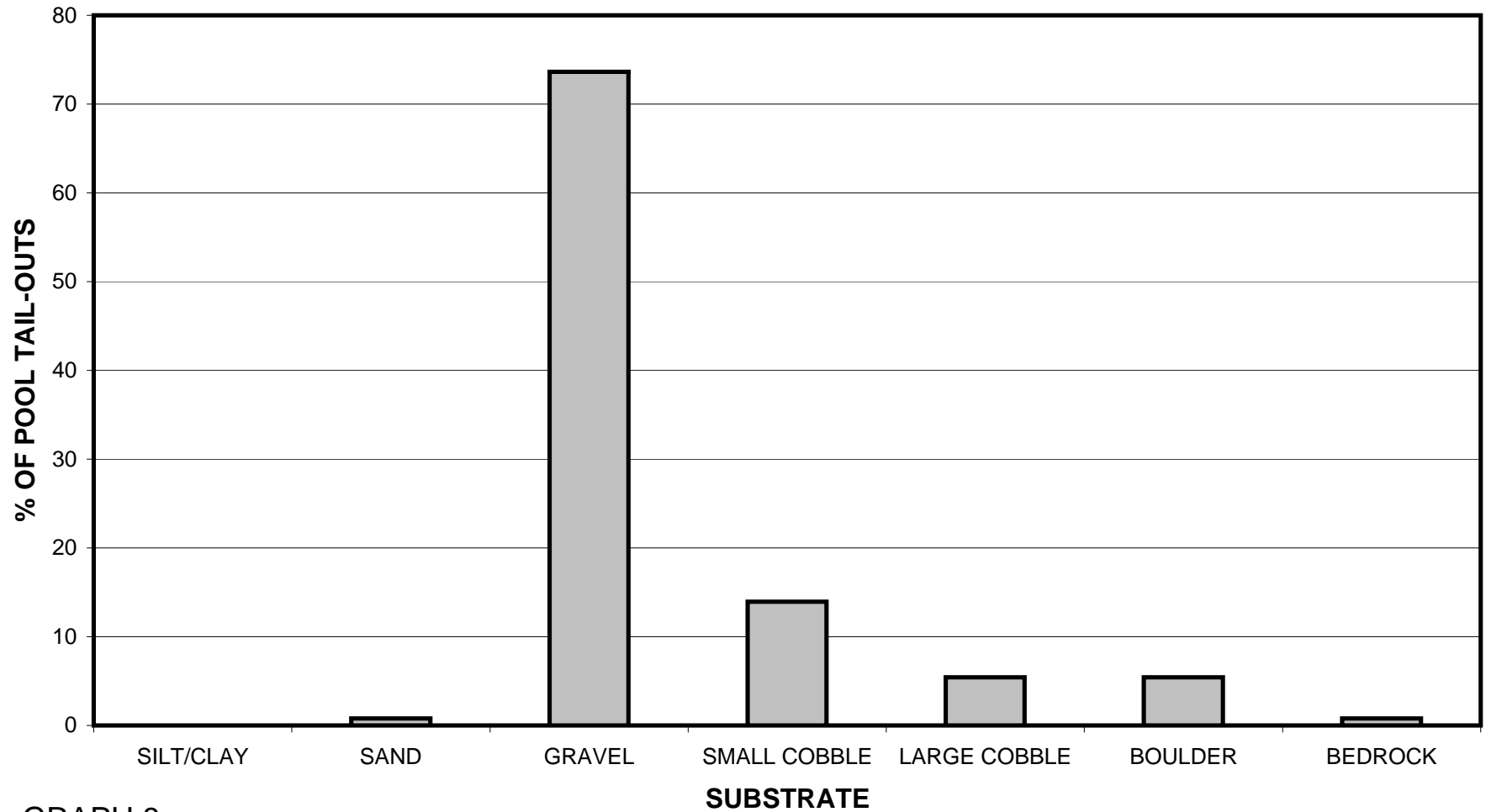
BEAR PEN CREEK 2007

MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

BEAR PEN CREEK 2007
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



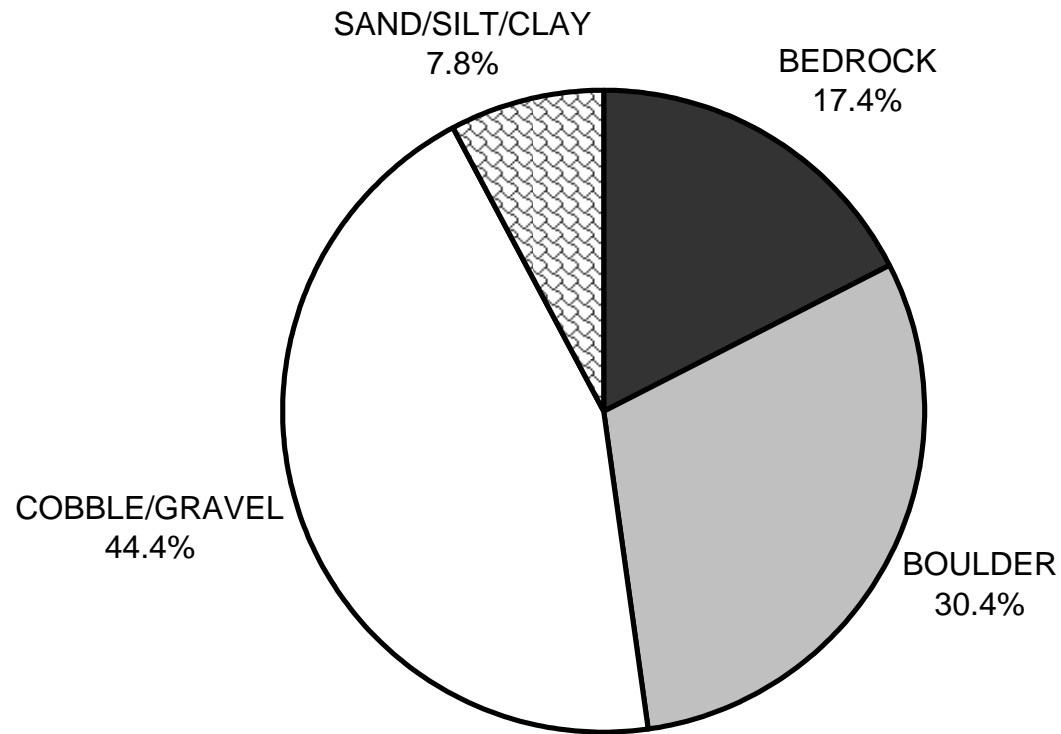
GRAPH 8

**BEAR PEN CREEK 2007
MEAN PERCENT CANOPY**



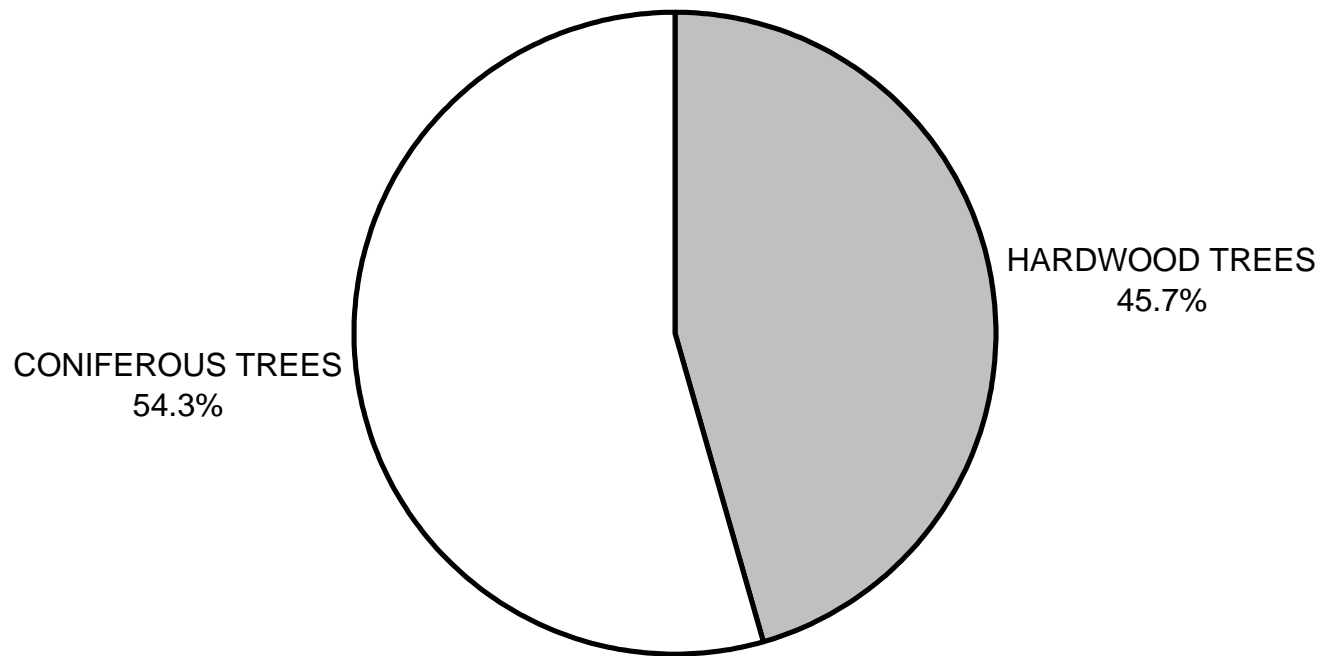
GRAPH 9

BEAR PEN CREEK 2007
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

BEAR PEN CREEK 2007
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

Map 1
Bear Pen Creek 2007
South Fork Eel Watershed
Piercy Quad, Mendocino County

Start of Survey

End of Survey

Legend

- Reach 1, B4 Channel Type
- Reach 2, F2 Channel Type
- Reach 3, B4 Channel Type

0 1,000 2,000 4,000 Feet



123°48'30"W

123°48'0"W

123°47'30"W

123°47'0"W

123°46'30"W

**Supplemental Map
Bear Pen Creek 2007
South Fork Eel Watershed
Piercy Quad, Mendocino County**

Start of Survey

LDA #1

Tributary #2

LDA #2

Tributary #3

LDA #4

Tributary #1

Tributary #5

LDA #7

LDA #5

Tributary #4

LDA #6

End of Survey

123°48'30"W

123°48'0"W




123°47'30"W

123°47'0"W

123°46'30"W



Legend

-  Reach 1, B4 Channel Type
-  Reach 2, F2 Channel Type
-  Reach 3, B4 Channel Type

0 700 1,400 2,800 Feet

Notes: LDA locations are approximate.
Only flowing tributaries are marked.

