

STREAM INVENTORY REPORT

Chadd Creek

INTRODUCTION

A stream inventory was conducted between 8/17/2005 to 9/6/2005 on Chadd Creek. The survey began at the confluence with the Eel River and extended upstream 3.8 miles.

The Chadd Creek inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Chadd Creek. The objective of the biological inventory was 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 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.

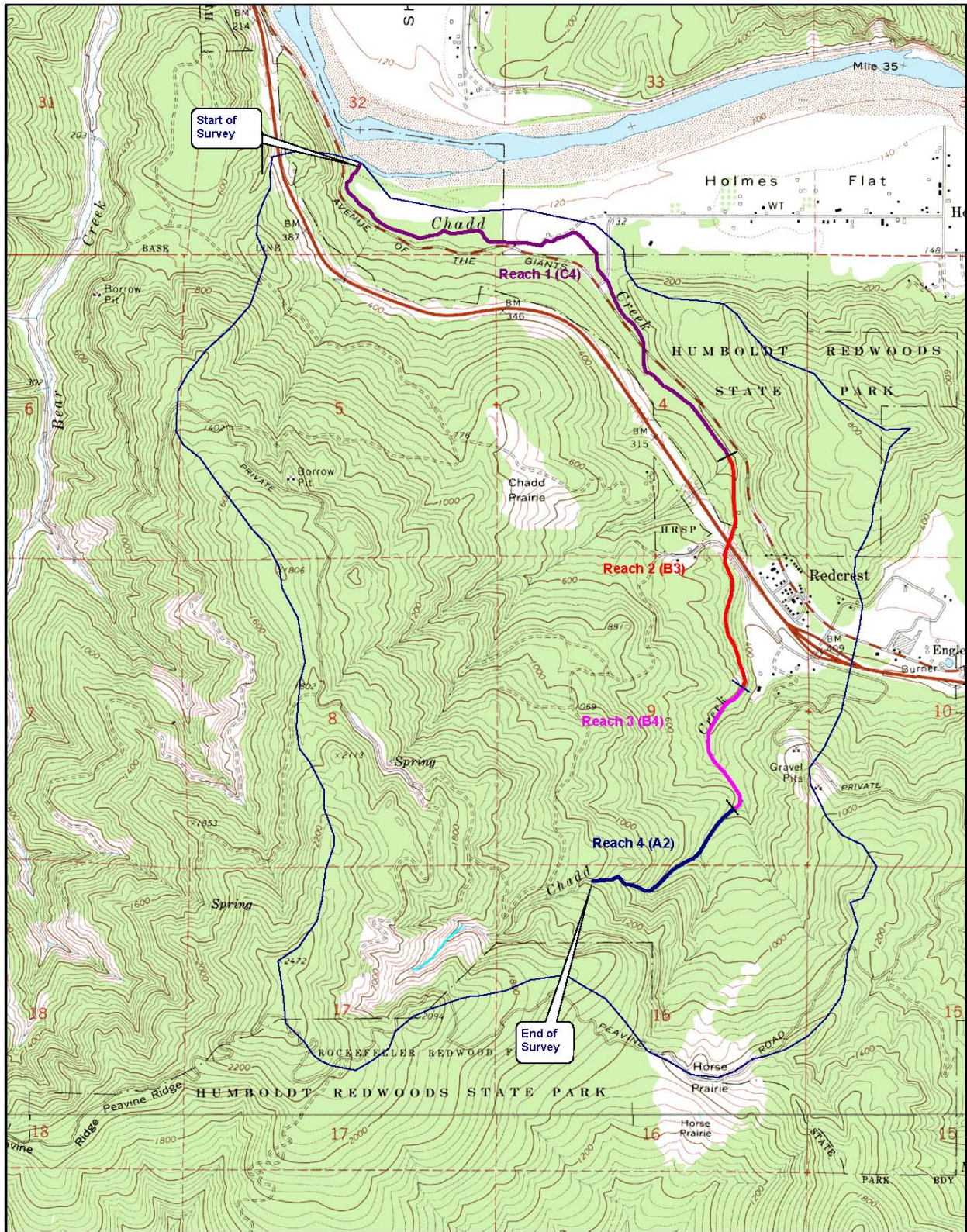
WATERSHED OVERVIEW

Chadd Creek is a tributary to the Eel River, a tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Chadd Creek's legal description at the confluence with Eel River is T01N R02E S32. Its location is 40°25'23.0" north latitude and 123°58'36.0" west longitude, LLID number is 1239768404231. Chadd Creek is a second order stream and has approximately 5.97 miles of blue line stream according to the USGS Redcrest 7.5 minute quadrangle. Chadd Creek drains a watershed of approximately 5.05 square miles. Elevations range from about 200 feet at the mouth of the creek to 2,000 feet in the headwater areas. Mixed conifer forest dominates the watershed and is prominently redwood. The watershed is primarily privately owned and is managed for timber production. The lower portion is primarily owned by state park and is managed for recreation. Vehicle access exists via Highway 101 to State Highway 254 (Avenue of the Giants) at Redcrest. The mouth of Chadd Creek is downstream of Redcrest approximately ½ a mile.

METHODS

The habitat inventory conducted in Chadd 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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Map1.

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SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the surveys 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. All pools were fully sampled on Chadd Creek.

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 Chadd 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". Chadd Creek habitat typing used standard basin level measurement criteria. These parameters require that the

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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 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 Chadd 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 Chadd 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Chadd 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

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withstand winter flows. In Chadd 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 (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 during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Chadd Creek. In addition, sites were dived and electrofished using a Smith-Root Model 12 electrofisher. 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 Chadd 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 8/17/2005 to 9/6/2005 was conducted by I. Mikus and S. McSmith (WSP). The total length of the stream surveyed was 20,043 feet with an additional 115 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.03 cfs on 8/25/05.

Chadd Creek is a C4 channel type for 10,027 feet of the stream surveyed (Reach 1), a B3 channel type for 4,411 feet of the stream surveyed (Reach 2), a B4 channel type for 2,717 feet of the stream surveyed (Reach 3) and an A2 channel type for 2,888 feet of the stream surveyed (Reach 4).

C4 channels are meandering point-bar riffle/pool alluvial channels with broad well defined floodplain on low gradients and gravel dominant substrates. B3 channels are moderately entrenched with a moderate gradient and are riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks and cobble dominant substrates. 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. A2 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and boulder dominant substrates.

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Water temperatures taken during the survey period ranged from 54 to 63 degrees Fahrenheit. Air temperatures ranged from 55 to 72 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 0.7% dry units, 35.2% pool units, 31.3% riffle units, 31.5% flatwater units, 0.4% culvert units and 0.9% no survey units (Graph 1). Based on total length of Level II habitat types there were 13.9% dry units, 24.0% pool units, 20.8% riffle units, 37.5% flatwater units, 3.4% culvert units and 0.4% no survey units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 29.3% mid-channel pool units, 15.4% high gradient riffle units and 15.7% low gradient riffle units (Graph 3). Based on percent total length there were 20.7% mid-channel pool units, 17.4% step run units and 13.9% dry units.

A total of 162 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 86%, and comprised 90% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Fifty of the 159 pools (31%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 157 pool tail-outs measured, 41 had a value of 1 (26.1%); 71 had a value of 2 (45.2%); 30 had a value of 3 (19.1%); 13 had a value of 4 (8.3%); 2 had a value of 5 (1.3%) (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 5, flatwater habitat types had a mean shelter rating of 11, and pool habitats had a mean shelter rating of 41 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 43, scour pools had a mean shelter rating of 30 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Chadd Creek. Graph 7 describes the pool cover in Chadd Creek. Small woody debris is 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 42% of pool tail-outs and small cobble was observed in 33% of pool tail-outs.

The mean percent canopy density for the surveyed length of Chadd Creek was 94% (Table 7). The mean percentages of hardwood and coniferous trees were 39.7% and 53.3%, respectively. Six percent of the canopy was open. Graph 9 describes the mean percent canopy in Chadd Creek.

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For the stream reach surveyed, the mean percent right bank vegetated was 97%. The mean percent left bank vegetated was 96%. The dominant elements composing the structure of the stream banks consisted of 1% bedrock, 5% boulder, 10% cobble/gravel and 84% sand/silt/clay (Graph 10). Coniferous trees were the dominant vegetation type observed in 53.3% of the units surveyed. Additionally, 43.3% of the units surveyed had deciduous trees as the dominant vegetation type, and 3.1% had brush as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

A biological survey was conducted by the Department of Fish and Game. The sample reach included 20,043 feet. Coho were observed throughout reach 1 and approximately 2,970 feet into reach 2, a total distance of 12,997 feet. In this survey trout include both resident (rainbow) and anadromous (steelhead). Trout were observed throughout the entire sample reach, a total distance of 20,043.

Thirty-nine sites were electrofished for species composition and distribution in Chadd Creek on October 12, 13 and 18, 2005. Water temperatures taken during the electrofishing period ranged from 50 to 54 degrees Fahrenheit. Air temperatures ranged from 51 to 55 degrees Fahrenheit. The sites were sampled by Sean McSmith, Sarah Wilson, Hillary Sgalitzer, Christopher Pollastrini and Tandra Fisher (WSP), Brandi Crivello and Nicole Daily (Fortuna High School) and Allan Renger, Paul Divine and Trevor Tollefson (DFG).

In reach 1, which comprised the first 10,027 feet of stream, 8 sites were sampled. The reach sites yielded 63 young-of-the-year steelhead/rainbow trout (SH/RT), 5 age 1+ SH/RT and 47 coho salmon.

In reach 2, 15 sites were sampled starting approximately 10,027 feet from the confluence with the Eel River and continuing upstream 4,411 feet. The reach sites yielded 99 young-of-the-year SH/RT, 19 age 1+ SH/RT and 45 coho salmon.

In reach 3, 13 sites were sampled starting approximately 14,438 from the confluence with the Eel River and continuing upstream 2,717 feet. The reach sites yielded 103 young-of-the-year SH/RT, 14 age 1+ SH/RT and no coho salmon.

In reach 4, 3 sites were sampled starting approximately 17,155 from the confluence with the Eel River and continuing upstream 2,888 feet. The reach sites yielded no young-of-the-year SH/RT, 3 age 1+ SH/RT and no coho salmon.

In addition, a total of 40 sites were dived.

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The following chart displays the information yielded from both the electro-fished and dived sites:

Reach #	Channel Type	Sample Type	TR0+	TR1+	CO
1	C4	Efish	63	5	47
1	C4	Dive	37	11	74
1	C4	Total	100	16	121
2	B3	Efish	99	19	45
2	B3	Dive	27	7	67
2	B3	Total	126	26	112
3	B4	Efish	103	14	0
3	B4	Dive	52	9	0
3	B4	Total	155	23	0
4	A2	Efish	0	3	0
4	A2	Dive	2	0	0
4	A2	Total	2	3	0

DISCUSSION

Chadd Creek is a C4 channel type for the first 10,027 feet of stream surveyed (Reach 1); a B3 channel type for the next 4,411 feet (Reach 2); a B4 channel type for the next 2,717 feet (Reach 3) and an A2 channel type for the remaining 2,888 feet of stream surveyed (Reach 4).

The suitability of C4 channel types for fish habitat improvement structures is good for bank-placed boulders and fair for plunge weirs; single and opposing wing-deflectors; channel constrictors and log cover. The suitability of B3 channel types for fish habitat improvement structures is excellent for plunge weirs, boulder clusters and bank placed boulder, as well as single and opposing wing deflectors and log cover. The suitability of B4 channel types for fish habitat improvement structures is excellent for low-stage plunge weirs, boulder clusters and bank placed boulders, as well as single and opposing wing-deflectors and log cover. A2 channel types are generally not suitable for fish habitat improvement structures due to high energy streams with stable stream banks and poor gravel retention capabilities.

The water temperatures recorded on the survey days 8/17/2005 to 9/6/2005, ranged from 54 to 63 degrees Fahrenheit. Air temperatures ranged from 55 to 72 degrees Fahrenheit. To make any 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 38% of the total length of this survey, riffles 21%, and pools 24%. The pools are relatively shallow, with only 50 of the 159 (31%) pools having a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when

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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 structures that will increase or deepen pool habitat is recommended within the stream reaches that are suitable.

One-hundred-twelve (71.3%) of the 157 pool tail-outs measured had embeddedness ratings of 1 or 2. Forty-three (27.4%) of the pool tail-outs had embeddedness ratings of 3 or 4. Two (1.3%) 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-eighteen (75.2%) of the 157 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 41. The shelter rating in the flatwater habitats was 11. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by small woody debris in Chadd Creek. Small woody debris is the dominant cover type in pools followed by large woody debris. Log and root wad cover structures in the pool and 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 93.5%. Reach 1 had a canopy density of 93.5%, Reach 2 had a canopy density of 93.0%, Reach 3 had a canopy density of 94.4%, and Reach 4 had a canopy density of 95.0%. 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 97% and 96%, 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) Chadd Creek should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile coho salmon. 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.
- 3) The culvert at 12,958' is a barrier to coho salmon. CalTrans and DFG are cooperating on a fish passage project to provide access to adult and juvenile salmonids. This project is scheduled for the summer of 2007.

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- 4) In the B and C channel types, where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.
- 5) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from small woody debris. Adding high quality complexity with woody cover in the pools is desirable.

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.

<u>Position (ft)</u>	<u>Habitat Unit #</u>	<u>Comments</u>
0	0001.00	The survey began at the confluence of Chadd Creek with the Eel River: The stream is dry for the first 1,925'. Channel type is a C4.
550	0001.00	Log debris accumulation (LDA); not a fish passage barrier; not retaining sediment
620	0001.00	Culvert enters from the left bank.
750	0001.00	Dry tributary enters from the left bank
2,005	0004.00	Tributary enters from the left bank
4,557	0033.00	Bridge crossing the stream.
5,075	0044.00	Unarmored road ford
6,566	0070.00	Cabled wood habitat structure
6,906	0075.00	Concrete bridge
8,413	0110.00	Culvert at the Avenue of the Giants road crossing.
10,027	0145.00	A 1' culvert enters from the right bank. Channel type changes to a B3.
10,366	0151.00	Dry tributary enters from the right bank
11,378	0173.00	Tributary enters from the right bank
11,513	0177.00	Culvert enters from the right bank
11,616	0181.00	LDA
12,031	0193.00	LDA.
12,293	0200.00	Young of the year salmonids observed
12,804	0211.00	Tributary enters from the right bank
12,942	0216.00	A 1.5' diameter culvert enters from the right bank
12,958	0217.00	The concrete culvert outlet apron for the Highway 101 crossing begins. There is a 4.5' jump for fish from the outlet pool to the outlet apron.

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<u>Position (ft)</u>	<u>Habitat Unit #</u>	<u>Comments</u>
12,973	0218.00	The pool is a concrete component of the Highway 101 crossing culvert outlet.
12,982	0219.00	The pool is a concrete component of the Highway 101 crossing culvert outlet.
12,997	0220.00	Highway 101 culvert crossing.
13,587	0221.00	A tributary enters from the left bank
13,672	0224.00	Young of the year salmonids observed
13,832	0228.00	Young of the year and 1+ age class salmonids observed
14,033	0234.00	LDA. Channel type changes to a B4.
15,342	0273.00	Erosion on the right bank
15,568	0276.00	Erosion, 25' high x 45' long on the left bank.
15,663	0277.00	Erosion, 8' high x 30' long on the right bank
15,691	0278.00	Erosion on the right bank
15,857	0285.00	Erosion on the right bank
15,890	0287.00	LDA
15,908	0289.00	Landslide on the left bank.
16,050	0296.00	Juvenile salmonids observed.
16,337	0302.00	Erosion on the left bank
16,631	0311.00	A 4' waterfall in a high gradient boulder dominated area.
17,021	0328.00	A 4.6' waterfall.
17,067	0330.00	Dry tributary enters from the left bank. Channel type changes to an A2.
17,615	0354.00	Juvenile salmonids were observed
17,671	0357.00	LDA
17,693	0358.00	Landslide on the left bank
18,351	0389.00	A 6.8' waterfall; a possible barrier to anadromous salmonids.
18,734	0405.00	Erosion, 20' long x 15' high on the left bank
19,277	0426.00	Tributary enters from the right bank.
19,630	0433.00	Landslide on the right bank
19,712	0438.00	A 4.4' high waterfall
19,735	0440.00	Water diversion
19,735	0440.00	A 4.6' high waterfall
19,828	0444.00	LDA
20,043	0454.00	The survey ended due to several waterfalls that were likely barriers to anadromous fish

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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: Chadd Creek

LLID: 1239768404231

Drainage: Eel River - Lower

Survey Dates: 8/17/2005 to 9/6/2005

Confluence Location: Quad: REDCREST

Legal Description: T01NR02ES32

Latitude: 40:25:23.0N

Longitude: 123:58:36.0

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
2	1	CULVERT	0.4	341	682	3.4	4.0	0.4	0.5	368	736	147	294		
3	0	DRY	0.7	933	2799	13.9									
146	28	FLATWATER	31.7	52	7599	37.7	10.1	0.6	5.1	527	76873	254	37049		11
4	0	NOSURVEY	0.9	20	79	0.4									255
161	160	POOL	35.0	30	4806	23.8	11.7	0.8	3.0	346	55706	402	63943	308	41
144	22	RIFFLE	31.3	29	4193	20.8	11.8	0.3	0.6	268	38520	82	11863		5
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
460	211				20158					171835			113149		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Chadd Creek

LLID: 1239768404231

Drainage: Eel River - Lower

Survey Dates: 8/17/2005 to 9/6/2005

Confluence Location: Quad: REDCREST

Legal Description: T01NR02ES32

Latitude: 40:25:23.0N

Longitude: 123:58:36.0W

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 (%)
72	11	LGR	15.7	33	2406	11.9	12	0.3	1.2	344	24752	109	7852		2	93
71	10	HGR	15.4	25	1741	8.6	11	0.3	0.8	184	13049	45	3219		3	93
1	1	CAS	0.2	46	46	0.2	10	0.6	1.9	266	266	159	159		60	94
39	11	GLD	8.5	58	2261	11.2	9	0.8	108	437	17034	300	11686		14	92
54	8	RUN	11.7	34	1832	9.1	12	0.4	1.2	651	35135	212	11439		5	95
53	9	SRN	11.5	66	3506	17.4	10	0.5	1.4	526	27874	235	12452		14	94
134	134	MCP	29.1	31	4142	20.5	12	0.8	3.8	359	48063	426	56592	328	43	94
4	4	STP	0.9	46	184	0.9	10	0.7	2.1	527	2109	599	2397	438	61	96
2	1	LSR	0.4	59	118	0.6	12	0.7	2.5	804	1608	724	1447	563	13	96
1	1	LSBo	0.2	68	68	0.3	13			884	884				30	97
20	20	PLP	4.3	15	294	1.5	13	0.7	205.8	175	3499	192	3833	137	32	97
3	0	DRY	0.7	933	2799	13.9										100
2	1	CUL	0.4	341	682	3.4	4	0.4	0.5	368	736	147	294			
4	0	NS	0.9	20	79	0.4									255	77

Total Units
460

Total Units Fully Measured
211

Total Length (ft.)
20158

Total Area (sq.ft.)
175008

Total Volume (cu.ft.)
111371

Table 3 - Summary of Pool Types

Stream Name: Chadd Creek

LLID: 1239768404231

Drainage: Eel River - Lower

Survey Dates: 8/17/2005 to 9/6/2005

Confluence Location: Quad: REDCREST

Legal Description: T01NR02ES32

Latitude: 40:25:23.0N

Longitude: 123:58:36.0W

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
138	138	MAIN	86	31	4326	90	11.5	0.8	364	50172	331	45392	43
23	22	SCOUR	14	21	480	10	13.2	0.7	236	5423	157	3445	30

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
161	160	4806	55595	48838

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

Stream Name: Chadd Creek

LLID: 1239768404231

Drainage: Eel River - Lower

Survey Dates: 8/17/2005 to 9/6/2005

Confluence Location: Quad: REDCREST

Legal Description: T01NR02ES32

Latitude: 40:25:23.0N

Longitude: 123:58:36.0W

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
133	MCP	84	13	10	77	58	35	26	8	6	0	0
4	STP	3	0	0	2	50	2	50	0	0	0	0
1	LSR	1	0	0	0	0	1	100	0	0	0	0
20	PLP	13	2	10	14	70	3	15	0	0	1	5

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
158	15	9	93	59	41	26	8	5	1	1

Mean Maximum Residual Pool Depth (ft.): 3

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Chadd Creek

LLID: 1239768404231

Drainage: Eel River - Lower

Survey Dates: 8/17/2005 to 9/6/2005

Dry Units: 3

Confluence Location: Quad: REDCREST

Legal Description: T01NR02ES32

Latitude: 40:25:23.0N

Longitude: 123:58:36.0W

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
72	11	LGR	1	4	0	1	5	0	0	7	0
71	10	HGR	0	13	1	0	0	0	1	17	0
1	1	CAS	0	0	0	0	0	0	35	65	0
144	22	TOTAL RIFFLE	0	8	0	0	3	0	2	14	0
39	11	GLD	24	21	26	11	0	0	0	0	0
54	8	RUN	11	10	1	1	13	0	1	0	0
53	9	SRN	1	17	11	0	6	0	6	38	0
146	28	TOTAL FLAT	13	16	14	5	5	0	2	12	0
134	133	MCP	19	24	22	12	2	0	1	12	0
4	4	STP	10	6	3	9	3	0	8	63	0
2	2	LSR	0	0	40	58	3	0	0	0	0
1	1	LSBo	70	30	0	0	0	0	0	0	0
20	20	PLP	6	6	4	3	1	0	14	65	3
161	160	TOTAL POOL	17	21	20	11	2	0	3	20	1
2	0	CUL									
4	2	NS	0	65	35	0	0	0	0	0	0
460	212	TOTAL	15	20	17	9	3	0	2	18	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Chadd Creek

LLID: 1239768404231

Drainage: Eel River - Lower

Survey Dates: 8/17/2005 to 9/6/2005

Dry Units: 3

Confluence Location: Quad: REDCREST

Legal Description: T01NR02ES32

Latitude: 40:25:23.0N

Longitude: 123:58:36.0W

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
72	11	LGR	0	0	64	27	9	0	0
71	9	HGR	0	0	11	56	33	0	0
1	1	CAS	0	0	0	0	0	100	0
39	11	GLD	9	9	73	9	0	0	0
54	8	RUN	0	0	88	13	0	0	0
53	9	SRN	0	0	22	44	11	22	0
134	134	MCP	13	10	60	10	4	2	0
4	4	STP	0	0	75	0	0	25	0
2	2	LSR	0	0	100	0	0	0	0
1	1	LSBo	0	0	100	0	0	0	0
20	20	PLP	0	5	60	0	10	25	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Chadd Creek

LLID: 1239768404231

Drainage: Eel River - Lower

Survey Dates: 8/17/2005 to 9/6/2005

Confluence Location: Quad: REDCREST

Legal Description: T01NR02ES32

Latitude: 40:25:23.0N

Longitude: 123:58:36.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
94	57	42	0	97	96

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: Chadd Creek LLID: 1239768404231 Drainage: Eel River - Lower
 Survey Dates: 8/17/2005 to 9/6/2005 Survey Length (ft.): 20158 Main Channel (ft.): 20043 Side Channel (ft.): 115
 Confluence Location: Quad: REDCREST Legal Description: T01NR02ES32 Latitude: 40:25:23.0N Longitude: 123:58:36.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: C4	Canopy Density (%): 93.5	Pools by Stream Length (%): 21.2
Reach Length (ft.): 10027	Coniferous Component (%): 34.3	Pool Frequency (%): 31.9
Riffle/Flatwater Mean Width (ft.): 12.6	Hardwood Component (%): 65.7	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 34
Range (ft.): 17 to 33	Vegetative Cover (%): 96.9	2 to 2.9 Feet Deep: 52
Mean (ft.): 25	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 14
Std. Dev.: 5	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 1.0	Occurrence of LWD (%): 14	Mean Max Residual Pool Depth (ft.): 2.2
Water (F): 58 - 63 Air (F): 58 - 72	LWD per 100 ft.:	Mean Pool Shelter Rating: 34
Dry Channel (ft): 2799	Riffles: 1	
	Pools: 3	
	Flat: 1	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 2 Gravel: 69 Sm Cobble: 29 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 31.0 2. 47.6 3. 14.3 4. 7.1 5. 0.0		

STREAM REACH: 2

Channel Type: B3	Canopy Density (%): 93.1	Pools by Stream Length (%): 27.8
Reach Length (ft.): 4411	Coniferous Component (%): 56.0	Pool Frequency (%): 35.0
Riffle/Flatwater Mean Width (ft.): 12.1	Hardwood Component (%): 44.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 66
Range (ft.): 13 to 35	Vegetative Cover (%): 97.8	2 to 2.9 Feet Deep: 29
Mean (ft.): 19	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 6
Std. Dev.: 6	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 1.0	Occurrence of LWD (%): 23	Mean Max Residual Pool Depth (ft.): 1.8
Water (F): 58 - 62 Air (F): 56 - 68	LWD per 100 ft.:	Mean Pool Shelter Rating: 43
Dry Channel (ft): 0	Riffles: 1	
	Pools: 8	
	Flat: 3	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 51 Sm Cobble: 49 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 5.7 2. 51.4 3. 20.0 4. 17.1 5. 5.7		

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: B4	Canopy Density (%): 94.4	Pools by Stream Length (%): 23.8
Reach Length (ft.): 2717	Coniferous Component (%): 63.0	Pool Frequency (%): 37.9
Riffle/Flatwater Mean Width (ft.): 9.2	Hardwood Component (%): 37.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 91
Range (ft.): 18 to 26	Vegetative Cover (%): 96.4	2 to 2.9 Feet Deep: 9
Mean (ft.): 21	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 3	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.5	Occurrence of LWD (%): 19	Mean Max Residual Pool Depth (ft.): 1.2
Water (F): 58 - 61 Air (F): 58 - 69	LWD per 100 ft.:	Mean Pool Shelter Rating: 43
Dry Channel (ft): 0	Riffles: 4	
	Pools: 10	
	Flat: 3	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 19 Sm Cobble: 38 Lg Cobble: 28 Boulder: 16 Bedrock: 0		
Embeddedness Values (%): 1. 37.5 2. 46.9 3. 15.6 4. 0.0 5. 0.0		

STREAM REACH: 4

Channel Type: A2	Canopy Density (%): 95.0	Pools by Stream Length (%): 26.8
Reach Length (ft.): 2888	Coniferous Component (%): 78.9	Pool Frequency (%): 36.4
Riffle/Flatwater Mean Width (ft.): 8.8	Hardwood Component (%): 21.1	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 87
Range (ft.): 12 to 29	Vegetative Cover (%): 96.7	2 to 2.9 Feet Deep: 11
Mean (ft.): 21	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0
Std. Dev.: 4	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 2
Base Flow (cfs.): 0.5	Occurrence of LWD (%): 14	Mean Max Residual Pool Depth (ft.): 5.8
Water (F): 54 - 59 Air (F): 55 - 66	LWD per 100 ft.:	Mean Pool Shelter Rating: 46
Dry Channel (ft): 0	Riffles: 6	
	Pools: 10	
	Flat: 7	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 30 Sm Cobble: 23 Lg Cobble: 23 Boulder: 23 Bedrock: 0		
Embeddedness Values (%): 1. 29.8 2. 38.3 3. 23.4 4. 8.5 5. 0.0		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Chadd Creek

LLID: 1239768404231

Drainage: Eel River - Lower

Survey Dates: 8/17/2005 to 9/6/2005

Confluence Location: Quad: REDCREST

Legal Description: T01NR02ES32

Latitude: 40:25:23.0N

Longitude: 123:58:36.0W

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	1	4	1.2
Boulder	12	8	4.8
Cobble / Gravel	17	23	9.6
Sand / Silt / Clay	179	174	84.4

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	1	0	0.2
Brush	8	5	3.1
Hardwood Trees	85	96	43.3
Coniferous Trees	115	108	53.3
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Chadd Creek

LLID: 1239768404231

Drainage: Eel River - Lower

Survey Dates: 8/17/2005 to 9/6/2005

Confluence Location: Quad: REDCREST

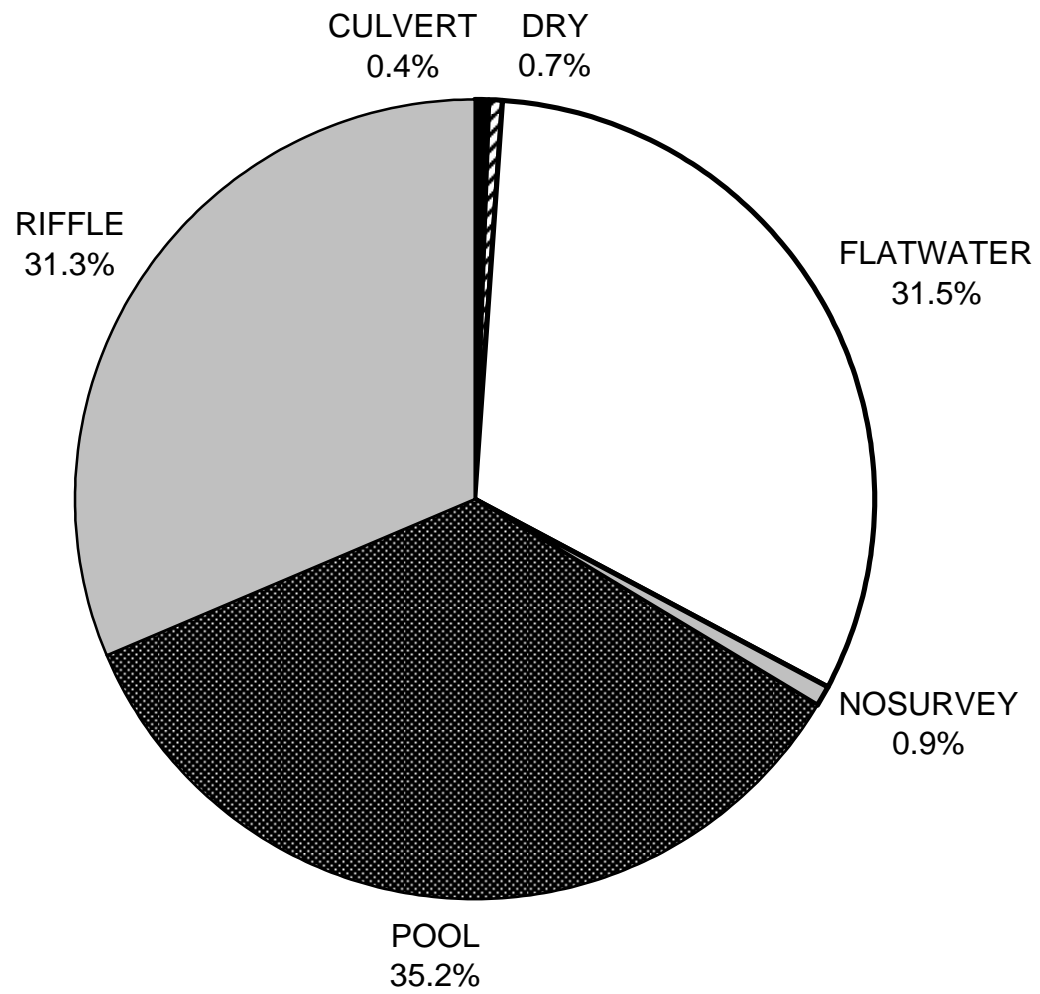
Legal Description: T01NR02ES32

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Longitude: 123:58:36.0W

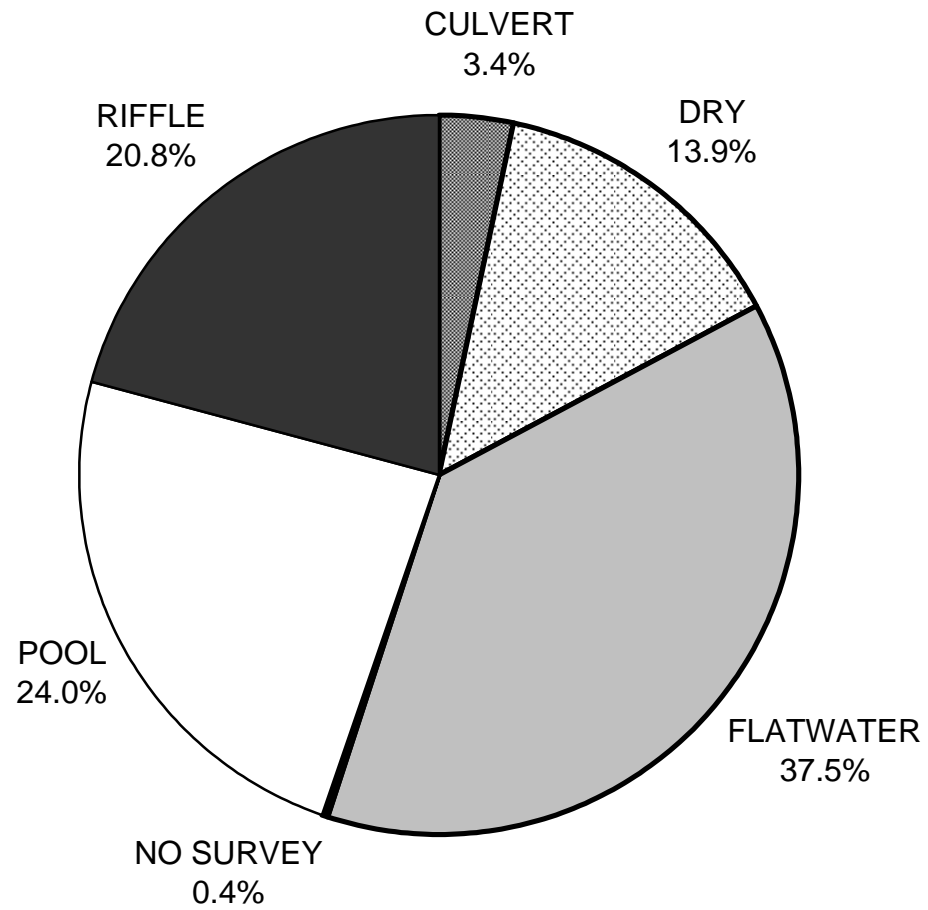
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	13	17
SMALL WOODY DEBRIS (%)	8	16	21
LARGE WOODY DEBRIS (%)	0	14	20
ROOT MASS (%)	0	5	11
TERRESTRIAL VEGETATION (%)	3	5	2
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	2	2	3
BOULDERS (%)	14	12	20
BEDROCK LEDGES (%)	0	0	1

CHADD CREEK 2005 HABITAT TYPES BY PERCENT OCCURRENCE



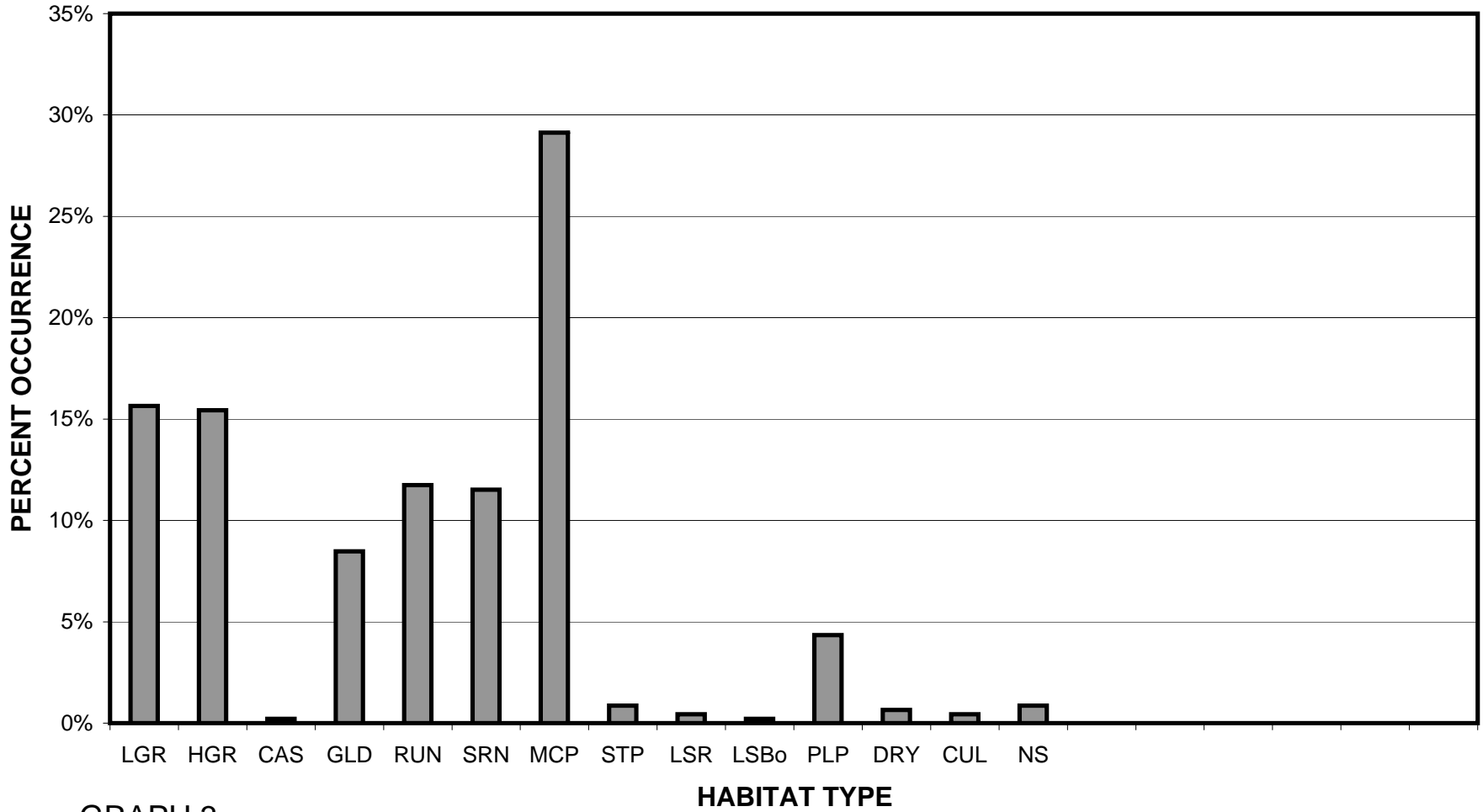
GRAPH 1

CHADD CREEK 2005 HABITAT TYPES BY PERCENT TOTAL LENGTH



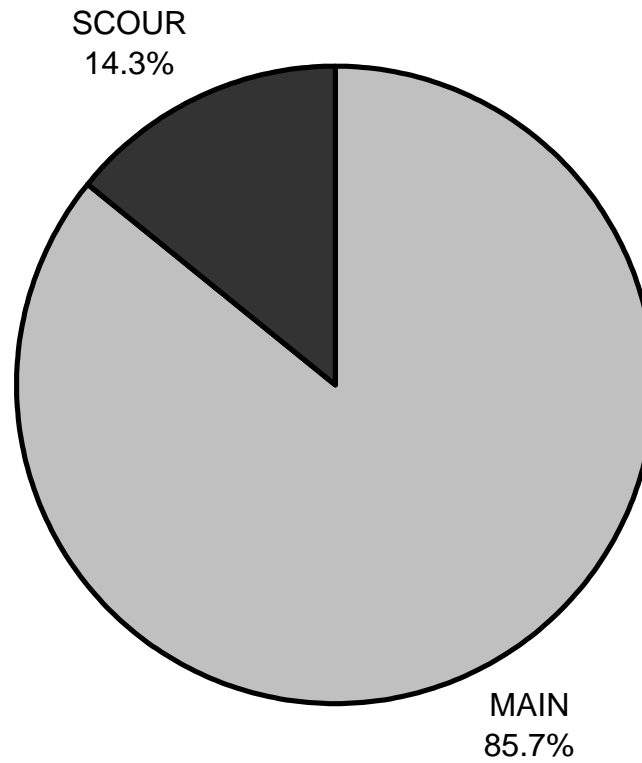
GRAPH 2

CHADD CREEK 2005 HABITAT TYPES BY PERCENT OCCURRENCE



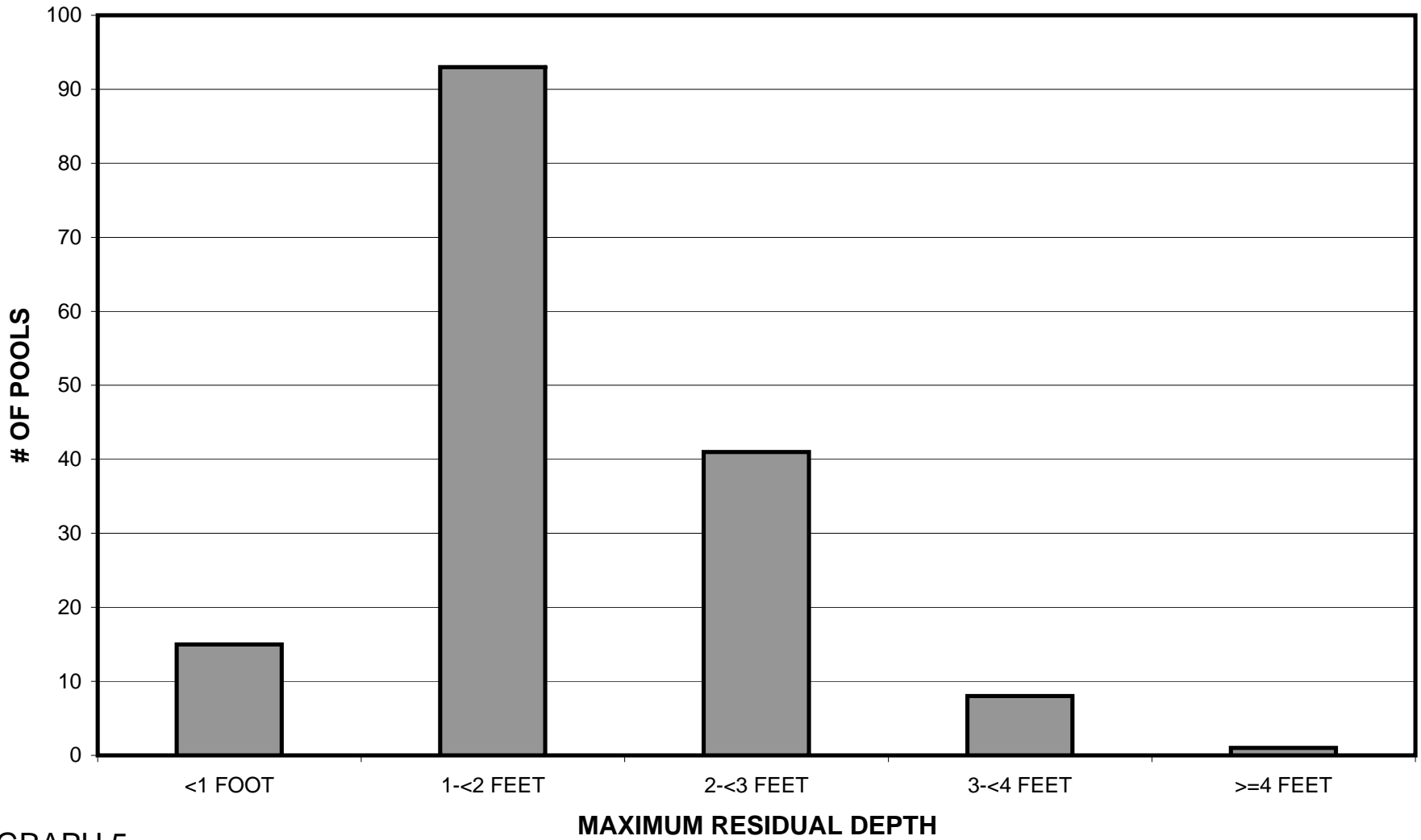
GRAPH 3

**CHADD CREEK 2005
POOL TYPES BY PERCENT OCCURRENCE**



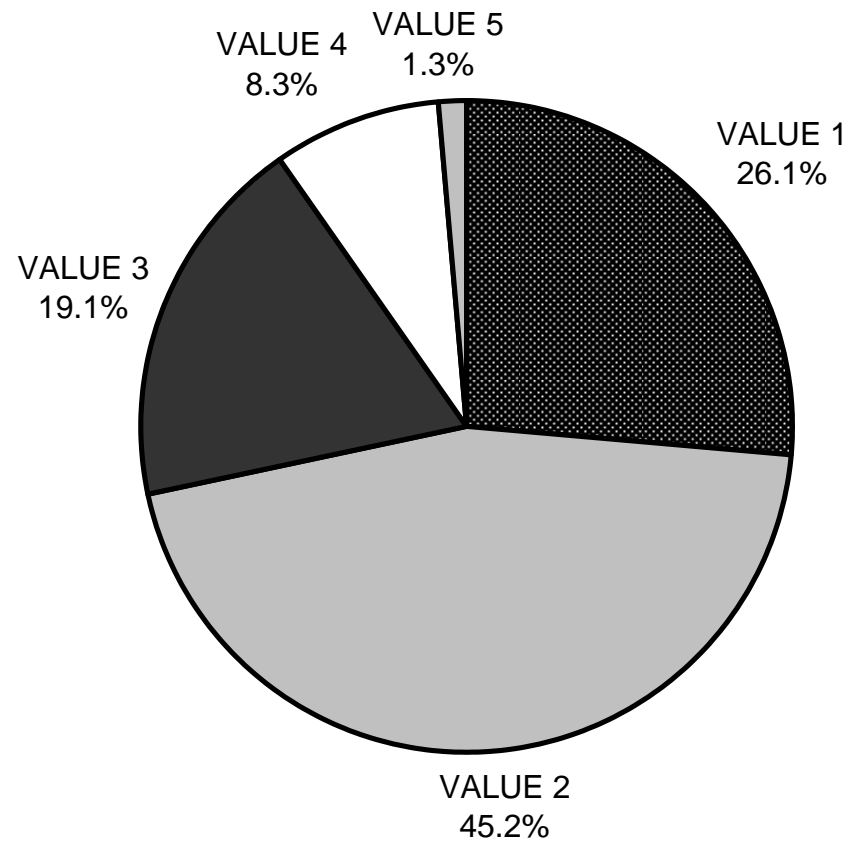
GRAPH 4

CHADD CREEK 2005 MAXIMUM DEPTH IN POOLS



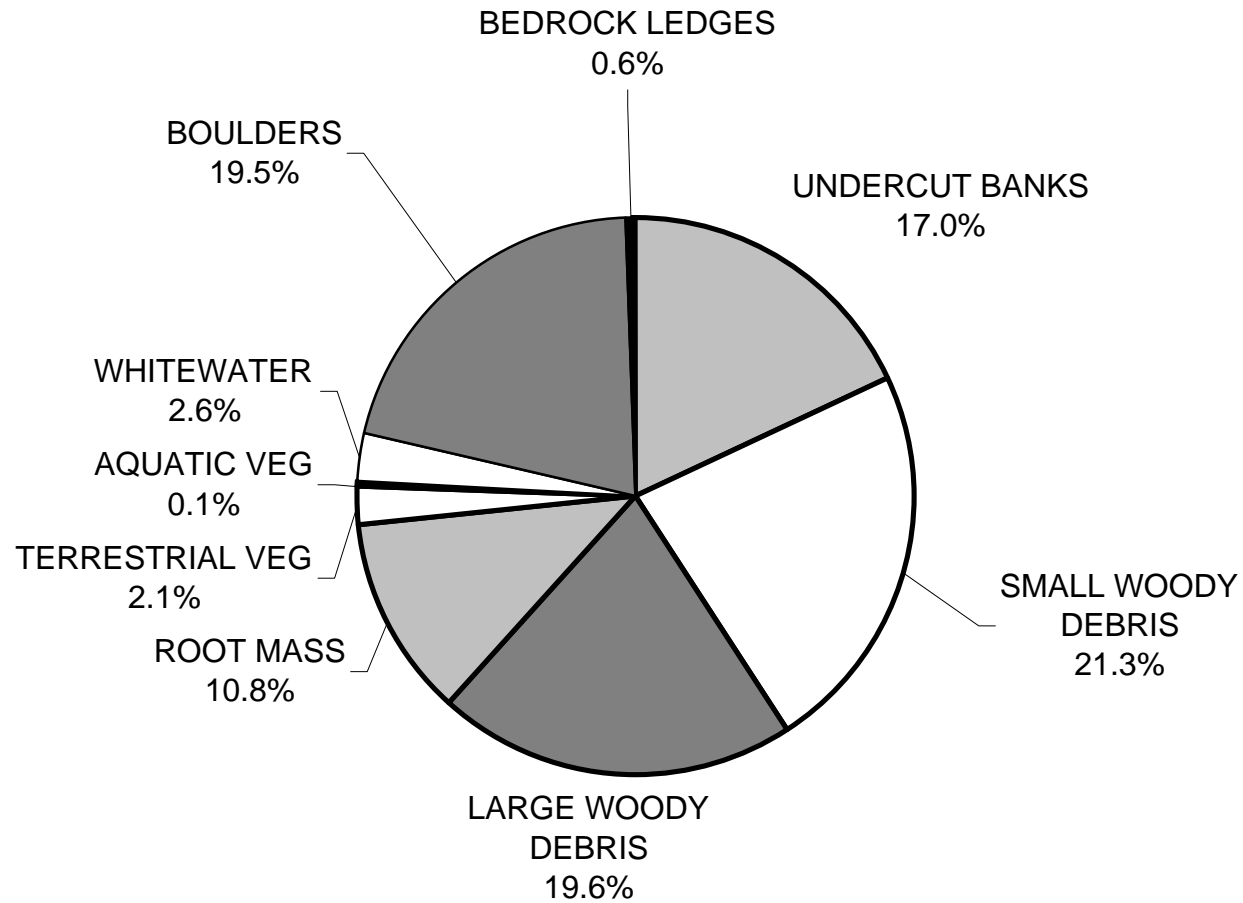
GRAPH 5

CHADD CREEK 2005 PERCENT EMBEDDEDNESS



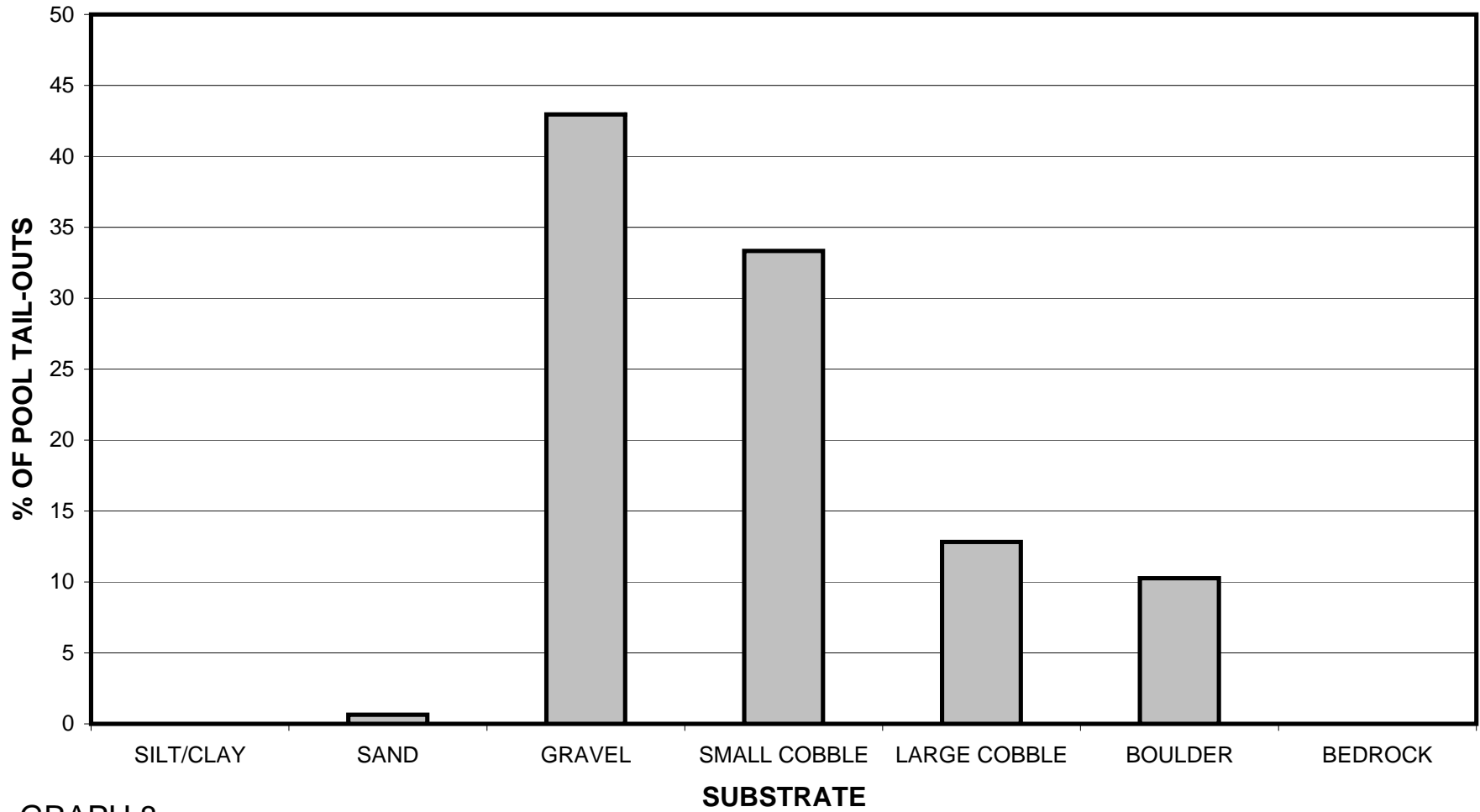
GRAPH 6

CHADD CREEK 2005 MEAN PERCENT COVER TYPES IN POOLS



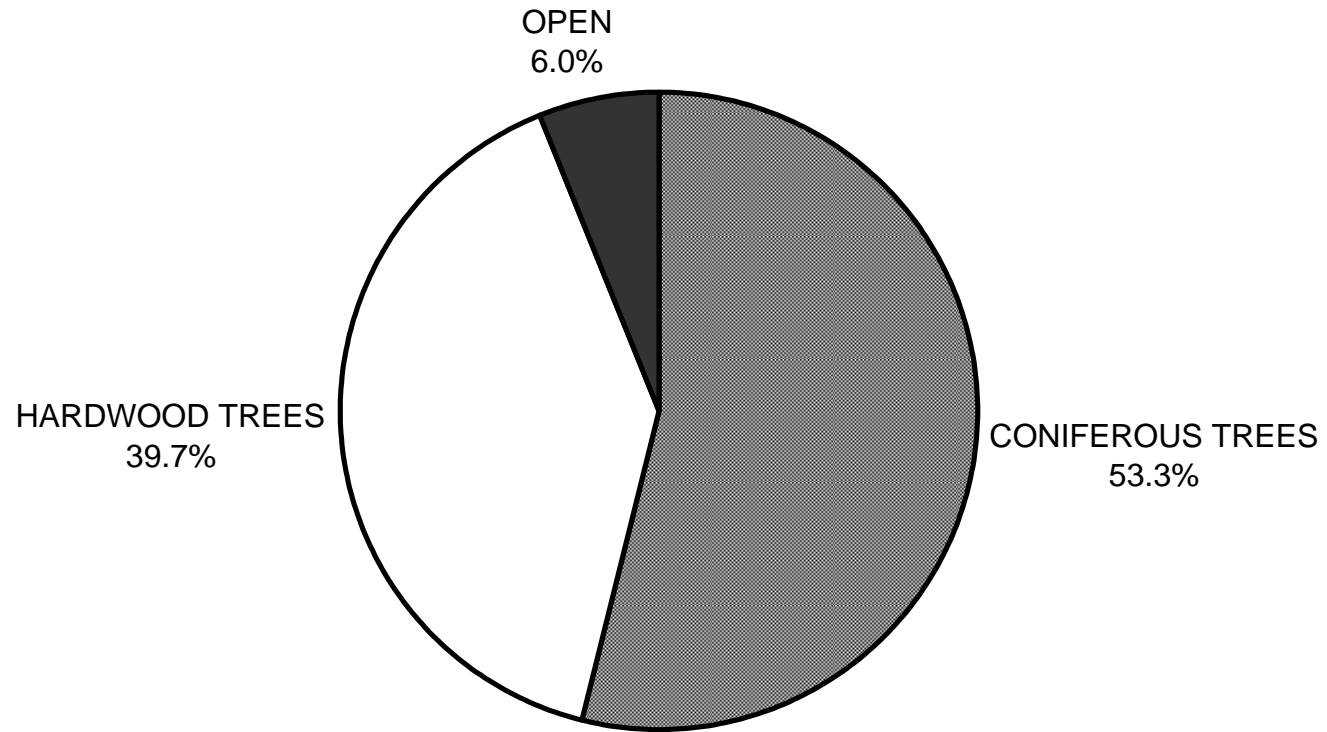
GRAPH 7

CHADD CREEK 2005 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



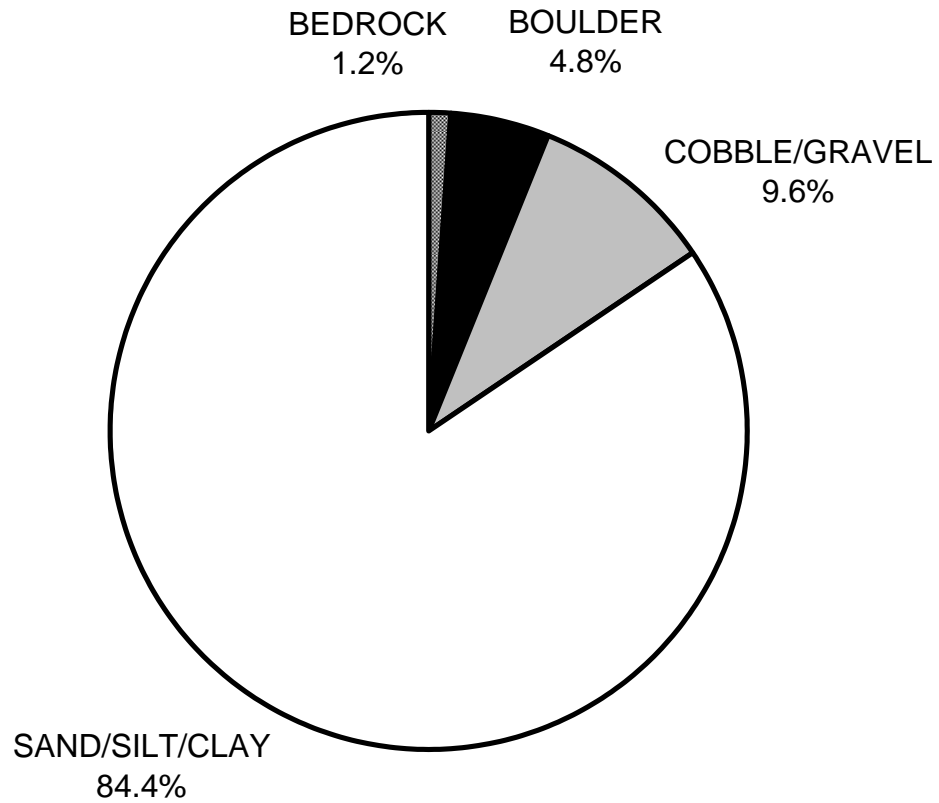
GRAPH 8

**CHADD CREEK 2005
MEAN PERCENT CANOPY**



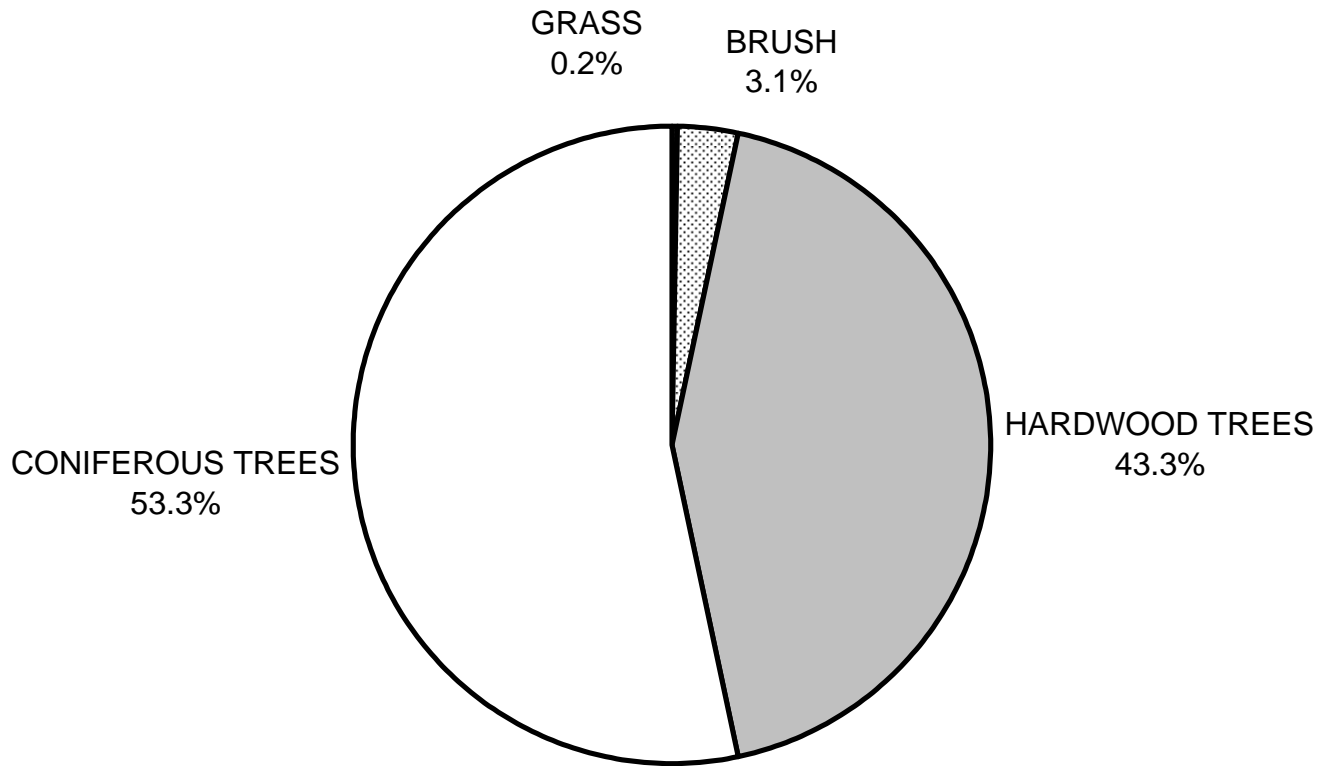
GRAPH 9

**CHADD CREEK 2005
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

**CHADD CREEK 2005
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11