STREAM INVENTORY REPORT

Chadbourne Gulch

INTRODUCTION

A stream inventory was conducted during June 9 to June 11, 2008 on Chadbourne Gulch. The survey began at the confluence with Pacific Ocean and extended upstream 1.4 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Chadbourne Gulch.

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

WATERSHED OVERVIEW

Chadbourne Gulch is a tributary to Pacific Ocean, located in Mendocino County, California. Chadbourne Gulch's legal description at the confluence with Pacific Ocean is T20N R17W S08. Its location is 39.6124 north latitude and 123.7813 west longitude, LLID number 1237809396134. Chadbourne Gulch is a first order stream and has approximately 2.1 miles of blue line stream according to the USGS Inglenook 7.5 minute quadrangle. Chadbourne Gulch drains a watershed of approximately 2.7 square miles. Elevations range from sea level at the mouth of the creek to 560 feet in the headwater areas. Mixed hardwood and conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production and recreation. Vehicle access exists via Highway 1.

METHODS

The habitat inventory conducted in Chadbourne Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Pacific States Marine Fisheries Commission (PSMFC) Fisheries Technicians that conducted the inventory and were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the 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 Sample 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". Sample 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 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 Sample 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 Sample 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 Sample 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 Sample 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.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.18, 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
- 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 Sample 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 June 9 to June 11, 2008 was conducted by W. Holloway and D. Wright (PSMFC). The total length of the stream surveyed was 7,192 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.28 cfs on June 5, 2008.

Chadbourne Gulch is a B4 channel type for 3,070 feet of the stream surveyed (Reach 1), and an F4 channel type for 4,122 feet of the stream surveyed (Reach 2).

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. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 52 to 60 degrees Fahrenheit. Air temperatures ranged from 56 to 71 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 46% pool units, 30% flatwater units, and 24% riffle units (Graph 1). Based on total length of Level II habitat types there were 61% flatwater units, 23% riffle units, and 16% pool units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were lateral scour pool - log enhanced units, 32%; step run units, 29%; and low gradient riffle units, 24% (Graph 3). Based on percent total length, step run units made up 60%, low gradient riffle units 23%, and lateral scour pool - log enhanced units 11%.

A total of 60 pools were identified (Table 3). All the pools were scour pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Nine of the 59 pools (15%) measured had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 59 pool tail-outs measured, 8 had a value of 1 (13.6%); 22 had a value of 2 (37.3%); 19 had a value of 3 (32.2%); and 10 had a value of 4 (16.9%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst.

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 34, flatwater habitat types had a mean shelter rating of 91, and pool habitats had a mean shelter rating of 93 (Table 1). Of the pool types, the scour pools had a mean shelter rating of 93 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Terrestrial vegetation is the dominant cover types in Chadbourne Gulch. Graph 7 describes the pool cover in Chadbourne Gulch. Terrestrial vegetation 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 the dominant substrate observed in 79% of the pool tail-outs measured. Small cobble was the next most frequently observed dominant substrate type and occurred in 14% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Chadbourne Gulch was 89%. Eleven percent of the canopy was open. The mean percentages of hardwood and coniferous trees were 83% and 15%, respectively. Graph 9 describes the mean percent canopy in Chadbourne Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 86%. The mean percent left bank vegetated was 90%. The dominant elements composing the structure of the stream banks consisted of 99% sand/silt/clay and 1% cobble/gravel (Graph 10). Brush was the dominant vegetation type observed in 58% of the units surveyed. Additionally, 42% of the units surveyed had grass as the dominant vegetation type, and 1% had deciduous trees as the dominant vegetation (Graph 11).

DISCUSSION

Chadbourne Gulch is a B4 channel type for the first 3,070 feet of stream surveyed and an F4 channel type for the remaining 4,122 feet. The suitability of a B4 and F4 channel types for fish habitat improvement structures is as follows: B4 channels are excellent for low-stage plunge weirs, boulder cluster, bank placed boulders, single and opposing wing-deflectors and log cover. F4 channels are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors and log cover.

The water temperatures recorded on the survey days June 9, 2008 to June 11, 2008 ranged from 52 to 60 degrees Fahrenheit. Air temperatures ranged from 56 to 71 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.

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Flatwater habitat types comprised 61% of the total length of this survey, riffles 23%, and pools 16%. Nine of the 59 (15%) pools measured had 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 channels width. Installing structure that will increase or deepen pool habitat is recommended.

Thirty of the 59 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty-nine of the pool tail-outs had embeddedness ratings of 3 or 4. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Chadbourne Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Fifty-three of the 57 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 93. The shelter rating in the flatwater habitats was 91. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by terrestrial vegetation in Chadbourne Gulch. Terrestrial vegetation 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 89%. Reach 1 had a canopy density of 88%, reach 2 had a canopy density of 89%. The percentage of right and left bank covered with vegetation was 86% and 90%, respectively.

RECOMMENDATIONS

1) Chadbourne Gulch should be managed as an anadromous, natural production stream.

2) Culvert under Highway 1 (lat: 39.6125N long: 123.7782W) needs to be assessed for fish passage. It is over 60% filled in with gravel.

3) 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.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from terrestrial vegetation. Adding high quality complexity with woody cover in the pools is desirable.

5) 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.

6) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

7) 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 Pacific Ocean.
110	0002.00	Salmonid young-of-the-year (YOY) observed.
169	0005.00	Willow dominating stream vegetation.
189	0006.00	Willow and alder tree accumulation in channel.
223	0008.00	Stream flowing against right bank creating bank erosion. Road on right bank.
233	0009.00	Stream flowing right bank. Road on right bank.
371	0012.00	Channel shows signs of backflooding during higher flows.
415	0014.00	Section full of alders within active channel. Log debris accumulation (LDA) appears to cause backflooding at higher flows.
514	0015.00	Alders form a pool that catch debris at higher flows.
532	0016.00	Salmonid YOY observed.
747	0022.00	Channel is more open due to less alders and willow vegetation.

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837	0024.00	One- plus salmonid observed.
1090	0026.00	LDA and signs of backflooding at higher flows.
1118	0027.00	Culvert #01, under Highway 1, is constructed of concrete and measures 5’ high x 8’ wide x 76’ long with a diameter of 8’ no plunge. The maximum depth within the culvert was 0.3’ and the slope of the culvert was approximately 1%. The culvert is approximately 60% filled with substrate ranging in size from sand to cobble. This culvert is a possible barrier to juvenile and adult anadromous salmonids.
1217	0029.00	Long open stretch of stream. Signs of backflooding area in lower section.
2156	0044.00	Left bank erosion in this unit.
2440	0050.00	Possible old road crossing. Erosion on left bank is 6’ high x 9’ long.
2674	0057.00	Erosion on left bank 30’ long x 10’ high.
2829	0060.00	Possible old road crossing.
2984	0064.00	Old road bed on left bank confining channel. Bank erosion is 10’ long x 6’ high. Channel type change to F4.
3141	0068.00	Right bank landslide is 15’ long x 25’ high.
3174	0070.00	Large redwoods in creek. Right bank landslide is 20’long x 35’ high.
3454	0075.00	Right bank landslide is 12’ long x 30’ high.
3521	0077.00	Decommissioned road on left bank.
3608	0078.00	Right bank landslide is 12’ long x 30’ high.
3853	0084.00	Right bank erosion is 15’ long x 7’ high.
4101	0088.00	LDA in this unit.
4831	0099.00	Right bank tributary enters this unit.
4935	0103.00	Two-plus salmonid observed.
5023	0106.00	LDA.
5048	0107.00	LDA.

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5087	0109.00	Large left bank landslide spanning entire LDA.
5902	0116.00	Small LDA
6002	0118.00	Small LDA. Left bank non-active landslide 15' long x 30' high.
6031	0119.00	Unnamed tributary on right bank.
6277	0122.00	Redwoods in creek.
6391	0123.00	Salmonid YOY. Several bank failures.
6490	0124.00	Salmonid one-plus observed. Decommissioned road crossing.
6605	0127.00	Landslide on right bank is 15' long x 30' high. There are a couple of bank failures in this unit with dense brush & fallen tree limbs.
6756	0131.00	End of survey. Extensive LWD, narrow channel, no pool habitat. There are several sediment plugs in the channel due to large redwoods fallen in creek. Possible LWD low-flow barrier. Five foot jump with no jump-pool below. No fish observed above unit.

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: Chadbourne Gulch LLID: 1237809396134 Drainage: Rockport

Survey Dates: 6/9/2008 to 6/11/2008

Confluence Location: Quad: INGLENOOK Legal Description: T20NR17WS08 Latitude: 39:36:48.0N Longitude: 123:46:51.0W

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
39	13	FLATWATER	29.8	112	4377	60.9	5.0	0.5	1.0	447	17429	215	8393		91
60	60	POOL	45.8	20	1174	16.3	9.7	1.0	1.5	176	10565	206	12161	173	93
32	6	RIFFLE	24.4	51	1641	22.8	4.8	0.2	0.4	93	2982	24	771		34

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
131	79	7192	30976	21325

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Chadbourne Gulch LLID: 1237809396134 Drainage: Rockport

Survey Dates: 6/9/2008 to 6/11/2008

Confluence Location: Quad: INGLENOOK Legal Description: T20NR17WS08 Latitude: 39:36:48.0N Longitude: 123:46:51.0W

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 (%)
32	6	LGR	24.4	51	1641	22.8	5	0.2	0.6	93	2982	24	771		34	86
1	0	RUN	0.8	30	30	0.4										100
38	13	SRN	29.0	114	4347	60.4	5	0.5	2	447	16982	215	8177		91	91
9	9	CRP	6.9	23	211	2.9	7	0.9	1.7	164	1475	168	1341	135	58	96
42	42	LSL	32.1	19	793	11.0	10	1.0	2.9	181	7622	217	9100	182	98	87
3	3	LSR	2.3	23	68	0.9	8	0.8	2	157	470	156	468	132	75	90
1	1	LSBk	0.8	28	28	0.4	5	1.8	2.1	133	133	266	266	239	150	85
3	3	LSBo	2.3	17	51	0.7	11	0.8	1.5	214	642	222	667	178	107	95
2	2	PLP	1.5	12	23	0.3	10	1.2	2	112	224	159	318	138	160	100

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
131	79	7192	30530	21109

Table 3 - Summary of Pool Types

Stream Name: Chadbourne Gulch LLID: 1237809396134 Drainage: Rockport

Survey Dates: 6/9/2008 to 6/11/2008

Confluence Location: Quad: INGLENOOK Legal Description: T20NR17WS08 Latitude: 39:36:48.0N Longitude: 123:46:51.0W

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
60	60	SCOUR	100	20	1174	100	9.7	1.0	176	10565	173	10178	93

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
60	60	1174	10565	10178

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

Stream Name: Chadbourne Gulch LLID: 1237809396134 Drainage: Rockport

Survey Dates: 6/9/2008 to 6/11/2008

Confluence Location: Quad: INGLENOOK Legal Description: T20NR17WS08 Latitude: 39:36:48.0N Longitude: 123:46:51.0W

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
8	CRP	14	0	0	8	100	0	0	0	0	0	0
42	LSL	71	6	14	30	71	6	14	0	0	0	0
3	LSR	5	0	0	2	67	1	33	0	0	0	0
1	LSBk	2	0	0	0	0	1	100	0	0	0	0
3	LSBo	5	0	0	3	100	0	0	0	0	0	0
2	PLP	3	0	0	1	50	1	50	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
59	6	10	44	75	9	15	0	0	0	0

Mean Maximum Residual Pool Depth (ft.): 1.5

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Chadbourne Gulch LLID: 1237809396134 Drainage: Rockport

Survey Dates: 6/9/2008 to 6/11/2008 Dry Units: 0

Confluence Location: Quad: INGLENOOK Legal Description: T20NR17WS08 Latitude: 39:36:48.0N Longitude: 123:46:51.0W

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
32	6	LGR	0	28	10	0	62	0	0	0	0
32	6	TOTAL RIFFLE	0	28	10	0	62	0	0	0	0
1	0	RUN									
38	11	SRN	0	28	22	0	50	0	0	0	0
39	11	TOTAL FLAT	0	28	22	0	50	0	0	0	0
9	9	CRP	10	10	3	3	74	0	0	0	0
42	37	LSL	3	25	37	1	32	0	1	1	0
3	2	LSR	20	5	15	20	40	0	0	0	0
1	1	LSBk	0	0	40	0	20	0	10	0	30
3	3	LSBo	0	33	5	0	35	0	0	27	0
2	1	PLP	0	70	0	0	20	0	10	0	0
60	53	TOTAL POOL	5	22	28	2	39	0	1	2	1
131	70	TOTAL	4	24	25	1	43	0	1	2	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Chadbourne Gulch LLID: 1237809396134 Drainage: Rockport

Survey Dates: 6/9/2008 to 6/11/2008 Dry Units: 0

Confluence Location: Quad: INGLENOOK Legal Description: T20NR17WS08 Latitude: 39:36:48.0N Longitude: 123:46:51.0W

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
32	6	LGR	0	0	100	0	0	0	0
1	0	RUN	0	0	0	0	0	0	0
38	14	SRN	0	0	100	0	0	0	0
9	9	CRP	0	0	89	11	0	0	0
42	42	LSL	2	21	76	0	0	0	0
3	3	LSR	0	0	100	0	0	0	0
1	1	LSBk	0	0	100	0	0	0	0
3	3	LSBo	0	33	67	0	0	0	0
2	2	PLP	0	0	50	50	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Chadbourne Gulch LLID: 1237809396134 Drainage: Rockport

Survey Dates: 6/9/2008 to 6/11/2008

Confluence Location: Quad: INGLENOOK Legal Description: T20NR17WS08 Latitude: 39:36:48.0N Longitude: 123:46:51.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
89	15	83	2	86	90

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: Chadbourne Gulch LLID: 1237809396134 Drainage: Rockport

Survey Dates: 6/9/2008 to 6/11/2008 Survey Length (ft.): 7192 Main Channel (ft.): 7192 Side Channel (ft.): 0

Confluence Location: Quad: INGLENOOK Legal Description: T20NR17WS08 Latitude: 39:36:48.0N Longitude: 123:46:51.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: B4
Reach Length (ft.): 3070
Riffle/Flatwater Mean Width (ft.): 4.6
BFW:
Range (ft.): 12 to 13
Mean (ft.): 12
Std. Dev.: 0
Base Flow (cfs.): 0.3
Water (F): 52 - 60 Air (F): 56 - 71
Dry Channel (ft): 0

Canopy Density (%): 88.4
Coniferous Component (%): 5.8
Hardwood Component (%): 94.2
Dominant Bank Vegetation: Brush
Vegetative Cover (%): 89.6
Dominant Shelter: Terrestrial Veg.
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 14
LWD per 100 ft.:
Riffles: 1
Pools: 6
Flat: 2

Pools by Stream Length (%): 19.8
Pool Frequency (%): 46.9
Residual Pool Depth (%):
< 2 Feet Deep: 100
2 to 2.9 Feet Deep: 0
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.2
Mean Pool Shelter Rating: 102

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 82 Sm Cobble: 11 Lg Cobble: 7 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 17.2 2. 44.8 3. 20.7 4. 17.2 5. 0.0

STREAM REACH: 2

Channel Type: F4
Reach Length (ft.): 4122
Riffle/Flatwater Mean Width (ft.): 5.3
BFW:
Range (ft.): 10 to 13
Mean (ft.): 11
Std. Dev.: 1
Base Flow (cfs.): 0.3
Water (F): 52 - 58 Air (F): 56 - 64
Dry Channel (ft): 0

Canopy Density (%): 89.3
Coniferous Component (%): 23.6
Hardwood Component (%): 76.4
Dominant Bank Vegetation: Brush
Vegetative Cover (%): 86.7
Dominant Shelter: Large Woody Debris
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 37
LWD per 100 ft.:
Riffles: 11
Pools: 18
Flat: 6

Pools by Stream Length (%): 13.7
Pool Frequency (%): 44.8
Residual Pool Depth (%):
< 2 Feet Deep: 70
2 to 2.9 Feet Deep: 30
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.7
Mean Pool Shelter Rating: 83

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 76 Sm Cobble: 17 Lg Cobble: 3 Boulder: 3 Bedrock: 0

Embeddedness Values (%): 1. 10.0 2. 30.0 3. 43.3 4. 16.7 5. 0.0

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Chadbourne Gulch LLID: 1237809396134 Drainage: Rockport

Survey Dates: 6/9/2008 to 6/11/2008

Confluence Location: Quad: INGLENOOK Legal Description: T20NR17WS08 Latitude: 39:36:48.0N Longitude: 123:46:51.0W

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	0	0	0.0
Boulder	0	0	0.0
Cobble / Gravel	0	2	1.3
Sand / Silt / Clay	77	75	98.7

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	35	29	41.6
Brush	41	48	57.8
Hardwood Trees	1	0	0.6
Coniferous Trees	0	0	0.0
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 3

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

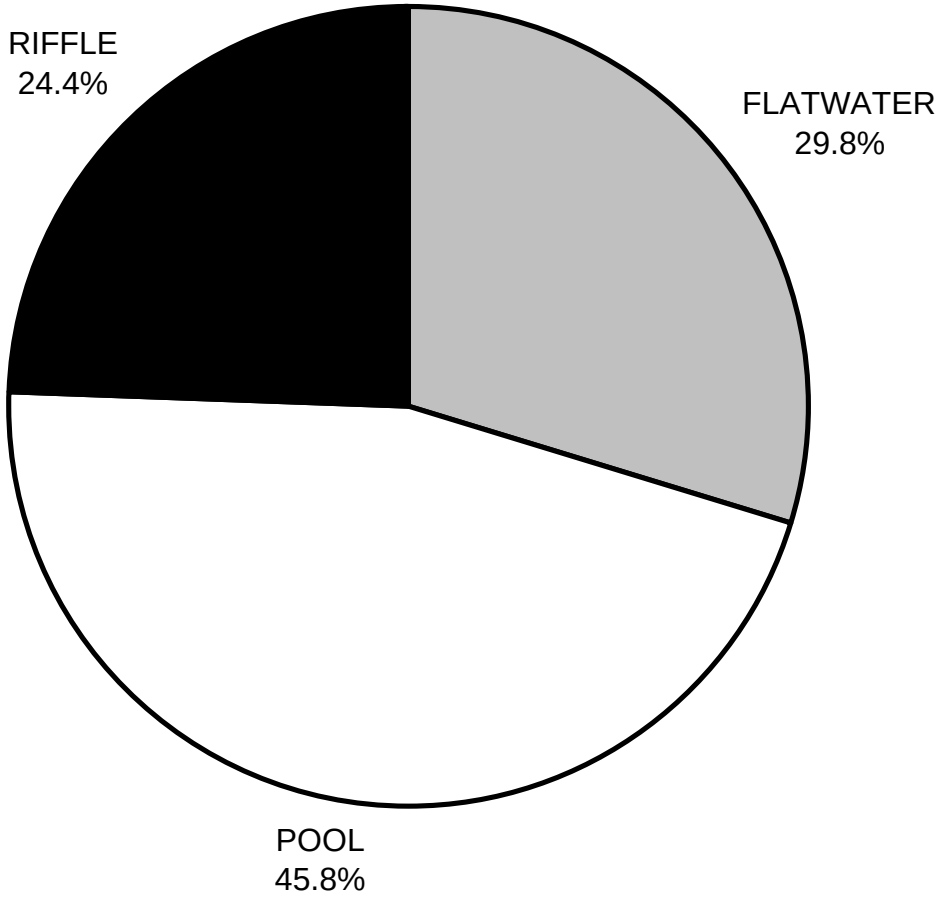
StreamName: Chadbourne Gulch LLID: 1237809396134 Drainage: Rockport

Survey Dates: 6/9/2008 to 6/11/2008

Confluence Location: Quad: INGLENOOK Legal Description: T20NR17WS08 Latitude: 39:36:48.0N Longitude: 123:46:51.0W

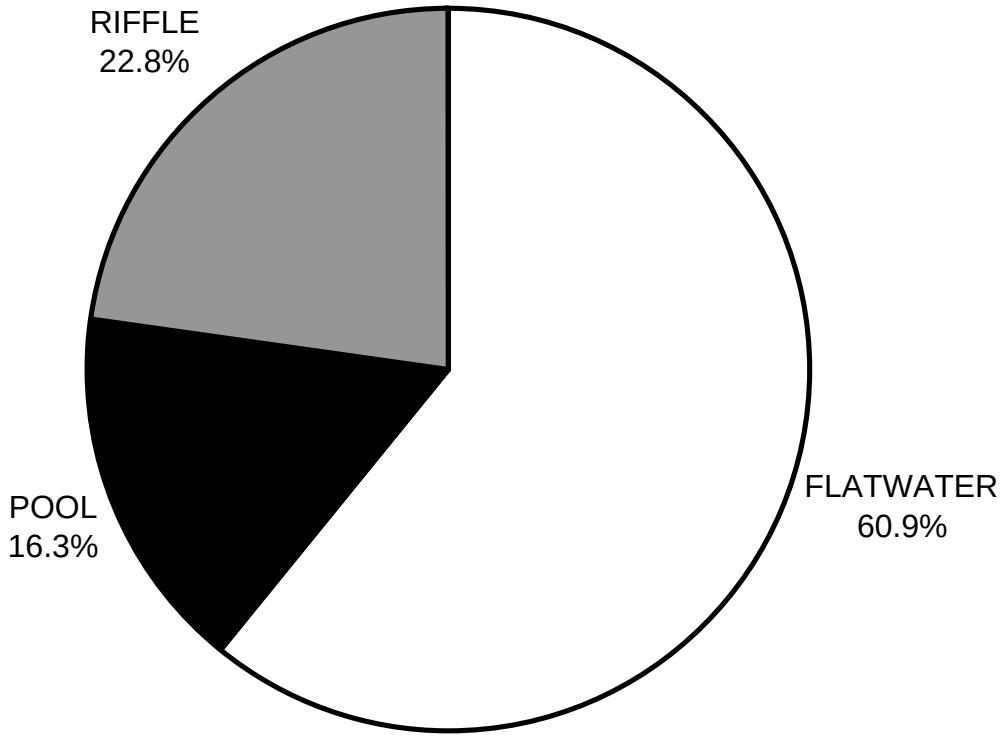
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	5
SMALL WOODY DEBRIS (%)	28	28	22
LARGE WOODY DEBRIS (%)	10	22	28
ROOT MASS (%)	0	0	2
TERRESTRIAL VEGETATION (%)	62	50	39
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	1
BOULDERS (%)	0	0	2
BEDROCK LEDGES (%)	0	0	1

CHADBOURNE GULCH 2008
HABITAT TYPES BY PERCENT OCCURRENCE



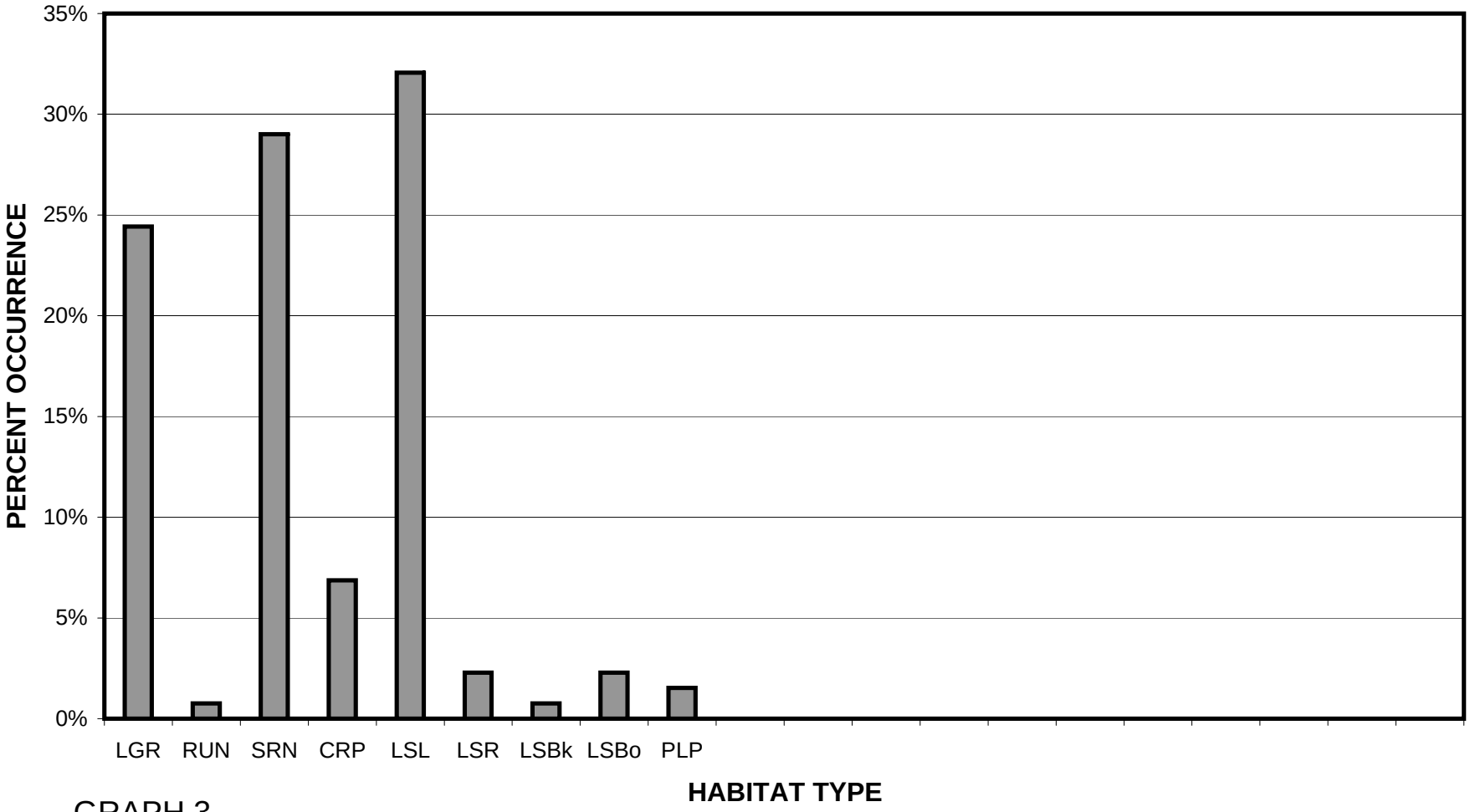
GRAPH 1

CHADBOURNE GULCH 2008
HABITAT TYPES BY PERCENT TOTAL LENGTH



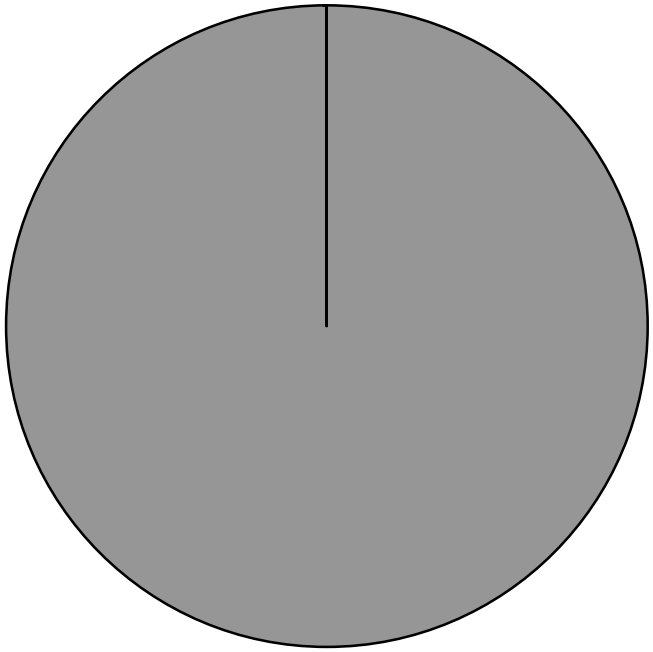
GRAPH 2

CHADBOURNE GULCH 2008
HABITAT TYPES BY PERCENT OCCURRENCE



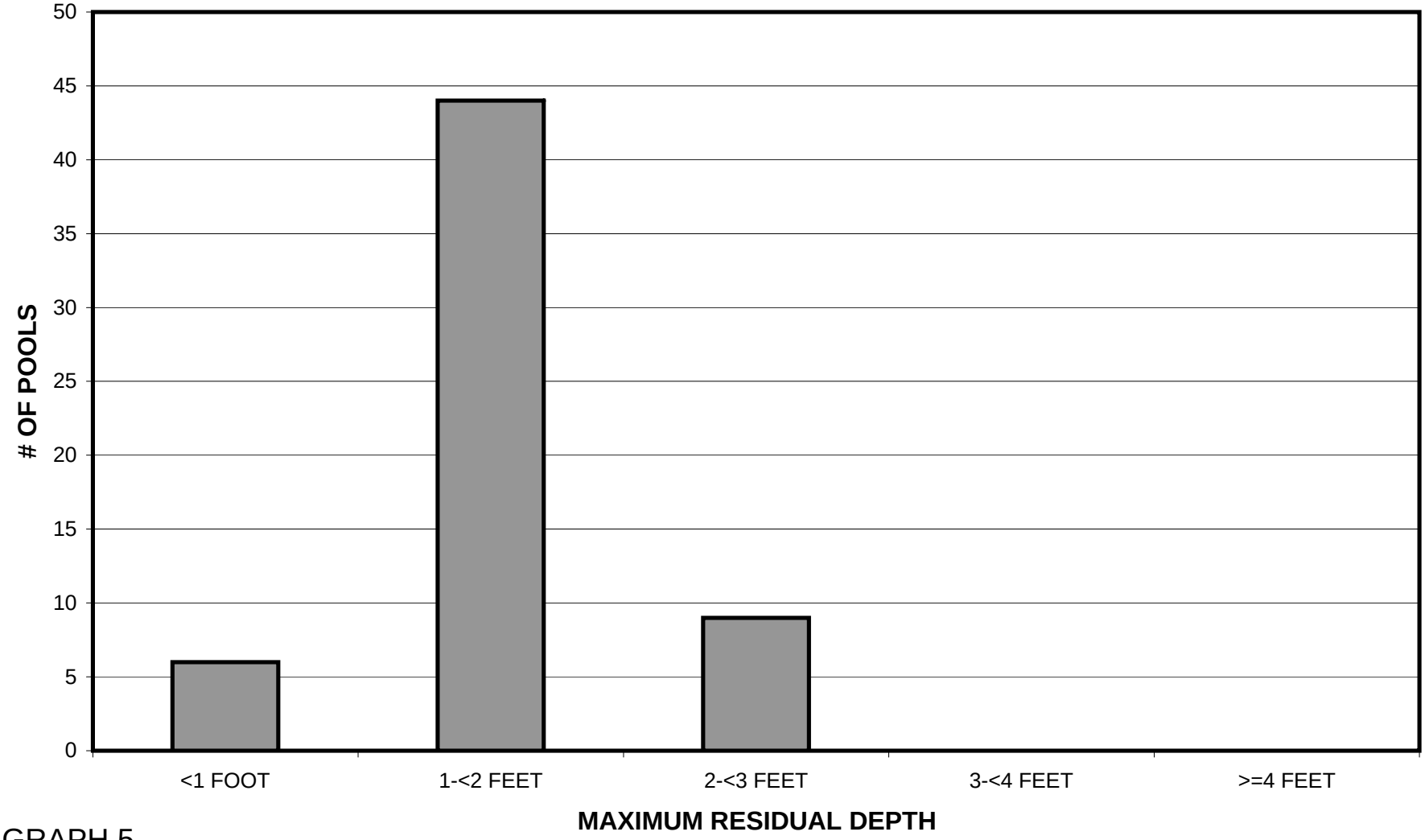
GRAPH 3

CHADBOURNE GULCH 2008
POOL TYPES BY PERCENT OCCURRENCE



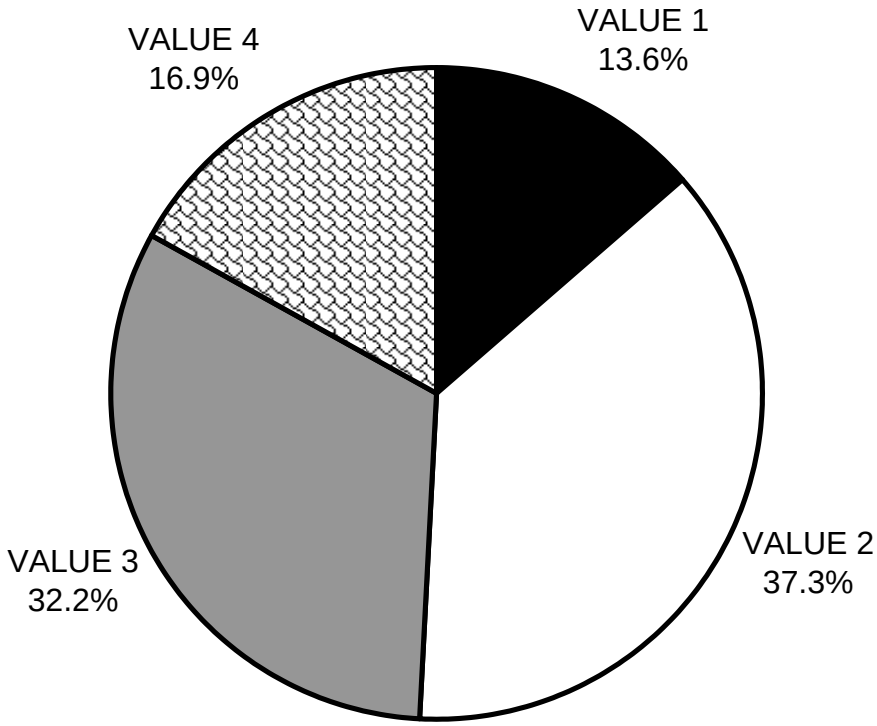
GRAPH 4

CHADBOURNE GULCH 2008
MAXIMUM DEPTH IN POOLS



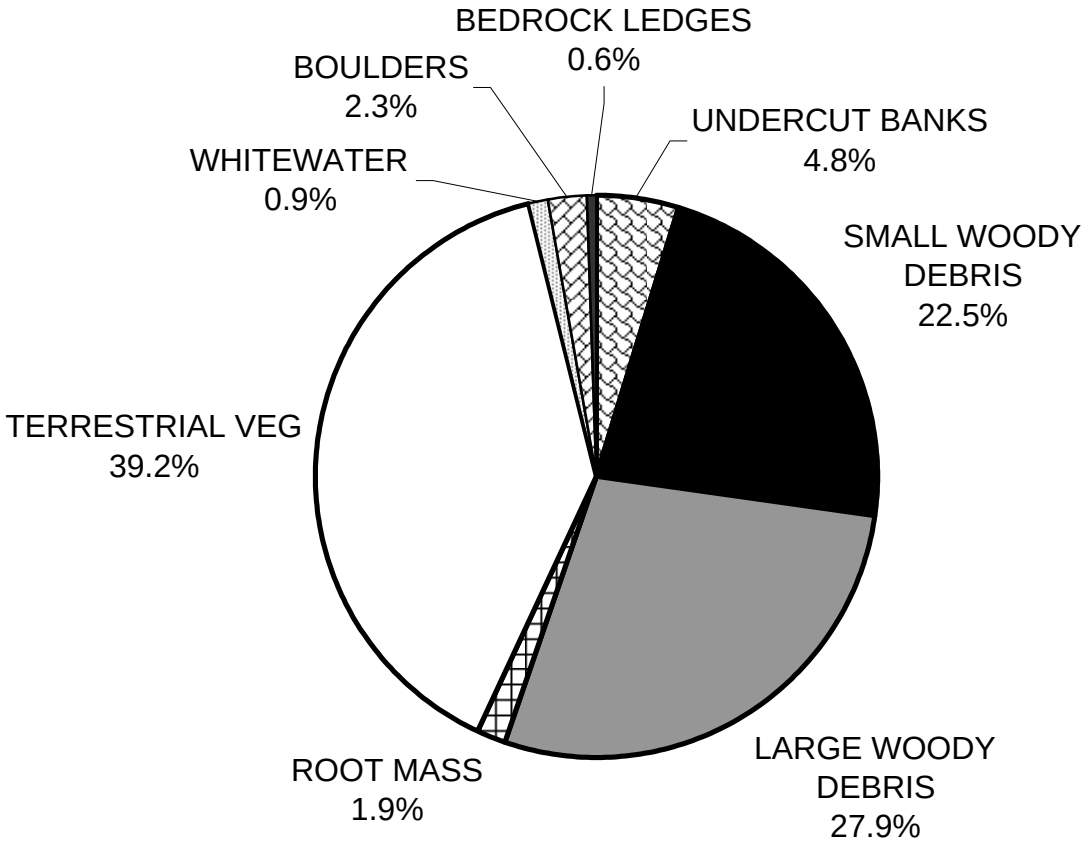
GRAPH 5

CHADBOURNE GULCH 2008
PERCENT EMBEDDEDNESS



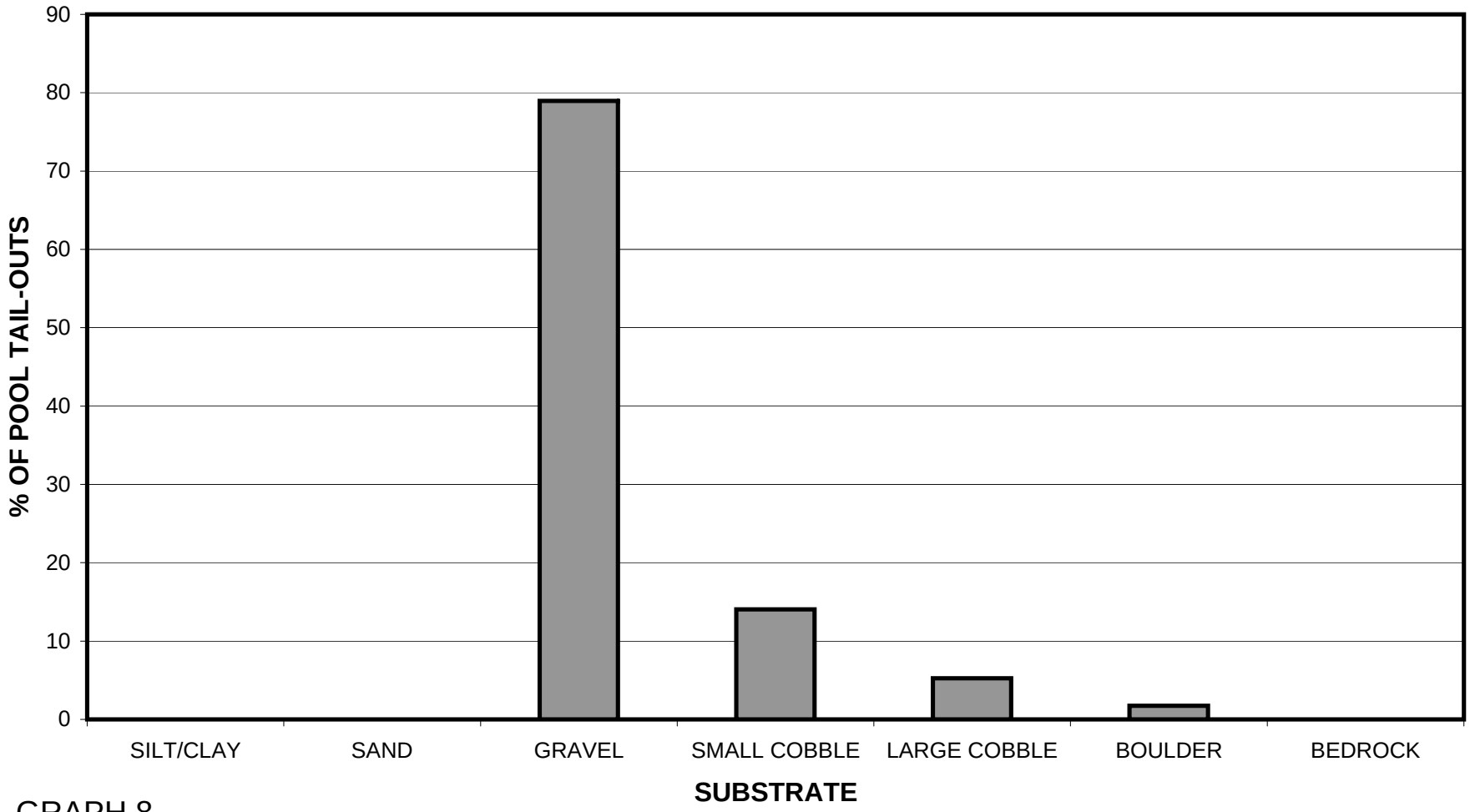
GRAPH 6

CHADBOURNE GULCH 2008
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

CHADBOURNE GULCH 2008
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS

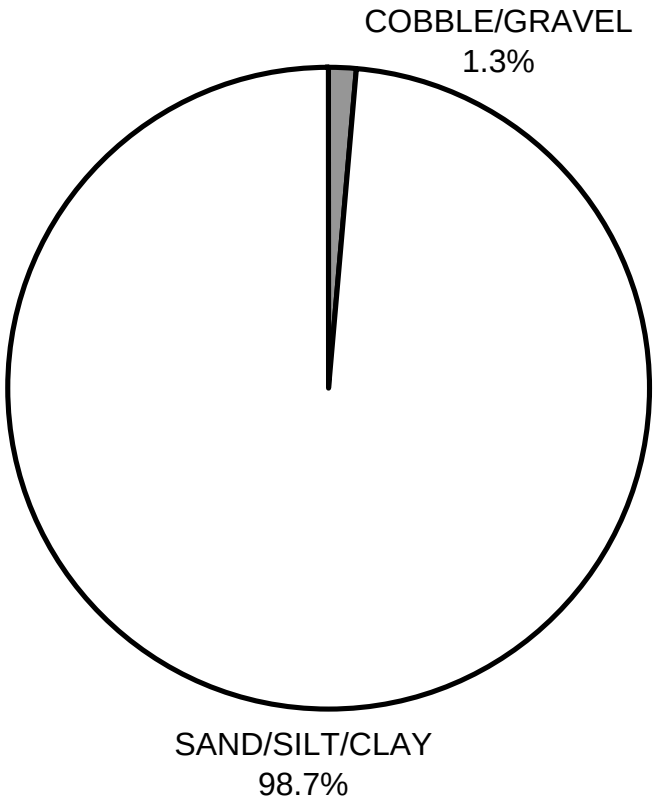


GRAPH 8

CHADBOURNE GULCH 2008
MEAN PERCENT CANOPY

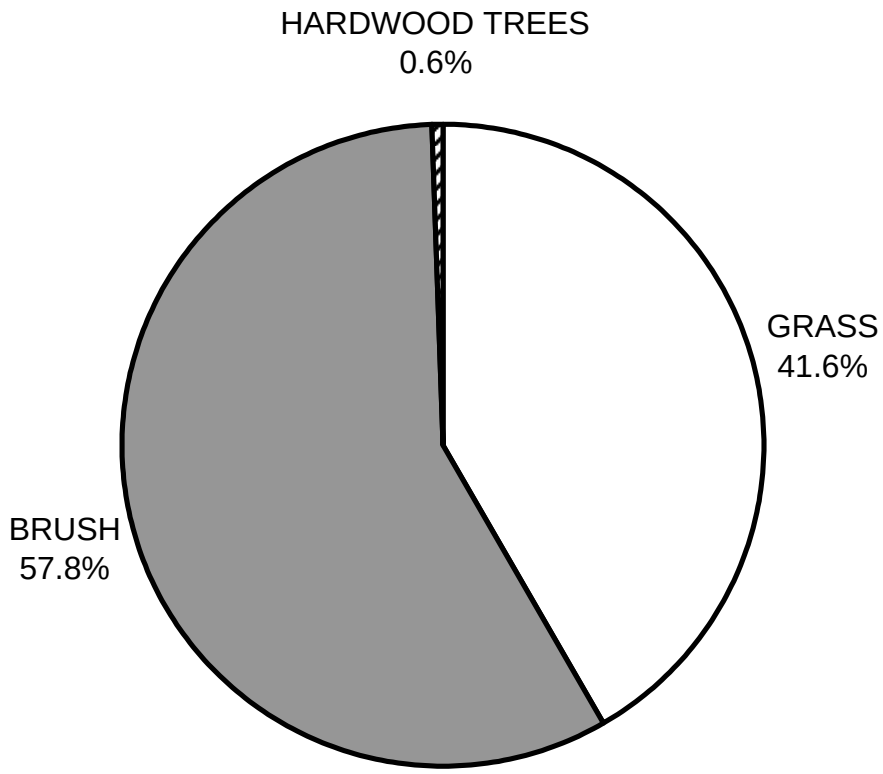
GRAPH 9

CHADBOURNE GULCH 2008
DOMINANT BANK COMPOSITION IN SURVEY REACH

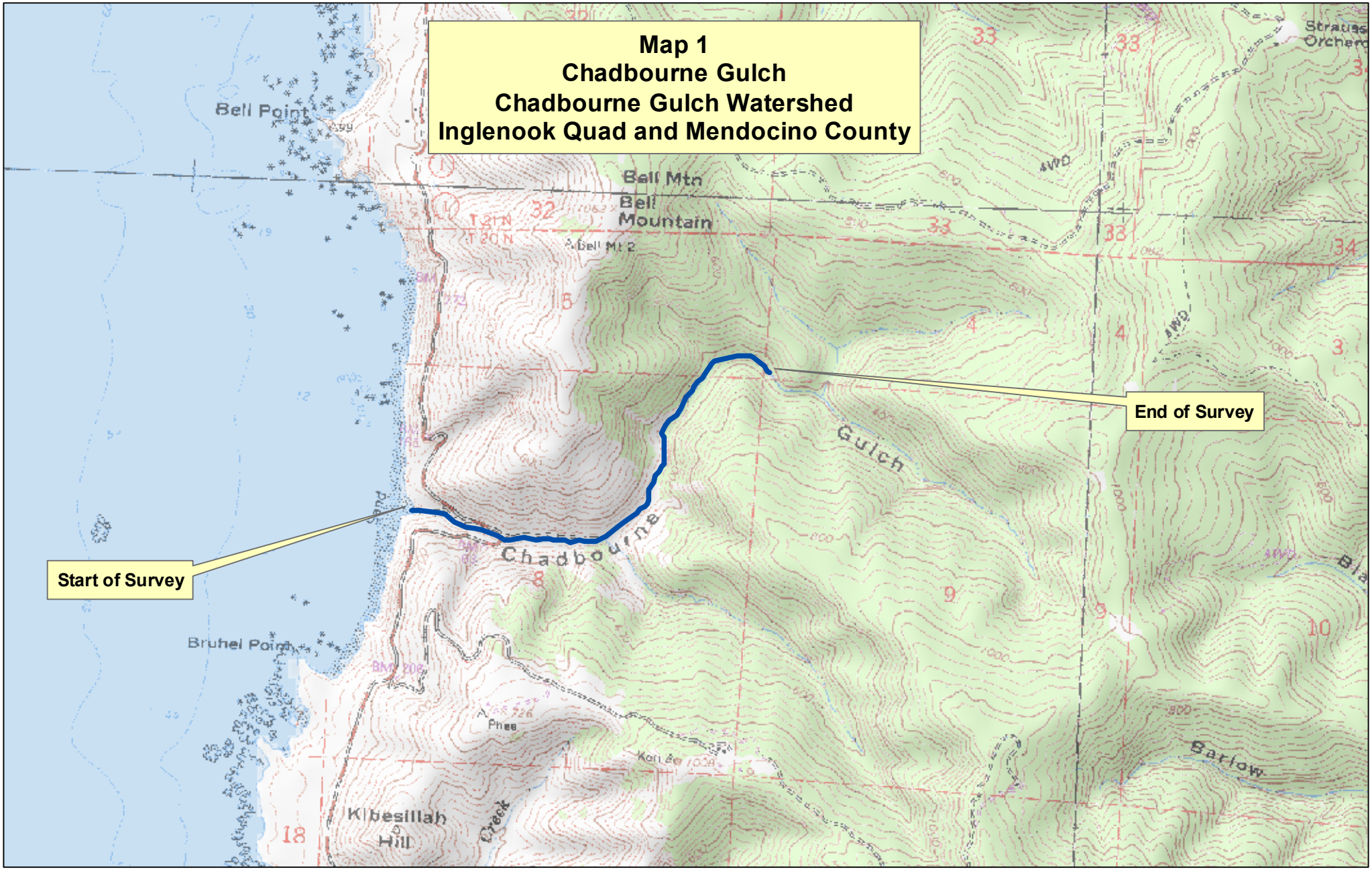


GRAPH 10

CHADBOURNE GULCH 2008
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11


Map 1
Chadbourne Gulch
Chadbourne Gulch Watershed
Inglenook Quad and Mendocino County
Bell Point
Bell Mtn
Bell Mountain
Bell Mt 2
End of Survey
Start of Survey
Chadbourne Gulch
Bruhel Point
Kibesillah Hill
Barlow
N
W
E
S
Legend
Chadbourne Gulch Survey 2008
0
1,100
2,200 Feet
RESOURCES AGENCY
CALIFORNIA
DEPARTMENT
FISH & GAME