STREAM INVENTORY REPORT
Martin Slough
2006

INTRODUCTION

A stream inventory was conducted August 8, 2006 to September 25, 2006 on Martin Slough. The survey began at the confluence with Swain Slough and extended upstream 3.1 miles. Stream inventories and subsections to this report were also completed for four tributaries to Martin Slough.

The Martin Slough 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 Martin Slough. 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 coho salmon, steelhead trout, and cutthroat trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Martin Slough is a tributary to Swain Slough, tributary to Elk River, tributary to the North Bay Channel of the Humboldt Bay, tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Martin Slough's legal description at the confluence with Swain Slough is T04N R01W S04. Its location is 40°45'09" north latitude and 124°10'53" west longitude, LLID number 1241815407524. Martin Slough is a 3rd order stream and has approximately 10.82 miles of blue line stream according to the USGS Eureka 7.5 minute quadrangle. Martin Slough drains a watershed of approximately 5.18 square miles. Elevations range from approximately 3 feet at the mouth of the creek to 200 feet in the headwater areas. Mixed conifer and mixed hardwood forest dominate the watershed. The watershed is primarily privately owned. Vehicle access exists via Fairway Drive and Campton Road in Eureka, California.

METHODS

The habitat inventory conducted in Martin Slough 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.

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 Martin Slough 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. Flow was taken in the lower portion of Martin Slough, downstream of Tributary #3 (LLID 1241709407568).

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. Additionally, nine recording thermographs (Onset HOBO® Water Temp Pro v2 data loggers) were deployed in Martin Slough from June 29th to October 18th to record temperatures on a 24 hour basis during warm summer months. Thermograph results are presented in Appendix B – Thermograph Report.

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". Martin Slough 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 Martin Slough, 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 Martin Slough, 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 Martin Slough, 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 Martin Slough, 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 during habitat typing in Martin Slough. In addition, sites were electrofished using a Smith-Root Model 12 and Model 12B electrofisher and additional sites were sampled with a 30 foot or 100 foot seine net, depending on channel size. Electrofishing 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
- 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 Martin Slough 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 August 8, 2006 to September 25, 2006 was conducted by A. Shows, S. McSmith, A. Stockwell, and B. Rahn (WSP). The total length of the stream surveyed was 16,379 feet with an additional 2,006 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 2.37 cubic feet per second (cfs) at 16:00 hr on August 16, 2006. It is believed that the location that flow was taken is in a tidally influenced portion of Martin Slough. The high tide on that day was at 18:27 (7.4feet).

Martin Slough is an E6 channel type for the entire 18,385 feet of the stream surveyed (Reach 1). In general, E6 channels are a low gradient, meandering, riffle/pool streams with low width/depth ratios and little deposition. E6 channels are very efficient and stable with high meander width ratios and silt/clay-dominant substrates. Martin Slough has been channelized for most of its length.

Water temperatures taken during the survey ranged from 52 to 64 degrees Fahrenheit. Air temperatures ranged from 57 to 75 degrees Fahrenheit. For a more complete and accurate water temperature profile, please refer to Appendix B – Thermograph Report at the end of this document.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 45% flatwater units, 19% pool units, and 11% riffle units. In addition, there were 9% culvert units, 9% no-survey units and 6% no-survey units (marsh) (Graph 1). Based on total length of Level II habitat types there were 59% flatwater units, 7% pool units, and 1% riffle units. In addition, there were 19% no-survey units, 11% no-survey units (marsh), and 2% culvert units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The three most frequent habitat types by percent occurrence were 17% glide units, 16% step-run units, and 14% mid-channel pool units (Graph 3). Based on percent total length, glide units made up 46%, step-run units 9%, mid-channel pool units 6%, and run units 5%. In addition, units not surveyed due to access constraints made up 19% and units not surveyed due to marsh area made up 11%.

A total of 18 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 83% (Graph 4), and comprised 97% 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. Three of the 18 pools (17%) had a residual depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 18 pool tail-outs measured, 2 had a value of 1 (11%); 2 had a value of 2 (11%); 14 had a value of 5 (78%) (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. Pool habitats had a mean shelter rating of 49, flatwater habitat types had a mean shelter rating of 39, and riffle habitat types had a mean shelter rating of 5 (Table 1). Of the pool types, scour pools had a mean shelter rating of 168, backwater pools had a mean shelter rating of 100, and main channel pools had a mean shelter rating of 29 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Terrestrial vegetation is the dominant cover type in Martin Slough. Graph 7 describes the pool cover in Martin Slough. Undercut bank is the dominant pool cover type followed by terrestrial vegetation.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. A silt/clay substrate type was observed in 72% of pool tail-outs and gravel was observed in 28% of pool tail-outs.

The mean percent canopy density for the surveyed length of Martin Slough was 74%. Twenty-six percent of the canopy was open. The mean percentages of hardwood and coniferous trees were 54% and 46%, respectively. Graph 9 describes the mean percent canopy in Martin Slough.

For the stream reach surveyed, the mean percent right bank vegetated was 86%. The mean percent left bank vegetated was 93%. The dominant elements composing the structure of the stream banks consisted of 98% sand/silt/clay and 2% cobble/gravel (Graph 10). Grass was the dominant vegetation type observed in 33% of the units surveyed. Additionally, 28% of the units surveyed had coniferous trees as the dominant vegetation type, and 22% had deciduous trees as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Five sites in total were electrofished for species composition and distribution in Martin Slough on October 17th, 24th, 25th and 26th, 2006. Four sites in total were seined using a 30 foot or 100 foot seine net depending on the size of the channel on February 9th, May 25th, August 10th and September 21st, 2006. Results from observations on the mainstem are listed below and results for each of the tributaries surveyed are displayed in the respective subsections to this report. Water temperatures taken during the electrofishing period ranged from 47.1°F to 52.7 °F. Air temperatures ranged from 54.5°F to 54.4°F. The sites were sampled by M. Gilroy and S. Monday (DFG); and A. Shows and B. Rahn (WSP).

In the mainstem, which comprised the total 16,379 feet of stream, side channels excluded, two sites were sampled. The reach sites yielded one lamprey ammocoete sp., one salamander sp. and zero salmonids. The sites that were sampled with a seine net in total yielded one young-of-the-year coho, 34 one-plus coho, one two-plus steelhead/rainbow trout, and five two-plus cutthroat trout as well as numerous three spine stickleback and prickly sculpin, and an amphibian egg mass. The sites were sampled by A. Shows (WSP), E. Ojerholm, M. Lomelli, D. Kyle, M. Gilroy, and M. Wallace (DFG).

The following chart displays the information yielded from these sites:

2006 Martin Slough seine net and electrofish observations. Reach 1, E6 Channel Type

Date	Method	Hab. Unit #	Hab. Type	Approx. Dist. from mouth (ft.)	Coho		SH/RT		Cut-throat
					YOY	1+	1+	2+	2+
02/09/06	Seine	009	3.2	3425	-	5	-	-	-
		009	3.2	3818	-	1	-	-	-
		010	4.2	3993	-	7	-	-	-
05/25/06	Seine	010	4.2	3993	-	14	-	-	-
		014	4.2	6670	-	2	-	-	-
08/10/06	Seine	009	3.2	3425	-	-	-	-	-
		010	4.2	3993	-	-	-	-	2
		014	4.2	6670	1	4	-	1	-
09/21/06	Seine	010	4.2	3993	-	-	-	-	3
		014	4.2	6670	-	1	-	-	-

2006 Martin Slough seine net and electrofish observations. Reach 1, E6 Channel Type

Date	Method	Hab. Unit #	Hab. Type	Approx. Dist. from mouth (ft.)	Coho		SH/RT		Cut-throat
					YOY	1+	1+	2+	2+
10/24/06	E-fish	039-044	3.4, 1.1, 4.2	13503	-	-	-	-	-
10/25/06	E-fish	070-079	3.3,1.1, 3.4, 6.5	14755	-	-	-	-	-

DISCUSSION

Martin Slough is an E6 channel type for the entire 18,385 feet of stream surveyed (side channel included). The suitability of E6 channel types for fish habitat improvement structures is as follows: Good for bank-placed boulders, fair for opposing wing-deflectors, and poor for plunge weirs, boulder clusters, and single wing-deflectors.

The water temperatures recorded on the survey days August 8, 2006 through September 25, 2006, ranged from 52 to 64 degrees Fahrenheit. Air temperatures ranged from 57 to 75 degrees Fahrenheit. For a more complete and accurate water temperature profile, please refer to Appendix B – Thermograph Report at the end of this document.

Flatwater habitat types comprised 59% of the total length of this survey, pools 7% and riffles 1%. Areas that were unsurveyable due to access constraints made up 19% of the total length of this survey and areas unsurveyable due marsh, overgrown aquatic and emergent vegetation, made up 11% of the total length of this survey. The pools are relatively shallow with only 3 of the 18 (17%) pools having a maximum residual depth greater than 3 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third and fourth order streams, a primary pool is defined to have a maximum residual depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low-flow channel width. Installing structures that will increase or deepen pool habitat is recommended.

Four of the 18 pool tail-outs measured had embeddedness ratings of 1 or 2. None of the pool tail-outs had embeddedness ratings of 3 or 4. Fourteen 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. Sediment sources in Martin Slough should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Thirteen of the 18 pool tail-outs had silt or sand as the dominant substrate. This is generally considered unsuitable for spawning salmonids.

The mean shelter rating for pools was 49. The shelter rating in the flatwater habitats was 39. A

pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by terrestrial vegetation in Martin Slough. Undercut banks are the dominant cover type in pools followed by terrestrial vegetation. 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 74%. In general, revegetation projects are considered when canopy density is less than 80%. The percentage of right and left bank covered with vegetation was 86% and 93%, respectively.

RECOMMENDATIONS

1) Martin Slough 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 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.

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 undercut banks. Adding high quality complexity with woody cover in the pools is desirable.

5) Suitable size spawning substrate on Martin Slough is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

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	Begin survey at confluence of Martin Slough and Swain Slough. Old tide gate at bottom of unit Bridge #1 is a tide gate. Three culverts make up tidegate, 40’ long x 5’ high x 33’ wide.
572	0003.00	Tributary #1 enters from right bank with a water temperature of 57 degrees Fahrenheit. The tributary is not accessible to fish.

		Tributary flows into main channel via 2 culverts with plunge heights of 2.5 feet.
960	0007.00	Side channel enters from left bank
1406	0007.01	Concrete culvert #1 is 3’ diameter and 25’ long.
1406	0007.03	Concrete culvert #2 is 2’ in diameter and 20’ long. There is no plunge height or baffles.
1406	0008.00	Concrete culvert #3 is 4.5’ in diameter and 73’ long with no plunge height or baffles
1479	0009.00	Top of side channel exits in this habitat unit. Drainage pipe on left bank, 1’ diameter, drainage pipe on left bank 0.5’ diameter. Last 200’ of habitat unit is choked with aquatic vegetation (reeds and reed canary grass) before reaching the pond. Tributary #2 enters from right bank. Water temperature is 64 degrees Fahrenheit. Tributary #3: Flowing in from left bank. No fish were observed in either tributary. Seine net sampling site #1. Bridge #2, wood footbridge 5.5’ high x 11’wide x 32’ long. Bridge #3, wood footbridge 6’ high x 10’ wide x 25 long. Bridge #4, wood footbridge 6’ high x 8’ wide x 26’ long. Bridge #5, wood footbridge 3.7’ high x 11.5’ wide x 41’ long.
3993	0010.00	Difficult access to stream due to a large amount of reeds along the banks. Seine net sampling site #2.
4153	0011.00	Channel is completely choked with vegetation, reeds and grasses. Bridge #6, wood footbridge 6.5’ high x 8’ wide x 26’ long. Bridge #7, lower Fairway Dr. bridge, 14’ high x 32’ wide x 70’ long. The channel beneath the bridge is deep and clear of instream vegetation.
4490	0012.00	Not surveyed, stream runs through the Eureka Municipal Golf Course. Bridge #8, wood footbridge 9’ high x 10’wide x 40’ long.
4630	0013.00	Drainage pipe comes in from left bank. The entire main channel within the golf course is choked with a variety of reeds and grasses. Surface water is only visible in shaded areas under trees or under bridges. Average width is 8 feet to 10 feet, average depth is 1 foot to 3 feet. Tributary #4 flows in from right bank. Water temperature is 66 degrees Fahrenheit. No fish were observed. Bridge #9, footbridge 6.5’ high x 8’ wide x 32’ long. Bridge #10, footbridge 4.5’ high x 8’ wide x 32’ long. Bridge #11, footbridge 6’ high x 8’ wide x 26’ long. Bridge #12, footbridge 5’ high x 12’ wide x 32’ long. Bridges #13, and #14, footbridges are both in this habitat unit.
6144	0014.00	Pool is very turbid, much like the rest of Martin Slough up to this point. Seine net sampling site #3. Bridge #15, upper Fairway Dr. Bridge, 8’ high x 8’ wide box culvert.

6784	0016.00	Broken out into pool habitat due to clearance from instream vegetation. One piece of large wood found on left bank, not in pool. Tributary #5, flowing in from left bank. Water temperature is 55˚F. No fish observed. Electro-fishing sampling site.
7041	0020.00	Tributary #6, flowing in from left bank. Water temperature is 56˚ F. No fish observed.
7550	0026.00	Bridge #16, wood bridge, private driveway crossing, 6’ high x 15’ wide x 28’ long.
8047	0027.00	Mid-channel pool with island in the middle vegetated with willows. Tributary #7, flowing in from left bank. Water temperature is 56˚ F. No fish observed up to 3 feet.
8145	0028.00	Tributary #8: Flowing in at left bank. Water temp is 59˚ F. No fish observed up to 50 feet.
8840	0029.00	End of Survey, Section 1, no property access.
8871	0030.00	No access from landowner. Distance was calculated from MapTech/Terrain Navigator, relying on GPS coordinates.
10671	0031.00	Start of Survey, Section 2. Began stream length measurements upstream of culverts/road crossing. End of Survey, Section 2, no property access. Tributary #9, flowing in from left bank. Water temp is 60˚ F. No fish observed. Five concrete culverts, 4 are plugged with sediment. Culvert #4, 4’ in diameter and with no plunge or baffles.
10770	0032.00	Not surveyed, no access from landowner. Distance found using MapTech/Terrain Navigator relying on GPS coordinates.
11570	0033.00	Start of Survey, Section 3. Creek appears to have been straightened or channelized.
12077	0034.00	Culvert #5, double concrete culvert with 2’ diameter. No baffles or plunge height.
12089	0035.00	Tributary #10, flowing in from right bank. Water temp is 72˚ F. No fish observed up to 200’feet.
12382	0036.00	Culvert #6, 2 metal culverts, one is 2.2’ in diameter; the other is 4’ diameter. They are both undercut, the smaller one is crushed. No baffles or plunge height. End of Survey, Section 3 survey ended due to no landowner access.
12424	0037.00	No access granted from landowner. Distance found using MapTech/Terrain Navigator relying on GPS coordinates.
13124	0038.00	Start of Survey, Section 4. Culvert #7, concrete with a 3’ diameter, 15’ length. No baffles and in good condition.
13139	0039.00	Possible juvenile fish barrier (2’ x 12’ plank under bridge in stream bed). First sign of spawning gravel found at confluence with tributary #11. Tributary #11, flowing in from right bank. Water temp is 58˚ F. No fish observed. Electro-fishing sampling site.

		Bridge #17 is a vehicle bridge on private drive, wood over a truck bed, not a barrier to salmonids. Bridge is 8.2' high x 12'wide x 28' long.
13357	0040.00	Gravel substrate noted. Electro-fishing sampling site.
13376	0041.00	Electro-fishing sampling site.
13394	0042.00	Electro-fishing sampling site.
13400	0043.00	Electro-fishing sampling site.
13430	0044.00	Electro-fishing sampling site.
13456	0045.00	Gravel substrate noted
13566	0049.00	Gravel substrate noted
13675	0052.00	The channel is a clay chute, 2' wide x 3' deep.
14067	0060.00	Plunge pool under root wad with plunge height of 1.3'.
14200	0062.00	Not surveyed, the stream runs under a live conifer tree.
14481	0068.00	Asphalt chunks in creek, silt screens on either bank at top of unit. Hay bales on right bank at top of unit, downstream of large fill site at Fern Street.
14607	0069.00	Used MapTech/Terrain Navigator to find distance. Sediment from the fill noted downstream of culvert. Asphalt chunks and gravel noted in habitat unit. Culvert #8, 3.5' diameter, 200' long, plunge height of 2.8' over rip-rap. Upstream end has corrugated plastic culverts; downstream end shows a concrete culvert. Culverts are under approximately 70' of fill.
14807	0070.00	Electro-fishing sampling site.
14875	0071.00	Culvert #9, made of corrugated metal, no baffles or weirs, 2' diameter x 20' long. Plunge height 0.9 feet. Rip-rap at bottom of plunge.
14895	0072.00	Electro-fishing sampling site.
15017	0073.00	Culvert #10, concrete culvert, good condition, no baffles or weirs 3.5 'diameter x 20' long.
15037	0074.00	Electro-fishing sampling site.
15085	0075.00	Small cobbles are asphalt chunks. Electro-fishing sampling site.
15110	0076.00	Area around stream is marshy, lots of skunk cabbage and bogs. Large diameter (2'-3') spruce and redwood forest, stream width is 2 feet – 3 feet, water depth is 0.2 feet - 0.3 feet. Bank height is less than 1 foot, low turbidity. Tributary #12 flows in from right bank. Water temp is 55˚ F. No fish observed up to 10 feet. Electro-fishing sampling site.
15354	0077.00	Electro-fishing sampling site.
15493	0078.00	Stream goes under large woody debris. There is a plunge underneath large woody debris 3 feet – 4 feet high.
15513	0079.00	Electro-fishing sampling site.
15554	0081.00	Not surveyed, stream goes under live spruce tree
15626	0083.00	Tributary #13 flows in from right bank. Water temp is 51˚ F. No fish observed.

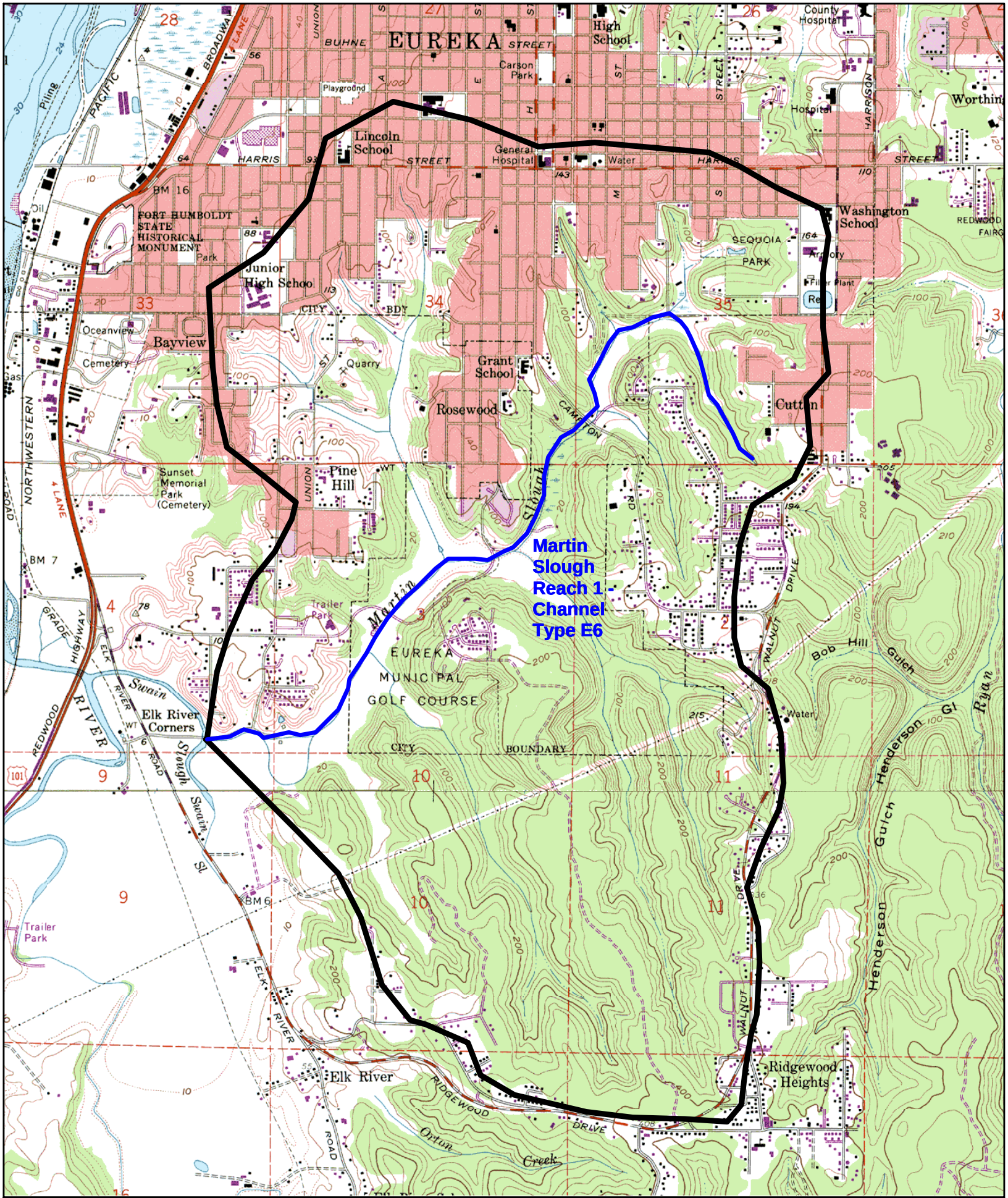
15795	0084.00	Not surveyed, blackberry bushes create wall
15880	0086.00	Stream flows over large wood at bottom of unit, plunge height 2.4 feet.
16051	0089.00	Stream goes under live redwood.
16061	0090.00	Tributary #14 flows in from left bank. Water temp is 52˚ F. No fish observed.
16173	0093.00	Two foot diameter drainage pipe on right bank sitting on rip-rap, silt screen for 40 feet at top of unit. Pipe drains subdivision.
16431	0094.00	End Survey, Section 4 and complete stream survey due to lack of landowner access.

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.

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]	



Name: EUREKA
Date: 12/12/2006
Scale: 1 inch equals 2105 feet

Location: 040° 45' 33.57" N 124° 09' 43.91" W
Caption: Martin Slough Watershed Boundary and Reach Information

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

Stream Name: Martin Slough LLID: 1241815407524 Drainage: Eureka Plain

Survey Dates: 8/8/2006 to 9/25/2006

Confluence Location: Quad: EUREKA Legal Description: T04NR01WS04 Latitude: 40:45:09.0N Longitude: 124:10:53.0

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
9	0	CULVERT	9.3	45	406	2.2									
44	9	FLATWATER	45.4	248	10932	59.5	7.1	0.8	1.2	1672	73578	2012	88523		39
9	0	NOSURVEY	9.3	393	3537	19.2									
6	0	NOSURVEY_	6.2	341	2047	11.1									
18	18	POOL	18.6	67	1200	6.5	14.4	0.8	1.6	1814	32654	5735	103231	1278	49
11	2	RIFFLE	11.3	24	263	1.4	3.5	0.4	0.6	54	591	25	272		5

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
97	29	18385	106823	192026

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Martin Slough LLID: 1241815407524 Drainage: Eureka Plain

Survey Dates: 8/8/2006 to 9/25/2006

Confluence Location: Quad: EUREKA Legal Description: T04NR01WS04 Latitude: 40:45:09.0N Longitude: 124:10:53.0W

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 (%)
10	2	LGR	10.3	24	239	1.3	4	0.4	0.7	54	538	25	248		5	77
1	0	HGR	1.0	24	24	0.1										
16	5	GLD	16.5	524	8379	45.6	9	1.2	2.7	2797	44755	3547	56749		39	57
13	3	RUN	13.4	73	945	5.1	5	0.3	0.7	216	2804	83	1073		50	84
15	1	SRN	15.5	107	1608	8.7	3	0.3	0.4	417	6255	125	1877		10	99
14	14	MCP	14.4	81	1128	6.1	17	0.9	4.1	2288	32028	7288	102039	1632	29	70
1	1	CCP	1.0	35	35	0.2	13	1.0	4.1	455	455	1092	1092	455		75
1	1	CRP	1.0	14	14	0.1	4	0.3	1	56	56	34	34	17	50	98
1	1	PLP	1.0	7	7	0.0	5	0.1	0.9	35	35	11	11	4	285	80
1	1	DPL	1.0	16	16	0.1	5	0.4	0.7	80	80	56	56	32	100	100
9	0	CUL	9.3	45	406	2.2										
9	0	NS	9.3	393	3537	19.2										100
6	0	MAR	6.2	341	2047	11.1										2

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
97	29	18385	87005	163178

Table 3 - Summary of Pool Types

Stream Name: Martin Slough LLID: 1241815407524 Drainage: Eureka Plain

Survey Dates: 8/8/2006 to 9/25/2006

Confluence Location: Quad: EUREKA Legal Description: T04NR01WS04 Latitude: 40:45:09.0N Longitude: 124:10:53.0W

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
15	15	MAIN	83	78	1163	97	16.3	0.9	2166	32483	1548	21675	29
2	2	SCOUR	11	11	21	2	4.5	0.2	46	91	10	20	168
1	1	BACKWATER	6	16	16	1	5.0	0.4	80	80	32	32	100

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
18	18	1200	32654	21728

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

Stream Name: Martin Slough LLID: 1241815407524 Drainage: Eureka Plain

Survey Dates: 8/8/2006 to 9/25/2006

Confluence Location: Quad: EUREKA Legal Description: T04NR01WS04 Latitude: 40:45:09.0N Longitude: 124:10:53.0W

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
14	MCP	78	4	29	7	50	1	7	0	0	2	14
1	CCP	6	0	0	0	0	0	0	0	0	1	100
1	CRP	6	0	0	1	100	0	0	0	0	0	0
1	PLP	6	1	100	0	0	0	0	0	0	0	0
1	DPL	6	1	100	0	0	0	0	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
18	6	33	8	44	1	6	0	0	3	17

Mean Maximum Residual Pool Depth (ft.): 1.6

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Martin Slough LLID: 1241815407524 Drainage: Eureka Plain

Survey Dates: 8/8/2006 to 9/25/2006 Dry Units: 0

Confluence Location: Quad: EUREKA Legal Description: T04NR01WS04 Latitude: 40:45:09.0N Longitude: 124:10:53.0W

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
10	2	LGR	0	25	0	0	75	0	0	0	0
1	0	HGR									
11	2	TOTAL RIFFLE	0	25	0	0	75	0	0	0	0
16	5	GLD	0	8	0	0	67	25	0	0	0
13	3	RUN	0	5	0	0	33	28	0	0	0
15	1	SRN	0	100	0	0	0	0	0	0	0
44	9	TOTAL FLAT	0	17	0	0	48	23	0	0	0
14	14	MCP	35	14	1	8	21	8	0	0	0
1	0	CCP									
1	1	CRP	75	0	0	25	0	0	0	0	0
1	1	PLP	20	0	0	60	0	0	20	0	0
1	1	DPL	75	0	25	0	0	0	0	0	0
18	17	TOTAL POOL	39	11	2	11	17	6	1	0	0
9	0	CUL									
9	0	NS									
6	0	MAR									
97	28	TOTAL	23	14	1	7	31	11	1	0	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Martin Slough LLID: 1241815407524 Drainage: Eureka Plain

Survey Dates: 8/8/2006 to 9/25/2006 Dry Units: 0

Confluence Location: Quad: EUREKA Legal Description: T04NR01WS04 Latitude: 40:45:09.0N Longitude: 124:10:53.0W

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
10	2	LGR	50	0	50	0	0	0	0
1	0	HGR	0	0	0	0	0	0	0
16	5	GLD	80	20	0	0	0	0	0
13	3	RUN	67	33	0	0	0	0	0
15	1	SRN	0	100	0	0	0	0	0
14	14	MCP	100	0	0	0	0	0	0
1	1	CCP	100	0	0	0	0	0	0
1	1	CRP	100	0	0	0	0	0	0
1	1	PLP	100	0	0	0	0	0	0
1	1	DPL	100	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Martin Slough LLID: 1241815407524 Drainage: Eureka Plain

Survey Dates: 8/8/2006 to 9/25/2006

Confluence Location: Quad: EUREKA Legal Description: T04NR01WS04 Latitude: 40:45:09.0N Longitude: 124:10:53.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
74	46	54	3	86	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: Martin Slough LLID: 1241815407524 Drainage: Eureka Plain

Survey Dates: 8/8/2006 to 9/25/2006 Survey Length (ft.): 18385 Main Channel (ft.): 16379 Side Channel (ft.): 2006

Confluence Location: Quad: EUREKA Legal Description: T04NR01WS04 Latitude: 40:45:09.0N Longitude: 124:10:53.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: E6
Reach Length (ft.): 16379
Riffle/Flatwater Mean Width (ft.): 6.5
BFW:
Range (ft.): 4 to 23
Mean (ft.): 9
Std. Dev.: 6
Base Flow (cfs.): 0.0
Water (F): 52 - 64 Air (F): 57 - 75
Dry Channel (ft): 0

Canopy Density (%): 74.4
Coniferous Component (%): 45.8
Hardwood Component (%): 54.2
Dominant Bank Vegetation: Grass
Vegetative Cover (%): 89.2
Dominant Shelter: Terrestrial Veg.
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 1
LWD per 100 ft.:
Riffles: 4
Pools: 0
Flat: 0

Pools by Stream Length (%): 6.5
Pool Frequency (%): 18.6
Residual Pool Depth (%):
< 2 Feet Deep: 78
2 to 2.9 Feet Deep: 6
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 17
Mean Max Residual Pool Depth (ft.): 1.6
Mean Pool Shelter Rating: 49

Pool Tail Substrate (%): Silt/Clay: 72 Sand: 0 Gravel: 28 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 11.1 2. 11.1 3. 0.0 4. 0.0 5. 77.8

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Martin Slough LLID: 1241815407524 Drainage: Eureka Plain

Survey Dates: 8/8/2006 to 9/25/2006

Confluence Location: Quad: EUREKA Legal Description: T04NR01WS04 Latitude: 40:45:09.0N Longitude: 124:10:53.0W

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	1	0	1.7
Sand / Silt / Clay	28	29	98.3

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	8	11	32.8
Brush	8	2	17.2
Hardwood Trees	8	5	22.4
Coniferous Trees	5	11	27.6
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 4

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

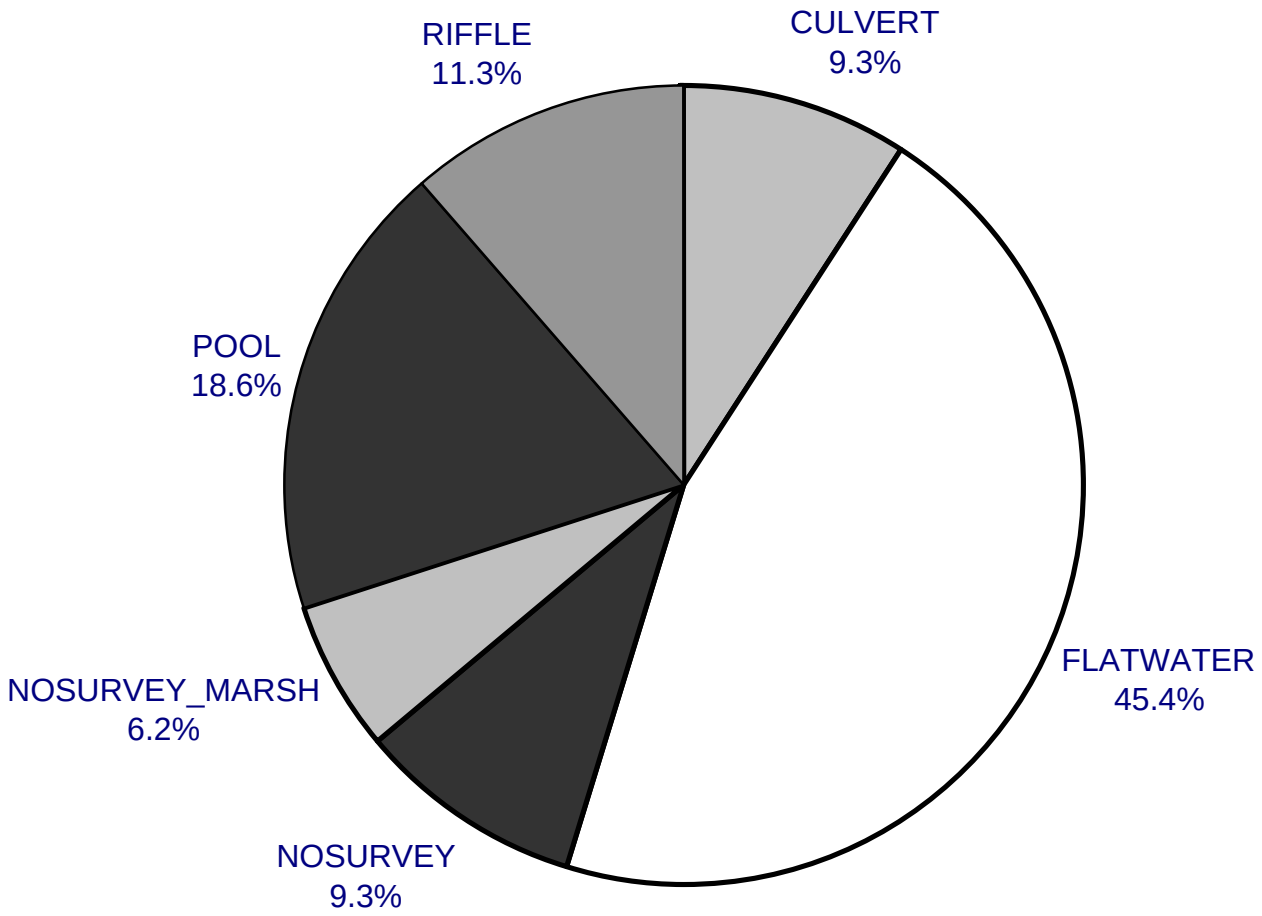
StreamName: Martin Slough LLID: 1241815407524 Drainage: Eureka Plain

Survey Dates: 8/8/2006 to 9/25/2006

Confluence Location: Quad: EUREKA Legal Description: T04NR01WS04 Latitude: 40:45:09.0N Longitude: 124:10:53.0W

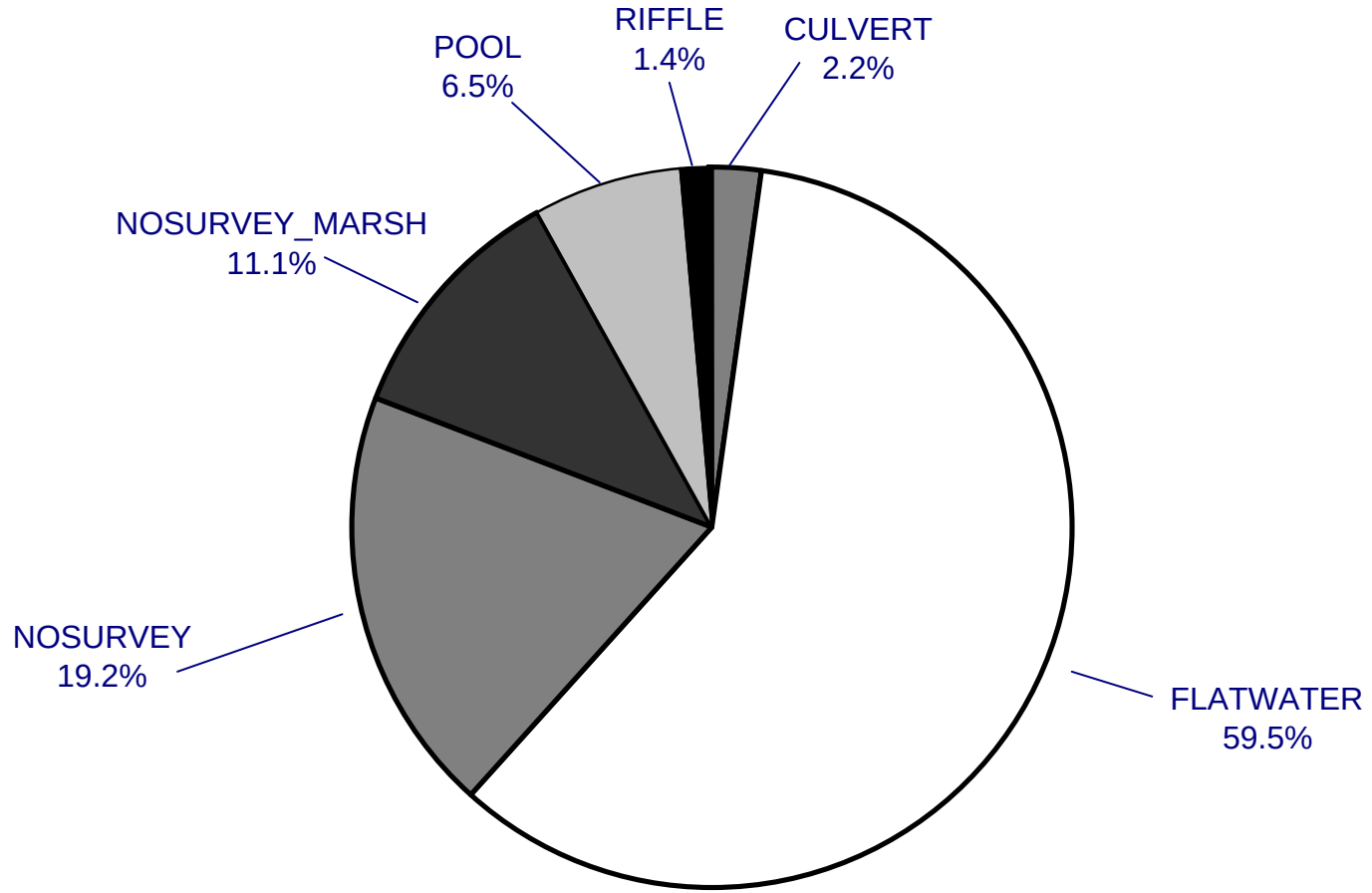
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	39
SMALL WOODY DEBRIS (%)	25	17	11
LARGE WOODY DEBRIS (%)	0	0	2
ROOT MASS (%)	0	0	11
TERRESTRIAL VEGETATION (%)	75	48	17
AQUATIC VEGETATION (%)	0	23	6
WHITEWATER (%)	0	0	1
BOULDERS (%)	0	0	0
BEDROCK LEDGES (%)	0	0	0

MARTIN SLOUGH 2006
HABITAT TYPES BY PERCENT OCCURRENCE



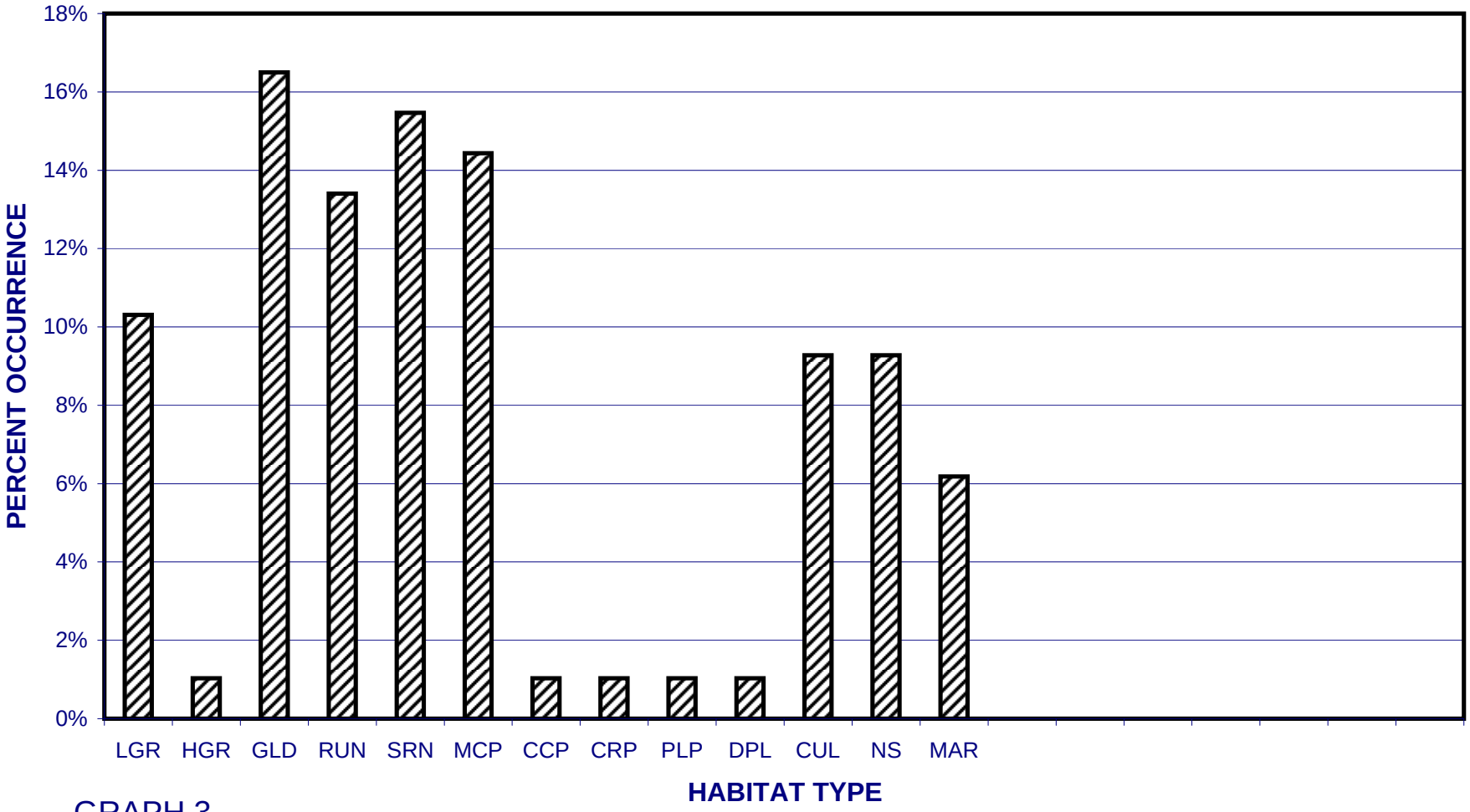
GRAPH 1

MARTIN SLOUGH 2006
HABITAT TYPES BY PERCENT TOTAL LENGTH



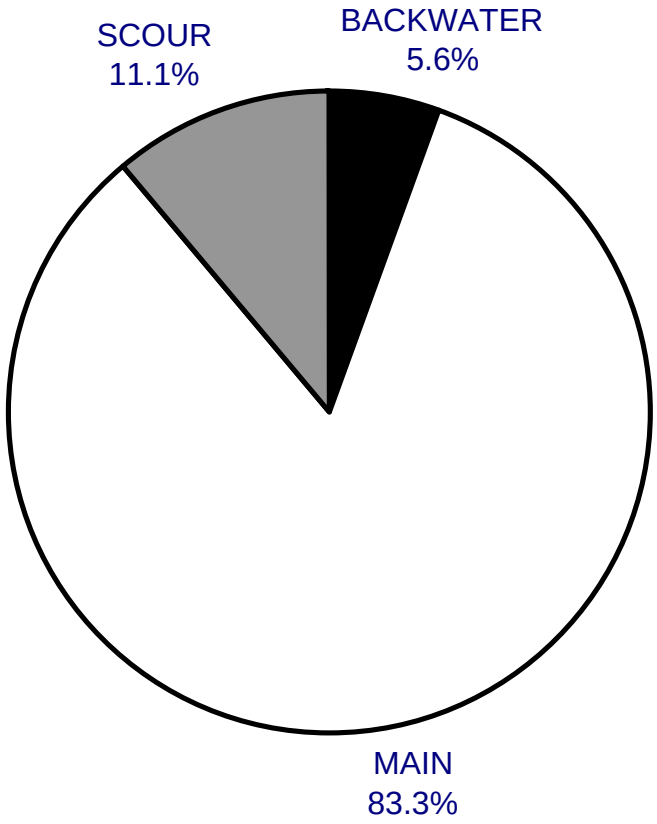
GRAPH 2

MARTIN SLOUGH 2006
HABITAT TYPES BY PERCENT OCCURRENCE



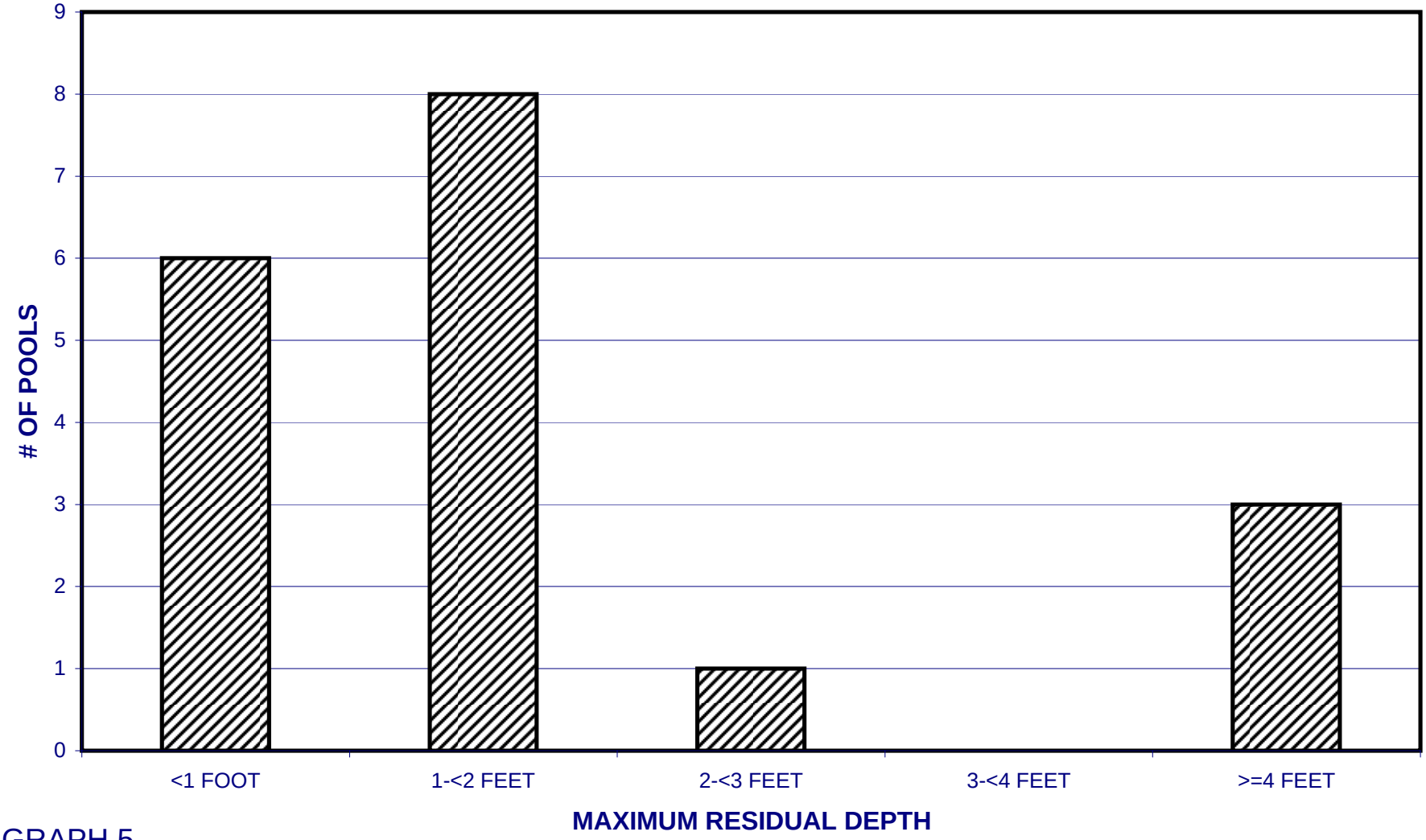
GRAPH 3

MARTIN SLOUGH 2006
POOL TYPES BY PERCENT OCCURRENCE



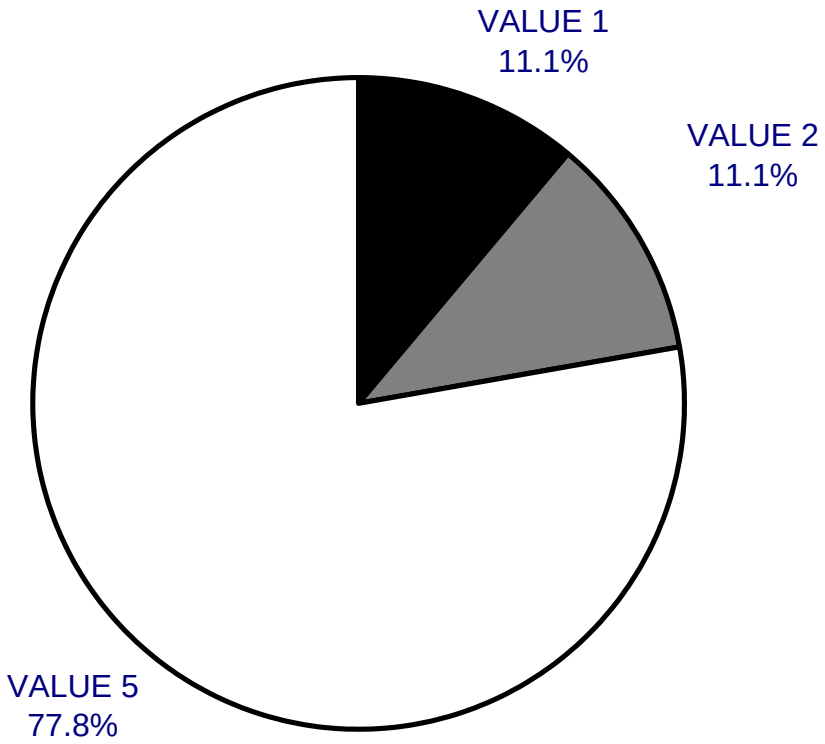
GRAPH 4

MARTIN SLOUGH 2006
MAXIMUM DEPTH IN POOLS



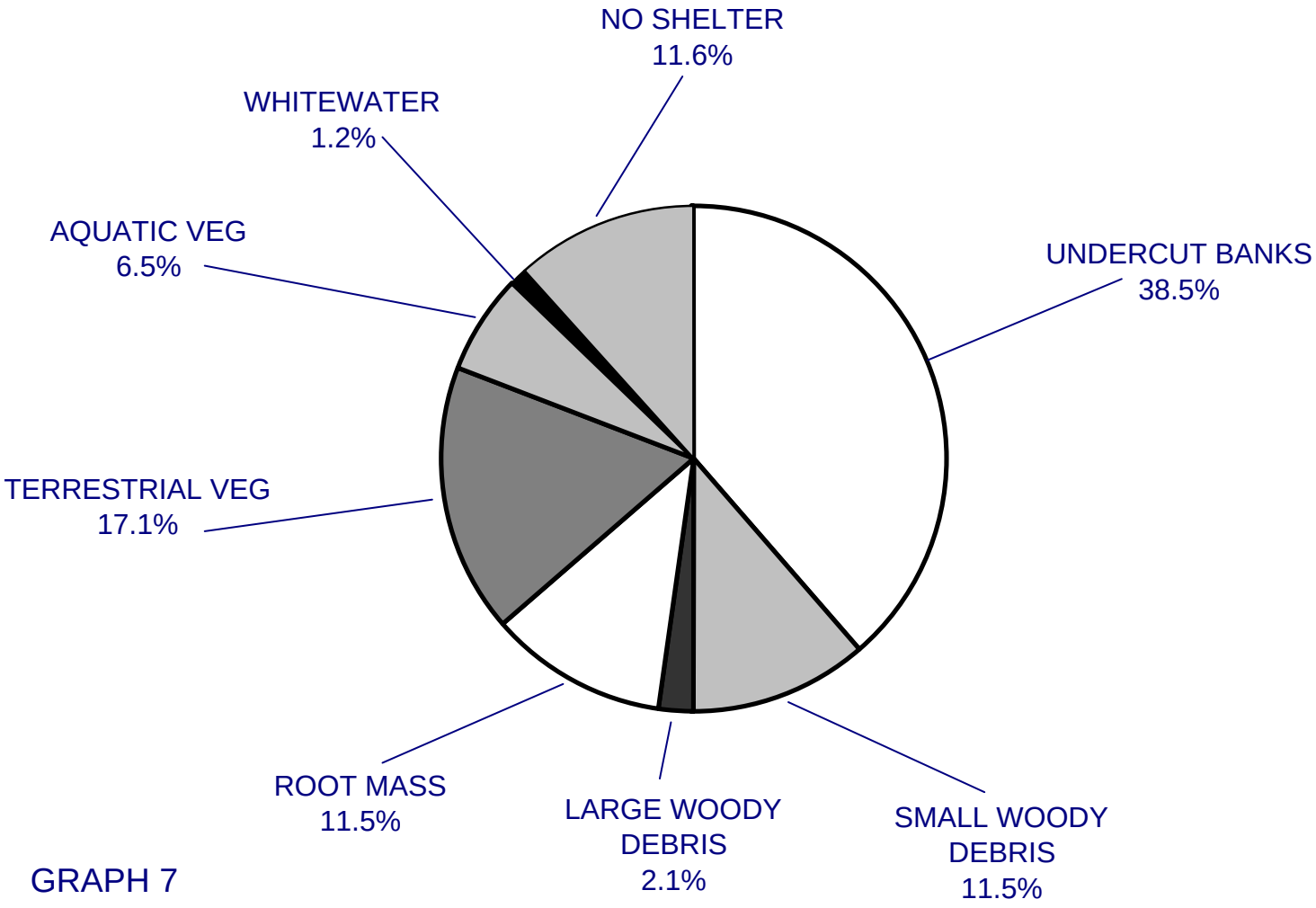
GRAPH 5

MARTIN SLOUGH 2006
PERCENT EMBEDDEDNESS



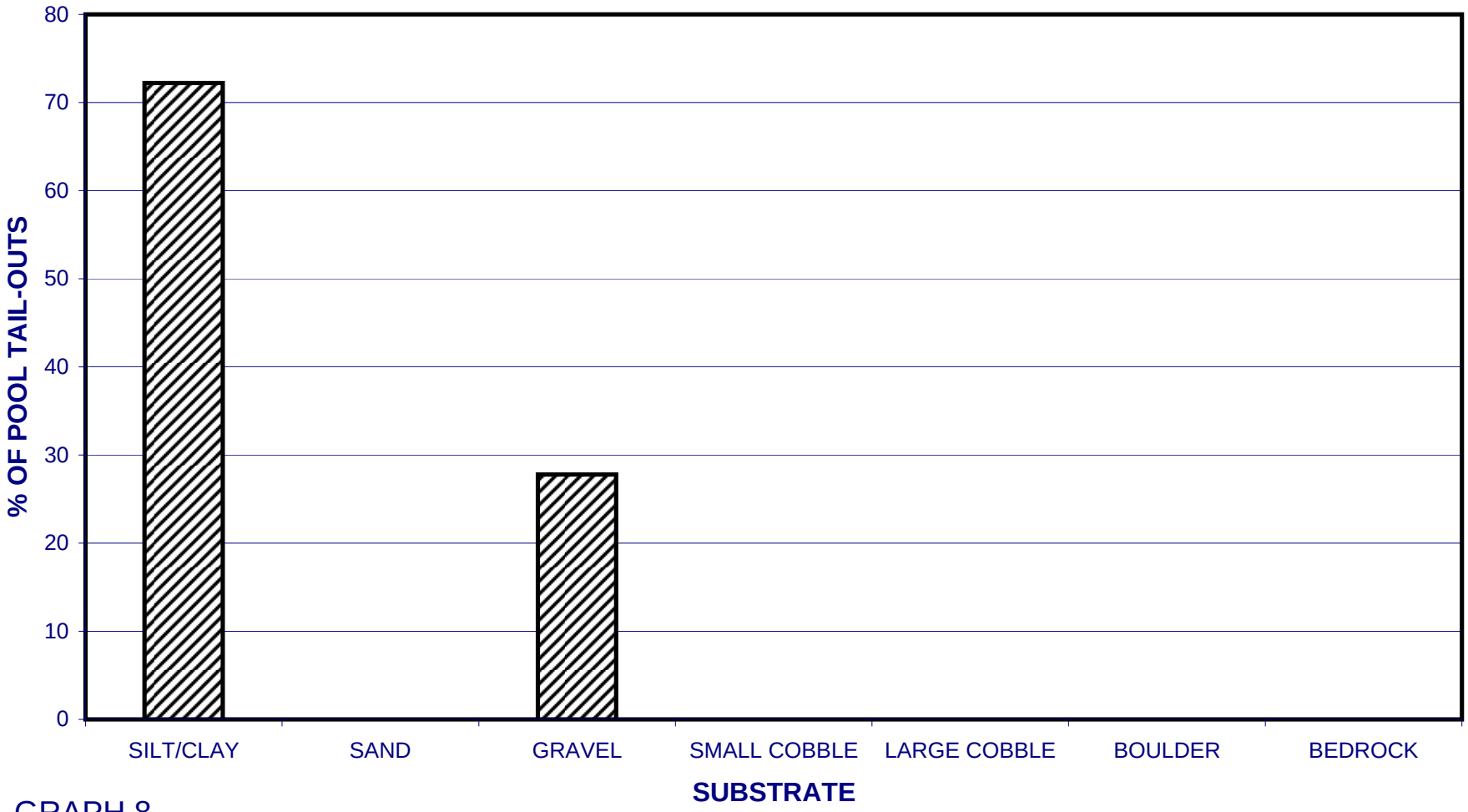
GRAPH 6

MARTIN SLOUGH 2006
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

MARTIN SLOUGH 2006
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS

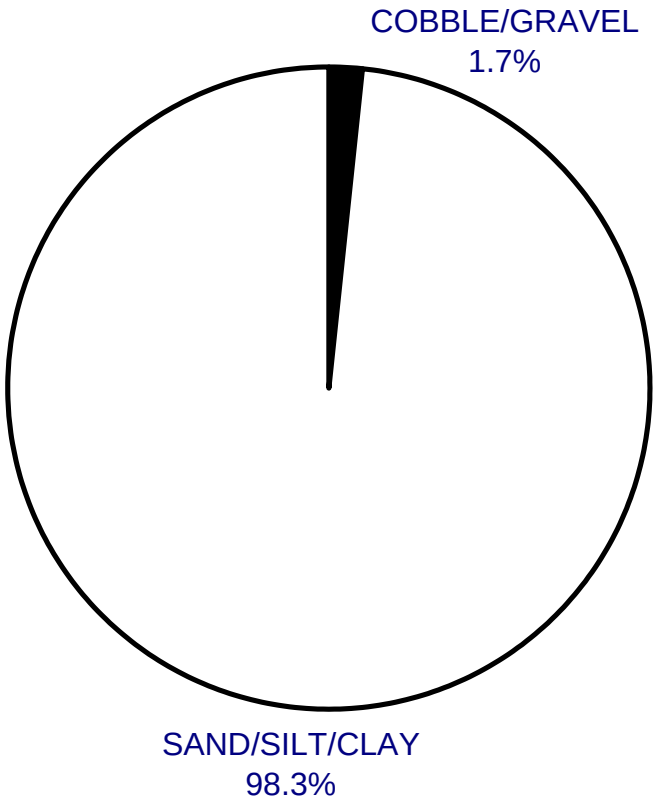


GRAPH 8

MARTIN SLOUGH 2006
MEAN PERCENT CANOPY

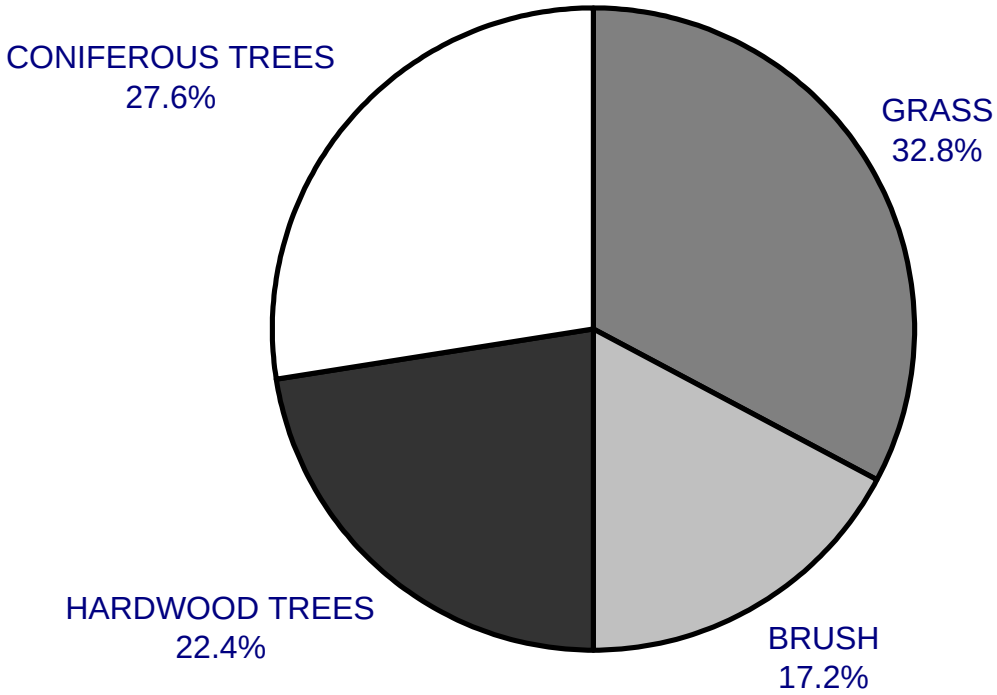
GRAPH 9

MARTIN SLOUGH 2006
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

MARTIN SLOUGH 2006
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11