STREAM INVENTORY REPORT

Powers Creek

INTRODUCTION

A stream inventory was conducted from July 18 to July 19, 2011 on Powers Creek. The survey began at the confluence with the Mad River and extended upstream 1.2 miles.

The Powers 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 Powers 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

Powers Creek is a tributary to the Mad River, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Powers Creek's legal description at the confluence with the Mad River is T06N R02E S30. Its location is 40.8827 degrees north latitude and 124.0031 degrees west longitude, LLID number 1240019408828. Powers Creek is a first order stream and has approximately 3.2 miles of blue line stream according to the USGS Arcata North 7.5 minute quadrangle. Powers Creek drains a watershed of approximately 3.5 square miles. Elevations range from about 75 feet at the mouth of the creek to 1,400 feet in the headwater areas. Mixed hardwood forest and redwood forest dominate the watershed. The watershed is entirely privately owned and is managed for urban development and timber production. Vehicle access exists via various Blue Lake road crossings.

METHODS

The habitat inventory conducted in Powers Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Game (DFG) personnel and Watershed Stewards Project/AmeriCorps (WSP) members that conducted the inventory were trained in standardized habitat inventory methods by the 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 Powers 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". Powers 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 Powers 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 not suitable 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. In Powers 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. Next, 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. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent 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 Powers 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 Powers 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 Powers Creek. In addition, two sites were 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
- 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 Powers Creek include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools

- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

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

The habitat inventory of July 18 to July 19, 2011 was conducted by A. Blessing, D. Opalacz, and T. Anderson (WSP). The total length of the stream surveyed was 6,093 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.14 cfs on July 21, 2011.

Powers Creek is a F3 channel type for the entire length of the survey, 6,093 feet. F3 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 59 to 65 degrees Fahrenheit. Air temperatures ranged from 62 to 70 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 30% riffle units, 22% pool units, 22% flatwater units, 14% dry units, and 14% culvert units (Graph 1). Based on total length of Level II habitat types there were 68% dry units, 11% flatwater units, 10% riffle units, 6% culvert units, and 5% pool units (Graph 2).

Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle units, 30%; and mid-channel pool units, 16%. Dry units, culvert units, and step run units all occurred with a frequency of 14% (Graph 3). Based on percent total length, dry units made up 68%, low gradient riffle units 10%, and step run units 10%.

A total of eight pools were identified (Table 3). Main channel pools were the most frequently encountered at 75% (Graph 4), and comprised 85% 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. Two of the 8 pools (25%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the eight pool tail-outs measured, one had a value of 1 (12.5%); seven had a value of 2 (87.5%); (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

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 12, and pool habitats had a mean

shelter rating of 19 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 20. Main channel pools had a mean shelter rating of 18 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Powers Creek. Graph 7 describes the pool cover in Powers Creek. Boulders are the dominant pool cover type followed by small 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 75% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 25% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Powers Creek was 72%. Twenty-eight percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 100% and 0%, respectively. Graph 9 describes the mean percent canopy in Powers Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 100%. The mean percent left bank vegetated was 100%. The dominant elements composing the structure of the stream banks consisted of 69% cobble/gravel, 15% boulder, 12% bedrock, and 4% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 46% of the units surveyed. Additionally, 42% of the units surveyed had deciduous trees as the dominant vegetation type, and 12% had grass as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted an electrofishing survey at two sites for species composition and distribution in Powers Creek on August 1, 2011. Water temperatures taken during the survey period of 0930 hours to 1015 hours ranged from 56 to 59 degrees Fahrenheit. Air temperatures ranged from 57 to 62 degrees Fahrenheit. The sites were sampled by E. Helgoth (DFG), I. Mikus (DFG), and A. Blessing (WSP).

In reach 1, which comprised the first 6,093 feet of stream, two sites were sampled. The reach sites yielded 15 steelhead and three coho salmon.

The following chart displays the information yielded from these sites:

2011 Powers Creek electrofishing observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
F3 Channel Type									
08/01/11	1	016	Pool	4,849	9	0	0	2	0
	2	035	Pool	5,875	6	0	0	1	0

Powers Creek

DISCUSSION

Powers Creek is an F3 channel type for the entire length of the survey, 6,093 feet. The suitability of F3 channels types for fish habitat improvement structures is as follows: F3 channels are good for bank-placed boulders, single and opposing wing-deflectors and fair for plunge weirs, boulder clusters, channel constrictors and log cover.

The water temperatures recorded on the survey days July 18 to July 19, 2011 ranged from 59 to 65 degrees Fahrenheit. Air temperatures ranged from 62 to 70 degrees Fahrenheit. This is a suitable water temperature range for steelhead. However, 60 degrees Fahrenheit, if sustained, is near the threshold stress level for coho salmon. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 11% of the total length of this survey, riffles 10%, and pools 5%. Two of the 8 (25%) pools 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 channel width. Installing structures that will increase or deepen pool habitat is recommended.

All 8 pool tail-outs measured had embeddedness ratings of 1 or 2. 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 Powers Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

All 8 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 is 19. The shelter rating in the flatwater habitats is 12. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Powers Creek. Boulders are the dominant cover type in pools followed by small woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 72%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 100% and 100%, 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.

Powers Creek

RECOMMENDATIONS

1) Powers 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 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 boulders. Adding high quality complexity with woody cover in the pools is desirable.

5) Increase the canopy on Powers Creek by planting appropriate native vegetation like willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is affected from upstream.

6) Due to the bridge crossing at 504 feet, access for migrating salmonids is an ongoing problem. Fish passage should be monitored and improved as soon as possible.

Powers Creek

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 #:	Comment:
0	0001.00	Start of survey at the confluence with the Mad River. The first 486 feet of the creek are dry. The channel is an F3 for the entire length of the survey.
504	0003.00	A road crosses the creek. The crossing is a 10' wide x 40' long x 7' high steel bridge. The creek bed below the bridge is concrete and there is a 7' high plunge below it, creating a possible barrier to salmonids.
3894	0004.00	South Railroad Avenue crosses the channel. The crossing is a 6.5' high x 12' wide x 65' long corrugated metal culvert with a natural bottom. The culvert is not a barrier to salmonids.
3959	0005.00	A road crosses the creek. The crossing is a 7' high x 12' wide x 70' long concrete and wood culvert with a natural bottom. The culvert is not a barrier to salmonids.
4091	0007.00	Railroad Avenue crosses the channel. The crossing is a 7.5' high x 14.5' wide x 43' long concrete culvert with a natural bottom. The culvert is not a barrier to salmonids.
4332	0009.00	First Avenue crosses the channel. The crossing is a 9' high x 13.5' wide x 64' long concrete culvert with a natural bottom. The culvert is not a barrier to salmonids.
4468	0013.00	A 7' wide x 74' long x 14' high wooden footbridge spans the channel. The bridge is not a barrier to salmonids.
4699	0015.00	A 5' wide x 17' long x 7' high wooden footbridge spans the channel. The bridge is not a barrier to salmonids.
5953	0037.00	End of survey due to lack of access. Blue Lake Boulevard crosses the channel. The crossing is a 7' high x 12' wide x 140' long concrete culvert with a fish ladder. The culvert has a 0.5' high plunge and the outlet; the maximum depth within 5' of the outlet is 0.6'. The slope of the culvert is approximately 6%.

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.

Powers Creek

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: Powers Creek LLID: 1240019408828 Drainage: Blue Lake

Survey Dates: 7/18/2011 to 7/19/2011

Confluence Location: Quad: ARCATA NORTH Legal Description: T06NR02ES30 Latitude: 40:52:58.0N Longitude: 124:00:07.0

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
5	0	CULVERT	13.5	76	382	6.3									
5	0	DRY	13.5	831	4156	68.2									
8	3	FLATWATER	21.6	82	659	10.8	7.8	0.3	0.6	475	3797	184	1469		12
8	8	POOL	21.6	39	315	5.2	11.2	1.1	1.9	415	3316	563	4501	485	19
11	1	RIFFLE	29.7	53	581	9.5	3.5	0.1	0.3	71	776	7	78		5

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
37	12	6093	7890	6047

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Powers Creek LLID: 1240019408828 Drainage: Blue Lake

Survey Dates: 7/18/2011 to 7/19/2011

Confluence Location: Quad: ARCATA NORTH Legal Description: T06NR02ES30 Latitude: 40:52:58.0N Longitude: 124:00:07.0W

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 (%)
11	1	LGR	29.7	53	581	9.5	4	0.1	0.3	71	776	7	78		5	0
3	2	RUN	8.1	17	52	0.9	8	0.3	0.6	152	455	51	154		8	50
5	1	SRN	13.5	121	607	10.0	8	0.4	0.9	1121	5603	448	2241		20	28
6	6	MCP	16.2	45	269	4.4	10	0.6	1.4	436	2614	368	2208	281	18	98
2	2	PLP	5.4	23	46	0.8	14	2.6	5.1	351	702	1147	2293	1096	20	88
5	0	DRY	13.5	831	4156	68.2										40
5	0	CUL	13.5	76	382	6.3										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
37	12	6093	10150	6973

Table 3 - Summary of Pool Types

Stream Name: Powers Creek LLID: 1240019408828 Drainage: Blue Lake

Survey Dates: 7/18/2011 to 7/19/2011

Confluence Location: Quad: ARCATA NORTH Legal Description: T06NR02ES30 Latitude: 40:52:58.0N Longitude: 124:00:07.0W

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
6	6	MAIN	75	45	269	85	10.1	0.6	436	2614	281	1689	18
2	2	SCOUR	25	23	46	15	14.5	2.6	351	702	1096	2192	20

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
8	8	315	3316	3881

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

Stream Name: Powers Creek LLID: 1240019408828 Drainage: Blue Lake

Survey Dates: 7/18/2011 to 7/19/2011

Confluence Location: Quad: ARCATA NORTH Legal Description: T06NR02ES30 Latitude: 40:52:58.0N Longitude: 124:00:07.0W

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
6	MCP	75	0	0	6	100	0	0	0	0	0	0
2	PLP	25	0	0	0	0	1	50	0	0	1	50

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
8	0	0	6	75	1	12	0	0	1	12

Mean Maximum Residual Pool Depth (ft.): 1.9

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Powers Creek LLID: 1240019408828 Drainage: Blue Lake

Survey Dates: 7/18/2011 to 7/19/2011 Dry Units: 5

Confluence Location: Quad: ARCATA NORTH Legal Description: T06NR02ES30 Latitude: 40:52:58.0N Longitude: 124:00:07.0W

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
11	1	LGR	0	0	0	0	100	0	0	0	0
11	1	TOTAL RIFFLE	0	0	0	0	100	0	0	0	0
3	2	RUN	0	0	0	0	50	0	0	50	0
5	1	SRN	0	0	0	0	75	0	0	25	0
8	3	TOTAL FLAT	0	0	0	0	58	0	0	42	0
6	6	MCP	17	20	0	3	15	0	0	45	0
2	2	PLP	0	0	0	0	0	0	0	100	0
8	8	TOTAL POOL	13	15	0	3	11	0	0	59	0
5	0	CUL									
37	12	TOTAL	8	10	0	2	30	0	0	50	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Powers Creek LLID: 1240019408828 Drainage: Blue Lake

Survey Dates: 7/18/2011 to 7/19/2011 Dry Units: 5

Confluence Location: Quad: ARCATA NORTH Legal Description: T06NR02ES30 Latitude: 40:52:58.0N Longitude: 124:00:07.0W

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
11	1	LGR	0	0	100	0	0	0	0
3	2	RUN	0	0	100	0	0	0	0
5	1	SRN	0	0	100	0	0	0	0
6	6	MCP	0	0	100	0	0	0	0
2	2	PLP	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Powers Creek LLID: 1240019408828 Drainage: Blue Lake

Survey Dates: 7/18/2011 to 7/19/2011

Confluence Location: Quad: ARCATA NORTH Legal Description: T06NR02ES30 Latitude: 40:52:58.0N Longitude: 124:00:07.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
72	0	100	15	100	100

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: Powers Creek LLID: 1240019408828 Drainage: Blue Lake

Survey Dates: 7/18/2011 to 7/19/2011 Survey Length (ft.): 6093 Main Channel (ft.): 6093 Side Channel (ft.): 0

Confluence Location: Quad: ARCATA NORTH Legal Description: T06NR02ES30 Latitude: 40:52:58.0N Longitude: 124:00:07.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F3
Reach Length (ft.): 6093
Riffle/Flatwater Mean Width (ft.): 6.8
BFW:
Range (ft.): 10 to 16
Mean (ft.): 14
Std. Dev.: 2
Base Flow (cfs.): 0.1
Water (F): 59 - 65 Air (F): 62 - 70
Dry Channel (ft): 4156

Canopy Density (%): 71.6
Coniferous Component (%): 0.0
Hardwood Component (%): 100.0
Dominant Bank Vegetation: Brush
Vegetative Cover (%): 100.0
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 0
LWD per 100 ft.:
Riffles: 0
Pools: 0
Flat: 0

Pools by Stream Length (%): 5.2
Pool Frequency (%): 21.6
Residual Pool Depth (%):
< 2 Feet Deep: 75
2 to 2.9 Feet Deep: 13
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 13
Mean Max Residual Pool Depth (ft.): 1.9
Mean Pool Shelter Rating: 19

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 75 Sm Cobble: 25 Lg Cobble: 0 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 12.5 2. 87.5 3. 0.0 4. 0.0 5. 0.0

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Powers Creek LLID: 1240019408828 Drainage: Blue Lake

Survey Dates: 7/18/2011 to 7/19/2011

Confluence Location: Quad: ARCATA NORTH Legal Description: T06NR02ES30 Latitude: 40:52:58.0N Longitude: 124:00:07.0W

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	2	1	11.5
Boulder	2	2	15.4
Cobble / Gravel	9	9	69.2
Sand / Silt / Clay	0	1	3.8

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	3	0	11.5
Brush	7	5	46.2
Hardwood Trees	3	8	42.3
Coniferous Trees	0	0	0.0
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

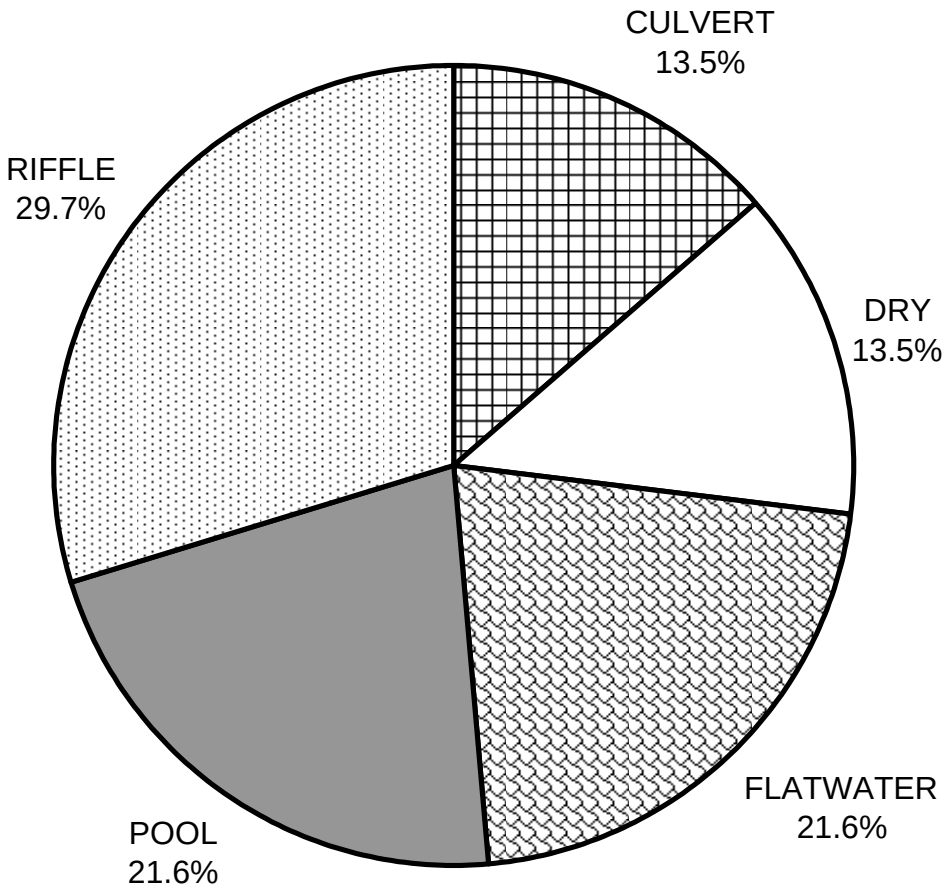
StreamName: Powers Creek LLID: 1240019408828 Drainage: Blue Lake

Survey Dates: 7/18/2011 to 7/19/2011

Confluence Location: Quad: ARCATA NORTH Legal Description: T06NR02ES30 Latitude: 40:52:58.0N Longitude: 124:00:07.0W

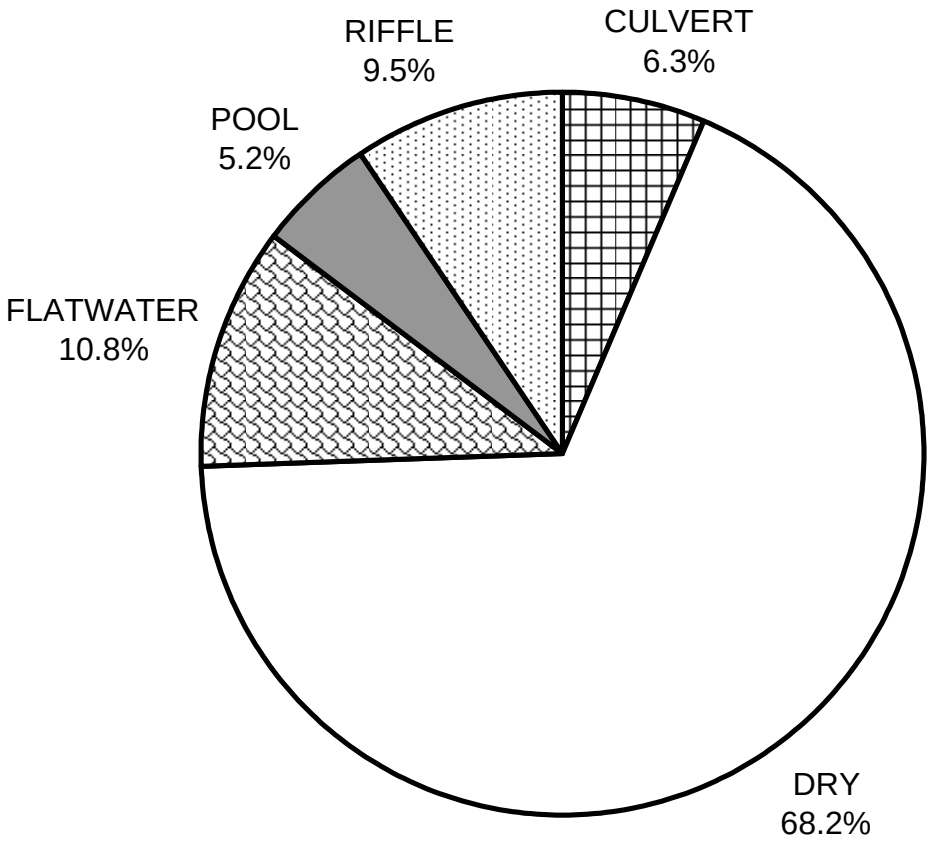
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	13
SMALL WOODY DEBRIS (%)	0	0	15
LARGE WOODY DEBRIS (%)	0	0	0
ROOT MASS (%)	0	0	3
TERRESTRIAL VEGETATION (%)	100	58	11
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	42	59
BEDROCK LEDGES (%)	0	0	0

POWERS CREEK 2011
HABITAT TYPES BY PERCENT OCCURRENCE



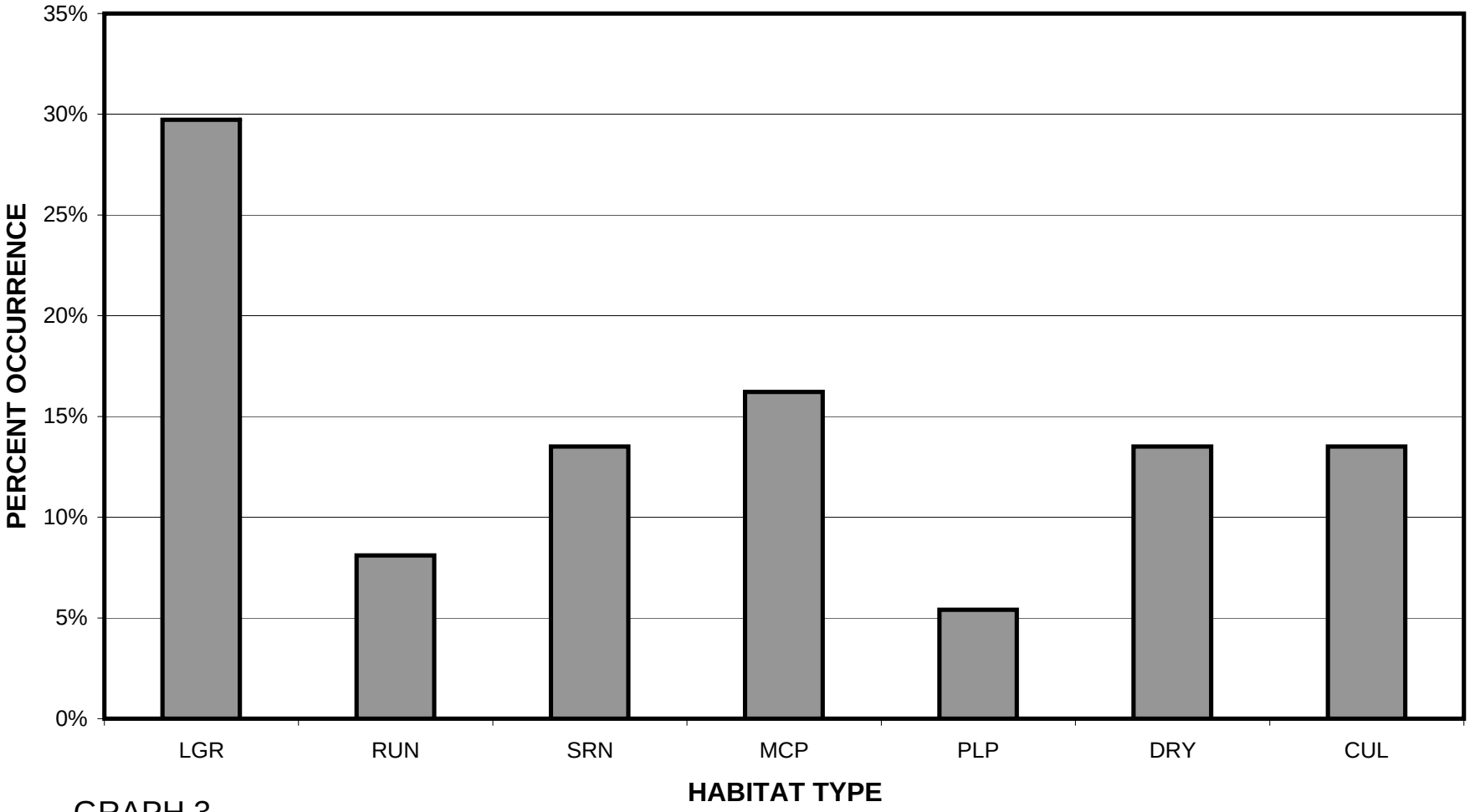
GRAPH 1

POWERS CREEK 2011
HABITAT TYPES BY PERCENT TOTAL LENGTH



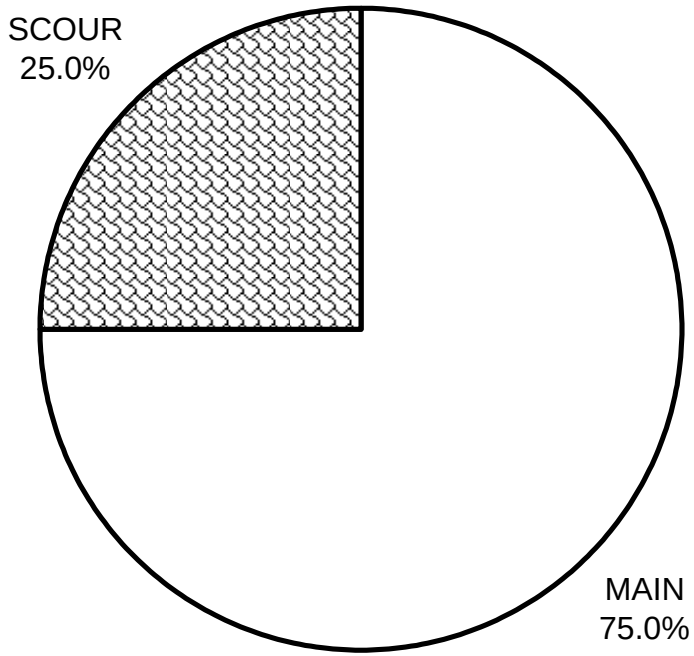
GRAPH 2

POWERS CREEK 2011
HABITAT TYPES BY PERCENT OCCURRENCE



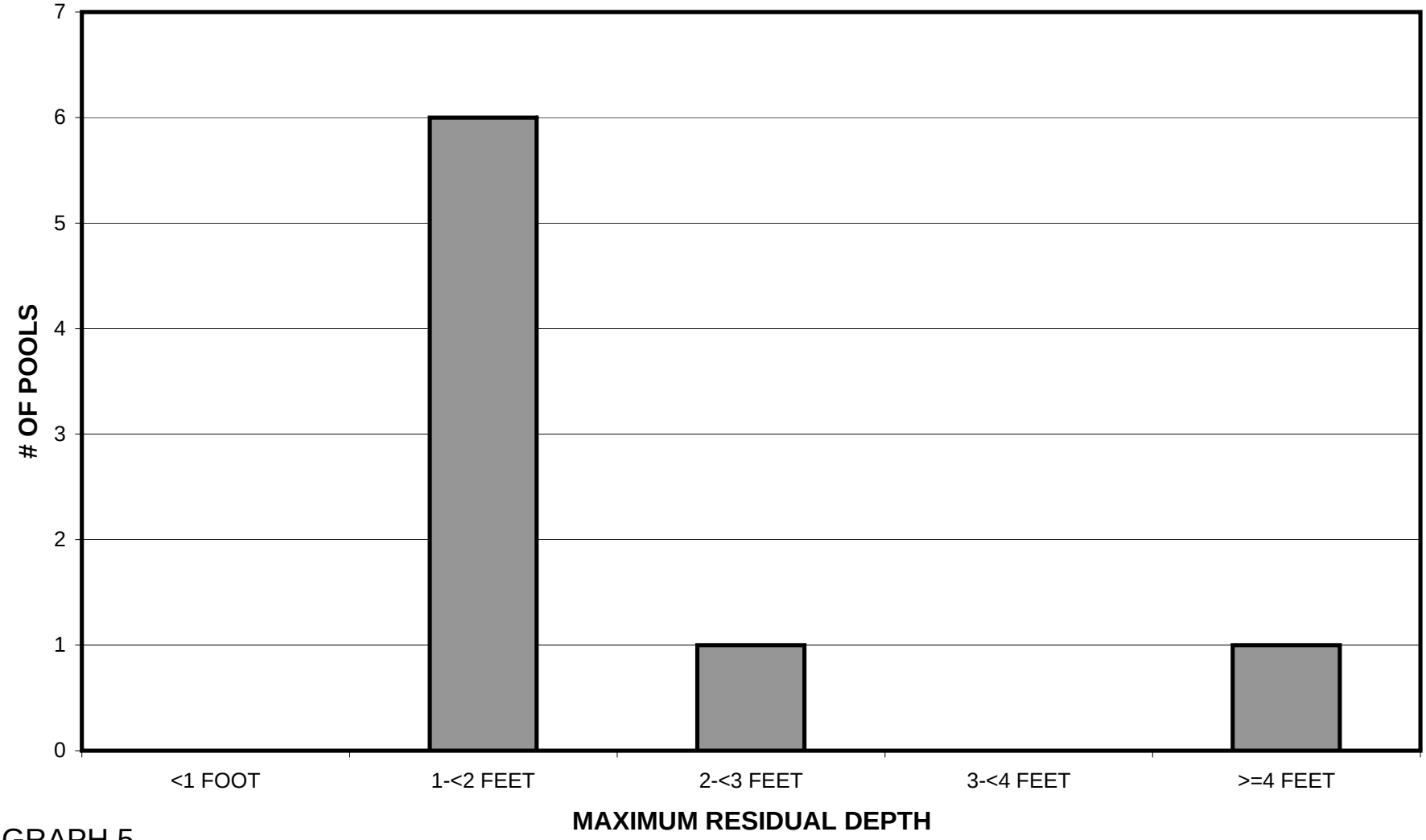
GRAPH 3

POWERS CREEK 2011
POOL TYPES BY PERCENT OCCURRENCE



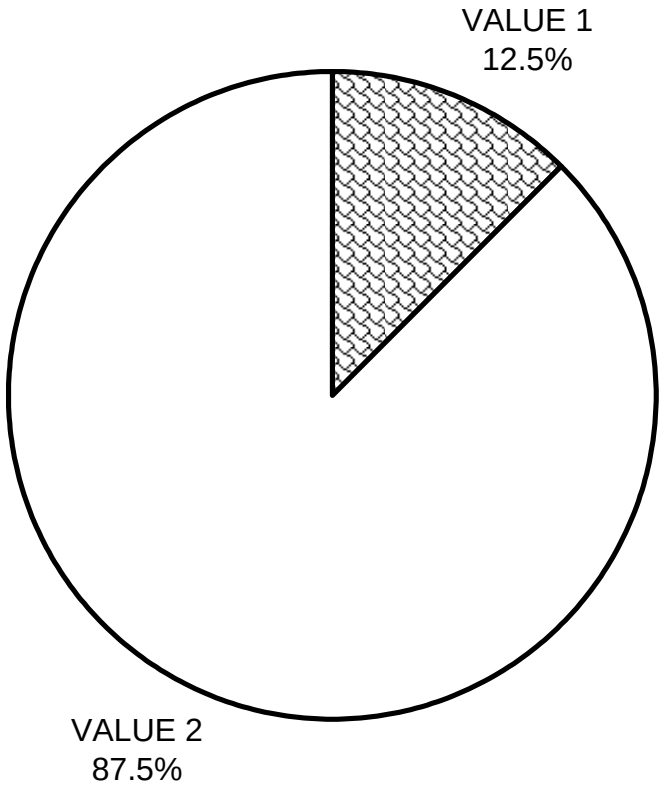
GRAPH 4

POWERS CREEK 2011
MAXIMUM DEPTH IN POOLS



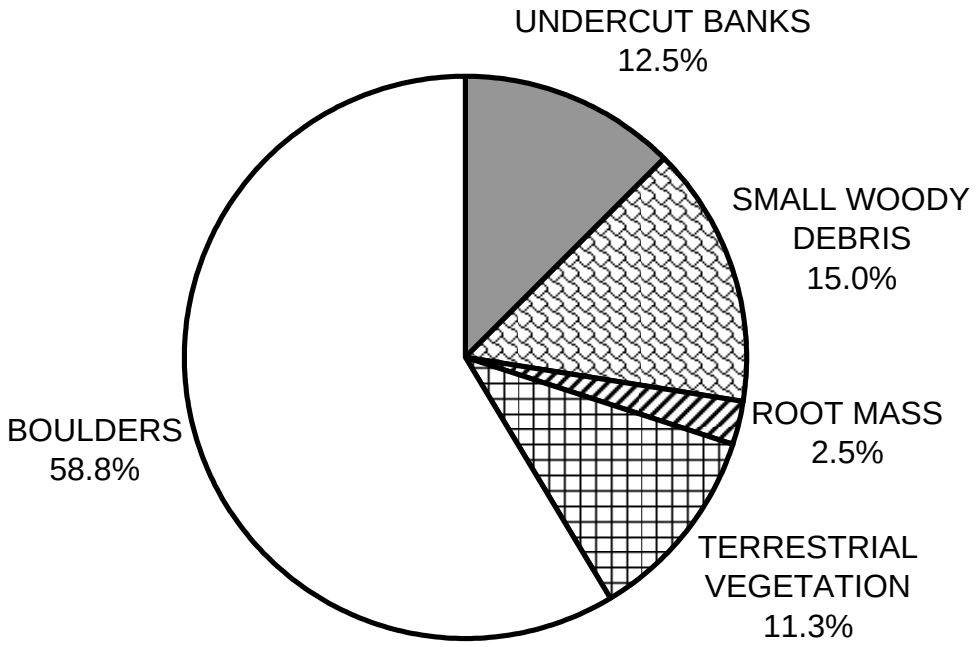
GRAPH 5

POWERS CREEK 2011
PERCENT EMBEDDEDNESS



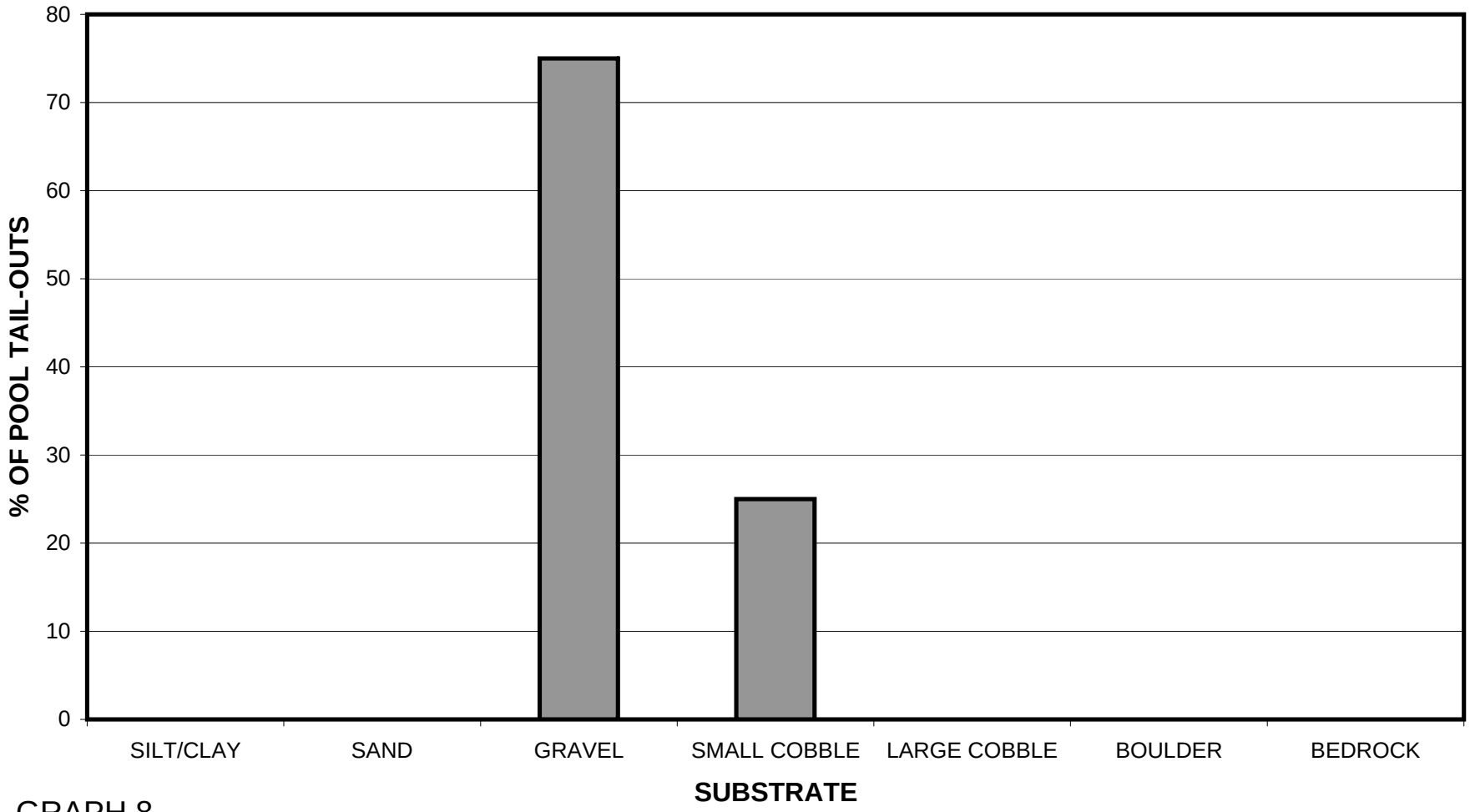
GRAPH 6

POWERS CREEK 2011
MEAN PERCENT COVER TYPES IN POOLS



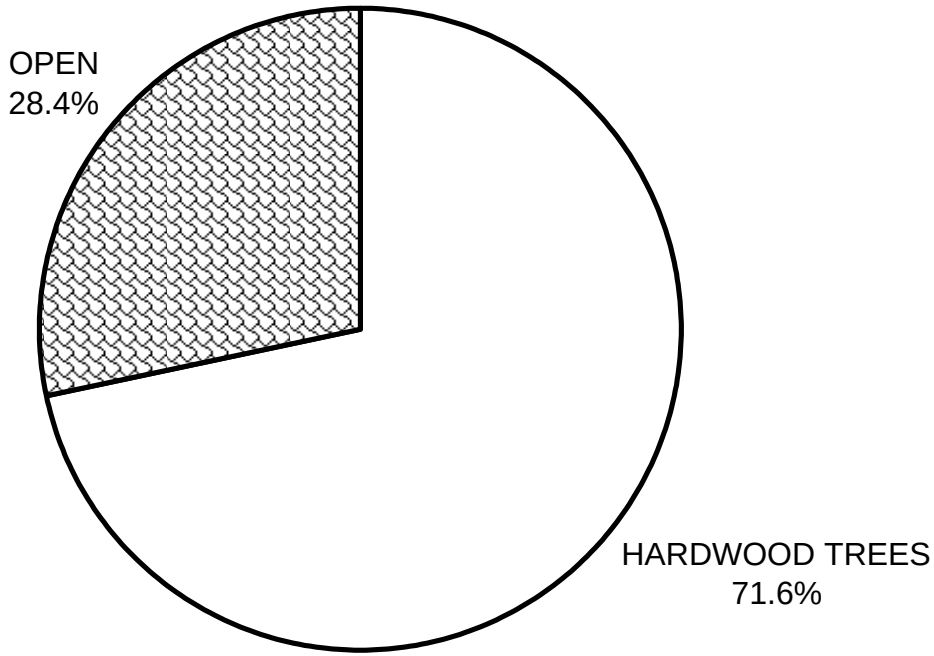
GRAPH 7

POWERS CREEK 2011
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



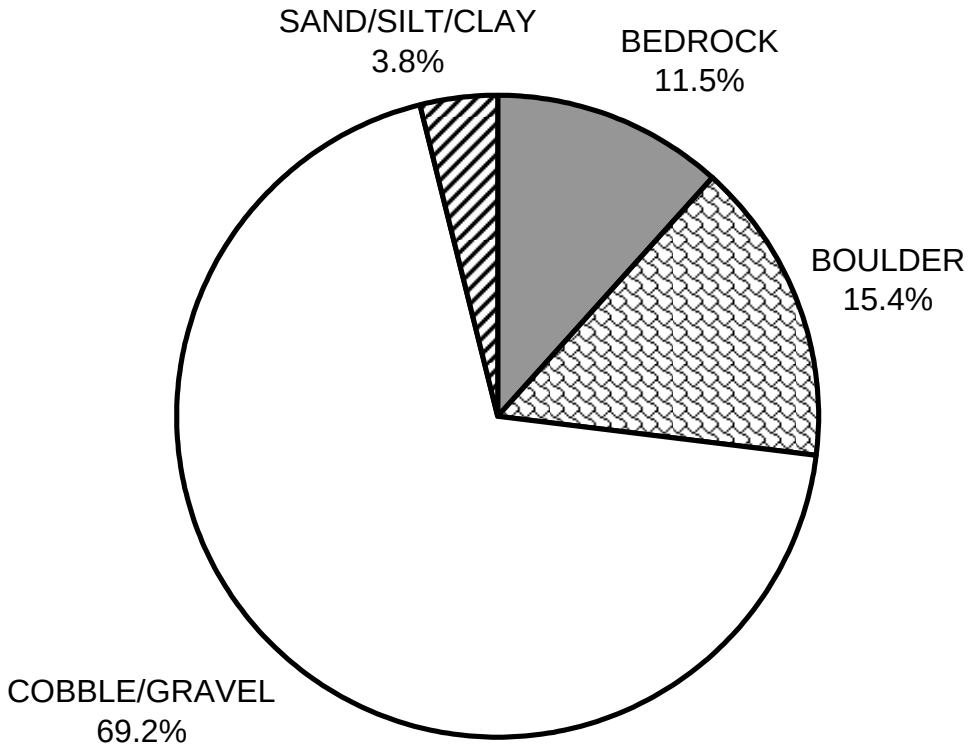
GRAPH 8

POWERS CREEK 2011
MEAN PERCENT CANOPY



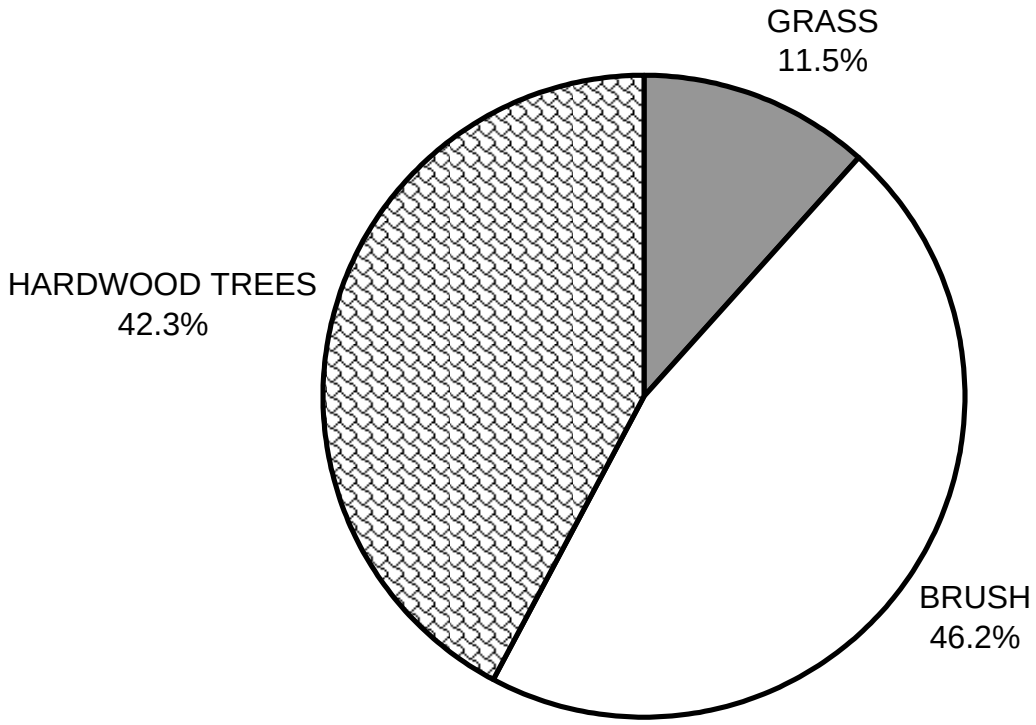
GRAPH 9

POWERS CREEK 2011
DOMINANT BANK COMPOSITION IN SURVEY REACH

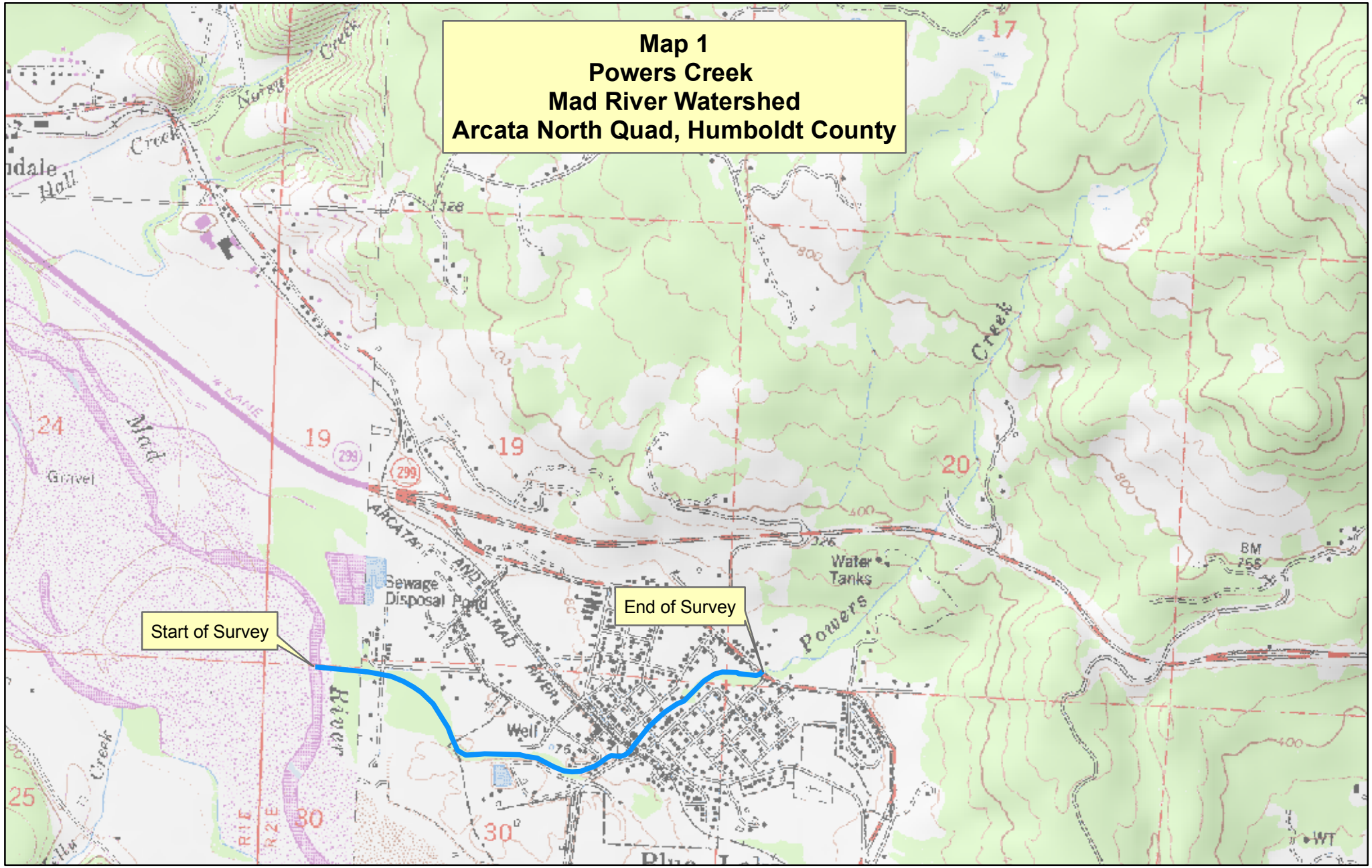


GRAPH 10

POWERS CREEK 2011
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11


Map 1
Powers Creek
Mad River Watershed
Arcata North Quad, Humboldt County
Start of Survey
End of Survey
Legend
Reach 1, F3 Channel Type
0
1,500
3,000 Feet
N
W
E
S
RESOURCES AGENCY
CALIFORNIA
DEPARTMENT
FISH & GAME