California Department of Fish and Wildlife
Marin County
Marin Coastal Watershed
Stream Habitat Assessment Report

Easkoot Creek

Surveyed 2010

Report Completed in 2013

STREAM INVENTORY REPORT

Easkoot Creek

INTRODUCTION

A stream inventory was conducted during 7/14/2010 to 7/15/2010 on Easkoot Creek. The survey began at the confluence with Pacific Ocean and extended upstream 0.7 miles. Stream inventories and reports were also completed for one tributary (Fitz Henry Creek) to Easkoot Creek.

The Easkoot 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 Easkoot 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

Easkoot Creek is a tributary to Bolinas Bay, tributary to the Pacific Ocean, located in Marin County, California (Map 1). Easkoot Creek's legal description at the confluence with Bolinas Bay is T01N R07W S20. Its location is 37°54'09" north latitude and 122°38'51" west longitude, LLID number 1226474379024. Easkoot Creek is a second order stream and has approximately 3.72 miles of blue line stream according to the USGS National Hydrology Dataset (NHD). Easkoot Creek drains a watershed of approximately 1.70 square miles. Elevations range from about 7 feet at the mouth of the creek to 2080 feet in the headwater areas. Grassland and evergreen forest dominates the watershed and is also characterized by low intensity residential, mixed forest, shrubland and deciduous forest. 83.5% of the watershed is natural and 16.5% is urban. The watershed is primarily state owned which accounts for 64.4% of the watershed and is managed for recreation. Vehicle access exists via Highway 1 near Stinson Beach.

METHODS

The habitat inventory conducted in Easkoot Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (WSP) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Wildlife (CDFW). 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 fully measured. All other habitat unit types encountered for the first time in each reach 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 Easkoot 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". Easkoot 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 Easkoot 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 Easkoot 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 Easkoot 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 Easkoot 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 Easkoot 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 2.0.18, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Wildlife. 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 Easkoot 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 7/14/2010 to 7/15/2010 was conducted by Griffin, A. and Bell, C. (WSP). The total length of the stream surveyed was 3,820 feet.

Stream flow was not measured on Easkoot Creek.

Easkoot Creek is a NA channel type for 100 feet of the stream surveyed (Reach 1), a F4 channel type for 2,504 feet of the stream surveyed (Reach 2), and a A3 channel type for 1,216 feet of the stream surveyed (Reach 3).

F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. A3 channels are steep, narrow, cascading, step-pool streams, high energy debris transporting channels associated with depositional soils, and cobble dominant substrates.

Water temperatures taken during the survey period ranged from 58 to 63 degrees Fahrenheit. Air temperatures ranged from 58 to 70 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 2% no survey units, 24% flatwater units, 21% culvert units, 14% pool units, 34% riffle units, and 5% dry units (Graph 1). Based on total length of Level II habitat types there were 3% no survey units, 39% flatwater units, 8% culvert units, 5% pool units, 37% riffle units, and 9% dry units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 24% Glide units, 21% Culvert units and 17% High Gradient Riffle units

(Graph 3). The most frequent habitat types based on percent total length were 39% Glide units, 23% High Gradient Riffle units and 12% Low Gradient Riffle units.

A total of 8 pools were identified (Table 3). Main Channel and scour pools were evenly encountered at 50% each. The Main Channel was comprised of 58% and scours was comprised of 42% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Zero of the 8 pools (0%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 8 pool tail-outs measured, 1 had a value of 1 (12.5%); 4 had a value of 2 (50%); 1 had a value of 3 (12.5%); 1 had a value of 4 (12.5%); and, 1 had a value of 5 (12.5%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 0, flatwater habitat types had a mean shelter rating of 4, and pool habitats had a mean shelter rating of 6 (Table 1). Of the pool types, the Main Channel pools had a mean shelter rating of 4 and Scour pools had a mean shelter rating of 9 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Terrestrial Vegetation is the dominant cover types in Easkoot Creek. Graph 7 describes the pool cover in Easkoot Creek. Terrestrial Vegetation is the dominant pool cover type followed by boulders.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs which were sand and small Cobble observed in 13%, each, of pool tail-outs, and gravel observed in 75% of pool tail-outs.

The mean percent canopy density for the surveyed length of Easkoot Creek was 59%. The mean percentages of hardwood and coniferous trees were 95% and 5%, respectively. Forty-one percent of the canopy was open. Graph 9 describes the mean percent canopy in Easkoot Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 68%. The mean percent left bank vegetated was 67%. The dominant elements composing the structure of the stream banks consisted of 10% bedrock, 10% boulder, 17% cobble/gravel, and 64% sand/silt/clay (Graph 10). Hardwood trees were the dominant vegetation type observed in 90.5% of the units surveyed. Additionally, 4.8% of the units surveyed had coniferous trees as the dominant vegetation type, and 4.8% had brush as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Easkoot Creek

Two sites were electrofished for species composition and distribution in Easkoot Creek on October 26, 2010. Water temperatures taken during the electrofishing period (10:37, 11:45, 12:05 and 12:35) ranged from 51 to 56 degrees Fahrenheit. Air temperatures ranged from 60 to 64 degrees Fahrenheit. The sites were sampled by Andrew Griffin and Chris Bell (WSP), and Dan Resnik (CDFW).

Reach 1, comprising of 100 feet, was not sampled due to no access. In reach 2, which comprised the next 2,504 feet of stream, two sites were sampled. The reach sites yielded 17 young-of-the-year steelhead/rainbow trout (SH/RT), 7 age 1+ SH/RT and 5 age 2+ SH/RT, 1 stickleback and 45 coastal sculpin.

The following chart displays the information yielded from these sites:

2010 Easkoot Creek e-fish observations

Date	Site #	Reference Point	Distance From Reference Point (ft.)	Steelhead/ Rainbow Trout			Non Salmonids Name species
				0+	1+	2+	
10/26/2010	1	Calle del Pratero Bridge	25 feet downstream	9	6	4	1 stickleback and 35 coastal sculpin
10/26/2010	2	HWY 1 Bridge	200 feet upstream	8	1	1	10 coastal sculpin

DISCUSSION

Easkoot Creek is a NA channel type for the first 100 feet of stream surveyed (Reach 1), a F4 channel type for 2,504 feet of the stream surveyed (Reach 2), and a A3 channel type for 1,216 feet of the stream surveyed (Reach 3). The suitability of F4 and A3 channel types for fish habitat improvement structures is as follows:

F4 channel is good for bank-placed boulders. It is fair for plunge weirs; single and opposing wing-deflectors; channel constrictors; and log cover. It is poor for boulder clusters.

A3 channel is good for bank-placed boulders. It is fair for plunge weirs; opposing wing-deflectors; and log cover. It is poor for boulder clusters and single wing-deflectors.

The water temperatures recorded on the survey days 7/14/2010 to 7/15/2010, ranged from 58 to 63 degrees Fahrenheit. Air temperatures ranged from 58 to 70 degrees Fahrenheit. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 39% of the total length of this survey, riffles 37%, and pools 5%. The pools are relatively shallow, with only 0 of the 8 (0%) pools having a maximum

residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

Five of the 8 pool tail-outs measured had embeddedness ratings of 1 or 2. Two of the pool tail-outs had embeddedness ratings of 3 or 4. One 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 Easkoot Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Seven of the 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 was 6. The shelter rating in the flatwater habitats was 4. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by Terrestrial Vegetation in Easkoot Creek. Terrestrial Vegetation is the dominant cover type in pools followed by boulders. 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 59%. Reach 2 had a canopy density of 50.4% and Reach 3 had a canopy density of 70.8%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 68% and 67%, 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.

GENERAL RECOMMENDATIONS

Easkoot Creek should be managed as an anadromous, natural production stream.

Winter storms often bring down large trees and other woody debris into the stream, which increases the number and quality of pools. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. Landowners should be sensitive about the natural and positive role woody debris plays in the system, and encouraged not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

RECOMMENDATIONS

1) 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.

2) 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.

3) Increase the canopy throughout Easkoot 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. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

4) Access for migrating salmonids should be assessed at all road crossings and dams. Sites of particular concern include all the indentified in-stream private driveway culverts and the Panoramic Highway Road in-stream culvert. All fish passage assessments should be done according to Part 9 of the California Salmonid Stream Habitat Restoration Manual (Flosi et al, 1998). Where needed, crossings should be replaced or modified to improve fish passage.

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. 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.

6) Due to the natural high gradient of the stream throughout Reach 3, access for migrating salmonids is an ongoing potential problem. Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish. Fish passage should be monitored and improved where possible.

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 just upstream of the tidal influence. Waypoint #22. N37.90012 W122.64429
192	0003.00	Bridge #1 is Calle Del Sierra Road with a length=31', a height=3', and a width=12'. It is made of concrete, is not retaining gravel, and has no sill. It is not creating down cutting and it is not a barrier to salmonids.
420	0006.00	Bridge #2 is Calle De Pradero road bridge with a length=13', a height=3', and a width=25'. It is made of concrete, not retaining gravel, and has no sill. It is not creating down cutting and is not a barrier to salmonids. Waypoint #23 N37.89937 W122.64312.
538	0009.00	Bridge #3 is a footbridge with a length=4', a height=2', and a width=12'. It is made of wood, is not retaining gravel and has no sill. It is not creating down cutting and is not a possible barrier to salmonids. No Waypoint taken
634	0011.00	Bridge #4 is Calle Del Pinos road bridge; it has a length=13', a height=3' and a width=20'. It is made of wood, not retaining gravel and has no sill. It is not down cutting and not a barrier to salmonids. No waypoint taken.
713	0014.00	Bridge #5 is a foot bridge with a length=3', a height=3', and a width=17'. It is made of wood, not retaining gravel and has no sill. It is not down cutting or creating a barrier to salmonids. No waypoint taken
892	0018.00	Possible bank placed large woody debris buried in silt.
1113	0019.00	Bridge #6 is a driveway road to beach access; it has a length=33', a height=4', and a width=28'. It is made of concrete, not retaining gravel, and has no sill. It is not down cutting and is not a barrier to salmonids.
1583	0024.00	Bridge #7 is a footbridge with a length=8', a height=3', and a width=9'. It is made of wood, not retaining gravel, and has no sill It is not down cutting and is not a barrier to salmonids. Waypoint #26. N37.89774 W122.63992.
1591	0025.00	Right bank retaining wall has a height=3 feet X 70 feet
1977	0028.00	Bridge #8 is a road bridge with a length=31', a height=4', and a width=20'. It is made of concrete, is not retaining gravel and has no sill It is not down cutting and is not a barrier to salmonids. Waypoint #27. N37.89785 W122.63898.
2008	0029.00	Several salmonids Young of the year observed. 2 inches-5 inches in length
2256	0031.00	Young of year Salmonid observed

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Position (ft.)	Habitat Unit #	Comments:
2449	0032.00	Bridge #9 is a Highway 1 road bridge with a length=50', a height=11', a width=20'. It is made of concrete, not retaining gravel, and has no sill. It is not down cutting and is not a barrier to salmonids. Waypoint #29 N37.89849 W122.63744.
2499	0033.00	Right bank tributary #1 marked on topographic map and flagged.
2499	0033.00	Right Bank Tributary #1 is Fitzhenry Creek. It is Flowing, and wet, with a Discharge <1, and Contributes 50% of flow to the receiving stream. The downstream water temperature = 61F, the upstream temperature = 62F, and the temperature within the tributary = 61F. The Survey crew checked 150' up and found it was accessible to fish, with a channel Slope=10%. Fish were observed. WP #30 N37.89867W122.63718
2638	0036.00	Not bedrock. Concrete from Culvert.
2651	0037.00	Culvert #1 is in good condition and is diverting flow under private driveway. It is made of CMP with a height=3', a width=3', a length=29', and a diameter=3'.The plunge height=6', with a max depth of water at the outlet =0.1'. The Slope of the culvert is estimated to be 2%, and is a possible barrier to salmonids. WP #31 N37.89865 W122.63697
2911	0041.00	Pump in creek.
2929	0042.00	Culvert #2 is diverting flow from under a private driveway. 2 culverts are made of CMP are stacked vertically out top of each other, with a height=5', a width=5', a length=15', and a diameter= 5'. There is no plunge height and the max depth at the outlet =0.5'. The Culvert is in good condition and has a slope=2%. It is a possible barrier to salmonids. No waypoint taken
3558	0054.00	Culvert #3 is diverting flow under Panoramic Highway. It is made of concrete with a height=5', a width=5', a length=74', and a diameter=5'. The plunge height= 0' due to a cascades below, with a max depth at the outlet=0'.The culvert slope =2%. The Culvert is a possible barrier to salmonids.WP #34 N37.89798 W122.63421
3820	0058.00	End of survey due to steep, slippery rocks and boulders; crew was unable to access upstream. Waypoint #35. N37.89799 W122.63365.

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.

McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

Rosgen, D.L., 1994. A Classification of Natural Rivers. Catena, Vol 22: 169-199, Elsevier Science, B. V. Amsterdam.

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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]	

Easkoot Creek

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Prepared by: Scott Webb, December 2010

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

Stream Name: Easkoot Creek **LLID:** 1226474379024 **Drainage:** Bolinas

Survey 7/14/2010 to 7/15/2010

Confluence Location: Quad: BOLINAS **Legal Description:** T01NR07WS20 **Latitude:** 37:54:09.0N **Longitude:** 122:38:51.0W

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
12	4	CULVERT	20.7	25	304	8.0									
3	3	DRY	5.2	120	359	9.4									
14	14	FLATWATER	24.1	105	1474	38.6	4.8	0.3	0.7	481	6737	159	2226		4
1	0	NOSURVEY	1.7	100	100	2.6									
8	8	POOL	13.8	22	180	4.7	7.1	0.9	1.4	177	1413	187	1493	160	6
20	20	RIFFLE	34.5	70	1403	36.7	3.9	0.2	0.4	268	5356	53	1062		0

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
58	49	3820	13505	4781

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Easkoot Creek **LLID:** 1226474379024 **Drainage:** Bolinas

Survey 7/14/2010 to 7/15/2010

Confluence Location: Quad: BOLINAS **Legal Description:** T01NR07WS20 **Latitude:** 37:54:09.0N **Longitude:** 122:38:51.0W

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	Mean Canopy (%)
5	5	LGR	8.6	88	438	11.5	4.0	0.1	0.5	327	1634	50	250		0	26
10	10	HGR	17.2	86	861	22.5	4.0	0.2	0.7	324	3242	76	764		0	65
5	5	CAS	8.6	21	104	2.7	4.0	0.1	0.3	96	480	10	48		0	91
14	14	GLD	24.1	105	1474	38.6	5.0	0.3	1.2	481	6737	159	2226		4	53
4	4	MCP	6.9	26	105	2.7	9.0	0.8	1.9	251	1004	262	1047	221	4	66
1	1	LSR	1.7	35	35	0.9	6.0	1.1	1.8	210	210	252	252	231	10	67
3	3	PLP	5.2	13	40	1.0	5.0	0.8	1.4	66	199	65	194	55	8	58
3	3	DRY	5.2	120	359	9.4	0.0			0	0					91
12	4	CUL	20.7	25	304	8.0	0.0			0	0					9
1	0	NS	1.7	100	100	2.6										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume
58	49	3820	13505	4781

Table 3 - Summary of Pool Habitat Types

Stream Name: Easkoot Creek **LLID:** 1226474379024 **Drainage:** Bolinas

Survey 7/14/2010 to 7/15/2010

Confluence Location: **Quad:** BOLINAS **Legal Description:** T01NR07WS20 **Latitude:** 37:54:09.0N **Longitude:** 122:38:51.0W

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
4	4	MAIN	50	26	105	58	9.0	0.8	251	1004	221	883	4
4	4	SCOUR	50	19	75	42	5.3	0.9	102	409	99	396	9

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
8	8	180	1413	1279

Easkoot Creek

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

Stream Name: Easkoot Creek **LLID:** 1226474379024 **Drainage:** Bolinas

Survey 7/14/2010 to 7/15/2010

Confluence Location: Quad: BOLINAS **Legal Description:** T01NR07WS20 **Latitude:** 37:54:09.0N **Longitude:** 122:38:51.0W

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 Occurence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
4	MCP	50	1	25	3	75	0	0	0	0	0	0
1	LSR	13	0	0	1	100	0	0	0	0	0	0
3	PLP	38	0	0	3	100	0	0	0	0	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Feet Max Resid. Depth	Total 1< 2 Feet % Occurrence	Total 2< 3 Feet Max Resid. Depth	Total 2< 3 Feet % Occurrence	Total 3< 4 Feet Max Resid. Depth	Total 3< 4 Feet % Occurrence	Total >= 4 Feet Max Resid. Depth	Total >= 4 Feet % Occurrence
8	1	13	7	88	0	0	0	0	0	0

Mean Maximum Residual Pool Depth (ft.): 1

Table 5 - Summary of Mean Percent Cover By Habitat

Stream Name: Easkoot Creek **Dry Units:** 3 **LLID:** 1226474379024 **Drainage:** Bolinas

Survey Dates: 7/14/2010 to 7/15/2010

Confluence Location: Quad: BOLINAS **Legal Description:** T01NR07WS20 **Latitude:** 37:54:09.0N **Longitude:** 122:38:51.0W

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
5	3	LGR	0	0	0	0	0	0	0	0	0
10	3	HGR	0	0	0	0	0	0	0	0	0
5	3	CAS	0	0	0	0	0	0	0	0	0
20	9	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
14	8	GLD	0	0	5	0	45	0	0	0	0
14	8	TOTAL FLAT	0	0	5	0	45	0	0	0	0
4	4	MCP	0	0	0	0	50	0	0	0	0
1	1	LSR	0	0	0	100	0	0	0	0	0
3	3	PLP	0	0	0	0	0	0	22	45	0
8	8	TOTAL POOL	0	0	0	13	25	0	8	17	0
12	0	CUL									
1	0	NS									
58	25	TOTAL	0	0	2	4	22	0	3	5	0

Easkoot Creek

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Easkoot Creek **Dry Units:** 3 **LLID:** 1226474379024 **Drainage:** Bolinas

Survey 7/14/2010 to 7/15/2010

Confluence Location: **Quad:** BOLINAS **Legal Description:** T01NR07WS20 **Latitude:** 37:54:09.0N **Longitude:** 122:38:51.0W

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
5	3	LGR	0	0	100	0	0	0	0
10	4	HGR	0	0	50	25	0	25	0
5	3	CAS	0	0	0	0	0	33	67
14	7	GLD	57	0	43	0	0	0	0
4	3	MCP	100	0	0	0	0	0	0
1	1	LSR	0	0	100	0	0	0	0
3	3	PLP	0	0	100	0	0	0	0
12	0	CUL	0	0	0	0	0	0	0
1	0	NS	0	0	0	0	0	0	0

Easkoot Creek

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Easkoot Creek **LLID:** 1226474379024 **Drainage:** Bolinas

Survey 7/14/2010 to 7/15/2010

Confluence Location: **Quad:** BOLINAS **Legal Description:** T01NR07WS20 **Latitude:** 37:54:09.0N **Longitude:** 122:38:51.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
59	5	95	27	68	67

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.

Easkoot Creek

Table 8 - Fish Habitat Inventory Data Summary

Stream Easkoot Creek LLID: 1226474379024 Drainage Bolinas

Survey Dates: 7/14/2010 to 7/15/2010 Survey Length (ft.): 3820 Main Channel (ft.): 3820 Side Channel (ft.): 0

Confluence Location: Quad BOLINAS Legal Description: T01NR07WS20 Latitude: 37:54:09.0N Longitude: 122:38:51.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: NA
Reach Length (ft.): 100
Riffle/Flatwater Mean Width (ft.):
BFW:
Range (ft.): 8.00 to 8.00
Mean (ft.): 8.00
Std. Dev.: 0.00
Base Flow (cfs): 0
Water (F): 63 - 63 Air (F): 64 - 64
Dry Channel (ft.): 0

Canopy Density (%):
Coniferous Component (%):
Hardwood Component
Dominant Bank
Vegetative Cover (%): 0.0
Dominant
Dominant Bank Substrate
Occurrence of LWD (%):
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length 0.0
Pool Frequency (%): 0.0
Residual Pool Depth (%):
< 2 Feet Deep:
2 to 2.9 Feet Deep:
3 to 3.9 Feet Deep:
>= 4 Feet Deep:
Mean Max Residual Pool Depth
Mean Pool Shelter

Pool Tail Substrate (%): Silt/Clay: Sand: Gravel: Sm Cobble: Lg Cobble: Boulder Bedrock:
Embeddedness Values (%): 1. 2. 3. 4. 5. 0.0

STREAM REACH: 2

Channel Type: F4
Reach Length (ft.): 2504
Riffle/Flatwater Mean Width (ft.): 4.3
BFW:
Range (ft.): 8.00 to 12.00
Mean (ft.): 9.63
Std. Dev.: 1.17
Base Flow (cfs): 0
Water (F): 62 - 63 Air (F): 64 - 70
Dry Channel (ft.): 359

Canopy Density (%): 50.4
Coniferous Component (%): 3.3
Hardwood Component 96.7
Dominant Bank Hardwood Trees
Vegetative Cover (%): 71.3
Dominant Terrestrial Veg.
Dominant Bank Substrate Sand/Silt/Clay
Occurrence of LWD (%): 2.5
LWD per 100 ft.:
Riffles: 0
Pools: 0
Flat: 0

Pools by Stream Length 5.6
Pool Frequency (%): 15.6
Residual Pool Depth (%):
< 2 Feet Deep: 100.0
2 to 2.9 Feet Deep: 0.0
3 to 3.9 Feet Deep: 0.0
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth 1.54
Mean Pool Shelter 5

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 20.0 Gravel: 80.0 Sm Cobble: 0.0 Lg Cobble: 0.0 Boulder 0.0 Bedrock: 0.0
Embeddedness Values (%): 1. 0.0 2. 60.0 3. 0.0 4. 20.0 5. 20.0

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: A3
Reach Length (ft.): 1216
Riffle/Flatwater Mean Width (ft.): 4.3
BFW:
Range (ft.): 7.00 to 12.00
Mean (ft.): 8.72
Std. Dev.: 2.09
Base Flow (cfs): 0
Water (F): 58 - 63 Air (F): 58 - 70
Dry Channel (ft.): 0

Canopy Density (%): 70.8
Coniferous Component (%): 8.0
Hardwood Component 92.0
Dominant Bank Hardwood Trees
Vegetative Cover (%): 62.0
Dominant Boulders
Dominant Bank Substrate Cobble/Gravel
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles: 0
Pools: 0
Flat: 0

Pools by Stream Length 3.3
Pool Frequency (%): 12.0
Residual Pool Depth (%):
< 2 Feet Deep: 100.0
2 to 2.9 Feet Deep: 0.0
3 to 3.9 Feet Deep: 0.0
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth 1.3
Mean Pool Shelter 8

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 66.7 Sm Cobble: 33.3 Lg Cobble: 0.0 Boulder 0.0 Bedrock: 0.0
Embeddedness Values (%): 1. 33.3 2. 33.3 3. 33.3 4. 0.0 5. 0.0

Table 9 -Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Easkoot Creek **LLID:** 1226474379024 **Drainage:** Bolinas

Survey 7/14/2010 to 7/15/2010

Confluence Location: Quad: BOLINAS **Legal Description:** T01NR07WS20 **Latitude:** 37:54:09.0N **Longitude:** 122:38:51.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Bedrock	2	2	9.5
Boulder	1	3	9.5
Cobble/Gravel	3	4	16.7
Sand/Silt/Clay	15	12	64.3

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage
Grass	0	0	0.0
Brush	2	0	4.8
Hardwood	19	19	90.5
Coniferous	0	2	4.8
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 3

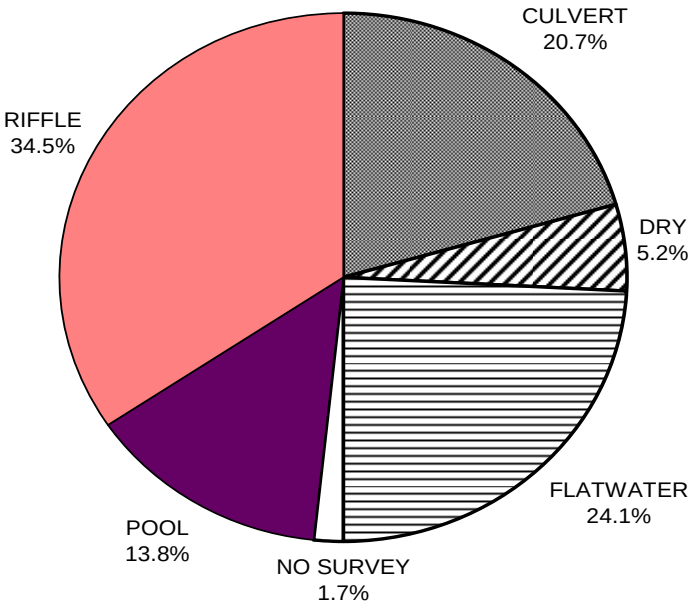
Table 10 - Mean Percent of Shelter Cover Types For Entire Stream

Stream Name: Easkoot Creek **LLID:** 1226474379024 **Drainage:** Bolinas
Survey 7/14/2010 to 7/15/2010
Confluence Location: **Quad:** BOLINAS **Legal Description:** T01NR07WS20 **Latitude:** 37:54:09.0N **Longitude:** 122:38:51.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	0
SMALL WOODY DEBRIS (%)	0	0	0
LARGE WOODY DEBRIS (%)	0	5	0
ROOT MASS (%)	0	0	13
TERRESTRIAL VEGETATION	0	45	25
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	8
BOULDERS (%)	0	0	17
BEDROCK LEDGES (%)	0	0	0

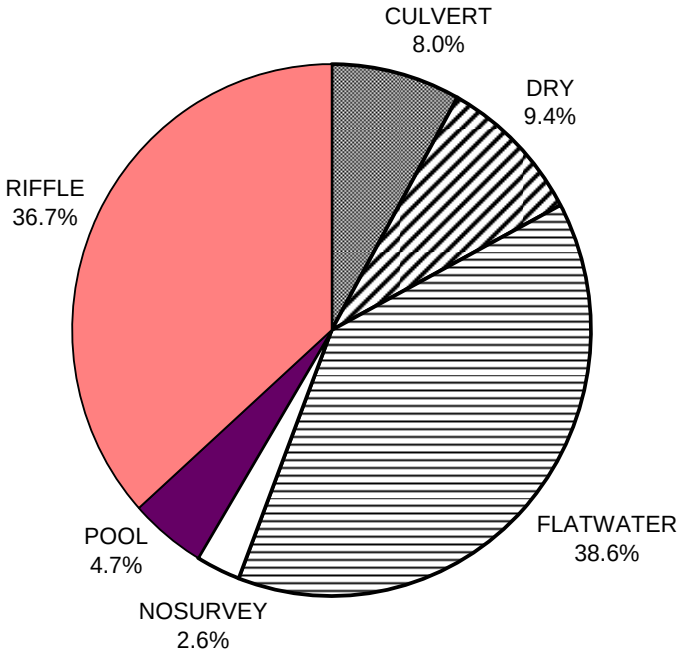
Easkoot Creek

EASKOOT CREEK 2010
HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

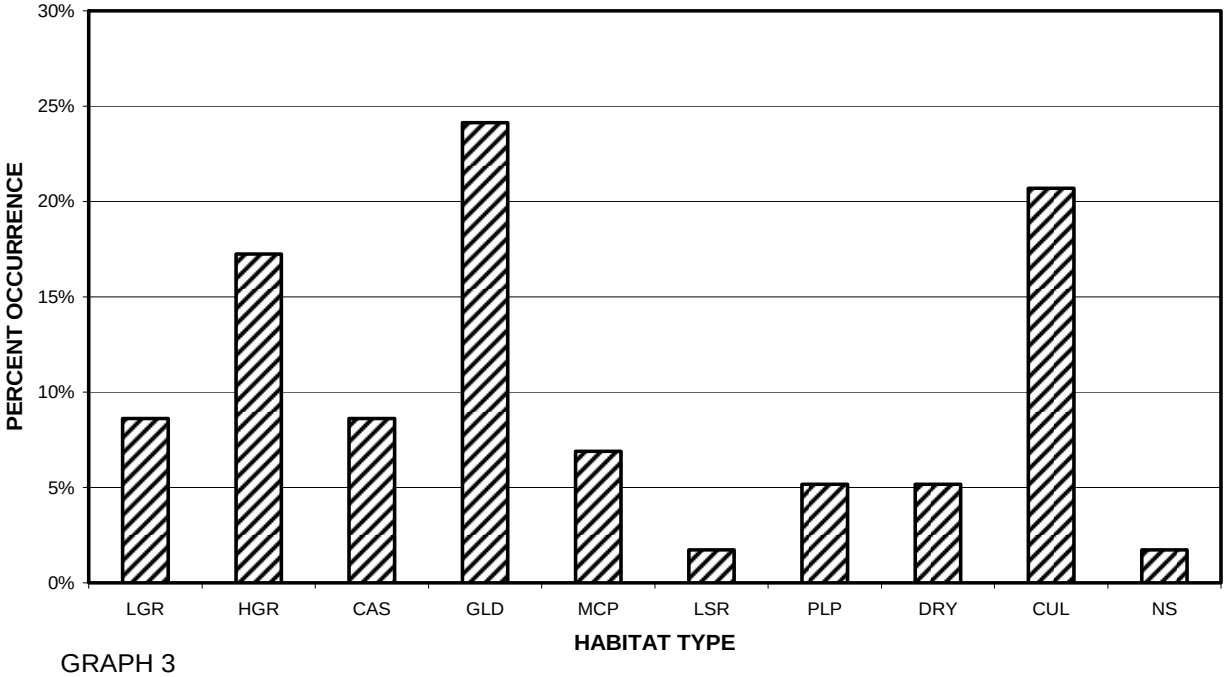
EASKOOT CREEK 2010
HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

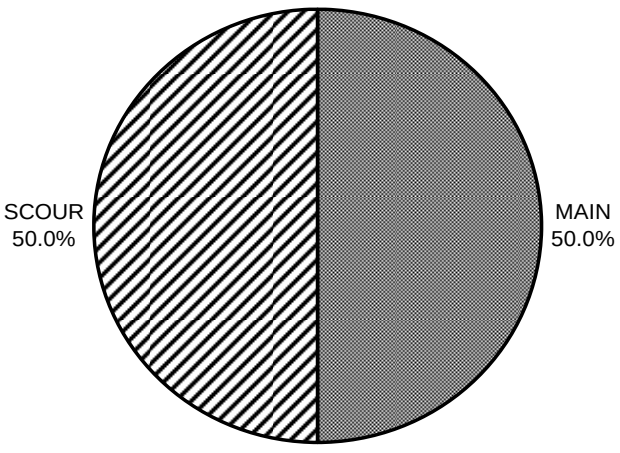
Easkoot Creek

EASKOOT CREEK 2010
HABITAT TYPES BY PERCENT OCCURRENCE



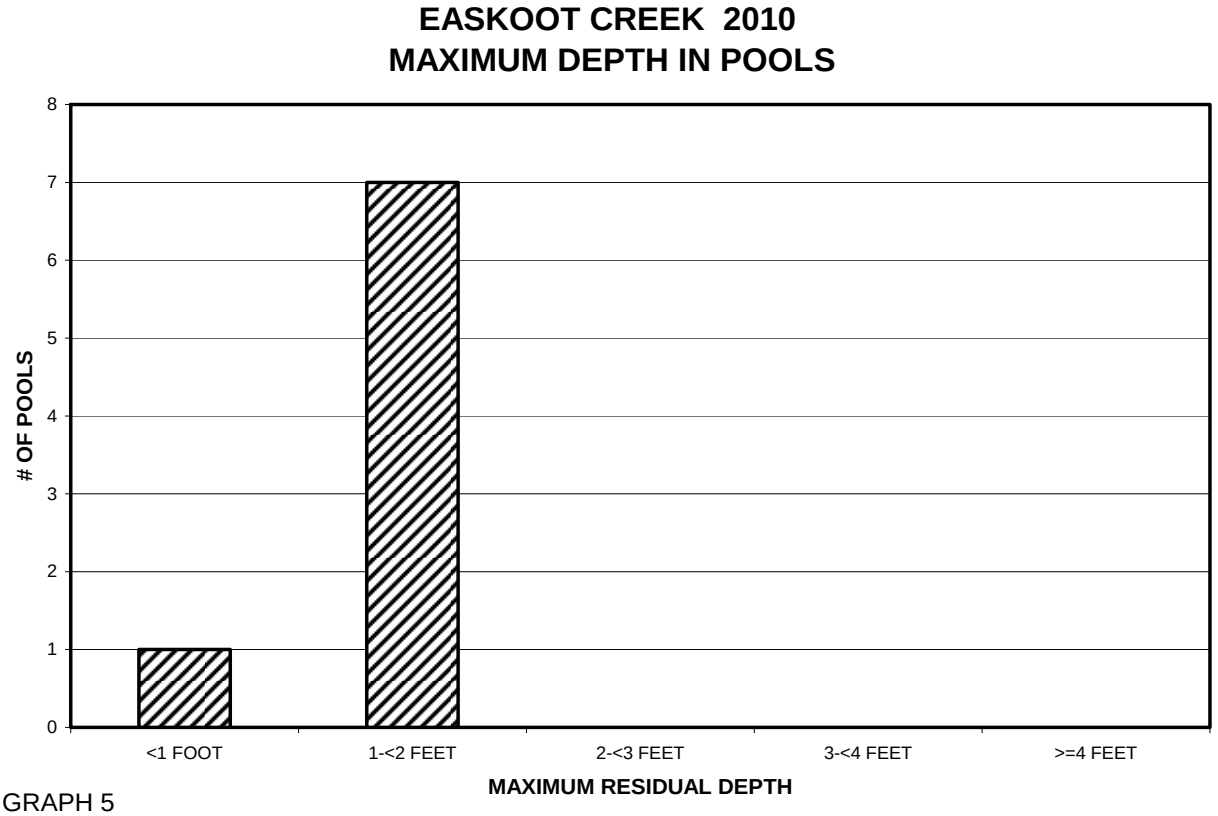
GRAPH 3

EASKOOT CREEK 2010
POOL TYPES BY PERCENT OCCURRENCE

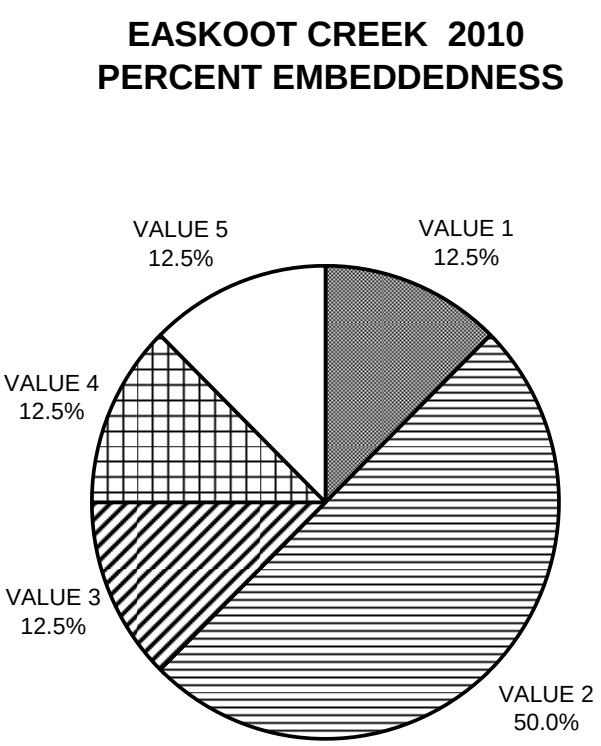


GRAPH 4

Easkoot Creek



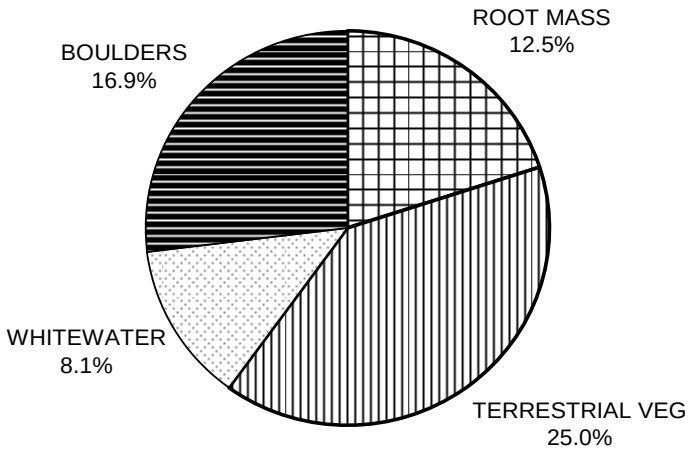
GRAPH 5



GRAPH 6

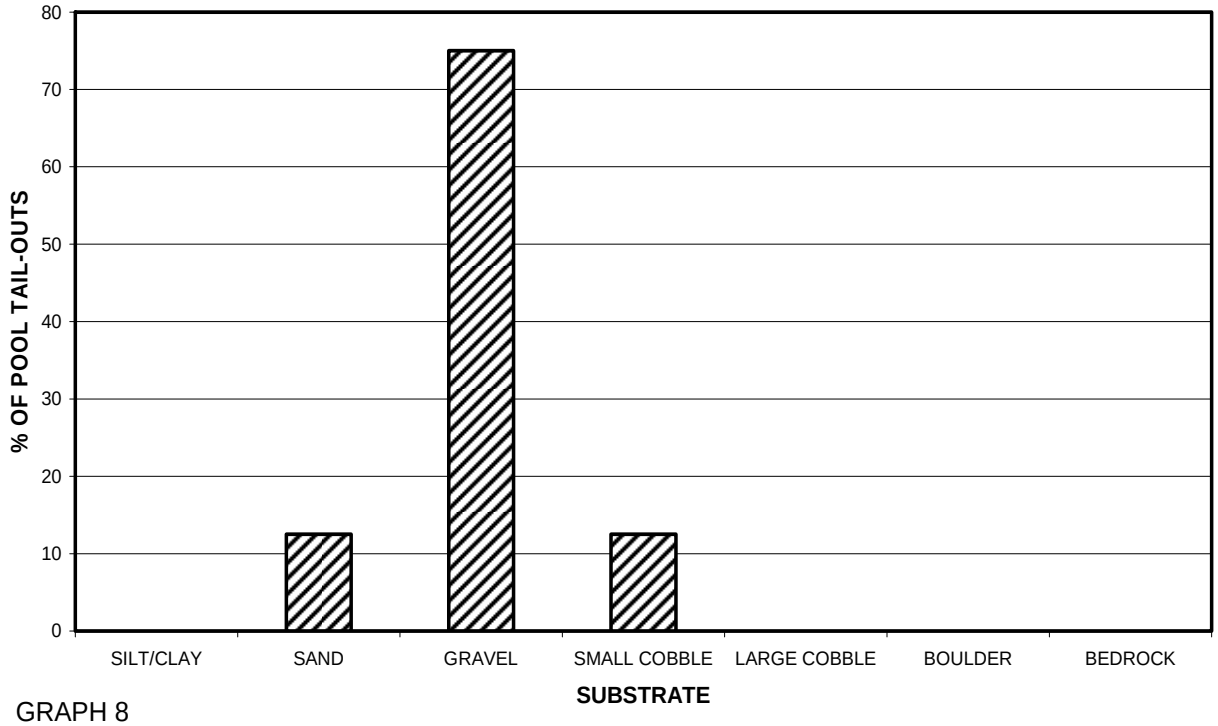
Easkoot Creek

EASKOOT CREEK 2010
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

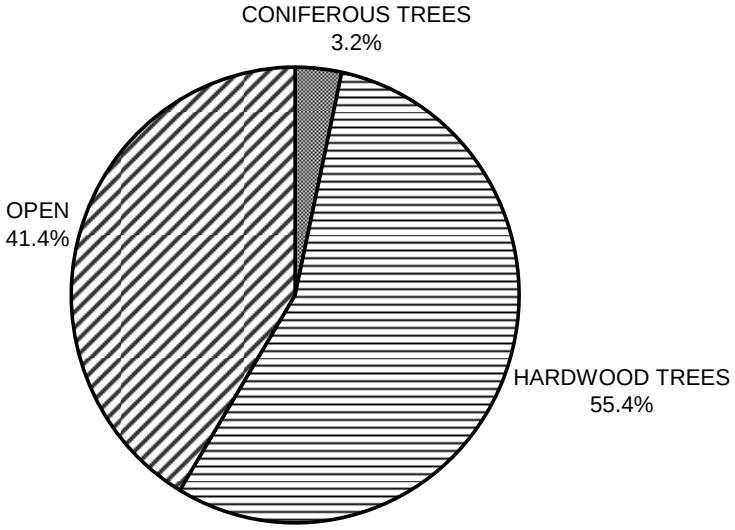
EASKOOT CREEK 2010
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



GRAPH 8

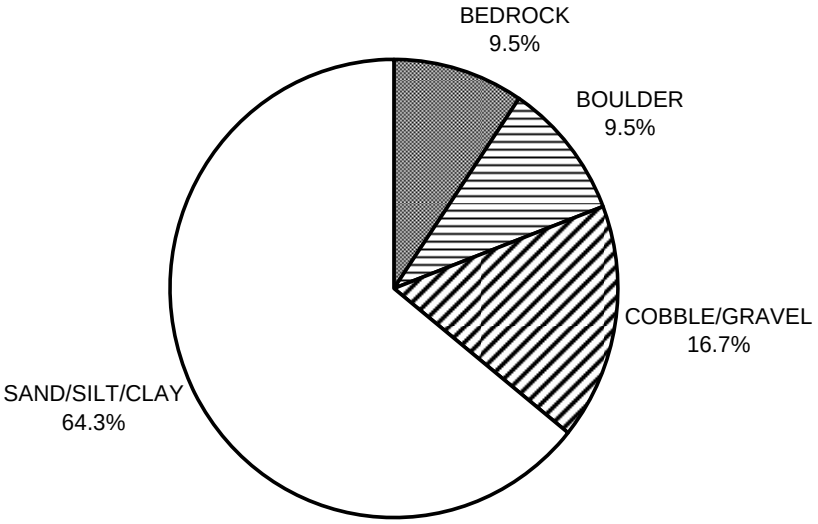
Easkoot Creek

EASKOOT CREEK 2010
MEAN PERCENT CANOPY



GRAPH 9

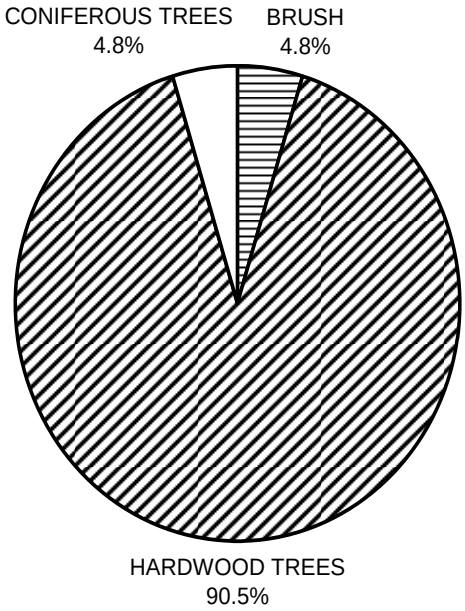
EASKOOT CREEK 2010
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

Easkoot Creek

EASKOOT CREEK 2010
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11