STREAM INVENTORY REPORT

Tramway Gulch

INTRODUCTION

A stream inventory was conducted from July 11 to July 13, 2011 on Tramway Gulch. The survey began at the confluence with Big River and extended upstream 0.7 miles.

The Tramway Gulch 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 Tramway Gulch. 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 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

Tramway Gulch is a tributary to Big River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Tramway Gulch's legal description at the confluence with Big River is T17N R16W S25. Its location is 39.3127 degrees north latitude and 123.6039 degrees west longitude, LLID number 1236027393127. Tramway Gulch is a first order stream and has approximately 1.4 miles of blue line stream according to the USGS Comptche 7.5 minute quadrangle. Tramway Gulch drains a watershed of approximately 1.0 square mile. Elevations range from about 90 feet at the mouth of the creek to 900 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via State Route 20.

METHODS

The habitat inventory conducted in Tramway Gulch 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 Tramway Gulch 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". Tramway Gulch 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 Tramway Gulch, 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. 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 Tramway Gulch, 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 Tramway Gulch, 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 Tramway Gulch, 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 Tramway Gulch. In addition, underwater observations were made at 16 sites using techniques 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

Tramway Gulch

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Tramway Gulch 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 11 to July 13, 2011 was conducted by G. Goforth and M. Horwitz (WSP). The total length of the stream surveyed was 3,785 feet.

Stream flow was not measured on Tramway Gulch.

Tramway Gulch is a B4 channel type for 2,255 feet of the stream surveyed (Reach 1), an E3 channel type for 753 feet of the stream surveyed (Reach 2), and a B3 channel type for 777 feet of the stream surveyed (Reach 3). B4 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks and gravel-dominant substrates. E3 channels are low gradient, meandering riffle/pool streams with low width/depth ratios and little deposition. They are very efficient and stable with a high meander width ratio and cobble-dominant substrates. B3 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks and cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 56 to 58 degrees Fahrenheit. Air temperatures ranged from 60 to 78 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 37% pool units, 31% riffle units, 30% flatwater units, 1% dry units, and 1% no survey units (Graph 1). Based on total length of Level II habitat types there were 45% flatwater units, 30% riffle units, 24% pool units, 1% no survey units, and 1% dry units (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 28%; low gradient riffle units, 27%; and step

run units, 20% (Graph 3). Based on percent total length, step run units made up 35%, low gradient riffle units 25%, and mid-channel pool units 17%.

A total of 42 pools were identified (Table 3). Main channel pools were the most frequently encountered at 81% (Graph 4), and comprised 80% 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. Ten of the 42 pools (24%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 42 pool tail-outs measured, 23 had a value of 1 (54.8%); 13 had a value of 2 (31%); and 6 had a value of 3 (14.3%); (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed not suitable 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 2, flatwater habitat types had a mean shelter rating of 4, and pool habitats had a mean shelter rating of 25 (Table 1). Of the pool types, the main channel pools and scour pools each had a mean shelter rating of 25 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Tramway Gulch. Graph 7 describes the pool cover in Tramway Gulch. Large woody debris is 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 81% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 12% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Tramway Gulch was 97%. Three percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 49% and 51%, respectively. Graph 9 describes the mean percent canopy in Tramway Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 93%. The mean percent left bank vegetated was 93%. The dominant elements composing the structure of the stream banks consisted of 64% cobble/gravel, 22% sand/silt/clay, 9% bedrock, and 5% boulder (Graph 10). Coniferous trees were the dominant vegetation type observed in 60% of the units surveyed. Additionally, 32% of the units surveyed had deciduous trees as the dominant vegetation type, and 6% had grass as the dominant vegetation type (Graph 11).

Tramway Gulch

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at 16 sites for species composition and distribution in Tramway Gulch on July 20, 2011. The water temperature taken during the survey period of 0945 hours to 1055 hours was 55 degrees Fahrenheit. The air temperature was 61 degrees Fahrenheit. The sites were sampled by I. Mikus and M. Groff (DFG).

In Reach 1, which comprised the first 2,255 feet of stream, 14 sites were sampled. The reach sites yielded four young-of-the-year steelhead/rainbow trout (SH/RT) and one coho salmon.

In Reach 2, two sites were sampled starting approximately 2,209 feet from the confluence with Big River and continuing upstream 46 feet. No fish were observed.

The following chart displays the information yielded from these sites:

2011 Tramway Gulch underwater observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
Reach 1: B4 Channel Type									
07/20/11	1	003	Pool	225	0	0	0	1	0
07/20/11	2	005	Pool	275	1	0	0	0	0
07/20/11	3	007	Pool	321	0	0	0	0	0
07/20/11	4	011	Pool	420	0	0	0	0	0
07/20/11	5	012	Pool	445	0	0	0	0	0
07/20/11	6	014	Pool	576	0	0	0	0	0
07/20/11	7	020	Pool	783	1	0	0	0	0
07/20/11	8	023	Pool	887	2	0	0	0	0
07/20/11	9	025	Pool	940	0	0	0	0	0
07/20/11	10	027	Pool	963	0	0	0	0	0
07/20/11	11	029	Pool	1,046	0	0	0	0	0
07/20/11	12	032	Pool	1,109	0	0	0	0	0
07/20/11	13	036	Pool	1,297	0	0	0	0	0
07/20/11	14	042	Pool	1,489	0	0	0	0	0
Reach 2: E3 Channel Type									
07/20/11	15	066	Pool	2,225	0	0	0	0	0
07/20/11	16	068	Pool	2,255	0	0	0	0	0

Tramway Gulch

DISCUSSION

Tramway Gulch is a B4 channel type for the first 2,255 feet of stream surveyed, an E3 channel type for the next 753 feet, and a B3 channel type for the remaining 777 feet. The suitability of B4, E3, and B3 channel types for fish habitat improvement structures is as follows: B4 channels are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover. E3 channels are good for bank-placed boulders and fair for opposing wing-deflectors. B3 channels are excellent for plunge weirs, boulder clusters and bank-placed boulders, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days July 11 to July 13, 2011 ranged from 56 to 58 degrees Fahrenheit. Air temperatures ranged from 60 to 78 degrees Fahrenheit. This is a suitable water temperature range for salmonids. 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 45% of the total length of this survey, riffles 30%, and pools 24%. Ten of the 42 (24%) 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.

Thirty-six of the 42 pool tail-outs measured had embeddedness ratings of 1 or 2. Six of the pool tail-outs had embeddedness ratings of 3 or 4. None 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.

Thirty-nine of the 42 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 25. The shelter rating in the flatwater habitats is 4. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in Tramway Gulch. Large woody debris is 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 97%. Reach 1 had a canopy density of 97%, Reach 2 had a canopy density of 100%, and Reach 3 had a canopy density of 98%. In general, revegetation projects are considered when canopy density is less than 80%.
The percentage of right and left bank covered with vegetation was 93% and 93%, 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.

Tramway Gulch

RECOMMENDATIONS

1) Tramway Gulch 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 large woody debris. Adding high quality complexity with woody cover in the pools is desirable.

5) There are several log debris accumulations present on Tramway Gulch that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

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	Comment: Unit #:
0	0001.00	Start of survey at the confluence with Big River. The channel is a B4.
698	0018.00	Large woody debris (LWD) is accumulating in the channel; it has the potential to become an LDA.
914	0025.00	Log debris accumulation (LDA) #01 contains three pieces of LWD and measures 6.5' high x 11' wide x 18' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to gravel and measures 12' wide x 11' long x 1' deep. It is a possible barrier to juvenile and adult salmonids. No fish were observed above the LDA.
1066	0031.00	LDA #02 contains three pieces of LWD and measures 7' high x 26' wide x 15' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to gravel and measures 18'

		wide x 22' long x 1' deep. It is a possible barrier to juvenile and adult salmonids.
1466	0042.00	LDA #03 contains seven pieces of LWD and measures 7' high x 20' wide x 25' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to gravel and measures 21' wide x 30' long x 2' deep. It is a possible barrier to juvenile and adult salmonids.
2255	0069.00	The channel changes from a B4 to an E3.
2491	0076.00	Tributary #01 enters on the left bank. The water temperature of the tributary is 56 degrees Fahrenheit; the water temperature downstream and upstream of the tributary is 56 degrees Fahrenheit. The slope of the tributary is approximately 3%. The tributary is accessible to salmonids, but no fish were observed.
2578	0079.00	LDA #04 contains three pieces of LWD and measures 4' high x 11' wide x 6' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to gravel and measures 11' wide x 14' long x 1' deep. It is a possible barrier to juvenile and adult salmonids. A logging road crosses the channel. The crossing is a 14' wide x 48' long x 10' high railcar bridge.
3008	0091.00	The channel changes from an E3 to a B3.
3624	0108.00	LDA #05 contains four pieces of LWD and measures 5' high x 15' wide x 11' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to gravel and measures 15' wide x 23' long x 1' deep. It is a possible barrier to juvenile and adult salmonids.
3745	0113.00	End of survey due to 8' high plunge into 1.3' deep pool. There is an LDA above the plunge that is a possible barrier to salmonids. The channel goes dry approximately 200' upstream of the end of survey point.

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.

Tramway Gulch

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: Tramway Gulch LLID: 1236027393127 Drainage: Big River

Survey Dates: 7/11/2011 to 7/13/2011

Confluence Location: Quad: COMPTCHE Legal Description: T17NR16WS24 Latitude: 39:18:46.0N Longitude: 123:36:10.0

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
1	0	DRY	0.9	20	20	0.5									
34	7	FLATWATER	30.1	50	1717	45.4	6.7	0.5	0.8	260	8839	141	4778		4
1	0	NOSURVEY	0.9	20	20	0.5									
42	42	POOL	37.2	22	908	24.0	7.2	0.8	1.5	150	6303	178	7458	130	25
35	5	RIFFLE	31.0	32	1120	29.6	4.2	0.4	0.6	125	4389	52	1833		2

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
113	54	3785	19532	14070

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Tramway Gulch LLID: 1236027393127 Drainage: Big River

Survey Dates: 7/11/2011 to 7/13/2011

Confluence Location: Quad: COMPTCHE Legal Description: T17NR16WS24 Latitude: 39:18:46.0N Longitude: 123:36:10.0W

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 (%)
30	2	LGR	26.5	31	937	24.8	6	0.5	0.9	143	4299	75	2237		0	100
4	2	HGR	3.5	42	167	4.4	4	0.4	0.5	159	636	52	208		3	100
1	1	CAS	0.9	16	16	0.4	2	0.4	0.6	22	22	9	9		5	96
1	1	GLD	0.9	39	39	1.0	12	0.5	0.8	468	468	234	234		5	96
11	2	RUN	9.7	33	358	9.5	4	0.5	0.9	104	1148	48	525		3	98
22	4	SRN	19.5	60	1320	34.9	7	0.6	0.9	286	6287	164	3599		5	98
32	32	MCP	28.3	20	650	17.2	7	0.7	3	133	4269	142	4529	100	24	97
2	2	STP	1.8	38	75	2.0	8	0.9	1.7	289	577	308	616	201	40	100
1	1	LSL	0.9	11	11	0.3	5	0.6	1.2	39	39	39	39	23	5	92
7	7	PLP	6.2	25	172	4.5	9	1.2	3.3	203	1419	325	2274	260	28	98
1	0	DRY	0.9	20	20	0.5										
1	0	NS	0.9	20	20	0.5										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
113	54	3785	19164	14270

Table 3 - Summary of Pool Types

Stream Name: Tramway Gulch LLID: 1236027393127 Drainage: Big River

Survey Dates: 7/11/2011 to 7/13/2011

Confluence Location: Quad: COMPTCHE Legal Description: T17NR16WS24 Latitude: 39:18:46.0N Longitude: 123:36:10.0W

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
34	34	MAIN	81	21	725	80	6.9	0.7	143	4846	106	3609	25
8	8	SCOUR	19	23	183	20	8.3	1.1	182	1457	230	1842	25

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
42	42	908	6303	5451

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

Stream Name: Tramway Gulch LLID: 1236027393127 Drainage: Big River

Survey Dates: 7/11/2011 to 7/13/2011

Confluence Location: Quad: COMPTCHE Legal Description: T17NR16WS24 Latitude: 39:18:46.0N Longitude: 123:36:10.0W

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
32	MCP	76	13	41	13	41	5	16	1	3	0	0
2	STP	5	0	0	2	100	0	0	0	0	0	0
1	LSL	2	0	0	1	100	0	0	0	0	0	0
7	PLP	17	1	14	2	29	3	43	1	14	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
42	14	33	18	43	8	19	2	5	0	0

Mean Maximum Residual Pool Depth (ft.): 1.5

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Tramway Gulch LLID: 1236027393127 Drainage: Big River

Survey Dates: 7/11/2011 to 7/13/2011 Dry Units: 1

Confluence Location: Quad: COMPTCHE Legal Description: T17NR16WS24 Latitude: 39:18:46.0N Longitude: 123:36:10.0W

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
30	2	LGR	0	0	0	0	0	0	0	0	0
4	2	HGR	0	0	0	0	0	0	0	100	0
1	1	CAS	0	50	0	0	0	0	0	50	0
35	5	TOTAL RIFFLE	0	25	0	0	0	0	0	75	0
1	1	GLD	0	0	100	0	0	0	0	0	0
11	2	RUN	100	0	0	0	0	0	0	0	0
22	4	SRN	0	99	0	0	0	0	0	1	0
34	7	TOTAL FLAT	17	66	17	0	0	0	0	1	0
32	32	MCP	17	25	25	15	1	0	2	16	0
2	2	STP	38	18	25	13	0	0	0	8	0
1	1	LSL	0	0	100	0	0	0	0	0	0
7	7	PLP	6	11	46	21	0	0	4	11	1
42	42	TOTAL POOL	16	22	30	15	1	0	2	14	0
1	0	NS									
113	54	TOTAL	15	27	28	13	0	0	2	15	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Tramway Gulch LLID: 1236027393127 Drainage: Big River

Survey Dates: 7/11/2011 to 7/13/2011 Dry Units: 1

Confluence Location: Quad: COMPTCHE Legal Description: T17NR16WS24 Latitude: 39:18:46.0N Longitude: 123:36:10.0W

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
30	1	LGR	0	0	100	0	0	0	0
4	2	HGR	0	0	0	50	50	0	0
1	1	CAS	0	0	0	0	0	0	100
1	1	GLD	0	100	0	0	0	0	0
11	2	RUN	50	0	50	0	0	0	0
22	4	SRN	0	0	75	25	0	0	0
32	32	MCP	28	47	22	3	0	0	0
2	2	STP	0	100	0	0	0	0	0
1	1	LSL	100	0	0	0	0	0	0
7	7	PLP	57	14	29	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Tramway Gulch LLID: 1236027393127 Drainage: Big River

Survey Dates: 7/11/2011 to 7/13/2011

Confluence Location: Quad: COMPTCHE Legal Description: T17NR16WS24 Latitude: 39:18:46.0N Longitude: 123:36:10.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
97	51	49	0	93	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: Tramway Gulch LLID: 1236027393127 Drainage: Big River

Survey Dates: 7/11/2011 to 7/13/2011 Survey Length (ft.): 3785 Main Channel (ft.): 3785 Side Channel (ft.): 0

Confluence Location: Quad: COMPTCHE Legal Description: T17NR16WS24 Latitude: 39:18:46.0N Longitude: 123:36:10.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: B4
Reach Length (ft.): 2255
Riffle/Flatwater Mean Width (ft.): 7.7
BFW:
Range (ft.): 7 to 15
Mean (ft.): 9
Std. Dev.: 3
Base Flow (cfs.):
Water (F): 0 - 58 Air (F): 61 - 78
Dry Channel (ft): 0

Canopy Density (%): 96.5
Coniferous Component (%): 47.4
Hardwood Component (%): 52.6
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 94.3
Dominant Shelter: Large Woody Debris
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 28
LWD per 100 ft.:
Riffles: 2
Pools: 5
Flat: 1

Pools by Stream Length (%): 28.8
Pool Frequency (%): 41.2
Residual Pool Depth (%):
< 2 Feet Deep: 75
2 to 2.9 Feet Deep: 25
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.4
Mean Pool Shelter Rating: 27

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 7 Gravel: 82 Sm Cobble: 7 Lg Cobble: 4 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 60.7 2. 32.1 3. 7.1 4. 0.0 5. 0.0

STREAM REACH: 2

Channel Type: E3
Reach Length (ft.): 753
Riffle/Flatwater Mean Width (ft.): 4.0
BFW:
Range (ft.): 4 to 8
Mean (ft.): 5
Std. Dev.: 1
Base Flow (cfs.): 0.0
Water (F): 56 - 56 Air (F): 60 - 65
Dry Channel (ft): 0

Canopy Density (%): 100.0
Coniferous Component (%): 65.0
Hardwood Component (%): 35.0
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 89.1
Dominant Shelter: Small Woody Debris
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 20
LWD per 100 ft.:
Riffles: 1
Pools: 7
Flat: 0

Pools by Stream Length (%): 21.0
Pool Frequency (%): 36.4
Residual Pool Depth (%):
< 2 Feet Deep: 88
2 to 2.9 Feet Deep: 0
3 to 3.9 Feet Deep: 13
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.4
Mean Pool Shelter Rating: 16

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 88 Sm Cobble: 13 Lg Cobble: 0 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 50.0 2. 0.0 3. 50.0 4. 0.0 5. 0.0

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: B3
Reach Length (ft.): 777
Riffle/Flatwater Mean Width (ft.): 3.3
BFW:
Range (ft.): 4 to 8
Mean (ft.): 6
Std. Dev.: 2
Base Flow (cfs.): 0.0
Water (F): 56 - 57 Air (F): 64 - 65
Dry Channel (ft): 20

Canopy Density (%): 97.9
Coniferous Component (%): 46.7
Hardwood Component (%): 53.3
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 91.9
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 21
LWD per 100 ft.:
Riffles: 1
Pools: 8
Flat: 2

Pools by Stream Length (%): 12.9
Pool Frequency (%): 26.1
Residual Pool Depth (%):
< 2 Feet Deep: 67
2 to 2.9 Feet Deep: 17
3 to 3.9 Feet Deep: 17
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.9
Mean Pool Shelter Rating: 28

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 67 Sm Cobble: 33 Lg Cobble: 0 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 33.3 2. 66.7 3. 0.0 4. 0.0 5. 0.0

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Tramway Gulch LLID: 1236027393127 Drainage: Big River

Survey Dates: 7/11/2011 to 7/13/2011

Confluence Location: Quad: COMPTCHE Legal Description: T17NR16WS24 Latitude: 39:18:46.0N Longitude: 123:36:10.0W

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	4	6	9.3
Boulder	1	4	4.6
Cobble / Gravel	37	32	63.9
Sand / Silt / Clay	12	12	22.2

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	3	5.6
Brush	2	0	1.9
Hardwood Trees	16	19	32.4
Coniferous Trees	33	32	60.2
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

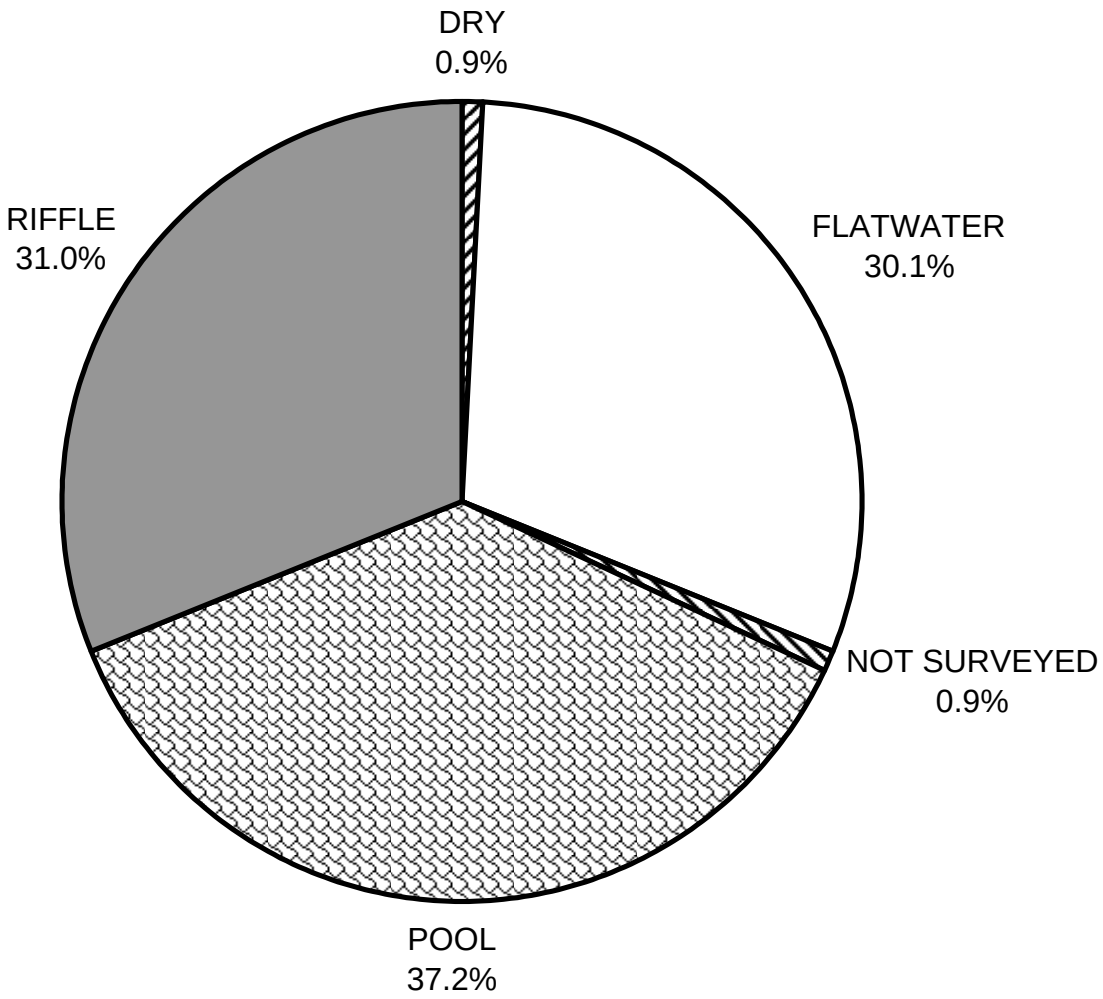
StreamName: Tramway Gulch LLID: 1236027393127 Drainage: Big River

Survey Dates: 7/11/2011 to 7/13/2011

Confluence Location: Quad: COMPTCHE Legal Description: T17NR16WS24 Latitude: 39:18:46.0N Longitude: 123:36:10.0W

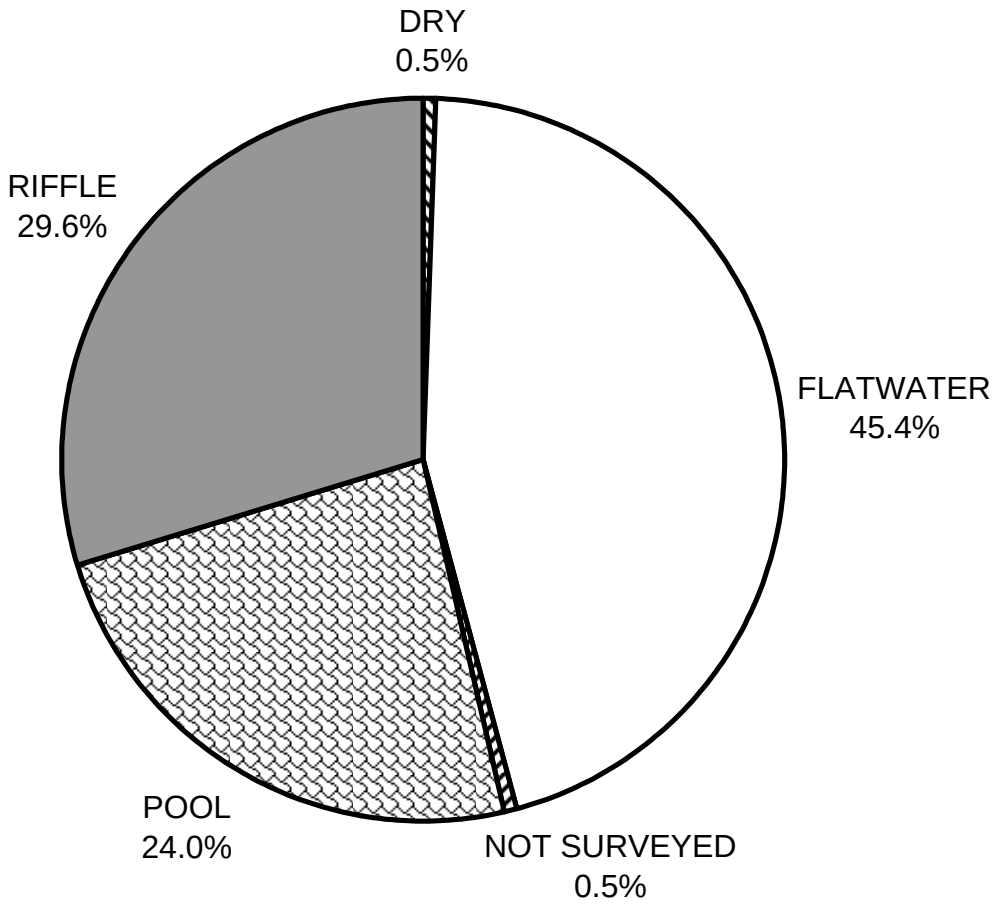
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	17	16
SMALL WOODY DEBRIS (%)	25	66	22
LARGE WOODY DEBRIS (%)	0	17	30
ROOT MASS (%)	0	0	15
TERRESTRIAL VEGETATION (%)	0	0	1
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	2
BOULDERS (%)	75	1	14
BEDROCK LEDGES (%)	0	0	0

TRAMWAY GULCH 2011
HABITAT TYPES BY PERCENT OCCURRENCE



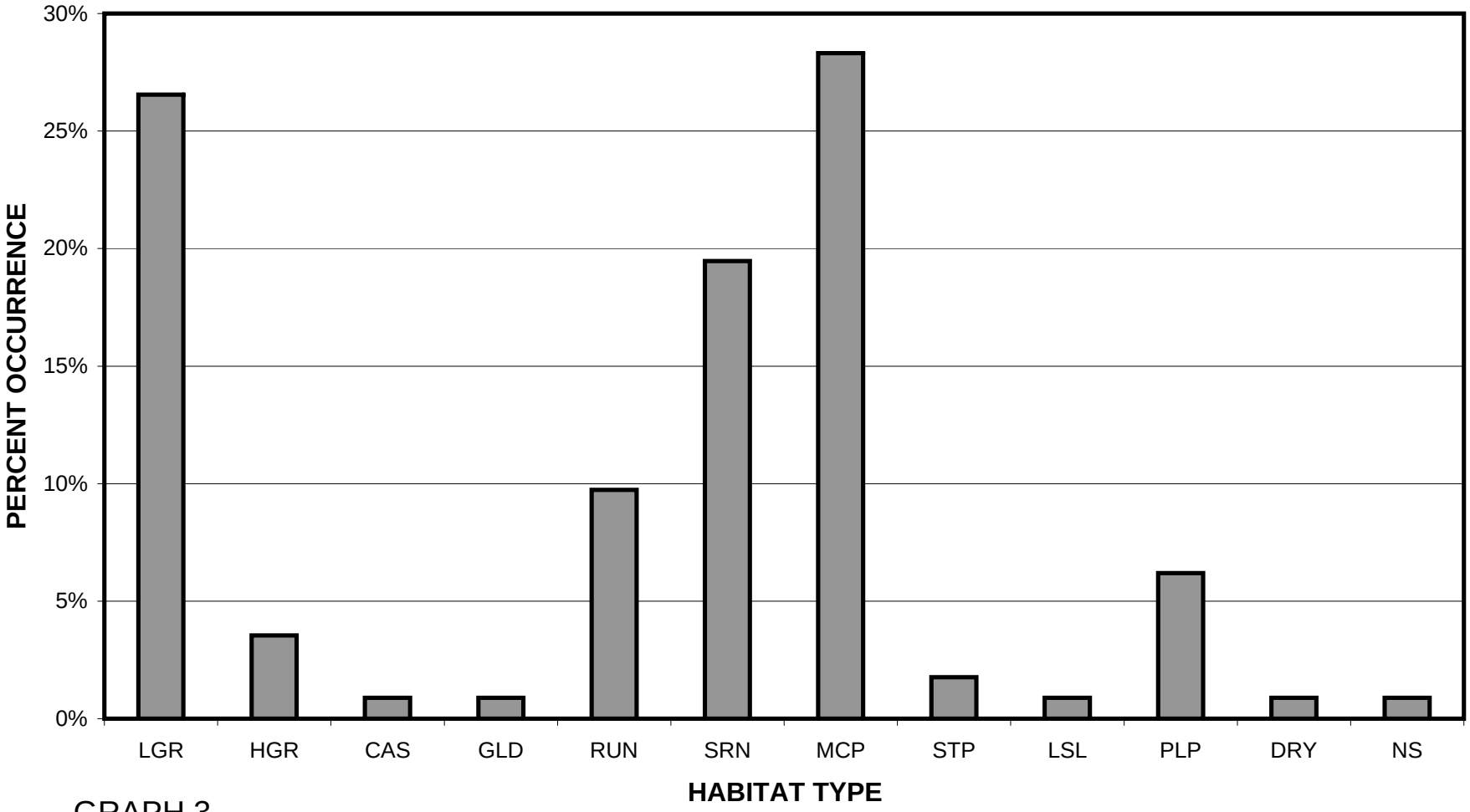
GRAPH 1

TRAMWAY GULCH 2011
HABITAT TYPES BY PERCENT TOTAL LENGTH



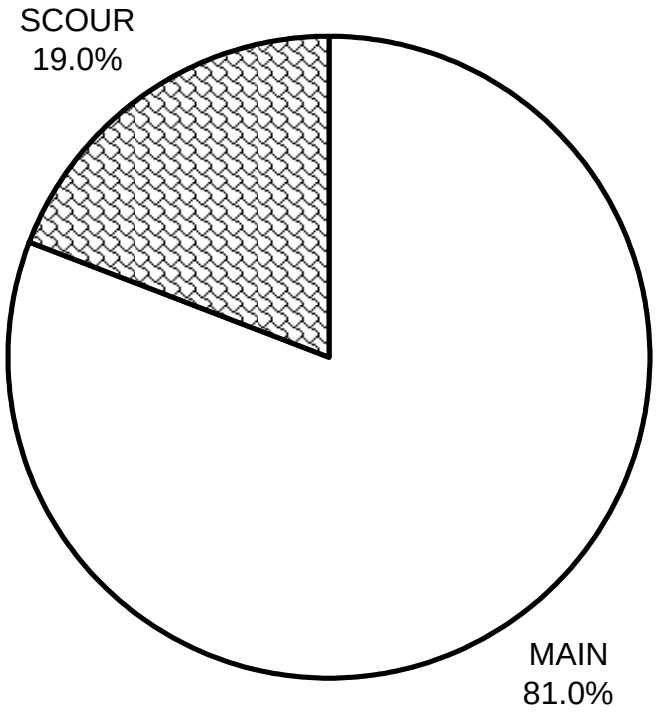
GRAPH 2

TRAMWAY GULCH 2011
HABITAT TYPES BY PERCENT OCCURRENCE



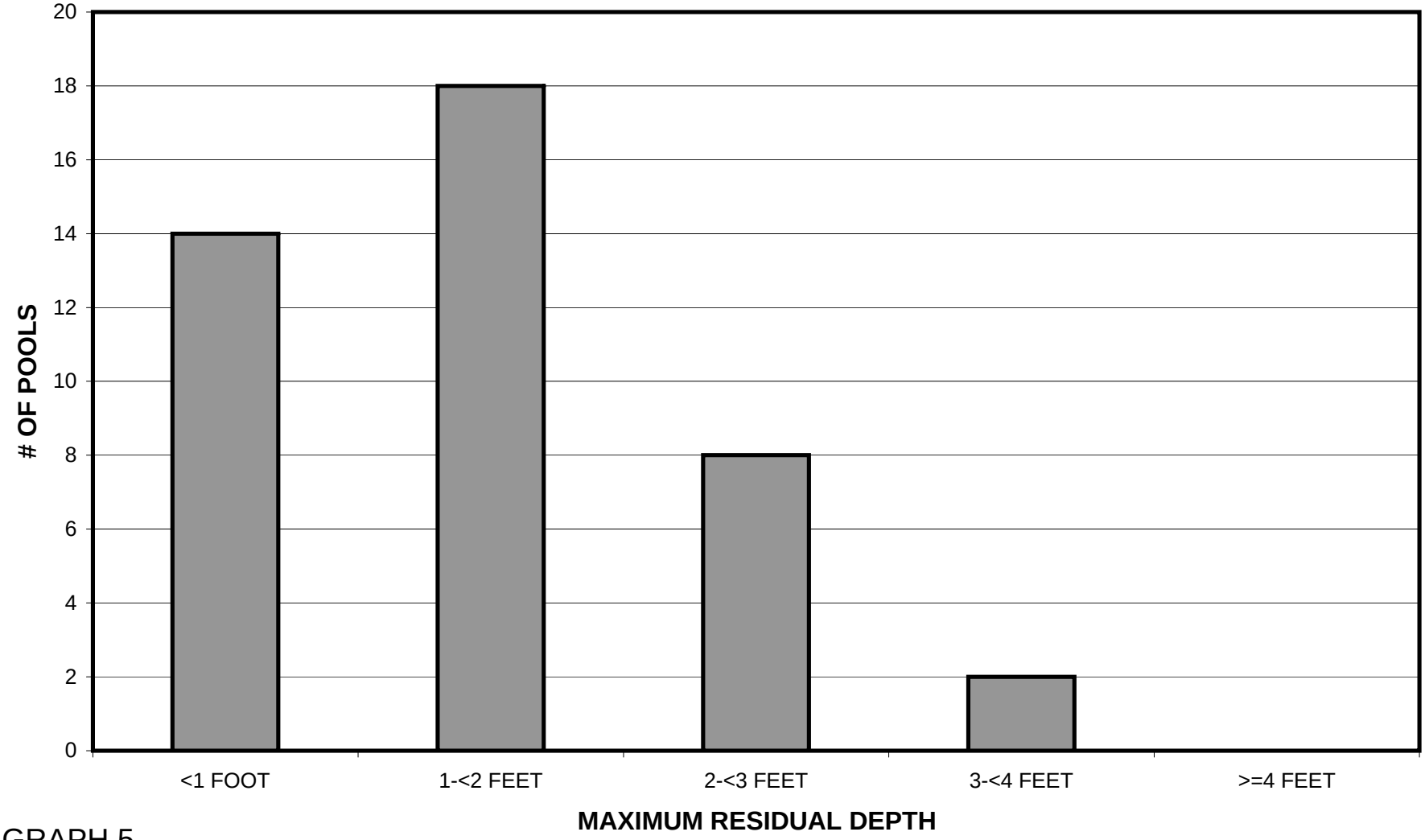
GRAPH 3

TRAMWAY GULCH 2011
POOL TYPES BY PERCENT OCCURRENCE



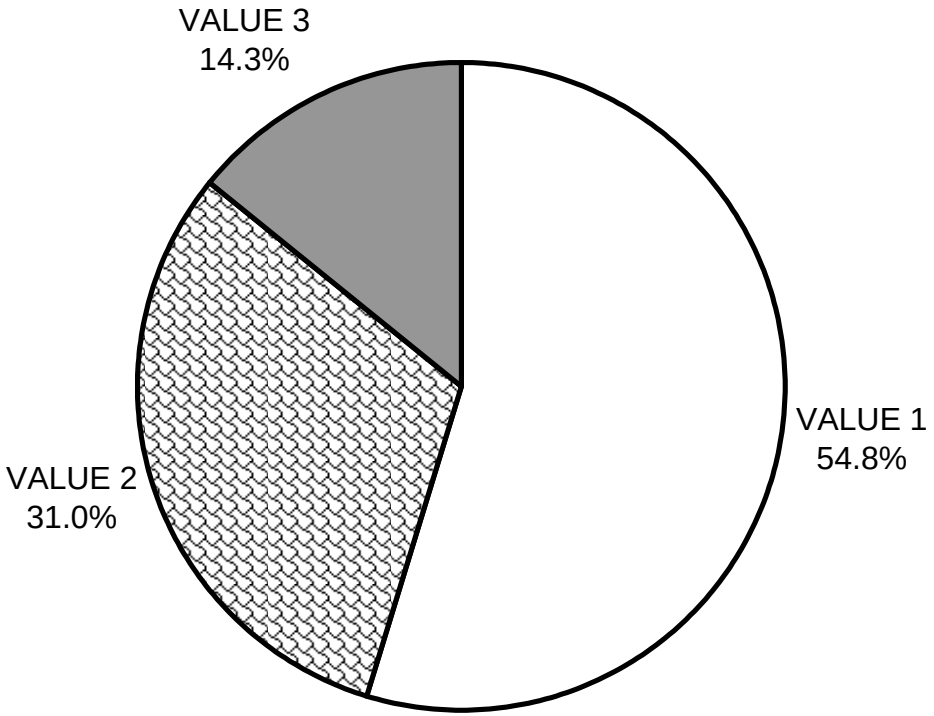
GRAPH 4

TRAMWAY GULCH 2011
MAXIMUM DEPTH IN POOLS



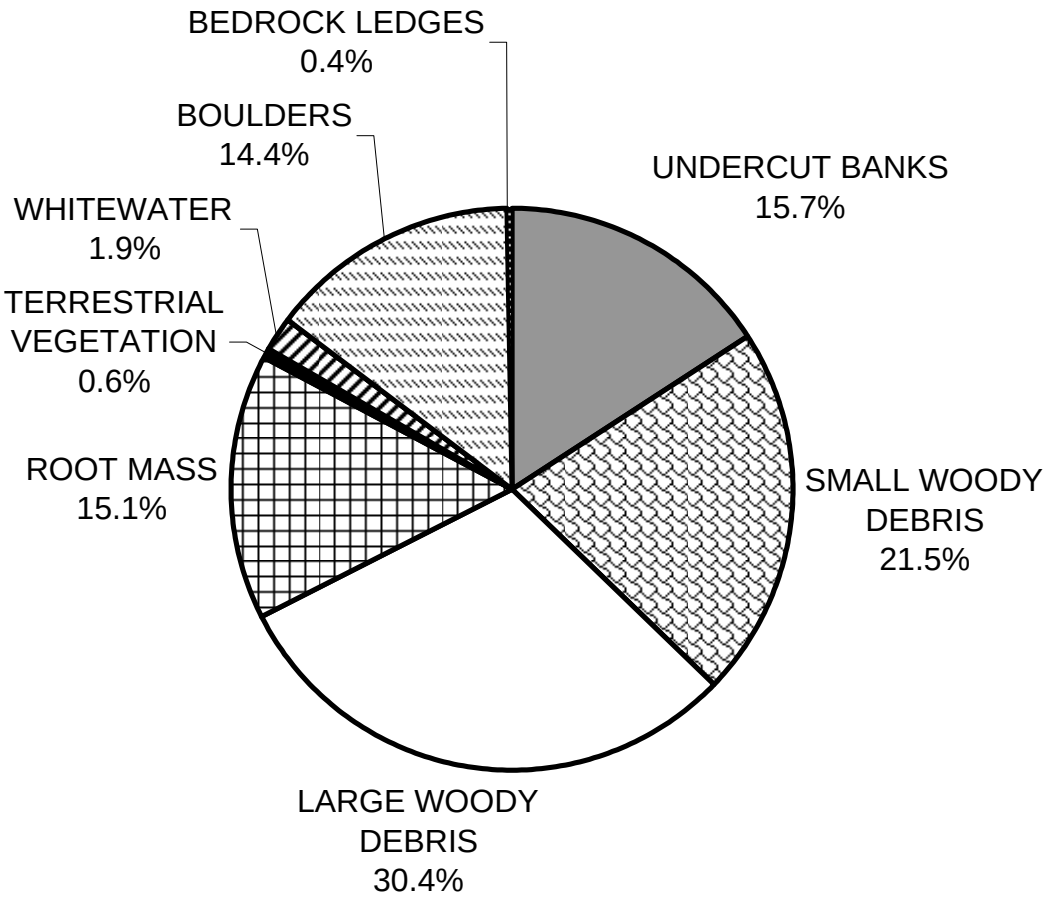
GRAPH 5

TRAMWAY GULCH 2011
PERCENT EMBEDDEDNESS



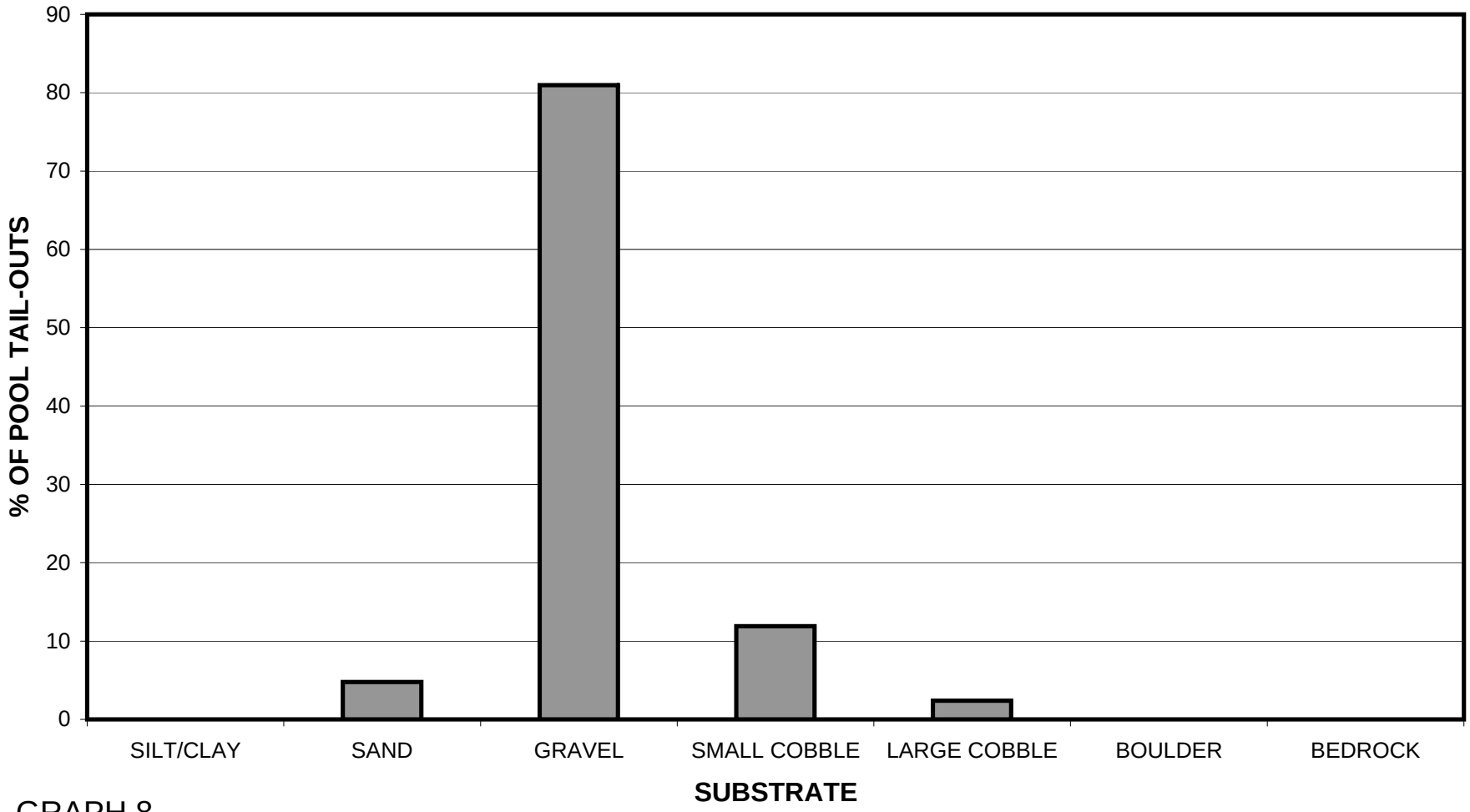
GRAPH 6

TRAMWAY GULCH 2011
MEAN PERCENT COVER TYPES IN POOLS



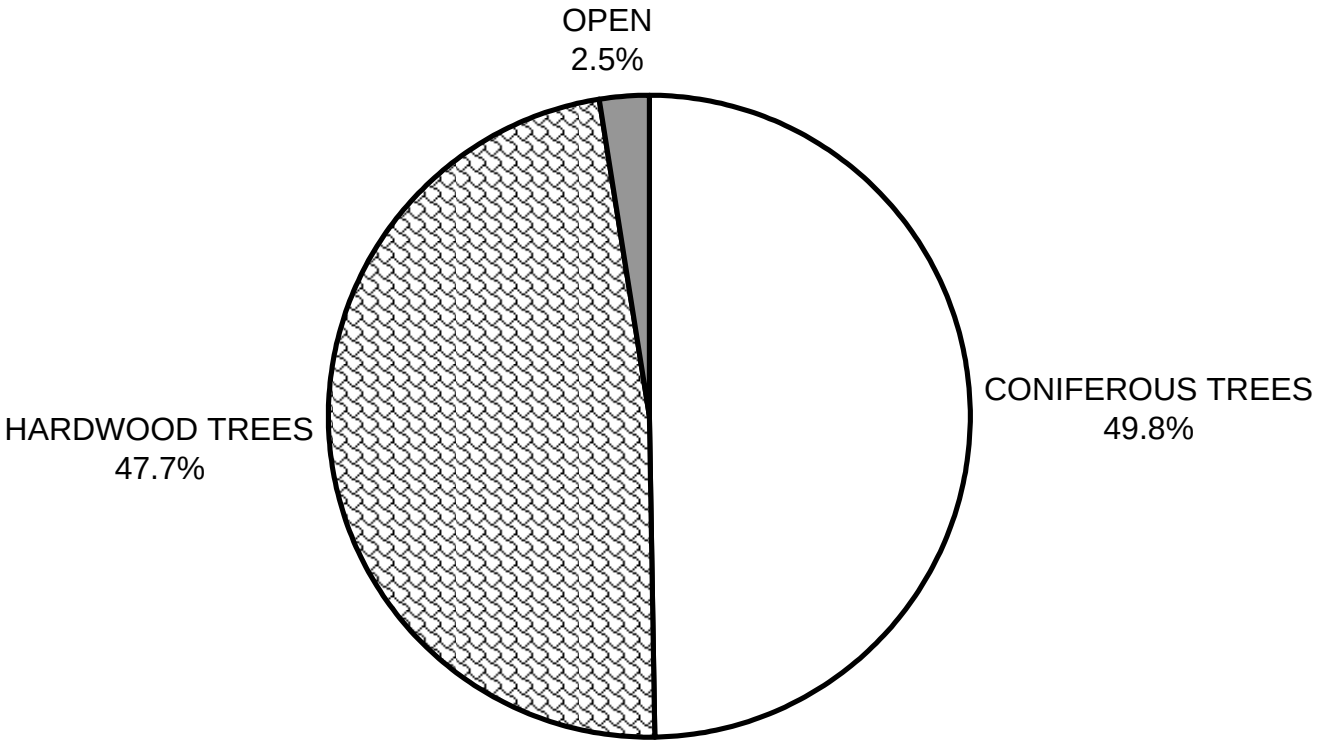
GRAPH 7

TRAMWAY GULCH 2011
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



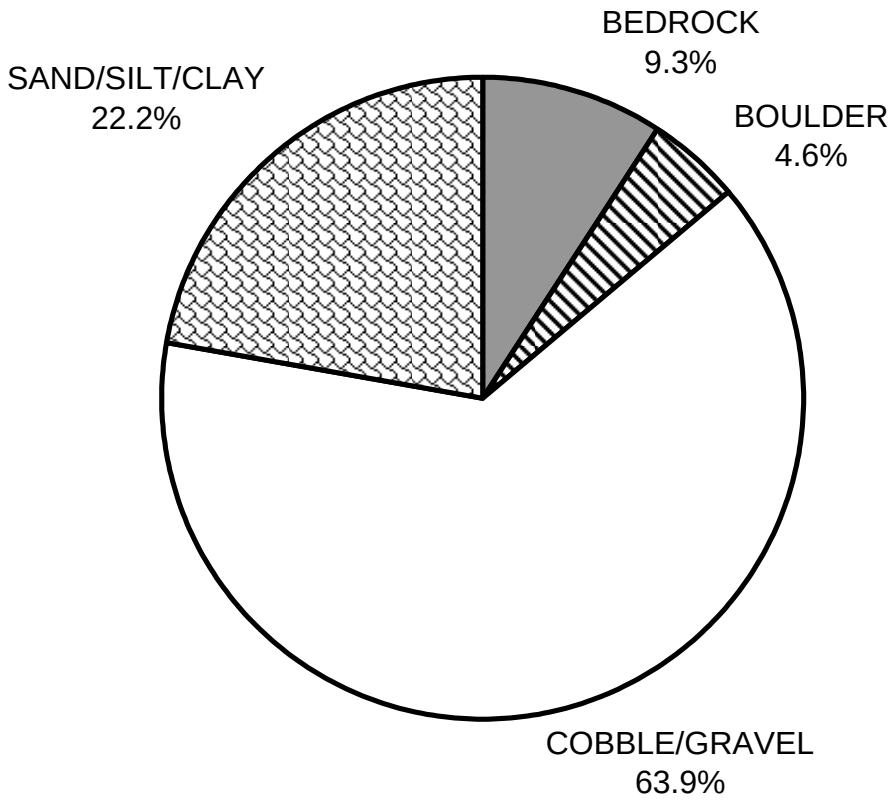
GRAPH 8

TRAMWAY GULCH 2011
MEAN PERCENT CANOPY



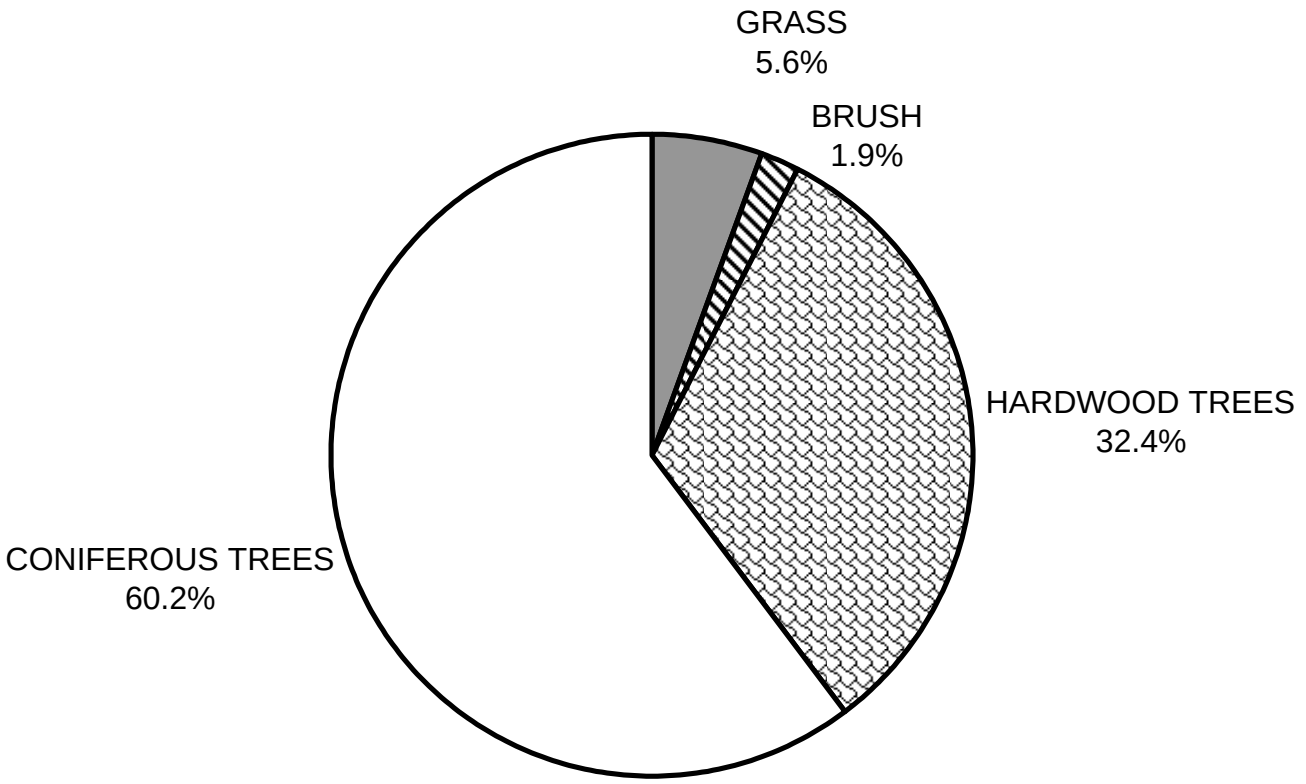
GRAPH 9

TRAMWAY GULCH 2011
DOMINANT BANK COMPOSITION IN SURVEY REACH



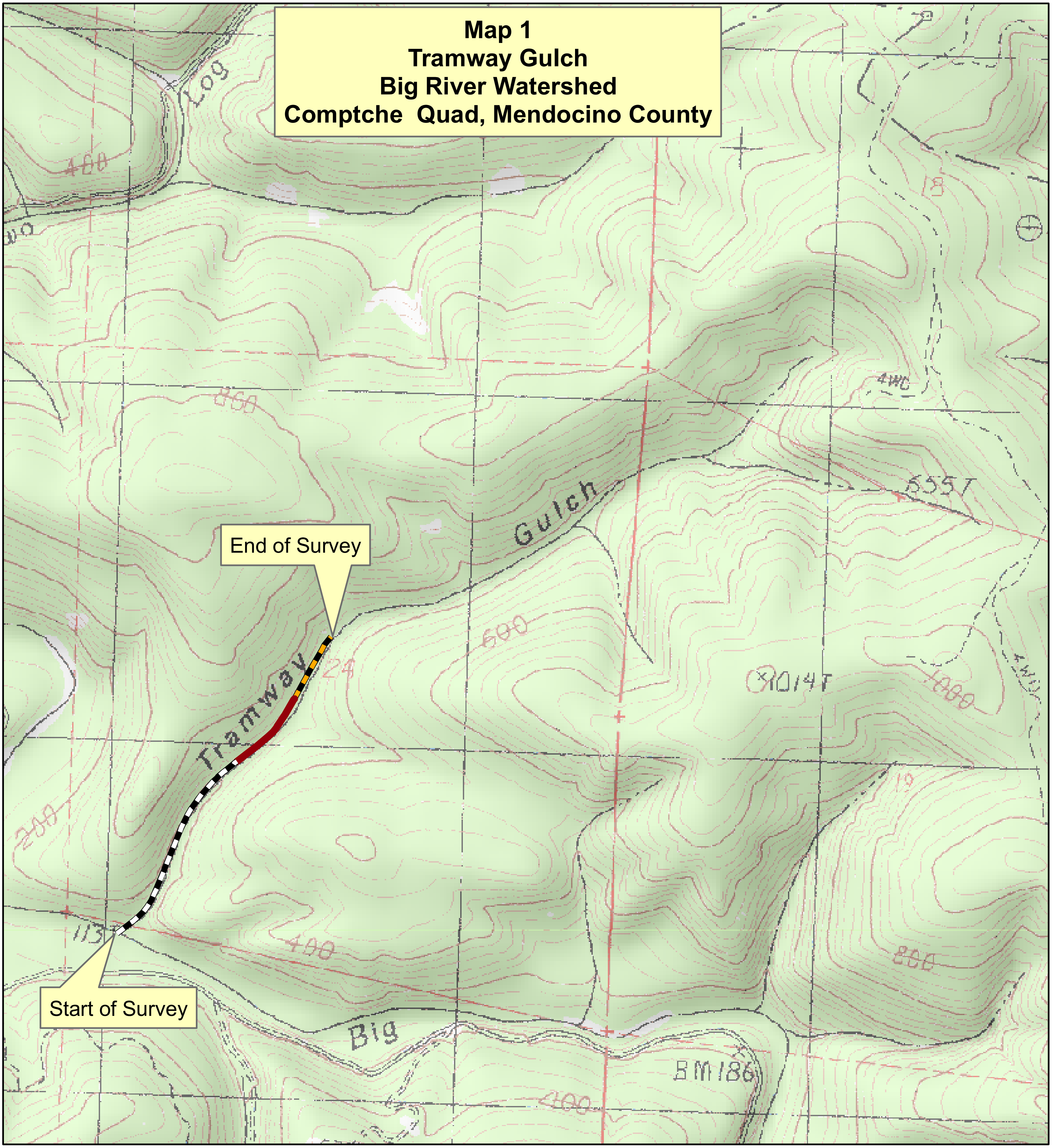
GRAPH 10

TRAMWAY GULCH 2011
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

Map 1
Tramway Gulch
Big River Watershed
Comptche Quad, Mendocino County



Legend

- Reach 1, B4 Channel Type
- Reach 2, E3 Channel Type
- Reach 3, B3 Channel Type

0 1,000 2,000 Feet