

STREAM INVENTORY REPORT

Tank 4 Gulch

INTRODUCTION

A stream inventory was conducted on August 22, 2012 on Tank 4 Gulch. The survey began at the confluence with Flynn Creek and extended upstream 0.4 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Tank 4 Gulch.

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

WATERSHED OVERVIEW

Tank 4 Gulch is a tributary to Flynn Creek, a tributary to the North Fork Navarro River, a tributary to the Navarro River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Tank 4 Gulch's legal description at the confluence with Flynn Creek is T16N R16W S35. Its location is 39.2031 degrees north latitude and 123.6065 degrees west longitude, LLID number 1236053392030. Tank 4 Gulch is a first order stream and has approximately one mile of blue line stream according to the USGS Navarro 7.5 minute quadrangle. Tank 4 Gulch drains a watershed of approximately 0.9 square miles. Elevations range from about 215 feet at the mouth of the creek to 600 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 Flynn Creek Road, approximately five miles south of Comptche, CA.

METHODS

The habitat inventory conducted in Tank 4 Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Wildlife (CDFW) personnel that conducted the inventory were trained in standardized habitat inventory methods by the 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 measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and

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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 Tank 4 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". Tank 4 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.

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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 Tank 4 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 Tank 4 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Tank 4 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 Tank 4 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.

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10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.19, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and 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 Tank 4 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

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- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

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

The habitat inventory of August 22, 2012 was conducted by M. Groff and I. Mikus, (CDFW). The total length of the stream surveyed was 2,339 feet.

Stream flow was not measured on Tank 4 Gulch.

Tank 4 Gulch is an E4 channel type for 1,372 feet of the stream surveyed (Reach 1), an A2 channel type for 288 feet of the stream surveyed (Reach 2), and an E4 channel type for 679 feet of the stream surveyed (Reach 3). E4 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 gravel-dominant substrates. A2 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and boulder-dominant substrates.

The water temperature taken during the survey period was 54 degrees Fahrenheit. Air temperatures ranged from 52 to 57 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 38% pool units, 28% dry units, 21% flatwater units, and 14% riffle units (Graph 1). Based on total length of Level II habitat types there were 45% dry units, 32% pool units, 16% flatwater units, and 7% riffle units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 35%; dry units, 28%; and run units, 11% (Graph 3). Based on percent total length, dry units made up 45%, mid-channel pool units 31%, and step run units 12%.

A total of 30 pools were identified (Table 3). Main channel pools were the most frequently encountered at 93% (Graph 4), and comprised 96% 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. Five of the 30 pools (17%) had a residual depth of two feet or greater (Graph 5).

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The depth of cobble embeddedness was estimated at pool tail-outs. Of the 30 pool tail-outs measured, 12 had a value of 1 (40%); nine had a value of 2 (30%); two had a value of 3 (6.7%); one had a value of 4 (3.3%); six had a value of 5 (20%) (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 0, flatwater habitat types had a mean shelter rating of 0, and pool habitats had a mean shelter rating of 2 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 3. Scour pools had a mean shelter rating of 0 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Tank 4 Gulch. Graph 7 describes the pool cover in Tank 4 Gulch. Small woody debris is the dominant pool cover type followed by undercut banks.

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 73% of the pool tail-outs. Bedrock was the next most frequently observed dominant substrate type and occurred in 17% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Tank 4 Gulch was 98%. Two percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 31% and 69%, respectively. Graph 9 describes the mean percent canopy in Tank 4 Gulch.

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 85% sand/silt/clay, 12% bedrock, and 2% cobble/gravel (Graph 10). Coniferous trees were the dominant vegetation type observed in 66% of the units surveyed. Additionally, 27% of the units surveyed had deciduous trees as the dominant vegetation type, and 6% had brush as the dominant vegetation type (Graph 11).

DISCUSSION

Tank 4 Gulch is an E4 channel type for the first 1,372 feet of stream surveyed, an A2 channel type for the next 288 feet, and an E4 channel type for the remaining 679 feet. The suitability of E4 and A2 channel types for fish habitat improvement structures is as follows: E4 channel types are good for bank-placed boulders and fair for opposing wing-deflectors. A2 channels are generally not suitable for fish habitat improvement projects.

The water temperature recorded on the survey day August 22, 2012 was 54 degrees Fahrenheit. Air temperatures ranged from 52 to 57 degrees Fahrenheit. This is a suitable water temperature

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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 16% of the total length of this survey, riffles 7%, and pools 32%. Five of the 30 (17%) 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 large wood structures that will increase or deepen pool habitat is recommended.

Twenty-one of the 30 pool tail-outs measured had embeddedness ratings of 1 or 2. Three of the pool tail-outs had embeddedness ratings of 3 or 4. Six of the pool tail-outs had a rating of 5, which is considered not suitable 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.

Twenty-two of the 30 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 2. The shelter rating in the flatwater habitats is 0. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by small woody debris in Tank 4 Gulch. Small woody debris is the dominant cover type in pools followed by undercut banks. 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 98%. Reach 1 had a canopy density of 97%, Reach 2 had a canopy density of 99%, 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 100% and 100%, respectively.

RECOMMENDATIONS

- 1) Tank 4 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) In the E4 channel type, increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from small woody debris. Adding high quality

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complexity with woody cover in the pools is desirable.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

Position (ft):	Habitat unit #:	Comments:
0	0001.00	Start of survey at the confluence with Flynn Creek. The channel is an E4. The first 83 feet of Tank 4 Gulch were dry.
83	0002.00	Remnants of a log bridge across the channel. The bridge was approximately 3' high x 8' long x 80' wide. Most of the logs are gone, but several still span the channel. There is a man-made berm on the right bank. It appears that the road met the creek on the right bank at the upstream end of the berm, followed the bridge approximately 80 feet downstream, then continued on to the left bank. There is a log debris accumulation (LDA) at the upstream end of the old bridge.
137	0005.00	Substrate of pool is covered with orange algae.
148	0006.00	Log debris accumulation (LDA) #01 contains seven pieces of large woody debris (LWD) and measures 6' high x 15' wide x 12' long. Water does not flow through the LDA; the channel is dry for 122 feet above it. There are visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 12' wide x 80' long x 1' deep. Fish were observed above the LDA.
1123	0038.00	LDA #02 contains nine pieces of LWD and measures 7' high x 25' wide x 12' long. Water does not flow through the LDA; the channel is dry for 191 feet above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 10' wide x 100' long x 2.5' deep. Fish were observed above the LDA.
1372	0041.00	The channel changes from an E4 to an A2.
1556	0050.00	An age 1+ salmonid observed.
1660	0056.00	The channel changes from an A2 to an E4. There is a 2.7' high plunge over roots and woody debris.
1855	0061.00	There is a 1.5' high plunge over roots and sediment.

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- 1990 0070.00 There is a dry tributary on right bank. LDA #03 contains 10 pieces of LWD and measures 4' high x 32' wide x 10' long. Water does not flow through the LDA; the channel is dry for 96 feet above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 10' wide x 100' long x 2' deep. Fish were observed above the LDA.
- 2329 0080.00 End of survey at a 5' high plunge over silt/clay and root mass. Visual observation for approximately 6,000 feet upstream of end of survey point found the channel to be more than 95% dry. The channel is entirely dry for approximately 1,300 feet past habitat unit 080, then short sections of wet interspersed with long sections of dry. Two young-of-the-year salmonids were observed in a pool approximately 2,600 feet upstream of 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.

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LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE

Low Gradient Riffle	(LGR)	[1.1]	{ 1 }
High Gradient Riffle	(HGR)	[1.2]	{ 2 }

CASCADE

Cascade	(CAS)	[2.1]	{ 3 }
Bedrock Sheet	(BRS)	[2.2]	{24}

FLATWATER

Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}

MAIN CHANNEL POOLS

Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}

SCOUR POOLS

Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }

BACKWATER POOLS

Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}

ADDITIONAL UNIT DESIGNATIONS

Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	

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

Stream Name: Tank Gulch

LLID: 1236053392030 Drainage: Navarro River

Survey Dates: 8/22/2012 to 8/22/2012

Confluence Location: Quad: NAVARRO Legal Description: T16NR16WS35 Latitude: 39:12:11.0N Longitude: 123:36:19.0

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
22	0	DRY	27.5	48	1053	45.0									
17	7	FLATWATER	21.3	21	364	15.6	3.4	0.4	0.7	86	1466	38	643		0
30	30	POOL	37.5	25	751	32.1	5.0	0.9	1.6	135	4054	151	4539	144	2
11	4	RIFFLE	13.8	16	171	7.3	1.4	0.1	0.3	24	261	2	26		0
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
80	41				2339					5781			5208		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Tank Gulch

LLID: 1236053392030

Drainage: Navarro River

Survey Dates: 8/22/2012 to 8/22/2012

Confluence Location: Quad: NAVARRO

Legal Description: T16NR16WS35

Latitude: 39:12:11.0N

Longitude: 123:36:19.0W

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 (%)
3	1	LGR	3.8	12	35	1.5	0	0.1	0.1	3	8	0	1		0	100
6	2	HGR	7.5	20	120	5.1	2	0.1	0.4	43	256	4	26		0	98
2	1	BRS	2.5	8	16	0.7	1	0.1	0.2	7	14	1	1		0	100
9	3	RUN	11.3	10	86	3.7	3	0.4	0.9	26	231	10	88		0	96
8	4	SRN	10.0	35	278	11.9	4	0.4	0.9	132	1053	59	471		0	97
28	28	MCP	35.0	26	718	30.7	5	0.9	3.4	137	3832	156	4373	149	3	98
1	1	CRP	1.3	13	13	0.6	6	1.1	1.9	78	78	94	94	86	0	99
1	1	PLP	1.3	20	20	0.9	8	0.4	1	144	144	72	72	58	0	99
22	0	DRY	27.5	48	1053	45.0										

Total Units
80

Total Units Fully Measured
41

Total Length (ft.)
2339

Total Area (sq.ft.)
5616

Total Volume (cu.ft.)
5126

Table 3 - Summary of Pool Types

Stream Name: Tank Gulch

LLID: 1236053392030

Drainage: Navarro River

Survey Dates: 8/22/2012 to 8/22/2012

Confluence Location: Quad: NAVARRO

Legal Description: T16NR16WS35

Latitude: 39:12:11.0N

Longitude: 123:36:19.0W

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
28	28	MAIN	93	26	718	96	4.9	0.9	137	3832	149	4169	3
2	2	SCOUR	7	17	33	4	7.0	0.8	111	222	72	143	0

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
30	30	751	4054	4313

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

Stream Name: Tank Gulch

LLID: 1236053392030

Drainage: Navarro River

Survey Dates: 8/22/2012 to 8/22/2012

Confluence Location: Quad: NAVARRO

Legal Description: T16NR16WS35

Latitude: 39:12:11.0N

Longitude: 123:36:19.0W

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
28	MCP	93	5	18	18	64	3	11	2	7	0	0
1	CRP	3	0	0	1	100	0	0	0	0	0	0
1	PLP	3	0	0	1	100	0	0	0	0	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
30	5	17	20	67	3	10	2	7	0	0

Mean Maximum Residual Pool Depth (ft.): 1.6

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Tank Gulch

LLID: 1236053392030

Drainage: Navarro River

Survey Dates: 8/22/2012 to 8/22/2012

Dry Units: 22

Confluence Location: Quad: NAVARRO

Legal Description: T16NR16WS35

Latitude: 39:12:11.0N

Longitude: 123:36:19.0W

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
3	1	LGR	0	0	0	0	0	0	0	0	0
6	2	HGR	0	0	0	0	0	0	0	0	0
2	1	BRS	0	0	0	0	0	0	0	0	0
11	4	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
9	3	RUN	0	0	0	0	0	0	0	0	0
8	4	SRN	0	0	0	0	0	0	0	0	0
17	7	TOTAL FLAT	0	0	0	0	0	0	0	0	0
28	28	MCP	33	42	24	0	0	0	0	0	0
1	1	CRP	0	0	0	0	0	0	0	0	0
1	1	PLP	0	0	0	0	0	0	0	0	0
30	30	TOTAL POOL	33	42	24	0	0	0	0	0	0
80	41	TOTAL	33	42	24	0	0	0	0	0	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Tank Gulch LLID: 1236053392030 Drainage: Navarro River
 Survey Dates: 8/22/2012 to 8/22/2012 Dry Units: 22
 Confluence Location: Quad: NAVARRO Legal Description: T16NR16WS35 Latitude: 39:12:11.0N Longitude: 123:36:19.0W

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
3	1	LGR	0	0	100	0	0	0	0
6	2	HGR	0	0	50	0	0	0	50
2	1	BRS	0	0	0	0	0	0	100
9	3	RUN	0	0	67	0	0	0	33
8	4	SRN	0	0	75	0	0	0	25
28	28	MCP	18	0	75	0	0	0	7
1	1	CRP	0	0	100	0	0	0	0
1	1	PLP	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Tank Gulch

LLID: 1236053392030

Drainage: Navarro River

Survey Dates: 8/22/2012 to 8/22/2012

Confluence Location: Quad: NAVARRO

Legal Description: T16NR16WS35

Latitude: 39:12:11.0N

Longitude: 123:36:19.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
98	69	31	0	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: Tank Gulch LLID: 1236053392030 Drainage: Navarro River
 Survey Dates: 8/22/2012 to 8/22/2012 Survey Length (ft.): 2339 Main Channel (ft.): 2339 Side Channel (ft.): 0
 Confluence Location: Quad: NAVARRO Legal Description: T16NR16WS35 Latitude: 39:12:11.0N Longitude: 123:36:19.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: E4	Canopy Density (%): 97.4	Pools by Stream Length (%): 19.8
Reach Length (ft.): 1372	Coniferous Component (%): 70.0	Pool Frequency (%): 30.0
Riffle/Flatwater Mean Width (ft.): 2.5	Hardwood Component (%): 30.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 92
Range (ft.): 8 to 9	Vegetative Cover (%): 99.9	2 to 2.9 Feet Deep: 0
Mean (ft.): 9	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 8
Std. Dev.: 1	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 3	Mean Max Residual Pool Depth (ft.): 1.6
Water (F): 54 - 54 Air (F): 52 - 56	LWD per 100 ft.:	Mean Pool Shelter Rating: 3
Dry Channel (ft): 864	Riffles: 5	
	Pools: 12	
	Flat: 10	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 92 Sm Cobble: 0 Lg Cobble: 8 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 58.3 2. 33.3 3. 8.3 4. 0.0 5. 0.0		

STREAM REACH: 2

Channel Type: A2	Canopy Density (%): 98.8	Pools by Stream Length (%): 23.6
Reach Length (ft.): 288	Coniferous Component (%): 50.5	Pool Frequency (%): 33.3
Riffle/Flatwater Mean Width (ft.): 2.1	Hardwood Component (%): 49.5	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 100
Range (ft.): 11 to 12	Vegetative Cover (%): 100.0	2 to 2.9 Feet Deep: 0
Mean (ft.): 11	Dominant Shelter:	3 to 3.9 Feet Deep: 0
Std. Dev.: 0	Dominant Bank Substrate Type: Bedrock	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 0	Mean Max Residual Pool Depth (ft.): 1.2
Water (F): 54 - 54 Air (F): 55 - 56	LWD per 100 ft.:	Mean Pool Shelter Rating: 0
Dry Channel (ft): 0	Riffles: 2	
	Pools: 4	
	Flat: 4	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 0 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 100		
Embeddedness Values (%): 1. 20.0 2. 0.0 3. 0.0 4. 0.0 5. 80.0		

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: E4	Canopy Density (%): 97.7	Pools by Stream Length (%): 60.5
Reach Length (ft.): 679	Coniferous Component (%): 80.0	Pool Frequency (%): 52.0
Riffle/Flatwater Mean Width (ft.): 4.0	Hardwood Component (%): 20.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 69
Range (ft.): 7 to 12	Vegetative Cover (%): 99.2	2 to 2.9 Feet Deep: 23
Mean (ft.): 10	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 8
Std. Dev.: 2	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 11	Mean Max Residual Pool Depth (ft.): 1.7
Water (F): 54 - 54 Air (F): 55 - 57	LWD per 100 ft.:	Mean Pool Shelter Rating: 3
Dry Channel (ft): 189	Riffles: 0	
	Pools: 6	
	Flat: 4	
Pool Tail Substrate (%): Silt/Clay: 15 Sand: 0 Gravel: 85 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 30.8 2. 38.5 3. 7.7 4. 7.7 5. 15.4		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Tank Gulch

LLID: 1236053392030

Drainage: Navarro River

Survey Dates: 8/22/2012 to 8/22/2012

Confluence Location: Quad: NAVARRO

Legal Description: T16NR16WS35

Latitude: 39:12:11.0N

Longitude: 123:36:19.0W

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	7	3	12.2
Boulder	0	0	0.0
Cobble / Gravel	1	1	2.4
Sand / Silt / Clay	33	37	85.4

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	1	0	1.2
Brush	1	4	6.1
Hardwood Trees	14	8	26.8
Coniferous Trees	25	29	65.9
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Tank Gulch

LLID: 1236053392030

Drainage: Navarro River

Survey Dates: 8/22/2012 to 8/22/2012

Confluence Location: Quad: NAVARRO

Legal Description: T16NR16WS35

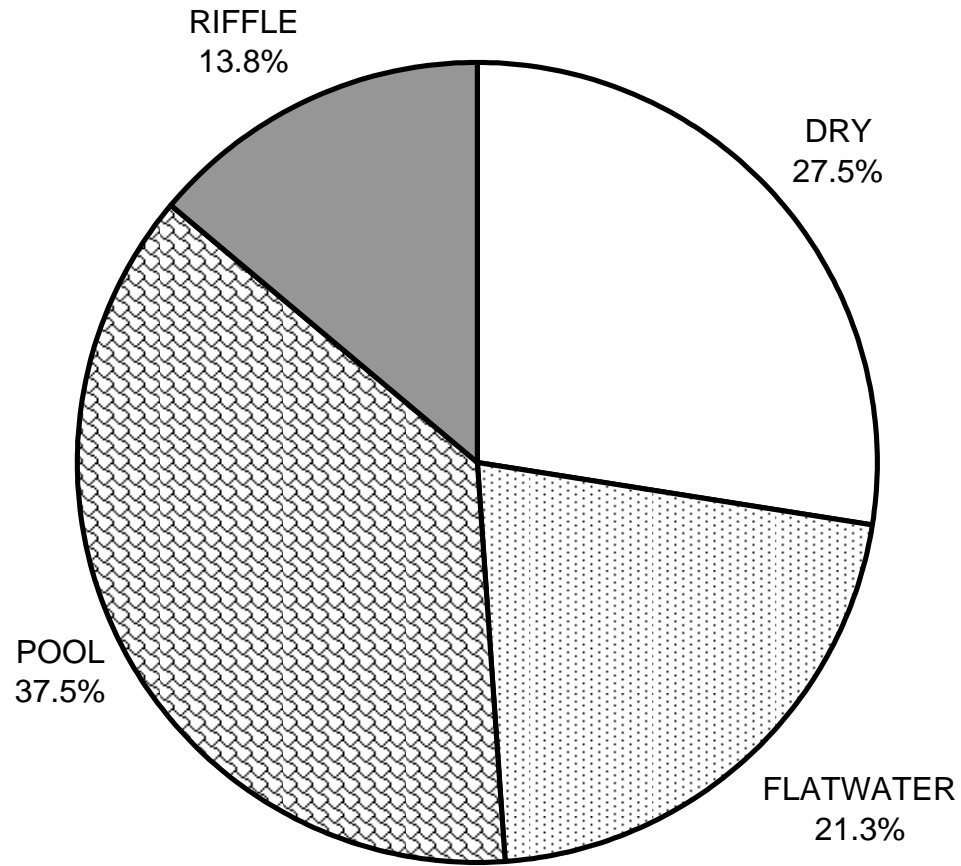
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Longitude: 123:36:19.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	33
SMALL WOODY DEBRIS (%)	0	0	42
LARGE WOODY DEBRIS (%)	0	0	24
ROOT MASS (%)	0	0	0
TERRESTRIAL VEGETATION (%)	0	0	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	0	0
BEDROCK LEDGES (%)	0	0	0

TANK 4 GULCH 2012

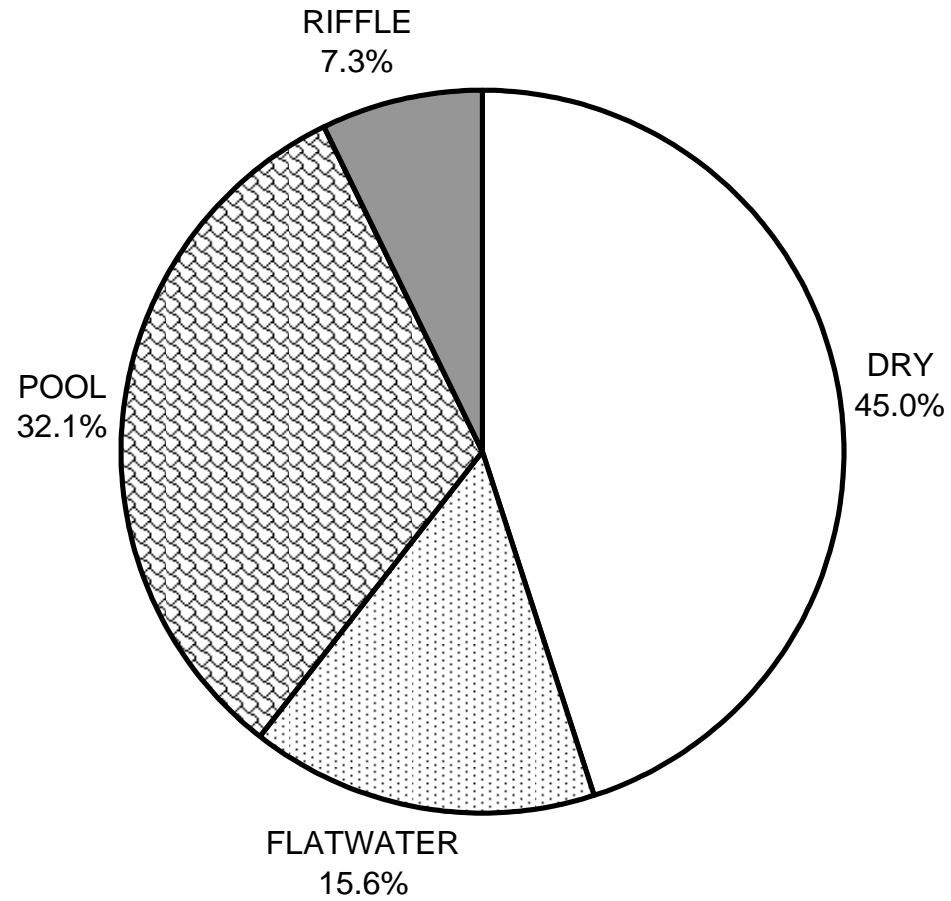
HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

TANK 4 GULCH 2012

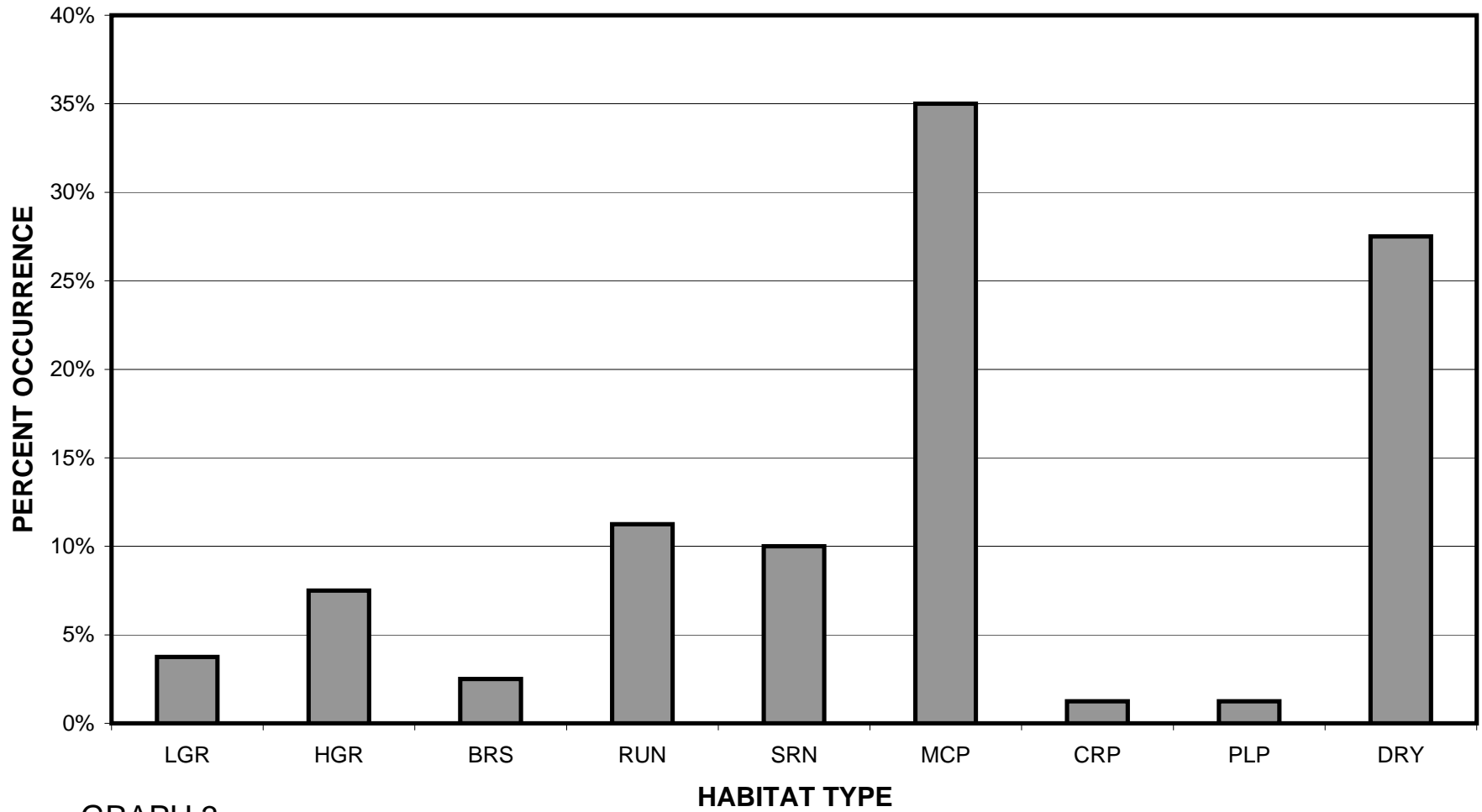
HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

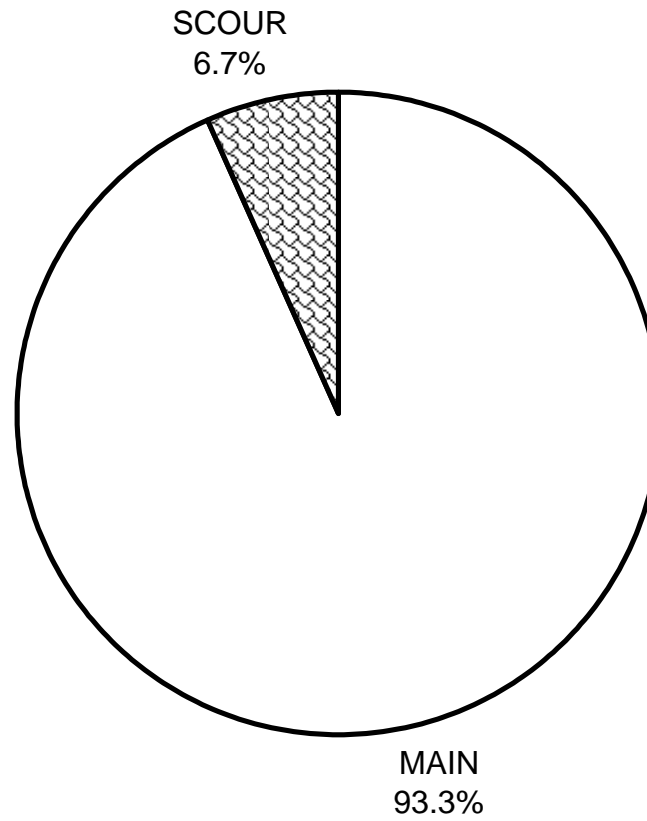
TANK 4 GULCH 2012

HABITAT TYPES BY PERCENT OCCURRENCE



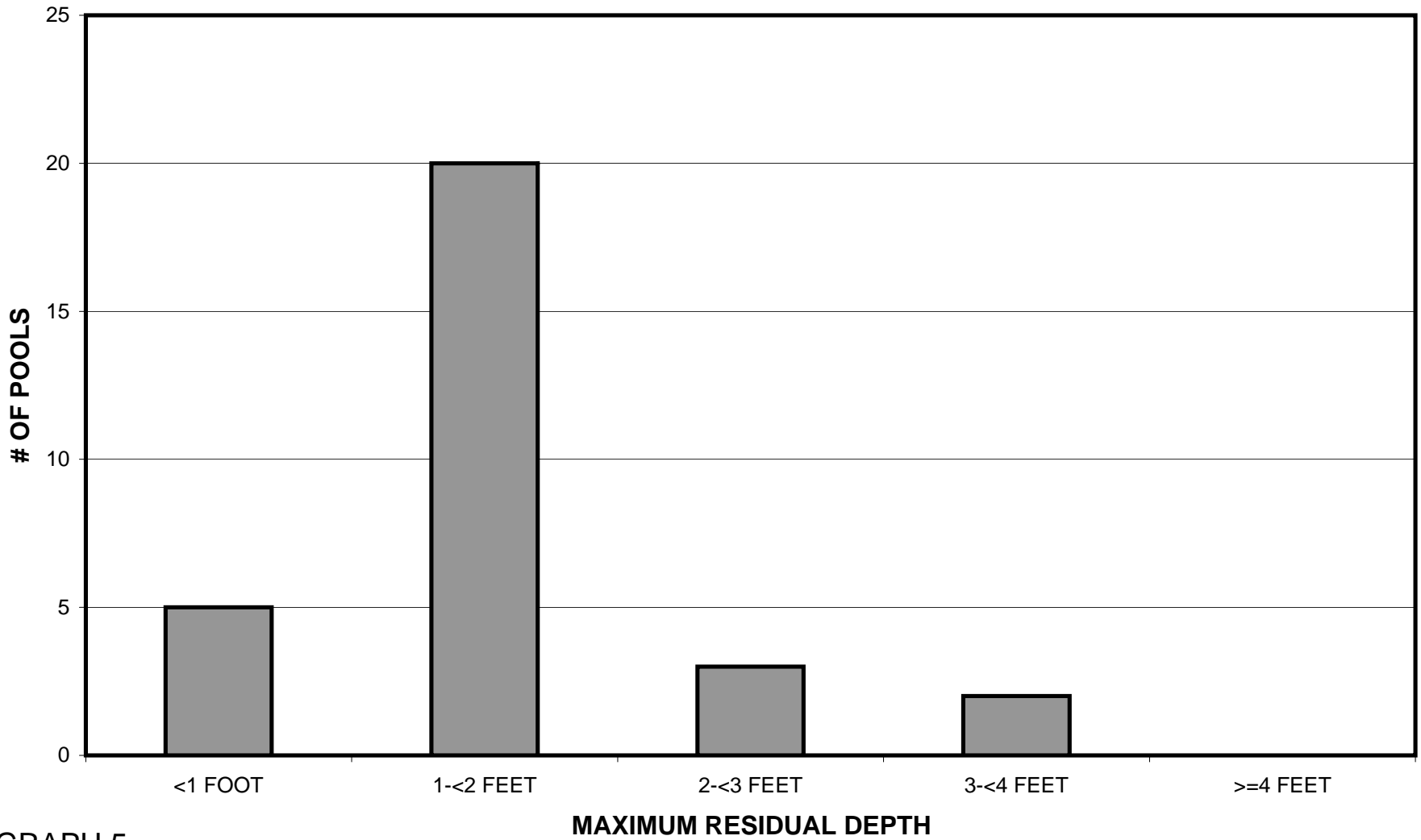
GRAPH 3

**TANK 4 GULCH 2012
POOL TYPES BY PERCENT OCCURRENCE**



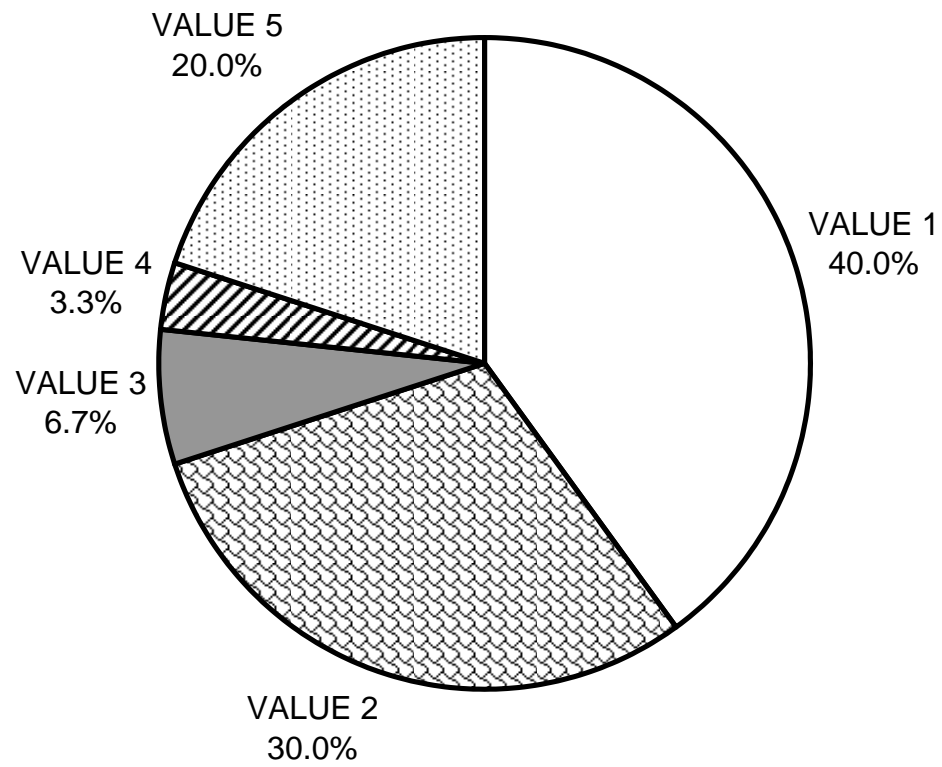
GRAPH 4

TANK 4 GULCH 2012 MAXIMUM DEPTH IN POOLS



GRAPH 5

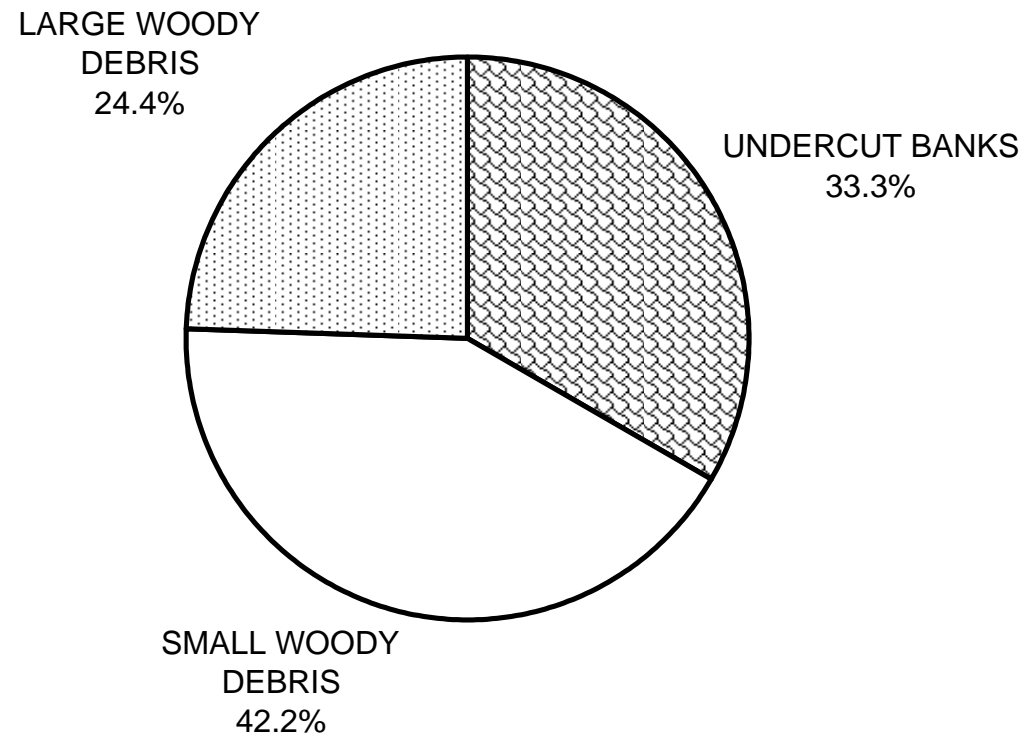
TANK 4 GULCH 2012 PERCENT EMBEDDEDNESS



GRAPH 6

TANK 4 GULCH 2012

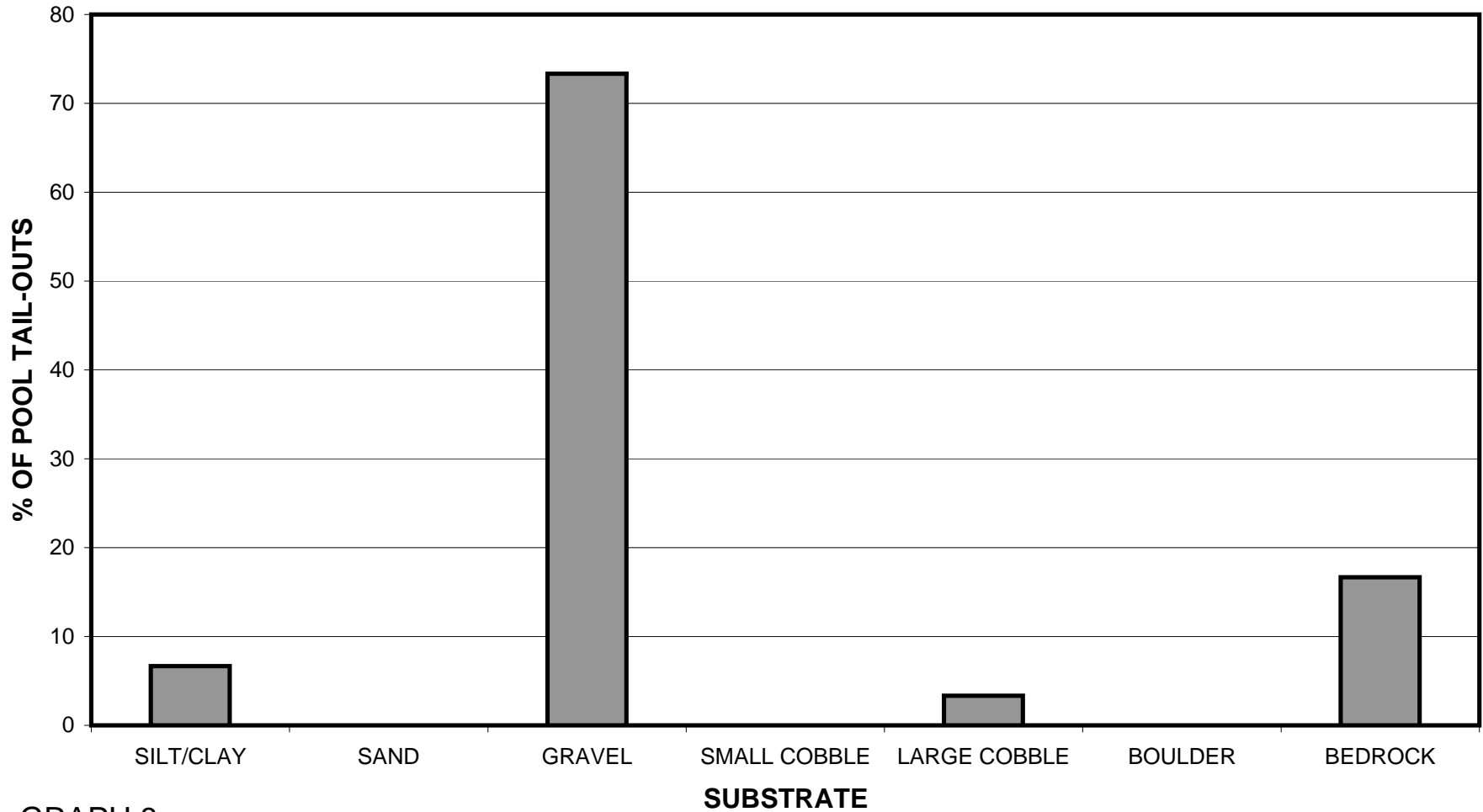
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

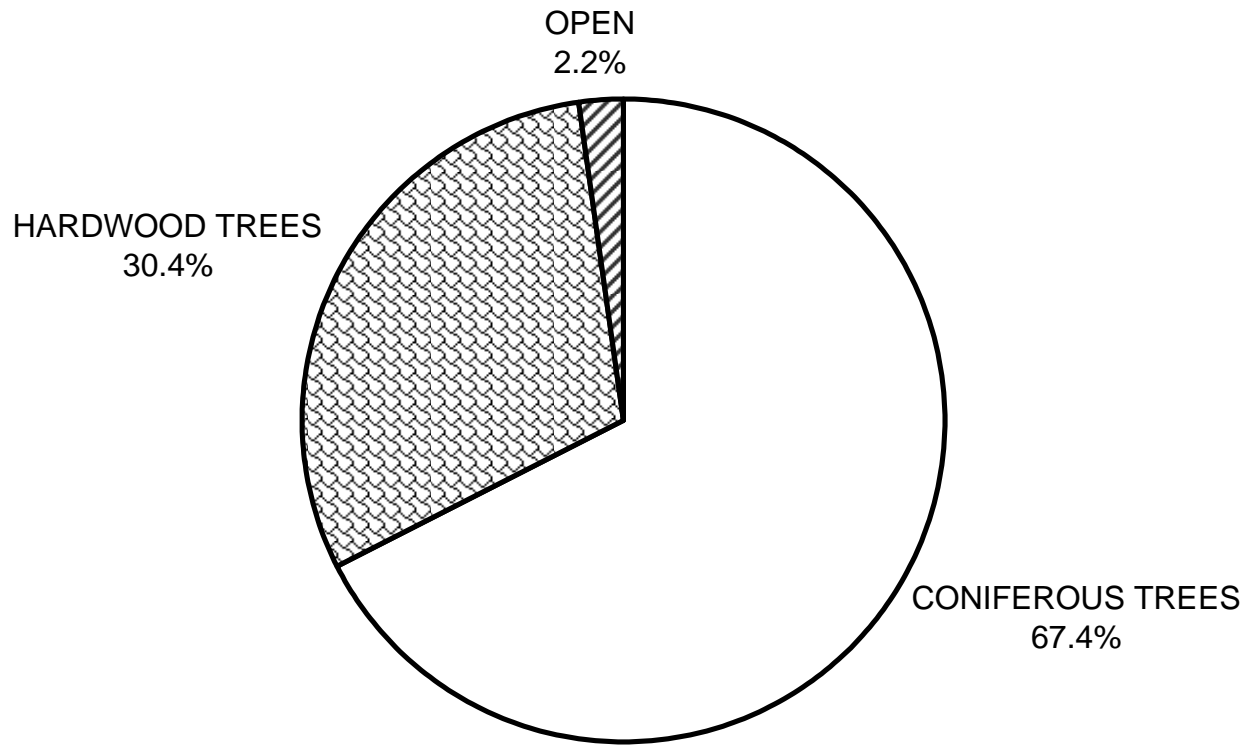
TANK 4 GULCH 2012

SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



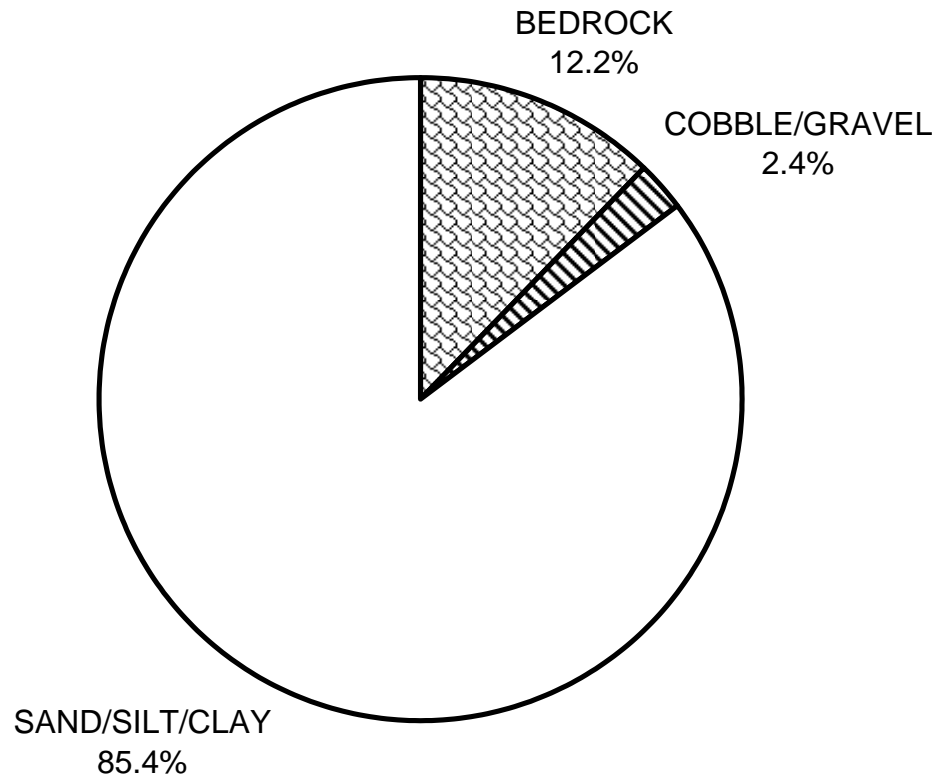
GRAPH 8

TANK 4 GULCH 2012 MEAN PERCENT CANOPY



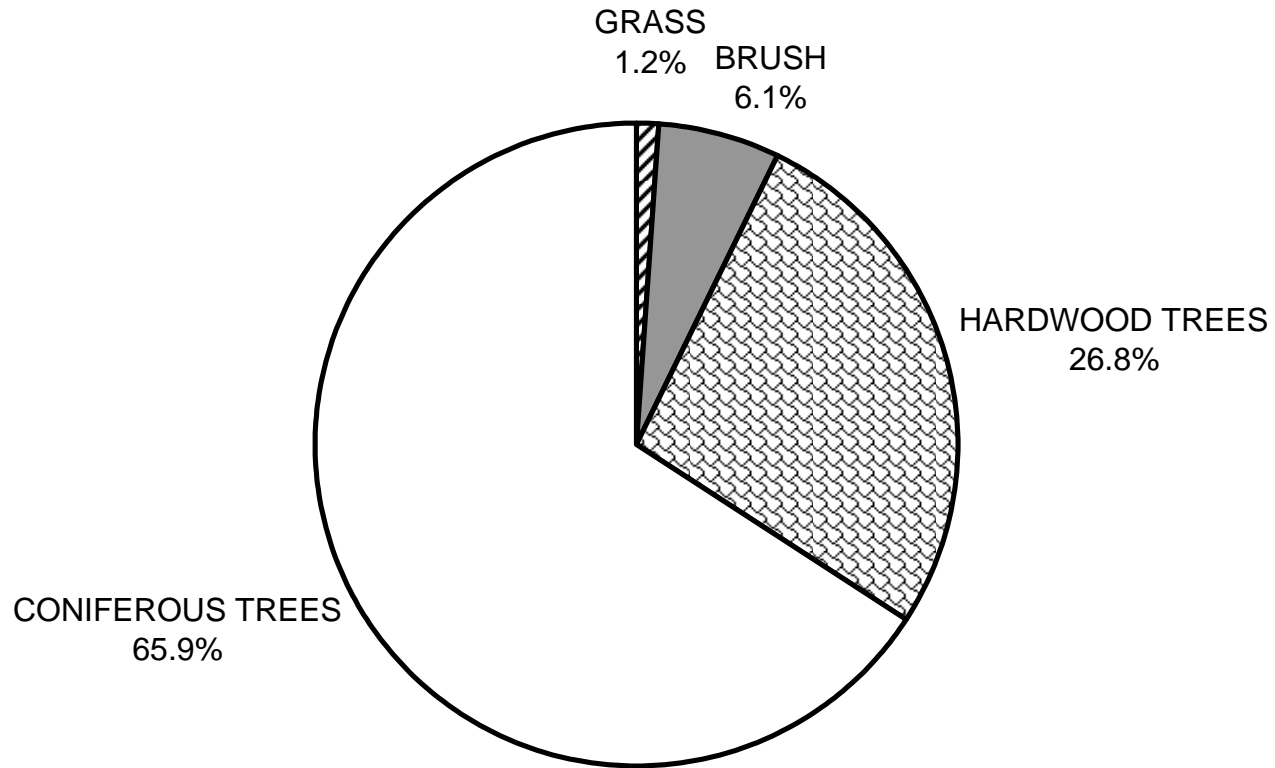
GRAPH 9

**TANK 4 GULCH 2012
DOMINANT BANK COMPOSITION IN SURVEY REACH**



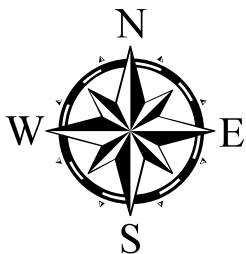
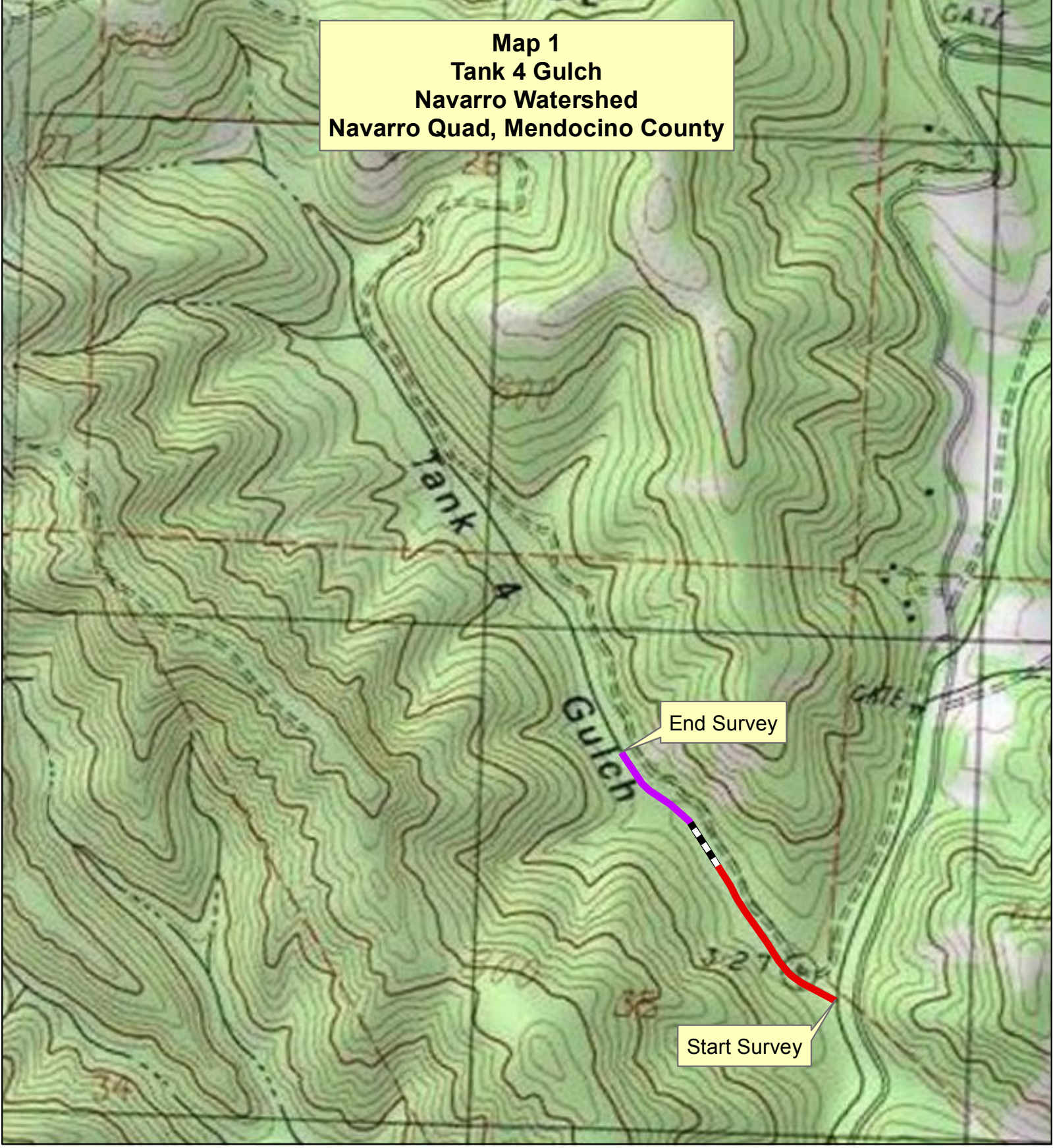
GRAPH 10




TANK 4 GULCH 2012
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

**Map 1
Tank 4 Gulch
Navarro Watershed
Navarro Quad, Mendocino County**



-  Reach 1, Channel Type E4
-  Reach 2, Channel Type A2
-  Reach 3, Channel Type E4

