

STREAM INVENTORY REPORT

Norden Gulch

INTRODUCTION

A stream inventory was conducted on October 18, 2011 on Norden Gulch. The survey began at the confluence with the South Fork Albion River and extended upstream 0.4 miles.

The Norden 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 Norden 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

Norden Gulch is a tributary to the South Fork Albion River, tributary to the Albion River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Norden Gulch's legal description at the confluence with the South Fork Albion River is T16N R16W S16. Its location is 39.2404 degrees north latitude and 123.6560 degrees west longitude, LLID number 1236549392404. Norden Gulch is an intermittent stream according to the USGS Elk 7.5 minute quadrangle. Norden Gulch drains a watershed of approximately 0.7 square miles. Elevations range from about 130 feet at the mouth of the creek to 970 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 a private logging road off Flynn Creek Road.

METHODS

The habitat inventory conducted in Norden 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 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

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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 Norden 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". Norden 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 Norden Gulch, embeddedness was

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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 Norden 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 Norden 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 Norden 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

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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 Norden Gulch. In addition, underwater observations were made at 14 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

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Norden Gulch include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence

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- 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 October 18, 2011 was conducted by M. Groff and I. Mikus (DFG). The total length of the stream surveyed was 2,126 feet.

Stream flow was not measured on Norden Gulch.

Norden Gulch is a G4 channel type for 1,485 feet of the stream surveyed (Reach 1), and an A4 channel type for 641 feet of the stream surveyed (Reach 2). G4 channels are entrenched “gully” step-pool channels on moderate gradients with low width /depth ratios and gravel-dominant substrates. A4 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and gravel-dominant substrates.

The water temperature taken during the survey period was 55 degrees Fahrenheit. Air temperatures ranged from 53 to 60 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 32% flatwater units, 32% pool units, 28% riffle units, and 8% dry units (Graph 1). Based on total length of Level II habitat types there were 46% flatwater units, 22% pool units, 16% riffle units, and 15% dry units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 24%; step run units, 16%; and run units, 16% (Graph 3). Based on percent total length, step run units made up 32%, mid-channel pool units 17%, and dry units 15%.

A total of 26 pools were identified (Table 3). Main channel pools were the most frequently encountered at 73% (Graph 4), and comprised 76% 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. Six of the 26 pools (23%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 26 pool tail-outs measured, 18 had a value of 1 (69.2%); seven had a value of 2 (26.9%); one had a value of 5

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(3.8%) (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 1, and pool habitats had a mean shelter rating of 11 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 13. Scour pools had a mean shelter rating of 6 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Norden Gulch. Graph 7 describes the pool cover in Norden 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 85% of the pool tail-outs. Large cobble was the next most frequently observed dominant substrate type and occurred in 8% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Norden Gulch was 98%. Two percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 13% and 87%, respectively. Graph 9 describes the mean percent canopy in Norden Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 97%. The mean percent left bank vegetated was 99%. The dominant elements composing the structure of the stream banks consisted of 73% sand/silt/clay, 19% cobble/gravel, 6% boulder, and 3% bedrock (Graph 10). Coniferous trees were the dominant vegetation type observed in 56% of the units surveyed. Additionally, 27% of the units surveyed had brush as the dominant vegetation type, and 14% had deciduous trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at 14 sites for species composition and distribution in Norden Gulch on October 24, 2011. The water temperature taken during the sampling period of 1415 hours to 1500 hours was 54 degrees Fahrenheit. Air temperatures ranged from 60 to 62 degrees Fahrenheit. The sites were sampled by I. Mikus and M. Groff (DFG).

In reach 1, which comprised the first 1,485 feet of stream, seven sites were sampled. The reach sites yielded two age 1+ steelhead/rainbow trout (SH/RT).

In reach 2, five sites were sampled starting approximately 1,629 from the confluence with the South Fork Albion River and continuing upstream 497 feet. The reach sites yielded no fish.

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Two sites were sampled above the end of survey point. The sites yielded no fish.

The following chart displays the information yielded from these sites:

2011 Norden 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: G4 Channel Type									
10/24/11	1	008	Pool	179	0	1	0	0	0
	2	010	Pool	232	0	0	0	0	0
	3	019	Pool	466	0	0	0	0	0
	4	021	Pool	500	0	0	0	0	0
	5	024	Pool	695	0	0	0	0	0
	6	029	Pool	878	0	0	0	0	0
	7	040	Pool	1,134	0	1	0	0	0
Reach 2: A4 Channel Type									
	8	064	Pool	1,651	0	0	0	0	0
	9	072	Pool	1,836	0	0	0	0	0
	10	076	Pool	2,070	0	0	0	0	0
	11	077	Pool	2,090	0	0	0	0	0
	12	080	Pool	2,126	0	0	0	0	0
Above end of survey									
	13	--	Pool	--	0	0	0	0	0
	14	--	Pool	--	0	0	0	0	0

DISCUSSION

Norden Gulch is a G4 channel type for the first 1,485 feet of stream surveyed and an A4 channel type for the remaining 641 feet. The suitability of G4 and A4 channel types for fish habitat improvement structures is as follows: G4 channel types are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover. A4 channels are generally not suitable for fish habitat improvement projects.

The water temperature recorded on the survey day October 18, 2011 was 55 degrees Fahrenheit. Air temperatures ranged from 53 to 60 degrees Fahrenheit. This is a suitable water temperature range for salmonids. To make any conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

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Flatwater habitat types comprised 46% of the total length of this survey, riffles 16%, and pools 22%. Six of the 26 (23%) 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 log structures that will increase or deepen pool habitat is recommended for Reach 1 the G4 channel type.

Twenty-five of the 26 pool tail-outs measured had embeddedness ratings of 1 or 2. None 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.

Twenty-two of the 26 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 11. The shelter rating in the flatwater habitats is 1. 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 Norden 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 98%. Reach 1 had a canopy density of 98%; Reach 2 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 97% and 99%, respectively.

RECOMMENDATIONS

- 1) Norden 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) 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.

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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 the South Fork Albion River. The channel is a G4.
28	0003.00	A logging road crosses the channel. The crossing is an 11.5' high x 14' wide x 54' long railcar bridge. Boulder rip-rap armors the banks on both sides around the bridge for approximately 60 feet. Some of the rip-rap has fallen into the channel and may impede fish passage. The right bank is eroding under the bridge. The erosion site measures approximately 10' long x 10' high; it is contributing silt and sand to the channel.
60	0005.00	A logging road crosses the channel. The crossing is a 7.5' high x 13.5' wide x 54' long railcar bridge.
156	0008.00	There is a 2.5' high plunge over root mass and woody debris.
297	0012.00	There is a 1.7' high plunge over silt/clay and woody debris.
472	0021.00	Woody debris is accumulating in the channel. There is a 2.4' high plunge over silt/clay.
910	0031.00	Log debris accumulation (LDA) #01 contains over five pieces of large woody debris (LWD) and measures 4' high x 22' wide x 10' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to gravel and measures 10' wide x 30' long x 2' deep. Fish are present above the LDA.
959	0034.00	LDA #02 contains two pieces of LWD and measures 3' high x 12' wide x 4' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to gravel and measures 8' wide x 30' long x 2' deep. Fish are present above the LDA.
1143	0042.00	Tributary #01 enters on the left bank. It contributes approximately 5% to Norden Gulch's flow. The water temperature of the tributary is 55 degrees Fahrenheit; the water temperature downstream and upstream of the tributary is 55 degrees Fahrenheit. The slope of the tributary is approximately 15%.
1217	0045.00	There is a 3' high plunge over silt/clay.

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1228	0046.00	There is a 3' high plunge over root mass and woody debris.
1485	0058.00	The channel changes from a G4 to an A4.
1541	0060.00	The right bank is eroding under a redwood rootwad. The erosion site measures approximately 20' long x 10' high; it is contributing fine sediment to the channel.
1590	0063.00	Right bank seep.
1700	0068.00	LDA #03 contains seven pieces of LWD and measures 3.5' high x 16' wide x 12' long. Water does not flow through the LDA; the channel is dry for 20' above it. There are no visible gaps in the LDA. The LDA is not retaining sediment. No fish were observed upstream of the LDA. There is a 3' high plunge over cobble and woody debris approximately 5' upstream from the LDA.
1828	0072.00	LDA #04 contains eight pieces of LWD and measures 6' high x 34' wide x 8' long. Water does not flow through the LDA; the channel is dry for 204' above the LDA. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 30' wide x 100' long x 3' deep.
2118	0080.00	End of survey. There is an LDA with a 6' high plunge over it. It contains over 10 pieces of LWD and measures approximately 10' long x 30' wide. No fish were observed above Habitat Unit #040.

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: Norden Gulch

LLID: 1236549392404

Drainage: Albion River

Survey Dates: 10/18/2011 to 10/18/2011

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS16

Latitude: 39:14:25.0N

Longitude: 123:39:18.0

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
6	0	DRY	7.5	54	327	15.4									
26	5	FLATWATER	32.5	37	972	45.7	3.2	0.3	0.6	72	1870	24	613		1
26	26	POOL	32.5	18	478	22.5	6.3	0.8	1.5	110	2865	117	3044	105	11
22	4	RIFFLE	27.5	16	349	16.4	3.6	0.1	0.3	43	945	4	95		0
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
80	35				2126					5680			3752		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Norden Gulch

LLID: 1236549392404

Drainage: Albion River

Survey Dates: 10/18/2011 to 10/18/2011

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS16

Latitude: 39:14:25.0N

Longitude: 123:39:18.0W

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 (%)
12	2	LGR	15.0	13	159	7.5	3	0.1	0.3	25	300	2	30		0	98
10	2	HGR	12.5	19	190	8.9	4	0.1	0.4	61	610	6	61		0	99
13	3	RUN	16.3	22	282	13.3	3	0.3	0.6	53	688	16	206		2	98
13	2	SRN	16.3	53	690	32.5	3	0.3	0.9	100	1306	35	457		0	97
19	19	MCP	23.8	19	361	17.0	6	0.8	3.5	112	2121	123	2335	109	13	98
4	4	LSBk	5.0	16	63	3.0	6	0.5	1.5	89	355	51	204	42	5	96
3	3	PLP	3.8	18	54	2.5	7	1.2	2.2	130	389	168	505	159	8	98
6	0	DRY	7.5	54	327	15.4										

Total Units
80

Total Units Fully Measured
35

Total Length (ft.)
2126

Total Area (sq.ft.)
5768

Total Volume (cu.ft.)
3798

Stream Name:	Norden Gulch	LLID:	1236549392404	Drainage:	Albion River
Survey Dates:	10/18/2011 to 10/18/2011				
Confluence Location:	Quad: MATHISON PEAK	Legal Description:	T16NR16WS16	Latitude:	39:14:25.0N
				Longitude:	123:39:18.0W

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
26	26	478	2865	2718

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

Stream Name: Norden Gulch

LLID: 1236549392404

Drainage: Albion River

Survey Dates: 10/18/2011 to 10/18/2011

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS16

Latitude: 39:14:25.0N

Longitude: 123:39:18.0W

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
19	MCP	73	2	11	14	74	2	11	1	5	0	0
4	LSBk	15	1	25	3	75	0	0	0	0	0	0
3	PLP	12	0	0	0	0	3	100	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
26	3	12	17	65	5	19	1	4	0	0

Mean Maximum Residual Pool Depth (ft.): 1.5

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Norden Gulch

LLID: 1236549392404

Drainage: Albion River

Survey Dates: 10/18/2011 to 10/18/2011

Dry Units: 6

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS16

Latitude: 39:14:25.0N

Longitude: 123:39:18.0W

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
12	2	LGR	0	0	0	0	0	0	0	0	0
10	2	HGR	0	0	0	0	0	0	0	0	0
22	4	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
13	3	RUN	0	100	0	0	0	0	0	0	0
13	2	SRN									
26	5	TOTAL FLAT	0	100	0	0	0	0	0	0	0
19	19	MCP	29	23	44	0	0	0	0	4	0
4	4	LSBk	0	43	57	0	0	0	0	0	0
3	3	PLP	0	45	5	0	0	0	0	50	0
26	26	TOTAL POOL	21	28	42	0	0	0	0	8	0
80	35	TOTAL	20	32	40	0	0	0	0	8	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Norden Gulch

LLID: 1236549392404

Drainage: Albion River

Survey Dates: 10/18/2011 to 10/18/2011

Dry Units: 6

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS16

Latitude: 39:14:25.0N

Longitude: 123:39:18.0W

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
12	2	LGR	0	0	100	0	0	0	0
10	2	HGR	0	0	100	0	0	0	0
13	3	RUN	0	0	100	0	0	0	0
13	2	SRN	0	0	100	0	0	0	0
19	19	MCP	5	0	89	0	0	0	5
4	4	LSBk	0	0	100	0	0	0	0
3	3	PLP	33	0	67	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Norden Gulch

LLID: 1236549392404

Drainage: Albion River

Survey Dates: 10/18/2011 to 10/18/2011

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS16

Latitude: 39:14:25.0N

Longitude: 123:39:18.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
98	87	13	0	97	99

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: Norden Gulch

LLID: 1236549392404

Drainage: Albion River

Survey Dates: 10/18/2011 to 10/18/2011

Survey Length (ft.): 2126

Main Channel (ft.): 2126

Side Channel (ft.): 0

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS16

Latitude: 39:14:25.0N

Longitude: 123:39:18.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: G4

Reach Length (ft.): 1485

Riffle/Flatwater Mean Width (ft.): 3.3

BFW:

Range (ft.): 8 to 12

Mean (ft.): 10

Std. Dev.: 1

Base Flow (cfs.): 0.0

Water (F): 55 - 55

Air (F): 53 - 57

Dry Channel (ft): 29

Canopy Density (%): 97.5

Coniferous Component (%): 83.4

Hardwood Component (%): 16.6

Dominant Bank Vegetation: Coniferous Trees

Vegetative Cover (%): 98.2

Dominant Shelter: Small Woody Debris

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 21

LWD per 100 ft.:

Riffles: 5

Pools: 7

Flat: 2

Pools by Stream Length (%): 25.9

Pool Frequency (%): 33.3

Residual Pool Depth (%):

< 2 Feet Deep: 68

2 to 2.9 Feet Deep: 26

3 to 3.9 Feet Deep: 5

>= 4 Feet Deep: 0

Mean Max Residual Pool Depth (ft.): 1.7

Mean Pool Shelter Rating: 11

Pool Tail Substrate (%): Silt/Clay: 0

Sand: 5

Gravel: 89

Sm Cobble: 0

Lg Cobble: 0

Boulder: 0

Bedrock: 5

Embeddedness Values (%): 1. 63.2

2. 31.6

3. 0.0

4. 0.0

5. 5.3

STREAM REACH: 2

Channel Type: A4

Reach Length (ft.): 641

Riffle/Flatwater Mean Width (ft.): 3.5

BFW:

Range (ft.): 8 to 12

Mean (ft.): 11

Std. Dev.: 1

Base Flow (cfs.): 0.0

Water (F): 55 - 55

Air (F): 57 - 60

Dry Channel (ft): 298

Canopy Density (%): 97.8

Coniferous Component (%): 94.2

Hardwood Component (%): 5.8

Dominant Bank Vegetation: Coniferous Trees

Vegetative Cover (%): 98.0

Dominant Shelter: Large Woody Debris

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 27

LWD per 100 ft.:

Riffles: 7

Pools: 24

Flat: 12

Pools by Stream Length (%): 14.5

Pool Frequency (%): 30.4

Residual Pool Depth (%):

< 2 Feet Deep: 100

2 to 2.9 Feet Deep: 0

3 to 3.9 Feet Deep: 0

>= 4 Feet Deep: 0

Mean Max Residual Pool Depth (ft.): 1.1

Mean Pool Shelter Rating: 11

Pool Tail Substrate (%): Silt/Clay: 0

Sand: 0

Gravel: 71

Sm Cobble: 0

Lg Cobble: 29

Boulder: 0

Bedrock: 0

Embeddedness Values (%): 1. 85.7

2. 14.3

3. 0.0

4. 0.0

5. 0.0

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Norden Gulch

LLID: 1236549392404

Drainage: Albion River

Survey Dates: 10/18/2011 to 10/18/2011

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS16

Latitude: 39:14:25.0N

Longitude: 123:39:18.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	2	0	2.9
Boulder	1	3	5.7
Cobble / Gravel	7	6	18.6
Sand / Silt / Clay	25	26	72.9

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	0	0	0.0
Brush	8	11	27.1
Hardwood Trees	6	4	14.3
Coniferous Trees	19	20	55.7
No Vegetation	2	0	2.9

Total Stream Cobble Embeddedness Values:

1

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

StreamName: Norden Gulch

LLID: 1236549392404

Drainage: Albion River

Survey Dates: 10/18/2011 to 10/18/2011

Confluence Location: Quad: MATHISON PEAK

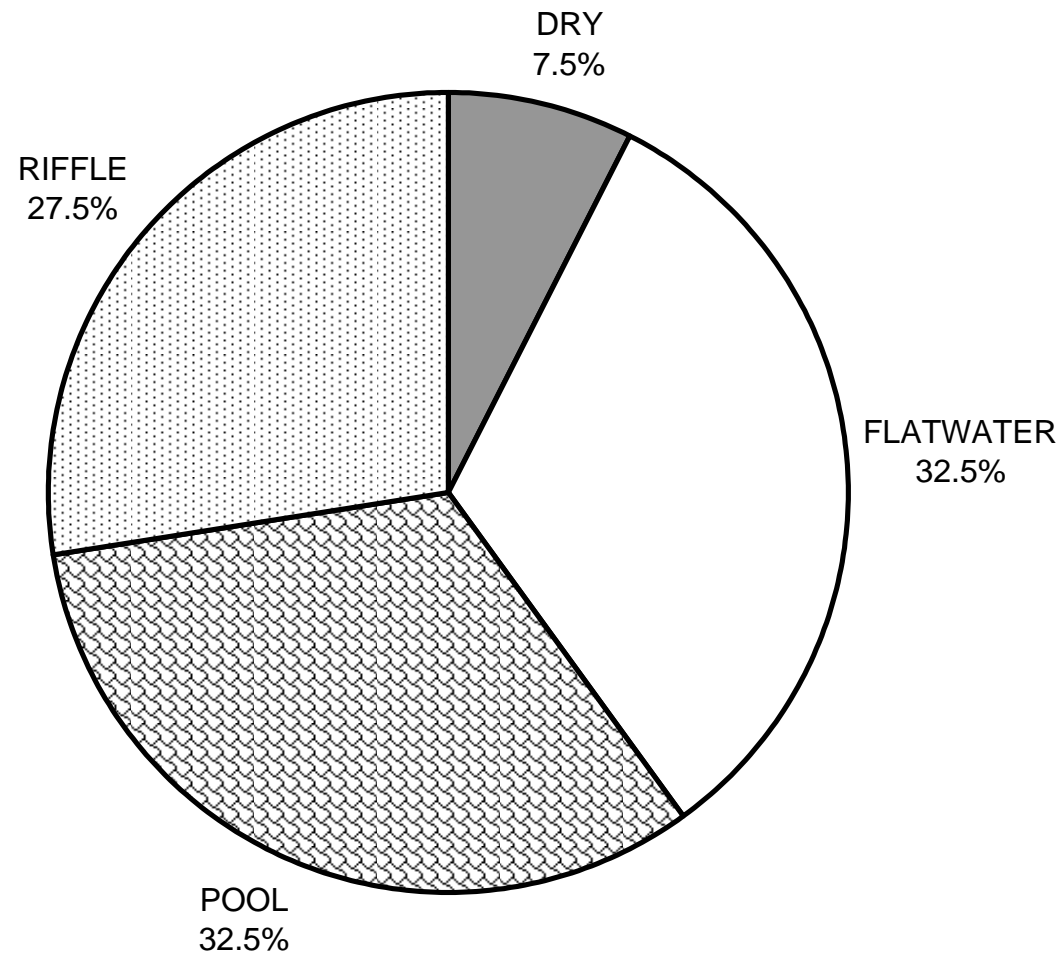
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Longitude: 123:39:18.0W

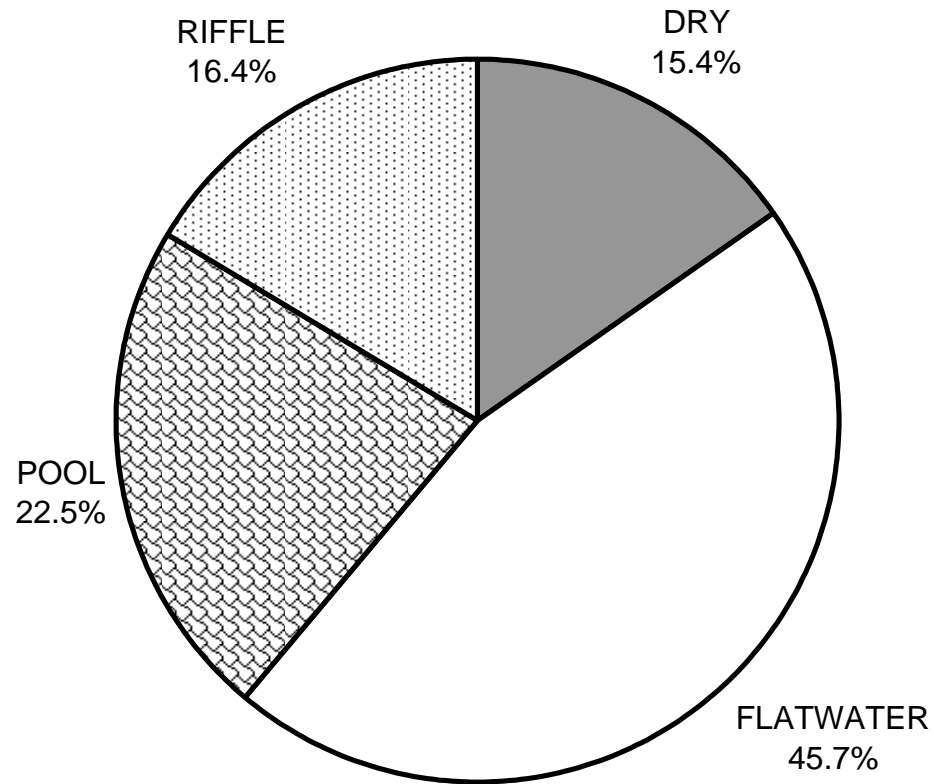
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	21
SMALL WOODY DEBRIS (%)	0	100	28
LARGE WOODY DEBRIS (%)	0	0	42
ROOT MASS (%)	0	0	0
TERRESTRIAL VEGETATION (%)	0	0	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	0	8
BEDROCK LEDGES (%)	0	0	0

NORDEN GULCH 2011
HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

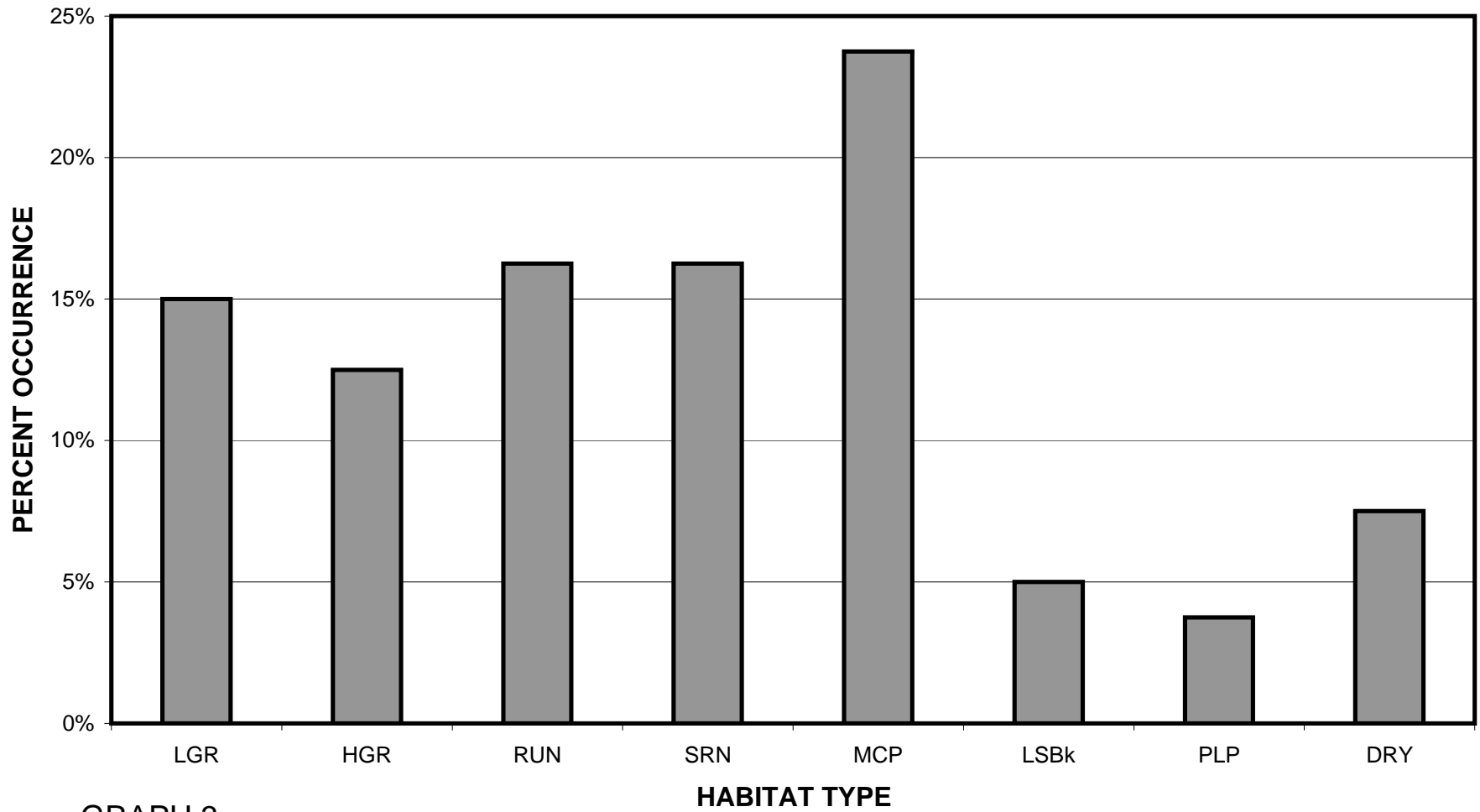
NORDEN GULCH 2011
HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

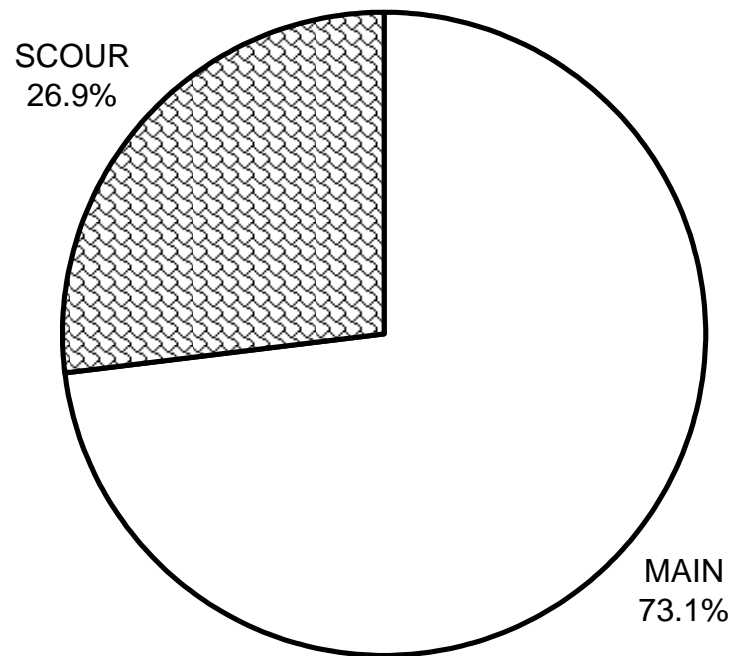
NORDEN GULCH 2011

HABITAT TYPES BY PERCENT OCCURRENCE



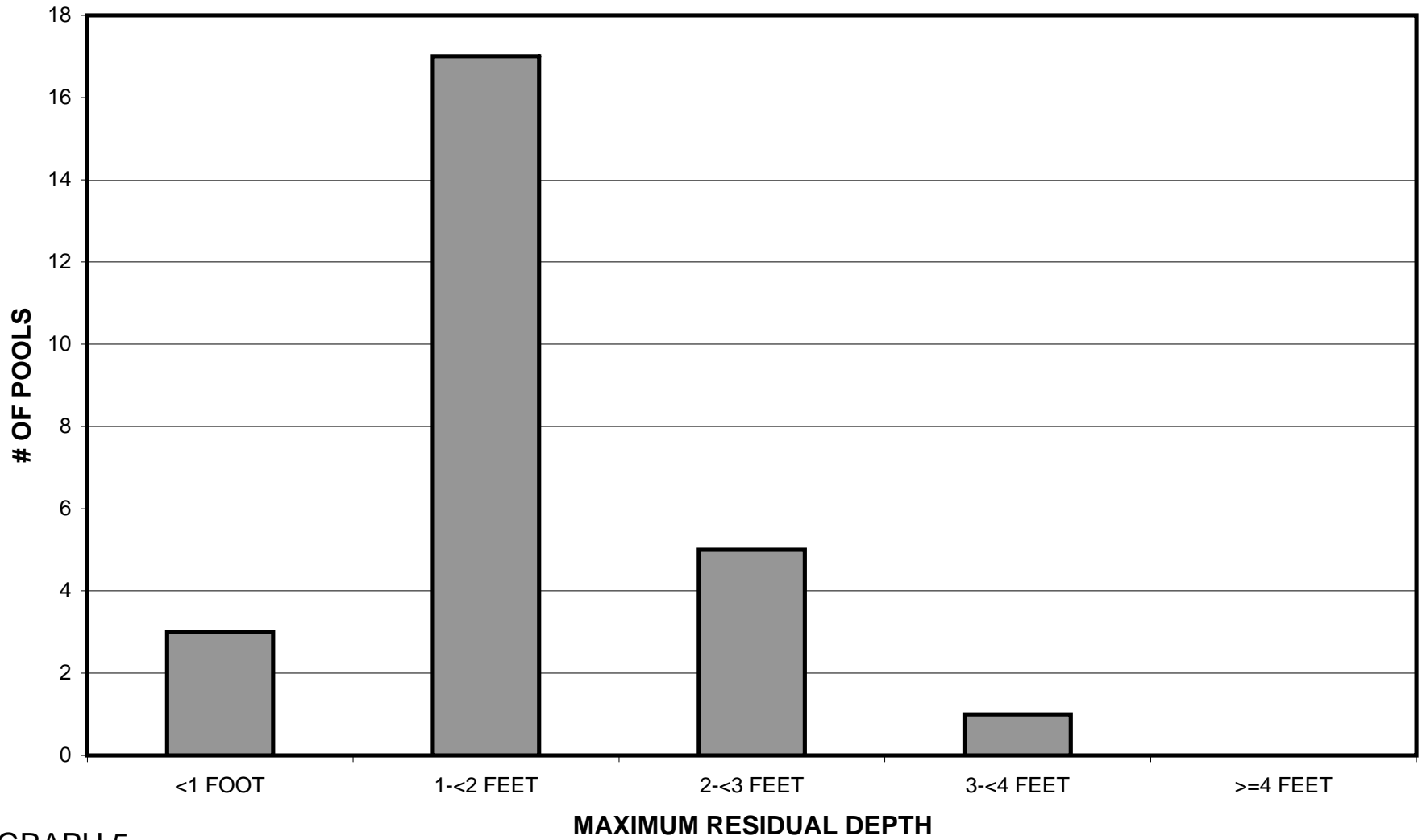
GRAPH 3

**NORDEN GULCH 2011
POOL TYPES BY PERCENT OCCURRENCE**



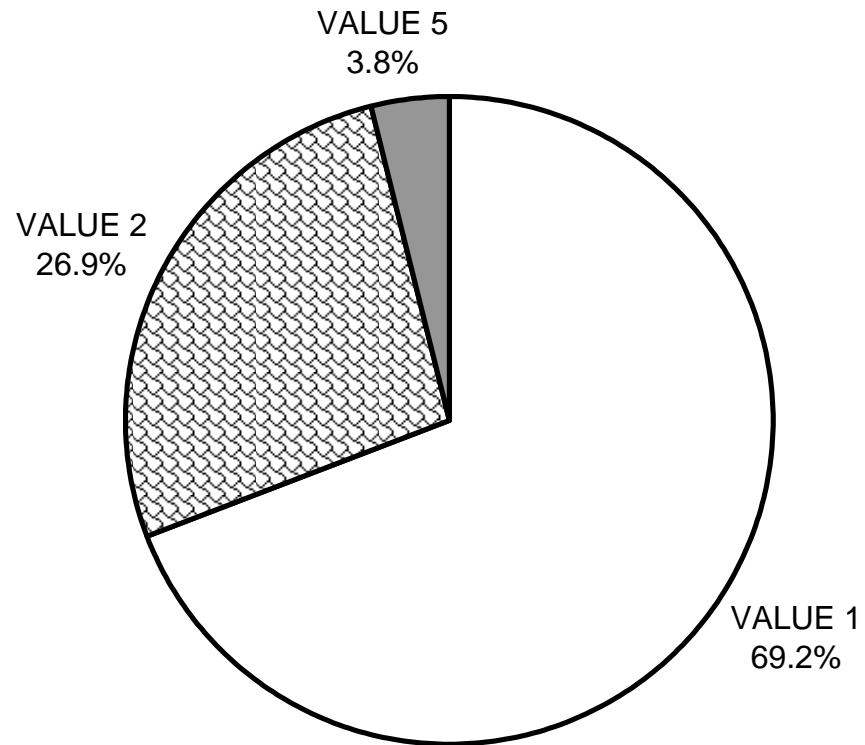
GRAPH 4

NORDEN GULCH 2011 **MAXIMUM DEPTH IN POOLS**



GRAPH 5

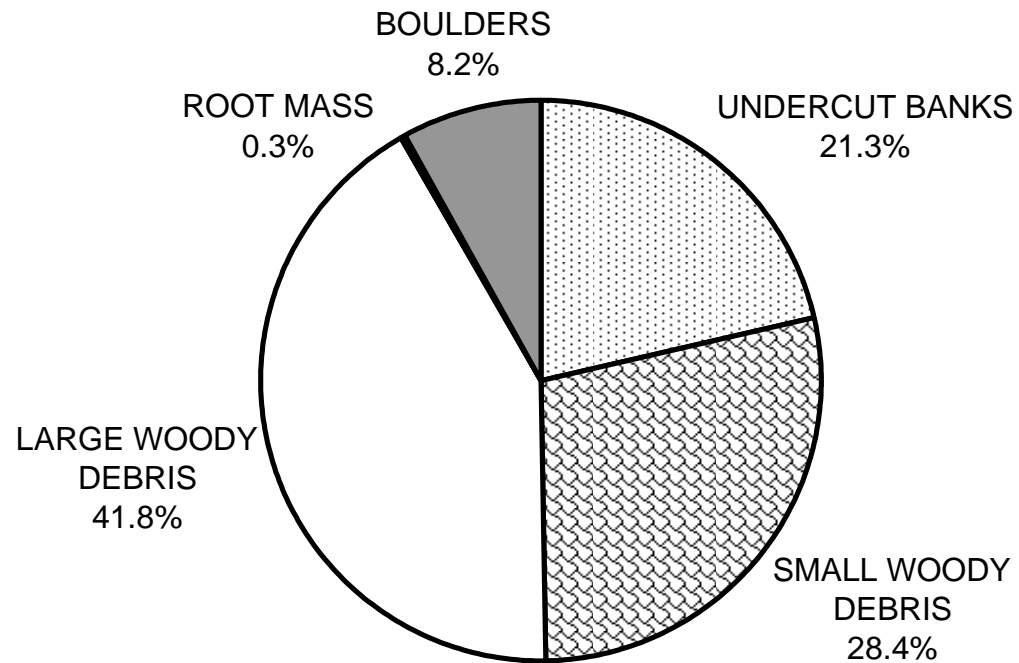
NORDEN GULCH 2011 PERCENT EMBEDDEDNESS



GRAPH 6

NORDEN GULCH 2011

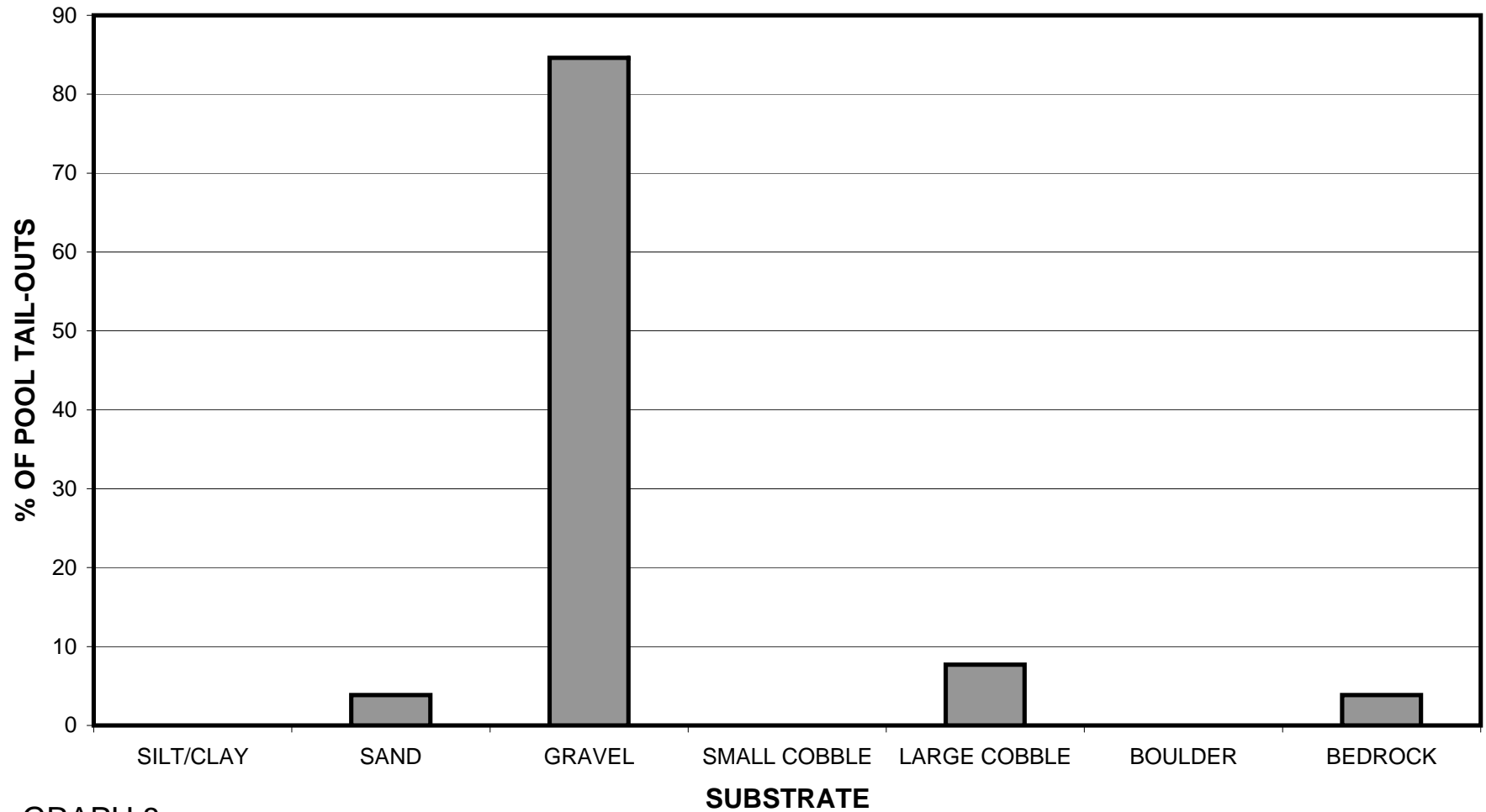
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

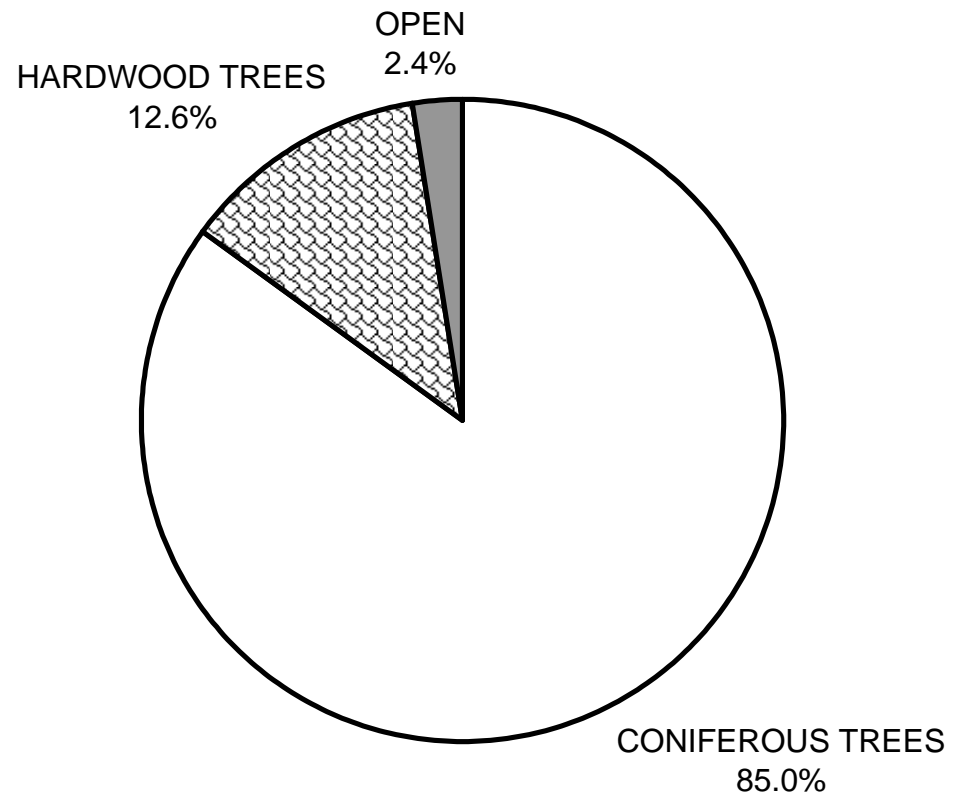
NORDEN GULCH 2011

SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



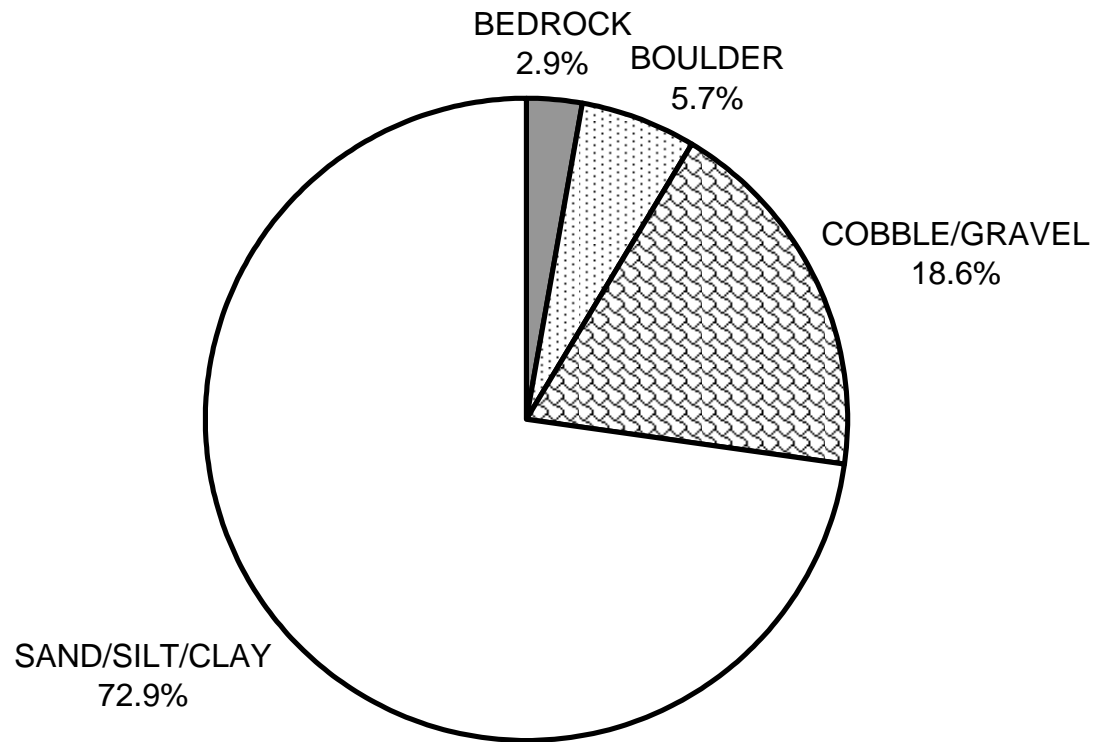
GRAPH 8

NORDEN GULCH 2011 MEAN PERCENT CANOPY



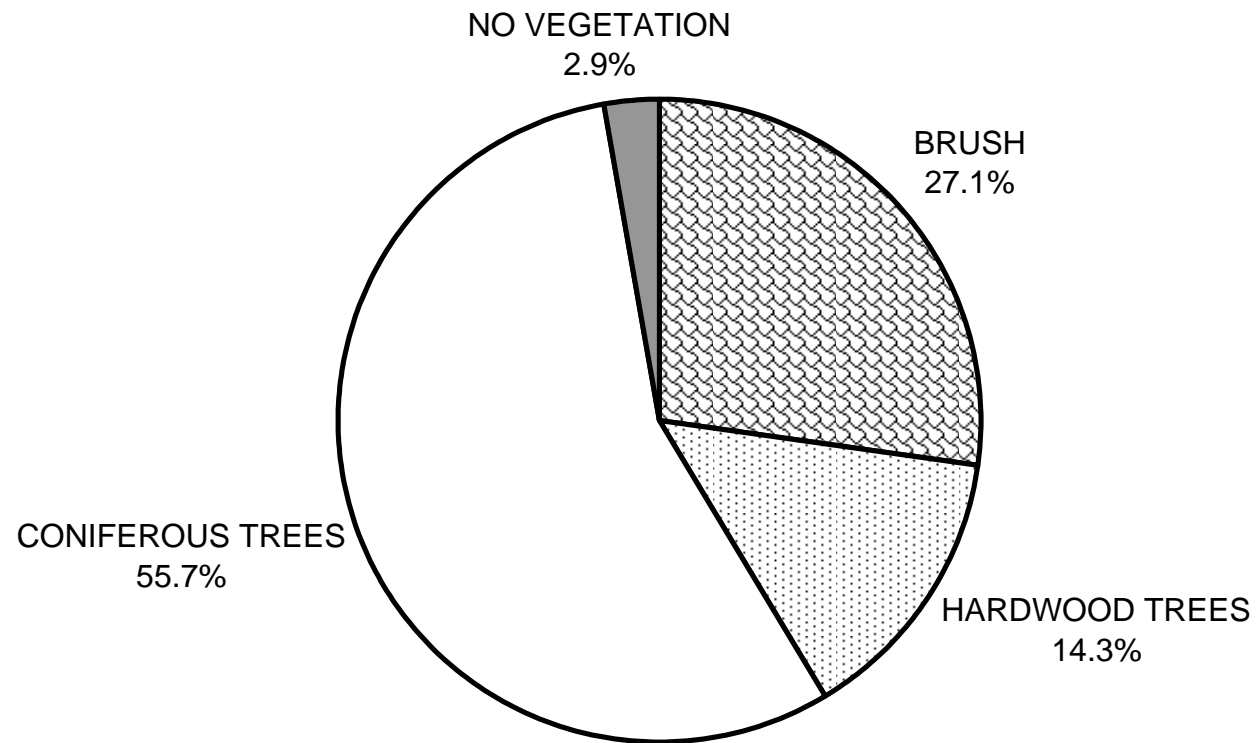
GRAPH 9

NORDEN GULCH 2011
DOMINANT BANK COMPOSITION IN SURVEY REACH



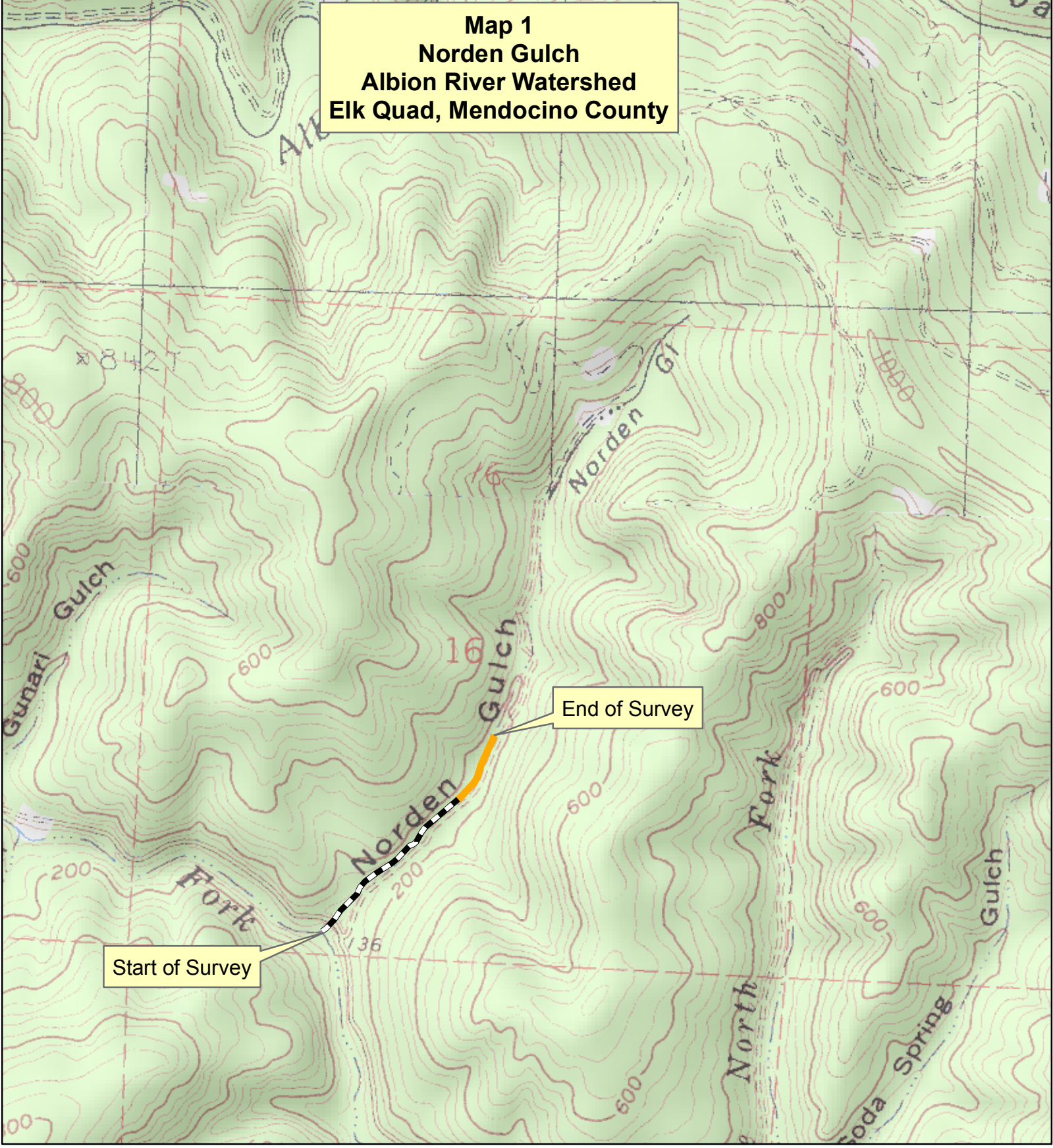
GRAPH 10

NORDEN GULCH 2011
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

Map 1
Norden Gulch
Albion River Watershed
Elk Quad, Mendocino County



Start of Survey

End of Survey



Legend

— Reach 1, G4 Channel Type

— Reach 2, A4 Channel Type

