



CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

STREAM INVENTORY REPORT

Kass Creek

INTRODUCTION

A stream inventory was conducted from September 14 to September 22, 2015 on Kass Creek. The survey began at the confluence with South Fork Noyo River and extended upstream 2.8 miles.

The Kass Creek inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Kass Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

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

WATERSHED OVERVIEW

Kass Creek is a tributary to South Fork Noyo River, a tributary to the Noyo River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Kass Creek's legal description at the confluence with South Fork Noyo River is T18N R17W S14. Its location is 39.4176 degrees north latitude and 123.7205 degrees west longitude, LLID number 1237193394176. Kass Creek is a second order stream and has approximately 2.4 miles of blue line stream according to the USGS Noyo Hill 7.5 minute quadrangle. Kass Creek drains a watershed of approximately 2.2 square miles. Elevations range from about 10 feet at the mouth of the creek to 850 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 the Georgia-Pacific Haul Road from Fort Bragg.

METHODS

The habitat inventory conducted in Kass Creek 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. The 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

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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 Kass Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a 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". Kass Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Kass Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

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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. 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 Kass Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. The shelter rating is then calculated by multiplying the qualitative shelter value by the percent of the unit covered. 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 Kass Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Kass Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

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

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests

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(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 Kass Creek. In addition, underwater observations were made at eight 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 2.0.18, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Wildlife. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Kass Creek include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

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

The habitat inventory of September 14 to September 22, 2015 was conducted by M. Groff and I. Mikus (CDFW). The total length of the stream surveyed was 15,041 feet.

Stream flow was not measured on Kass Creek.

Kass Creek is an E4 channel type for 3,038 feet of the stream surveyed (Reach 1), an F4 channel type for 764 feet of the stream surveyed (Reach 2), a B2 channel type for 440 feet of the stream surveyed (Reach 3), an F4 channel type for 10,091 feet of the stream surveyed (Reach 4), and a G4 channel type for 708 feet of the stream surveyed (Reach 5). 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. F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. B2 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks and boulder-dominant substrates. G4 channels are entrenched “gully” step-pool channels on moderate gradients with low width /depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 51 to 57 degrees Fahrenheit. Air temperatures ranged from 48 to 67 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 33% flatwater units, 28% dry units, 24% pool units, and 15% riffle units (Graph 1). Based on total length of Level II habitat types there were 35% dry units, 33% flatwater units, 22% pool units, and 10% riffle units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were dry units, 28%; mid-channel pool units, 22%; and run units, 22% (Graph 3). Based on percent total length, dry units made up 35%, mid-channel pool units 20%, and step run units 19%.

A total of 129 pools were identified (Table 3). Main channel pools were the most frequently encountered at 91% (Graph 4), and comprised 92% 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. Thirty-five of the 129 pools (27%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 129 pool tail-outs measured, 34 had a value of 1 (26.4%); 59 had a value of 2 (45.7%); 31 had a value of 3 (24%); two had a value of 4 (1.6%); three had a value of 5 (2.3%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate. Additionally, a value of 5 was assigned to tail-outs deemed unsuitable for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

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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 15 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 16. Main channel pools had a mean shelter rating of 15 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Kass Creek. Graph 7 describes the pool cover in Kass Creek. 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 80% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 9% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Kass Creek was 98%. Two percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 43% and 57%, respectively. Graph 9 describes the mean percent canopy in Kass Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 99%. The mean percent left bank vegetated was 99%. The dominant elements composing the structure of the stream banks consisted of 93% sand/silt/clay, 2% bedrock, 2% boulder, and 2% cobble/gravel (Graph 10). Brush was the dominant vegetation type observed in 38% of the units surveyed. Additionally, 34% of the units surveyed had coniferous trees as the dominant vegetation type, and 28% had hardwood trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at eight sites for species composition and distribution in Kass Creek on September 22, 2015 (Table A). The sites were sampled by I. Mikus and M. Groff (CDFW).

In Reach 1, which comprised the first 3,038 feet of stream, one site was sampled. The reach site yielded 11 young-of-the-year (YOY) coho salmon, one age 1+ coho salmon, and one sculpin.

In Reach 2, one site was sampled starting approximately 3,529 feet from the confluence with South Fork Noyo River and continuing upstream 31 feet. The reach site yielded one YOY steelhead trout (SH), seven YOY coho salmon, one age 1+ coho salmon, and one coastal/California giant salamander.

In Reach 3, one site was sampled starting approximately 4,219 feet from the confluence with South Fork Noyo River and continuing upstream 13 feet. The reach site yielded seven YOY coho salmon.

In Reach 4, five sites were sampled starting approximately 12,782 feet from the confluence with South Fork Noyo River and continuing upstream 857 feet. The reach sites yielded three age 1+ SH, 16 YOY coho salmon, and three age 1+ coho salmon.

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During the survey, the upstream-most observation of juvenile coho salmon occurred at 39.4230 degrees north latitude, 123.6851 degrees west longitude, approximately 13,172 feet upstream from the confluence with South Fork Noyo River.

Table A. Summary of results for a fish composition and distribution survey within Kass Creek, 2015.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	Steelhead Trout			Coho Salmon		Additional Aquatic Species Observed
					YOY	1+	2+	YOY	1+	
Reach 1: E4 Channel Type										
09/22/15	1	054	Pool	2,103	0	0	0	11	1	SCP
Reach 2: F4 Channel Type										
09/22/15	2	106	Pool	3,560	1	0	0	7	1	CGS
Reach 3: B2 Channel Type										
09/22/15	3	127	Pool	4,232	0	0	0	7	0	
Reach 4: F4 Channel Type										
09/22/15	4	131	Pool	4,345	0	2	0	15	0	
09/22/15	5	406	Pool	12,826	0	1	0	1	0	
09/22/15	6	428	Pool	13,172	0	0	0	0	3	
09/22/15	7	448	Pool	13,549	0	0	0	0	0	
09/22/15	8	454	Pool	13,639	0	0	0	0	0	

Species Abbreviations: CGS=Coastal/California Giant Salamander; SCP=Sculpin (Unidentified Species)

DISCUSSION

Kass Creek is an E4 channel type for the first 3,038 feet of stream surveyed, an F4 channel type for the next 764 feet, a B2 channel type for the next 440 feet, an F4 channel type for the next 10,091 feet, and a G4 channel type for the remaining 708 feet. The suitability of E4, F4, B2, and G4 channel types for fish habitat improvement structures is as follows: E4 channels are good for bank-placed boulders and fair for opposing wing-deflectors. F4 channels are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover. B2 channels excellent for plunge weirs, single and opposing wing-deflectors, and log cover. G4 channels are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days September 14 to September 22, 2015 ranged from 51 to 57 degrees Fahrenheit. Air temperatures ranged from 48 to 67 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.

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Flatwater habitat types comprised 33% of the total length of this survey, riffles 10%, and pools 22%. Thirty-five of the 129 (27%) pools had a maximum residual depth greater than two 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.

Ninety-three of the 129 pool tail-outs measured had embeddedness ratings of 1 or 2. Thirty-three of the pool tail-outs had embeddedness ratings of 3 or 4. Three of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Kass Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

One hundred fourteen of the 129 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 15. 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 Kass Creek. 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 97%, Reach 2 had a canopy density of 98%, Reach 3 had a canopy density of 99%, Reach 4 had a canopy density of 98%, and Reach 5 had a canopy density of 96%. The percentage of right and left bank covered with vegetation was 99% and 99%, respectively.

RECOMMENDATIONS

Kass Creek should be managed as an anadromous, natural production stream. Recommendations for potential habitat improvement activities are based on target habitat values suitable for salmonids in California's north coast streams. Considering the results from this stream habitat inventory, factors that affect salmonid productivity and CDFW's professional judgment, the following list prioritizes habitat improvement activities in Kass Creek. Keep in mind, watershed and stream ecosystem processes, land use alterations, changes in land ownership, and other factors could potentially change the order of these recommendations or create the need to remove/add recommendations in the future.

- 1) 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.
- 2) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

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- 3) 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 three to five years.

COMMENTS AND LANDMARKS

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

Position (ft):	Habitat unit #:	Comments:
0	0001.00	Start of survey at the confluence with South Fork Noyo River. The channel is an E4. The first 50 of Kass Creek were dry.
67	0003.00	A road crosses the channel. The crossing is a 12.3' high metal bridge.
1233	0033.00	Dry left bank tributary. There is a 15' high waterfall approximately 150' upstream from the mouth.
2548	0073.00	Log debris accumulation (LDA) #01 contains six pieces of large woody debris (LWD) and measures approximately 4' high x 24' wide x 16' long. Most of the mass of the LDA is small woody debris. Water does not flow through the LDA; the channel is dry above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures approximately 5' wide x 15' long x 1' deep. Fish were observed above the LDA.
3038	0087.00	The channel changes from an E4 to an F4.
3345	0098.00	Tributary #01 enters on the right bank. It contributes less than 5% to Kass Creek's flow. The water temperature of the tributary was 55 degrees Fahrenheit; the water temperature downstream and upstream of the confluence was 54 degrees Fahrenheit. The slope of the tributary is approximately 10%. The culvert at its mouth is steep and flow is subsurface below it.
3802	0115.00	The channel changes from an F4 to a B2.
4098	0123.00	Right bank scarp measures approximately 20' high x 50' long and is contributing sediment ranging in size from silt to boulders to the channel.
4219	0127.00	There is a 2.4' high plunge over woody debris.
4242	0129.00	The channel changes from a B2 to an F4.

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4933	0153.00	LDA #02 contains four pieces of LWD and measures approximately 3' high x 23' wide x 8' long. Most of the mass of the LDA is small woody debris. Water does not flow through the LDA; the channel is dry above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to sand and measures approximately 10' wide x 10' long x 1.5' deep. Fish were observed above the LDA.
5291	0161.00	Right bank seep.
5845	0177.00	Dry left bank tributary.
6362	0197.00	Boulder rip-rap armoring right bank.
7512	0234.00	Small woody debris accumulation.
7741	0241.00	Rain from 09/15-09/16 raised flow a small amount.
8022	0249.00	Dry left bank tributary.
9380	0289.00	Dry 2.5' high plunge over LWD.
9620	0301.00	Left bank seep.
10346	0344.00	There is a 478' long dry section.
11176	0349.00	LDA #03 contains five pieces of LWD and measures approximately 4' high x 21' wide x 9' long. Water does not flow through the LDA; the channel is dry above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures approximately 10' wide x 80' long x 2' deep. Fish were observed above the LDA.
11243	0352.00	Dry right bank tributary.
12510	0394.00	A road crosses the channel. The crossing is a 12' high railcar bridge.
12782	0406.00	Dry right bank tributary.
12826	0407.00	Dry left bank tributary.
13285	0437.00	There is a 3' high plunge over sediment and woody debris.
13415	0444.00	LDA #04 contains two pieces of LWD and measures approximately 4' high x 21' wide x 7' long. Water does not flow through the LDA; the channel is dry above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures approximately 10' wide x 5' long x 1.5' deep. There is a 3' high plunge over the LDA. Fish were not observed above it.

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13609	0454.00	Dry left bank tributary.
14329	0494.00	Tributary #02 enters on the left bank. The tributary is intermittently dry and contains standing water only. The water temperature of the tributary was 52 degrees Fahrenheit; the water temperature downstream and upstream of the confluence was 51 degrees Fahrenheit. The slope of the tributary is approximately 4%. There is a 5' high plunge over sediment approximately 40' upstream from the mouth. The channel is dry above it.
14333	0495.00	The channel changes from an F4 to a G4.
14347	0496.00	A road crosses the channel. The crossing is a 9.3' high metal bridge with a concrete abutment. Boulder rip-rap lines each bank below the bridge for approximately 90 feet.
14621	0508.00	There is a 3' high plunge over woody debris.
15023	0533.00	There is a 5' high plunge over sediment and woody debris. End of survey. Above the 5' high plunge the channel is dry for approximately 80 feet, then it is intermittently wet with shallow runs. Visibility is poor due to excess orange algae. Approximately 300 feet upstream of the plunge the channel changes to a dry marsh. The last sighting of fish was below Habitat Unit #437.

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 }

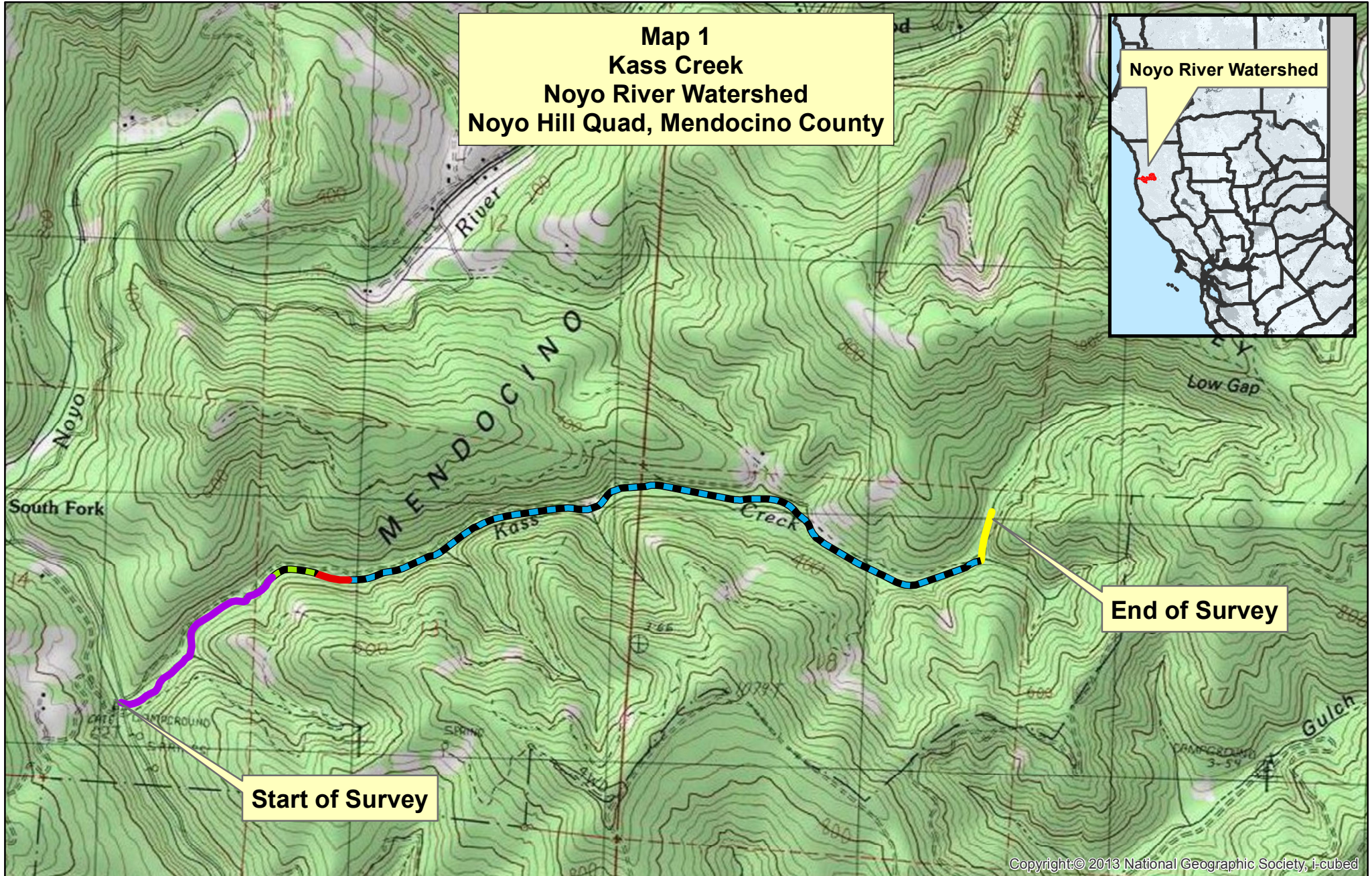
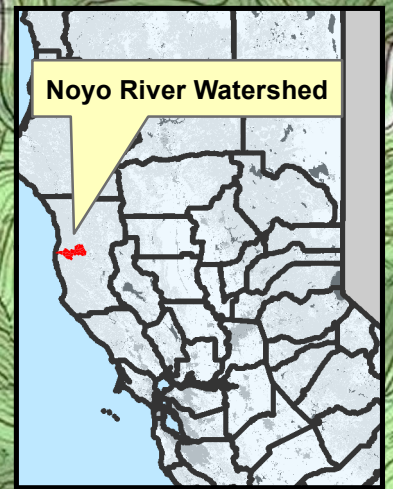
BACKWATER POOLS

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]	

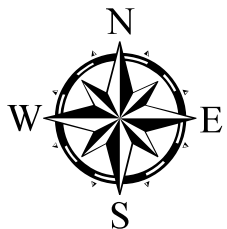
Map 1
Kass Creek
Noyo River Watershed
Noyo Hill Quad, Mendocino County



Start of Survey

End of Survey

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- Reach 1: E4 Channel Type
- Reach 2: F4 Channel Type
- Reach 3: B2 Channel Type
- Reach 4: F4 Channel Type
- Reach 5: G4 Channel Type

0 0.175 0.35 0.7 Miles



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

Stream Name: Kass Creek

LLID: 1237193394176

Drainage: Noyo River

Survey Dates: 9/14/2015 to 9/22/2015

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS14

Latitude: 39:25:03.0N

Longitude: 123:43:09.0

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
147	0	DRY	27.6	36	5316	35.3									
178	34	FLATWATER	33.4	28	4919	32.7	3.6	0.3	0.6	91	16125	31	5443		1
129	129	POOL	24.2	26	3323	22.1	7.6	0.9	1.7	198	25563	195	25155	181	15
79	9	RIFFLE	14.8	19	1483	9.9	3.6	0.1	0.3	31	2415	3	242		0
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
533	172				15041					44103			30840		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Kass Creek

LLID: 1237193394176

Drainage: Noyo River

Survey Dates: 9/14/2015 to 9/22/2015

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS14

Latitude: 39:25:03.0N

Longitude: 123:43:09.0W

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 (%)
39	3	LGR	7.3	18	692	4.6	2	0.1	0.3	8	331	1	33		0	92
40	6	HGR	7.5	20	791	5.3	4	0.1	0.6	42	1665	4	166		0	99
117	23	RUN	22.0	17	2010	13.4	4	0.3	1.3	84	9812	32	3738		2	99
61	11	SRN	11.4	48	2909	19.3	3	0.2	0.9	105	6384	28	1690		1	97
117	117	MCP	22.0	26	3066	20.4	8	0.9	3.4	204	23849	204	23850	190	15	98
2	2	CRP	0.4	20	39	0.3	8	0.8	1.6	158	315	113	227	113	5	99
7	7	LSL	1.3	22	155	1.0	6	0.7	2.9	134	937	105	732	92	16	97
2	2	LSR	0.4	20	41	0.3	8	0.7	1.5	174	347	133	266	116	30	99
1	1	LSBo	0.2	22	22	0.1	6	0.6	1.2	115	115	80	80	69	10	99
147	0	DRY	27.6	36	5316	35.3										99

Total Units
533

Total Units Fully Measured
172

Total Length (ft.)
15041

Total Area (sq.ft.)
43754

Total Volume (cu.ft.)
30783

Stream Name: Kass Creek	LLID: 1237193394176	Drainage: Noyo River
Survey Dates: 9/14/2015 to 9/22/2015		
Confluence Location: Quad: NOYO HILL	Legal Description: T18NR17WS14	Latitude: 39:25:03.0N Longitude: 123:43:09.0W

[illegible]

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

Stream Name: Kass Creek

LLID: 1237193394176

Drainage: Noyo River

Survey Dates: 9/14/2015 to 9/22/2015

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS14

Latitude: 39:25:03.0N

Longitude: 123:43:09.0W

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
117	MCP	91	1	1	82	70	29	25	5	4	0	0
2	CRP	2	0	0	2	100	0	0	0	0	0	0
7	LSL	5	1	14	5	71	1	14	0	0	0	0
2	LSR	2	0	0	2	100	0	0	0	0	0	0
1	LSBo	1	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
129	2	2	92	71	30	23	5	4	0	0

Mean Maximum Residual Pool Depth (ft.): 1.7

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Kass Creek

LLID: 1237193394176

Drainage: Noyo River

Survey Dates: 9/14/2015 to 9/22/2015

Dry Units: 147

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS14

Latitude: 39:25:03.0N

Longitude: 123:43:09.0W

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
39	3	LGR	0	0	0	0	0	0	0	0	0
40	6	HGR	0	0	0	0	0	0	0	0	0
79	9	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
117	23	RUN	0	60	20	0	0	0	0	20	0
61	11	SRN	0	100	0	0	0	0	0	0	0
178	34	TOTAL FLAT	0	71	14	0	0	0	0	14	0
117	117	MCP	10	36	45	1	1	0	0	5	1
2	2	CRP	0	50	0	50	0	0	0	0	0
7	7	LSL	9	63	29	0	0	0	0	0	0
2	2	LSR	0	50	45	5	0	0	0	0	0
1	1	LSBo	20	40	40	0	0	0	0	0	0
129	129	TOTAL POOL	9	39	43	2	1	0	0	5	0
533	172	TOTAL	9	41	41	2	1	0	0	5	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Kass Creek

LLID: 1237193394176

Drainage: Noyo River

Survey Dates: 9/14/2015 to 9/22/2015

Dry Units: 147

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS14

Latitude: 39:25:03.0N

Longitude: 123:43:09.0W

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
39	3	LGR	0	0	67	33	0	0	0
40	6	HGR	0	0	83	0	0	17	0
117	23	RUN	0	26	74	0	0	0	0
61	11	SRN	0	9	91	0	0	0	0
117	117	MCP	2	38	56	2	1	3	0
2	2	CRP	0	50	50	0	0	0	0
7	7	LSL	0	0	100	0	0	0	0
2	2	LSR	0	0	100	0	0	0	0
1	1	LSBo	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Kass Creek

LLID: 1237193394176

Drainage: Noyo River

Survey Dates: 9/14/2015 to 9/22/2015

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS14

Latitude: 39:25:03.0N

Longitude: 123:43:09.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
98	57	43	0	99	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.

Stream Name: Kass Creek	LLID: 1237193394176	Drainage: Noyo River
Survey Dates: 9/14/2015 to 9/22/2015	Survey Length (ft.): 15041	Main Channel (ft.): 15041
		Side Channel (ft.): 0
Confluence Location: Quad: NOYO HILL	Legal Description: T18NR17WS14	Latitude: 39:25:03.0N
		Longitude: 123:43:09.0W

STREAM REACH: 1									
Channel Type: E4			Canopy Density (%): 96.8				Pools by Stream Length (%): 37.0		
Reach Length (ft.): 3038			Coniferous Component (%): 35.3				Pool Frequency (%): 33.7		
Riffle/Flatwater Mean Width (ft.): 4.4			Hardwood Component (%): 64.7				Residual Pool Depth (%):		
BFW:			Dominant Bank Vegetation: Brush				< 2 Feet Deep: 62		
Range (ft.): 17 to 21			Vegetative Cover (%): 99.4				2 to 2.9 Feet Deep: 34		
Mean (ft.): 19			Dominant Shelter: Large Woody Debris				3 to 3.9 Feet Deep: 3		
Std. Dev.: 1			Dominant Bank Substrate Type: Sand/Silt/Clay				>= 4 Feet Deep: 0		
Base Flow (cfs.): 0.0			Occurrence of LWD (%): 28				Mean Max Residual Pool Depth (ft.): 1.8		
Water (F): 54 - 57			Air (F): 51 - 61				LWD per 100 ft.:		
Dry Channel (ft): 288			Riffles: 0				Mean Pool Shelter Rating: 16		
			Pools: 6						
			Flat: 2						
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 62 Sm Cobble: 21 Lg Cobble: 10 Boulder: 7 Bedrock: 0									
Embeddedness Values (%): 1. 41.4 2. 51.7 3. 6.9 4. 0.0 5. 0.0									

Channel Type:	F4	Canopy Density (%):	97.5	Pools by Stream Length (%):	39.4		
Reach Length (ft.):	764	Coniferous Component (%):	42.1	Pool Frequency (%):	35.7		
Riffle/Flatwater Mean Width (ft.):	6.3	Hardwood Component (%):	57.9	Residual Pool Depth (%):			
BFW:		Dominant Bank Vegetation:	Brush	< 2 Feet Deep:	80		
Range (ft.):	16 to 21	Vegetative Cover (%):	98.8	2 to 2.9 Feet Deep:	20		
Mean (ft.):	18	Dominant Shelter:	Large Woody Debris	3 to 3.9 Feet Deep:	0		
Std. Dev.:	2	Dominant Bank Substrate Type:	Sand/Silt/Clay	>= 4 Feet Deep:	0		
Base Flow (cfs.):	0.0	Occurrence of LWD (%):	23	Mean Max Residual Pool Depth (ft.):	1.5		
Water (F):	54 - 55	Air (F):	51 - 53	Mean Pool Shelter Rating:	10		
Dry Channel (ft):	16	Riffles:	2				
		Pools:	7				
		Flat:	1				
Pool Tail Substrate (%):	Silt/Clay: 0	Sand: 0	Gravel: 70	Sm Cobble: 30	Lg Cobble: 0	Boulder: 0	Bedrock: 0
Embeddedness Values (%):	1. 60.0	2. 30.0	3. 10.0	4. 0.0	5. 0.0		

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: B2	Canopy Density (%): 99.2	Pools by Stream Length (%): 6.6
Reach Length (ft.): 440	Coniferous Component (%): 20.0	Pool Frequency (%): 14.3
Riffle/Flatwater Mean Width (ft.): 3.7	Hardwood Component (%): 80.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 50
Range (ft.): 18 to 21	Vegetative Cover (%): 97.5	2 to 2.9 Feet Deep: 50
Mean (ft.): 19	Dominant Shelter: Undercut Banks	3 to 3.9 Feet Deep: 0
Std. Dev.: 1	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 0	Mean Max Residual Pool Depth (ft.): 1.9
Water (F): 54 - 55 Air (F): 53 - 54	LWD per 100 ft.:	Mean Pool Shelter Rating: 5
Dry Channel (ft): 114	Riffles: 4	
	Pools: 3	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 0 Sm Cobble: 0 Lg Cobble: 0 Boulder: 100 Bedrock: 0		
Embeddedness Values (%): 1. 0.0 2. 50.0 3. 0.0 4. 0.0 5. 50.0		

STREAM REACH: 4

Channel Type: F4	Canopy Density (%): 98.4	Pools by Stream Length (%): 17.4
Reach Length (ft.): 10091	Coniferous Component (%): 62.6	Pool Frequency (%): 21.9
Riffle/Flatwater Mean Width (ft.): 3.2	Hardwood Component (%): 37.4	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 74
Range (ft.): 7 to 19	Vegetative Cover (%): 98.5	2 to 2.9 Feet Deep: 21
Mean (ft.): 13	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 5
Std. Dev.: 3	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 28	Mean Max Residual Pool Depth (ft.): 1.7
Water (F): 51 - 55 Air (F): 48 - 67	LWD per 100 ft.:	Mean Pool Shelter Rating: 17
Dry Channel (ft): 4711	Riffles: 1	
	Pools: 8	
	Flat: 3	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 5 Gravel: 88 Sm Cobble: 3 Lg Cobble: 1 Boulder: 4 Bedrock: 0		
Embeddedness Values (%): 1. 20.0 2. 43.8 3. 32.5 4. 1.3 5. 2.5		

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 5

Channel Type: G4	Canopy Density (%): 95.6	Pools by Stream Length (%): 16.4
Reach Length (ft.): 708	Coniferous Component (%): 97.5	Pool Frequency (%): 20.5
Riffle/Flatwater Mean Width (ft.): 2.5	Hardwood Component (%): 2.5	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 100
Range (ft.): 7 to 12	Vegetative Cover (%): 99.8	2 to 2.9 Feet Deep: 0
Mean (ft.): 10	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 2	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 30	Mean Max Residual Pool Depth (ft.): 1.3
Water (F): 51 - 54 Air (F): 48 - 51	LWD per 100 ft.:	Mean Pool Shelter Rating: 11
Dry Channel (ft): 187	Riffles: 10	
	Pools: 9	
	Flat: 4	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 100 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 0.0 2. 62.5 3. 25.0 4. 12.5 5. 0.0		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Kass Creek

LLID: 1237193394176

Drainage: Noyo River

Survey Dates: 9/14/2015 to 9/22/2015

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS14

Latitude: 39:25:03.0N

Longitude: 123:43:09.0W

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	6	2.3
Boulder	7	1	2.3
Cobble / Gravel	4	3	2.0
Sand / Silt / Clay	159	162	93.3

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	66	63	37.5
Hardwood Trees	57	40	28.2
Coniferous Trees	49	69	34.3
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Kass Creek

LLID: 1237193394176

Drainage: Noyo River

Survey Dates: 9/14/2015 to 9/22/2015

Confluence Location: Quad: NOYO HILL

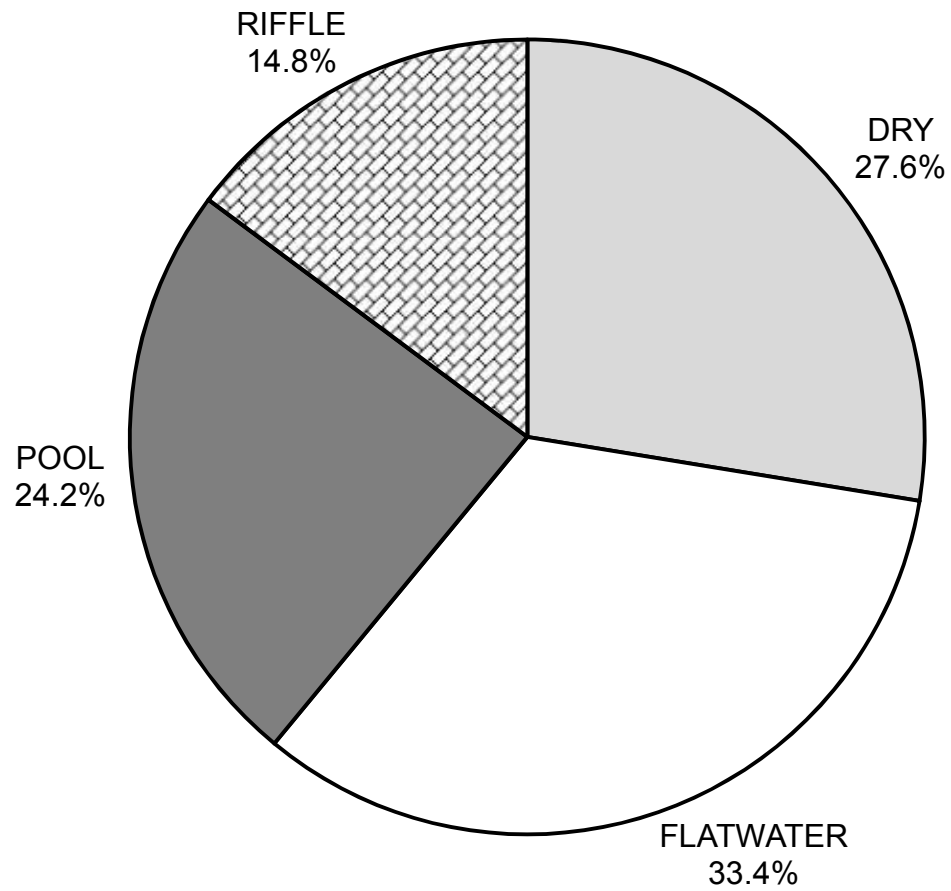
Legal Description: T18NR17WS14

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Longitude: 123:43:09.0W

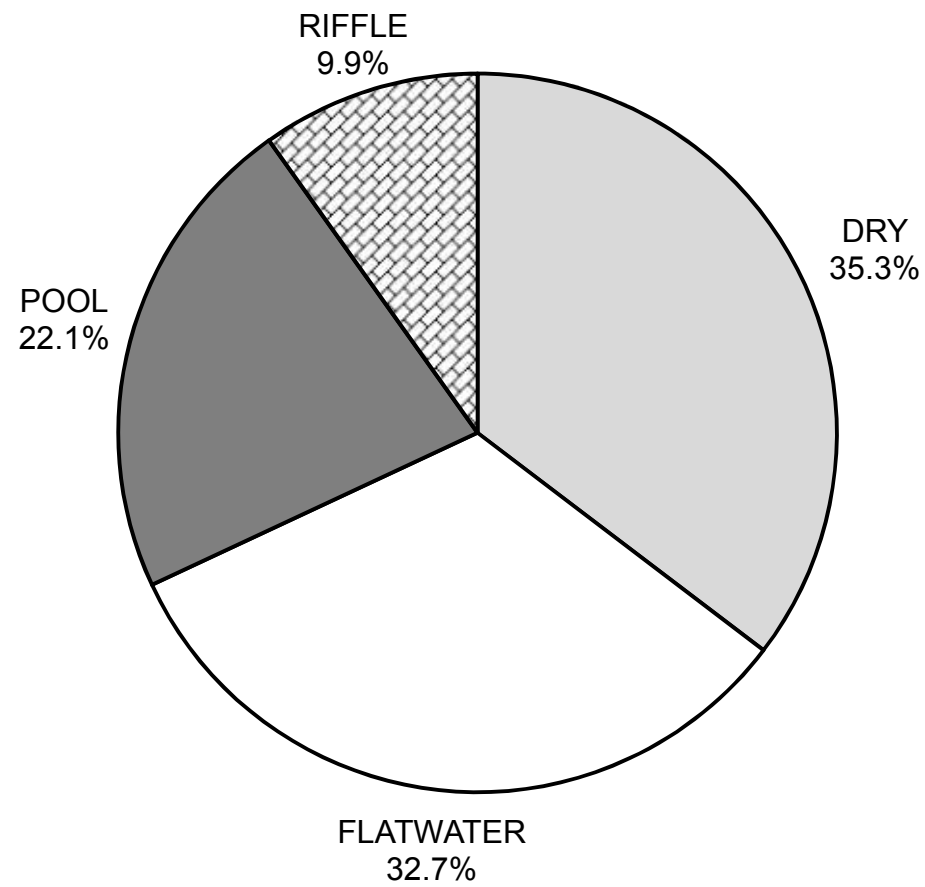
	Riffles	Flatwater	Pools
<hr/>			
UNDERCUT BANKS (%)	0	0	9
SMALL WOODY DEBRIS (%)	0	71	39
LARGE WOODY DEBRIS (%)	0	14	43
ROOT MASS (%)	0	0	2
TERRESTRIAL VEGETATION (%)	0	0	1
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	14	5
BEDROCK LEDGES (%)	0	0	0

KASS CREEK 2015 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

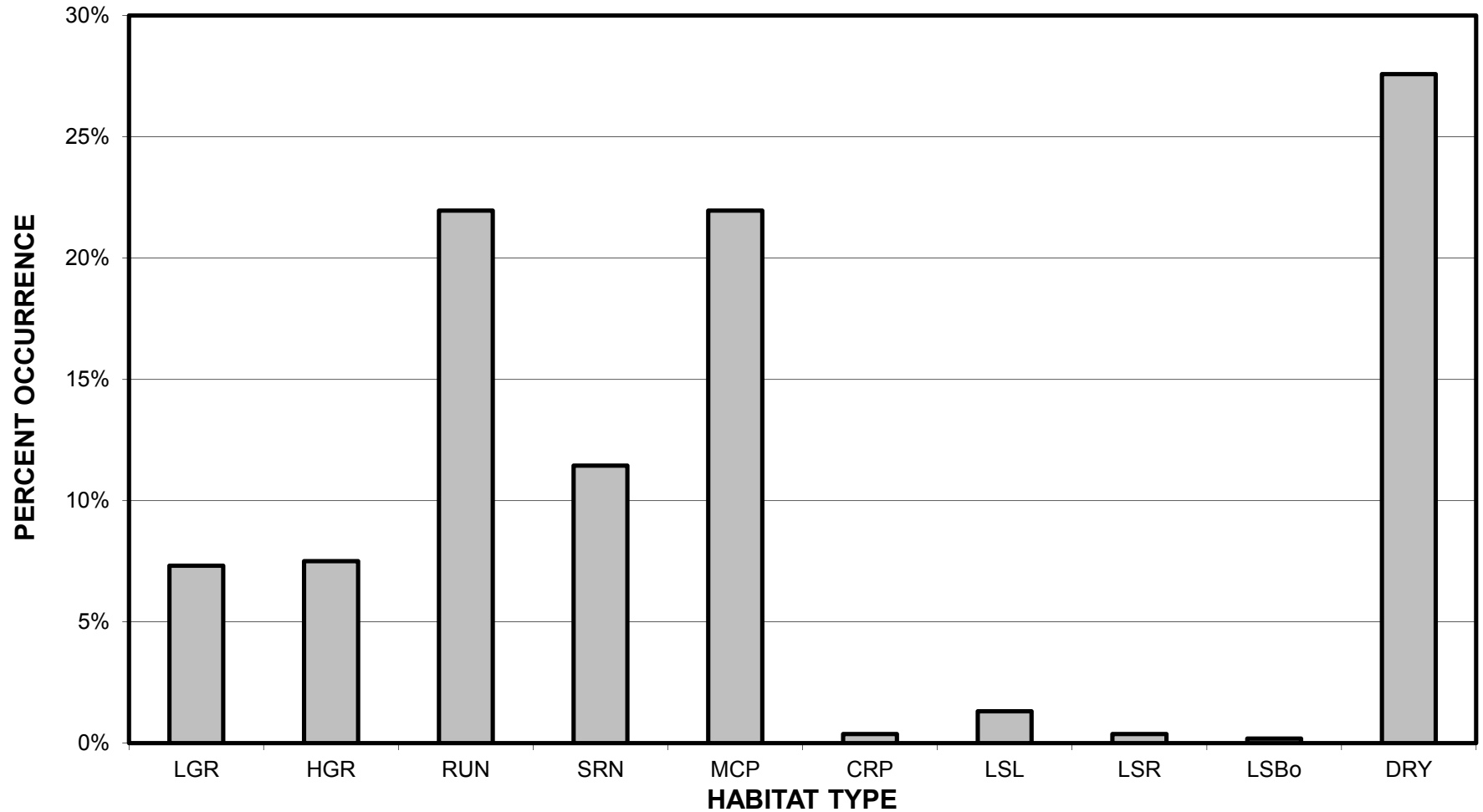
KASS CREEK 2015
HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

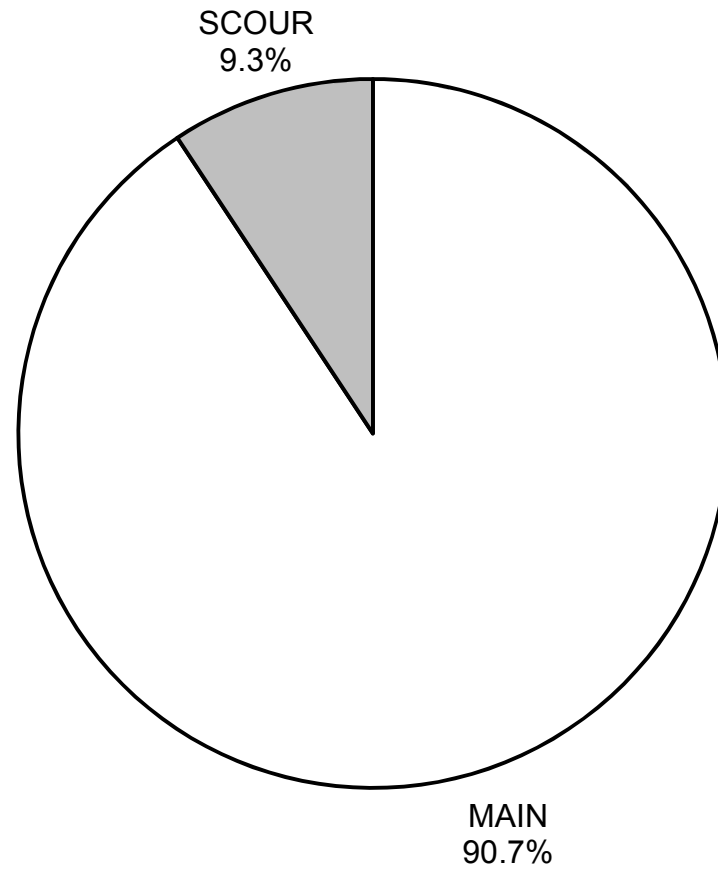
KASS CREEK 2015

HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 3

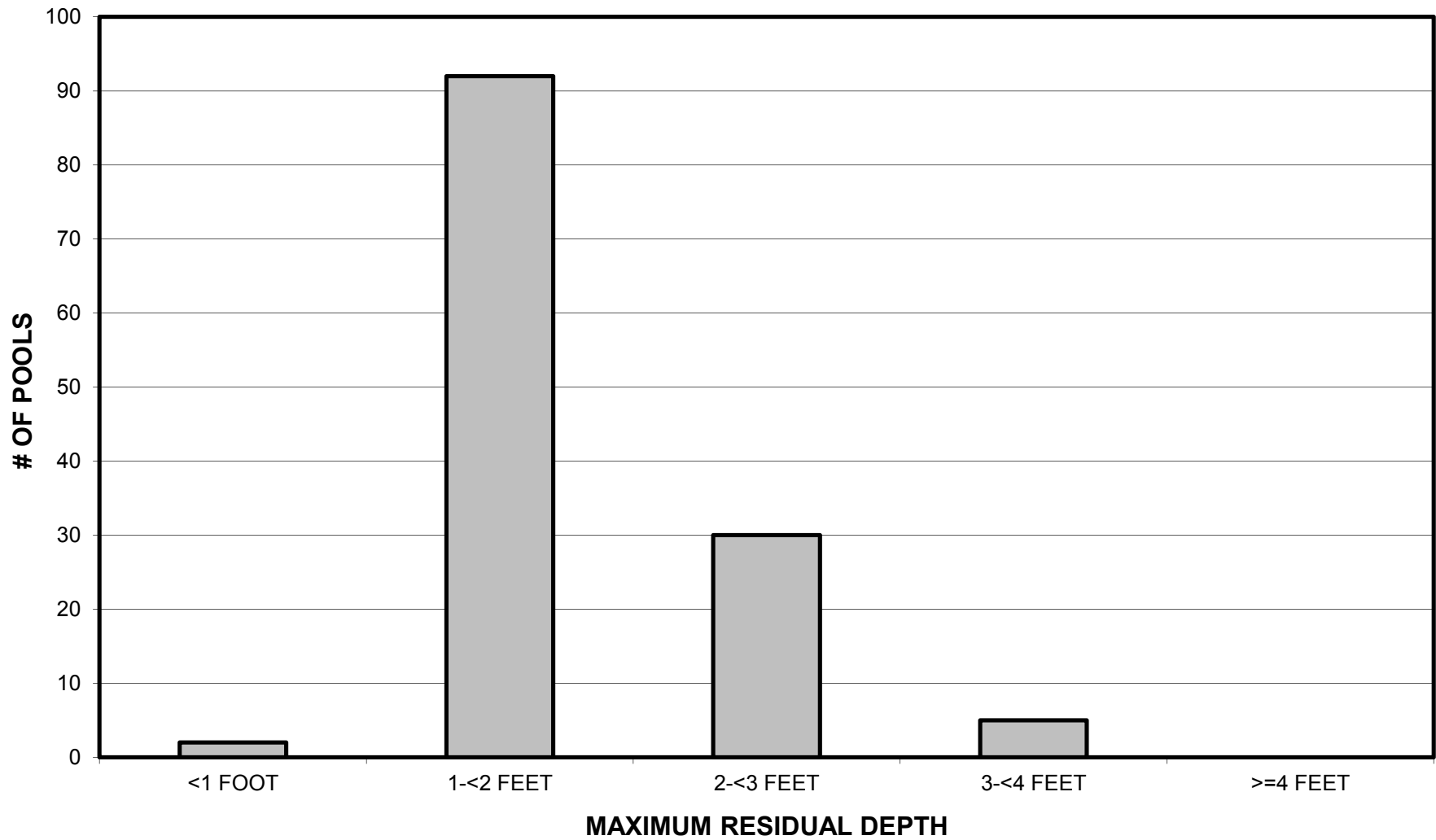
**KASS CREEK 2015
POOL TYPES BY PERCENT OCCURRENCE**



GRAPH 4

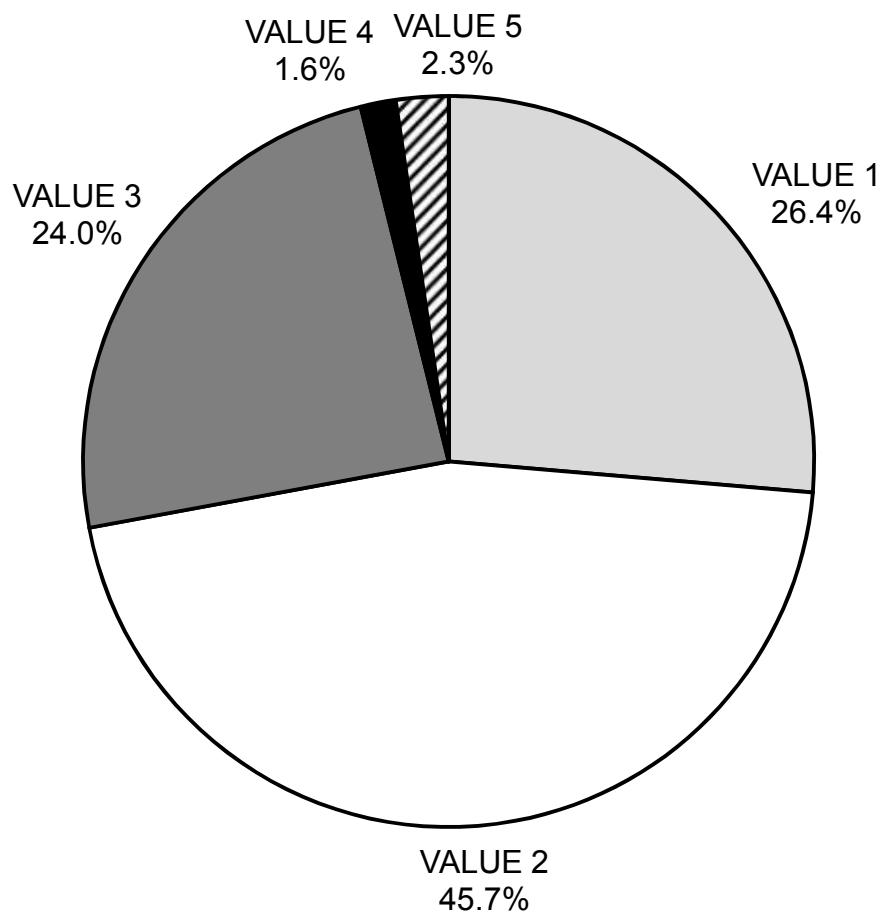
KASS CREEK 2015

MAXIMUM DEPTH IN POOLS



GRAPH 5

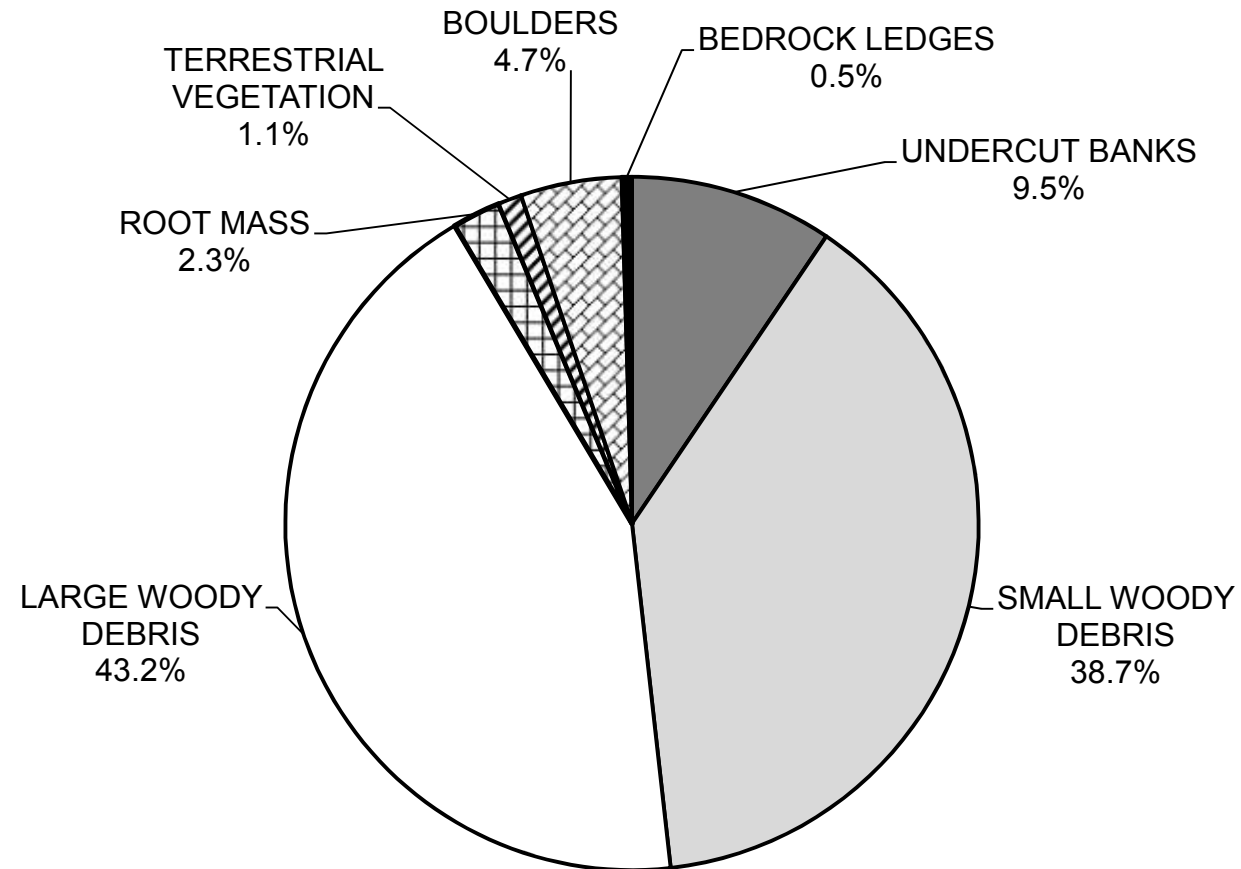
KASS CREEK 2015 PERCENT EMBEDDEDNESS



GRAPH 6

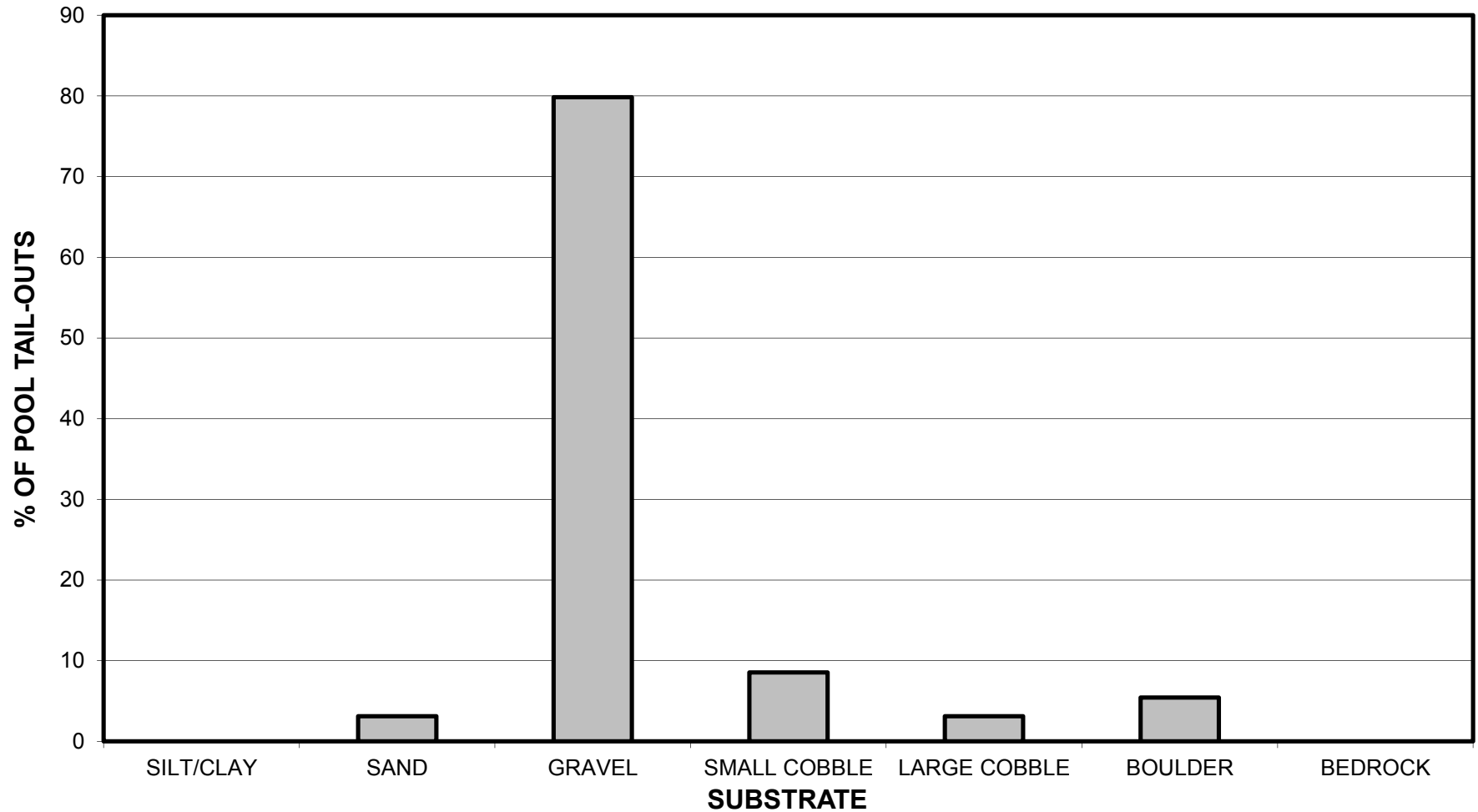
KASS CREEK 2015

MEAN PERCENT COVER TYPES IN POOLS



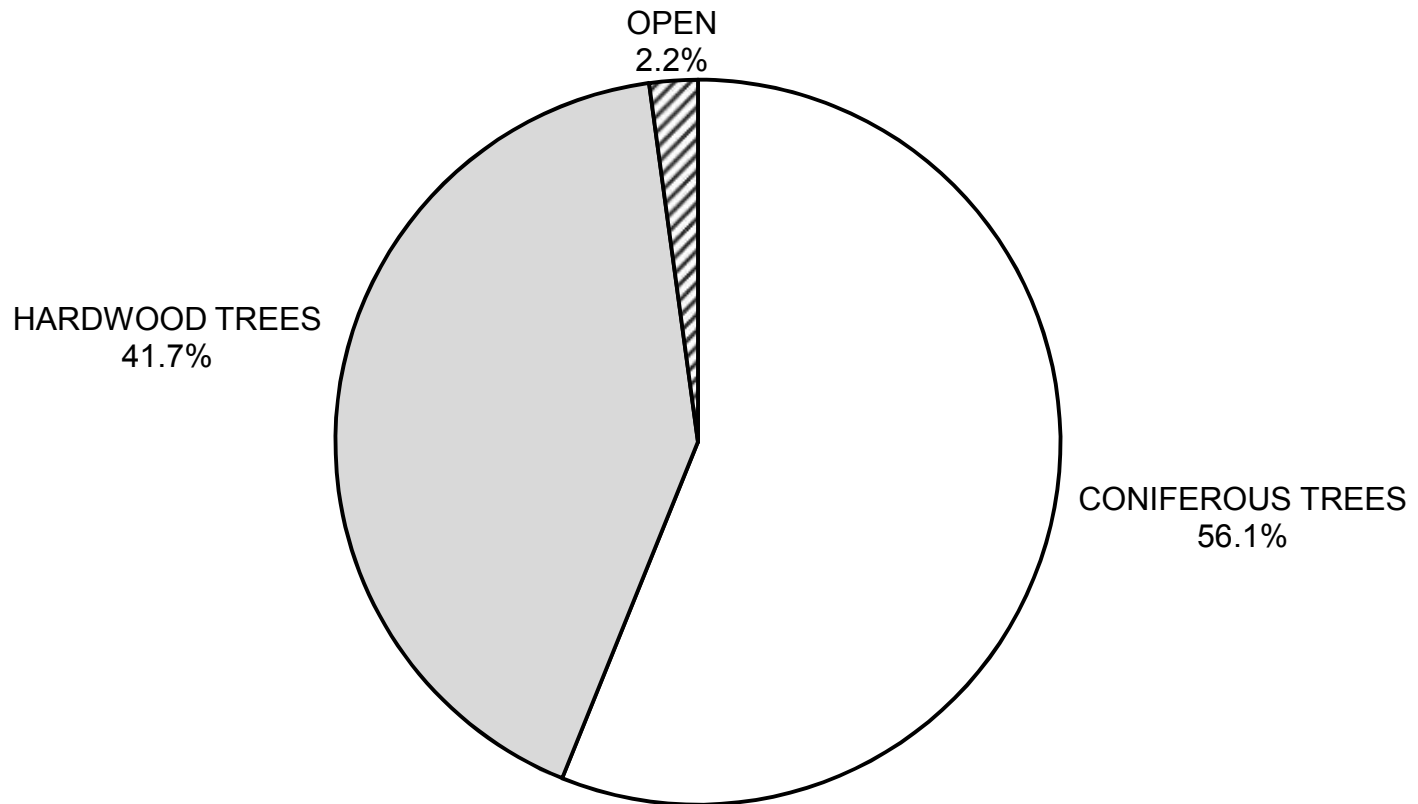
GRAPH 7

KASS CREEK 2015 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



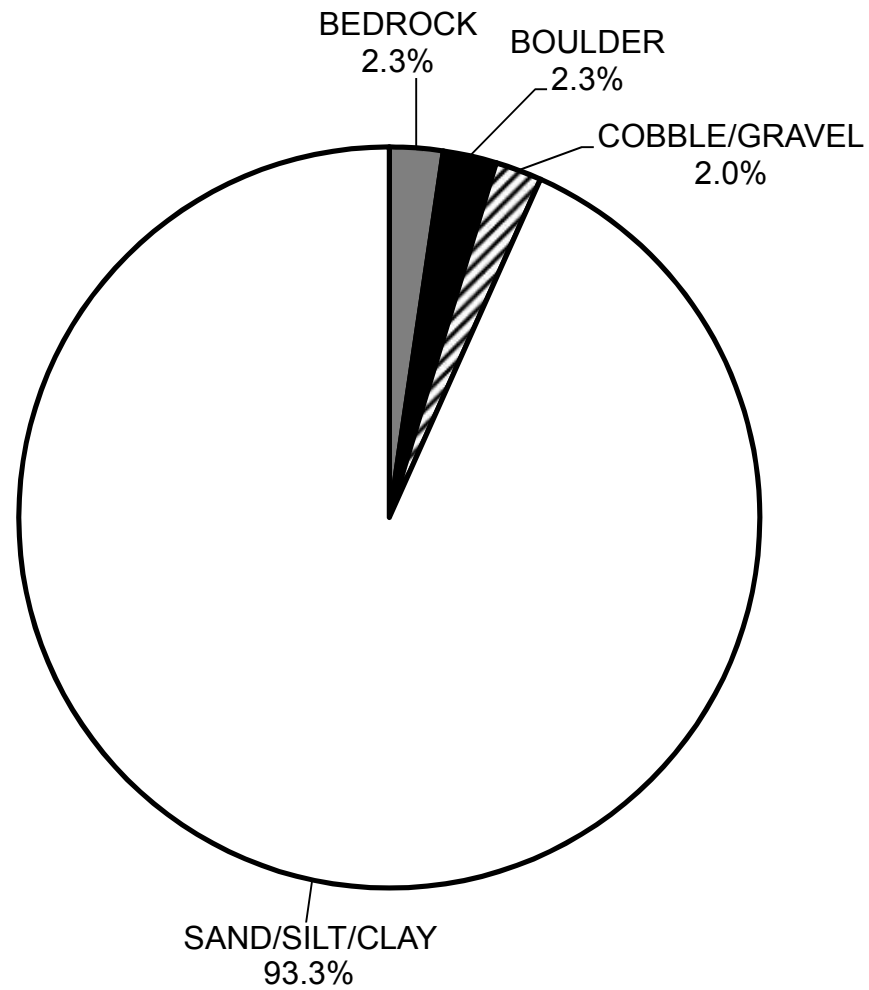
GRAPH 8

**KASS CREEK 2015
MEAN PERCENT CANOPY**



GRAPH 9

KASS CREEK 2015
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

KASS CREEK 2015
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11