NORTH COAST WATERSHED AND FISHERY IMPROVEMENT PROGRAM

STREAM INVENTORY REPORT

Boardman Gulch, South Fork Big River, 2003

CALIFORNIA DEPARTMENT OF FISH AND GAME

2003

Northern California-North Coast Region

STREAM INVENTORY REPORT

Boardman Gulch

INTRODUCTION

A stream inventory was conducted beginning June 25 and ending June 27, 2002 on Boardman Gulch. The survey began at the confluence with South Fork Big River and extended upstream 1.3 miles.

The Boardman 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 Boardman Gulch. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

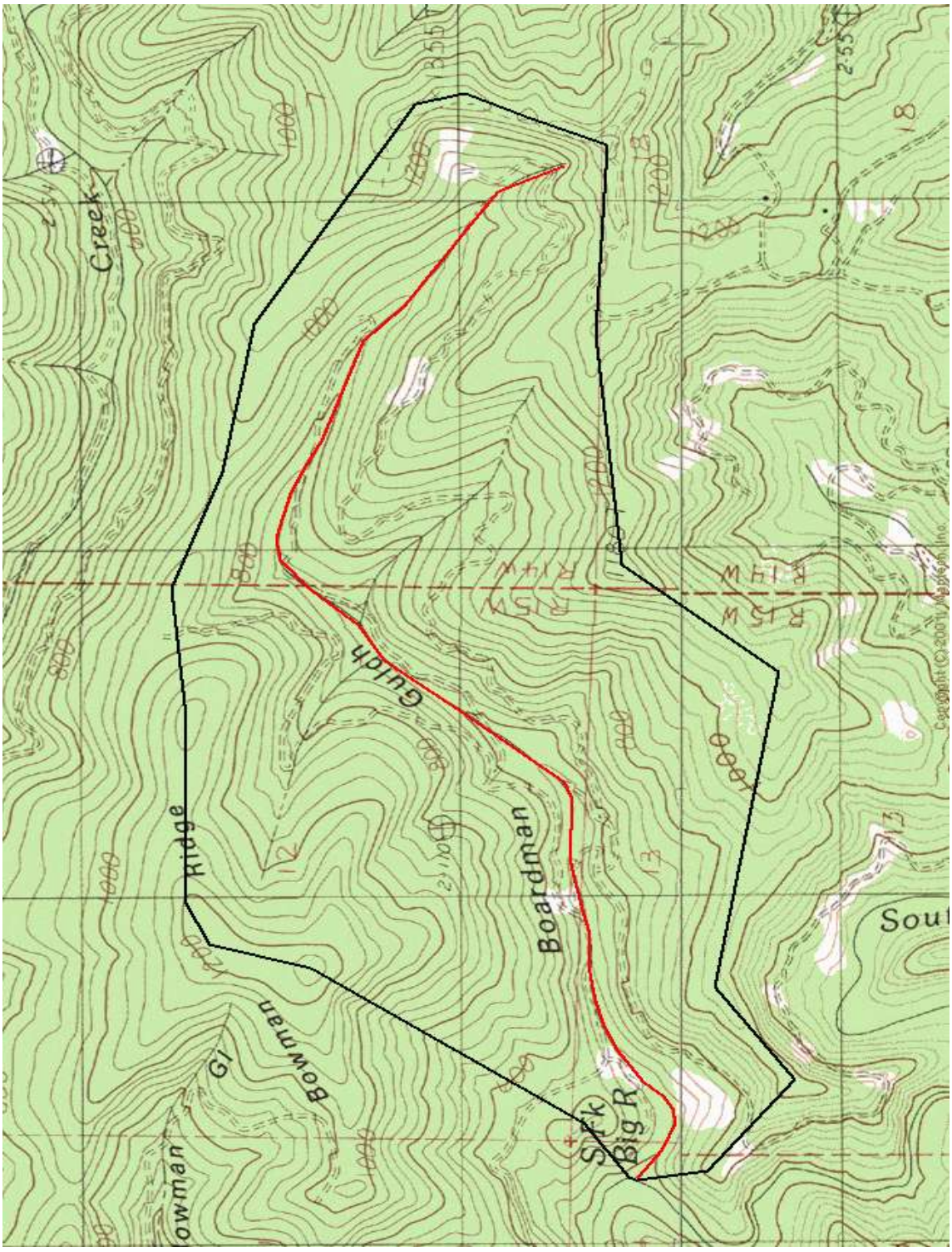
The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for coho salmon, and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's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

WATERSHED OVERVIEW

Boardman Gulch is a tributary to the South Fork Big River, a tributary to the Big River, located in Mendocino County, California (Map 1). Boardman Gulch's legal description at the confluence with South Fork Big River is T16N R15W S14. Its location is 39°29′56″ North latitude and 123°53′26″ West longitude. Boardman Gulch is a first order stream and has approximately 2.09 miles of solid blue line stream according to the USGS Greenough Ridge 7.5 minute quadrangle. Boardman Gulch drains a watershed of approximately 1.24 square miles. Elevations range from about 400 feet at the mouth of the creek to 1200 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 Highway 20 at mile marker 17.

METHODS

The habitat inventory conducted in Boardman Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Game Scientific Aids and Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.



MAP 1. BOARDMAN GULCH

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Boardman Gulch to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) at 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 (1985 rev. 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 (1988).

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". Boardman 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 Boardman 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 unsuited for spawning due to inappropriate substrate particle size, bedrock, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide 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. 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 Boardman 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 Boardman 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 deciduous 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 Boardman 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.

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 Boardman Gulch. This sampling technique is discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat 8.4, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following six tables:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

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

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence
- Pool types by percent occurrence
- Total pools by maximum depths

- Embeddedness
- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Mean percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

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

The habitat inventory of June 25, through June 27, 2002, was conducted by Mike McNeil and Kristi Knecthle (DFG). The total length of the stream surveyed was 6,759 feet.

Stream flow was not measured on Boardman Gulch.

Boardman Gulch is a B4 channel type for the first 6,588 feet of the stream and B3 for 171 feet of the stream surveyed. B4 channel are classified as moderately entrenched, moderate gradient, riffle dominated channel with frequently spaced pools; very a stable plan and profile, stable banks, and gravel-dominated channel. B3 channels are moderately entrenched, moderate gradient, rifle dominated channels with frequently spaced pools, very stable plan and profile, stable banks and cobble-dominated substrates.

Water temperatures taken during the survey period ranged from 55 to 62 degrees Fahrenheit. Air temperatures ranged from 57 to 77 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 44% pool units, 41% flatwater units, and 15% riffle units, (Graph 1). Based on total length of Level II habitat types there were 81% flatwater units, 10% pool units, and 9% riffle units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were step runs, 35%; mid-channel pools, 28%; low gradient riffles, 14%; and plunge pools, 10% (Graph 3). Based on percent total length, step runs made up 78%, low gradient riffles 9%, and mid-channel pools 7%.

A total of 44 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 66%, and comprised 70% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Fourteen of the 44 pools (32%) had a depth of two feet or greater (Graph

5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 44 pool tail-outs measured, 0 had a value of 1 (0%); 7 had a value of 2 (16%); 21 had a value of 3 (48%); 5 had a value of 4 (11%); and 11 had a value of 5 (25%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

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. Pool habitats had a mean shelter rating of 23, flatwater habitat types had a mean shelter rating of 13, and riffle habitat types had a mean shelter rating of 6, (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 25. Scour pools had a mean shelter rating of 19 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover types in Boardman Gulch. Graph 7 describes the pool cover in Boardman Gulch. Small woody debris is the dominant pool cover type followed by large 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 59% of pool tail-outs while small cobble was the next most frequently observed substrate type, at 23%.

The mean percent canopy density for the surveyed length of Boardman Gulch was 87%. The mean percentages of deciduous and coniferous trees were 10% and 90%, respectively. Graph 9 describes the mean percent canopy in Boardman Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 60%. The mean percent left bank vegetated was 64%. The dominant elements composing the structure of the stream banks consisted of 82% sand/silt/clay and 18% bedrock (Graph 10). Coniferous trees were the dominant vegetation type observed in 43% of the units surveyed. Additionally, 29% of the units surveyed had deciduous trees as the dominant vegetation type, and 29% had brush as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Young of year salmonids were observed from the stream banks in Boardman Gulch up to 5,863 feet.

DISCUSSION

Boardman Gulch is a B4 channel type for the 6,588 feet and a B3 for 171 feet of stream

surveyed. The suitability of B4 and B3 channel types for fish habitat improvement structures are as follows: B4 channel types are excellent for low stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover. B3 channel types are excellent for plunge weirs, boulder clusters and bank placed boulders, single and opposing wing-deflectors and log cover.

The water temperatures recorded on the survey days June 25 through 27, 2002 ranged from 55 to 62 degrees Fahrenheit. Air temperatures ranged from 57 to 77 degrees Fahrenheit. This is a suitable water temperature range for salmonids. However, 60° F, if sustained, is near the threshold stress level for salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 81% of the total length of this survey, pools 10%, and riffles 9%. The pools are relatively shallow, with only 14 of the 44 (32%) pools having a maximum 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 depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

Seven of the 44 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty-Six of the pool tail-outs had embeddedness ratings of 3 or 4. Eleven 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 Boardman Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Thirty-six of the 44 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 23. The shelter rating in the flatwater habitats was 13. 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 all habitat types. Additionally, large woody debris contributes a small amount. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 87%. In general, revegetation projects are

considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 60% and 64%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Boardman Gulch should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from small woody debris. Adding high quality complexity with log and root mass cover is desirable.

5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

6) 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.

7) Increase the canopy on Boardman Gulch by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is affected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

8) Suitable size spawning substrate on Boardman Gulch is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

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

10) Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish. Fish passage should be monitored and improved where possible.

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.

0'	BEGIN SURVEY 50 FEET FROM THE CONFLUENCE WITH SOUTH FORK OF BIG RIVER. THE CHANNEL TYPE IS A B4. BEFORE THE SURVEY WAS BEGUN WE PASSED A 2.1 FOOT CASCADE OVER BEDROCK.
48'	SALMONID YOUNG OF YEAR (YOY).
110'	SHORT CASCADE INTO POOL.
311'	1.5 FOOT PLUNGE.
427'	CHANNEL BEGINNING TO GET OVERGROWN WITH VEGETATION.
664'	LATERAL SCOUR BEDROCK POOL - POOL GREATER THAN 60 % OF WETTED WIDTH.
683'	STEELHEAD YEARLING ABOUT 5 INCHES LONG. SMALL RIGHT BANK TRIB/SPRING.
940'	TRIB ON THE LEFT BANK. TRIB HAS A VERY HIGH GRADIENT.
959'	4 FOOT PLUNGE INTO POOL.
1363'	SHORT PLUNGE OVER LOG AT THE TOP OF THE POOL.
1507'	FROG.
1587'	TOOK CHANNEL TYPE IN THIS UNIT. B4.
1630'	LARGE WOODY DEBRIS (LWD) PILE OVER POOL 7 FEET HIGH, 15 FEET WIDE, AND 10 FEET LONG. SEDIMENT PILED AT TOP POTENTIAL FISH BARRIER. FLOW SEEPING THROUGH THE SEDIMENT.
1692'	SALMONID YOY.
1866'	1+ STEELHEAD.
1887'	LOG JAM, 5 FEET HIGH, 15 FEET WIDE, AND 15 FEET LONG. SEDIMENT PILED

AT THE TOP.

2185' 4 TO 6 PIECES OF LWD ASSOCIATED WITH SWD.

2209' DRY LEFT BANK TRIB.

2281' LEFT BANK EROSION CONOTRIBUTING FINES. 10 FEET HIGH AND 20 FEET WIDE.

2289' LOG JAM 25 FEET WIDE, 7 FEET HIGH, AND 15 FEET LONG.

2650' LEFT BANK EROSION 60 FEET HIGH AND 30 FEET WIDE.

2718' DRY LEFT BANK TRIB.

3175' LEFT BANK EROSION CONTRIBUTING FINES 40 FEET HIGH, AND 50 FEET WIDE.

3324' ROOTMASS ENHANCED SEDIMENT PILE ABOVE HOLDING SEDIMENT PILE ABOVE HELD BY LWD 4 FEET HIGH.

3350' LWD IN CHANNEL..

3381' LOG ENHANCED MID CHANNEL POOL. NO FISH HAVE BEEN OBSERVED SINCE HABITAT UNIT 38.

3396' RIGHT BANK EROSION.

3553' 1+ STEELHEAD.

3565' UNIT ENDS AT CULVERT/ROADCROSSING. FILLING WITH SEDIMENT. ESTIMATED LENGTH OF CULVERT WAS 50 FEET.

3808' ONE PLUS STEELHEAD.

3987' LEFT BANK EROSION CONTRIBUTING FINES.

3998' 4 INCH STEELHEAD AND 50 CM STEELHEAD.

4120' LWD PILED AT TOP OF UNIT, TRAPPING SEDIEMT AT THE TOP.

4190' 2 FOOT CASCADE INTO PLUNGE POOL. YELLOW LEGGED FROG.

4609' LEFT BANK TRIB.

5021' 6 INCH STEELHEAD AND 2, 1+ STEELHEAD. DRY RIGHT BANK TRIB.

5496' UNIDENTIFIED FROG. 4 INCH STEELHEAD/RESIDENT.

5520' CULVERT IN CHANNEL. DRY LEFT BANK TRIB. 3 YEARLING + STEELHEAD.
5852' 6 INCH STEELHEAD/RESIDENT.

5863' 2 YEARLING + STEELHEAD.

5945'	7 FOOT CASCADE SEDIMENT PILE ABOVE HELD BY LWD.
6128'	DRY RIGHT BANK TRIB.
6140'	RIGHT AND LEFT BANK EROSION CONTRIBUTING FINES INTO CREEK.
6195'	POSSIBLE CHANNEL CHANGE. SWD PILE OVER POOL SEDIMENT PILE AT TOP.
6208'	CHANNEL VERY OVERGROWN. OLD HUMBOLDT CROSSING OVER CHANNEL. FALLING APART.
6302'	SWD PILE AT THE TOP OF THE POOL.
6316'	RIGHT BANK CULVERT INTO STREAM, 4 FOOT DIAMETER WITH A RAMP,
6547'	RIGHT BANK EROSION 15 FEET HIGH AND 20 FEET LONG, CONTRIBUTING FINES.
6588'	CHANNEL TYPE CHANGE TO B3.
6642'	POOL CAUSED BY LWD GREATER THAN 60% OF WETTED WIDTH.
6662'	END OF SURVEY. MASSIVE BANK EROSION ON RIGHT AND LEFT BANKS. STREAM HAS BEEN FILLED IN WITH SEDIMENT/MUD. COMPLETE LOSS OF HABITAT FOR SALMONIDS FOR 80 FEET IN THIS UNIT. AT TOP OF THE UNIT THERE IS A BIG SINK HOLE WITH BARELY ANY FLOW. WALKED ABOVE THE SLIDE.

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.

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 8. FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: BOARDMAN GULCH
SAMPLE DATES: 06/25/02 to 06/27/02
STREAM LENGTH: 6759 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: GREENOUGH — Latitude: 39°29'56"
Legal Description: T16NR15WS14 — Longitude: 123°53'26"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 01

Channel Type: B4	Canopy Density: 87%
Channel Length: 6588 ft.	Coniferous Component: 90%
Riffle/flatwater Mean Width: 3 ft.	Deciduous Component: 10%
Total Pool Mean Depth: 0.9 ft.	Pools by Stream Length: 10%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 2%
Water: 055- 062°F Air: 057-077°F	Mean Pool Shelter Rtn: 22
Dom. Bank Veg.: Coniferous Trees	Dom. Shelter: Small Woody Debris
Vegetative Cover: 62%	Occurrence of LOD: 17%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 0 ft.

Embeddness Value: 1. 0% 2.16% 3. 47% 4. 12% 5. 26%

STREAM REACH 02

Channel Type: B3	Canopy Density: 95%
Channel Length: 171 ft.	Coniferous Component: 100%
Riffle/flatwater Mean Width: *********	Deciduous Component: 0%
Total Pool Mean Depth: 1.0 ft.	Pools by Stream Length: 12%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 0%
Water: 055- 055°F Air: 057-057°F	Mean Pool Shelter Rtn: 80
Dom. Bank Veg.: Coniferous Trees	Dom. Shelter: Undercut Banks
Vegetative Cover: **********%	Occurrence of LOD: 20%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 0 ft.

Embeddness Value: 1. 0% 2.0% 3. 100% 4. 0% 5. 0%

ULCH

Drainage: SF BIG RIVER

SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES

Survey Dates: 06/25/02 to 06/27/02

Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T16NR15WS14 LATITUDE:39°29'56" LONGITUDE:123°53'26"

UNITS FULLY ASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN 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
5	RIFFLE	15	40	605	9	2.9	0.2	72	1079	12	177	0	6
9	FLATWATER	41	133	5459	81	3.6	0.3	239	9804	64	2610	0	13
44	POOL	44	16	695	10	7.3	0.9	114	5004	107	4688	85	23

TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq. ft.)	TOTAL VOL. (cu. ft.)
58	6759	15886	7475

ULCH

Drainage: SF BIG RIVER

SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS

Survey Dates: 06/25/02 to 06/27/02

Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T16NR15WS14 LATITUDE:39°29'56" LONGITUDE:123°53'26"

UNITS FULLY MEASURED	HABITAT TYPE	HABITAT OCCURRENCE %	MEAN LENGTH ft.	TOTAL LENGTH ft.	TOTAL LENGTH %	MEAN WIDTH ft.	MEAN DEPTH ft.	MAXIMUM DEPTH ft.	MEAN AREA sq.ft.	TOTAL AREA EST. sq.ft.	MEAN VOLUME cu.ft.	TOTAL VOLUME EST. cu.ft.	MEAN RESIDUAL POOL VOL cu.ft.	MEAN SHELTER RATING	MEAN CANOPY %
4	LGR	14	42	588	9	3	0.2	1.6	78	1089	12	173	0	6	86
1	HGR	1	17	17	0	3	0.2	0.9	49	49	10	10	0	5	85
4	RUN	6	34	201	3	4	0.3	0.9	141	845	36	216	0	13	90
5	SRN	35	150	5258	78	4	0.3	1.2	318	11123	86	3005	0	14	87
28	MCP	28	17	468	7	7	0.9	3.5	118	3301	116	3251	95	25	88
1	CCP	1	18	18	0	9	1.0	2.1	162	162	162	162	113	20	75
2	CRP	2	12	23	0	7	0.9	1.7	77	154	66	132	51	20	83
1	LSL	1	12	12	0	5	0.9	1.7	60	60	54	54	42	5	85
2	LSBk	2	22	44	1	6	0.6	1.7	119	238	66	132	48	5	95
10	PLP	10	13	130	2	9	0.9	2.5	109	1088	96	957	72	23	89

TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
58	6759	18109	8091

GULCH

Drainage: SF BIG RIVER

SUMMARY OF POOL TYPES

Survey Dates: 06/25/02 to 06/27/02

e Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T16NR15WS14 LATITUDE:39°29'56" LONGITUDE:123°53'26"

UNITS FULLY MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN DEPTH (ft.)	MEAN AREA (sq.ft.)	TOTAL AREA EST. (sq.ft.)	MEAN VOLUME (cu.ft.)	TOTAL VOLUME EST. (cu.ft.)	MEAN RESIDUAL POOL VOL. (cu.ft.)	MEAN SHELTER RATING
29	MAIN	66	17	486	70	7.0	0.9	119	3463	118	3413	96	25
15	SCOUR	34	14	209	30	7.9	0.8	103	1540	85	1275	64	19

TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
44	695	5004	4688

)MAN GULCH Drainage: SF BIG RIVER

4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES Survey Dates: 06/25/02 to 06/27/02

uence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T16NR15WS14 LATITUDE:39°29'56" LONGITUDE:123°53'26"

ITS RED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	<1 FOOT MAXIMUM DEPTH	<1 FOOT PERCENT OCCURRENCE	1-<2 FT. MAXIMUM DEPTH	1-<2 FOOT PERCENT OCCURRENCE	2-<3 FT. MAXIMUM DEPTH	2-<3 FOOT PERCENT OCCURRENCE	3-<4 FT. MAXIMUM DEPTH	3-<4 FOOT PERCENT OCCURRENCE	>=4 FEET MAXIMUM DEPTH	>=4 FEET PERCENT OCCURRENCE
28	MCP	64	0	0	18	64	9	32	1	4	0	0
1	CCP	2	0	0	0	0	1	100	0	0	0	0
2	CRP	5	0	0	2	100	0	0	0	0	0	0
1	LSL	2	0	0	1	100	0	0	0	0	0	0
2	LSBk	5	0	0	2	100	0	0	0	0	0	0
10	PLP	23	0	0	7	70	3	30	0	0	0	0

)TAL
ITS
44

BOARDMAN GULCH Drainage: SF BIG RIVER

Table 5 - SUMMARY OF MEAN PERCENT COVER BY HABITAT TYPE Survey Dates: 06/25/02 to 06/27/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T16NR15WS14 LATITUDE:39°29'56" LONGITUDE:123°53'26"

UNITS MEASURED	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
14	4	LGR	0	35	0	5	6	8	0	41	5
1	1	HGR	0	0	0	50	0	0	0	0	50
6	4	RUN	29	18	20	0	18	0	0	16	0
35	5	SRN	13	28	2	17	14	1	0	25	0
28	28	MCP	18	23	24	10	10	0	3	4	8
1	1	CCP	5	10	75	0	5	5	0	0	0
2	2	CRP	10	48	3	0	38	0	0	3	0
1	1	LSL	0	50	0	0	50	0	0	0	0
2	2	LSBk	20	0	0	0	0	0	0	10	70
10	10	PLP	6	20	15	34	4	1	9	3	11

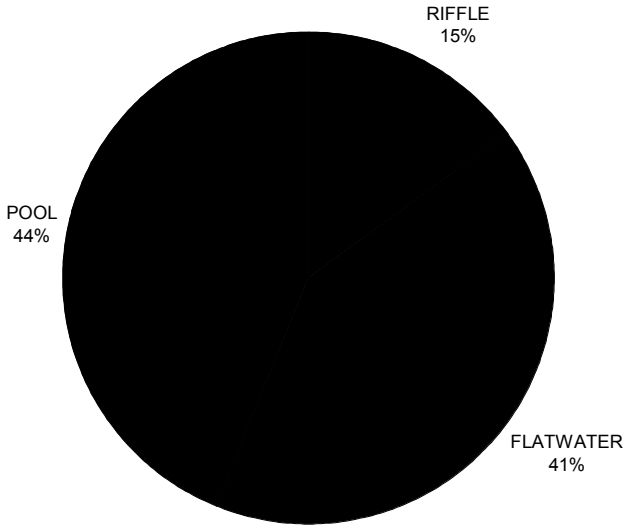
Drainage: SF BIG RIVER

MARY OF DOMINANT SUBSTRATES BY HABITAT TYPE Survey Dates: 06/25/02 to 06/27/02

cation: QUAD: GREENOUGH LEGAL DESCRIPTION: T16NR15WS14 LATITUDE:39°29'56" LONGITUDE:123°53'26"

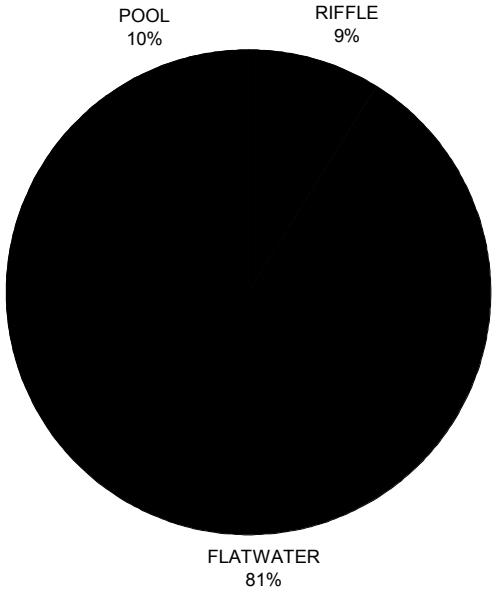
UNITS FULLY SURED	HABITAT TYPE	% TOTAL SILT/CLAY DOMINANT	% TOTAL SAND DOMINANT	% TOTAL GRAVEL DOMINANT	% TOTAL SM COBBLE DOMINANT	% TOTAL LG COBBLE DOMINANT	% TOTAL BOULDER DOMINANT	% TOTAL BEDROCK DOMINANT
4	LGR	0	0	25	25	25	0	25
1	HGR	0	0	0	0	0	0	100
4	RUN	25	0	75	0	0	0	0
5	SRN	20	0	60	20	0	0	0
6	MCP	33	67	0	0	0	0	0
1	CCP	100	0	0	0	0	0	0
2	CRP	50	0	50	0	0	0	0
1	LSL	100	0	0	0	0	0	0
1	LSBk	0	100	0	0	0	0	0
4	PLP	50	25	25	0	0	0	0

BOARDMAN GULCH
HABITAT TYPES BY PERCENT OCCURENCE



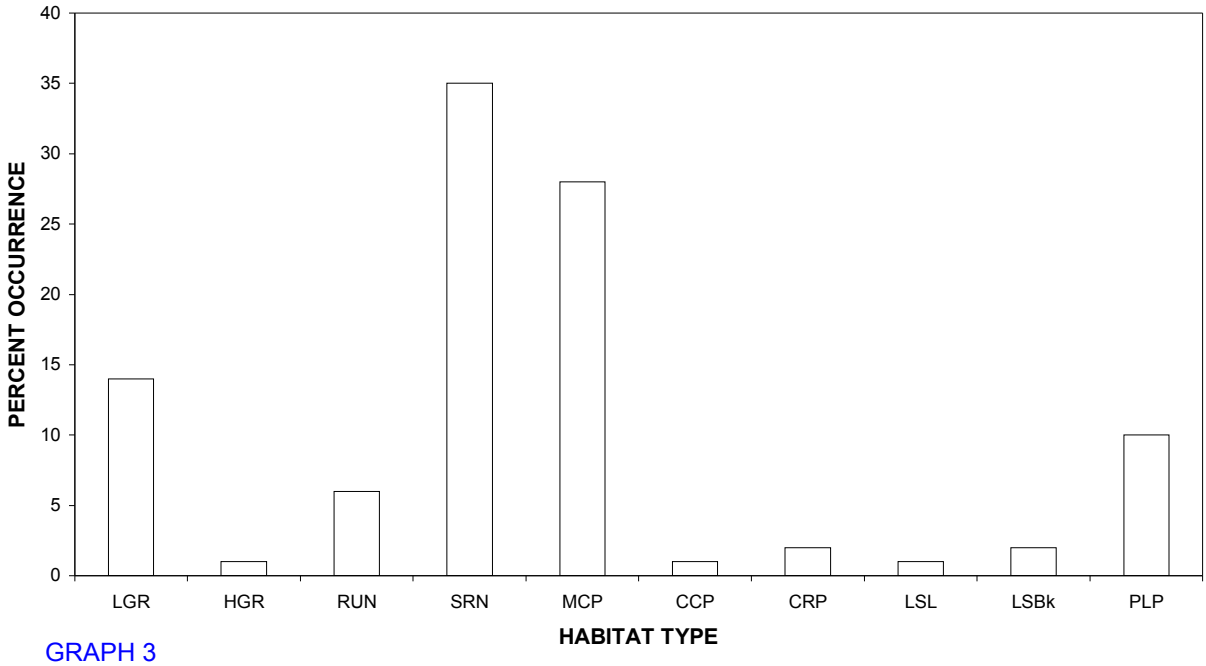
GRAPH 1

BOARDMAN GULCH
HABITAT TYPES BY PERCENT TOTAL LENGTH



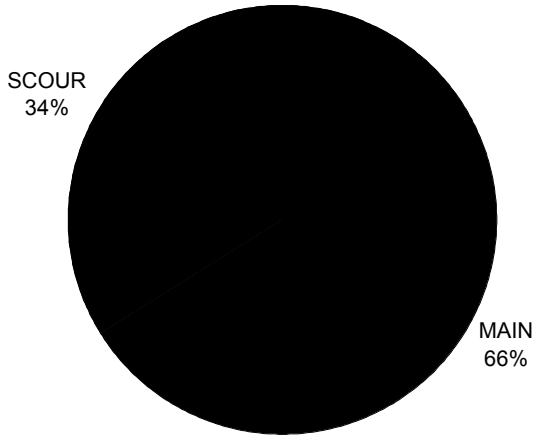
GRAPH 2

BOARDMAN GULCH
HABITAT TYPES BY PERCENT OCCURRENCE



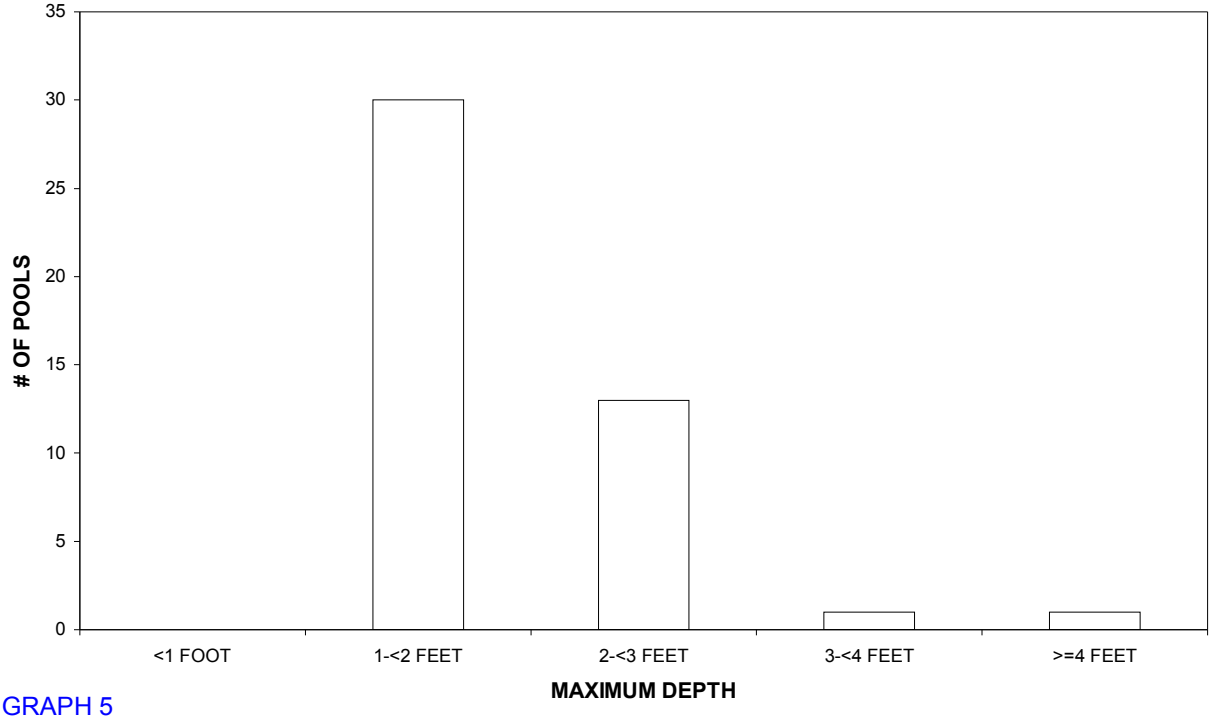
GRAPH 3

BOARDMAN GULCH
POOL HABITAT TYPES BY PERCENT OCCURRENCE



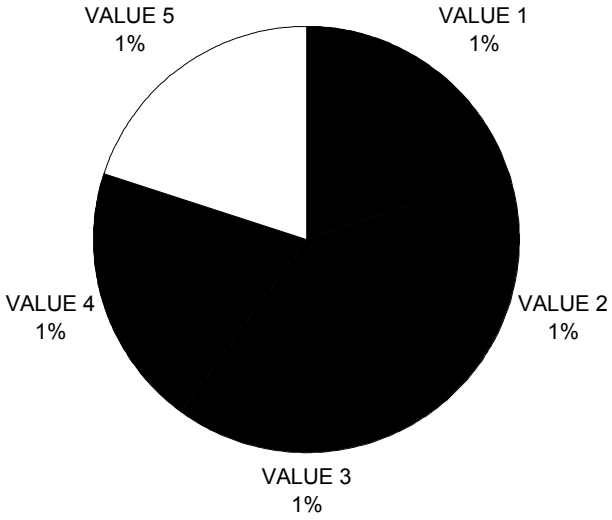
GRAPH 4

BOARDMAN GULCH
MAXIMUM DEPTH IN POOLS



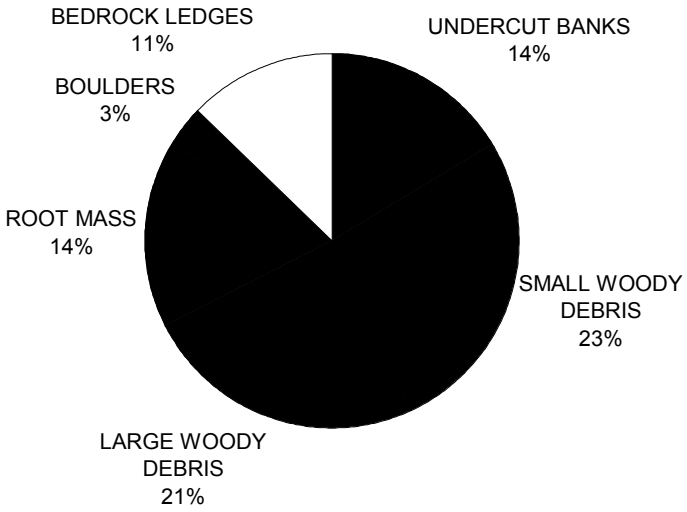
GRAPH 5

BOARDMAN GULCH
PERCENT EMBEDDEDNESS



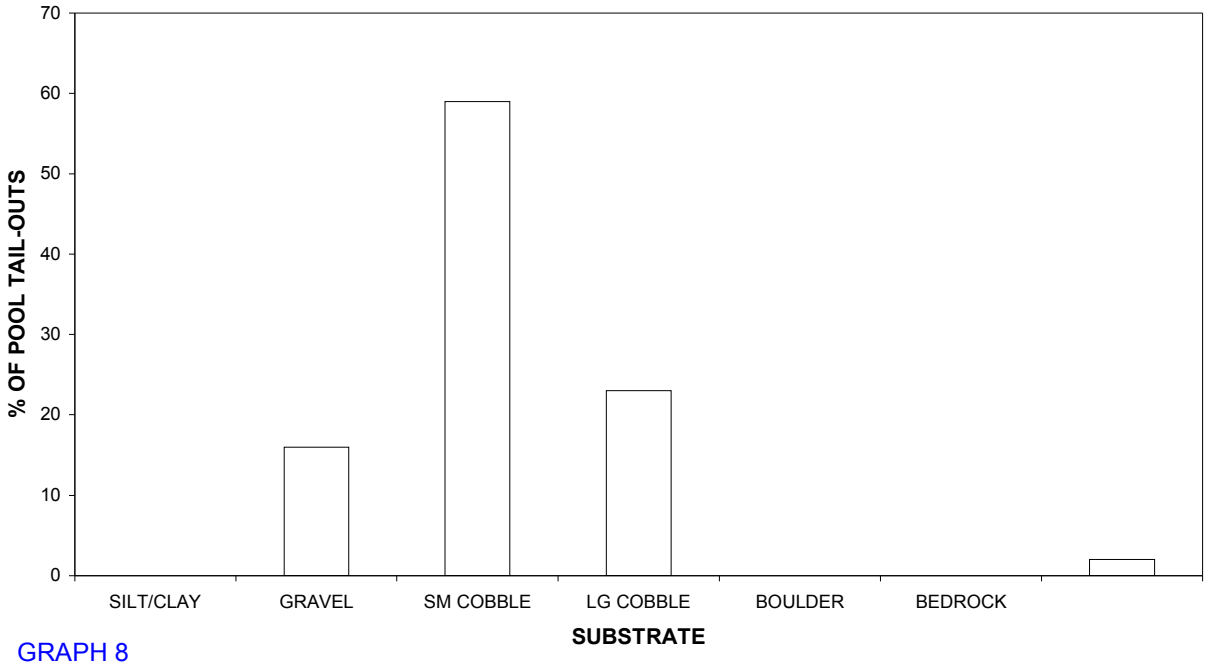
GRAPH 6

BOARDMAN GULCH
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

BOARDMAN GULCH
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS

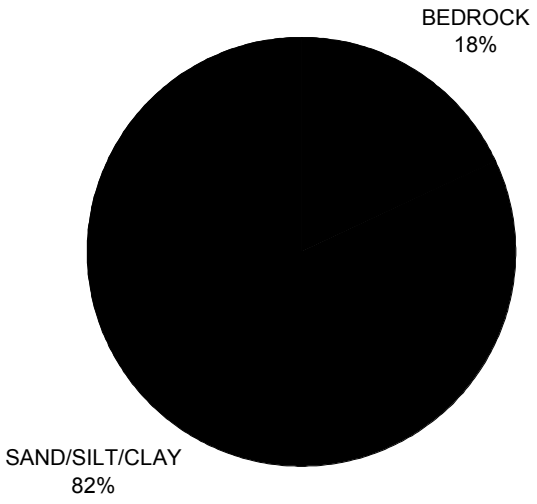


GRAPH 8

BOARDMAN GULCH
MEAN PERCENT CANOPY

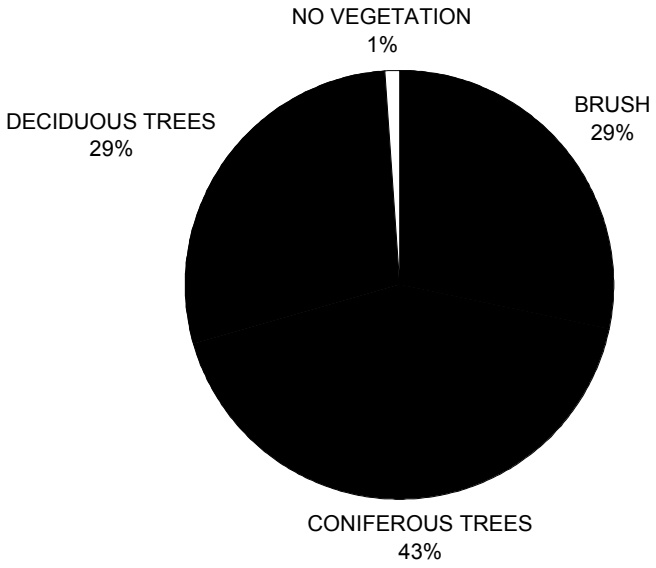
GRAPH 9

BOARDMAN GULCH
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

BOARDMAN GULCH
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11