STREAM INVENTORY REPORT

Bear Gulch

INTRODUCTION

A stream inventory was conducted during the summer of 1995 on Bear Gulch. The 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 Bear Gulch. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species. There is no known record of adult spawning surveys having been conducted on Bear Gulch.

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

Bear Gulch is tributary to the South Fork Noyo River, tributary to the Noyo River, located in Mendocino County, California (Figure 1). Bear Gulch's legal description at the confluence with South Fork Noyo River is T18N R16W S32. Its location is 39°23′03″ north latitude and 123°40′21″ west longitude. Bear Gulch is a first order stream and has approximately 0.7 miles of blue line stream according to the USGS Noyo Hill 7.5 minute quadrangle. Bear Gulch drains a watershed of approximately 0.9 square miles. Summer base runoff is approximately 0.03 cubic feet per second (cfs) at the mouth. Elevations range from about 130 feet at the mouth of the creek to 1200 feet in the headwater areas. Redwood and Douglas fir forest dominates the watershed. The watershed is located within Jackson Demonstration State Forest and is managed for timber production. Vehicle access exists via California Department of Forestry and Fire Protection (CDF) Road 300. Bear Gulch is upstream of the Department of Fish and Game egg taking station on the South Fork Noyo River.

METHODS

The habitat inventory conducted in Bear Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 1994). The California Conservation Corps (CCC) Technical Advisors 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). Bear Gulch personnel were trained in May, 1995, by Gary Flosi. This inventory was conducted by a two-person team.

Bear Gulch

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach (Hopelain, 1994). 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. Habitat unit types encountered for the first time are further 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 Bear 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 standard flow measuring equipment, if available. In some cases flows are estimated.

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.

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". Bear 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. Channel dimensions were measured using hip chains, range finders, tape measures, and stadia rods. All units were measured for mean length; additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were sampled for all features on the

sampling form (*Sampling Levels for Fish Habitat Inventory*, Hopelain, 1995). Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were taken in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Bear 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), 76 - 100% (value 4). Additionally, a rating of "not suitable" (NS) was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, having a bedrock tail-out, 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 Bear 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.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*, 1994. Canopy density relates to the amount of stream shaded from the sun. In Bear 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 Bear Gulch, the dominant composition type (options 1-4) and the dominant vegetation type (options 5-9) 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 was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Bear Gulch fish presence was observed from the stream banks, and five sites were electrofished using one Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, 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 Lotus 1,2,3. Graphics developed for Bear 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
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

The habitat inventory of October 4, 1995, was conducted by Heidi Hickethier and Craig Mesman (CCC). The total length of the stream surveyed was 4,213 feet with an additional 11 feet of side channel.

Bear Gulch

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.03 cfs on October 5, 1995.

Bear Gulch is an F4 channel type for the entire 4,213 feet of stream reach surveyed. F4 channels are entrenched, meandering riffle/pool channels on low gradients with high width/depth ratios and gravel substrates.

Water temperatures ranged from 52 to 55 degrees Fahrenheit. Air temperatures ranged from 46 to 63 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 38% pool units, 33% flatwater units, and 25% riffle units (Graph 1). Based on total **length** of Level II habitat types there were 61% flatwater units, 26% pool units and 13% riffle units (Graph 2).

Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools 22%, low-gradient riffles 22%, and step runs 21% (Graph 3). Based on total **length**, step runs made up 53%, mid-channel pools 16%, and low-gradient riffles 11%.

A total of 53 pools were identified (Table 3). Main channel pools were most frequently encountered at 68% and comprised 67% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat type. Depth is an indicator of pool quality. Seventeen of the 53 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 41 pool tail-outs measured, none had a value of 1 (0%); 17 had a value of 2 (41.5%); 24 had a value of 3 (58.5%); and none had a value of 4 (0%) (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 habitat types had a mean shelter rating of 19, and flatwater habitats had a mean shelter rating of 8 (Table 1). Of the pool types, scour pools had a mean shelter rating of 29, and mid-channel pools had a mean shelter rating of 14 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Terrestrial vegetation and undercut banks are the dominant cover types in Bear Gulch. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Bear Gulch.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in one of the two low gradient riffles measured (50%). Small cobble was the dominant substrate type observed in the other low-gradient riffle measured (Graph 8).

The mean percent canopy density for the stream reach surveyed was 98%. The mean percentages of deciduous and coniferous trees were 2% and 98%, respectively. Graph 9

describes the canopy in Bear Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 94%. The mean percent left bank vegetated was 92%. The dominant elements composing the structure of the stream banks consisted of 14.3% bedrock, 0% boulder, 64.3% cobble/gravel, and 21.4% sand/silt/clay (Graph 10). Grass was the dominant vegetation type observed in 87.5% of the units surveyed. Additionally, 9% of the units surveyed had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Five sites were electrofished on October 3, 1995, in Bear Gulch. The units were sampled by Heidi Hickethier and Craig Mesman (CCC).

The first site sampled included habitat units 9-17, a series of pools, runs, riffles, and bedrock sheets approximately 245 feet from the confluence with South Fork Noyo River. This site had a length of 143 feet. The site yielded seven 0+ coho and one sculpin. Several Pacific giant salamanders were observed.

The second site was habitat unit 103, a mid-channel pool located approximately 2,942 feet above the creek mouth. This site had a length of 15 feet. The site yielded two 0+ coho.

The third site sampled included habitat units 105-121, a series of runs, pools, and riffles located approximately 2,998 feet above the creek mouth. The site had a length of 506 feet. The site yielded four 0+ coho and two 1+ steelhead.

The fourth site sampled included habitat units 127-129, a plunge pool/step run/mid-channel pool combination located approximately 3,772 feet above the creek mouth. The site had a length of 45 feet. The site yielded one 1+ steelhead.

The fifth site sampled was upstream of the surveyed reach, a series of riffles and runs located approximately 4,488 feet above the creek mouth. The site had a length of 375 feet. No fish were sampled.

DISCUSSION

Bear Gulch is an F4 channel type for the entire 4,213 feet of stream surveyed. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for low-stage weirs, single and opposing wing deflectors, channel constrictors, and log cover; and poor for medium-stage weirs and boulder clusters.

The water temperatures recorded on the survey day October 4, 1995, ranged from 52 to 55 degrees Fahrenheit. Air temperatures ranged from 46 to 63 degrees Fahrenheit. This is a very good water temperature range 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 61% of the total **length** of this survey, riffles 13%, and pools 26%. The pools are relatively shallow, with only 17 of the 53 (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.

Twenty-four of the 41 pool tail-outs measured had embeddedness ratings of 3 or 4. None had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. In Bear Gulch, sediment sources should be mapped and rated according to their potential sediment yields, and control measures should be taken.

The mean shelter rating for pools was low with a rating of 19. The shelter rating in the flatwater habitats was lower at 8. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by terrestrial vegetation and undercut banks in all habitat types. Log and root wad cover structures in the pool and flatwater habitats are needed to improve 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.

Both of the two low gradient riffles measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 98%. This is a relatively high percentage of canopy. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 94% and 92%, 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.
Coho were observed through habitat unit 105, approximately 3,012 feet from the confluence with South Fork Noyo River. Steelhead were observed through habitat unit 127, approximately 3,772 feet from the confluence, where a log and debris accumulation (LDA) of unspecified dimensions retaining 4 to 5 feet of sediment impedes further passage. No fish were sampled or observed upstream of that point.

RECOMMENDATIONS

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

2) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from terrestrial vegetation and undercut banks. Adding high quality complexity with woody cover is desirable and in some areas the material is locally available. In particular, large wood should be placed in a manner to increase backwater areas to produce winter holdover habitat.

3) 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.

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

5) 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.

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):	Comment:
0'	Begin survey at confluence with the South Fork Noyo River.
52'	CDF Road 300 bridge 40' long x 8' wide x 3.5' clearance.
523'	Left bank tributary. Flow estimated at <0.1 cfs. Accessible to fish.
1210'	Partial LDA 4' high x 15' wide x 20' long retaining sediment 2' deep at base. Not a barrier.
1444'	Right bank failure contributing clay.
1721'	LDA 6' high x 20' wide x 30' long retaining sediment 2' deep at base. Not a barrier.
2040'	Left bank failure associated with a debris accumulation 3' high x 10' wide x 20' long.
2307'	Relic trestle.

Bear Gulch

3125'	Down trees accumulating debris.
3139'	Debris accumulation retaining 2' of sediment. Left bank failure.
3461'	Relic trestle.
3701'	Foot bridge.
3772'	LDA retaining sediment 4' deep at base. Possible barrier.
3818'	LDA 6' high x 40' wide x 8' long retaining gravel 5' deep at base. Possible barrier.
4213'	Stream forks. Reduced flow and marginal habitat above this point. End of survey.

REFERENCES

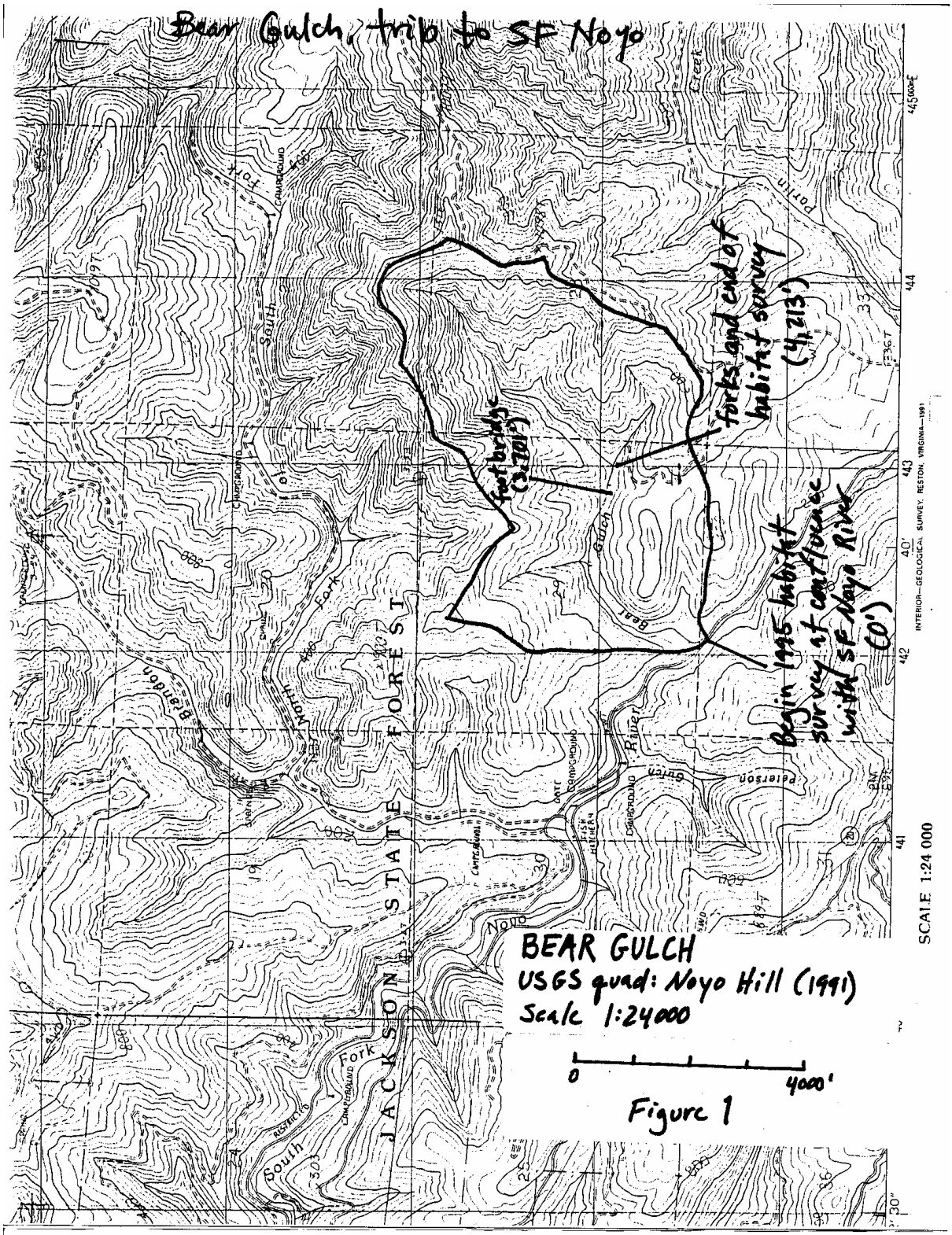
Flosi, G., and F. Reynolds. 1994. California salmonid stream habitat restoration manual, 2nd edition. California Department of Fish and Game, Sacramento, California.

Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

LEVEL III and LEVEL IV HABITAT TYPE KEY

HABITAT TYPE	LETTER	NUMBER
RIFFLE		
Low Gradient Riffle	[LGR]	1.1
High Gradient Riffle	[HGR]	1.2
CASCADE		
Cascade	[CAS]	2.1
Bedrock Sheet	[BRS]	2.2
FLATWATER		
Pocket Water	[POW]	3.1
Glide	[GLD]	3.2
Run	[RUN]	3.3
Step Run	[SRN]	3.4
Edgewater	[EDW]	3.5
MAIN CHANNEL POOLS		
Trench Pool	[TRP]	4.1
Mid-Channel Pool	[MCP]	4.2
Channel Confluence Pool	[CCP]	4.3
Step Pool	[STP]	4.4
SCOUR POOLS		
Corner Pool	[CRP]	5.1
Lateral Scour Pool - Log Enhanced	[LSL]	5.2
Lateral Scour Pool - Root Wad Enhanced	[LSR]	5.3
Lateral Scour Pool - Bedrock Formed	[LSBk]	5.4
Lateral Scour Pool - Boulder Formed	[LSBo]	5.5
Plunge Pool	[PLP]	5.6
BACKWATER POOLS		
Secondary Channel Pool	[SCP]	6.1
Backwater Pool - Boulder Formed	[BPB]	6.2
Backwater Pool - Root Wad Formed	[BPR]	6.3
Backwater Pool - Log Formed	[BPL]	6.4
Dammed Pool	[DPL]	6.5

Bear Gulch


Bear Gulch, trib to SF Noyo
Footbridge (3,301')
Forks and end of habitat survey (4,213')
Begin 1995 habitat survey at confluence with SF Noyo River (0')
BEAR GULCH
USGS quad: Noyo Hill (1991)
Scale 1:24000
0
4000'
SCALE 1:24 000
JACKSON STATE FOREST
Bear Gulch
South Fork
Noyo River
Figure 1