STREAM INVENTORY REPORT

South Branch North Fork Elk River

INTRODUCTION

A stream inventory was conducted from June 6 to June 30, 2005 on South Branch North Fork Elk River. The survey began at the confluence with North Fork Elk River and extended upstream 1.7 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in South Branch North Fork Elk River.

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

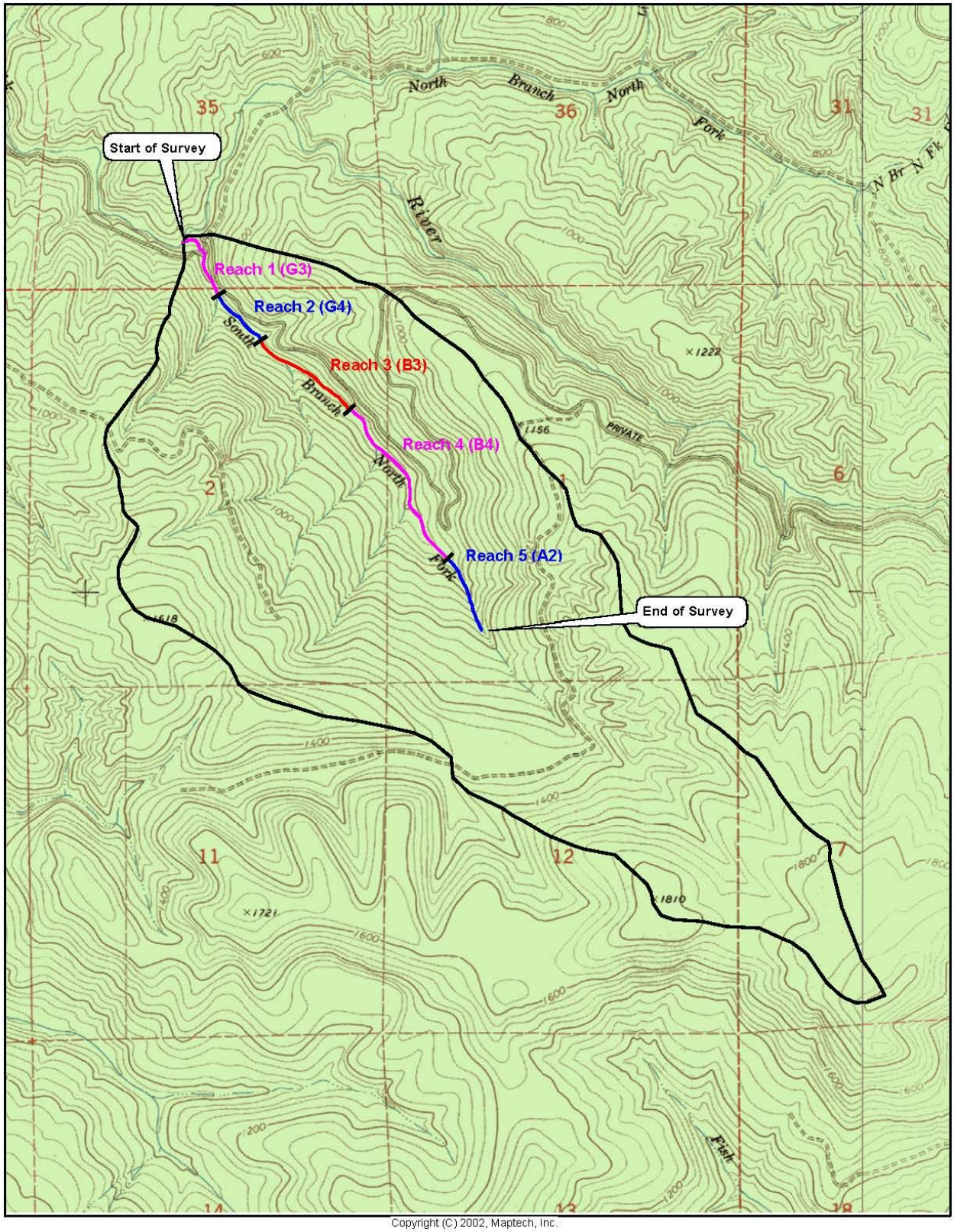
South Branch North Fork Elk River is a tributary to North Fork Elk River, a tributary to Elk River, a tributary to Humboldt Bay, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). South Branch North Fork Elk River's legal description at the confluence with North Fork Elk River is T04N R01E S35. Its location is 40.6811 degrees north latitude and 124.0364 degrees west longitude, LLID number 1240364406810. South Branch North Fork Elk River is a first order stream and has approximately 1.3 miles of blue line stream according to the USGS McWhinney Creek 7.5 minute quadrangle. South Branch North Fork Elk River drains a watershed of approximately 1.9 square miles. Elevations range from about 345 feet at the mouth of the creek to 1,200 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Highway 101 to Elk River Road.

METHODS

The habitat inventory conducted in South Branch North Fork Elk River follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (WSP) 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.

South Branch North Fork Elk River

Map 1



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. All pools except step-pools are fully sampled.

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 South Branch North Fork Elk River to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

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

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". South Branch North Fork Elk River 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 South Branch North Fork Elk River, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In South Branch North Fork Elk River, 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 South Branch North Fork Elk River, 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 South Branch North Fork Elk River, 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 (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.19, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Game. This program processes and summarizes the data, and produces the following ten tables:

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

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Graphics are produced from the tables using Microsoft Excel. Graphics developed for South Branch North Fork Elk River 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 June 6 to June 30, 2005 was conducted by I. Mikus, S. McSmith, and J. Freewoman (WSP). The total length of the stream surveyed was 9,113 feet with no side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.98 cfs on June 6, 2005.

South Branch North Fork Elk River is a G3 channel type for 1,495 feet of the stream surveyed (Reach 1), a G4 channel type for 1,047 feet of the stream surveyed (Reach 2), a B4 channel type for 1,796 feet of the stream surveyed (Reach 3), a B3 channel type for 3,271 feet of the stream surveyed (Reach 4), and an A2 channel type for 1,504 feet of the stream surveyed (Reach 5). G3 channels are entrenched "gully" step-pool channels on moderate gradients with low width /depth ratios and cobble dominant substrates. G4 channels are entrenched "gully" step-pool channels on moderate gradients with low width/depth ratios and gravel dominant substrates. B4 channels are moderately entrenched riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks on moderate gradients with low width /depth ratios and gravel dominant substrates. B3 channels are moderately entrenched riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks on moderate gradients with low width /depth ratios and cobble dominant substrates. A2 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and boulder dominant substrates.

Water temperatures taken during the survey period ranged from 51 to 58 degrees Fahrenheit. Air temperatures ranged from 49 to 64 degrees Fahrenheit.

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Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 44% pool units, 30% riffle units, 24% flatwater units, and 1% unsurveyed units (Graph 1). Based on total length of Level II habitat types there were 38% pool units, 31% riffle units, 30% flatwater units, 1% unsurveyed units, and 1% dry units (Graph 2).

Twelve Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 31%; low gradient riffle units, 19%; and run units, 16% (Graph 3). Based on percent total length, mid-channel pool units made up 27%, low gradient riffle units 19%, and run units 15%.

A total of 158 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 77%, and comprised 82% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Forty-two of the 158 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 158 pool tail-outs measured, 44 had a value of 1 (28%); 41 had a value of 2 (26%); 44 had a value of 3 (28%); 17 had a value of 4 (11%); and 12 had a value of 5 (8%); (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 24, flatwater habitat types had a mean shelter rating of 27, and pool habitats had a mean shelter rating of 71 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 210. Scour pools had mean shelter rating of 79. Main channel pools had a mean shelter rating of 67 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in South Branch North Fork Elk River. Graph 7 describes the pool cover in South Branch North Fork Elk River. 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 53% of pool tail-outs. Small cobble was the dominant substrate observed in 27% of pool tail-outs.

The mean percent canopy density for the surveyed length of South Branch North Fork Elk River was 94%. Six percent of the canopy was open. The mean percentages of hardwood and coniferous trees were 55% and 45%, respectively. Graph 9 describes the mean percent canopy in South Branch North Fork Elk River.

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For the stream reach surveyed, the mean percent right bank vegetated was 95%. The mean percent left bank vegetated was 94%. The dominant elements composing the structure of the stream banks consisted of 48% cobble/gravel, 43% sand/silt/clay, 5% bedrock, and 4% boulders (Graph 10). Coniferous trees were the dominant vegetation type observed in 58% of the units surveyed. Additionally, 35% of the units surveyed had deciduous trees as the dominant vegetation type, and 6% had grass as the dominant vegetation (Graph 11).

DISCUSSION

South Branch North Fork Elk River is a G3 channel type for the first 1,495 feet of stream surveyed, a G4 for the next 1,047 feet surveyed, a B4 for the next 1,796 feet, a B3 for the next 3,271 feet, and an A2 channel type for the for the remaining 1,504 feet. The suitability of G3 and G4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for plunge weirs, opposing wing deflectors and log cover; and poor for boulder clusters and single wing deflectors. B3 and B4 channel types are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors and log cover. A2 channel types are generally not suitable for any habitat improvement structures.

The water temperatures recorded on the survey days June 6 to June 30, 2005 ranged from 51 to 58 degrees Fahrenheit. Air temperatures ranged from 49 to 64 degrees Fahrenheit. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 30% of the total length of this survey, riffles 31%, and pools 38%. The pools are relatively shallow, with only 42 of the 158 (27%) pools having 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 structure that will deepen pool habitat is recommended.

Eight-five of the 158 pool tail-outs measured had embeddedness ratings of 1 or 2. Sixty-one of the pool tail-outs had embeddedness ratings of 3 or 4. Twelve of the pool tail-outs had a rating of 5, which is considered not suitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in South Branch North Fork Elk River should be mapped and rated according to their potential sediment yields, and control measures should be taken.

One-hundred-twenty-six of the 158 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 71. The shelter rating in the flatwater habitats was 27. 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 South Branch North Fork Elk River. 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 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 94%. Reach 1 had a canopy density of 92%, Reach 2 had a canopy density of 94%, Reach 3 had a canopy density of 94%, Reach 4 had a canopy density of 94%, and Reach 5 had a canopy density of 98%. In general, re-vegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 95% and 94%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) South Branch North Fork Elk River should be managed as an anadromous, natural production stream.

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

3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from large woody debris. Adding high quality complexity with woody cover in the pools is desirable.

4) 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.

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	Start of at the confluence with North Fork Elk River. Channel type is a G3.
61	0003	Fish habitat improvement structure.

132	0004	Bank erosion measures 6’ wide x 15’ high. Three logs anchored in pool.
304	0010	Structures for bank protection and pool enhancement.
432	0014	Bank erosion measures 7' wide x 3' long and is contributing sediment to the channel.
487	0016	Decommissioned crossing with log bank protection in-place.
500	0017	Foot bridge to stream monitoring station.
534	0018	Two digger logs.
549	0019	Stream monitoring station.
658	0023	Bank protection structure. Left bank slide measures 8' wide.
749	0027	Log structures.
951	0034	Log debris accumulation (LDA) measures 8’ high x 29’ wide x 9’ long and is composed of 11 pieces of large wood. Salmonids observed upstream.
1,007	0038	Multiple anchored logs.
1,136	0044	Erosion on left bank.
1,244	0048	Digger & cover logs anchored.
1,303	0051	Slide measures 5' high x 5' long.
1,368	0055	Left bank erosion.
1,495	0060	Channel type changes to G4; start of Reach 2. Left bank protection.
1,520	0061	Left bank tributary. Not accessible to fish.
1,717	0067	Plunge 1.8' high.
1,735	0068	Left bank erosion.
1,822	0071	Single log structure spanning channel.
1,846	0072	Log and rock right bank protection.

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1,980	0077	LDA measures 11' high x 20' wide x 15' long and is composed of 11 pieces of large wood.
2,044	0080	Right bank erosion site measures 25' long x 7' high.
2,257	0089	Cover/scour structure.
2,542	0099	Channel type changes to B4; start of Reach 3.
2,602	0101	Digger logs in good condition.
2,853	0109	Log structure in good condition.
2,876	0110	Left bank tributary. Digger/cover logs.
2,953	0113	Right bank erosion site measures 12' long x 20' high.
3,149	0121	Left bank tributary.
3,301	0126	Right bank erosion site measures 60' high x 10' long.
3,350	0127	Digger log working well.
3,374	0128	Pool enhancement structure.
3,528	0131	LDA measurse 6' high x 18' wide x 4' long and is composed of nine pieces of large wood. Fish observed above. LDA has accumulated on log structure.
3,628	0137	LDA measures 8' high x 25' wide x 4' long and is composed of 13 pieces of large wood.
3,804	0145	Digger log working well. Right bank eroding due to undercut.
3,875	0148	LDA measures 10' high x 21' wide x 7' long and is composed of eight pieces of large wood. Two juvenile salmonids observed above LDA.
3,944	0150	Right bank erosion.
4,047	0154	Seep/spring.
4,094	0156	Digger logs working well.
4,145	0158	Plunge 1.4’ high.
4,154	0159	Digger logs in good condition.

4,172	0160	Plunge 1.5' high.
4,185	0161	Left bank tributary. Not accessible to fish.
4,207	0162	Right bank erosion site measures 30' long x 4' high and is contributing sediment to the channel.
4,297	0166	Fish habitat structure.
4,337	0168	Channel type changes to B3, start of Reach 4. LDA retaining sediment on the left bank.
4,586	0173	Digger logs.
4,709	0178	Right bank heavy erosion site measures 20' long x 4' high.
4,731	0179	Right bank erosion site measures 20' long x 3' wide.
4,771	0181	Right bank structure.
4,793	0182	Seep/spring on right bank.
4,871	0184	Bank erosion on both banks.
4,912	0186	Fish habitat structure.
4,961	0188	Plunge 1.6’ high.
5,054	0192	Juvenile salmonid observed.
5,116	0194	Left bank tributary. LLID #1240260406726. Not accessible to fish.
5,173	0195	Right bank erosion.
5,225	0196	Left bank erosion site measures 9' high x 5' wide.
5,269	0198	LDA measures 7’ high x 29’ wide x 9’ long and is composed of two pieces of large wood.
5,314	0200	LDA measures 8’ high x 20’ wide x 20’ long and is composed of 10 pieces of large wood. Fish observed upstream.
5,620	0214	LDA composed of nine pieces of large wood.
5,732	0220	Plunge 1.7’ high.

5,852	0224	Right bank tributary. Not accessible to fish.
5,880	0225	Juvenile salmonid observed (last fish observation).
5,918	0226	Seep/spring on left bank.
6,268	0240	Bank protection structure on left bank.
6,380	0242	LDA spans creek. Plunge 1.1' high.
6,416	0244	Bank protection structure on the right bank.
6,647	0255	Left bank tributary. LLID# 1240242406703. Not accessible to fish.
6,805	0261	LDA measures 8.8’ high x 22’ wide x 3.5’ long and is composed of five pieces of large wood.
6,911	0268	Left bank erosion site measures 12' wide x 6' high.
6,940	0270	Left bank erosion site measures 20' long x 7' high.
7,049	0276	Plunge 2.5' high.
7,075	0278	Left bank erosion site measures 20' wide x 8' high.
7,196	0283	Plunge 1.9’ high. Minor erosion on left bank.
7,243	0286	Landslide causing water to run subsurface, possible barrier. Stream not surveyed.
7,291	0287	Water flows under a pile of wood 18' long and goes subsurface at the landslide.
7,434	0291	Right bank erosion site measures 20' wide x 12' high.
7,451	0292	Right bank tributary. Not accessible to fish.
7,591	0297	Channel type changes to A2, start of Reach 5. Plunge 3.5’ high.
7,609	0298	LDA measures 7’ high x 24’ wide x 4’ long and is composed of two pieces of large wood.
7,681	0301	Plunge 2’ high.
7,746	0305	Plunge 2’ high.

7,787	0307	LDA measures 4.5’ high x 14’ wide x 3.5’ long and is composed of two pieces of large wood.
8,273	0323	Plunge 2.3’ high.
8,383	0330	Plunge 2’ high.
8,519	0336	Plunge 1.5’ high.
8,643	0341	Left bank erosion site measures 11' wide x 11' high. Plunge 1.8’ high.
8,804	0345	Left bank erosion site measures 11' wide x 16' high.
8,860	0346	Plunge 3.9’ high.
8,873	0347	LDA composed of a single 1.5’ diameter log spanning the channel creating a 3.9' plunge.
9,061	0355	Plunge 1.2' high.
9,075	0356	Left bank erosion site measures 8' wide x 15' high.
9,113	0357	End of survey due to the high gradient of the stream and no fish observed since 5,880’.

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.

McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

Rosgen, D.L., 1994. A Classification of Natural Rivers. Catena, Vol 22: 169-199, Elsevier Science, B. V. Amsterdam.

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]	

Appendix A

Large Woody Debris (LWD) Riparian Inventory

South Branch North Fork Elk River
Humboldt County
June 2005

BACKGROUND

The importance of large woody debris (LWD) in the development of a stream's morphological and biological productivity has been well documented. It strongly influences stream habitat characteristics and biotic composition. Large woody debris is often the structural element associated with pool formation and is considered one of the major elements that create complex fish habitat vital for juvenile salmonid survival. Habitat complexity is particularly important for coho salmon and steelhead trout juveniles because these salmonids remain in the stream for at least one year before migrating to the ocean.

Large woody debris inventories describe the present relative abundance of LWD elements providing, or with the potential to provide, fish habitat within the stream channel. Large woody debris inventories also describe the relative abundance of "recruitable" LWD. Recruitable LWD is the large wood existing out of the stream channel that has a high potential of entering the stream channel in the future.

METHODS

Prior to conducting the LWD inventory, the stream was habitat typed employing the methods described by Flosi, et al (1998). The South Branch North Fork Elk River habitat typing survey delineated 5 stream reaches. The start and end points for the LWD inventory reaches correspond to stream reach start and end points of the habitat survey.

Large woody debris inventory methods, data recording forms, and database structure are described in Flosi, et al (1998). Large woody debris minimum size criteria was 12-inches in diameter and 6 feet in length. Root wads had the 12-inch minimum diameter criteria but had no minimum length requirement. Diameter and length categories consisted of the following:

Diameter Category	**Length Category**
1. 1-2 feet 2. 2-3 feet 3. 3-4 feet 4. Over 4 feet	1. 6-20 feet 2. Over 20 feet

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Condition or status categories included:

a) dead and down
b) dead and standing
c) perched for imminent delivery to the stream channel
d) live coniferous trees
e) live broadleaf trees (a.k.a. deciduous/hardwood)

The sampling strategy consisted of selecting a random starting point near the beginning of the LWD survey reach, and then systematically sampling 200 foot sections out of every 1,000 feet of stream length surveyed. The first 1,200 feet of the LWD survey reach was segmented into 200 foot sections and consecutively numbered 1 through 6. One of these six 200 foot sections was randomly selected as the beginning of the *first* sample section. After conducting the inventory survey in the initial 200 foot section, surveyors proceeded upstream 800 feet and surveyed the next 200 feet as the *second* sample section. The *third* sample section began 800 feet upstream of the end of the second sample section and the next 200 feet were surveyed, and so on. Systematic sampling continued upstream until the end of the LWD survey reach. This method produced a sampling level of approximately 20 percent. For channel type reaches that were less than 1000 feet, the entire reach was surveyed.

South Branch North Fork Elk River

RESULTS

*Tables 1 and 2 are located at the end of this report.

Figure 1. Large Woody Debris Inventory for South Branch North Fork Elk River, Humboldt County, California 2005.
Expressed in Number of Pieces Per 100 linear Feet of Stream Channel.

STREAM	REACH	CHANNEL TYPE	TOTAL LENGTH	DEAD DOWN	DEAD STANDING	--LIVE TREES-- PERCHED	CONIFER	BROADLEAF	TOTAL
				Number of pieces per 100 linear feet of stream out of channel on right and left banks					
SB NF Elk River	1	G3	1495	3	0	0	5.5	1.5	10
	2	G4	1047	0.5	0.5	0	6	1	8
	3	B4	1795	4	1	1.5	8.3	1.5	16.3
	4	B3	3273	2.2	0.7	0.5	8.7	2.8	14.8
	5	A2	1503	1.5	0.5	0	6.5	0.5	9
				Number of pieces per 100 linear feet of stream within the bankfull channel					
SB NF Elk River	1	G3	1495	26	0.5		0	0	26.5
	2	G4	1047	8	0		0	0.5	8.5
	3	B4	1795	7.3	0.3		0.3	0	7.9
	4	B3	3273	13.3	0		0.3	0	13.7
	5	A2	1503	3	0		0	0	3
				Number of pieces per 100 linear feet of stream out of channel on right and left banks and within the bankfull channel					
SB NF Elk River	1	G3	1495	29	0.5	0	5.5	1.5	36.5
	2	G4	1047	8.5	0.5	0	6	1.5	16.5
	3	B4	1795	11.3	1.3	1.5	8.5	1.5	24.1
	4	B3	3273	15.5	0.7	0.5	9	2.8	28.5
	5	A2	1503	4.5	0.5	0	6.5	0.5	12
				Percentage of LWD pieces found out of channel on right and left banks					
SB NF Elk River	1	G3	1495	30	0	0	55	15	100
	2	G4	1047	6.25	6.25	0	75	12.5	100
	3	B4	1795	24.54	6.13	9.20	50.92	9.20	100
	4	B3	3273	14.86	4.73	3.38	58.78	18.92	100
	5	A2	1503	16.67	5.56	0.00	72.22	5.56	100
				Percentage of LWD pieces found within the bankfull channel					
SB NF Elk River	1	G3	1495	98.1	1.9	0.0	0.0	0.0	100
	2	G4	1047	94.1	0.0	0.0	0.0	5.9	100
	3	B4	1795	92.4	3.8	0.0	3.8	0.0	100
	4	B3	3273	97.1	0.0	0.0	2.2	0.0	100
	5	A2	1503	100.0	0.0	0.0	0.0	0.0	100
				Percentage of LWD pieces found out of channel on right and left banks and within the bankfull channel					
SB NF Elk River	1	G3	1495	79.5	1.4	0.0	15.1	4.1	100
	2	G4	1047	51.5	3.0	0.0	36.4	9.1	100
	3	B4	1795	46.9	5.4	6.2	35.3	6.2	100
	4	B3	3273	54.39	2.46	1.75	31.58	9.82	100
	5	A2	1503	37.50	4.17	0.00	54.17	4.17	100

The South Branch North Fork Elk River LWD inventory consisted of 5 inventory reaches. Reach 1, a G3 channel type extended upstream approximately 0 feet from the mouth. This reach contained 10 pieces of LWD on both the right and the left banks per 100 linear feet of stream. In descending proportions, the condition of the pieces were 55.0% live coniferous, 30.0% dead and

down, 15.0% live broadleaf, 0% dead and standing, and 0% perched (Figure 1). Within the bankfull channel, Reach 1 contained 26.5 pieces of LWD per 100 linear feet of stream. The conditions of the pieces were 94.1% dead and down, 5.9% live broadleaf, 0% live coniferous, 0% dead and standing, and 0% perched. The total number of pieces per 100 linear feet for both the banks and bankfull channel were 36.5, of which 79.5% were dead and down, 15.1% were live coniferous, 4.1% live broadleaf, 1.4% dead and standing, and 0% perched. Of the pieces in Reach 1, 64.4% were in LWD size category of 1-2 foot in diameter, 23.3% were in the 2-3 foot category, 8.2% were in the 3-4 foot category and 4.1% were in the >4 foot category (Figure 2).

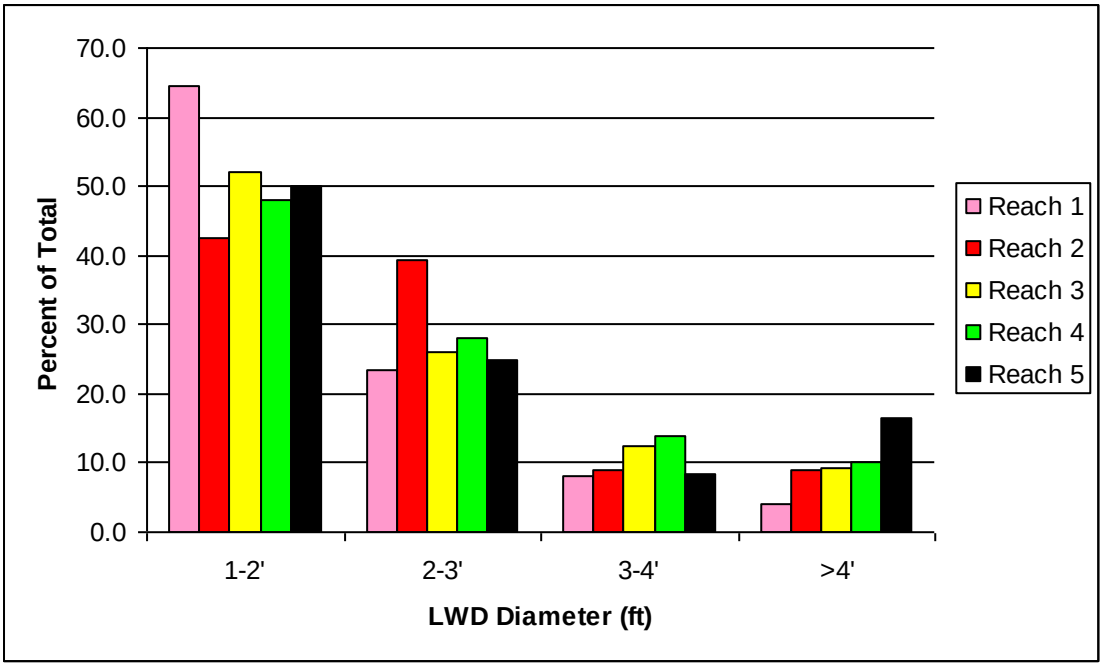
Reach 2, a G4 channel type extended upstream approximately 2542 feet from the mouth. This reach contained 8 pieces of LWD on both the right and the left banks per 100 linear feet of stream. In descending proportions, the condition of the pieces were 75.0% live coniferous, 12.5% live broadleaf, 6.3% dead and down, 6.3% dead and standing and 0% perched (Figure 1). Within the bankfull channel, Reach 2 contained 8.5 pieces of LWD per 100 linear feet of stream. The conditions of the pieces were 94.1% dead and down, 5.9% live broadleaf, 0% live coniferous, 0% dead and standing, and 0% perched. The total number of pieces per 100 linear feet for both the banks and bankfull channel were 16.5, of which 51.5% were dead and down, 36.4% were live coniferous, 9.1% live broadleaf, 3.0% dead and standing and 0% perched. Of the pieces in Reach 1, 42.4% were in LWD size category of 1-2 foot in diameter, 39.4% were in the 2-3 foot category, 9.1% were in the 3-4 foot category and 9.1% were in the >4 foot category (Figure 2).

Reach 3, a B4 channel type extended upstream approximately 4337 feet from the mouth. This reach contained 16.3 pieces of LWD on both the right and the left banks per 100 linear feet of stream. In descending proportions, the condition of the pieces were 50.9% live coniferous, 24.5% dead and down, 9.2% live broadleaf, 9.2% perched and 6.1% dead and standing (Figure 1). Within the bankfull channel, Reach 3 contained 7.9 pieces of LWD per 100 linear feet of stream. The conditions of the pieces were 92.4% dead and down, 3.8% live coniferous, 3.8% dead and standing, 0% live broadleaf and 0% perched. The total number of pieces per 100 linear feet for both the banks and bankfull channel were 24.1 of which 46.9% were dead and down, 35.3% were live coniferous, 6.2% live broadleaf, 6.2% perched and 5.4% dead and standing. Of the pieces in Reach 1, 52.1% were in LWD size category of 1-2 foot in diameter, 26.0% were in the 2-3 foot category, 12.5% were in the 3-4 foot category and 9.4 % were in the >4 foot category (Figure 2).

Reach 4, a B3 channel type extended upstream approximately 7610 feet from the mouth. This reach contained 14.8 pieces of LWD on both the right and the left banks per 100 linear feet of stream. In descending proportions, the condition of the pieces were 58.8% live coniferous, 14.9% dead and down, 18.9% live broadleaf, 4.2% dead and standing and 3.8% perched (Figure 1). Within the bankfull channel, Reach 4 contained 13.7 pieces of LWD per 100 linear feet of stream. The conditions of the pieces were 97.1% dead and down, 2.2% live coniferous, 0% live broadleaf, 0% dead and standing and 0% perched. The total number of pieces per 100 linear feet for both the banks and bankfull channel were 28.5, of which 54.4% were dead and down, 31.6% were live coniferous, 9.8% live broadleaf, 2.5% dead and standing, and 1.8% perched. Of the pieces in Reach 1, 48.0% were in LWD size category of 1-2 foot in diameter, 28.0% were in the 2-3 foot category, 14.0% were in the 3-4 foot category and 10% were in the >4 foot category (Figure 2).

Reach 5, an A2 channel type extended upstream approximately 9,113 feet from the mouth. This reach contained 9 pieces of LWD on both the right and the left banks per 100 linear feet of stream. In descending proportions, the condition of the pieces were 72.2% live coniferous, 16.7% dead and down, 5.6% live broadleaf, 5.6% dead and standing and 0% perched (Figure 1). Within the bankfull channel, Reach 5 contained 3 pieces of LWD per 100 linear feet of stream. The conditions of the pieces were 100% dead and down, 0% live broadleaf, 0% live coniferous, 0% dead and standing, and 0% perched. The total number of pieces per 100 linear feet for both the banks and bankfull channel were 12, of which 37.5% were dead and down, 54.2% were live coniferous, 4.2% live broadleaf, 4.2% dead and standing and 0% perched. Of the pieces in Reach 1, 50.0% were in LWD size category of 1-2 foot in diameter, 25.0% were in the 2-3 foot category, 8.3% were in the 3-4 foot category and 16.6 % were in the >4 foot category (Figure 2).

Figure 2: Percent of LWD according to diameter size class and stream reach



DISCUSSION

South Branch North Fork of the Elk River had 5 reaches. Reach 1, a G3 channel type had a bankfull width of 19 feet. Reach 2, a G4 channel type had a bankfull width of 21 feet. Reach 3, a B4 channel type had a bankfull width of 21 feet. Reach 4, a B3 channel type had a bankfull width of 17 feet. Reach 5, an A2 channel type had a bankfull width of 13 feet.

One goal of conducting LWD inventories is to provide data that, along with fish population and habitat type data, will enable resource managers to characterize the quality of available and potential fish habitat. Although, the relationship between the number, size, and type of LWD pieces per 100 feet, and quality of fish habitat has not been fully established, it is generally

accepted that LWD in the stream channel plays a vital role in contributing to the quality of fish habitat. Large woody debris within the bank zone is the source for future instream LWD and addresses the issue of LWD recruitment to the stream channel. Information in this report will enable resource managers to identify areas lacking in LWD, subsequently leading to planning and prioritizing prescriptions for improvement. This information will also be useful in detecting changes in LWD relative abundance with relation to land use practices or riparian zone restoration projects.