

STREAM INVENTORY REPORT

Unnamed Tributary to Strongs Creek (Mill Creek)

INTRODUCTION

A stream inventory was conducted from 11/16/2004 to 11/18/2004 on an unnamed tributary to Strongs Creek, hereafter called Mill Creek. The survey began at the footbridge approximately 300 feet downstream of Rhonerville Road and extended upstream 0.2 miles. Stream inventories and reports were conducted on Mill Creek only. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Mill Creek.

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

Mill Creek is a tributary to Strongs Creek, a tributary to the Eel River, a tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Mill Creek's legal description at the confluence with Strong's Creek is T02N R01W S02. Its location is 40°34'45" north latitude and 124°08'48" west longitude, LLID number 124166405793. Mill Creek is a first order stream and has approximately 2.04 miles of blue line stream according to the USGS Fortuna 7.5 minute quadrangle. Mill Creek drains a watershed of approximately 1.25 square miles. Elevations range from about 158 feet at the mouth of the creek to 396 feet in the headwater areas. Mill Creek is an urban stream in the lower watershed area and a Redwood/ mixed hardwood forest in the headwater area. The watershed is entirely privately owned and a small portion of the upper watershed is managed for timber production and grazing. Vehicle access exists via Rhonerville Road.

METHODS

The habitat inventory conducted in Mill Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Eel River Watershed Improvement Group (ERWIG) 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 three-person team.

SAMPLING STRATEGY

The inventory for Mill Creek used a 100% sampling methodology where 100% of the habitat units within the survey reach were measured. All habitat units included in the survey are classified according to habitat type and all parameters and characteristics on the field form are measured.

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

1. Flow:

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

2. Channel Type:

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

5. Embeddedness:

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

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6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. 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 Mill Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Mill Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

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

10. Large Woody Debris Count:

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

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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 2.0.3, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Game. This program processes and summarizes the data, and produces the following ten tables:

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

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

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

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HABITAT INVENTORY RESULTS

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

The habitat inventory of 11/16/2004 to 11/18/2004 was conducted by Ryan Wells (ERWIG), and Justin Williams and Sara. Luring (WSP). The total length of the stream surveyed was 942 feet. Stream flow was measured ten feet upstream of the Rohnerville Road culvert inlet with a Marsh-McBirney Model 2000 flowmeter at 0.056 cfs on 12/3/2004.

Mill Creek is a B4 channel type for 942 feet of the stream surveyed (Reach 1). 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.

Water temperatures taken during the survey period ranged from 53 to 55 degrees Fahrenheit. Air temperatures ranged from 55 to 57 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 39.1% pool units, 30.4% riffle units, 26.1% flatwater units and 4.3% culvert units (Graph 1). Based on total length of Level II habitat types there were 48% flatwater units, 19% riffle units, 18% pool units, 15% culvert units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 30% low gradient riffle units, 22% run units and 22% mid-channel pool units (Graph 3). Habitat types based on percent total length are 38% run units, 19% low gradient riffle units, 10% mid-channel pool units. A culvert unit comprised 15% of the total length.

A total of 9 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 67% and comprised 67% 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. One of the nine pools (11%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 9 pool tail-outs measured, 3 had a value of 1 (33.3%); 4 had a value of 2 (44.4%); 2 had a value of 5 (22.2%); (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 unsuited for spawning due to inappropriate substrate like bedrock, log sills, boulders, etc.

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 8, flatwater habitat types had a mean shelter rating of 13, and pool habitats had a mean shelter rating of 27 (Table 1). Of the pool types, the scour pools had a mean shelter rating of 5, main channel pools had a mean shelter rating of 38, backwater pools had a mean shelter rating of 10 (Table 3).

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Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Mill Creek. Graph 7 describes the pool cover in Mill Creek. Small woody debris is the dominant pool cover type followed by terrestrial vegetation.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Small cobble substrate was observed in 44% of pool tail-outs and gravel substrate was observed in 33% of pool tail-outs.

The mean percent canopy density for the surveyed length of Mill Creek was 80%. The mean percentages of hardwood and coniferous trees were 96% and 4%, respectively (Table 7). Twenty percent of the canopy was open. Graph 9 describes the mean percent canopy in Mill Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 77%. The mean percent left bank vegetated was 68%. The dominant elements composing the structure of the stream banks consisted of 55% sand/silt/clay, 39% cobble/gravel and 7% boulder (Graph 10). Brush was the dominant vegetation type observed in 73% of the units surveyed. Additionally, 20% of the units surveyed had hardwood trees as the dominant vegetation type, and 7% had grass as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

A biological inventory was not taken.

DISCUSSION

Mill Creek is a B4 channel type for the entire 942 feet of stream surveyed. The suitability of B4 channel types for fish habitat improvement structures is 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.

The water temperatures recorded on the survey days 11/16/2004 to 11/18/2004, ranged from 53 to 55 degrees Fahrenheit. Air temperatures ranged from 55 to 57 degrees Fahrenheit. This is a good water temperature range for juvenile 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 48% of the total length of this survey, riffles 19%, and pools 18%. The pools are relatively shallow with only 1 of the 9 (11%) pools having a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width.

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Seven of the 9 pool tail-outs measured had embeddedness ratings of 1 or 2. None of the pool tail-outs had embeddedness ratings of 3 or 4. Two 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.

Seven of the 9 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 27. 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 Mill Creek. Small woody debris is the dominant cover type in pools followed by terrestrial vegetation. 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 80%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 77% and 68%, 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) Mill Creek 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) Biological sampling for salmonids was not conducted as part of this survey. Fish sampling needs to be conducted on Mill Creek to determine salmonid use and distribution.
- 4) The Mill Creek culvert under Rohnerville Road has been evaluated for fish passage as described in the *California Salmonid Stream Habitat Restoration Manual*, Part IX (Flosi et al. 2002). The culvert fails to meet the California Department of Fish & Game and NOAA Fisheries fish passage criteria. Replacement or retrofit of this culvert to meet fish passage criteria needs to be explored.
- 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.

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- 6) Explore opportunities to remove exotic vegetation such as Himalaya berry and ivy. Replant these areas with appropriate native vegetation like 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.

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 survey at footbridge. Heavy blackberry vegetation on both banks
41	0002	Nearly vertical 8 foot left bank.
55	0003	Nine foot vertical left bank.
65	0004	Severely undercut left bank.
79	0005	Twenty foot vertical left bank.
149	0006	Heavy English ivy and Himalayan blackberry growth.
265	0008	Culvert under Rhonerville Road. This is a 6' diameter, concrete culvert, 142' in length, with a slope of 5.9%. This culvert fails to meet DFG and NOAA fish passage criteria.
652	0017	Old milled wood debris in pool
662	0018	Eight foot vertical left bank
720	0019	Heavy blackberries
825	0021	Large broken pieces of concrete in pool
942	0023	End of survey due to landowner access.

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REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

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LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE

Low Gradient Riffle	(LGR)	[1.1]	{ 1 }
High Gradient Riffle	(HGR)	[1.2]	{ 2 }

CASCADE

Cascade	(CAS)	[2.1]	{ 3 }
Bedrock Sheet	(BRS)	[2.2]	{24}

FLATWATER

Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}

MAIN CHANNEL POOLS

Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}

SCOUR POOLS

Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }

BACKWATER POOLS

Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}

ADDITIONAL UNIT DESIGNATIONS

Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	