STREAM INVENTORY AND ASSESSMENT REPORT
FOR THE
CARLEY RANCH, ROUND VALLEY, CALIFORNIA

Prepared for:

State Water Resources Control Board
Division of Water Rights
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June 6, 2006

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INTRODUCTION

An instream habitat assessment was conducted on an unnamed intermittent tributary within the Carley Ranch in Round Valley, California. The Carleys constructed a dam on the unnamed tributary with the intent to impound up to 19 acre-feet of water. The purpose of this assessment was to:

1. Try and determine the type and quality of instream fish habitat that may have been inundated by the construction of the Carley's 10 acre-foot impoundment,
2. Identify instream fish habitat that may be affected downstream of the impoundment,
3. Determine suitability of the instream habitat for salmonid use, and
4. Potential impacts to salmonid resources from the impoundment.

This report will be used to assist in the processing of the Carley's water rights application #31360. In addition, the information contained in this report will contribute to the Clean Water Act 401 and 404 permits, a California Department of Fish and Game 1603 Agreement, and development of an Initial Study as required under the California Environmental Quality Act.

Watershed Overview

The project area is an unnamed intermittent tributary (Tributary 1) to Turner Creek, thence Mill Creek, thence Middle Fork Eel River, and thence the Eel River in Mendocino County. The legal description of the project area is T22N, R12W, Section 29 (MDB&M) on the Jamison Ridge 7.5 minute Quadrangle (see attached map). The assessment area extended from the impoundment site downstream to Turner Creek, a distance of approximately 0.75 miles. Tributary 1 drains approximately 0.93 square miles (595 acres) of watershed area. Contained within the Tributary 1 watershed are two smaller intermittent watercourses. One of these smaller tributaries (Tributary 1a) contains the impoundment structure. It is a 0 Order intermittent stream that drains an area of approximately 0.27 square miles (173 acres). Approximately 500 feet downstream of the dam it is joined by another 0 Order unnamed tributary (Tributary 1b) that drains approximately 0.32 square miles (205 acres).

The Tributary 1 watershed starts in the southern Round Valley foothills and runs through cultivated fields and pastures prior to joining Turner Creek. Elevations in the watershed range from 1,360 feet to 2,230 feet. The stream begins to go intermittent in the spring and is dry in the summer through early fall when the seasonal rains begin. Winter baseflows average 1.2 cfs. The stream is contained in an incised channel running through a mixed grassland and oak woodland. The dominant streamside tree specie was Oregon white oak (*Quercus garryana*). Land use in the watershed consists primarily of agriculture and cattle grazing.

METHODS

The habitat inventory follows the Level IV methodology presented in the California Salmonid Stream Habitat Restoration Manual, Third Edition (Flosi et al. 1998). Dennis Halligan, NRM Fisheries Biologist, conducted the habitat inventory on May 19, 2003. The survey was broken into two reaches: Reach 1was between the dam and Tributary 1b (512 feet) with Reach 2

extending 394 feet downstream from the mouth of Tributary 1b. A streambank observation was also conducted between the downstream end of Reach 2 and Turner Creek; a distance of approximately 1,800 feet. A pre-project field inspection was also conducted on February 21, 2003.

Habitat Inventory Components

A standardized habitat inventory form has been developed for use in California surveys and can be found in Flosi et al. (1998). This form was used to record measurements and observations during the habitat inventory. There are nine major components to the inventory form.

1) Flow:

Flows were determined by ocular estimation and based on experience.

2) Channel Type:

Channel types were not determined during this inventory.

3) Temperatures:

Water temperatures were recorded using a handheld thermometer. The temperature and time of the measurement was recorded on a field data form during the habitat survey. Temperatures were taken in degrees Celsius (C^0).

4) Habitat Type:

The Level IV Stream Inventory, found in Flosi et al. (1998), uses 24 habitat classification types including riffle, cascade, flatwater, main channel pool, scour pool, and backwater pool (see Appendix C for description of Level IV habitat types). Habitat units were numbered sequentially and assigned a type identification number of one through six. Each unit's mean length and mean width were estimated by pacing and measured by tape and/or stadia rod. Pacing measurements were periodically compared to the tape measure to insure accuracy. Readings for mean depth, maximum depth, and pool tail crest were taken to the nearest tenth of a foot by using a stadia rod marked in increments of one/tenth inch. Pool tail crest depth at each pool unit was measured in the thalweg.

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 sediments. The values were recorded using the following ranges: 0-25% (value 1), 26-50% (value 2), 51-75% (value 3), 76-100% (value 4), non-habitat (value 5).

6) Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide salmonids with protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of terrestrial units to reduce density related competition. The shelter rating was calculated for each habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered was made.

All cover was then classified according to the list of nine cover types found on the data sheet. Standard qualitative shelter values of 0 (none), 1 (low), 2 (medium), or 3 (high) were 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 consisted of a range of particle sizes from silt/clay to boulders and bedrock. In all habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as one and two, respectively.

8) Canopy:

Percent total canopy was determined through use of a spherical densiometer. Measurements were taken in the center of the channel. Total canopy refers to the amount of each habitat unit covered by vegetation leaning or hanging over the bank. The results were recorded on the data sheet.

9) Bank Substrate and Vegetation Composition:

Bank substrate composition elements can range from bedrock to bare soil. The vegetative component can vary from bare soil to brush to young trees. These factors influence the ability of stream banks to withstand winter flows. The dominant vegetation types of both the right and left banks were entered onto the habitat inventory form. Additionally, the percent of each bank covered by vegetation was estimated and recorded. The bank substrate and vegetation composition was recorded only for the area bordering the wetted channel.

Biological Inventory

Biological sampling used to determine the biological diversity present in the surveyed section of stream. Biological inventory can be conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, and 3) electrofishing. These sampling techniques are discussed in Flosi et al. (1998). Streambank observation was used for this survey due to the narrowness of the stream, clarity of water, and scarcity of instream cover.

Data Analysis

Data from the habitat inventory form were entered into an Access program developed by NRM. This program processed and summarized the data as well as produced tables and figures. Tables for each reach include:

- Summary of Level II riffle, flatwater, and pool habitat types
- Summary of Level IV habitat types
- Summary of pool types and depths
- Summary of mean percent instream shelter by habitat type
- Summary of dominant substrates by habitat type
- Summary of sub-dominant substrates by habitat type

- Summary of canopy, streambank, and vegetative characteristics
- Summary of measured fish habitat elements

Figures for each reach include:

- Level II habitat types by percent of total reach length
- Level IV habitat types by percent of total reach length
- Percentage pooltail embeddedness values
- Percent of dominant substrate by total reach length
- Percent of sub-dominant substrate by total reach length
- Left bank dominant vegetative cover by percent of total reach length
- Right bank dominant vegetative cover by percent of total reach length
- Left bank substrate composition by percent of total reach length
- Right bank substrate composition by percent of total reach length

HABITAT INVENTORY RESULTS

*ALL TABLES (except #17) AND FIGURES ARE LOCATED IN APPENDIX B. *

Reach 1 - Dam to Tributary 1b

The total length of the stream surveyed was 512 feet or approximately 75 bankfull widths. A total of 27 individual habitat units were identified and measured.

The mean flow was approximately 0.1 cfs. The bankfull width averaged 6.7 feet with an average wetted width of 3.6 feet.

Water temperature was 22°C (72^{0}F) at 12:20 in the afternoon.

Table 1 summarizes the relative percentages of Level II riffle, flatwater, and pool habitat types. Based on percent **occurrence,** riffles made up 41%, flatwater 37%, and pools 22%. Flatwater units made up 45% of the total **length** of level II habitat types, pools 16%, and riffles 39% (Figure 1).

Five Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types, by percent **occurrence**, were low gradient riffles (41%), runs (37%), corner pools (7%), lateral scour pools – bedrock formed (7%), and lateral scour pools – rootwad formed (7%). Percent total **length** was divided into runs (45%), riffles (39%), with the three pools making up 5% each (Figure 2).

Generally, pool quality for salmonids increases with depth. All of the pools had maximum depths of less than 1.5 feet (Table 3). The average maximum depth for all the pools was 1.1 feet. The average residual pool depth (maximum depth minus depth of pool tail crest) was 0.9 feet.

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 6 pool tail-outs measured, 2 had a value of 3 (33%); and 4 had a value of 4 (67%) (Figure 3). The average embeddedness for the reach was 3.7 (Table 3). Embeddedness data indicate spawning habitat quality is poor in the survey reach.

A shelter rating was calculated for the habitat types within the survey reach using a scale of 0-300. A shelter rating of 80 or greater is desirable. Pools averaged a shelter rating of only 24. Corner pools had the highest shelter ratings, averaging 60 (Table 4). Runs and riffles had ratings of at 8 and 5, respectively. Aquatic vegetation was the dominant cover type within the survey reach and composed primarily of algae.

Table 5 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed throughout the reach. Small cobble was dominant only in one of the pools. Figure 4 shows the dominant substrate by length of the survey reach.

Table 6 summarizes the sub-dominant substrate by habitat type. Small cobble was the primary sub-dominant substrate observed in the survey reach. Figure 5 shows the sub-dominant substrate by length of the survey reach.

The average percent canopy density for the stream reach surveyed was 11% and composed of deciduous trees (Table 7).

The mean percentage of right bank vegetation coverage was 63%. The mean percent left bank vegetation coverage was 73% (Table 7). Grass was the dominant vegetation type observed in most of the units surveyed (Figures 6 and 7). Brush (manzanita and poison oak) made up the remaining stream bank vegetation cover.

The low-flow channel streambank substrate elements differed relatively little between the left and right streambanks (Figures 8 and 9). Cobble/gravel dominated the bank substrate with silt, sand, and clay making up the remainder.

Table 8 summarizes Level IV habitat type attributes.

Reach 2 – Tributary 1b Downstream

The total length of the stream surveyed was 394 feet or approximately 40 bankfull widths. A total of 20 individual habitat units were identified and measured.

The mean flow was approximately 0.2 cfs. The bankfull width averaged 10.5 feet with an average wetted width of 4.1 feet.

Water temperature ranged from 17 to 19°C (63-67^{0}F) between 11:00 and 11:40 in the morning.

Table 9 summarizes the relative percentages of Level II riffle, flatwater, and pool habitat types. Based on percent **occurrence,** riffles made up 45%, pools 40%, and flatwater 15%. Pools made up 51% of the total **length** of level II habitat types, riffles 36%, and flatwaters 13% (Figure 10).

Four Level IV habitat types were identified. The data are summarized in Table 10. The most frequent habitat types, by percent **occurrence**, were low gradient riffles (45%), corner pools

(35%), runs (15%), and lateral scour pools – bedrock formed (5%). Percent total **length** was divided into corner pools (44%), riffles (36%), Runs (13%), and scour pools (6%) (Figure 11).

All of the pools had maximum depths of less than 1.6 feet (Table 11). The average maximum depth for all the pools was 1.3 feet. The average residual pool depth (maximum depth minus depth of pool tail crest) was 1.1 feet.

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 8 pool tail-outs measured, 1 had a value of 1 (13%), 3 had a value of 2 (38%); and 4 had a value of 3 (49%) (Figure 12). The average embeddedness for the reach was 2.4 (Table 11). Embeddedness data indicate spawning habitat quality is poor in the survey reach.

A shelter rating was calculated for the habitat types within the survey reach using a scale of 0-300. A shelter rating of 80 or greater is desirable. Pools averaged a shelter rating of only 1.8. Corner pools had the highest shelter ratings, averaging 3 (Table 12). Instream shelter was extremely low, nearly non-existent.

Table 13 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed throughout the reach. Silt/clay was dominant in 23% of the habitat units. Figure 13 shows the dominant substrate by length of the survey reach.

Table 14 summarizes the sub-dominant substrate by habitat type. Small cobble was the primary sub-dominant substrate observed in riffles and runs. Sand, silt and clay were subdominant in pools. Figure 14 shows the sub-dominant substrate by length of the survey reach.

The average percent canopy density for the stream reach surveyed was 8% and composed of deciduous trees (Table 15).

The mean percentage of right bank vegetation coverage was 49%. The mean percent left bank vegetation coverage was 57% (Table 15). Grass was the dominant vegetation type observed in all of the units surveyed (Figures 15 and 16).

The low-flow channel streambank substrate elements differed relatively little between the left and right streambanks (Figures 17 and 18). Cobble/gravel slightly dominated the left bank substrate with silt, sand, and clay dominating the right bank.

Table 16 summarizes Level IV habitat type attributes.

Biological Inventory Results

No salmonids were observed from the streambank within the survey reach even though the water was low and clear and instream cover was scarce. However, bluegills or sunfish, both non-native exotic species, were observed in the dam outfall pool.

A streambank survey was conducted from the downstream end of the project reach to the confluence with Turner Creek. No fish of any species were observed. Tributary 1 was dry for 700 feet upstream of its mouth.

No redds were observed throughout the survey reach.

No evidence of salmonids was observed during the pre-project field inspection in February 2003.

DISCUSSION

Instream Habitat

Flatwater habitat types in Reach 1 comprised 45% of the total survey length, riffles 39%, and pools 16%. The habitat ratios for Reach 2 were 51% pools, riffles 36%, and flatwaters 13% by stream length. In steelhead streams, CDFG believes it is desirable to have primary pools (>3 feet deep) make up approximately 50% of total habitat. Reach 1 does not even come close to meeting this standard for either pool depth or amount of habitat. Reach 2 meets the standard for amount of habitat, but not pool depth. Even though the habitat may not reach the optimum level of desirability that does not mean the watercourses are non-habitable by steelhead. One needs to look at other parameters, such as streamflow and habitat quality and quantity, to get a better understanding of habitat suitability.

One of the primary habitat parameters necessary for salmonid use of a stream is adequate streamflow. As stated above Tributary 1 is subject to intermittent flow, which could allow for some limited spawning or rearing as long as the fish are able to exit the watercourse prior to it going dry. Tributary 1 goes dry first at the mouth and then progressively further upstream until the entire watershed has no flowing surface water. In 2003, following a very wet April, the lower 700 feet of Tributary 1 was dry by May 19, the date of the survey. Since mid-spring is generally the peak of the downstream steelhead and Chinook migration period, any migrating juveniles in Tributary 1 would have been halted by the lack of flow and be trapped in the upper reaches where the watercourse was still wet. If adults used the creek for spawning at least some juveniles should have been observed during the survey. No steelhead or Chinook juveniles were observed. The dry creek mouth also prevented any late running adult steelhead from entering and spawning. In addition, no evidence of salmonids was evident during the February 2003 field inspection. Discharge at that time was approximately 1 cfs and followed a series of storms that should have allowed salmonids access to Tributary 1.

Good quality spawning gravel is another critical factor in maintaining salmonid use in a watercourse. As mentioned in the Results section, spawning gravel was found to be moderately to highly embedded with sand and fine sediment. The spawning substrate tended to be primarily made up of gravel in the 0.5-1.5-inch size. This small-sized, embedded substrate likely significantly reduces if not precludes successful spawning through emergence of fry. In addition, a shallow clay layer was observed in some areas, which would restrict redd depth. No redds were observed throughout Tributary 1 even though the survey was conducted at the end of the normal steelhead spawning period.

Spawning habitat quality habitat was particularly poor in Tributary 1a. Embeddedness levels were very high. In addition, the channel width appeared to be too narrow with a bankfull width of averaging 6.7 feet and wetted width of 3.6 feet. Steelhead make redds that average 24 square feet. The riffles appeared too small to accommodate spawning adults. Spawning adult salmonids, or females holding on redds following spawning, also require escape cover into which they can hide when disturbed. Escape cover was entirely lacking.

Rearing habitat quality is a factor in salmonid success in streams. Even if Tributary 1 did not dry up in the summer and fall, rearing habitat quality was still very poor as evident by the very low pool shelter ratings. The relative lack of cover would make fish in the watercourse highly susceptible to being preyed upon by herons, egrets, and other predators. The annual drying of the watercourse also restricts the establishment of benthic macroinvertebrate populations, which tend to serve as the primary food source for juvenile fish. Many of these insect species require at least one year of larval development in water. The seasonal drying of Tributary 1 does not allow this to occur. Therefore, potential food resources for fish are generally limited to insect fall from the very sparse overhead streamside vegetation.

Water temperatures reached a surprisingly high level for mid-May. A temperature of 22°C is very stressful for rearing salmonids especially in a low flow situation where dissolved oxygen concentrations may not be at their optimum. In addition, the relatively small size and embedded nature of the substrate impairs the ability of juvenile steelhead to conceal themselves in the streambed where cooler interstitial flow may be available.

Based upon habitat data collected during the survey, streambank observations, and professional judgment, it does not appear Tributary 1, and especially Tributary 1a, supports a salmonid population and no evidence of salmonid use was observed. This observation is consistent with that of Mr. Weldon Jones, CDFG Fishery Biologist, who reviewed the Carley project area. In a June 6, 2001 letter referring to the Carley dam project, Mr. Jones stated, "No fish use the unnamed stream for the subject project, but Chinook salmon and steelhead do migrate into the mainstem of Turner Creek and the South Fork of Turner Creek for spawning and limited rearing."

The dam outfall pool is fed by seepage and contains the only permanent surface water in the Tributary 1 watershed, with the exception of the impoundment itself. The presence of exotic bluegill or sunfish in the dam outfall pool may be explained by these few individuals migrating up the unnamed tributary during high flows and becoming trapped prior to the rest of the stream going dry. Neither the dam or outfall pool was present when Mr. Jones conducted his survey.

Potential Project Impacts on Salmonid Fisheries

It appears that the Carley dam may have two potential impacts on salmonid resources in Turner Creek. These potential effects may result from the altered hydrograph due to the impoundment and the loss of sediment of an appropriate size to contribute to habitat development.

Brown (2004) concluded that Tributary 1a produces an average annual runoff of 328.5 acre-feet (af) of water per year and 215 af during the December 15 to March 31 diversion season at the dam. If the dam were to be drained completely every year then the 19 af impoundment would account for approximately 5.7% of the annual yield and 8.8% of the diversion season yield. The Turner Creek watershed upstream of the mouth of Tributary 1 is approximately 2,656 acres and yields approximately 3,455 af during the diversion season. The dam would impound approximately 0.5% of Turner Creek's diversion season flow. The entire Turner Creek watershed has an area of approximately 8,000 acres. It yields approximately 10,849 af during the season of diversion. The impoundment would account for approximately 0.2% of the

diversion season flow for Turner Creek. On an annual flow basis the loss of water to Turner Creek appears to be minimal at best.

Cumulative Flow Impairment Index (CFII) calculations were developed for Tributaries 1 and 1a by Brown (2004). The CFII is used to determine if the natural hydrograph is appreciably impaired during the primary migratory and spawning period of anadromous salmonids (December 15 through March 31). If the CFII is less than 5%, there is little chance of significant cumulative impacts. If the CFII is between 5 and 10% then the applicant must provide additional analysis. Based on the information contained in Brown (2004) the CFII at the point of interest (POI) #1 (just upstream of the mouth of Tributary 1b) is 8.5%. However, this percentage only applies for approximately 500 feet of channel between the dam and POI #1, after which the larger 205-acre Tributary 1b enters along the left bank. This would effectively cut the CFII by more than half to about 3.9%. The CFII for all other points downstream is less than 3.9%. This means there is little chance for significant cumulative impact to migrating and spawning salmonids downstream of Tributary 1b.

A review of the period of record (1958-1975) at the Black Butte Creek gage showed that on the average discharges increase significantly at the beginning of the second week of November. For example, on November 8 during the period of record the discharge averaged 380 cfs (Table 17). On November 9, 10, and 12 it averaged 554 cfs, 2,300 cfs, and 4,300 cfs respectively. As discharge increases the number of days it takes to fill the impoundment decreases rapidly.

Table 17: Dates of first significant runoff during the month of November for the entire period of record (1958-1975) discharge at the Black Butte Creek gage, conversion to the Point of Diversion discharge, and days to fill the 19 acre-feet impoundment.

Date	Black Butte Discharge (cfs)	Point of Diversion Discharge (cfs)	Number of Days to Fill 19 acre-feet
November 8	380	0.63	15
November 9	554	0.92	10.4
November 10	2,300	3.8	2.5
November 12	4,300	7.1	1.4

Burger et al. (1983), Hammarstrom et al. (1985), and Farout et al. (2001) reported upstream adult Chinook salmon migration rates ranging from 1.5 to 6 miles per day. The mouth of Turner Creek is roughly 140 miles upstream of Fernbridge, where adult Chinook salmon hold while waiting for the fall rains to begin. Therefore, once there is enough rainfall runoff to trigger upstream migration it could possibly take at least 23 days for the first fish to make it into Turner Creek. By that time the dam would be full and spilling. These results should alleviate the

concerns Weldon Jones (CDFG) expressed in his letter regarding potential impact to the hydrograph and migrating salmonids in Turner Creek.

The additional analysis also showed that except for the driest year in the period of record, the dam would typically fill during the first significant storm event after December 15 start of the diversion season (Table 18). This assumed that all flow prior to December 15 would be allowed to spill through the valve at the bottom of the dam. If this valve were closed the dam could fill earlier in the season and on the average, be completely filled by the end of November. This filling would, on the average, be complete prior to migrating adult salmonids entering Turner Creek.

Table 18: Estimated runoff for three normal and two low water years and impoundment fill time after the December 15 start of the diversion season.

Water Year (WY)	Normal or Low WY	Maximum Peakflow on Black Butte Ck for WY	Date of Peakflow	Cumulative ac-ft runoff between Dec. 15th and March 31st from drainage upstream of dam	Date exceeding 19 af if pipe closed on Dec. 15th	Days to fill 19 af impoundment from 1st significant storm event following Dec. 15th
1973	Normal	8,550	1/16/73	312	Dec. 17	2
1968	Normal	9,000	2/19/68	268	Jan. 14	5
1966	Normal	7,660	1/4/66	203	Jan. 4	2
1961	Low	3,950	1/31/61	166	Dec. 26	11
1962	Low	3,900	2/13/62	124	Jan. 27	6

The other potential impact relates to the interruption of gravel movement downstream due to the dam installation. Loss of gravel may result in downcutting of Tributary 1 and 1a streambeds and subsequent destabilization of the streambanks. Periodically removing the sediment plume at the head of the impoundment and placing it within or below the spillway or outfall may easily remedy this situation. The later season peak flows would be able to distribute the material downstream and maintain channel and streambank integrity once the dam is filled and the overflow begins spilling.

SUMMARY

1. No salmonids or evidence of salmonids were observed during the survey or a prior visit to the project area during the winter.

2. Tributary 1, and especially Tributary 1a, does not appear to be suitable for use by salmonids for spawning or rearing due to poor instream habitat and flow patterns. This conclusion is in agreement with that of CDFG.
3. The CFII calculations indicate less than significant cumulative impact to migrating and spawning salmonids in Tributary 1, downstream of Tributary 1a, and Turner Creek.
4. Although the CFII calculations for Tributary 1a exceeded 5% further analysis shows impacts to migrating and spawning salmonids to be less than significant.
5. The loss of gravel supply to Tributary 1, downstream of the dam, can be mitigated by the placement of substrate material that settled out at the head of the impoundment.

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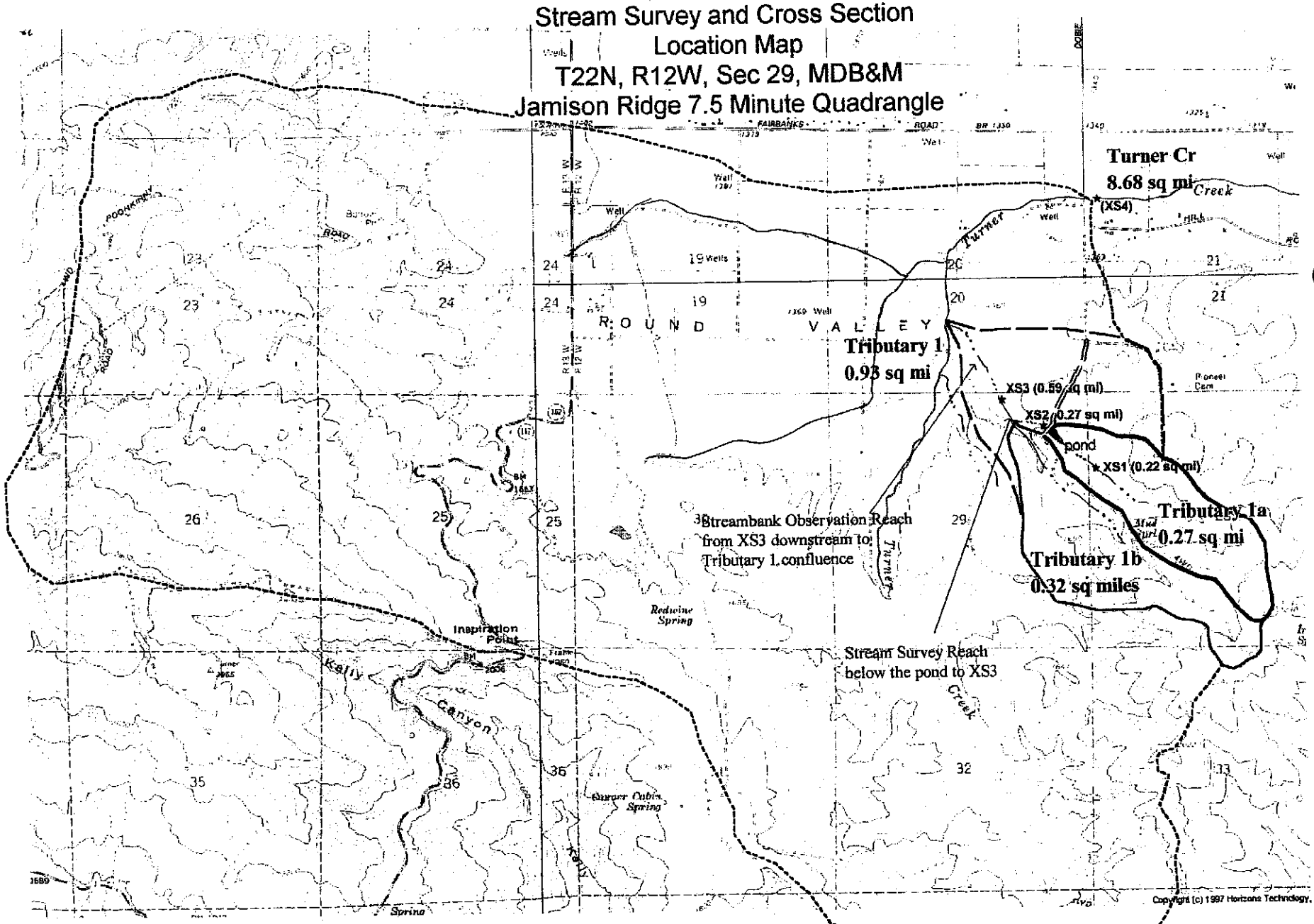
Appendix A

Survey Location Map

Stream Survey and Cross Section Location Map

T22N, R12W, Sec 29, MDB&M

Jamison Ridge 7.5 Minute Quadrangle



1" is approximately 0.5 miles

Appendix B

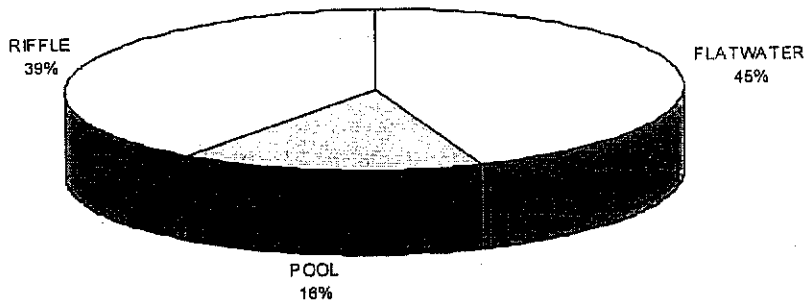
Tables and Figures

Table 1: Post-Project Level II Habitat Types

Carley Unnamed Tributary 1 **Reach 1: Dam to Tributary 1b** **5/19/2003**

Level 2 Habitat Type	# Units	% Occurrence	Total Length	% by Total Length
RIFFLE	11	41	202	39
FLATWATER	10	37	228	45
POOL	6	22	82	16
TOTALS	27	100	512	100

Figure 1: Level II Habitat Types by % Total Length



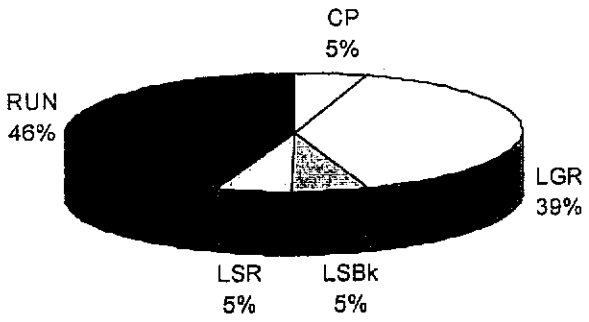
No side channels in reach.

Table 2: Level IV Habitat Types

Carley Unnamed Tributary 1 **Reach 1: Dam to Tributary 1b** **5/19/2003**

Level 4 Habitat Types	# Units	% Occurrence	Total Length	% by Total Length
LGR Low Gradient Riffle	11	41	202	39
RUN Run	10	37	228	45
CP Corner Pool	2	7	27	5
LSBk Lateral Scour - Bedrock Formed	2	7	28	5
LSR Lateral Scour - Root Wad Enhanced	2	7	27	5
Totals	27	100	512	100

Figure 2: Level IV Habitat Types by Total % Length



No side channels in reach.

Table 3: Level IV Pool Habitat Type Metrics

Carley Unnamed Tributary 1 **Reach 1: Dam to Tributary 1b** **5/19/2003**

Pool Type (-Side Channel)	Residual Depth Range	# Units	% Occur.	Total Length	% by Total Length	Ave Max Depth	Ave Res. Depth	Ave. PTail Embed.
Corner Pool	<2 FT.	2	33	27	33	0.8	0.6	3.5
Lateral Scour - Bedrock Formed	<2 FT.	2	33	28	34	1.2	1.0	3.5
Lateral Scour - Root Wad Enhanced	<2 FT.	2	33	27	33	1.4	1.2	4.0
Scour Pool Total		**6**	**100**	**82**	**100**	**1.1**	**0.9**	**3.7**
Reach Total		6	100	82	100	1.1	0.9	3.7

Embeddedness: 1 = <25%; 2 = 25-50%; 3 = 51-75%; 4 = 75%; 5 = Unsuitable (bedrock, etc.) Not included in average

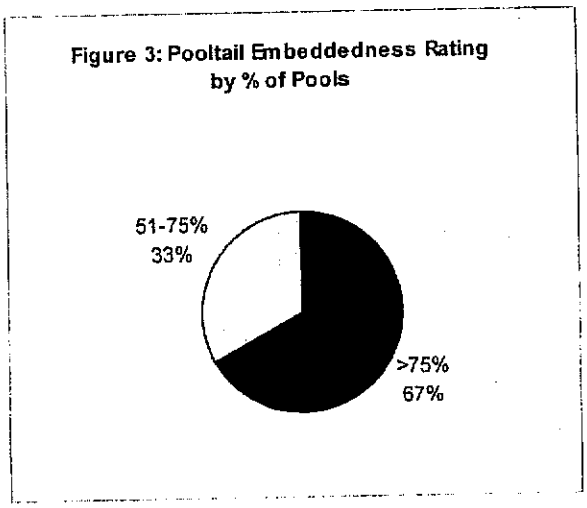


Table 4: Fish Shelter Characteristics in Level IV Habitat Types

Carley Unnamed Tributary 1 **Reach 1: Dam to Tributary 1b** **5/19/2003**

Level 4 Habitat Type	# Units	Mean Shelter Value	Mean % Shelter	Mean Shelter Rating	*Composition of Mean Percent Shelter*								
					% u-cut	% swd	% lwd	% root wad	% terr. veg	% aqua veg	% bubble curtain	% boulder	% bedrock
Low Gradient Riffle	11	0.2	5	5	0	0	0	0	0	100	0	0	0
Run	10	0.8	4	8	0	0	0	0	58	42	0	0	0
Corner Pool	2	2.0	20	40	30	13	0	0	55	3	0	0	0
Lateral Scour - Bedrock Formed	2	0.5	5	5	0	0	0	0	0	100	0	0	0
Lateral Scour - Root Wad Enhanced	2	1.0	8	8	50	0	0	50	0	0	0	0	0

Table 5: Post-Project Dominant Substrate by % Total Length

Carley Unnamed Tributary 1 **Reach 1: Dam to Tributary 1b** **5/19/2003**

40% Survey of Non-pool Habitat Types Level IV Habitat Type	Substrate	% of Substrate within Habitat Type	% of Substrate by Total Reach Length
	non-sample	60%	24%
	Gravel	40%	16%
39% Low Gradient Riffle			
39% RIFFLE			
	non-sample	46%	21%
	Gravel	54%	24%
45% Run			
45% FLATWATER			
	Gravel	100%	5%
5% Corner Pool			
	Gravel	59%	3%
	Sm Cobble	41%	2%
5% Lateral Scour - Root Wad Enhanced			
	Gravel	100%	5%
5% Lateral Scour - Bedrock Formed			
16% POOL			

Figure 4: Dominant Substrate by Percentage of Total Length

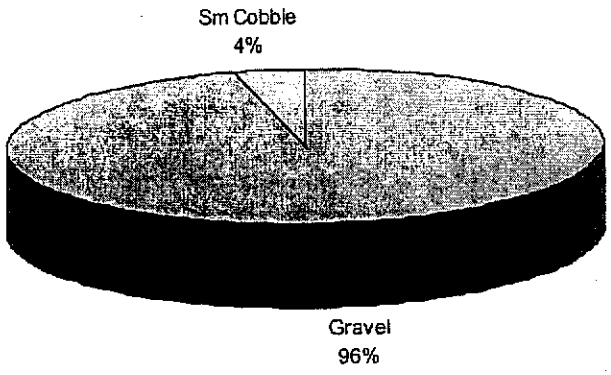


Table 6: Post-Project Subdominant Substrate by % Total Length

Carley Unnamed Tributary 1 **Reach 1: Dam to Tributary 1b** **5/19/2003**

40% Survey of Non-pool Habitat Types Level IV Habitat Type	Substrate	% of Substrate within Habitat Type	% of Substrate by Total Reach Length
	non-sample	60%	24%
	Sand	5%	2%
	Sm Cobble	35%	14%
39% Low Gradient Riffle			
39% RIFFLE			
	non-sample	46%	21%
	Sand	8%	4%
	Sm Cobble	46%	21%
45% Run			
45% FLATWATER			
	Sm Cobble	100%	5%
5% Corner Pool			
	Gravel	41%	2%
	Silt/Clay	59%	3%
5% Lateral Scour - Root Wad Enhanced			
	Sm Cobble	100%	5%
5% Lateral Scour - Bedrock Formed			
16% POOL			

Figure 5: SubDominant Substrate by Percentage of Total Length

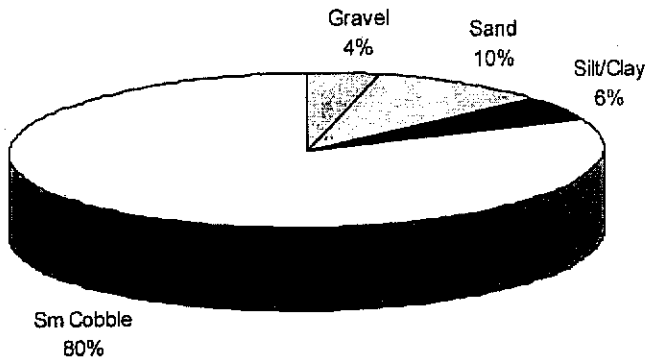


Table 7: Post-Project Canopy, Bank, and Vegetation Characteristics

Carley Unnamed Tributary 1 **Reach 1: Dam to Tributary 1b** **5/19/2003**

Habitat Type	# Units	Average % Canopy Cover	Canopy Composition % Broadleaf	% Evergreen	Average % Left Bank Veg	Average % Right Bank Veg
Riffle	11	5	100	0	66	65
Flatwater	10	7	100	0	86	80
Scour Pool	6	31	100	0	68	51
Overall	**27**	**11**			**73**	**63**

Figure 6: Left Bank Dominant Bank Vegetation by % Total Length

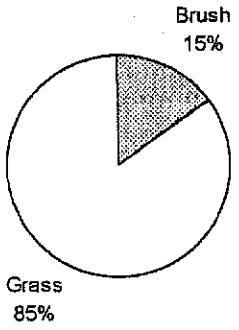


Figure 7: Right Bank Dominant Bank Vegetation by % Total Length

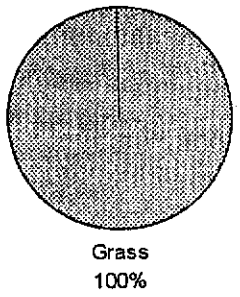


Figure 8: Left Bank Substrate Composition by % Total Length

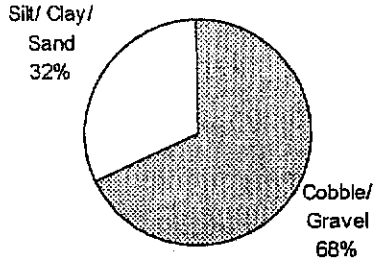


Figure 9: Right Bank Substrate Composition by % Total Length

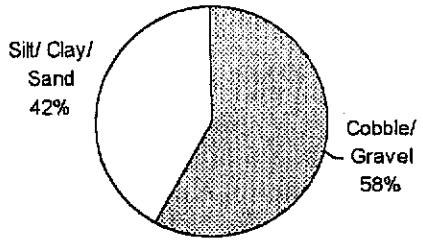


Table 8: Post-Project Summary of Level IV Habitat Type Data

Carley Unnamed Tributary 1 **Reach 1: Dam to Tributary 1b** **5/19/2003**

Side Ch.	Habitat Type	# Units	Total Hab. Length	% of Total Len.	Ave Len.	Ave Width	Ave Depth	Ave Max Dpth	Ave Dpth Pool Crest	Ave Area	Ave Res Pool Dpth	Ave Volume	Ave Res Pool Vol	Ave In-strm Cover	Ave Canopy Low Flow
	Low Gradient Riffle	11	202	39%	18	3.2	0.2	0.3		59		11		5%	5%
	Run	10	228	45%	23	3.5	0.2	0.3		80		14		4%	7%
	Corner Pool	2	27	5%	14	3.7	0.5	0.8	0.2	49	0.6	25	30	20%	0%
	Lateral Scour - Bedrock Formed	2	28	5%	14	3.9	0.9	1.2	0.1	54	1.0	47	55	5%	48%
	Lateral Scour - Root Wad Enhanced	2	27	5%	14	5.5	1.0	1.4	0.2	74	1.2	74	89	8%	45%
	Overall:	**27**	**512**			**3.6**		**0.7**						**6%**	**11%**

Stream: Carley Unnamed Tributary 1

Reach: Reach 1: Dam to Tributary 1b

Date: 5/19/2003 Surveyors: D. Halligan Landowner: Carley

100% survey of pool habitats; 40% survey of non-pool habitats

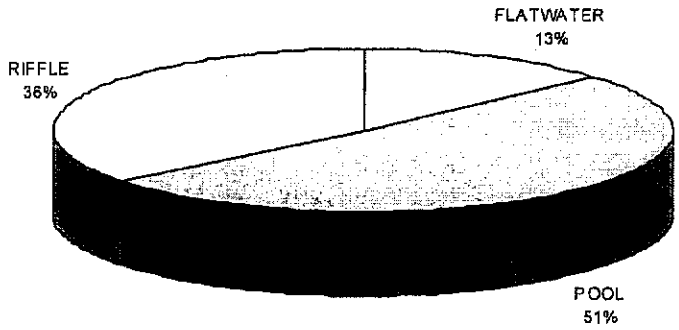
Flow (cfs): 0.1

Table 9: Post-Project Level II Habitat Types

Carley Unnamed Tributary 1 **Reach 2: Downstream of Tributary 1b** **5/19/2003**

Level 2 Habitat Type	# Units	% Occurrence	Total Length	% by Total Length
RIFFLE	9	45	141	36
FLATWATER	3	15	53	13
POOL	8	40	200	51
TOTALS	20	100	394	100

Figure 10: Level II Habitat Types by % Total Length



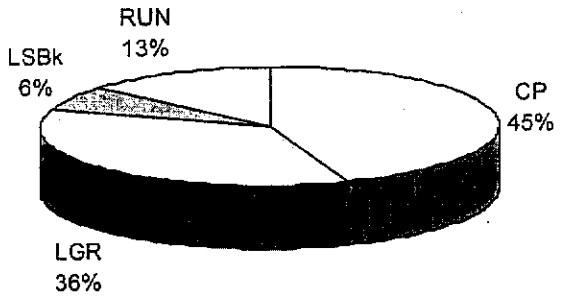
No side channels in reach.

Table 10: Level IV Habitat Types

Carley Unnamed Tributary 1 **Reach 2: Downstream of Tributary 1b** **5/19/2003**

Level 4 Habitat Types	# Units	% Occurrence	Total Length	% by Total Length
LGR Low Gradient Riffle	9	45	141	35.8
RUN Run	3	15	53	13.3
CP Corner Pool	7	35	175	44.5
LSBk Lateral Scour - Bedrock Formed	1	5	25	6.4
Totals	20	100	394	100

Figure 11: Level IV Habitat Types by Total % Length



No side channels in reach.

Table 11: Level IV Pool Habitat Type Metrics

Carley Unnamed Tributary 1 **Reach 2: Downstream of Tributary 1b** **5/19/2003**

Pool Type (-Side Channel)	Residual Depth Range	# Units	% Occur.	Total Length	% by Total Length	Ave Max Depth	Ave Res. Depth	Ave. PTail Embed.
Corner Pool	<2 FT.	7	88	175	88	1.3	1.1	2.4
Lateral Scour - Bedrock Formed	<2 FT.	1	13	25	13	1.2	1.0	2.0
Scour Pool Total		**8**	**100**	**200**	**100**	**1.3**	**1.1**	**2.4**
Reach Total		8	100	200	100	1.3	1.1	2.4

Embeddedness: 1 = <25%; 2 = 25-50%; 3 = 51-75%; 4 = 75%; 5 = Unsuitable (bedrock, etc.) Not included in average

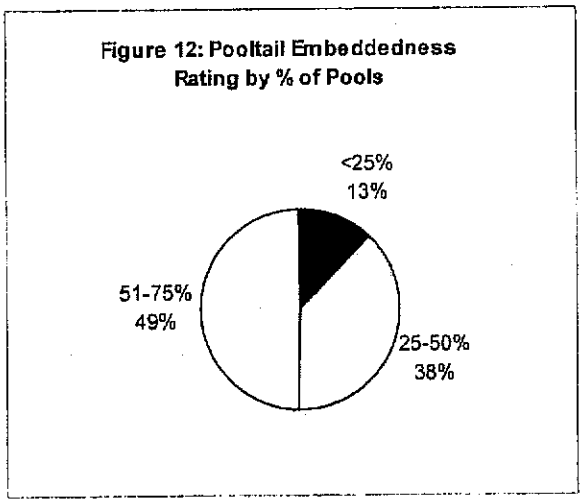


Table 12: Fish Shelter Characteristics in Level IV Habitat Type

Carley Unnamed Tributary 1 **Reach 2: Downstream of Tributary 1b** **5/19/2003**

Level 4 Habitat Type	# Units	Mean Shelter Value	Mean % Shelter	Mean Shelter Rating	*Composition of Mean Percent Shelter*								
					% u-cut	% swd	% lwd	% root wad	% terr. veg	% aqua veg	% bubble curtain	% boulder	% bedrock
Low Gradient Riffle	9	0.0	0	0	0	0	0	0	0	0	0	0	0
Run	3	0.0	0	0	0	0	0	0	0	0	0	0	0
Corner Pool	7	0.4	3	3	33	0	0	33	33	0	0	0	0
Lateral Scour - Bedrock Formed	1	0.0	0	0	0	0	0	0	0	0	0	0	0

Table 13: Post-Project Dominant Substrate by % Total Length

Carley Unnamed Tributary 1 **Reach 2: Downstream of Tributary 1b** **5/19/2003**

40% Survey of Non-pool Habitat Types Level IV Habitat Type	Substrate	% of Substrate within Habitat Type	% of Substrate by Total Reach Length
	non-sample	40%	14%
	Gravel	60%	22%
36% Low Gradient Riffle			
36% RIFFLE			
	Gravel	71%	10%
	Silt/Clay	29%	4%
13% Run			
13% FLATWATER			
	Gravel	64%	28%
	Silt/Clay	36%	16%
44% Corner Pool			
	Gravel	100%	6%
6% Lateral Scour - Bedrock Formed			
51% POOL			

Figure 13: Dominant Substrate by Percentage of Total Length

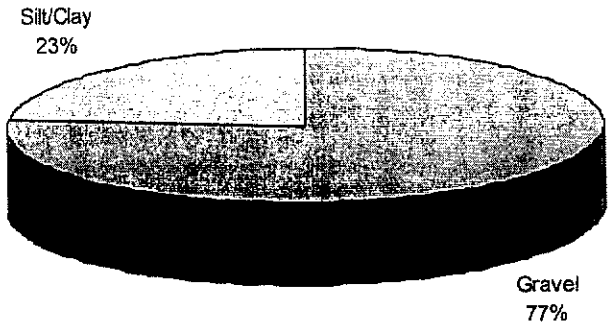


Table 14: Post-Project Subdominant Substrate by % Total Length

Carley Unnamed Tributary 1 **Reach 2: Downstream of Tributary 1b** **5/19/2003**

40% Survey of Non-pool Habitat Types Level IV Habitat Type	Substrate	% of Substrate within Habitat Type	% of Substrate by Total Reach Length
	non-sample	40%	14%
	Sm Cobble	60%	22%
36% Low Gradient Riffle			
36% RIFFLE			
	Gravel	29%	4%
	Sm Cobble	71%	10%
13% Run			
13% FLATWATER			
	Gravel	25%	11%
	Sand	25%	11%
	Silt/Clay	51%	23%
44% Corner Pool			
	Sand	100%	6%
6% Lateral Scour - Bedrock Formed			
51% POOL			

Figure 14: SubDominant Substrate by Percentage of Total Length

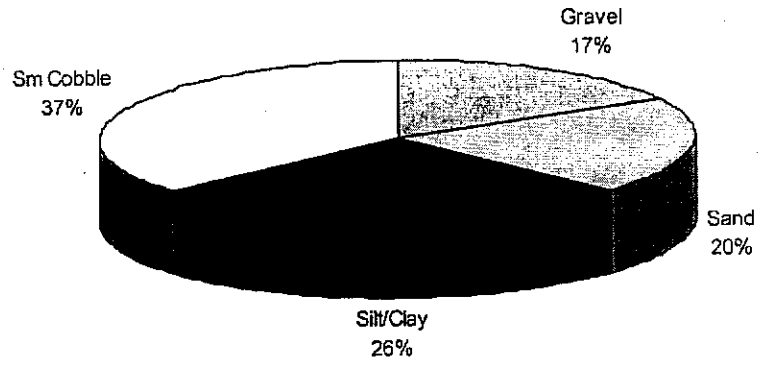


Table 15: Post-Project Canopy, Bank, and Vegetation Characteristics

Carley Unnamed Tributary 1 **Reach 2: Downstream of Tributary 1b** **5/19/2003**

Habitat Type	# Units	Average % Canopy Cover	Canopy Composition % Broadleaf	% Evergreen	Average % Left Bank Veg	Average % Right Bank Veg
Riffle	9	0			80	87
Flatwater	3	0			55	50
Scour Pool	8	19	100	0	48	34
Overall	**20**	**8**			**57**	**49**

Figure 15: Left Bank Dominant Bank Vegetation by % Total Length

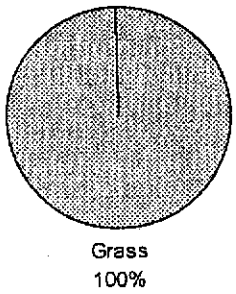


Figure 16: Right Bank Dominant Bank Vegetation by % Total Length

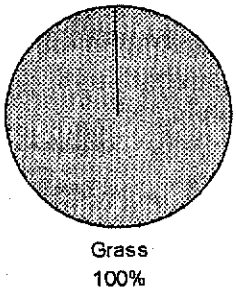


Figure 17: Left Bank Substrate Composition by % Total Length

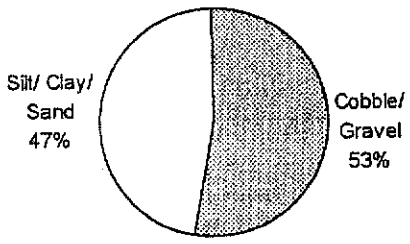


Figure 18: Right Bank Substrate Composition by % Total Length

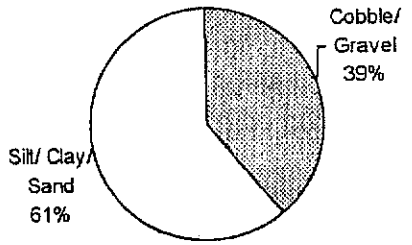


Table 16: Post-Project Summary of Level IV Habitat Type Data

Carley Unnamed Tributary 1 **Reach 2: Downstream of Tributary 1b** **5/19/2003**

Side Ch.	Habitat Type	# Units	Total Hab. Length	% of Total Len.	Ave Len.	Ave Width	Ave Depth	Ave Max Dpth	Ave Dpth Pool Crest	Ave Area	Ave Res Pool Dpth	Ave Volume	Ave Res Pool Vol	Ave In-strm Cover	Ave Canopy Low Flow
	Low Gradient Riffle	9	141	36%	16	3.3	0.2	0.3		52		10		0%	0%
	Run	3	53	13%	18	3.5	0.3	0.4		62		19		0%	0%
	Corner Pool	7	175	44%	25	5.0	0.9	1.3	0.2	125	1.1	108	142	3%	22%
	Lateral Scour - Bedrock Formed	1	25	6%	25	5.0	1.0	1.2	0.2	125	1.0	125	125	0%	0%
	Overall:	**20**	**394**			**4.0**		**0.9**						**1%**	**8%**

Stream: Carley Unnamed Tributary 1

Reach: Reach 2: Downstream of Tributary 1b

Date: 5/19/2003 Surveyors: D. Halligan Landowner: Carley

100% survey of pool habitats; 40% survey of non-pool habitats

Flow (cfs): 0.2