CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT

Tyler Creek

Report Revised April 14, 2006
Report Completed 2005
Assessment Completed 2002

INTRODUCTION

A stream inventory was conducted during the summer of 2002 on Tyler Creek, a stream in the Russian River basin. The inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the amount and condition of available habitat to fish, and other aquatic species with an emphasis on anadromous salmonids in Tyler Creek. The objective of the biological inventory was to document the salmonid and other aquatic species present and their distribution.

The objective of this report is to document the current habitat conditions and, after analyzing historical and recent data, 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

Tyler Creek is located in Mendocino and Lake Counties, California and is a tributary of Pieta Creek which drains into the Russian River (see Tyler Creek map, APPENDIX A). The legal description at the confluence with Pieta Creek is T12N, R10W, S15. Its location is 38°53'14.28"N latitude and 122°57'50.95"W longitude. Access to the headwaters exists from Pine Mountain Road, access to the mouth exist from Pieta Creek and several 4-wheel drive roads cross or approach the creek at various points.

Tyler Creek and its tributaries drain a basin of approximately 5531.6 acres (8.6 square miles). Tyler Creek is a maximum third order stream and has approximately 38189.0 feet (7.23 miles) of blue line stream, according to the USGS “Highland Springs” 7.5 minute quadrangles. Hoil Creek is a major tributary to Tyler Creek and is discussed in a separate report. Tyler creek has numerous minor unnamed tributaries that were not survey in 2002. Elevations range from about 1654 feet at the mouth of the creek to 3645 feet in the headwaters. The vegetation is primarily shrub (56%) and hardwood (33%) with some mixed hardwood/conifer (5%), conifer (4%), and herbaceous vegetation (2%). None of the watershed is agricultural or urban. The watershed is 84.1% privately owned and 15.9% federally owned and is managed as Cow Mountain Recreation Area.

Salmonid fish species historically present include steelhead trout. Endangered, threatened, or sensitive species include Bell's sage sparrow (*Amphispiza belli belli*) and glandular western flax (*Hesperolinon adenophyllum*) (*Ndbb source*).

METHODS

The habitat inventory conducted in Tyler Creek follows the methodology presented in the California

Salmonid Stream Habitat Restoration Manual (Flosi, et al., 1998). The California Department of Fish and Game (DFG) field crew that conducted the inventory was trained in standardized habitat inventory methods by DFG. This inventory was conducted by two person teams and was supervised by Derek Acomb, Russian River Planner (DFG).

SAMPLING STRATEGY

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

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the California Salmonid Stream Habitat Restoration Manual. This form was used in Tyler Creek to record measurements and observations. There are nine components to the inventory form: flow, channel type, air and water temperatures, habitat type, embeddedness, shelter rating, substrate composition, canopy, and bank composition.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated. Flows were also measured or estimated at major tributary confluences.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 1994). This methodology is described in the California Salmonid Stream Habitat Restoration Manual. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Water and air temperatures, and time, are measured by crew members with hand held thermometers and recorded at each tenth unit typed. Temperatures are measured in Fahrenheit at the middle of the habitat unit and within one foot of the water surface. Temperatures are also recorded using remote temperature recorders which log temperatures every half hour, 24 hours/day.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1988). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled dry. Tyler 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 were in feet to the nearest tenth. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Tyler Creek, embeddedness was visually estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3), 76 - 100% (value 4). Additionally, a rating of "not suitable" (value 5) was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, having a bedrock tail-out, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All shelter is then classified according to a list of nine shelter types. In Tyler Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the shelter. The shelter rating is calculated for each habitat unit by multiplying shelter value and percent covered. 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 measured habitat units, dominant and sub-dominant substrate elements were visually estimated using a list of seven size classes which are defined in the California Salmonid Stream Habitat Restoration Manual.

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 Tyler Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the top 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 visually into percentages of evergreen or deciduous trees.

9. Bank Composition and Vegetation:

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

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. Biological inventory is conducted using one or more of four basic methods: 1) stream bank observation, 2) underwater observation, 3) electro fishing, or 4) seine netting. Methods 1-3 are discussed in the California Salmonid Stream Habitat Restoration Manual. Seine netting is a fish capture technique that involves the use of a one meter square net attached to dowels on two parallel sides. The surveyor pushes the seine through the habitat unit to catch aquatic organisms. At the end of the unit the surveyor scoops up the seine and places all captured organisms in a bucket partially filled with stream water for holding. The water is aerated with a bubbler to maintain dissolved oxygen levels and minimize stress on the organisms. All fish, amphibians, and reptiles in the holding bucket are identified to species, counted and returned to the steam. Data is recorded on an electro-fishing field form. Seine netting is used to confirm the presence of a species, particularly salmon and steelhead, and is not intended to quantify a population estimate.

IMPACT INVENTORY & ANALYSIS

Problems such as migration barriers, streambed erosion, poor water quality or temperatures are noted in the comments and landmarks section. In some cases measurements are taken, an analysis of what caused the problem is made and restoration potential and alternatives are recommended.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat for data storage and analysis. Habitat is a Visual Basic extension to Microsoft Access, developed by Zebulon Young, University of California, Berkeley. This program processes and summarizes the data, and produces the following tables and appendices:

- Summary of riffle, flatwater, and pool habitat types
- Summary of habitat types and measured parameters
- Summary of pool types
- Summary of maximum pool depths by pool habitat types
- Summary of shelter by habitat types
- Summary of dominant substrates by habitat types
- Summary of fish habitat elements by stream reach

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

- Level II habitat types by % occurrence
- Level II habitat types by % total length
- Level IV habitat types by % occurrence
- Level I pool habitat types by % occurrence
- Maximum depth in pools
- Percent embeddedness estimated in pool tail-outs
- Mean percent cover types in pools
- Substrate composition in pool tail-outs
- Mean percent canopy
- Dominant bank composition in survey reach
- Dominant bank vegetation in survey reach

HISTORICAL STREAM SURVEYS:

Tyler Creek was included in two studies of the Pieta Creek drainage conducted by the Mendocino County Resource Conservation District (MCRCD). In 1985, Sari Sommarstrom, Ph.D., conducted the Pieta Creek Gerothermal Watershed Assessment for MCRCD. The report sought to establish a baseline of biological and enviromemental factors to facilitate future geothermal energy development with minimal impact. Along with being a valuable steelhead habitat, most of Tyler Creek lies within the Geysers-Calistoga Known Geothermal Resource Area (KGRA). Vegatative cover in the Tyler Creek Basin was 46.6% chapparal (1,847 acres), 45.1% oak woodland (1,785 acres), and some mixed evergreen, grassland, and other vegetation (329 acres). The most extensive historical logging operation in the Pieta Creek basin occurred around 1973 when a approximately 150 acres were cut along a 1.7 mile section of Tyler Creek. In 1985, noticable effects of the logging included gullies, debis slides, stumps, and fallen cut logs in the stream below the logged site. In 1982 and 1983 perscribed fires burned a combined 135 acres, accounting for 3.0% of the area in the Tyler sub-basin. A channel stability evaulation of Tyler Creek revealed 2.0 miles in excellent condition, 1.1 mile in good condition, and 1.0 mile in fair condition - an unstable area in its mid-section. The study found the overall water quality of Pieta and its tributaries to be very good. On July 23, 1985 at 1437 hours the water temperture was 66.4ºF. A small resevoir stored runoff of the top 3,400 ft of the stream.

The 1990-91 Pieta Creek Basin Stream Assesment was conducted by A. A. Rich and Associates for MCRCD. The two year monitering project was also conducted to obtain baseline data for various stream habitat parameters. Primary erosion problems reported were steep slopes and debris jams with some mass wasting, landslides, and channel scour and deposition. Tyler Creek had the second highest stream channel stability rating, behind Hoil Creek, in the Pieta basin. Despite the high rating, erosion had "silted-in" large portions of Tyler Creek. Near the mouth, there was abundant overhanging vegetation near the mouth and the water temperature was 68.0ºF. Limiting factors were shallow depth, low pool velocity, and silted substrate. Three miles upstream from the mouth, water temperature was 62.6ºF and had abundant canopy cover, good boulder shelter, and suitable spawning gravel. Upstream 4.7 miles from the mouth, the

habitat was similar but large mouth bass were found which prey on juvenile salmonids. Just below the mouth of Hoil Creek, the substrate was heavily embedded and few salmonids were found despite good shelter. Above the mouth of Hoil Creek, fast moving water and clean, spawnable gravel existed. Abundant canopy and 66.2ºF water made this site the best salmonid rearing habitat in Tyler Creek.

HABITAT INVENTORY RESULTS FOR TYLER CREEK

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

The habitat inventory of Tyler Creek, 7/28/2002 - 7/31/2002, was conducted by Mike Shugars and Justin Smith (DFG) with supervision and analysis by California Department of Fish and Game (DFG). The survey began at the confluence with Pieta Creek and extended up Tyler Creek. The total length of stream surveyed was 33467 feet, with an additional 235 feet of side channel.

Flows were not measured on Tyler Creek.

This section of Tyler Creek has four reaches with three distinct channel types: from the mouth to 16429 feet a F3, 7423 feet a F2, 720 feet a C4 and 8895 feet a F3. F channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio. F3 channel types have a predominantly cobble substrate, F2 channel types a predominantly boulder clay substrate.

C4 channel types are low gradient (<2%), meandering, point-bar, riffle/pool, alluvial channels with a broad, well defined floodplain and a predominantly gravel substrate.

Water temperatures ranged from 56ºF to 69ºF. Air temperatures ranged from 59ºF to 78ºF. Summer temperatures were also measured using remote temperature recorders placed in pools (see Temperature Summary graphs at end of report). A recorder in Reach 1, approximately 14853 feet from the mouth, logged temperatures every half hour from July 16 to October 26, 2002. The highest temperature recorded was 63.4°F on July 31 and August 1 and the lowest was 46.0°F on October 26. The mean of the daily highs was 61.8°F for the month of July, 59.6°F for August, 55.3°F for September and 49.4°F for October.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 51% flatwater units, 8% riffle units, 33% pool units, 1% no survey units, 7% dry units, (Graph 1). Based on total **length** of Level II habitat types there were 62% flatwater units, 2% riffle units, 9% pool units, 4% no survey units, 23% dry units, (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were 41% Run units, 9% Glide units, 8% Low Gradient Riffle units, 32% Mid-Channel Pool units, 1% Not Surveyed units, 7% Dry units, 1% Lateral Scour Pool - Bedrock Formed units, 2% Step Run units, 1% Lateral Scour Pool - Boulder Formed units, 1% Channel Confluence Pool units, (Graph 3). Based on percent total **length**, 56% Run units, 5% Glide units, 2% Low Gradient Riffle units, 9% Mid-Channel Pool units, 4% Not Surveyed units,

23% Dry units.

A total of 61 pools were identified (Table 3). Main Channel pools were the most frequently encountered, at 97%, and comprised 98% 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. Thirteen of the 60 pools (22%) had a residual depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 58 pool tail-outs measured, nine had a value of 1 (15.5%); twenty-nine had a value of 2 (50%); six had a value of 3 (10.3%); one had a value of 4 (1.7%); thirteen had a value of 5 (22.4%); (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.

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 45 , flatwater habitat types had a mean shelter rating of 7 , and pool habitats had a mean shelter rating of 9 (Table 1). Of the pool types, the Main Channel pools had a mean shelter rating of 9, Scour pools had a mean shelter rating of 18, (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in Tyler Creek. Graph 7 describes the pool cover in Tyler Creek. Boulders are the dominant pool cover type followed by undercut banks.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Small cobble was observed in 38% of pool tail-outs and large cobble was observed in 23% of pool tail-outs.

The mean percent canopy density for the surveyed length of Tyler Creek was 49%. The mean percentages of hardwood and coniferous trees were 75% and 26%, respectively. Fifty-one percent of the canopy was open. Graph 9 describes the mean percent canopy in Tyler Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 62%. The mean percent left bank vegetated was 54%. The dominant elements composing the structure of the stream banks consisted of 15% bedrock, 17% boulder, 56% cobble/gravel, 12% sand/silt/clay, (Graph 10). Grass was the dominant vegetation type observed in 4% of the units surveyed. Additionally, 81% of the units surveyed had hardwood trees as the dominant vegetation type, and 10% had coniferous trees as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

In 1961 and 1966, DFG records indicate that fish rescued from Pieta Creek were released into Tyler

Creek. Another recorded transfer of steelhead occurred in 1967 when 3,450 fingerlings from Sonoma County Mobile Camp were released into Tyler Creek. Transfers into Tyler Creek averaged 27606 fish per year.

Summary of transfers, rescues, and hatchery stocking						
YEAR	SPECIES	TYPE	LOCATION	SOURCE	NUMBER	SIZE
1961	SH	TRNSFR	TYLER CREEK	PIETA CREEK	2496	FING
1966	SH	TRNSFR	TYLER CREEK	PIETA CREEK	76872	FING
1967	SH	TRNSFR	TYLER CREEK	SONOMA CO. MOBIL CAMP	3450	FING

SH = Steelhead Trout *(Oncorhynchus mykiss)*

In 1975, the KGRA Fisheries Investigations report was released by D. Price. This cooperative study by PG&E and DFG electro-shocked 100' sections of Tyler Creek to sample steelhead populations in 1974. They estimated steelhead numbered 143 per 100' and 100% relative abundance.

Another cooperative effort produced a thorough fisheries resource inventory, The Geysers KGRA Fisheries Investigation, released in 1980 by Price and R. Geary. The study, conducted in August and September 1976, estimated juvenile steelhead had a relative abundance of 80%, numbered 77 per 100', and had a mean fork length of 2.85". The only other fish species observed was Pacific Lamprey at a relative abundance of 20%. Average fish density was 9,386 fish per hectare (a range of 2,795 to 21,957).

The 1985 study estimated juvenile salmonids had a relative abundance of 98%, numbered 108 per 100', and had a mean fork length of 2.66". Pacific Lamprey was the only other species of fish observed. Average fish density was 9,148 (a range of 6,686 to 12,818 fish per hectare). The study also noted fish populations vary naturally from year to year and that 1974, 1976, and 1985 were all quite different, hydrologically, from each other.

The 1991 survey, which conducted biological inventories for two years, found steelhead averaged 0.3 to 0.8 fish per square meter in 1990 and 0.3 to 1.6 fish per square meter in 1991. Steelhead had a relative abundance of 97% in 1990 and 100% in 1991. In 1990, large mouth bass were found at two sites, presumably escaped from a farm pond upstream, and accounted for 2.9% of the total fish sampled. One Green Sunfish was also recorded in 1990. Total fish estimates for steelhead in 1990 were not significantly different from 1991 but, estimates for steelhead at the two sites nearest the headwaters were significantly greater in 1991. Hydrologically, both years were similar; drought conditions prevailed. Compared to historical data, the survey suggested that steelhead populations had not changed since 1976 but suspected past methods were not rigorous enough.

Species Observed in Historical and Recent Surveys			
YEARS	**SPECIES**	**SOURCE**	**Native/ Introduced**
1974, 1976, 1985, 1990, 1991	Steelhead Trout *(Oncorhynchus mykiss)*	DFG, MCRCD	N
1976, 1985	Pacific Lamprey (*Lampetra tridentatus)*	DFG, MCRCD	N
1990	Green Sunfish *(Lepomis cyanellus)*	MCRCD	I
1990	Large Mouth Bass *(Micropterus salmoides)*	MCRCD	I

On 10/26/02 a biological inventory was conducted at one site on Tyler Creek to document fish species presence at the site sampled. The sites were seine netted. Fish from the site were counted by species, and returned to the stream. The air temperature ranged from 54ºF to 59ºF and the water temperature was 50ºF. The observers were Cassie Simons and Amy Livingston (Americorps).

The inventory began at 1430 hours in Reach 1 and ended upstream at 1600 hours. The distance sampled was approximately 1100 feet. Habitat types sampled were glides, runs, and mid-channel pools. Salmonids were observed. More than 50 juvenile newts were also observed. The following table displays the total fish yielded from these sites.

Species Observed	**Numbers recorded at Site 1**
STEELHEAD 0+	29
STEELHEAD 1+	2

DISCUSSION FOR TYLER CREEK

Tyler Creek has three channel types: F3, F2,and C4. Many site specific projects can be designed within an F channel type, especially to increase pool frequency, volume and shelter.

According to the DFG Salmonid Stream Habitat Restoration Manual, F3 channel types are good for bank-placed boulders as well as single and opposing wing-deflectors. They are fair for low-stage weirs, boulder clusters, channel constrictors and log cover. F2 channel types are fair for low-stage weirs, single and opposing wing-deflectors and log cover. Any work considered will require careful design, placement, and construction that must include protection for any unstable banks.

C4 channel types are good for bank-placed boulders and log cover. They are fair for low-stage weirs, single and opposing wing-deflectors, channel constrictors and log cover.

The water temperatures recorded on the survey days 7/28/2002 - 7/31/2002 ranged from 56ºF to 69ºF. Air temperatures ranged from 59ºF to 78ºF. The warmest water temperatures were recorded in Reach 4. Water temperatures greater than 65°F, if sustained, are above the threshold stress level for salmonids.

Summer temperatures measured using a remote temperature recorder in Reach 1 ranged from 46.0° to 63.4°F. The Temperature Summary graph shows that for much of the summer (July through August) the upper watershed exhibited temperatures at the optimal for salmonids. It is unknown if this thermal regime is typical. To make any further conclusions, temperatures need to be monitored for a longer period of time in more locations through the critical summer months, and extensive biological sampling need be conducted.

Flatwater habitat types comprised 62% of the total length of this survey, riffles 2%, and pools 9%. The pools are relatively shallow/deep, with only 13 of the 60 (22%) 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 third and fourth order streams, a primary pool is defined to have a maximum residual depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

Thirty eight of the 58 pool tail-outs measured had embeddedness ratings of 1 or 2. Seven of the pool tail-outs had embeddedness ratings of 3 or 4. Thirteen of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Tyler Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Thirty two of the 60 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 9. The shelter rating in the flatwater habitats was 7. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by Boulders in Tyler Creek. Boulders are the dominant cover type in pools followed by undercut banks . 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 49%. Reach 1 had a canopy density of 51.5%, Reach 2 had a canopy density of 48.1%, Reach 3 had a canopy density of 22.5%, Reach 4 had a canopy density of 43.75%, . In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 62% and 54%, 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.

GENERAL RECOMMENDATIONS

Tyler Creek should be managed as an anadromous, natural production stream.

Winter storms often bring down large trees and other woody debris into the stream, which increases the number and quality of pools. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. Landowners should be sensitive about the natural and positive role woody debris plays in the system, and encouraged not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

RECOMMENDATIONS

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

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

3) Where feasible, design and engineer pool enhancement structures to increase the number

of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

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.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey.

0'	Tyler Creek flows into Upper Pieta, the majority of the flow is coming from Tyler.
186'	Lower section of Tyler is low gradient and lacking canopy.
2280'	Steelhead 0+, 1+, and 2+ observed in abundance from 2280' and 26795'.
2717'	Newts observed from 2717' to 26795'.
3176'	Moderately steep canyon; oak, fir, and madrone shading steam, cool water, numerous steelhead.
5218'	Wet tributary (trib) on right bank (RB), 3' jump into trib, trib water temperature 58°F, Tyler creek water temperature 60°F.
5440'	Large tree fallen over pool.
6704'	Salamanders and salamander larvae observed periodically from 6704' to 14453'.
8009'	Alders line both sides of creek.
9192'	Wet trib on RB at end of the unit.
9422'	Road access at end of the unit.
10781'	Wet trib on RB, too steep to survey.
11007'	2 fallen trees each 3' in diameter, across creek.
13055'	Road crossing.
13426'	Dry trib on left bank (LB), 200' into unit.
14853'	Hobo temp pool.
14952'	Old road RB, 200' up unit.
15673'	Cabin on RB.
16182'	LOG ACCUMULATION retaining gravel.
16331'	EROSION spots on alternating banks.
16463'	Approximately 20 trees in channel.
18728'	Dry trib on LB
19876'	Instream CULVERT 600' up in unit, L 40', diameter 2', full of gravel with some water flowing.
21503'	Dry trib on RB.
23852'	Wet road crossing 40' into unit.

23914' Road crosses back through creek & is adding sediment to creek.
23980' Canyon opens into meadow, no canopy-good section for planting.
24464' Road runs over a 1' diameter PVC pipe that water runs through
25357' Hoil Creek enters on RB, majority of flow is from Hoil Creek.
25464' Dry trib on RB 600' up unit.
26807' Would be good shade and habitat with water.
28397' Dry trib on RB & LB. Tyler Creek has been mostly dry since Hoil Creek. END OF SURVEY at large reservoir dam.

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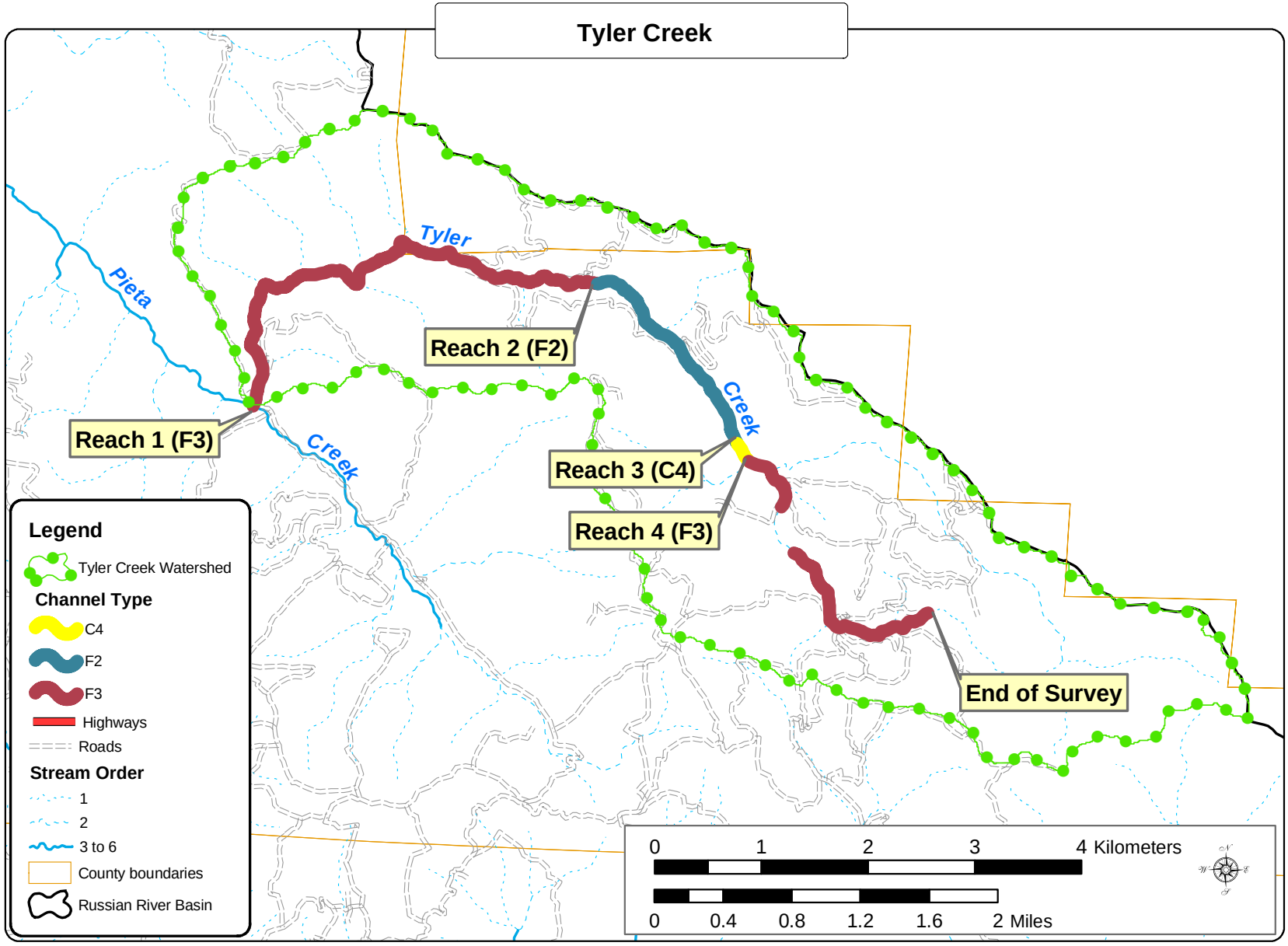

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Prepared by: Ann-Marie Osterback, May 16, 2003

Tyler Creek Tables Graphs Map
Assessment Completed 2002

APPENDIX B: TABLES

Table 1 - Summary of Riffle, Flatwater, and Pool Habitat Types

Stream Name: Tyler Creek

LLID: 1229636388871

Drainage: Russian River - Upper

Survey Dates: 7/28/2002 to 7/31/2002

Confluence Location: Quad: HIGHLAND SPRINGS Legal Description: T12NR10WS15 Latitude: 38:53:14.0N Longitude: 122:57:49.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
13	0	DRY	7.1	592	7692	22.8									
94	15	FLATWATER	51.1	222	20850	61.9	8.5	0.6	1.4	1229	115519	804	75582		7
1	0	NOSURVEY	0.5	1423	1423	4.2									
61	60	POOL	33.2	50	3068	9.1	12.5	1.1	3.3	662	40392	981	58843	784	9
15	2	RIFFLE	8.2	45	669	2.0	4.0	0.3	0.5	102	1530	28	414		45

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
184	77	33702	157441	134839

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Tyler Creek

LLID: 1229636388871

Drainage: Russian River - Upper

Survey Dates: 7/28/2002 to 7/31/2002

Confluence Location: Quad: HIGHLAND SPRINGS Legal Description: T12NR10WS15 Latitude: 38:53:14.0N Longitude: 122:57:49.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating	Mean Canopy (%)
15	2	LGR	8.2	45	669	2.0	4	0.3	0.6	102	1530	28	414		45	54
16	4	GLD	8.7	111	1778	5.3	8	0.5	1.9	677	10832	339	5419			44
75	10	RUN	40.8	252	18914	56.1	9	0.6	1.9	1543	115748	1053	78979		7	49
3	1	SRN	1.6	53	158	0.5	6	0.6	1	293	878	176	527			50
58	57	MCP	31.5	51	2967	8.8	12	1.1	49.7	673	39053	996	56763	798	9	52
1	1	CCP	0.5	34	34	0.1	20	1.6	2.9	680	680	1360	1360	1088	10	80
1	1	LSBk	0.5	51	51	0.2	10	0.6	1.8	510	510	510	510	306	15	55
1	1	LSBo	0.5	16	16	0.0	10	1.0	2.9	160	160	224	224	160	20	60
13	0	DRY	7.1	592	7692	22.8										23
1	0	NS	0.5	1423	1423	4.2										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
184	77	33702	169391	144196

Table 3 - Summary of Pool Types

Stream Name: Tyler Creek LLID: 1229636388871 Drainage: Russian River - Upper

Survey Dates: 7/28/2002 to 7/31/2002

Confluence Location: Quad: HIGHLAND SPRINGS Legal Description: T12NR10WS15 Latitude: 38:53:14.0N Longitude: 122:57:49.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Residual Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Residual Pool Vol (cu.ft.)	Estimated Total Resid.Vol. (cu.ft.)	Mean Shelter Rating
59	58	MAIN	97	51	3001	98	12.6	1.1	673	39733	803	46551	9
2	2	SCOUR	3	34	67	2	10.0	0.8	335	670	233	466	18

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
61	60	3068	40403	47017

Table 4 - Summary of Maximum Residual Pool Depths By Pool Habitat Types

Stream Name: Tyler Creek LLID: 1229636388871 Drainage: Russian River - Upper

Survey Dates: 7/28/2002 to 7/31/2002

Confluence Location: Quad: HIGHLAND SPRINGS Legal Description: T12NR10WS15 Latitude: 38:53:14.0N Longitude: 122:57:49.0W

Habitat Units	Habitat Type	Habitat Occurrence (%)	< 1 Foot Maximum Residual Depth	< 1 Foot Percent Occurrence	1 < 2 Feet Maximum Residual Depth	1 < 2 Feet Percent Occurrence	2 < 3 Feet Maximum Residual Depth	2 < 3 Feet Percent Occurrence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
57	MCP	95	0	0	15	26	29	51	8	14	5	9
1	CCP	2	0	0	0	0	1	100	0	0	0	0
1	LSBk	2	0	0	1	100	0	0	0	0	0	0
1	LSBo	2	0	0	0	0	1	100	0	0	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
60	0	0	16	27	31	52	8	13	5	8

Mean Maximum Residual Pool Depth (ft.): 3.3

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Tyler Creek LLID: 1229636388871 Drainage: Russian River - Upper

Survey Dates: 7/28/2002 to 7/31/2002 Dry Units: 13

Confluence Location: Quad: HIGHLAND SPRINGS Legal Description: T12NR10WS15 Latitude: 38:53:14.0N Longitude: 122:57:49.0W

Habitat Units	Units Fully Measured	Habitat Type	Mean % Undercut Banks	Mean % SWD	Mean % LWD	Mean % Root Mass	Mean % Terr. Vegetation	Mean % Aquatic Vegetation	Mean % White Water	Mean % Boulders	Mean % Bedrock Ledges
15	1	LGR	0	0	0	0	100	0	0	0	0
15	1	TOTAL RIFFLE	0	0	0	0	100	0	0	0	0
16	0	GLD									
75	5	RUN	0	21	2	1	4	7	0	65	0
3	0	SRN									
94	5	TOTAL FLAT	0	21	2	1	4	7	0	65	0
58	51	MCP	12	13	11	3	3	5	0	44	10
1	1	CCP	90	0	0	10	0	0	0	0	0
1	1	LSBk	0	0	0	40	0	0	0	0	60
1	1	LSBo	0	10	0	0	0	0	0	30	60
61	54	TOTAL POOL	13	13	10	4	3	4	0	42	11
1	0	NS									
184	60	TOTAL	12	13	9	3	5	5	0	43	10

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Tyler Creek LLID: 1229636388871 Drainage: Russian River - Upper

Survey Dates: 7/28/2002 to 7/31/2002 Dry Units: 13

Confluence Location: Quad: HIGHLAND SPRINGS Legal Description: T12NR10WS15 Latitude: 38:53:14.0N Longitude: 122:57:49.0W

Habitat Units	Units Fully Measured	Habitat Type	% Total Silt/Clay Dominant	% Total Sand Dominant	% Total Gravel Dominant	% Total Small Cobble Dominant	% Total Large Cobble Dominant	% Total Boulder Dominant	% Total Bedrock Dominant
15	2	LGR	0	0	0	100	0	0	0
16	4	GLD	0	0	25	25	25	0	25
75	10	RUN	0	10	10	30	20	30	0
3	1	SRN	0	0	0	0	100	0	0
58	4	MCP	25	0	0	25	50	0	0
1	1	CCP	0	0	100	0	0	0	0
1	1	LSBk	0	0	100	0	0	0	0
1	1	LSBo	0	0	0	0	0	100	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Tyler Creek LLID: 1229636388871 Drainage: Russian River - Upper

Survey Dates: 7/28/2002 to 7/31/2002

Confluence Location: Quad: HIGHLAND SPRINGS Legal Description: T12NR10WS15 Latitude: 38:53:14.0N Longitude: 122:57:49.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
49	26	75	0	62	54

Note: Mean percent conifer and hardwood for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Tyler Creek LLID: 1229636388871 Drainage: Russian River - Upper

Survey Dates: 7/28/2002 to 7/31/2002

Confluence Location: Quad: HIGHLAND SPRINGS Legal Description: T12NR10WS15 Latitude: 38:53:14.0N Longitude: 122:57:49.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	3	4	14.6
Boulder	4	4	16.7
Cobble / Gravel	14	13	56.3
Sand / Silt / Clay	3	3	12.5

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	0	2	4.2
Brush	0	1	2.1
Hardwood Trees	22	17	81.3
Coniferous Trees	2	3	10.4
No Vegetation	0	1	2.1

Total Stream Cobble Embeddedness Values: 3

Table 10 - Mean Percent of Shelter Cover Types For Entire Stream

StreamName: Tyler Creek LLID: 1229636388871 Drainage: Russian River - Upper

Survey Dates: 7/28/2002 to 7/31/2002

Confluence Location: Quad: HIGHLAND SPRINGS Legal Description: T12NR10WS15 Latitude: 38:53:14.0N Longitude: 122:57:49.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	13
SMALL WOODY DEBRIS (%)	0	21	13
LARGE WOODY DEBRIS (%)	0	2	10
ROOT MASS (%)	0	1	4
TERRESTRIAL VEGETATION (%)	100	4	3
AQUATIC VEGETATION (%)	0	7	4
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	65	42
BEDROCK LEDGES (%)	0	0	11

Appendix C - Fish Habitat Inventory Data Summary

Stream Name: Tyler Creek LLID: 1229636388871 Drainage: Russian River -
Survey Dates: 7/28/2002 to 7/31/2002 Survey Length (ft.): 33702 Main Channel (ft.): 33467 Side Channel (ft.): 235
Confluence Location: Quad: HIGHLAND Legal Description: T12NR10WS15 Latitude: 38:53:14.0N Longitude: 122:57:49.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F3
Reach Length (ft.): 16429
Riffle/Flatwater Mean Width (ft.): 8.7
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 56 - 66 Air (F): 59 - 78
Dry Channel (ft.): 93

Canopy Density (%): 51.5
Coniferous Component (%): 21.6
Hardwood Component (%): 78.4
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 62.0
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 11.5
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 12.0
Pool Frequency (%): 29.7
Residual Pool Depth (%):
< 2 Feet Deep: 21.2
2 to 2.9 Feet Deep: 54.5
3 to 3.9 Feet Deep: 12.1
>= 4 Feet Deep: 12.1
Mean Max Residual Pool Depth (ft.): 4.03
Mean Pool Shelter Rating: 8

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 12.1 Sm Cobble: 42.4 Lg Cobble: 30.3 Boulder: 3.0 Bedrock: 12.1
Embeddedness Values (%): 1. 21.2 2. 57.6 3. 6.1 4. 0.0 5. 15.2

STREAM REACH: 2

Channel Type: F2
Reach Length (ft.): 7423
Riffle/Flatwater Mean Width (ft.): 7.3
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 59 - 62 Air (F): 66 - 77
Dry Channel (ft.): 0

Canopy Density (%): 48.1
Coniferous Component (%): 36.5
Hardwood Component (%): 63.5
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 52.1
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Boulder
Occurrence of LWD (%): 8.9
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 10.2
Pool Frequency (%): 47.5
Residual Pool Depth (%):
< 2 Feet Deep: 21.1
2 to 2.9 Feet Deep: 52.6
3 to 3.9 Feet Deep: 21.1
>= 4 Feet Deep: 5.3
Mean Max Residual Pool Depth (ft.): 2.58
Mean Pool Shelter Rating: 12

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 10.5 Sm Cobble: 31.6 Lg Cobble: 21.1 Boulder: 31.6 Bedrock: 5.3
Embeddedness Values (%): 1. 5.3 2. 47.4 3. 10.5 4. 0.0 5. 36.8

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: C4
Reach Length (ft.): 720
Riffle/Flatwater Mean Width (ft.):
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 59 - 68 Air (F): 74 - 75
Dry Channel (ft.): 0

Canopy Density (%): 22.5
Coniferous Component (%): 10.0
Hardwood Component (%): 90.0
Dominant Bank Vegetation:
Vegetative Cover (%): 0.0
Dominant Shelter: Terrestrial Veg.
Dominant Bank Substrate Type:
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 9.2
Pool Frequency (%): 25.0
Residual Pool Depth (%):
< 2 Feet Deep: 100.0
2 to 2.9 Feet Deep: 0.0
3 to 3.9 Feet Deep: 0.0
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 1.8
Mean Pool Shelter Rating: 5

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 0.0 Sm Cobble: 100. Lg Cobble: 0.0 Boulder: 0.0 Bedrock: 0.0
Embeddedness Values (%): 1. 100.0 2. 0.0 3. 0.0 4. 0.0 5. 0.0

STREAM REACH: 4

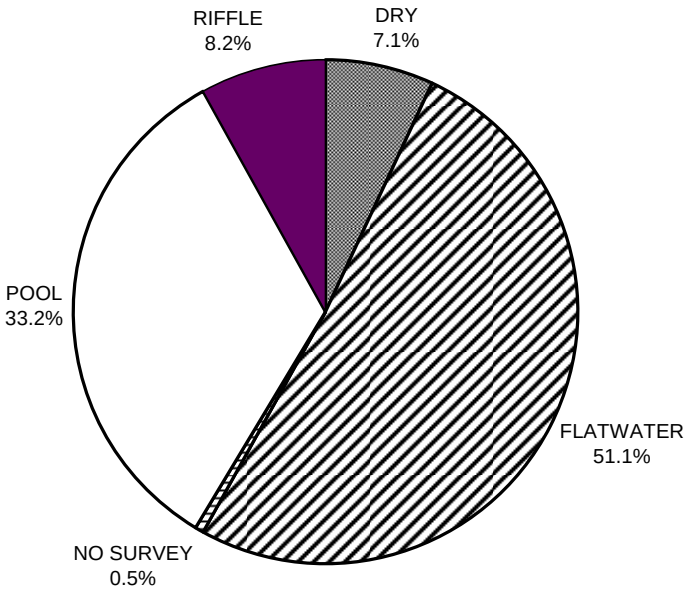
Channel Type: F3
Reach Length (ft.): 8895
Riffle/Flatwater Mean Width (ft.): 3.0
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 58 - 69 Air (F): 74 - 76
Dry Channel (ft.): 7579

Canopy Density (%): 43.8
Coniferous Component (%): 33.8
Hardwood Component (%): 66.3
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 52.5
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 1.8
Pool Frequency (%): 26.1
Residual Pool Depth (%):
< 2 Feet Deep: 60.0
2 to 2.9 Feet Deep: 40.0
3 to 3.9 Feet Deep: 0.0
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 2.08
Mean Pool Shelter Rating: 7

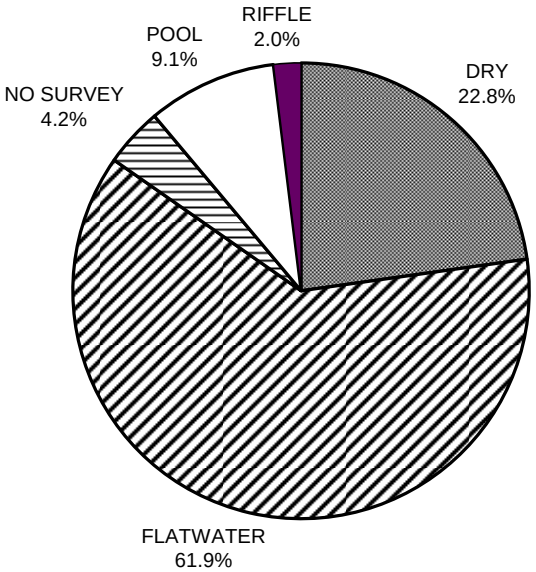
Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 20.0 Gravel: 40.0 Sm Cobble: 20.0 Lg Cobble: 0.0 Boulder: 20.0 Bedrock: 0.0
Embeddedness Values (%): 1. 0.0 2. 16.7 3. 33.3 4. 16.7 5. 16.7

TYLER CREEK 2002
HABITAT TYPES BY PERCENT OCCURRENCE



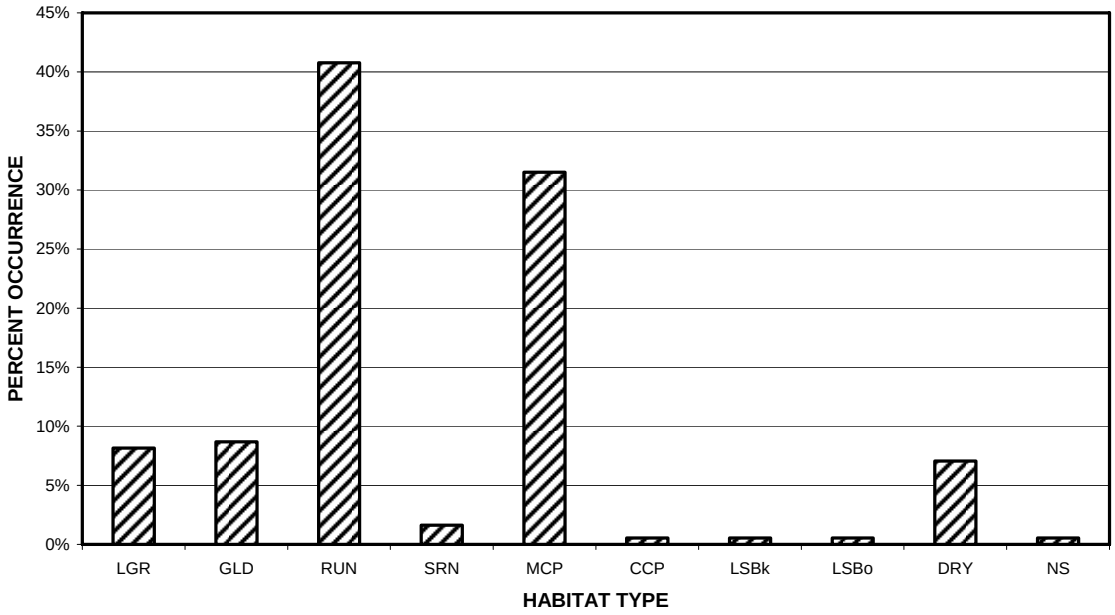
GRAPH 1: Level II habitat types by percent occurrence

TYLER CREEK 2002
HABITAT TYPES BY PERCENT TOTAL LENGTH



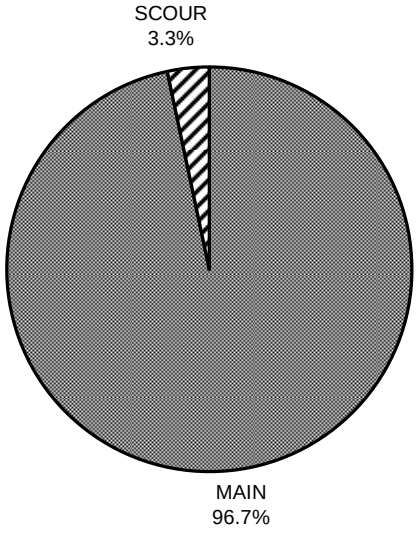
GRAPH 2: Level II habitat types by percent total length

TYLER CREEK 2002
HABITAT TYPES BY PERCENT OCCURRENCE



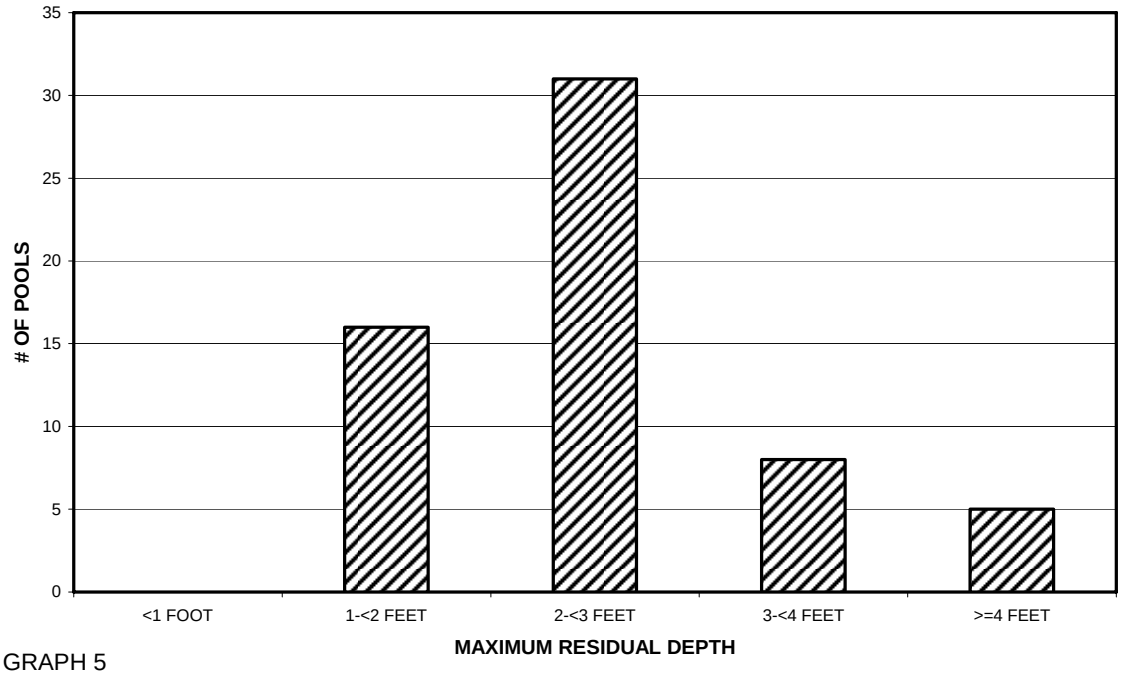
GRAPH 3: Level IV habitat types by percent occurrence

TYLER CREEK 2002
POOL TYPES BY PERCENT OCCURRENCE



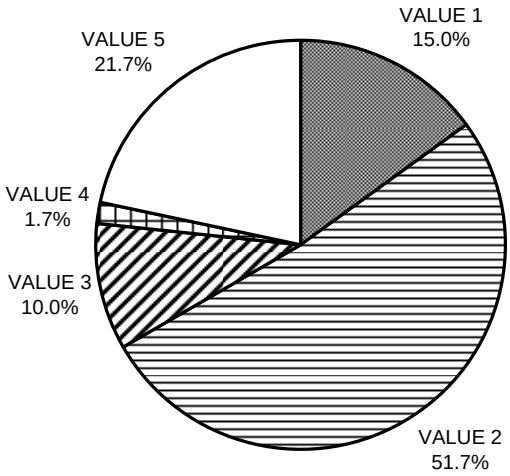
GRAPH 4: Level I pool types by percent occurrence

TYLER CREEK 2002
MAXIMUM DEPTH IN POOLS



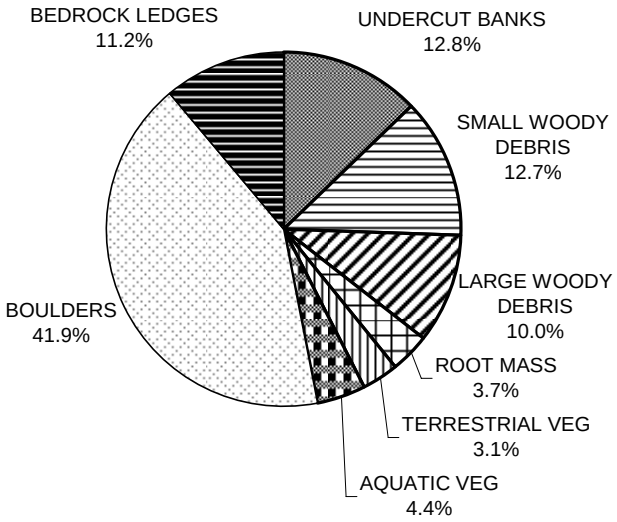
GRAPH 5

TYLER CREEK 2002
PERCENT EMBEDDEDNESS



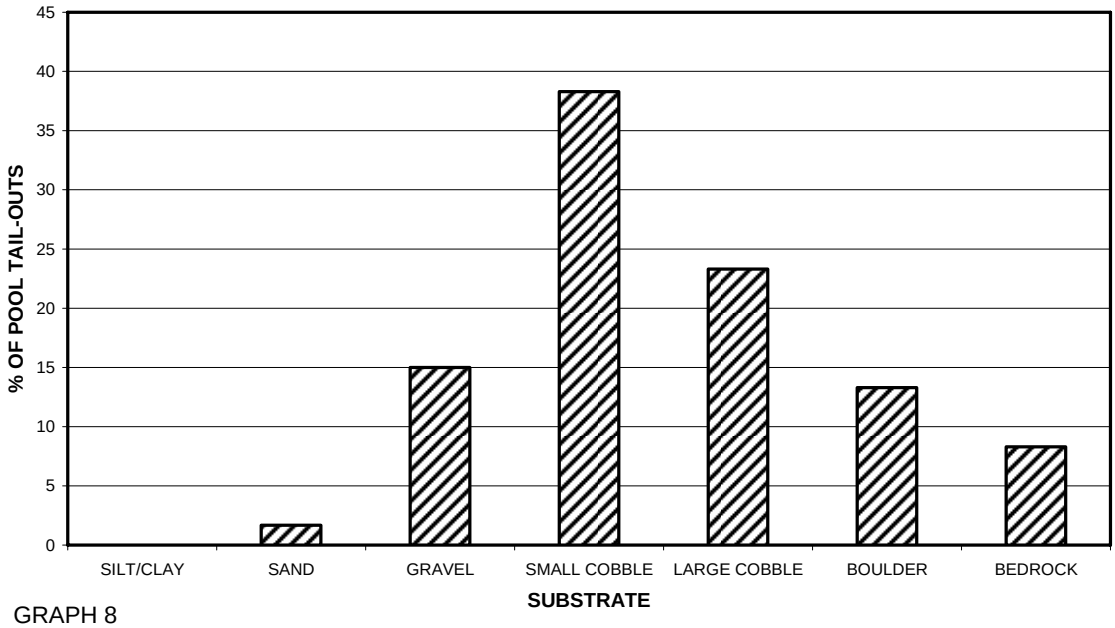
GRAPH 6

TYLER CREEK 2002
MEAN PERCENT COVER TYPES IN POOLS



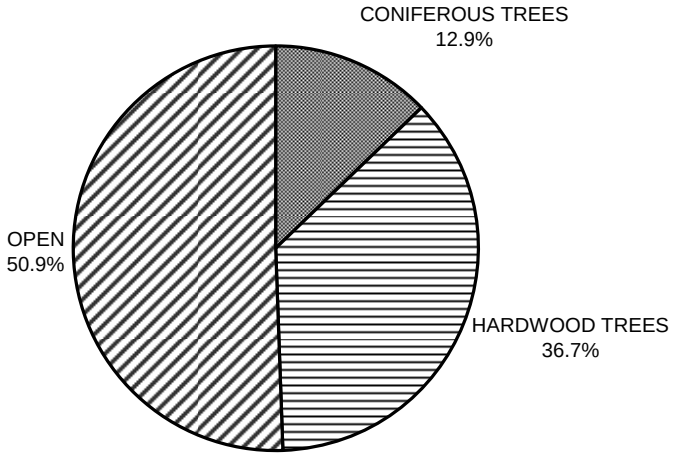
GRAPH 7

TYLER CREEK 2002
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



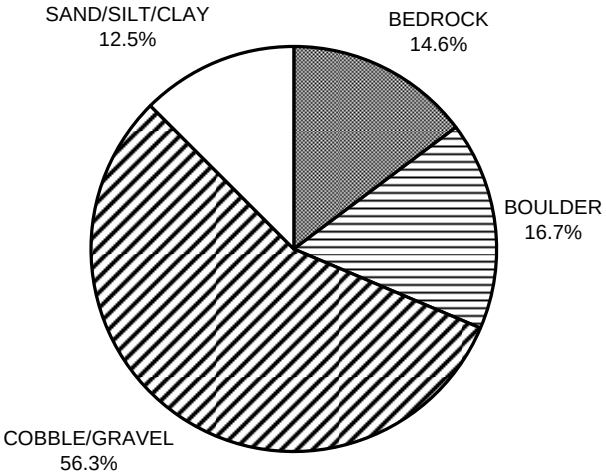
GRAPH 8

TYLER CREEK 2002
MEAN PERCENT CANOPY



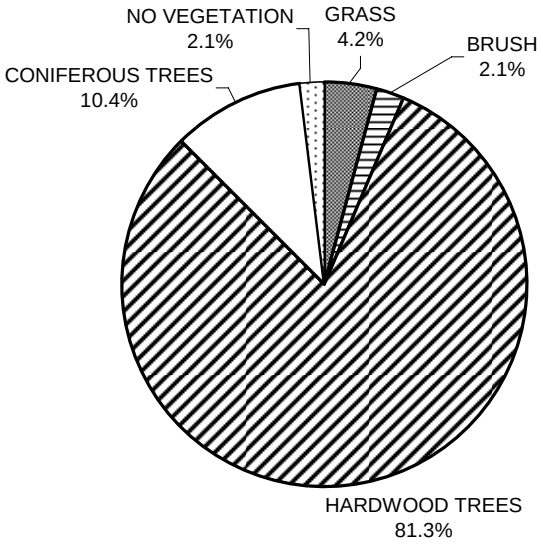
GRAPH 9

TYLER CREEK 2002
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

TYLER CREEK 2002
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

Tyler Creek Water Temperature 2002
(Reach 1)