Stream Inventory Report

Tannery Creek

Salmon Creek Watershed
Sonoma County, California

Survey: Summer 2002
Final Report: September, 2004

Revised May 2007

California Department of Fish and Game
Central Coast Region
Watershed Restoration Program

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2003

CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT

Tannery Creek

INTRODUCTION

A stream inventory was conducted during the summer of 2002 on Tannery Creek, a tributary to Salmon Creek in the Salmon Creek watershed. 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 Tannery 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 coho salmon and steelhead trout. Recommendations for habitat improvement activities are based on target habitat values for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Tannery Creek is located in Sonoma County, California and is a tributary to Salmon Creek. The legal description at the confluence with Salmon Creek is T6N R10W Section Bodega. Its location is 38°21'17.74"N latitude and 122°59'20.33"W longitude. Tannery Creek and its tributaries drain a basin of approximately 2.05 square miles. Tannery Creek is a maximum first order stream and has approximately 2.7 miles of blue line or dashed blue line stream, according to the USGS Valley Ford 7.5 minute quadrangle. Tannery Creek has 2 minor unnamed tributaries, which were not surveyed. Elevations range from about 30' at the mouth of the creek to 750' in the headwaters. Mixed hardwood forest dominates the watershed. The watershed is primarily privately owned and is managed for rangeland/recreation. Vehicle access exists via Salmon Creek Road via Bodega Highway near the town of Bodega.

Salmonid fish species historically present include coho salmon*(Oncorhynchus kisutch)* and steelhead trout*(Oncorhynchus mykiss).* Salmonid fish species currently present include steelhead trout*(Oncorhynchus mykiss),* listed as threatened on the federal endangered species list.

METHODS

The habitat inventory conducted in Tannery 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 2 person teams and was supervised by DFG's North Bay Watershed Restoration Planner, Gail Seymour.

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 Tannery Creek to record measurements and observations. There are nine components to the inventory form: flow, channel type, 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.

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. Tannery 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 Tannery 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 Tannery 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 Tannery 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 Tannery 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 electrofishing 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 Tannery 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:

The Department of Fish and Game has not conducted previous surveys of Tannery Creek.

HABITAT INVENTORY RESULTS FOR TANNERY CREEK

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

The habitat inventory of Tannery Creek, 9/23/2002 - 9/29/2002, was conducted by Cassie Simons and Douglas Mitchel with supervision and analysis by California Department of Fish and Game (DFG). The survey began at the confluence with Salmon Creek and extended up Tannery Creek to the end of anadromous fish passage at a rock falls. The total length of stream surveyed was 15,188 feet, with an additional 23 feet of side channel.

Flows were not measured on Tannery Creek.

The surveyed section of Tannery Creek has two reaches with two distinct channel types: from the mouth to 14,412 feet an **F4** and from 14,412 feet to 15,188 feet an **A2**. F4 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly gravel substrate. A2 channel types are steep (4-10%), narrow, cascading, step-pool streams with a high energy/debris transport associated with depositional soils and a predominantly boulder substrate.

Water temperatures on the survey days ranged from 48°F to 52°F. Air temperatures ranged from 50°F to 62°F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 44.5% Flatwater units, 23.7% Dry units, 17.1% Riffle units and 14.7% Pool units (Graph 1). Based on total length there were 45.9% Flatwater units, 33.8% Dry units, 11.3% Riffle units and 9.1% Pool units (Graph 2).

Four hundred nine habitat units were measured and 14% were completely sampled. Seventeen Level IV habitat types were identified. The data is summarized in Table 2. The most frequent habitat types by percent occurrence were Glide at 28%, Dry at 24%, Step Run at 10%, Low Gradient Riffle at 9%, Lateral Scour Pool - Root Wad Enhanced at 7%, Run at 6%, High Gradient Riffle at 6%, Mid-Channel Pool at 4%, Cascade at 2%, Lateral Scour Pool - Bedrock Formed at 2%, and Lateral Scour Pool - Log Enhanced at 1% (Graph 3). By percent total length, Dry at 34%, Glide at 21%, Step Run at 19%, Run at 6%, Low Gradient Riffle at 6%, Lateral Scour Pool - Root Wad Enhanced at 4%, High Gradient Riffle at 4%,

Mid-Channel Pool at 2%, Cascade at 1%, Lateral Scour Pool - Bedrock Formed at 1%, and Lateral Scour Pool - Log Enhanced at 1%.

Sixty pools were identified (Table 3). Lateral Scour Pool - Root Wad Enhanced pools were most often encountered at 7% of all habitat types (Table 2) and comprised 47% of the total length of pools.

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Forty four of the sixty pools (73%) had a depth of two feet or greater (Graph 5). These deeper pools comprised 7% of the total length of stream habitat.

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. Pools rated 36, and Flatwater units rated 2 (Table 1). Of the pool types, Secondary Channel Pool rated 110, Plunge Pool rated 80, Lateral Scour Pool - Root Wad Enhanced rated 73, Lateral Scour Pool - Boulder Formed rated 18, Mid-Channel Pool rated 12, Lateral Scour Pool - Bedrock Formed rated 6 and Lateral Scour Pool - Log Enhanced rated 10 (Table 2).

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were Root Mass at 24%, Undercut Banks at 26%, Large Wood at 12%, Small Wood at 11%, Boulders at 7%, and Bedrock at 5%. Graph 7 describes the pool shelter in Tannery Creek.

Table 6 summarizes the dominant substrate by habitat type. In the two of the 35 Low-Gradient Riffles surveyed, the dominant substrate was: Sand in one riffle and Gravel in one riffle.

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 60 pool tail-outs measured, twenty one had a value of 1 (35%), twenty had a value of 2 (33%), nine had a value of 3 (15%) and one had a value of 4 (2%). Nine (15%) riffles rated a 5 (unsuitable substrate type for spawning). On this scale, a value of one is best for fisheries. Small cobble was the dominant substrate observed at pool tail-outs (Graph 8). Graph 6 describes percent embeddedness. No mechanical gravel sampling was conducted in 2002 surveys due to inadequate staffing levels.

The mean percent canopy density for the stream reach surveyed was 89%. The mean percentages of deciduous and evergreen trees were 47% and 53%, respectively (Table 2). Graph 9 describes the canopy for the entire survey and Table 7 summarizes the mean percent vegetative cover for the entire surveyed stream.

For the entire stream reach surveyed, the mean percent right bank vegetated was 39% and the mean percent left bank vegetated was 38%. For the habitat units measured, the dominant vegetation types for the stream banks were: 34% Evergreen Trees, 31% Brush, 30% Deciduous Trees, 4% Bare Soil and 2% Grass (Table 8 and Graph 11). The dominant substrate for the stream banks were: 54% Silt, Clay & Sand, 32% Cobble & Gravel, 8% Bedrock and 6% Boulder (Table 8 and Graph 10).

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

The Department of Fish and Game has conducted previous biological inventories of Tannery Creek and there are no records of hatchery releases or fish rescues in the Salmon Creek watershed. A biological inventory was not conducted in 2002, although during the stream habitat inventory surveyors observed many juvenile steelhead as well as other fish including stickleback and sculpin.

Historic Biological Surveys Summaries

In September, 2001, DFG staff, Bill Cox, conducted a biological survey in three reaches of Tannery Creek. The focus was to determine coho salmon presence/absence. The creek was split into three reaches and ten pools per reach were electrofished using DFG's "10 Pool" Protocol.

Species Observed in Recent Surveys

YEARS	SPECIES	SOURCE	NATIVE/ INTRODUCED
2001	STEELHEAD TROUT *(Oncorhynchus mykiss)*	DFG	N
2001	THREESPINE STICKLEBACK (Gasterosteus aculeatus williamsoni)	DFG	N

DISCUSSION FOR TANNERY CREEK

Tannery Creek has two reaches: mouth to 14,412 feet an **F4** and 14,412 feet to 15,188 feet an **A2**.

There are 14,412 feet of F4 channel type in Reach 1. According to the DFG Salmonid Stream Habitat Restoration Manual, F4 channel

types are good for bank-placed boulders and fair for low-stage weirs, single and opposing wing-deflectors, channel constrictors and log cover. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and shelter. Any work considered will require careful design, placement, and construction that must include protection for any unstable banks.

There are 776 feet of A2 channel type in Reach 2. According to the DFG Salmonid Stream Habitat Restoration Manual, the high energy, steep gradient A2 channel types have stable stream banks and poor gravel retention capabilities and are generally not suitable for instream enhancement structures.

The water temperatures recorded on the survey days 9/23/2002 - 9/29/2002 ranged from 48°F to 52°F. Air temperatures ranged from 50°F to 62°F. The warmest water temperatures were recorded in Reach 2. This temperature regime is favorable to salmonids. To make any further conclusions, temperatures need to be monitored for a longer period of time through the critical summer months.

Pools comprised 9% of the total length of this survey. In first and second order streams a primary pool is defined to have a maximum depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. In Tannery Creek, the pools are relatively deep with 73% having a maximum depth of at least two feet. These pools comprised 7% of the total length of stream habitat. In coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat length.

The mean shelter rating for pools was 42. A pool shelter rating of approximately 80 is desirable. The relatively small amount of pool shelter that now exists is being provided primarily by Root Mass at 24%, Undercut Banks at 26%, Large Wood at 12%, Small Wood at 11%, Boulders at 7%, and Bedrock at 5% (Table 10). Log and root wad cover in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Log cover provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density-related competition. One of the two low gradient riffles measured (50%) had either gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

Seventeen percent of the pool tail-outs measured had embeddedness ratings of either 3 or 4. Only 35% had a rating of 1. Cobble embeddedness measured to be 25% or less (a rating of 1) is considered best for the needs of salmon and steelhead.

The higher the percent of fine sediment, the lower the probability that eggs will survive to hatch. This is due to the reduced quantity of oxygenated water able to percolate through the gravel, or because of fine sediment capping the redd and preventing fry emergence. In Tannery Creek all reaches should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean percent canopy for the survey was 90%.
This is very good, since 80% is generally considered desirable. Reach 1 had a canopy of 88%, however there were occurrences of bank erosion problems. This reach as well as other areas with bank erosion could benefit from bio-technical re-vegetation techniques using native species.

Seven major large woody debris accumulations were identified which have the potential for becoming barriers or causing erosion. Six major erosion sites were also noted.

GENERAL MANAGEMENT RECOMMENDATIONS

Tannery 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. Efforts to increase flood protection or improve fish access in the short run, have led to long term problems in the system. 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.

PRIORITY FISHERY ENHANCEMENT OPPORTUNITIES

1) Where feasible, design and engineer pool enhancement structures to increase the number of pools in the upper reaches. This must be done in conjunction with stream bank armor to prevent erosion (Reach 1).

2) Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream. Most of the existing shelter is from undercut banks and root mass. Adding high quality complexity with larger woody cover is desirable. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool

locations in Reach 1. This must be done in conjunction with stream bank armor to prevent erosion. In some areas the material is at hand.

3) There are several log debris accumulations present on Tannery Creek that have the potential for causing bank erosion. The modification of these debris accumulations is not recommended at this time, but they should be monitored for fish passage and erosion. If modification becomes necessary, it must be done carefully to preserve existing habitat provided by the woody debris.

4) Map sources of upslope and in-channel 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. Near-stream riparian planting along any portion of the stream should be encouraged to provide bank stability and a buffering against agricultural, grazing and urban runoff.

5) In Tannery Creek, active and potential sediment sources related to the road system need to be mapped and treated according to their potential for sediment yield to the stream and its tributaries.

6) Reach 1 would benefit from the utilization of bio-technical vegetative techniques to re-establish floodplain benches and a defined low flow channel. This would discourage lateral migration of the base flow channel and decrease bank erosion.

7) Conduct gravel sampling in Reach 1. Results of future sampling may indicate the need for structures to decrease channel incision, recruit and sort spawning gravel, and expand redd distribution in 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.

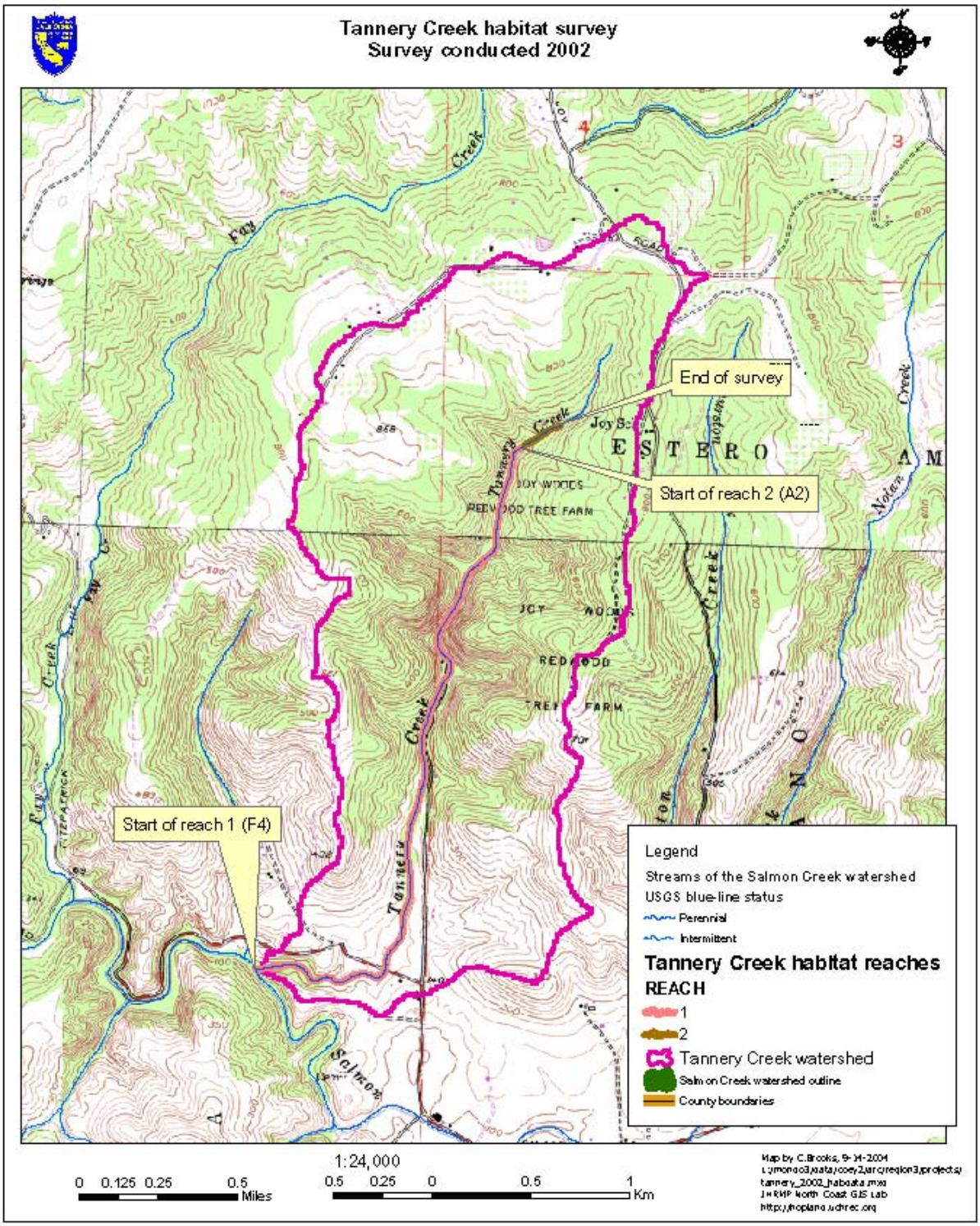
0'	Begin survey at confluence with Salmon Creek. Channel type is F4.
647’	Juvenile salmonids observed.
1,697’	Riprap falling into creek.
1,778’	Juvenile salmonids observed.

2,243′	Bridge crossing.
2,755′	Large Debris Accumulation.
2,847′	Juvenile salmonids observed.
3,110′	Bridge crossing.
3,836′	Cattle guard present at time of survey.
4,105′	Fence crosses creek.
4,734′	Riprap falling into creek.
4,829′	Large Debris Accumulation.
4,978′	Large Debris Accumulation.
5,104′	Large Debris Accumulation.
6,327′	Large Debris Accumulation contributing to left bank erosion.
6,524′	Large Debris Accumulation.
6,690′	Unnamed tributary enters from right bank, dry at time of survey.
6,785′	Juvenile salmonids observed.
7,506′	Restoration project: boulder weir.
7,640′	Restoration project: boulder weir.
7,739′	Spring enters from right bank.
7,886′	Erosion, right bank.
7,929′	Spring enters from left bank.
8,262′	Gabion on left bank. Culvert on left bank. Erosion.
8,343′	Erosion on left bank.
8,536′	Shotgun culvert on left bank: 8″ diameter.
8,885′	Juvenile salmonids observed.

9,237′	Bridge crossing.
9,455′	Erosion on right bank.
10,174′	Erosion on left bank.
10,420′	Old road crossing.
11,348′	Unnamed tributary enters from right bank.
11,919′	Juvenile salmonids observed.
12,131′	Erosion on left bank.
12,167′	Unnamed tributary enter from left bank, dry at time of survey.
12,308′	Unnamed tributary enters from left bank, tributary temperature was 49 degrees Fahrenheit at time of survey.
12,588′	Large debris accumulation.
14,067′	Unnamed tributary enters from right bank, tributary temperature was 50 degrees Fahrenheit at time of survey.
14412′	Channel changes from an F4 channel to an A2 channel.
14,551′	Waterfall with 6.2′ plunge.
14,591′	Waterfall with 6.0′ plunge, one juvenile salmonid observed.
15,188′	End of survey.

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.


Tannery Creek habitat survey
Survey conducted 2002
End of survey
Start of reach 2 (A2)
Start of reach 1 (F4)
ESTERO
JOY WOODS
REDWOOD TREE FARM
Legend
Streams of the Salmon Creek watershed
USGS blue-line status
Perennial
Intermittent
Tannery Creek habitat reaches
REACH
1
2
Tannery Creek watershed
Salmon Creek watershed outline
County boundaries
1:24,000
0 0.125 0.25 0.5 Miles
0.5 0.25 0 0.5 1 Km

LEVEL III and LEVEL IV HABITAT TYPE KEY:

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

Tannery Creek — Drainage: Salmon Creek

Table 1 - SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES — Survey Dates: 09/23/02 to 09/29/02

Confluence Location: QUAD: Valley Ford LEGAL DESCRIPTION: — LATITUDE: 38.3548396' LONGITUDE: 122.9999461'

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN 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
70	10	RIFFLE	17	24	1712	11	3.4	0.1	70	4887	7	502	0	0
182	23	FLATWATER	44	38	6975	46	5.4	0.3	152	27738	43	7860	0	2
60	20	POOL	15	23	1377	9	7.8	1.1	172	10300	202	12133	189	38
97	0	DRY	24	53	5147	34	0.0	0.0	0	0	0	0	0	0

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq. ft.)	TOTAL VOL. (cu. ft.)
409	53	15211	42925	20494

Tannery Creek — Drainage: Salmon Creek

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS — Survey Dates: 09/23/02 to 09/29/02

Confluence Location: QUAD: Valley Ford LEGAL DESCRIPTION: — LATITUDE: 38.3548396' LONGITUDE: 122.9999461'

HABITAT UNITS #	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT OCCURRENCE %	MEAN LENGTH ft.	TOTAL LENGTH ft.	TOTAL LENGTH %	MEAN WIDTH ft.	MEAN DEPTH ft.	MAXIMUM DEPTH ft.	MEAN AREA sq.ft.	TOTAL AREA EST. sq.ft.	MEAN VOLUME cu.ft.	TOTAL VOLUME EST. cu.ft.	MEAN RESIDUAL POOL VOL cu.ft.	MEAN SHELTER RATING	MEAN CANOPY %
35	2	LGR	9	25	874	6	3	0.2	0.3	20	704	3	105	0	0	92
25	5	HGR	6	24	599	4	5	0.1	0.4	125	3129	13	313	0	0	92
9	2	CAS	2	25	224	1	2	0.1	0.3	1	10	0	1	0	0	97
1	1	BRS	0	15	15	0	2	0.1	0.3	30	30	3	3	0	0	100
1	0	POW	0	31	31	0	0	0.0	0.0	0	0	0	0	0	0	95
116	9	GLD	28	27	3126	21	5	0.4	1.6	124	14374	50	5791	0	1	87
26	6	RUN	6	36	941	6	4	0.2	0.9	158	4101	32	839	0	1	90
39	8	SRN	10	74	2877	19	7	0.3	1.3	180	7017	44	1724	0	3	90
15	3	MCP	4	22	328	2	11	1.7	3.6	276	4140	480	7196	567	12	79
4	1	LSL	1	21	83	1	14	1.0	2.4	224	896	224	896	202	10	83
27	6	LSR	7	24	654	4	7	1.1	3.4	157	4233	155	4179	109	73	91
9	6	LSBk	2	25	224	1	6	1.0	3.1	155	1392	160	1444	177	8	91
2	2	LSBo	0	31	62	0	8	1.0	2.0	203	406	190	379	142	18	91
1	1	PLP	0	7	7	0	9	0.8	1.7	63	63	50	50	44	80	85
1	1	SCP	0	10	10	0	6	1.7	3.2	60	60	102	102	96	110	95
1	0	BPL	0	9	9	0	0	0.0	3.0	0	0	0	0	0	0	0
97	0	DRY	24	53	5147	34	0	0.0	0.0	0	0	0	0	0	0	87

TOTAL UNITS	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
409	53	15211	40555	23021

Tannery Creek — Drainage: Salmon Creek

Table 3 - SUMMARY OF POOL TYPES — Survey Dates: 09/23/02 to 09/29/02

Confluence Location: QUAD:Valley Ford LEGAL DESCRIPTION: — LATITUDE: 38.3548396' LONGITUDE: 122.9999461'

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN DEPTH (ft.)	MEAN AREA (sq.ft.)	TOTAL AREA EST. (sq.ft.)	MEAN VOLUME (cu.ft.)	TOTAL VOLUME EST. (cu.ft.)	MEAN RESIDUAL POOL VOL. (cu.ft.)	MEAN SHELTER RATING
15	3	MAIN	25	22	328	24	11.3	1.7	276	4140	480	7196	567	12
43	16	SCOUR	72	24	1030	75	7.3	1.0	160	6873	159	6843	134	38
2	1	BACKWATER	3	10	19	1	6.0	1.7	60	120	102	204	96	110

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOLUME (cu.ft.)
60	20	1377	11133	14243

Tannery Creek — Drainage: Salmon Creek

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES — Survey Dates: 09/23/02 to 09/29/02

Confluence Location: QUAD: Valley Ford LEGAL DESCRIPTION: — LATITUDE: 38.3548396' LONGITUDE: 122.9999461'

UNITS MAX DPTH MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	<1 FOOT MAXIMUM DEPTH	<1 FOOT PERCENT OCCURRENCE	1-<2 FT. MAXIMUM DEPTH	1-<2 FOOT PERCENT OCCURRENCE	2-<3 FT. MAXIMUM DEPTH	2-<3 FOOT PERCENT OCCURRENCE	3-<4 FT. MAXIMUM DEPTH	3-<4 FOOT PERCENT OCCURRENCE	>=4 FEET MAXIMUM DEPTH	>=4 FEET PERCENT OCCURRENCE
15	MCP	25	0	0	3	20	11	73	1	7	0	0
4	LSL	7	0	0	1	25	3	75	0	0	0	0
27	LSR	45	0	0	8	30	18	67	1	4	0	0
9	LSBk	15	0	0	3	33	5	56	1	11	0	0
2	LSBo	3	0	0	0	0	2	100	0	0	0	0
1	PLP	2	0	0	1	100	0	0	0	0	0	0
1	SCP	2	0	0	0	0	0	0	1	100	0	0
1	BPL	2	0	0	0	0	0	0	1	100	0	0

TOTAL UNITS
60

Tannery Creek (So. Sonoma) Drainage: Salmon Creek

Table 5 - Summary of Shelter by Habitat Type Survey Dates: 09/23/02 to 09/29/02

Confluence Location: QUAD: Valley Ford LEGAL DESCRIPTION: LATITUDE: 38.3548396' LONGITUDE: 122.9999461'

UNITS MEASURED	UNITS SHELTER MEASURED	HABITAT TYPE	% TOTAL UNDERCUT BANKS	% TOTAL SWD	% TOTAL LWD	% TOTAL ROOT MASS	% TOTAL TERR. VEGETATION	% TOTAL AQUATIC VEGETATION	% TOTAL WHITE WATER	% TOTAL BOULDERS	% TOTAL BEDROCK LEDGES
35	2	LGR	0	0	0	0	0	0	0	0	0
25	5	HGR	0	0	0	0	0	0	0	0	0
9	2	CAS	0	0	0	0	0	0	0	0	0
1	1	BRS	0	0	0	0	0	0	0	0	0
1	0	POW	0	0	0	0	0	0	0	0	0
116	10	GLD	0	3	10	74	0	0	0	12	0
26	6	RUN	0	0	0	0	0	0	0	100	0
39	8	SRN	16	15	0	28	25	0	0	16	0
15	3	MCP	53	13	12	15	0	0	0	6	0
4	1	LSL	32	12	33	23	0	0	0	0	0
27	6	LSR	32	3	12	54	0	0	0	0	0
9	6	LSBk	16	43	0	29	0	0	0	0	13
2	2	LSBo	39	0	0	0	3	0	0	57	0
1	1	PLP	0	35	30	35	0	0	0	0	0
1	1	SCP	20	20	60	0	0	0	0	0	0
1	0	BPL	0	0	0	0	0	0	0	0	0
97	0	DRY	0	0	0	0	0	0	0	0	0
ALL HABITAT TYPES 409	54		29	11	12	36	3	0	0	9	1
POOLS ONLY 60	20		32	10	13	36	0	0	0	7	1

Tannery Creek (So. Sonoma) Drainage: Salmon Creek

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE Survey Dates: 09/23/02 to 09/29/02

Confluence Location: QUAD: Valley Ford LEGAL DESCRIPTION: LATITUDE: 38.3548396' LONGITUDE: 122.9999461'

TOTAL HABITAT UNITS	UNITS SUBSTRATE MEASURED	HABITAT TYPE	% TOTAL SILT/CLAY DOMINANT	% TOTAL SAND DOMINANT	% TOTAL GRAVEL DOMINANT	% TOTAL SM COBBLE DOMINANT	% TOTAL LG COBBLE DOMINANT	% TOTAL BOULDER DOMINANT	% TOTAL BEDROCK DOMINANT
35	2	LGR	0	50	50	0	0	0	0
25	5	HGR	20	20	40	0	20	0	0
9	2	CAS	0	0	0	0	0	100	0
1	1	BRS	0	0	0	0	0	0	100
1	0	POW	0	0	0	0	0	0	0
116	10	GLD	80	10	0	10	0	0	0
26	7	RUN	0	29	43	14	0	0	14
39	9	SRN	11	11	33	33	11	0	0
15	3	MCP	33	67	0	0	0	0	0
4	1	LSL	0	100	0	0	0	0	0
27	6	LSR	17	67	17	0	0	0	0
9	7	LSBk	14	71	14	0	0	0	0
2	2	LSBo	0	50	0	50	0	0	0
1	1	PLP	0	100	0	0	0	0	0
1	1	SCP	100	0	0	0	0	0	0
1	0	BPL	0	0	0	0	0	0	0
97	0	DRY	0	0	0	0	0	0	0

Table 7. Summary of Mean Percent Vegetative Cover for Entire Stream

Mean Percent Canopy	Mean Percent Evergreen	Mean Percent Deciduous	Mean Right bank % Cover	Mean Left Bank % Cover
88.65	53.73	46.27	33.81	32.11

Table 8. Tannery Creek

Mean Percentage of Dominant Substrate

Dominant Class of Substrate	Number Units Right Bank	Number Units Left Bank	Percent Total Units
Bedrock	4	5	7.89
Boulder	2	5	6.14
Cobble/Gravel	22	14	31.58
Silt/clay	29	33	54.39

Mean Percentage of Dominant Vegetation

Dominant Class of Vegetation	Number Units Right Bank	Number Units Left Bank	Percent Total Units
Grass	1	1	1.75
Brush	15	20	30.70
Deciduous Trees	19	15	29.82
Evergreen Trees	21	18	34.21
No Vegetation	1	3	3.51

Table 9 - FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: Tannery Creek
SAMPLE 09/23/2002 to 09/29/2002
SURVEY LENGTH:
MAIN 15188 ft. SIDE CHANNEL: 23 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: Valley Ford Latitude: 38°21'17.74"N
Legal Description: T6N R10W Section Bodega Longitude: 122°59'20.33"W

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

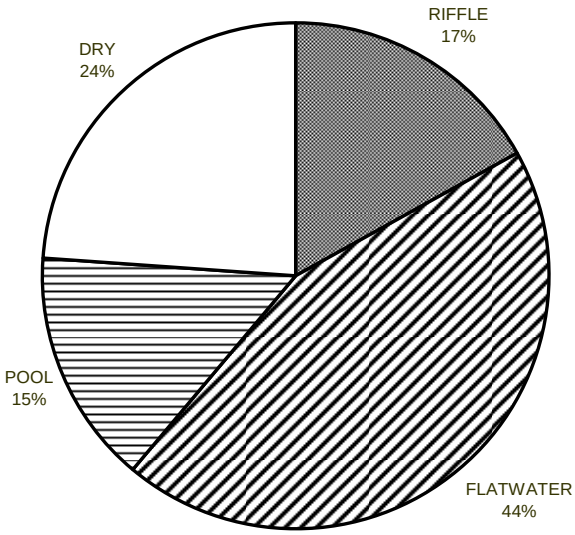
STREAM REACH 01 (Units 1-370)

Channel Type:	F4	Mean Canopy Density:	88 %
Main Channel	14412 ft.	Evergreen	50 %
Side Channel Length:	23 ft.	Deciduous	50 %
Riffle/Flatwater Mean Width	5 ft.	Pools by Stream	9%
Pool Mean Depth:	1.1 ft.	Pools >=2 ft. Deep:	72 %
Base Flow:	not measured	Pools >=3 ft. Deep:	7 %
Water: 48-59°F	Air: 50-68°F	Mean Pool Shelter:	38%
Dom. Bank: Evergreen Trees		Dom. Shelter: Root Masses	
Bank Vegetative Cover:	35 %	LOD Pool Shelter:	8 %
Dom. Bank Substrate:	Silt/Clay/Sand	Dry Channel: 4910 ft.	
Embeddness	1.35% 2. 33% 3. 15%	4. 2 % 5. 15%	

STREAM REACH 02 (Units 371-407)

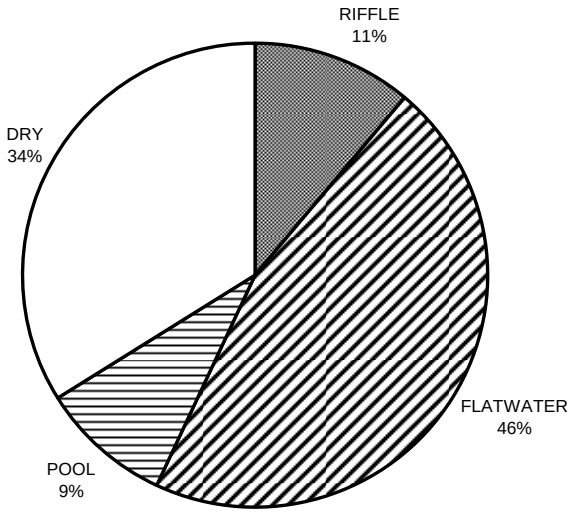
Channel Type:	A2	Mean Canopy Density:	92 %
Main Channel	776 ft.	Evergreen	87 %
Side Channel Length:	0 ft.	Deciduous	13 %
Riffle/Flatwater Mean	5 ft.	Pools by Stream	12%
Pool Mean Depth:	1 ft.	Pools >=2 ft. Deep:	76%
Base Flow:	not measured	Pools >=3 ft. Deep:	9%
Water: 48-52°F	Air: 58-60°F	Mean Pool Shelter:	40
Dom. Bank: Evergreen Trees		Dom. Shelter: Boulders	
Bank Vegetative Cover:	19 %	LOD Pool Shelter:	0 %
Dom. Bank Substrate:	Silt/Clay/Sand	Dry Channel: 237 ft.	
Embeddness: not measured			

TANNERY CREEK 2002
HABITAT TYPES BY PERCENT OCCURENCE



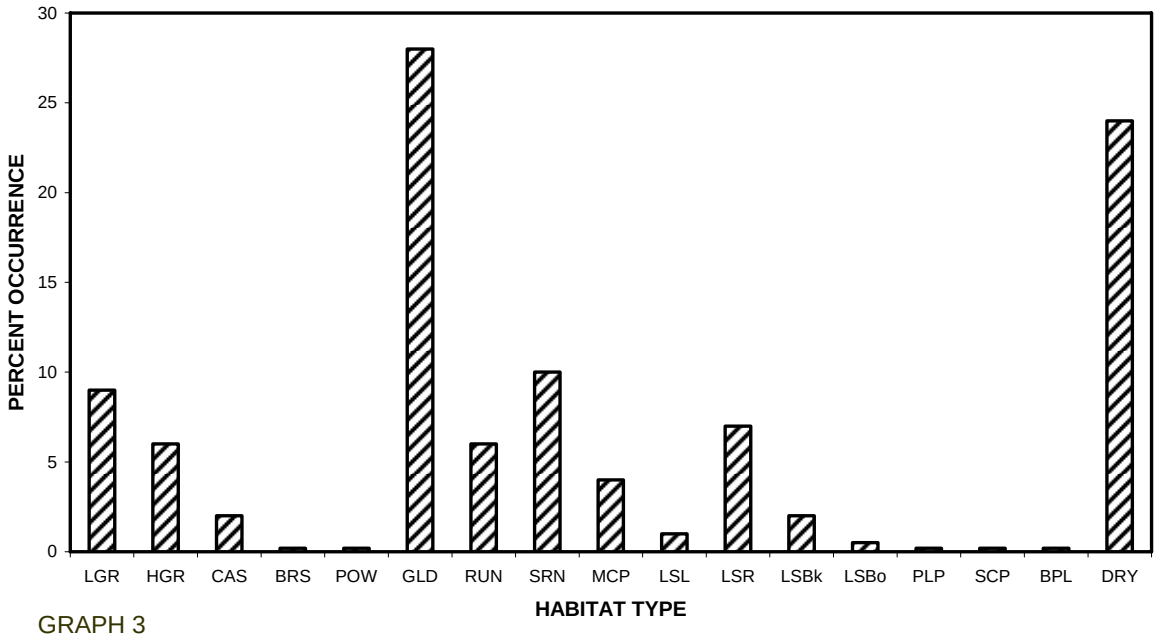
GRAPH 1

TANNERY CREEK 2002
HABITAT TYPES BY PERCENT TOTAL LENGTH



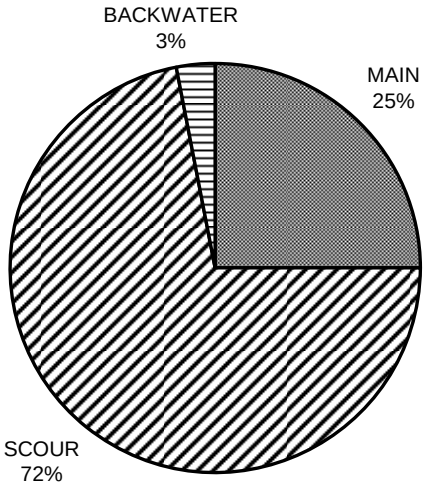
GRAPH 2

TANNERY CREEK 2002
HABITAT TYPES BY PERCENT OCCURRENCE

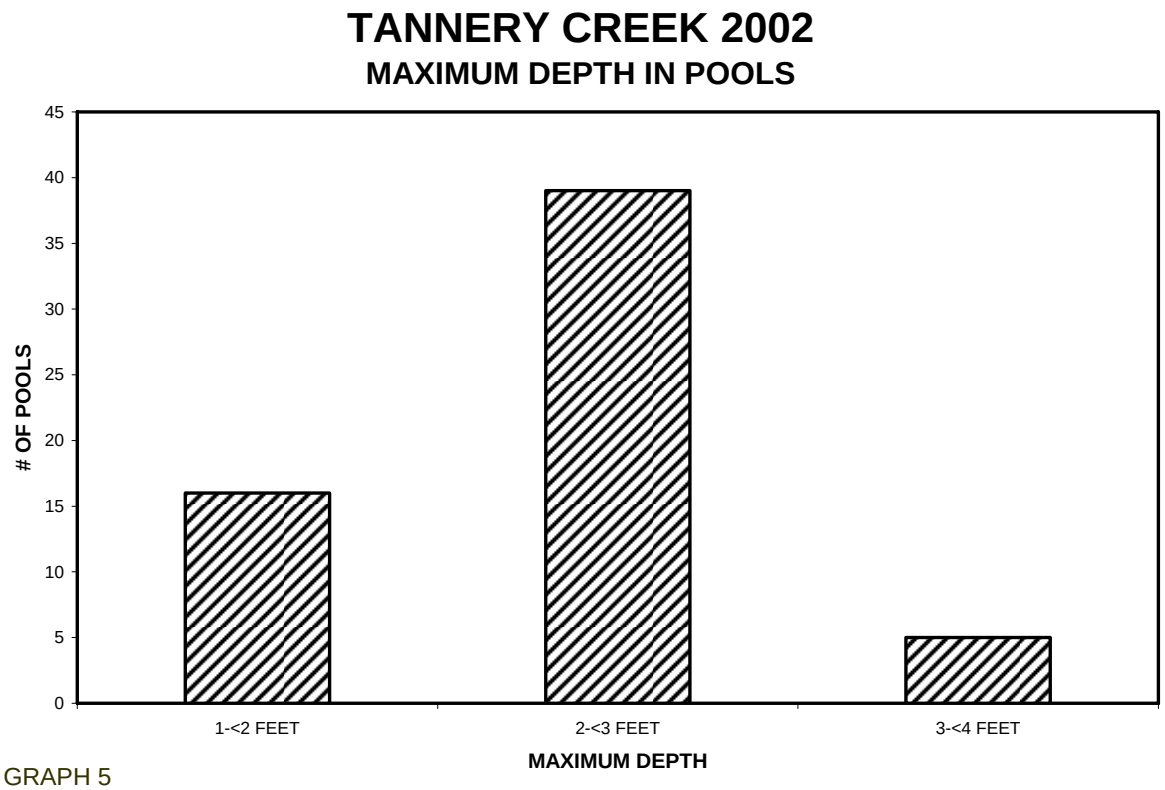


GRAPH 3

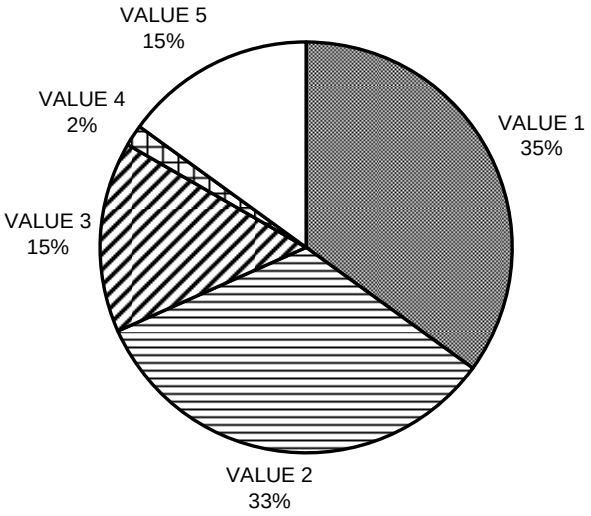
TANNERY CREEK 2002
POOL HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 4

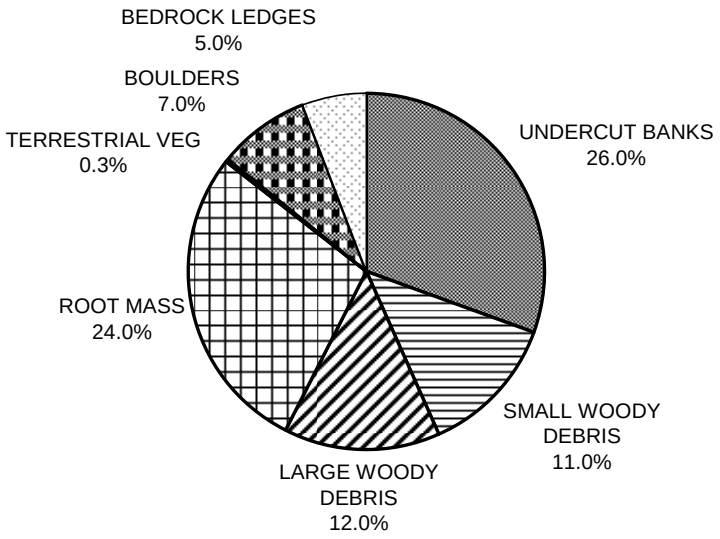


GRAPH 5



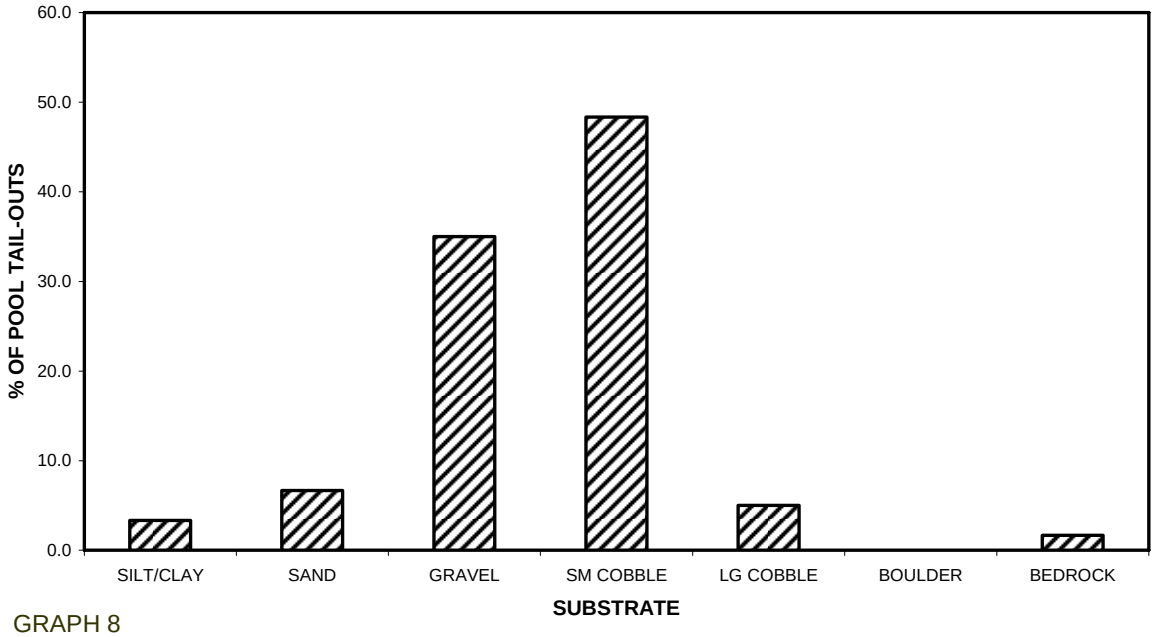
GRAPH 6

TANNERY CREEK 2002
MEAN PERCENT COVER TYPES IN POOLS



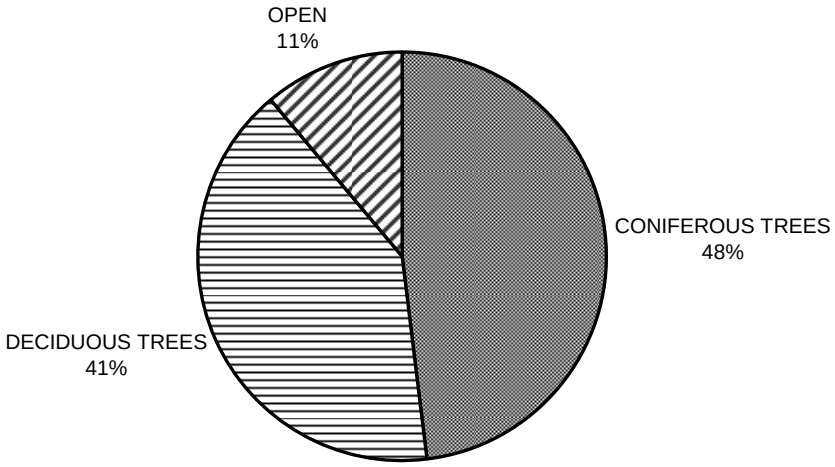
GRAPH 7

TANNERY CREEK 2002
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



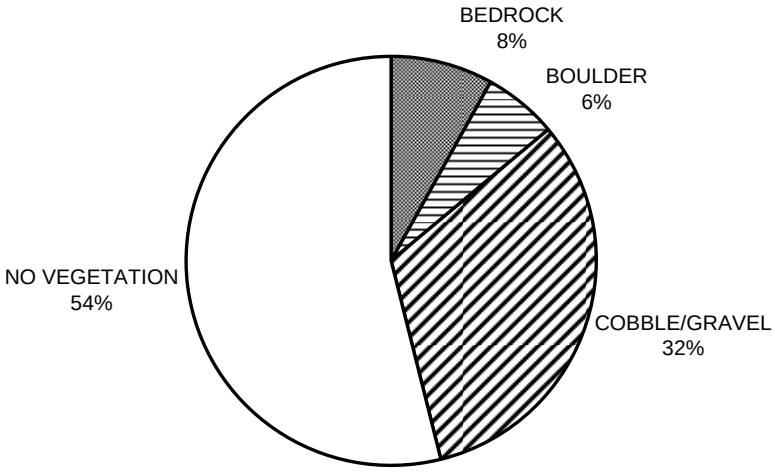
GRAPH 8

TANNERY CREEK 2002
MEAN PERCENT CANOPY



GRAPH 9

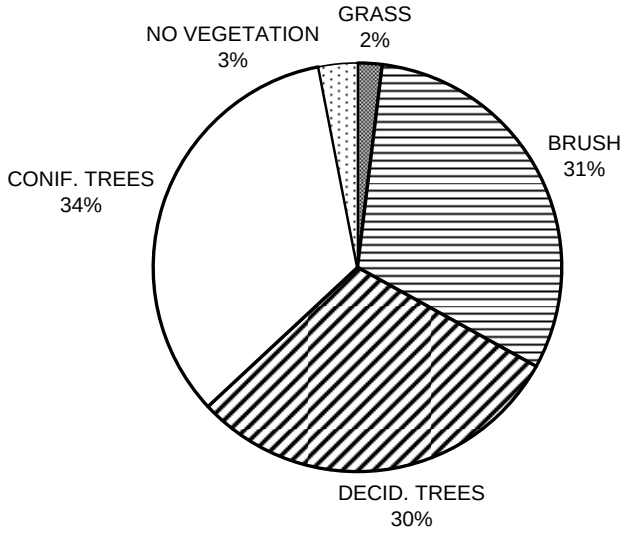
TANNERY CREEK 2002
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

TANNERY CREEK 2002

DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11