CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT

Vasser Creek

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Report Completed 2005
Assessment Completed 2002

INTRODUCTION

A stream inventory was conducted during the summer of 2002 on Vasser Creek, 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 Vasser 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

Vasser Creek is located in Mendocino County, California and is a tributary of Coleman Creek which is a tributary of Pieta Creek which drains into the Russian River (see Vasser Creek map, APPENDIX A). The legal description at the confluence with Coleman Creek is T12N, R11W, S2. Its location is 38°55'17.38"N latitude and 123°02'41.13"W longitude. Access exists from a dirt road off of Hwy 101. Turn east on the forth road north of Squaw Rock, continue east, the road gradually turns north to follow Coleman Creek. After crossing Coleman, a jeep trail on the right leads to the mouth of Vasser Creek.

Vasser Creek and its tributaries drain a basin of approximately 9227.6 acres (14.4 square miles). Vasser Creek is a maximum fourth order stream and has approximately 36689.6 feet (6.95 miles) of blue line stream, according to the USGS “Hopland” 7.5 minute quadrangles. Jakes Creek is a major tributary and is discussed in a separate report. Several minor unnamed tributaries were noted but no surveyed. Elevations range from about 558 feet at the mouth of the creek to 3291 feet in the headwaters. The vegetation is primarily shrub (47%) and hardwood (44%) with some herbaceous (5%), mixed hardwood/conifer (4%), and conifer (1%). None of the watershed is urban and only 7.91 acres are agricultural. The watershed is 63.4% privately owned and 36.6% federally owned and is managed by the BLM as Cow Mountain Recreation Area.

Salmonid fish species historically present include steelhead trout. Endangered, threatened, or sensitive species include foothill yellow-legged frog (*Rana boylii*), Bell's sage sparrow (*Amphispiza belli belli*), serpentine cryptantha (*Cryptantha clevelandii var dissita*), and colusa layia (*Layia septentrionalis*) (Ndbb source).

METHODS

The habitat inventory conducted in Vasser 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 Vasser 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.

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. Vasser 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 Vasser 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 Vasser 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 Vasser 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 Vasser 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 Vasser 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:

Vasser 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, a portion of the Pieta Creek basin (none of Vasser Creek) lies within the Geysers-Calistoga Known Geothermal Resource Area (KGRA). Vegatative cover in the Vasser Creek Basin was 54.6% oak woodland (1,918 acres), 33.6% chapparal (1,183 acres), 11.7% grassland and 0.1% other (5 acres, not mixed conifer/hardwood). In 1982-84, perscribed fires burned a combined 680 acres, accounting for 18.9% of the area in the Vasser sub-basin. In addition, between 1944-84 wildfires burned 344 acres. The study found the overall water quality of Pieta and its tributaries to be very good. No fish populations estimates were made.

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. Numerous erosion problems reported included steep slopes, mass wasting, potential debris jams, denuded banks and bank cutting, and channel scour and deposition. Vasser Creek did not provide good salmonid habitat because of low flows and high water temperature. Near the mouth, juveniles were stranded in drying pools and were rescued. Better habitat existed upstream.

HABITAT INVENTORY RESULTS FOR VASSER CREEK

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

The habitat inventory of Vasser Creek, 8/21/2002 - 9/11/2002, was conducted by Amy Livingston (Americorps), Douglas Mitchel (DFG) and Sarah Green (DFG) with supervision and analysis by California Department of Fish and Game (DFG). The survey began at the confluence with Coleman and extended up Vasser Creek beyond the end of androumous fish passage. The total length of stream surveyed was 17778 feet, with an additional 173 feet of side channel.

A flow of 0.1 cfs was measured 9/27/02, in Reach 1, 7043'above survey start with a Marsh-McBirney

Model 2000 flowmeter. Because of shallow water depth, the surveyor took 4 readings and averaged the flows.

This section of Vasser Creek has four reaches with three distinct channel types: from the mouth to 10970 feet a F4, 2685 feet a F3, 1006 feet a F4 and 3117 feet a A3. F channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio. F4 channel types have a predominantly gravel substrate. F3 channel types have a predominantly cobble substrate.

A3 channel types are steep (4-10%), narrow, cascading, step-pool streams with a high energy/debris transport associated with depositional soils and a predominantly cobble substrate.

Water temperatures ranged from 56ºF to 70ºF. Air temperatures ranged from 57ºF to 82ºF.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 5% dry units, 60% flatwater units, 19% riffle units, 15% pool units, (Graph 1). Based on total **length** of Level II habitat types there were 5% dry units, 81% flatwater units, 10% riffle units, 5% pool units, (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were 5% Dry units, 13% Run units, 19% Glide units, 29% Step Run units, 12% Low Gradient Riffle units, 10% Mid-Channel Pool units, 2% Lateral Scour Pool - Boulder Formed units, 2% High Gradient Riffle units, 5% Cascade units, 2% Step Pool units, (Graph 3). Based on percent total **length**, 5% Dry units, 14% Run units, 9% Glide units, 58% Step Run units, 6% Low Gradient Riffle units, 3% Mid-Channel Pool units, 1% Lateral Scour Pool - Boulder Formed units, 1% High Gradient Riffle units, 3% Cascade units, 1% Step Pool units.

A total of 34 pools were identified (Table 3). Main Channel pools were the most frequently encountered, at 82%, and comprised 82% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Two of the 32 pools (6%) had a residual depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 27 pool tail-outs measured, eight had a value of 1 (29.6%); sixteen had a value of 2 (59.3%); three had a value of 3 (11.1%); (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 2, flatwater habitat types had a mean shelter rating of 4, and pool habitats had a mean shelter rating of 12 (Table 1). Of the pool types, the Main Channel pools had a mean shelter rating of 11, Scour pools had a mean shelter rating of 20, Backwater pools had a mean shelter rating of 5, (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in Vasser Creek. Graph 7 describes the pool cover in Vasser Creek. Boulders are the dominant pool cover type followed by bedrock ledges.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was observed in 30% of pool tail-outs,and boulders observed in 33% of pool tail-outs.

The mean percent canopy density for the surveyed length of Vasser Creek was 68%. The mean percentages of hardwood and coniferous trees were 49% and 51%, respectively. Thirty two percent of the canopy was open. Graph 9 describes the mean percent canopy in Vasser Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 12%. The mean percent left bank vegetated was 14%. The dominant elements composing the structure of the stream banks consisted of 14% bedrock, 41% boulder, 27% cobble/gravel, 16% sand/silt/clay, (Graph 10). (8% grass, 24% brush, 24% deciduous trees, 23% coniferous trees, - Use these numbers to choose 2 dominant types.) Brush was the dominant vegetation type observed in 24% of the units surveyed. Additionally, 24% of the units surveyed had hardwood trees as the dominant vegetation type, and 23% had coniferous trees as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

In 1956-57 and 1961-63 DFG rescued juvenile steelhead from pools in portions of Vassar Creek that were drying up during the summer months. Steelhead fingerlings transferred to the Russian River averaged of 3064 fish per year over the 5 years rescues were conducted.

Summary of transfers, rescues, and hatchery stocking

YEAR	SPECIES	TYPE	LOCATION	SOURCE	NUMBER	SIZE
1956	SH	TRNSFR	RUSSIAN RIVER	VASSER CREEK	400	FING
1957	SH	TRNSFR	RUSSIAN RIVER	VASSER CREEK	9227	FING
1961	SH	TRNSFR	RUSSIAN RIVER	VASSER CREEK	1594	FING
1962	SH	TRNSFR	RUSSIAN RIVER	VASSER CREEK	2400	FING
1963	SH	TRNSFR	RUSSIAN RIVER	VASSER CREEK	1700	FING

SH = Steelhead Trout *(Oncorhynchus mykiss)*

The 1991 survey, which conducted biological inventories for two years, found steelhead ranged 0.2 to 1.0 fish per square meter in 1990 and 1991. Steelhead had a relative abundance of 47% in 1990 and 45% in 1991. California Roach collected ranged 0.1 to 0.9 fish per meter squared in 1990 and 1991. Total fish

estimates for steelhead and California Roach in 1990 were not significantly different from 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
1956-57, 1961-63, 1990-91, 2002	STEELHEAD TROUT *(Oncorhynchus mykiss)*	DFG, MCRCD	N
1990-91	CALIFORNIA ROACH *(Hesperoleucus symmetricus)*	MCRCD	N
2002	SACRAMENTO PIKE MINNOW OR SQUAWFISH (*Ptychocheilus grandis)*	DFG	N

On 11/5/02 a biological inventory was conducted at 2 sites on Vasser Creek to document fish species presence at the site sampled. The site was seine netted. Fish from the sites were counted by species, and returned to the stream. The air temperature ranged from 51ºF to 53ºF and the water temperature ranged from 55ºF to 52ºF. The observers were Cassie Simons and Amy Livingston (Americorps).

The inventory of the lower watershed began at 1400 hours at habitat Reach 1 and ended upstream at 1515 hours. The distance sampled was approximately 1500 feet. Habitat types sampled were glides and mid-channel pools. Salmonids were observed. Newts and frogs were also observed. The inventory of the middle watershed began at 1130 hours in Reach 1 and ended upstream at 1305 hours. The distance sampled was approximately 2500 feet. Habitat types sampled were glides and mid-channel pools. Salmonids were observed. Crayfish were also observed. The following table displays the total fish yielded from these sites.

Species Observed	Numbers recorded at Site 1
STEELHEAD 0+	75
STEELHEAD 1+	2
STEELHEAD 2+	1
SACRAMENTO PIKE MINNOW	1

Species Observed	Numbers recorded at Site 2
STEELHEAD 0+	32
STEELHEAD 1+	2
STEELHEAD 2+	1

DISCUSSION FOR VASSER CREEK

Vasser Creek has three channel types: F4, F3, and A3. 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, 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. 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. Any work considered will require careful design, placement, and construction that must include protection for any unstable banks.

A3 channel types are good for bank-placed boulders and fair for low-stage weirs, opposing wing-deflectors and log cover.

The water temperatures recorded on the survey days 8/21/2002 - 9/11/2002 ranged from 56ºF to 70ºF. Air temperatures ranged from 57ºF to 82ºF. The warmest water temperatures were recorded in Reach 1. Water temperatures above 65°F, if sustained, are above the threshold stress level for salmonids.

Flatwater habitat types comprised 81% of the total length of this survey, riffles 10%, and pools 5%. The pools are relatively shallow 2 of the 32 (6%) 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.

Twenty four of the 27 pool tail-outs measured had embeddedness ratings of 1 or 2. Three of the pool tail-outs had embeddedness ratings of 3 or 4. None 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 Vasser Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Seventeen of the 30 pool tail-outs had silt, sand, large cobble, boulders or bedrock as the dominant substrate. This is generally considered unsuitable for spawning salmonids.

The mean shelter rating for pools was 12 . The shelter rating in the flatwater habitats was 4. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by Boulders in Vasser Creek. Boulders are the dominant cover type in pools followed by bedrock ledges . 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 68%. Reach 1 had a canopy density of 52.9%, Reach 2 had a canopy density of 80.4%, Reach 3 had a canopy density of 81.5%, Reach 4 had a canopy density of 88.8%, . In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was low at 12% and 14%, 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

Vasser 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) There are sections where the stream is being impacted from cattle trampling the riparian zone.

Alternatives should be explored with the grazier and developed if possible.

2) Increase the canopy on Vasser 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.

3) 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.

4) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

5) 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.

6) 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.

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'	Road 110’ into unit.
208'	Cattle presence, 3’. into unit there is a gully/cow path. Roach observed in abundance from 208' to 8168'. Frogs observed periodically from 208' to 17362'.
251'	Left bank (LB) EROSION, 300’ x 15’ dumping exposed sediment into the creek, exposed madrone roots.
716'	Steelhead 0+, 1+, and 2+ observed from 716' to 15970'.
742'	Clumps of barbed wire in the creek. Loose bank material.
795'	There is significant algae bloom in the unit.
951'	77’ into unit there is a barb wire fence.
1053'	Crayfish observed periodically from 1053' to 15970'.
1227'	64’ weir (natural), less than 1’ drop. Photos taken. EROSION LB 150’H x 125’. EROSION RB 150’H x 30’ contributing fine sediment. Evergreen roots exposed.
1895'	Fish are using this glide as a pool. Photo taken.
1951'	40’ high EROSION on LB contributing fines and large cobble through the unit.
2057'	Large woody debris (LWD) not blocking salmon passage.
2083'	Minor EROSION both banks.
2157'	Much algae. Minor erosion both banks. Exposed roots.

2209'	EROSION LB 125’L x 60’H x 50’D. In units 23 and 24, RB EROSION 150’L x 100’H. All size substrate falling into creek. Little to no vegetation.
2396'	LB spring bottom of unit.
2435'	Algae is abundant.
2475'	50’ dead Live Oak has fallen on LB and crown is hanging in this unit.
2506'	RB gully 15’ into unit, has a steep grade.
2599'	At 56’ into unit there is a dry tributary (trib) on the left bank with a steep grade. On the RB there is a dry gully at the top of the unit.
2785'	Small woody debris (SWD) in the unit. One piece of LWD at the top of the unit. Cattle presence for the last 10 units.
2931'	Shelter is significant for the actual pool in this large unit.
2973'	RB steep dry gully 70’ into the unit. Cattle presence. Huge alder shading 100% of upper 50’ of unit.
3365'	RB spring at bottom of unit is flowing, (not gushing).
3405'	RB gully at 380’ into unit. At 500-600’ into the unit RB erosion is 10’ high, around the bend in the creek.
4056'	5” sucker fish observed, lots of algae.
4132'	LB erosion 8’ high. A small live oak is about to fall into creek due to scoured out bank and exposed roots.
4247'	Cattle presence for last ten units.
4325'	Most of this unit is covered by a live oak falling off the RB, roots exposed, about to fall into the unit. Newts observed from 4325' to 16694'. Salamanders and juvenile salamanders observed from 4325' to 17362'.
4584'	Pool with a lot of silt and gravel. LWD almost in the creek.
4608'	Serious EROSION begins at 250’ and continues for 150’, 150’L x 50’H x 40’D. The erosion is dumping all sized sediment into the creek. At 400’ there is a spring on the LB.
5127'	Algae is abundant.
5944'	RB dry trib at bottom of the unit.
5978'	Road on LB, 50' above creek, goes on for many units and drops to flood plane level. EROSION below road in some parts dumping sediment into the creek.
6054'	Road along the left bank.
6193'	Road continues on the LB.
6285'	Wet road
6334'	One piece of LWD on LB. 120’ into unit, wet road.
6922'	Wet road through creek, starting 175' into unit.
7122'	Significant algae bloom, some aquatic vegetation is permanent, but algae makes up some of the shelter in this unit.
7136'	LB trib wet.
7159'	In units 060.01-060.02 (side channel), 12 madrones on gravel bar that are 2-3 years old.
7171'	The road is no longer beside the creek. This is not a true side channel, there are no tall trees.
7187'	Active gully/bank EROSION, in unit 062:40’D x 100’L x 300’W, high flow influenced, not debris influence, roots exposed, lots of marco-invertebrates, this erosion corresponds with erosion on the LB in unit 065. In units 61 and 62 the RB is undercut.

7225'	DEBRIS ACCUMULATION, RB unit 063, 4’D x 6’L x 35’W, retaining 1’ gravel, fish observed upstream, erosion and downcutting, (photos 13 & 14), consists of 2-3 pieces of LWD. The erosion is vertical 125’L and 50’H, active, live trees falling into creek.
7254'	RB EROSION on corner, unit 30’ wide, water runs on left side of channel.
7294'	Active Gully/ Bank EROSION, in unit 065, vertical and undercut, 8’L x 100’W, high flow influenced, not debris influence, this erosion corresponds to unit 062 RB, photo taken. Stream meandering into LB corner, mats of roots exposed on LB.
7309'	Water runs on right side of channel. LB tribs and wet springs adding to main channel.
7492'	Road on LB is 50' from creek.
7550'	46' into unit there is a dry trib on the RB. The stream is almost dry.
7754'	Wet road runs through creek.
7938'	Wet road runs through creek.
8682'	There is a dry gully at the beginning of the unit on the LB, and another dry gully 36’ into the unit.
8784'	Alder 2' diameter in the middle of the channel.
8825'	Possible dry trib on RB. There is erosion consisting of large cobble and boulders.
8968'	Active gully/ Bank EROSION, unit 090: 70’D x 50’L x 75’W, high flow influenced, not debris influenced.
9278'	Wet road crosses creek.
9556'	At the beginning of the unit there is a small, dry, gully.
9627'	Road runs along the creek for 20’. Units 97-101: LB gully is steep and dry causing LB erosion. More importantly, the gully is causing erosion/gully effect down the gravel road which runs along creek on LB. Road will soon be impassable by trucks/cars.
10095'	Road above the creek on both sides.
10162'	Gully/bank EROSION, units 97-101, LB gully, steep and dry, causing LB erosion on bank. The gully is causing erosion/gully effect down the gravel road which runs along creek on LB. Road will soon be impassable by vehicles, good place for a culvert.
10198'	On the LB there is a road that is 30ft from the creek. No vegetation between road and creek.
10277'	One piece of LWD at the top of the unit.
10440'	DEBRIS ACCUMULATION, unit 106: 7’D x 12’L x 25’W, retaining 1’ gravel, fish observed upstream, no erosion or downcutting, four pieces of LWD. Log Accumulation is concentrated on RB.
10525'	0.8' plunge at rock weirs. LWD at top of unit. LB erosion on left side of channel at the top of the unit.
10890'	Possible redds.
10970'	Bedrock is eroding into boulders. A lot of silt and fine gravel in pool.
10997'	Erosion on RB, 75’L x 40’H.
11155'	Douglas Fir fallen over creek. LB spring
11179'	LB steep, dry gully at bottom of the unit. LWD at 100' in creek.
11306'	Cattle presence throughout last ten units. This is the end of cattle in the creek.
11353'	RB erosion 40'W x 35'H, contributing silt, gravel, and shale. Minor DEBRIS ACCUMULATION, does not affect passage, does not block the channel, 3' diameter, LWD crosses creek above bankfull.
11428'	Horsetail and pampas grasses in the channel. RB erosion, roots exposed.
11574'	RB steep, dry trib at 22' into the unit. LB steep dry gully at 120' into the unit.

11747' Unit is channelized by steep banks.
11918' Lots of Douglas fir, bay, madrone, live oak, and maple, some nutmeg is the dominant vegetation.
12143' RB bank wet trib at 75’ into the unit. Trib is too steep, no pooling, and not big enough to support salmonids but water temperature is 56ºF. RB erosion: 100’D x 75’H x 100’W. RB spring. Live oaks cross creek, 2’ diameter.
12166' 30' into unit LOG ACCUMULATION. Large boulders in creek.
12581' RB spring.
12600' Pampas grass in creek.
12688' RB erosion 50' H. Black plastic pipe in creek.
13159' Alder in middle of channel.
13182' Large boulders in creek, ten feet high.
13302' EROSION RB: 100'L x 60'H x 40'D, dumping all size substrate into the unit.
13404' 3'-4' plunges throughout unit.
13628' At bottom of unit dry trib/gully on LB.
13655' Active Gully/ Bank EROSION, units 146 and 147: 2’D x 25’L x 100’W, not high flow influenced or debris influence, the erosion is about 40’ from the creek. Debris influenced only in a flood.
13906' RB EROSION, steep, contributing fines into the creek.
13940' Active gully/ Bank EROSION, units 150 and 151: 50’D x 100’L x 75’W, high flow influenced, debris influenced. About 60’ up there is a valley and then more erosion. Over land water flow is influencing the erosion. Many oaks are in peril of falling into creek.
14064' Possible redds in units 150-151.
14193' Active gully/bank EROSION, unit 156: 20’D x 70’L x 50’W, high flow influenced, debris influenced, loose debris entering creek.
14373' Creek steps up 2’ at the end of the step run.
14587' Confluence with Jakes Creek.
14661' Algae abundant in this unit.
14912' Two 2’drops found at top of unit. LB erosion at top of unit: 50’L x 30’H x 10’D.
15059' Erosion on RB approximately 70’H x 30’W.
16074' Steep walls of bank provide much cover. There is a steep wet trib entering at the RB 100' into the unit.
16274' Lots of macroinvertebrates.
16408' LB erosion: 15’L x 50’H x 20’D. All size substrate entering the creek, many fines.
16571' LWD creates cascade cavern.
16687' This unit is 1-2’ higher than the two units around it.
16707' Right now the pool beneath this ten foot jump is 3', but during rains it will probably be 5' deep.
16719' This unit has two jumps over 3' high. Minor LB erosion at the top of the unit dumping some fines into the top pool.
16786' During the rainy season it will be a 4' pool below with a 9' jump.
16806' 4' jump in unit.
16832' LB EROSION, units 199-201: 75'L x 40'H x 20'D, actively dumping fines to boulders into the creek. This unit has 6' vertical jumps.
16868' Dead live oak blocks the bottom of unit 201. It fell because of the erosion on the LB.

16951' Lots of macroinvertebrates. 3' jump into the next unit.
17003' LB spring in the middle of this unit.
17031' Algae is abundant.
17344' 4' jump at top of unit into the next unit.
17362' Many 2'-4' jumps throughout the unit.
17763' END OF SURVEY. No fish since 15059' (unit 172), over 2000' downstream. We have seen lots of good rearing habitat. The end of the survey is steep A channel type, very steep and bouldery with shale for substrate. Many amphibians and marcoinvertebrates were observed. Deciduous trees dominate creek more so that others creeks in the Pieta watershed.

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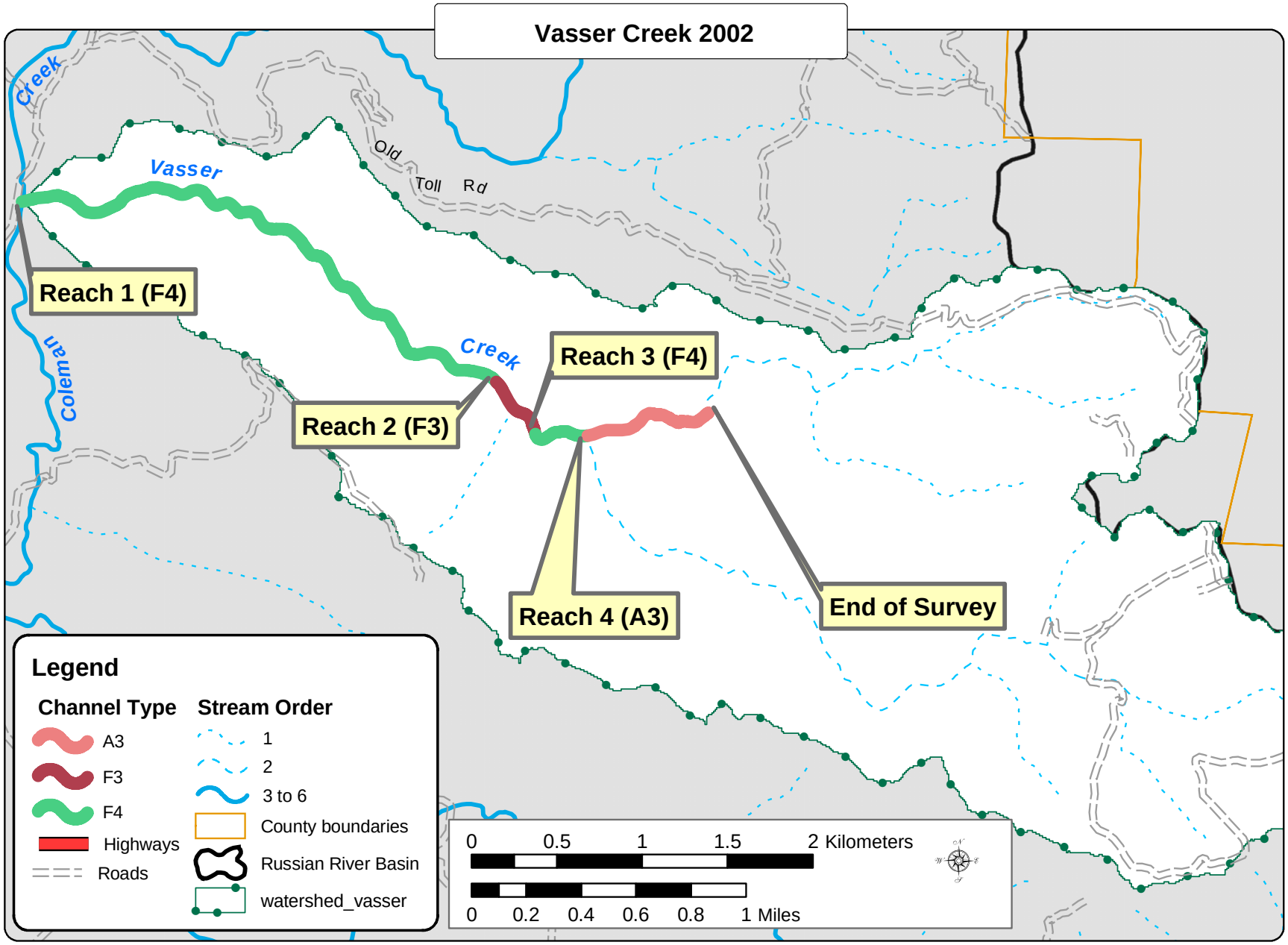
Sommarstrom, Sari. 1985. Pieta Creek – Geothermal Watershed Assessment. Mendocino County Resource Conservation District, Ukiah. 107+p.



Note: GIS layer shows Coleman flowing into Vasser, but DFG crews surveyed as Vasser a tributary to Coleman

L:\mondo3\data\stream-maps\vasser.mxd

Prepared by: Ann-Marie Osterback, May 14, 2003

APPENDIX B: TABLES

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

Stream Name: Vasser Creek

LLID: 1230449389215

Drainage: Russian River - Upper

Survey Dates: 8/21/2002 to 9/11/2002

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS02 Latitude: 38:55:17.0N Longitude: 123:02:42.0W

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
11	0	DRY	5.0	82	901	5.0									
133	34	FLATWATER	60.5	109	14452	80.5	8.9	0.5	1.1	352	46760	190	25293		4
34	33	POOL	15.5	24	827	4.6	8.6	1.1	2.1	201	6823	245	7812	214	12
42	15	RIFFLE	19.1	42	1770.9	9.9	4.8	0.2	0.5	89	3739	23	966		3

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
220	82	17950.9	57322	34071

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Vasser Creek

LLID: 1230449389215

Drainage: Russian River - Upper

Survey Dates: 8/21/2002 to 9/11/2002

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS02 Latitude: 38:55:17.0N Longitude: 123:02:42.0W

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 (%)
26	9	LGR	11.8	43	1115	6.2	5	0.2	0.6	123	3187	30	787		3	55
5	4	HGR	2.3	31	153	0.9	6	0.3	0.8	57	283	18	90		3	69
11	2	CAS	5.0	46	503	2.8	2	0.2	0.5	3	33	0	5		3	91
41	12	GLD	18.6	39	1611	9.0	9	0.7	1.7	265	10878	168	6889		5	62
29	9	RUN	13.2	86	2487	13.9	9	0.3	1	245	7107	75	2188		5	62
63	13	SRN	28.6	164	10354	57.7	9	0.5	3.1	505	31810	290	18272		3	71
23	22	MCP	10.5	21	477	2.7	8	1.1	3.1	175	4034	222	4634	196	12	77
5	5	STP	2.3	40	201	1.1	5	1.2	2.6	191	953	264	1319	234	5	99
5	5	LSBo	2.3	27	135	0.8	15	0.9	2.7	343	1713	350	1752	296	20	80
1	1	BPB	0.5	14	14	0.1	7	0.6	1.8	98	98	78	78	59	5	56
11	0	DRY	5.0	82	901	5.0										51

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
220	82	17950.9	60097	36014

Table 3 - Summary of Pool Types

Stream Name: Vasser Creek

LLID: 1230449389215 Drainage: Russian River - Upper

Survey Dates: 8/21/2002 to 9/11/2002

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS02 Latitude: 38:55:17.0N Longitude: 123:02:42.0W

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
28	27	MAIN	82	24	678	82	7.5	1.1	178	4990	203	5274	11
5	5	SCOUR	15	27	135	16	14.8	0.9	343	1713	296	1479	20
1	1	BACKWATER	3	14	14	2	7.0	0.6	98	98	59	59	5

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
34	33	827	6801	6811

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Vasser Creek LLID: 1230449389215 Drainage: Russian River - Upper

Survey Dates: 8/21/2002 to 9/11/2002 Dry Units: 11

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS02 Latitude: 38:55:17.0N Longitude: 123:02:42.0W

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
26	4	LGR	0	0	0	0	25	0	0	25	0
5	4	HGR	0	0	0	0	5	0	0	45	0
11	2	CAS	0	0	0	0	0	0	0	50	0
42	10	TOTAL RIFFLE	0	0	0	0	12	0	0	38	0
41	8	GLD	0	0	0	0	0	0	0	69	6
29	4	RUN	0	16	0	4	3	0	0	28	0
63	12	SRN	0	0	0	0	0	0	0	41	0
133	24	TOTAL FLAT	0	3	0	1	0	0	0	48	2
23	21	MCP	9	3	1	5	0	0	4	58	21
5	5	STP	15	4	0	7	0	0	0	50	24
5	5	LSBo	28	2	0	0	0	0	0	71	0
1	1	BPB	0	0	0	0	0	10	0	90	0
34	32	TOTAL POOL	12	3	1	5	0	0	3	60	17
220	66	TOTAL	6	2	0	3	2	0	1	52	9

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Vasser Creek LLID: 1230449389215 Drainage: Russian River - Upper

Survey Dates: 8/21/2002 to 9/11/2002 Dry Units: 11

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS02 Latitude: 38:55:17.0N Longitude: 123:02:42.0W

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
26	9	LGR	0	0	78	11	11	0	0
5	4	HGR	0	0	0	0	0	100	0
11	2	CAS	0	0	0	0	0	50	50
41	12	GLD	8	0	58	17	8	8	0
29	9	RUN	0	0	67	11	11	0	11
63	14	SRN	0	0	36	14	0	50	0
23	12	MCP	17	0	17	0	8	33	25
5	2	STP	0	0	0	0	0	50	50
5	4	LSBo	25	25	50	0	0	0	0
1	1	BPB	0	0	0	0	0	100	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Vasser Creek LLID: 1230449389215 Drainage: Russian River - Upper

Survey Dates: 8/21/2002 to 9/11/2002

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS02 Latitude: 38:55:17.0N Longitude: 123:02:42.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
68	51	49	2	12	14

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: Vasser Creek LLID: 1230449389215 Drainage: Russian River - Upper

Survey Dates: 8/21/2002 to 9/11/2002

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS02 Latitude: 38:55:17.0N Longitude: 123:02:42.0W

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	13	7	14.3
Boulder	25	32	40.7
Cobble / Gravel	19	19	27.1
Sand / Silt / Clay	12	11	16.4

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	3	8	7.9
Brush	14	20	24.3
Hardwood Trees	17	17	24.3
Coniferous Trees	17	15	22.9
No Vegetation	18	9	19.3

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Vasser Creek LLID: 1230449389215 Drainage: Russian River - Upper

Survey Dates: 8/21/2002 to 9/11/2002

Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS02 Latitude: 38:55:17.0N Longitude: 123:02:42.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	12
SMALL WOODY DEBRIS (%)	0	3	3
LARGE WOODY DEBRIS (%)	0	0	1
ROOT MASS (%)	0	1	5
TERRESTRIAL VEGETATION (%)	12	0	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	3
BOULDERS (%)	38	48	60
BEDROCK LEDGES (%)	0	2	17

Appendix C - Fish Habitat Inventory Data Summary

Stream Name: Vasser Creek LLID: 1230449389215 Drainage: Russian River -
Survey Dates: 8/21/2002 to 9/11/2002 Survey Length (ft.): 17950. Main Channel (ft.): 17777. Side Channel (ft.): 173
Confluence Location: Quad: HOPLAND Legal Description: T12NR11WS02 Latitude: 38:55:17.0N Longitude: 123:02:42.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4
Reach Length (ft.): 12014
Riffle/Flatwater Mean Width (ft.): 8.6
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 58 - 70 Air (F): 57 - 79
Dry Channel (ft.): 841

Canopy Density (%): 53.0
Coniferous Component (%): 53.3
Hardwood Component (%): 46.7
Dominant Bank Vegetation: Brush
Vegetative Cover (%): 11.1
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Boulder
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 3.1
Pool Frequency (%): 10.3
Residual Pool Depth (%):
< 2 Feet Deep: 25.0
2 to 2.9 Feet Deep: 66.7
3 to 3.9 Feet Deep: 8.3
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 2.21
Mean Pool Shelter Rating: 15

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 66.7 Sm Cobble: 8.3 Lg Cobble: 8.3 Boulder: 8.3 Bedrock: 8.3
Embeddedness Values (%): 1. 25.0 2. 58.3 3. 8.3 4. 0.0 5. 0.0

STREAM REACH: 2

Channel Type: F3
Reach Length (ft.): 1614
Riffle/Flatwater Mean Width (ft.): 11.7
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 56 - 62 Air (F): 66 - 82
Dry Channel (ft.): 0

Canopy Density (%): 80.4
Coniferous Component (%): 63.5
Hardwood Component (%): 36.5
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 17.0
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Boulder
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 1.8
Pool Frequency (%): 11.1
Residual Pool Depth (%):
< 2 Feet Deep: 0.0
2 to 2.9 Feet Deep: 100.0
3 to 3.9 Feet Deep: 0.0
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 2.45
Mean Pool Shelter Rating: 20

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 0.0 Sm Cobble: 0.0 Lg Cobble: 50.0 Boulder: 50.0 Bedrock: 0.0
Embeddedness Values (%): 1. 50.0 2. 50.0 3. 0.0 4. 0.0 5. 0.0

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: A3
Reach Length (ft.): 1757
Riffle/Flatwater Mean Width (ft.): 7.3
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 56 - 60 Air (F): 66 - 74
Dry Channel (ft.): 0

Canopy Density (%): 81.5
Coniferous Component (%): 53.5
Hardwood Component (%): 46.5
Dominant Bank Vegetation: Brush
Vegetative Cover (%): 13.0
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 5.6
Pool Frequency (%): 20.0
Residual Pool Depth (%):
< 2 Feet Deep: 20.0
2 to 2.9 Feet Deep: 80.0
3 to 3.9 Feet Deep: 0.0
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 2.12
Mean Pool Shelter Rating: 13

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 20.0 Sm Cobble: 40.0 Lg Cobble: 0.0 Boulder: 40.0 Bedrock: 0.0
Embeddedness Values (%): 1. 20.0 2. 80.0 3. 0.0 4. 0.0 5. 0.0

STREAM REACH: 4

Channel Type: A3
Reach Length (ft.): 2392.9
Riffle/Flatwater Mean Width (ft.): 4.2
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 58 - 60 Air (F): 66 - 82
Dry Channel (ft.): 42

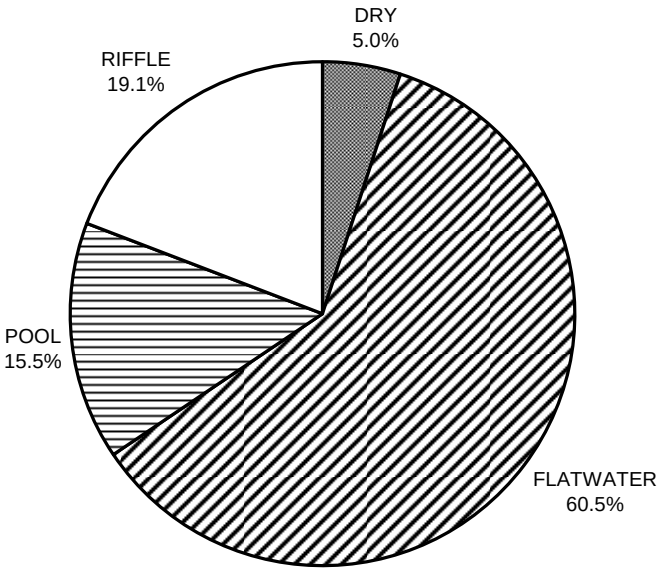
Canopy Density (%): 88.8
Coniferous Component (%): 40.2
Hardwood Component (%): 59.8
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 15.8
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Bedrock
Occurrence of LWD (%): 0.9
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 13.0
Pool Frequency (%): 30.2
Residual Pool Depth (%):
< 2 Feet Deep: 75.0
2 to 2.9 Feet Deep: 16.7
3 to 3.9 Feet Deep: 8.3
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 1.975
Mean Pool Shelter Rating: 8

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 0.0 Sm Cobble: 10.0 Lg Cobble: 10.0 Boulder: 60.0 Bedrock: 20.0
Embeddedness Values (%): 1. 27.3 2. 36.4 3. 18.2 4. 0.0 5. 0.0

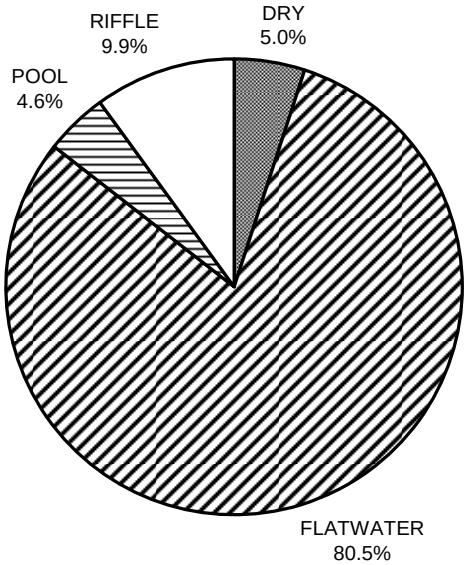
APPENDIX D: GRAPHS

VASSER CREEK 2002
HABITAT TYPES BY PERCENT OCCURRENCE



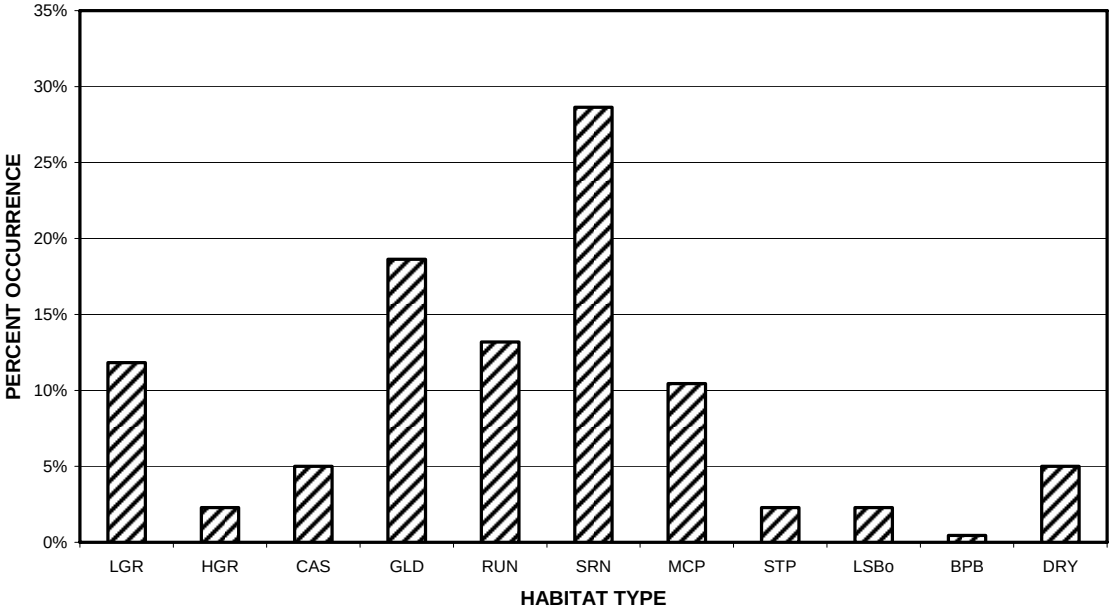
GRAPH 1: Level II habitat types by percent occurrence

VASSER CREEK 2002
HABITAT TYPES BY PERCENT TOTAL LENGTH



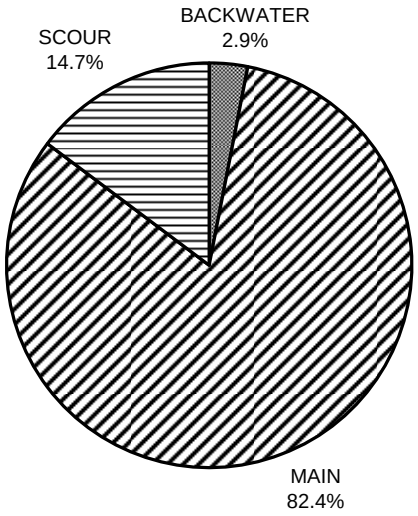
Graph 2: Level II habitat types by percent total length

VASSER CREEK 2002
HABITAT TYPES BY PERCENT OCCURRENCE



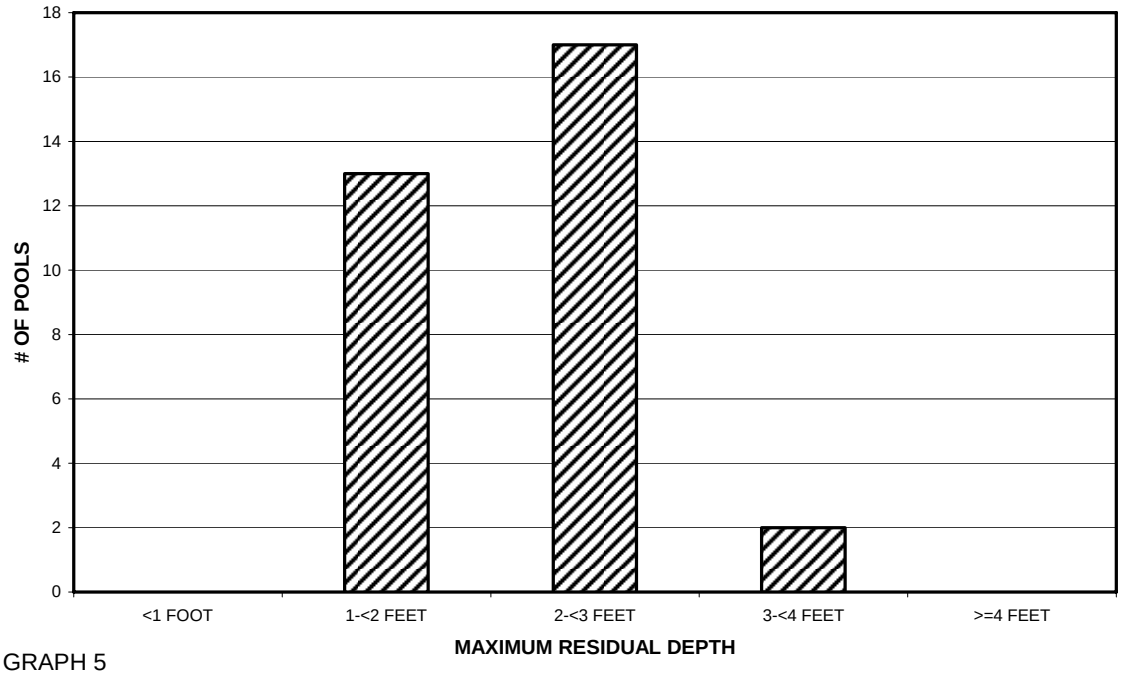
GRAPH 3: Level IV habitat types by percent occurrence

VASSER CREEK 2002
POOL TYPES BY PERCENT OCCURRENCE



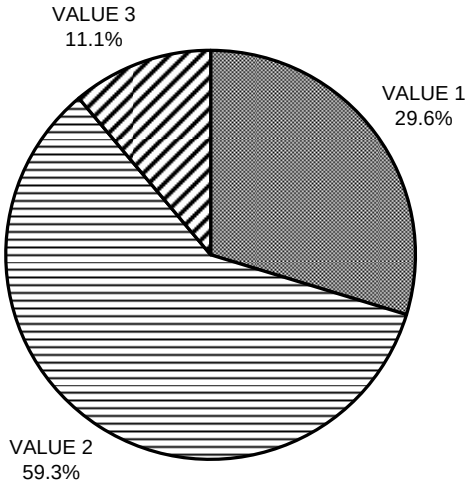
GRAPH 4: Level I pool types by percent occurrence

VASSER CREEK 2002
MAXIMUM DEPTH IN POOLS



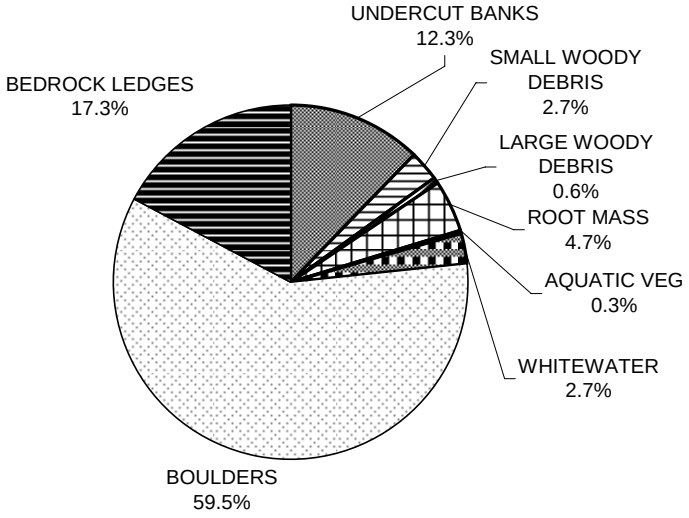
GRAPH 5

VASSER CREEK 2002
PERCENT EMBEDDEDNESS



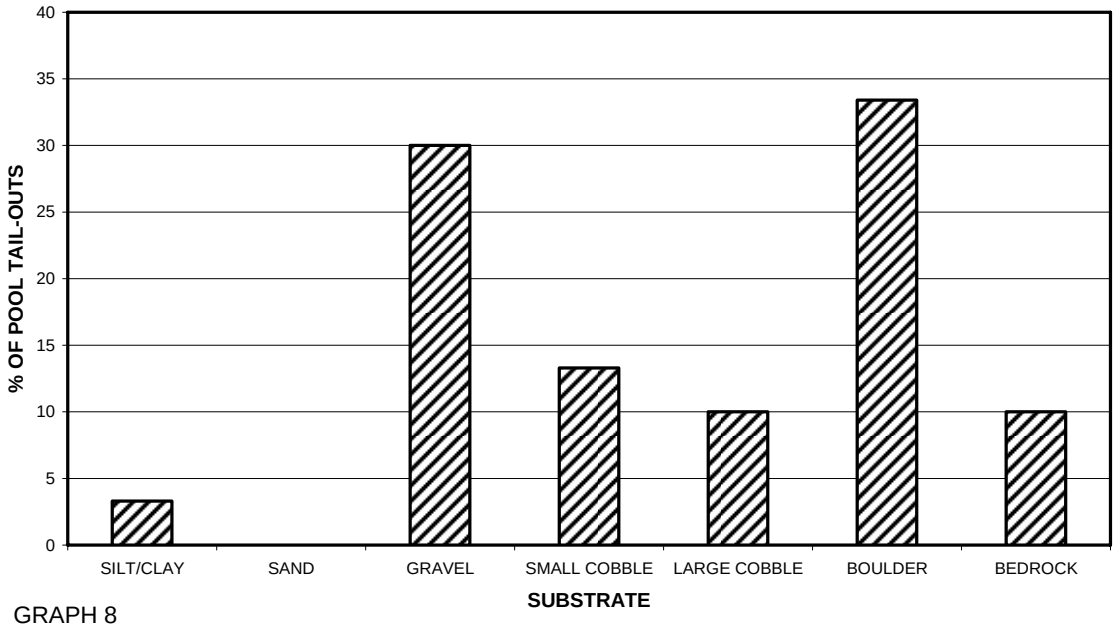
GRAPH 6

VASSER CREEK 2002
MEAN PERCENT COVER TYPES IN POOLS



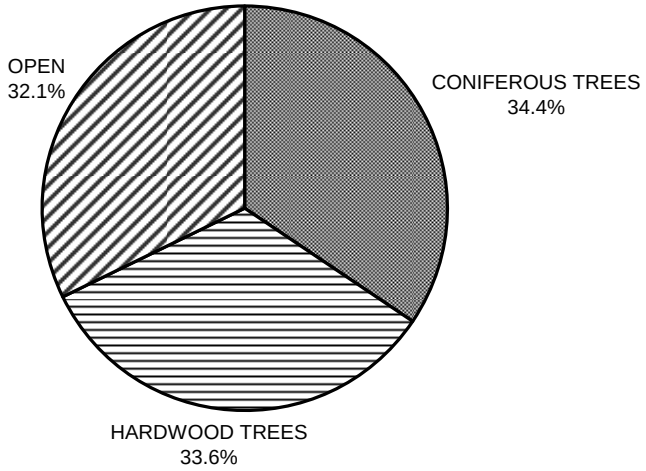
GRAPH 7

VASSER CREEK 2002
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



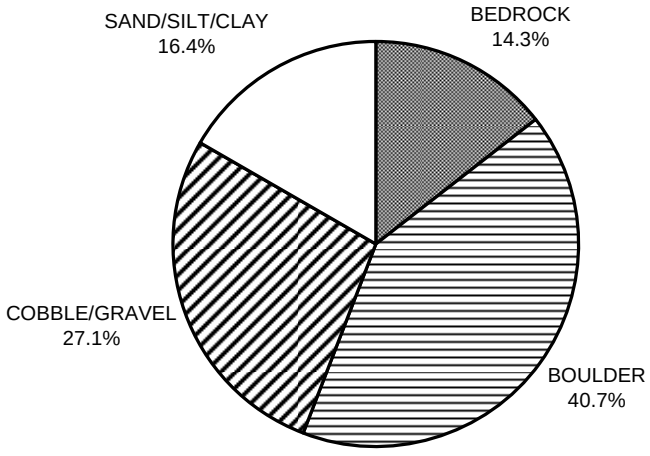
GRAPH 8

VASSER CREEK 2002
MEAN PERCENT CANOPY



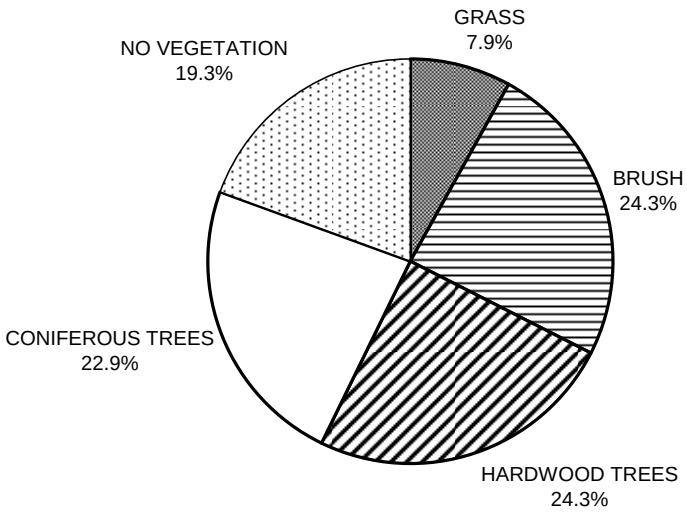
GRAPH 9

VASSER CREEK 2002
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

VASSER CREEK 2002
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11