STREAM INVENTORY REPORT

Larsen Creek

INTRODUCTION

A stream inventory was conducted on 9/14/2005 on Larsen Creek. The survey began at the confluence with San Geronimo Creek and extended upstream 0.5 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Larsen Creek.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for Chinook salmon, coho salmon, and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Larsen Creek is a tributary to San Geronimo Creek (LLID), a tributary to Lagunitas Creek, a tributary to the Pacific Ocean located in Marin County, California (Map 1). Larsen Creek's legal description at the confluence with San Geronimo Creek is T000 R000 S00. Its location is 38°00'55.0" north latitude and (122:40:25.0W) 122°40'25.0" west longitude, LLID number is1226736380154. Larsen Creek is a first order stream and has approximately 1.64 miles of intermittent blue line stream according to the USGS San Geronimo 7.5 minute quadrangle. Larsen Creek drains a watershed of approximately 465.43 acres. Elevations range from about 250 feet at the mouth of the creek to 700 feet in the headwater areas. Oak and mixed hardwood forest dominates the watershed. The watershed is primarily privately owned and is managed for rural private residences, recreation (golf course) and grassland. Vehicle access exists via Francis Drake highway.

METHODS

The habitat inventory conducted in Larsen Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Project/AmeriCorps (WSP) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

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. All pools are fully sampled.

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

1. Flow:

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

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 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:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Larsen Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Larsen Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was

assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Larsen Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Larsen Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

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

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is

twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.18, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Game. This program processes and summarizes the data, and produces the following ten tables:

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

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

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

- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

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

The habitat inventory of 9/14/2005, was conducted by H. Reese (WSP), S. Philipps (WSP). The total length of the stream surveyed was 2,588 feet.

Stream flow was not measured on Larsen Creek.

Larsen Creek is a B6 channel type for 1,051 feet of the stream surveyed (Reach 1), an F3 channel type for 1,537 feet of the stream surveyed (Reach 2). B6 channels are moderately entrenched riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks on moderate gradients with low width /depth ratios and silt/clay dominant substrates. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and cobble dominant substrates.

Water temperatures taken during the survey period ranged from 51 to 54 degrees Fahrenheit. Air temperatures ranged from 53 to 61 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 42% pool units, 36% flatwater units, 17% riffle units, 3% dry units and 3% culvert units (Graph 1). Based on total length of Level II habitat types there were 67% flatwater units, 19% pool units,10% riffle units, 3% culvert units and1% dry units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 22% Mid-Channel Pool units, 19% Glide units, 14% Low Gradient Riffle units and 14% Run units (Graph 3). Based on percent total length there were 37% Glide units, 23% Run units and 11% Mid-Channel Pool units.
A total of 15 pools were identified (Table 3). Main Channel pools were the most frequently encountered, at 67%, and comprised 70% 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. Four of the 15 pools (27%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 15 pool tail-outs measured, 11 had a value of 1 (73.3%); 4 had a value of 2 (26.7%) (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 such as bedrock, log sills, boulders, or other considerations.

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. Shelter rating was not measured for riffle and flatwater habitat types. Pool habitats had a mean shelter rating of 27 (Table 1). Of the pool

types, the Scour pools had a mean shelter rating of 28, Main Channel pools had a mean shelter rating of 26 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small Woody Debris is the dominant cover types in Larsen Creek. Graph 7 describes the pool cover in Larsen Creek. Small Woody Debris is the dominant pool cover type followed by root mass.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was observed in 47% while large cobble was observed in 27% of pool tail-outs.

The mean percent canopy density for the surveyed length of Larsen Creek was 98% The mean percentages of hardwood and coniferous trees were 100% and 0%, respectively (Table 7). Two percent of the canopy was open. Graph 9 describes the mean percent canopy in Larsen Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 68%. The mean percent left bank vegetated was 74% (Table 7) The dominant elements composing the structure of the stream banks consisted of 67% sand/silt/clay 17% bedrock, 13% boulder and 2% cobble/gravel (Graph 10). Hardwood trees were the dominant vegetation type observed in 61% of the units surveyed. Additionally, 28% of the units surveyed had brush as the dominant vegetation type, and 11% had grass as the dominant vegetation (Graph 11).

DISCUSSION

Larsen Creek is a B6 channel type for the first 1,051 feet of stream surveyed and an F3 channel type for the remaining 1,537 feet (Reach 2). The suitability of B6 channel types for fish habitat improvement structures is as follows: Excellent for bank-placed boulders and log cover; good for plunge weirs, single and opposing wing deflectors and channel constrictors; fair for boulder clusters.

The water temperatures recorded on 9/14/2005, ranged from 51 to 54 degrees Fahrenheit. Air temperatures ranged from 53 to 61 degrees Fahrenheit. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 67% of the total length of this survey, riffles 10%, and pools 19%. The pools are relatively shallow, with only 4 of the 15 (27%) pools having a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. 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.

All of the 15 pool tail-outs measured had embeddedness ratings of 1 or 2. None 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 Larsen Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Ten of the 15 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 27. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by Small Woody Debris in Larsen Creek. Small Woody Debris is the dominant cover type in pools followed by root mass and boulders. 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 98%. Reach 1 had a canopy density of 97.9%, Reach 2 had a canopy density of 98.2%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 68% and 74%, 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

Larsen 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) Fish passage should be monitored and improved at the Francis Drake Highway box culvert approximately 51 feet upstream from the confluence with San Geronimo Creek.

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

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

4) 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.

5) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from Small Woody Debris. Adding high quality complexity with woody cover in the pools is desirable.

6) 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.

7) The limited water temperature data available suggest that maximum temperatures are within/above the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

8) Suitable size spawning substrate on Larsen Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

COMMENTS AND LANDMARKS

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

Position (ft.)	Habitat unit #	Comments:
0	1.00	Start of Survey with confluence with San Geronimo
0	1.00	General Comment: Artificial-concrete rip rap lines left bank creates cascade
15	2.00	Bio Sample: (Bank Observation) No fish observed - possibly rescued by SPAWN.
51	4.00	Structures: Bridge with box culvert, 12 wooden baffles to slow water.
256	6.00	Bio Sample: (Bank Observation) approx. 10-15 small fish
286	7.00	Bio Sample: (Bank Observation) Undercut bank with approx. 2-5 fish.

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Position (ft.)	Habitat unit #	Comments:
338	8.00	Structures: footbridge at school
588	13.00	Erosion Site: (Bank) Right bank culvert with associated erosion above pool.
645	15.00	Bio Sample: (Bank Observation) fish present, approx. 5-10 young of the year (YOY) one 2+.
673	16.00	General Comment: 20 feet of undercut bank.
673	16.00	Bio Sample: (Bank Observation) 10-15 fish present, not identified.
673	16.00	General Comment: channel type changes from B6 to F4.
959	18.00	General Comment: Substrate is concrete chunks and bedrock.
959	18.00	Structures: bridge/road crossing
959	18.00	Bio Sample: (Bank Observation) 5-10 fish present, not identified.
1296	23.00	Bio Sample: (Bank Observation) Fish present in undercut bank, lots of overhanging vegetation along bank.
1455	26.00	Bio Sample: (Bank Observation) 20-30 YOY present, not identified.
1477	27.00	Tributaries: Right bank tributary, 20 ft. to culvert - culvert is possible fish barrier, dry above. 150 ft. to another culvert, dry above that for 500 ft. End of tributary survey.
1502	28.00	Bio Sample: (Bank Observation) fish present; approx. 5-10 salmonids.
1767	32.00	General Comment: At 130 ft. changes from 100% canopy to 0% canopy through golf course drive to 326 ft; at least 2 fish and lots of frogs observed.
2408	35.00	General Comment: 9 ft. bedrock cascade; possible fish barrier. Water very murky, no fish observed.
2588	36.00	End of Survey: Water too murky to observe any fish, end of unit becomes swampy.

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.

McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

Rosgen, D.L., 1994. A Classification of Natural Rivers. Catena, Vol 22: 169-199, Elsevier Science, B. V. Amsterdam.

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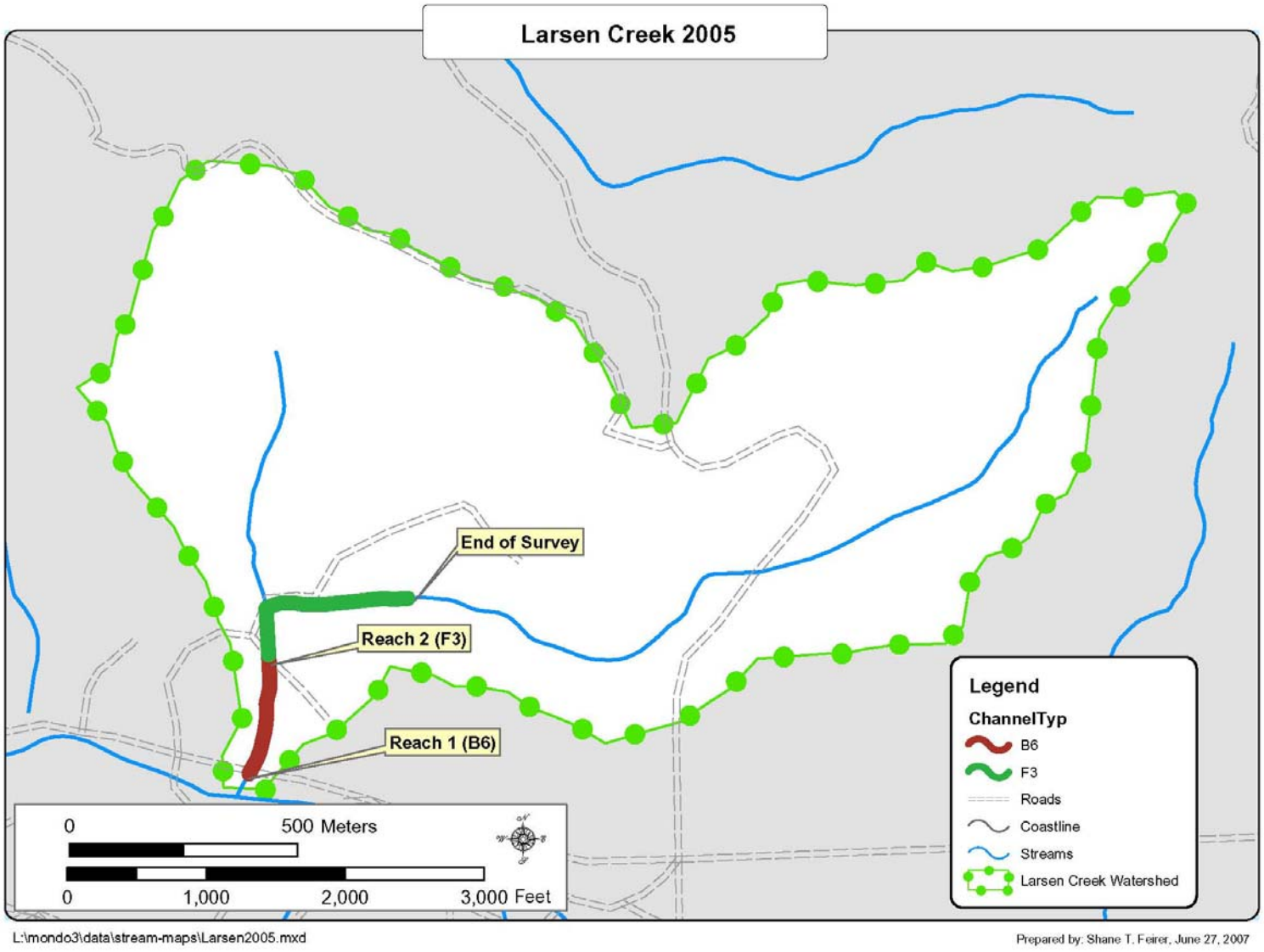
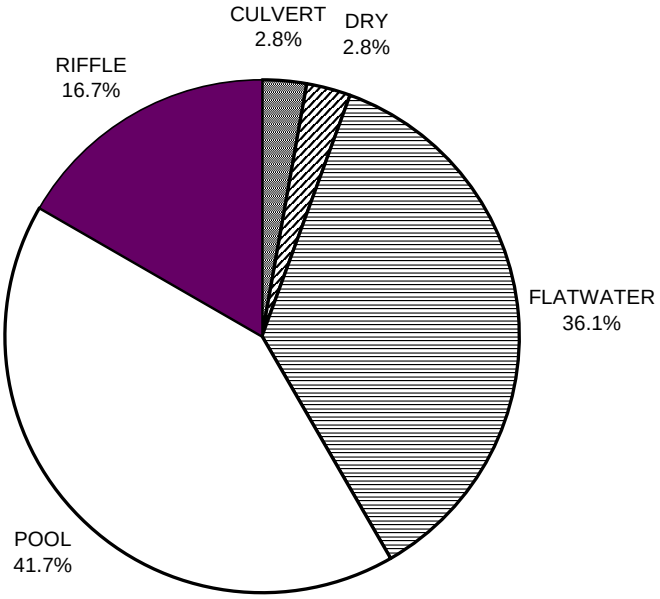
LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE			
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}
CASCADE			
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}
FLATWATER			
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}
MAIN CHANNEL POOLS			
Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}
SCOUR POOLS			
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }
BACKWATER POOLS			
Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}
ADDITIONAL UNIT DESIGNATIONS			
Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	



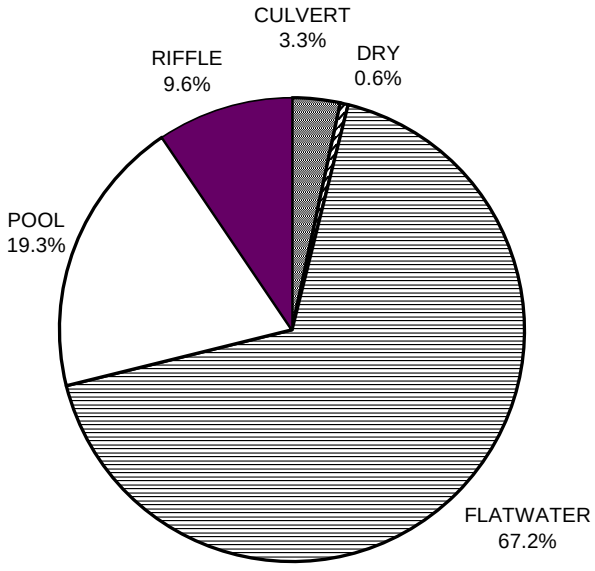
Map1. Larsen Creek Habitat Inventory 9/14/2005

LARSEN CREEK 2005
HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

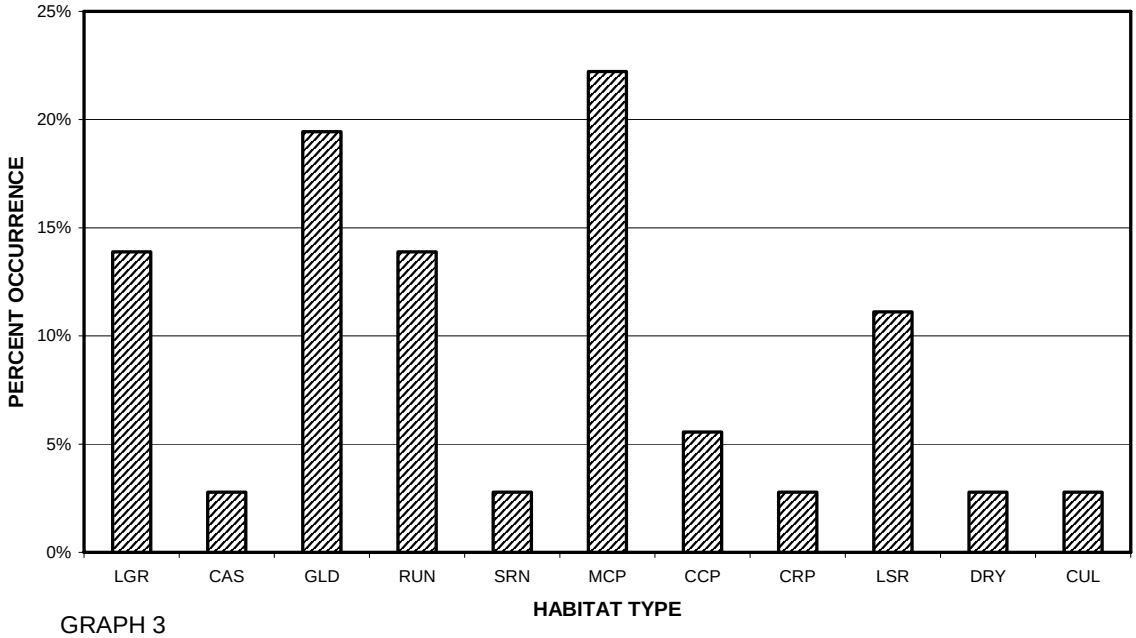
LARSEN CREEK 2005
HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

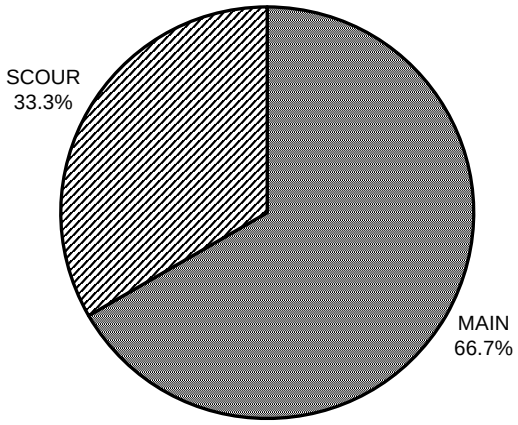
Larsen Creek

LARSEN CREEK 2005
HABITAT TYPES BY PERCENT OCCURRENCE



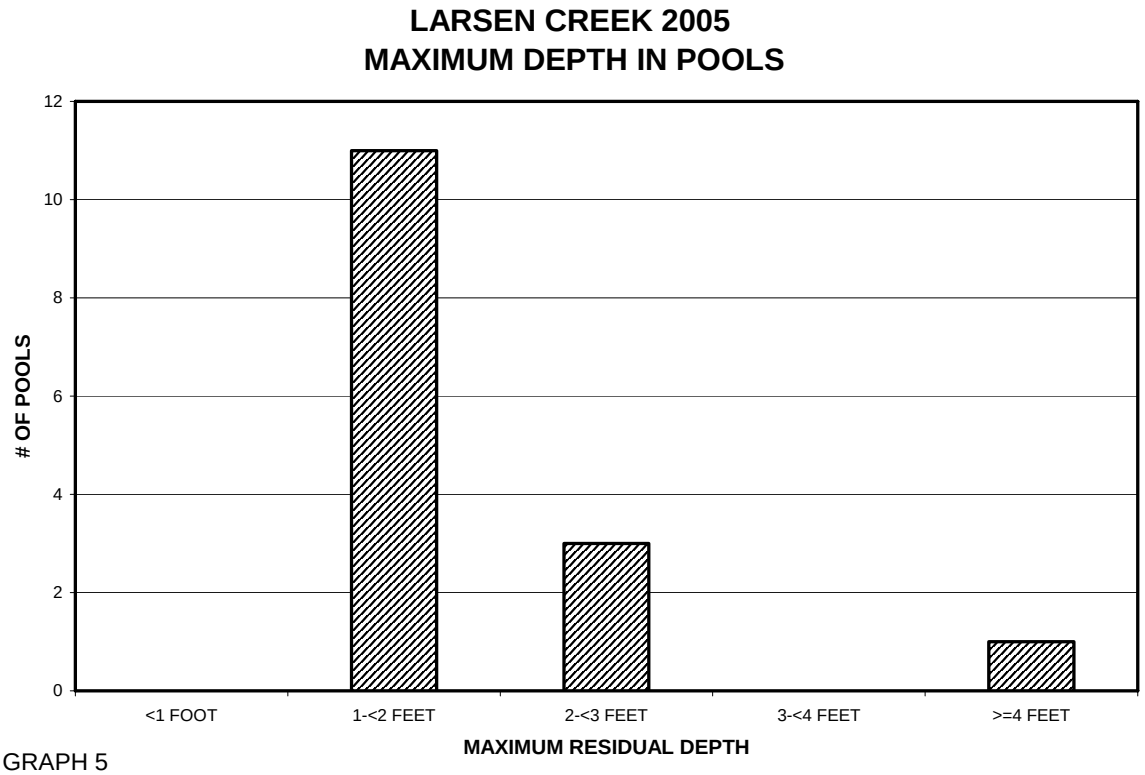
GRAPH 3

LARSEN CREEK 2005
POOL TYPES BY PERCENT OCCURRENCE

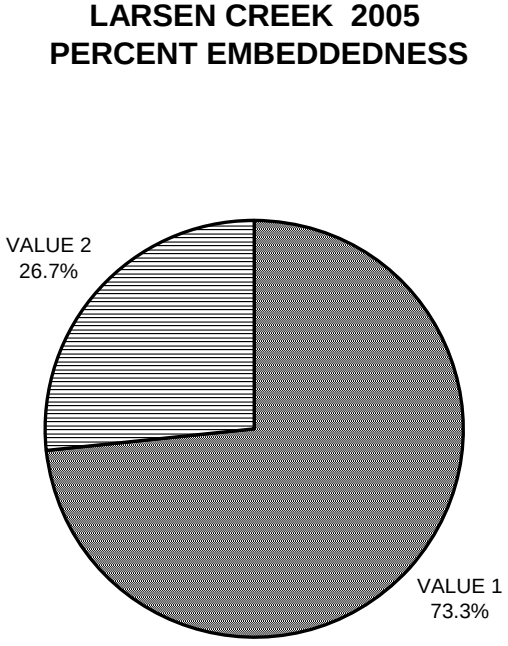


GRAPH 4

Larsen Creek

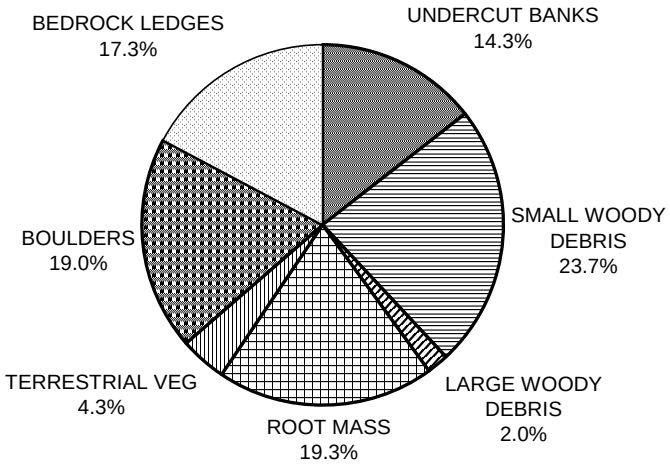


GRAPH 5



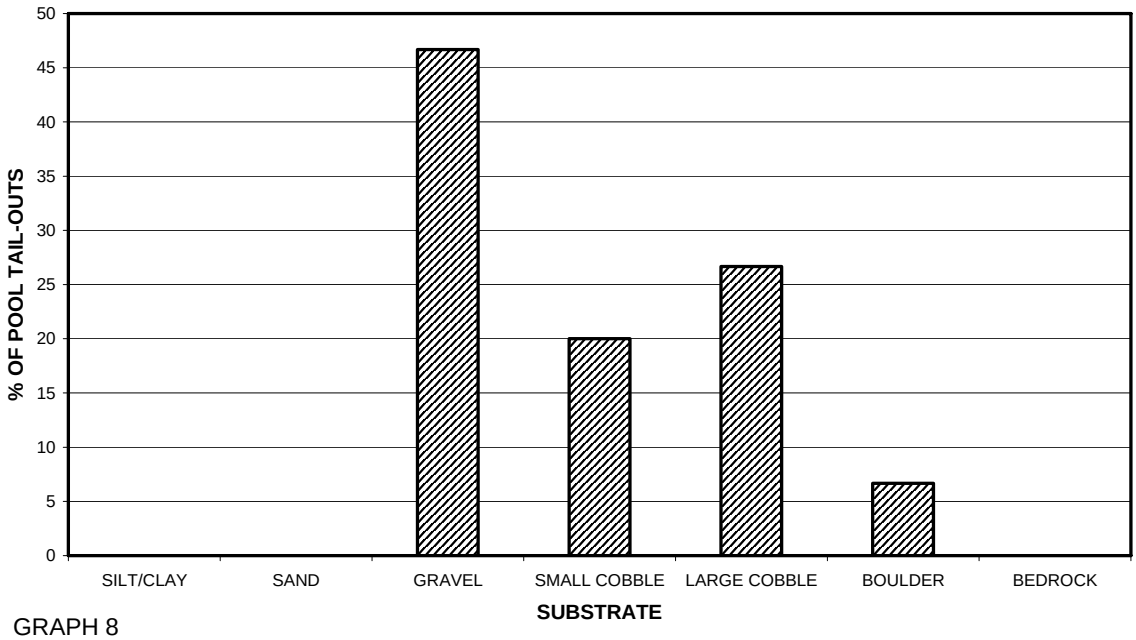
GRAPH 6

LARSEN CREEK 2005
MEAN PERCENT COVER TYPES IN POOLS



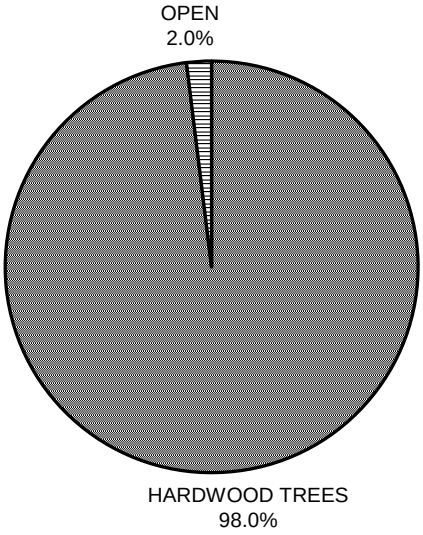
GRAPH 7

LARSEN CREEK 2005
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



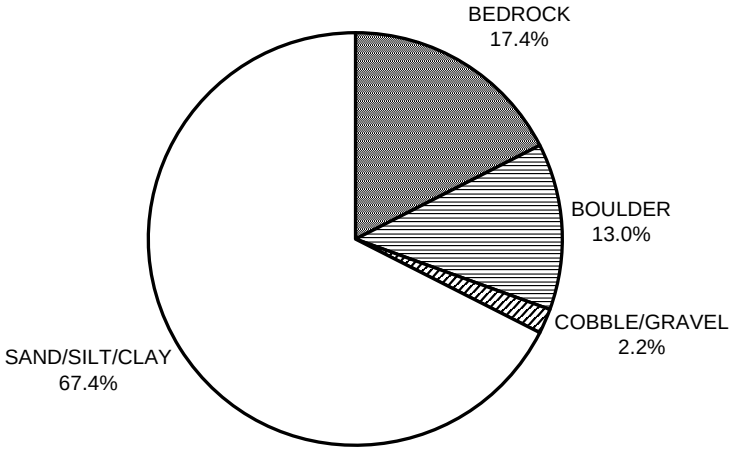
GRAPH 8

LARSEN CREEK 2005
MEAN PERCENT CANOPY



GRAPH 9

LARSEN CREEK 2005
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

LARSEN CREEK 2005
DOMINANT BANK VEGETATION IN SURVEY REACH

GRAPH 11

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

Stream Name: Larsen Creek **LLID:** 1226736380154 **Drainage:** Tomales Bay

Survey Dates: 9/14/2005 to 9/14/2005

Confluence Location: **Quad:** SAN GERONIMO **Legal Description:** T000R000S00 **Latitude:** 38:00:55.0N **Longitude:** 122:40:25.0W

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
1	1	CULVERT	2.8	85	85	3.3	7.0	0.4	0.5	595	595	238	238		
1	1	DRY	2.8	16	16	0.6	7.0			112	112				
13	5	FLATWATER	36.1	134	1739	67.2	6.6	0.5	1.1	653	8483	337	4380		
15	15	POOL	41.7	33	500	19.3	9.3	0.8	1.8	294	4412	300	4503	244	27
6	2	RIFFLE	16.7	41	248	9.6	3.5	0.2	0.4	101	609	11	64		

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
36	24	2588	14211	9185

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Larsen Creek **LLID:** 1226736380154 **Drainage:** Tomales Bay

Survey Dates: 9/14/2005 to 9/14/2005

Confluence Location: Quad: SAN GERONIMO **Legal Description:** T000R000S00 **Latitude:** 38:00:55.0N **Longitude:** 122:40:25.0W

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	Mean Canopy (%)
5	1	LGR	13.9	47	233	9.0	4.0	0.1	0.4	198	992	20	99			95
1	1	CAS	2.8	15	15	0.6	3.0	0.3	0.5	5	5	1	1			100
7	2	GLD	19.4	136	952	36.8	8.0	0.6	1.4	750	5250	421	2944			98
5	2	RUN	13.9	117	587	22.7	6.0	0.4	1.2	581	2907	272	1359			100
1	1	SRN	2.8	200	200	7.7	6.0	0.5	1.1	600	600	300	300			100
8	8	MCP	22.2	37	296	11.4	9.0	0.6	2.0	291	2328	227	1815	179	29	98
2	2	CCP	5.6	26	52	2.0	10.0	1.5	4.3	232	464	432	863	362	13	100
1	1	CRP	2.8	27	27	1.0	12.0	1.0	2.1	324	324	421	421	324	40	100
4	4	LSR	11.1	31	125	4.8	10.0	0.8	2.6	324	1296	351	1403	293	25	98
1	1	DRY	2.8	16	16	0.6	7.0			112	112					100
1	1	CUL	2.8	85	85	3.3	7.0	0.4	0.5	595	595	238	238			

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
36	24	2588	14873	9445

Table 3 - Summary of Pool Types

Stream Name: Larsen Creek **LLID:** 1226736380154 **Drainage:** Tomales Bay

Survey Dates: 9/14/2005 to 9/14/2005

Confluence Location: **Quad:** SAN GERONIMO **Legal Description:** T000R000S00 **Latitude:** 38:00:55.0N **Longitude:** 122:40:25.0W

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
10	10	MAIN	67	35	348	70	9.0	0.8	279	2792	216	2157	26
5	5	SCOUR	33	30	152	30	10.0	0.8	324	1620	300	1498	28

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
15	15	500	4412	3654

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

Stream Name: Larsen Creek **LLID:** 1226736380154 **Drainage:** Tomales Bay

Survey Dates: 9/14/2005 to 9/14/2005

Confluence Location: Quad: SAN GERONIMO **Legal Description:** T000R000S00 **Latitude:** 38:00:55.0N **Longitude:** 122:40:25.0W

Habitat Units	Habitat Type	Habitat Occurrence (%)	< 1 Foot Maximum Residual Depth	< 1 Foot Percent Occurrence	1 < 2 Feet Maximum Residual Depth	1 < 2 Feet Percent Occurrence	2 < 3 Feet Maximum Residual Depth	2 < 3 Feet Percent Occurence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
4	LSR	27	0	0	3	75	1	25	0	0	0	0
8	MCP	53	0	0	7	88	1	13	0	0	0	0
2	CCP	13	0	0	1	50	0	0	0	0	1	50
1	CRP	7	0	0	0	0	1	100	0	0	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Feet Max Resid. Depth	Total 1< 2 Feet % Occurrence	Total 2< 3 Feet Max Resid. Depth	Total 2< 3 Feet % Occurrence	Total 3< 4 Feet Max Resid. Depth	Total 3< 4 Feet % Occurrence	Total >= 4 Feet Max Resid. Depth	Total >= 4 Feet % Occurrence
15	0	0	11	73	3	20	0	0	1	7

Mean Maximum Residual Pool Depth (ft.): 2

Table 5 - Summary of Mean Percent Cover By Habitat Types

Stream Name: Larsen Creek **LLID:** 1226736380154 **Drainage:** Tomales Bay

Survey Dates: 9/14/2005 to 9/14/2005

Confluence Location: **Quad:** SAN GERONIMO **Legal Description:** T000R000S00 **Latitude:** 38:00:55.0N **Longitude:** 122:40:25.0W

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
5	0	LGR									
1	0	CAS									
7	0	GLD									
5	0	RUN									
1	0	SRN									
8	8	MCP	13	23	3	13	6	0	0	29	15
2	2	CCP	0	10	0	0	0	0	0	20	70
1	1	CRP	50	30	10	10	0	0	0	0	0
4	4	LSR	16	30	0	45	5	0	0	4	0
1	0	CUL									

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Larsen Creek **LLID:** 1226736380154 **Drainage:** Tomales Bay

Survey Dates: 9/14/2005 to 9/14/2005

Confluence Location: **Quad:** SAN GERONIMO **Legal Description:** T000R000S00 **Latitude:** 38:00:55.0N **Longitude:** 122:40:25.0W

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
5	1	LGR	0	0	0	100	0	0	0
1	1	CAS	0	0	0	0	0	100	0
7	2	GLD	0	0	50	50	0	0	0
5	2	RUN	0	0	0	50	0	0	50
1	1	SRN	0	0	0	0	0	100	0
8	8	MCP	13	0	25	25	25	0	13
2	2	CCP	0	0	0	0	0	0	100
1	1	CRP	0	0	0	0	100	0	0
4	4	LSR	0	0	0	75	25	0	0
1	0	CUL	0	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Larsen Creek **LLID:** 1226736380154 **Drainage:** Tomales Bay

Survey Dates: 9/14/2005 to 9/14/2005

Confluence Location: **Quad:** SAN GERONIMO **Legal Description:** T000R000S00 **Latitude:** 38:00:55.0N **Longitude:** 122:40:25.0W

Habitat Units	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
98	0	100	0	68	74

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 8 - Fish Habitat Inventory Data Summary

Stream Name: Larsen Creek LLID: 1226736380154 Drainage: Tomales Bay

Survey Dates: 9/14/2005 to 9/14/2005 Survey Length (ft.): 2588 Main Channel (ft.): 2588 Side Channel (ft.): 0

Confluence Location: Quad: SAN GERONIMO Legal Description: T000R000S00 Latitude: 38:00:55.0N Longitude: 122:40:25.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: B6

Reach Length (ft.): 1051

Riffle/Flatwater Mean Width (ft.): 5.3

BFW:

Range (ft.): to

Mean (ft.):

Std. Dev.:

Base Flow (cfs): 0

Water (F): 51 - 52 Air (F): 53 - 54

Dry Channel (ft.): 16

Canopy Density (%): 97.9

Coniferous Component (%): 0.0

Hardwood Component (%): 100.0

Dominant Bank Vegetation: Hardwood Trees

Vegetative Cover (%): 73.1

Dominant Shelter: Root masses

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 2.5

LWD per 100 ft.:

Riffles: 0

Pools: 1

Flat: 0

Pools by Stream Length (%): 22.5

Pool Frequency (%): 40.0

Residual Pool Depth (%):

< 2 Feet Deep: 75.0

2 to 2.9 Feet Deep: 25.0

3 to 3.9 Feet Deep: 0.0

>= 4 Feet Deep: 0.0

Mean Max Residual Pool Depth (ft.): 1.675

Mean Pool Shelter Rating: 26

Larsen Creek

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 37.5 Sm Cobble: 25.0 Lg Cobble: 25.0 Boulder: 12.5 Bedrock: 0.0

Embeddedness Values (%): 1. 87.5 2. 12.5 3. 0.0 4. 0.0 5. 0.0

STREAM REACH: 2

Channel Type: F3

Reach Length (ft.): 1537

Riffle/Flatwater Mean Width (ft.): 6.3

BFW:

Range (ft.): to

Mean (ft.):

Std. Dev.:

Base Flow (cfs): 0

Water (F): 52 - 54 Air (F): 57 - 61

Dry Channel (ft.): 0

Canopy Density (%): 98.2

Coniferous Component (%): 0.0

Hardwood Component (%): 100.0

Dominant Bank Vegetation: Hardwood Trees

Vegetative Cover (%): 69.0

Dominant Shelter: Boulders

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 1.4

LWD per 100 ft.:

Riffles: 0

Pools: 1

Flat: 0

Pools by Stream Length (%): 17.2

Pool Frequency (%): 43.8

Residual Pool Depth (%):

< 2 Feet Deep: 71.4

2 to 2.9 Feet Deep: 14.3

3 to 3.9 Feet Deep: 0.0

>= 4 Feet Deep: 14.3

Mean Max Residual Pool Depth (ft.): 1.95

Mean Pool Shelter Rating: 27

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 57.1 Sm Cobble: 14.3 Lg Cobble: 28.6 Boulder: 0.0 Bedrock: 0.0

Embeddedness Values (%): 1. 57.1 2. 42.9 3. 0.0 4. 0.0 5. 0.0

Table 9 -Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Larsen Creek **LLID:** 1226736380154 **Drainage:** Tomales Bay

Survey Dates: 9/14/2005 to 9/14/2005

Confluence Location: **Quad:** SAN GERONIMO **Legal Description:** T000R000S00 **Latitude:** 38:00:55.0N **Longitude:** 122:40:25.0W

Mean Percentage of Dominant Stream Bank

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Bedrock	5	3	17.4
Boulder	1	5	13.0
Cobble/Gravel	1	0	2.2
Sand/Silt/Clay	16	15	67.4

Mean Percentage of Dominant Stream Bank

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Grass	2	3	10.9
Brush	7	6	28.3
Hardwood Trees	14	14	60.9
Coniferous Trees	0	0	0.0
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness 1

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

Stream Name: Larsen Creek **LLID:** 1226736380154 **Drainage:** Tomales Bay

Survey Dates: 9/14/2005 to 9/14/2005

Confluence Location: **Quad:** SAN GERONIMO **Legal Description:** T000R000S00 **Latitude:** 38:00:55.0N **Longitude:** 122:40:25.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)			14
SMALL WOODY DEBRIS (%)			24
LARGE WOODY DEBRIS (%)			2
ROOT MASS (%)			19
TERRESTRIAL VEGETATION (%)			4
AQUATIC VEGETATION (%)			0
WHITEWATER (%)			0
BOULDERS (%)			19
BEDROCK LEDGES (%)			17