

**CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT**

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

INTRODUCTION

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

Orrs Creek is located in Sonoma County, California and is a tributary of the Russian River (see Orrs Creek map, APPENDIX A). The legal description at the confluence with the Russian River is T07N, R11W, S14. Its location is 38°27'01.77"N latitude and 123°03'01.65"W longitude. Access to Orrs Creek exists from several roads, including B Street, in the town of Duncans Mills. Orrs Creek and its tributaries drain a basin of approximately 800.28 acres (1.25 square miles). Orrs Creek is a maximum second order stream and has approximately 9960.6 feet (1.89 miles) of blue line stream, according to the USGS "Duncans Mills" 7.5 minute quadrangles. Elevations range from sea level at the mouth of the creek to 1184 feet in the headwaters. The vegetation is primarily mixed hardwood/conifer (59%) and conifer (23%) with some hardwood (9%) and herbaceous vegetation (8%). None of the basin is agricultural and 1% is urban. The watershed is 100% privately owned.

Endangered, threatened, or sensitive species include Point Reyes checkerbloom (*Sidalcea calycosa ssp rhizomata*), Sonoma alopecurus (*Alopecurus aequalis var sonomensis*), Napa false indigo (*Amorpha californica var napensis*), red tree vole (*Arborimus pomo*), swamp harebell (*Campanula californica*), Northwest pond turtle (*Clemmys marmorata marmorata*), and osprey (*Pandion haliaetus*). The basin also contains coastal and valley freshwater marsh (*Nddb source*).

METHODS

The habitat inventory conducted in Orrs 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 Orrs 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.

Orrs 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 a 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 Orrs 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 Orrs 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 densimeters as described in the California Salmonid Stream Habitat Restoration Manual. Canopy density relates to the amount of stream shaded from the sun. In Orrs 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 Orrs 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 three basic methods: 1) stream bank observation, 2) underwater observation, 3) electro fishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual.

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 Orrs 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 Orrs Creek.

HABITAT INVENTORY RESULTS FOR ORRS CREEK

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

The habitat inventory of Orrs Creek, 7/23/2002 - 8/1/2002, was conducted by Cassie Simons (Americorps), Jake Newell (DFG), Mitsuko Terry (DFG), and Douglas Mitchel (DFG) with supervision and analysis by California Department of Fish and Game (DFG).

The survey began at the confluence with the Russian River and extended up Orrs Creek to where dry tributaries join the main stem just after a series of debris jams. The total length of stream surveyed was 10995 feet (2.08 miles), with an additional 940 feet (0.18 miles) of side channel.

Flows were not measured on Orrs Creek.

This section of Orrs Creek has three reaches with three distinct channel types: from the mouth to 3503 feet a F6, 5791 feet a D6 and 1701 feet a A3. F6 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly silt/clay substrate.

D6 channel types are multiple channels with longitudinal and transverse bars. They have a very wide low gradient (<2%) channel with eroding banks and a predominantly silt/clay 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 56°F to 60°F. Air temperatures ranged from 63°F to 70°F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 42% dry units, 13% culvert units, 18% pool units, 2% no survey units, 24% flatwater units, (Graph 1). Based on total **length** of Level II habitat types there were 73% dry units, 2% culvert units, 3% pool units, 8% no survey units, 14% flatwater units, (Graph 2).

Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were 42% Dry units, 13% Culvert units, 9% Mid-Channel Pool units, 2% Not Surveyed units, 20% Glide units, 7% Trench Pool units, 2% Step Pool units, 4% Run units, (Graph 3). Based on percent total **length**, 73% Dry units, 2% Culvert units, 1% Mid-Channel Pool units, 8% Not Surveyed units, 13% Glide units, 1% Trench Pool units, 1% Step Pool units, and 1% Run units.

A total of eight pools were identified (Table 3). Main Channel pools were the most frequently encountered, at 100%, and comprised 100% 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. Three of the seven pools (43%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the three pool tail-outs measured, one had a value of 3 (33.3%); two had a value of 4 (66.7%); (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 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. Flatwater habitat types had a mean shelter rating of 5, and pool habitats had a mean shelter rating of 21 (Table 1). Of the pool types, the Main Channel pools had a mean shelter rating of 21, (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. A silt/clay substrate type was observed in

57% of pool tail-outs, and gravel observed in 43% of pool tail-outs.

The mean percent canopy density for the surveyed length of Orrs Creek was 79%. The mean percentages of hardwood and coniferous trees were 18% and 82%, respectively. Twenty-one percent of the canopy was open. Graph 9 describes the mean percent canopy in Orrs Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 25%. The mean percent left bank vegetated was 27%. The dominant elements composing the structure of the stream banks consisted of 17% bedrock, 4% cobble/gravel, 79% sand/silt/clay, (Graph 10). Grass was the dominant vegetation type observed in 8% of the units surveyed. Additionally, 17% of the units surveyed had hardwood trees as the dominant vegetation type, and 50% had coniferous trees as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

Department of Fish and Game has not conducted previous biological inventories of Orrs Creek nor are there any records of hatchery releases or fish rescues in the Orrs Creek watershed. A biological inventory was not conducted in 2002. However, during the stream habitat inventory, surveyors observed steelhead 2+ in the creek.

DISCUSSION FOR ORRS CREEK

Orrs Creek has three channel types: F6, D6 and A3.

According to the DFG Salmonid Stream Habitat Restoration Manual, many site specific projects can be designed within an F channel type, especially to increase pool frequency, volume and shelter. F6 channel types are good for bank-placed boulders and fair for low-stage weirs, boulder clusters, single and opposing wing deflectors and log cover. Any work considered will require careful design, placement, and construction that must include protection for any unstable banks.

D6 channel types are fair for bank-placed boulders, single and opposing wing-deflectors and channel constrictors.

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 7/23/2002 - 8/1/2002 ranged from 56°F to 60°F. Air temperatures ranged from 63°F to 70°F. The warmest water temperatures were recorded in Reach 1. This temperature regime is favorable to salmonids. Water temperatures above 65°F, if sustained, are above the threshold stress

level for salmonids.

Flatwater habitat types comprised 14% of the total length of this survey and pools 3%. The pools are relatively shallow/deep, with only three of the seven (43%) 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.

None of the three 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 Orrs Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Four of the seven 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 21 . The shelter rating in the flatwater habitats was 5. 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 Orrs Creek. Small Woody Debris is the dominant cover type in pools followed by undercut banks . Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 79%. Reach 1 had a canopy density of 78.3%, Reach 2 had a canopy density of 84.1%, Reach 3 had a canopy density of 61%, . 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/MODERATE/LOW at 25% and 27%, 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 MANAGEMENT RECOMMENDATIONS

Orrs 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. Signs of recent and historic tree and log removal were evident in the active channel during our survey. 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. Access for migrating salmonids is an ongoing potential problem in Orrs Creek therefore, fish passage should be monitored, and improved where possible.
2. In Orrs 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.
3. 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.
4. There are sections in Reach 1 where the stream is being impacted from livestock in the riparian zone. Livestock in streams generally inhibit the growth of new trees, exasperate erosion, and reduce summertime survival of juvenile fish by defecating in the water. Alternatives to limit cattle access, control erosion and increase canopy, should be explored with the landowner, and developed if possible.
5. Where feasible, design and engineer pool enhancement structures to increase the number of pools in the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.
6. Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream. Most of the existing shelter is from vegetation and undercut banks. 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 the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion. In some areas the material is at hand.
7. Increase the canopy on Orrs Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reach above the survey section should be assessed for planting and treated as well, since water temperatures

throughout are effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

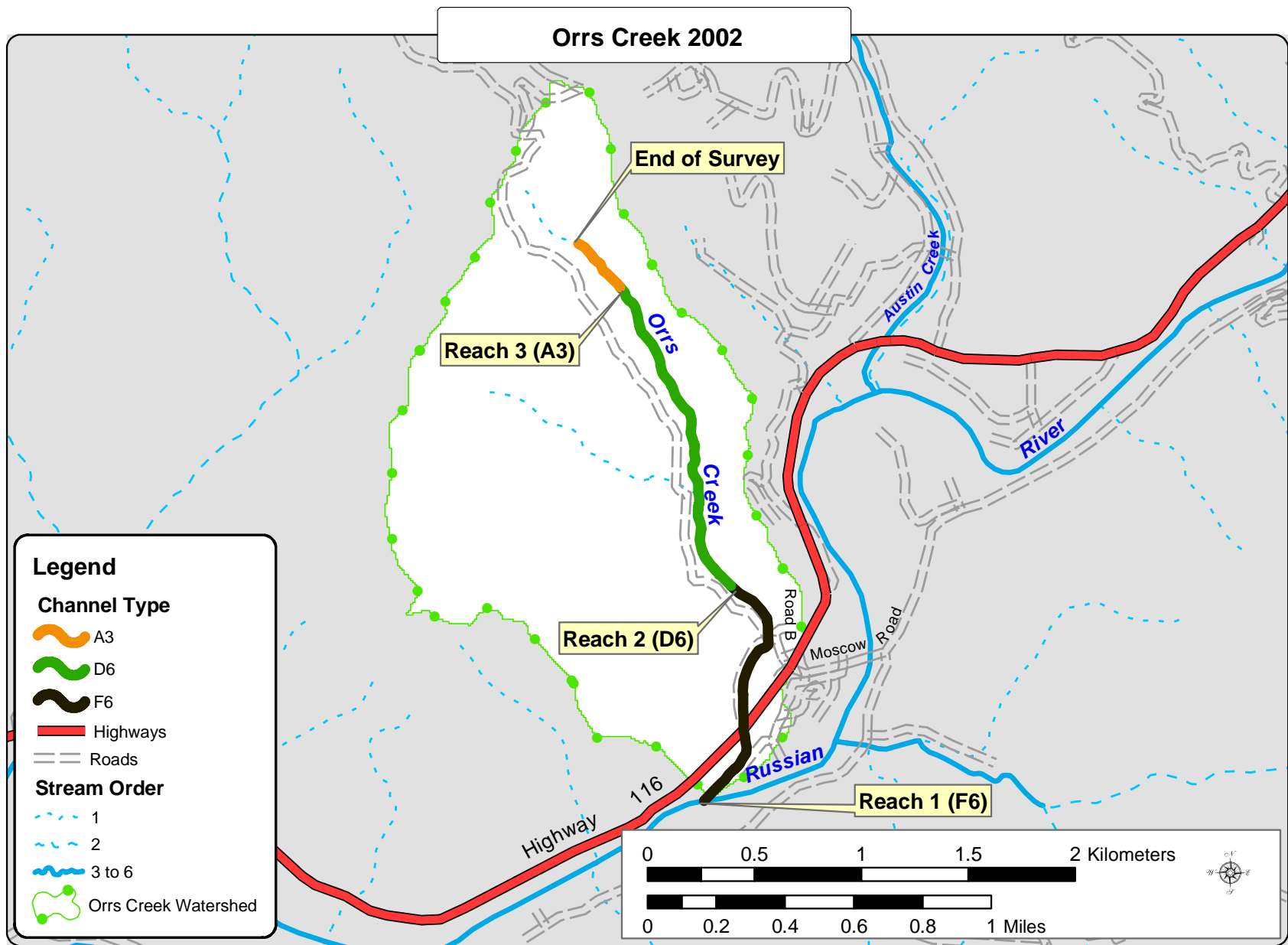
COMMENTS AND LANDMARKS

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

- 0' Cattle presence. Overgrown with blackberry, high silt & erosion. Instream CULVERT (Ferrer):30'L x 5'W, not downcutting, retaining 0.5' gravel, no maintenance required.
- 630' Unit length estimated.
- 1530' Muddy and stagnant.
- 1553' Barbed wire fence across creek.
- 2673' BRIDGE: 4.3'H x 12'W x 32'L, not downcutting, not retaining gravel. Cattle presence.
- 2783' Overgrown with blackberry and non-native grasses, some mature willow & ash in riparian. Cattle presence. BRIDGE: 3.4'H x 10'W x 14'L, not downcutting, not retaining gravel.
- 2803' Artificial wetland spanning entire valley bottom approximately 350', no stream channel, undefined banks, non-native vegetation
- 3503' Stream channel unclear
- 4183' Downed wood HU 19-28
- 4686' Steelhead 2+ observed
- 5147' Rusted oil drum left bank (LB).
- 5217' Instream CULVERT (private road): 30'L x 6'W x 5.5'H, not downcutting, retaining 0.2' gravel, no maintenance required. Substrate gravel cobble.
- 6255' Instream CULVERT (private road): 25'L x 10'W x 4'H, no downcutting, not retaining gravel, no maintenance required.
- 6280' Dry tributary right bank (RB) at 230', dry tributary RB at 400', 6' jump.
- 8080' Instream CULVERT (old logging road): 20'L x 3'W, downcutting 0.5', not retaining gravel, no maintenance required.
- 8100' Every 100', for 300', there are spillways into the creek from the LB road.
- 9264' Instream CULVERT (old logging road): 30'L x 4'W, downcutting 0.7', retaining 0.3' gravel, no maintenance required.
- 9764' 5' jump at end of unit.
- 9777' DEBRIS ACCUMULATION: 8'H x 15'W x 25'D at 56' into HU creating a 5' jump.
- 10397' Series of 2' jumps, intermittent water.
- 10469' Dry tributary RB at 90'. DEBRIS ACCUMULATION at confluence. DEBRIS ACCUMULATION: 6'H x 10'W x 6'D at 70'. Passable DEBRIS ACCUMULATION: 6'H x 10'W x 20'L at 210'. Dry tributary RB at 472'. Dry tributary LB 472'.
END OF SURVEY at dry tributaries entering mainstem.

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.



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Prepared by: Jacob Newell, May 16, 2003

APPENDIX B: TABLES

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

Stream Name: Orrs Creek

LLID:

1230570384478

Drainage:

Russian River - Lower

Survey Dates: 7/23/2002 to 8/1/2002

Confluence Location: Quad: DUNCAN MILLS

Legal Description: T000R000S00

Latitude: 38:26:52.0N

Longitude: 123:03:25.0W

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
6	0	CULVERT	13.3	39	235	2.0									
19	1	DRY	42.2	456	8668	72.6	5.0								
11	3	FLATWATER	24.4	151	1660	13.9	5.3	0.3	0.6	323	3556	90	991		5
1	0	NO SURVEY	2.2	1000	1000	8.4									
8	8	POOL	17.8	46	372	3.1	5.9	1.3	2.3	244	1951	317	2217	312	21
Total Units	Total Units Fully Measured			Total Length (ft.)						Total Area (sq.ft.)			Total Volume (cu.ft.)		
45	12			11935						5507			3208		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Orrs Creek

LLID:

1230570384478

Drainage: Russian River - Lower

Survey Dates: 7/23/2002 to 8/1/2002

Confluence Location:

Quad: DUNCAN MILLS

Legal Description: T000R000S00

Latitude: 38:26:52.0N

Longitude: 123:03:25.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	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 (%)
9	2	GLD	20.0	173	1556	13.0	6	0.4	0.7	341	3069	106	957		5	63
2	1	RUN	4.4	52	104	0.9	4	0.2	0.4	288	576	58	115			76
3	3	TRP	6.7	58	174	1.5	6	1.4	2.2	353	1060	521	1564	521	25	95
4	4	MCP	8.9	33	133	1.1	7	0.8	1.9	205	819	158	474	146	18	83
1	1	STP	2.2	65	65	0.5	1	2.5	5.9	72	72	179	179	179	20	95
19	1	DRY	42.2	456	8668	72.6	5			0	0					75
6	0	CUL	13.3	39	235	2.0										100
1	0	NS	2.2	1000	1000	8.4										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
45	12	11935	5595	3289

Table 3 - Summary of Pool Types

Stream Name: Orrs Creek

LLID:

1230570384478

Drainage:

Russian River - Lower

Survey Dates: 7/23/2002 to 8/1/2002

Confluence Location:

Quad: DUNCAN MILLS

Legal Description:

T000R000S00

Latitude: 38:26:52.0N

Longitude:

123:03:25.0W

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
8	8	MAIN	100	47	372	100	5.9	1.3	244	1951	312	2182	21

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
8	8	372	1950	2182

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

Stream Name: Orrs Creek

LLID:

1230570384478

Drainage: Russian River - Lower

Survey Dates: 7/23/2002 to 8/1/2002

Confluence Location: Quad: DUNCAN MILLS

Legal Description: T000R000S00

Latitude: 38:26:52.0N

Longitude: 123:03:25.0W

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 Occurrence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
3	TRP	43	0	0	1	33	2	67	0	0	0	0
3	MCP	43	1	33	2	67	0	0	0	0	0	0
1	STP	14	0	0	0	0	0	0	0	0	1	100

Total Units

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1 < 2 Foot Max Resid. Depth	Total 1 < 2 Foot % Occurrence	Total 2 < 3 Foot Max Resid. Depth	Total 2 < 3 Foot % Occurrence	Total 3 < 4 Foot Max Resid. Depth	Total 3 < 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
7	1	14	3	43	2	29	0	0	1	14

Mean Maximum Residual Pool Depth (ft.): 2.3

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Orrs Creek LLID: 1230570384478 Drainage: Russian River - Lower
 Survey Dates: 7/23/2002 to 8/1/2002 Dry Units: 19
 Confluence Location: Quad: DUNCAN MILLS Legal Description: T000R000S00 Latitude: 38:26:52.0N Longitude: 123:03:25.0W

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
0	0	TOTAL RIFFLE									
9	1	GLD	0	100	0	0	0	0	0	0	0
2	0	RUN									
11	1	TOTAL FLAT	0	100	0	0	0	0	0	0	0
3	3	TRP	65	33	0	2	0	0	0	0	0
4	3	MCP	0	37	25	32	7	0	0	0	0
1	1	STP	0	90	10	0	0	0	0	0	0
8	7	TOTAL POOL	28	43	12	14	3	0	0	0	0
6	0	CUL									
1	0	NS									
45	8	TOTAL	24	50	11	13	3	0	0	0	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Orrs Creek

LLID:

1230570384478

Drainage: Russian River - Lower

Survey Dates: 7/23/2002 to 8/1/2002

Dry Units: 19

Confluence Location: Quad: DUNCAN MILLS

Legal Description: T000R000S00

Latitude: 38:26:52.0N

Longitude: 123:03:25.0W

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
9	2	GLD	100	0	0	0	0	0	0
2	1	RUN	0	0	100	0	0	0	0
3	3	TRP	67	33	0	0	0	0	0
4	4	MCP	100	0	0	0	0	0	0
1	1	STP	100	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Orrs Creek

LLID:

1230570384478 Drainage: Russian River - Lower

Survey Dates: 7/23/2002 to 8/1/2002

Confluence Location: Quad: DUNCAN MILLS

Legal Description: T000R000S00

Latitude: 38:26:52.0N Longitude: 123:03:25.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
79	82	18	0	25	27

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: Orrs Creek

LLID:

1230570384478 Drainage: Russian River - Lower

Survey Dates: 7/23/2002 to 8/1/2002

Confluence Location: Quad: DUNCAN MILLS Legal Description: T000R000S00 Latitude: 38:26:52.0N Longitude: 123:03:25.0W

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	2	2	16.7
Boulder	0	0	0.0
Cobble / Gravel	0	1	4.2
Sand / Silt / Clay	10	9	79.2

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	1	1	8.3
Brush	0	0	0.0
Hardwood Trees	2	2	16.7
Coniferous Trees	6	6	50.0
No Vegetation	2	2	16.7

Total Stream Cobble Embeddedness Values: 5

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

StreamName: Orrs Creek LLID: 1230570384478 Drainage: Russian River - Lower
 Survey Dates: 7/23/2002 to 8/1/2002
 Confluence Location: Quad: DUNCAN MILLS Legal Description: T000R000S00 Latitude: 38:26:52.0N Longitude: 123:03:25.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)		0	28
SMALL WOODY DEBRIS (%)		100	43
LARGE WOODY DEBRIS (%)		0	12
ROOT MASS (%)		0	14
TERRESTRIAL VEGETATION (%)		0	3
AQUATIC VEGETATION (%)		0	0
WHITEWATER (%)		0	0
BOULDERS (%)		0	0
BEDROCK LEDGES (%)		0	0

Appendix C - Fish Habitat Inventory Data Summary

Stream Name: Orrs Creek	LLID: 1230570384478	Drainage: Russian River -
Survey Dates: 7/23/2002 to 8/1/2002	Survey Length (ft.): 11935	Main Channel (ft.): 10995 Side Channel (ft.): 940
Confluence Location: Quad: DUNCAN MILLS	Legal Description: T000R000S00	Latitude: 38:26:52.0N Longitude: 123:03:25.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F6	Canopy Density (%): 78.3	Pools by Stream Length (%): 1.2
Reach Length (ft.): 3503	Coniferous Component (%): 69.2	Pool Frequency (%): 18.2
Riffle/Flatwater Mean Width (ft.):	Hardwood Component (%): 30.8	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Grass	< 2 Feet Deep: 100.0
Range (ft.): to	Vegetative Cover (%): 28.0	2 to 2.9 Feet Deep: 0.0
Mean (ft.):	Dominant Shelter: Root masses	3 to 3.9 Feet Deep: 0.0
Std. Dev.:	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0.0
Base Flow (cfs): 0	Occurrence of LWD (%): 37.5	Mean Max Residual Pool Depth (ft.): 0.8
Water (F): 56 - 60 Air (F): 65 - 70	LWD per 100 ft.:	Mean Pool Shelter Rating: 20
Dry Channel (ft.): 1630	Riffles:	
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: 100. Sand: 0.0 Gravel: 0.0 Sm Cobble: 0.0 Lg Cobble: 0.0 Boulder: 0.0 Bedrock: 0.0		
Embeddedness Values (%): 1. 0.0 2. 0.0 3. 0.0 4. 0.0 5. 0.0		

STREAM REACH: 2

Channel Type: D6	Canopy Density (%): 84.1	Pools by Stream Length (%): 5.7
Reach Length (ft.): 5791	Coniferous Component (%): 89.6	Pool Frequency (%): 23.1
Riffle/Flatwater Mean Width (ft.): 5.0	Hardwood Component (%): 10.4	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 50.0
Range (ft.): to	Vegetative Cover (%): 26.9	2 to 2.9 Feet Deep: 33.3
Mean (ft.):	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 0.0
Std. Dev.:	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 16.7
Base Flow (cfs): 0	Occurrence of LWD (%): 1.7	Mean Max Residual Pool Depth (ft.): 2.58
Water (F): 56 - 58 Air (F): 63 - 70	LWD per 100 ft.:	Mean Pool Shelter Rating: 22
Dry Channel (ft.): 4582	Riffles:	
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: 50.0 Sand: 0.0 Gravel: 50.0 Sm Cobble: 0.0 Lg Cobble: 0.0 Boulder: 0.0 Bedrock: 0.0		
Embeddedness Values (%): 1. 0.0 2. 0.0 3. 16.7 4. 33.3 5. 0.0		

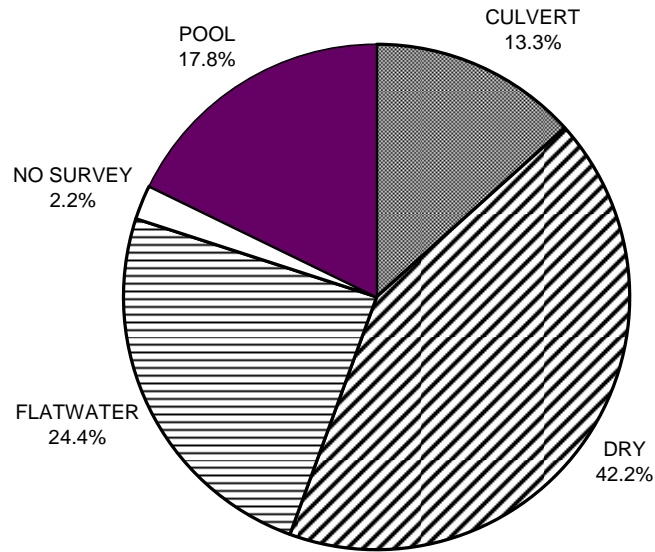
Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: A3	Canopy Density (%): 61.0	Pools by Stream Length (%): 0.0
Reach Length (ft.): 1701	Coniferous Component (%): 73.3	Pool Frequency (%): 0.0
Riffle/Flatwater Mean Width (ft.): 5.5	Hardwood Component (%): 26.7	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep:
Range (ft.): to	Vegetative Cover (%): 20.0	2 to 2.9 Feet Deep:
Mean (ft.):	Dominant Shelter:	3 to 3.9 Feet Deep:
Std. Dev.:	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep:
Base Flow (cfs):	Occurrence of LWD (%):	Mean Max Residual Pool Depth (ft.):
Water (F): 0 - 0 Air (F): 69 - 69	LWD per 100 ft.:	Mean Pool Shelter Rating:
Dry Channel (ft.): 1616	Riffles:	
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: Sand: Gravel: Sm Cobble: Lg Cobble: Boulder: Bedrock:		
Embeddedness Values (%): 1. 2. 3. 4. 5. 0.0		

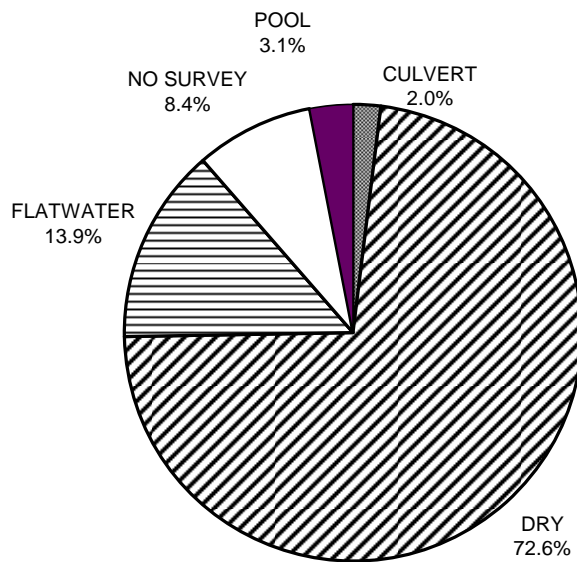
APPENDIX D: GRAPHS

**ORRS CREEK 2002
HABITAT TYPES BY PERCENT OCCURRENCE**



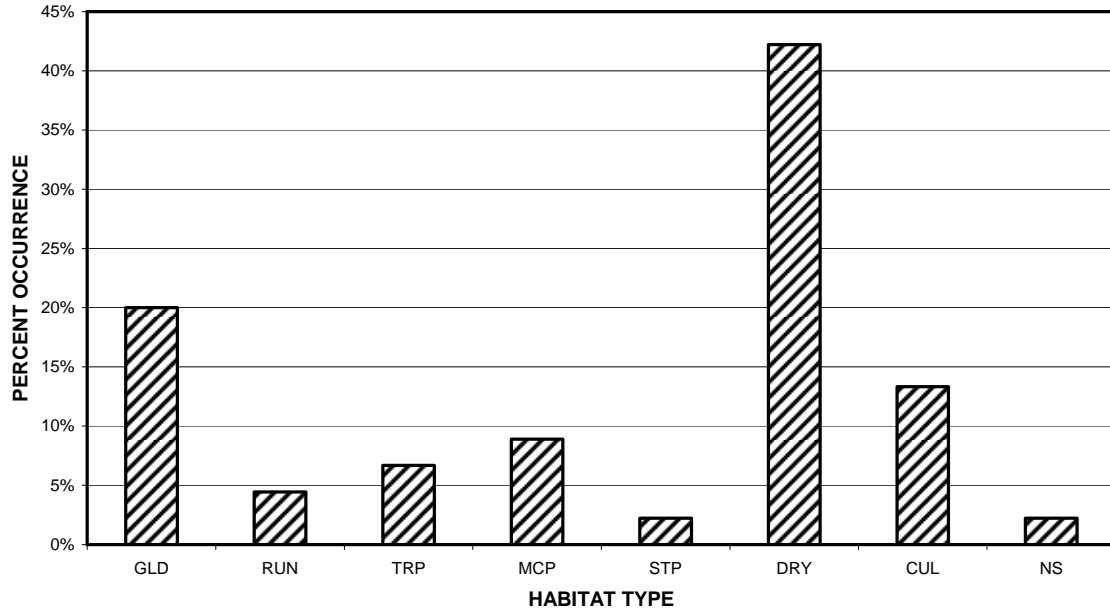
GRAPH 1: Level II habitat types by percent occurrence

**ORRS CREEK 2002
HABITAT TYPES BY PERCENT TOTAL LENGTH**



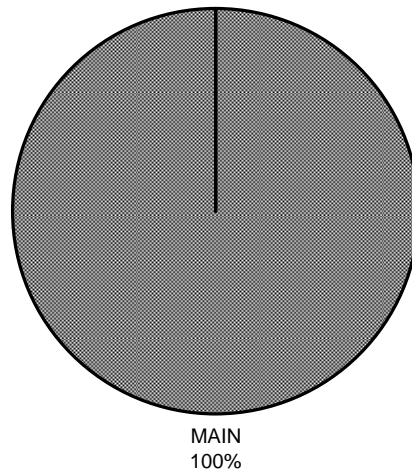
GRAPH 2: Level II habitat types by percent total length

**ORRS CREEK 2002
HABITAT TYPES BY PERCENT OCCURRENCE**



GRAPH 3: Level IV habitat types by percent occurrence

**ORRS CREEK 2002
POOL TYPES BY PERCENT OCCURRENCE**



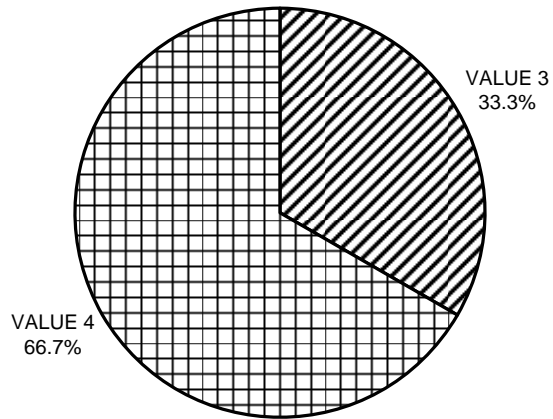
GRAPH 4: Level I pool types by percent occurrence

**ORRS CREEK 2002
MAXIMUM DEPTH IN POOLS**



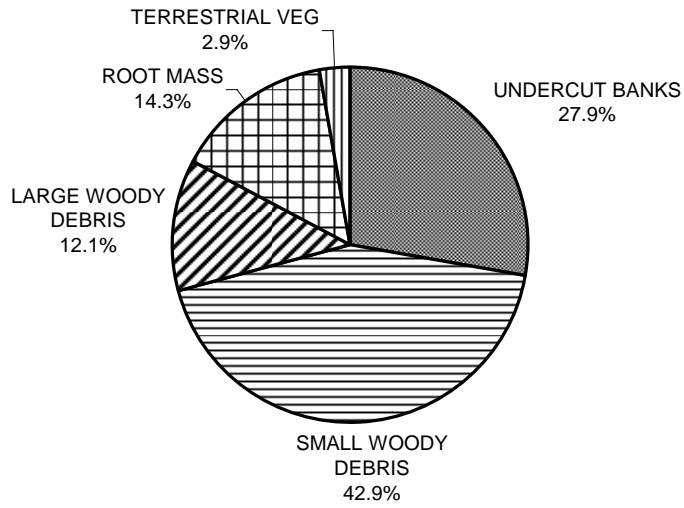
GRAPH 5

**ORRS CREEK 2002
PERCENT EMBEDDEDNESS**



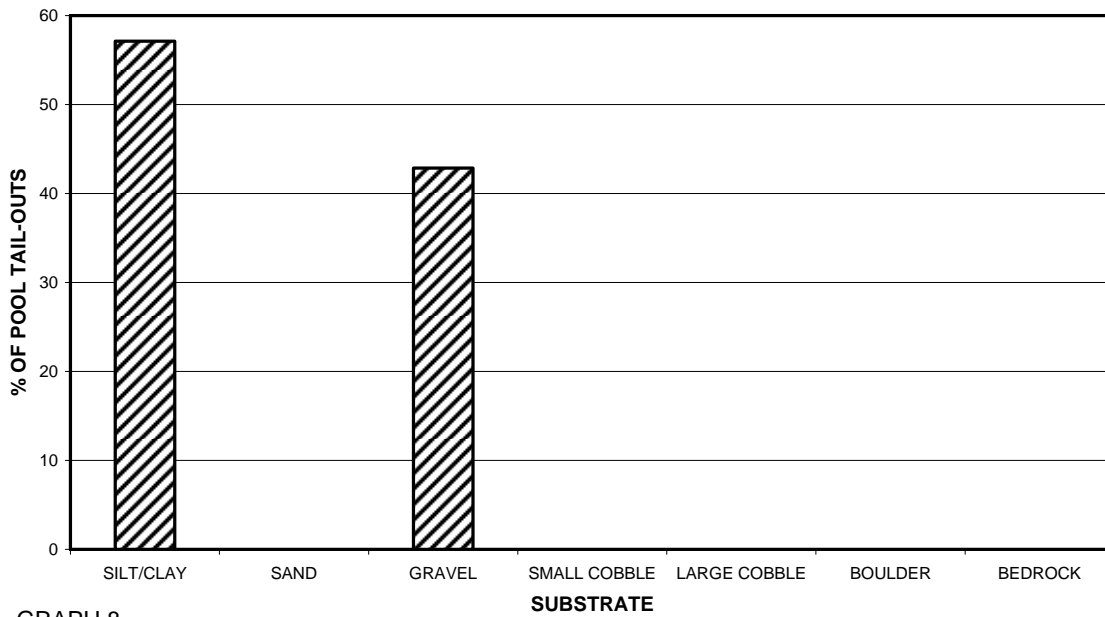
GRAPH 6

**ORRS CREEK 2002
MEAN PERCENT COVER TYPES IN POOLS**



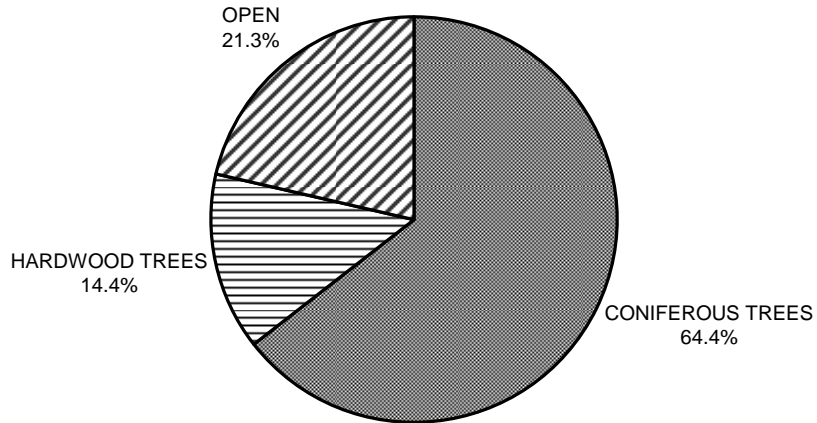
GRAPH 7

**ORRS CREEK 2002
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS**



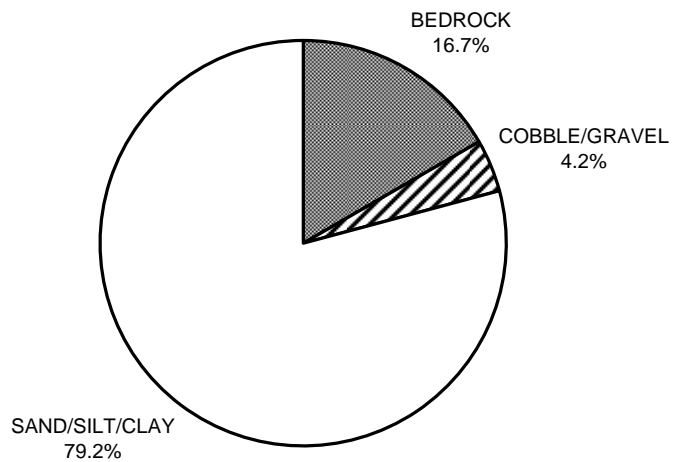
GRAPH 8

**ORRS CREEK 2002
MEAN PERCENT CANOPY**



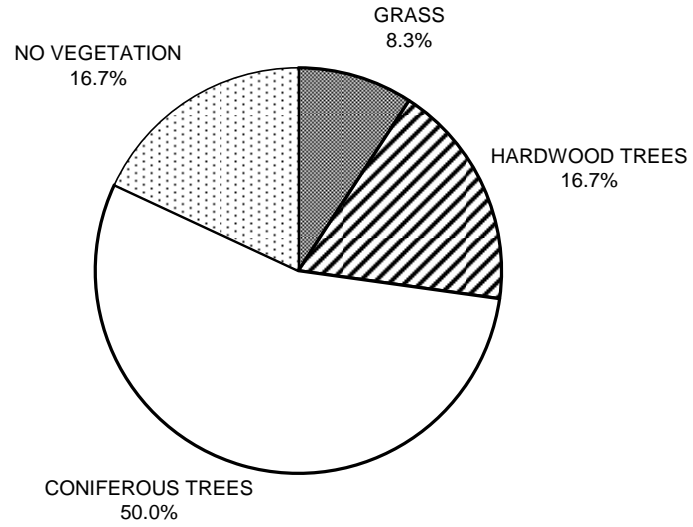
GRAPH 9

**ORRS CREEK 2002
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

**ORRS CREEK 2002
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11