

Evaluation of Fish Passage Improvement Projects in the South Coast and Rogue River Basins 2009



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Introduction

In the summer of 2009, Duck Creek Associates was contracted by the Oregon Watershed Enhancement Board (OWEB) to evaluate various fish passage enhancement projects carried out from 1992 to 2001 in the Southwest Region of Oregon. In 1993, the Oregon Legislature created the Watershed Health program (in Senate Bill 81 and House Bill 2215) as part of a new natural resources strategy. The program was budgeted for \$10 million and \$6.5 million from this was allocated for watershed restoration projects in two basins, the Grande Ronde River in Northeastern Oregon and the South Coast and Rogue River Basins in Southwestern Oregon. These funds were allocated to restoration projects between 1994 and 1995. In June 1995 the Watershed Health Program ended and the Governor's Watershed Enhancement Board took on an expanded set of duties including administering the projects initiated by the Watershed Health Program. Between the two basins, 36 fish screens were installed on major water diversions and 8 projects were initiated to improve fish passage.

Duck Creek conducted field assessments at 64 of these project sites. The two primary objectives of this study were to determine if fish passage improvement projects provide adequate passage for salmonids and if juvenile salmonids utilize the habitat above the passage improvement projects.

During the 2009 field studies, we collected data on these projects. The projects included replacing existing non-functional culverts and dams with bridges, stream simulated culverts, culverts designed with baffles, and fish ladder projects. There were several sites in the Applegate Valley and near Ashland that were visited. Those sites were fish screen projects that did not require any actual data collection; we simply verified the location and checked to see if the projects functioned as intended. This report includes the results from the field survey and the post field work analysis.

The site reports are organized by the sub-basin in which the project is found. For example, all the sites that fell within the Coquille sub-basin are presented together in ascending order by the Site Number. Site Number corresponds to the Unique_ID field assigned by Duck Creek. All of the identifiers (Project Name, OWEB Grant Number, Oregon Watershed Restoration Inventory (OWRI) Project Number, Global ID) assigned by OWEB have been retained for cross-reference purposes. Each site report has a map that illustrates the site's location within the boundary of the watershed council to which it is assigned. Each site report contains "Site Notes" which provide a narrative pertaining to field observations and the data analysis. The site reports also contain the results of the snorkeling surveys, any longitudinal or cross sectional profiles, and the results from FishXings software. Additionally, there is a stand alone photolog that contains photographs of each site.

Study Area

All of the survey sites were located in western Oregon within the Southwest Region of Oregon (Map 1). The majority of the sites fell within the Coos and Coquille Watersheds. Table 1 lists the sites visited in 2009.



Map 1. The location of the survey sites within the Southwest Region of Oregon. See the individual site maps in the Site Summary section for finer scale maps that provided Unique Id labels for each site.

Table 1. The sites surveyed during the summer of 2009. Unique ID is the Site number assigned by the contractor, (OWRI) PROJNUM, OWEB grant #, and GlobalID were assigned by OWEB, and Crossing_Description is how the contractor described the site.

UNIQUE_ID	PROJNUM	OWEB grant #	GlobalID	Crossing_Description
1	440	SC-007	{CD736D2C-EE98-42FF-B495-22B9A9D3A216}	Pond/Riparian
2	441	SC-007	{2C30C889-5704-4020-A9A7-81ABB8F35253}	Pond/Riparian
2.1	441	SC-007	{2C30C889-5704-4020-A9A7-81ABB8F35253}	Culvert
3	523	SC-009	{2912785E-0ACD-4699-B22D-F9610321D0FE}	Culvert
4	1026	SC-009	{1B4F5D13-D57E-4DBF-A619-90B53BC60DB2}	Culvert
5	1029	SC-009	{424223FB-E06A-4693-BF1B-3633F4D18443}	Bridge
6	1035	097-067	{634286DF-67DF-4041-A1A3-A0A8F6E9CEF3}	Culvert
8	1283	SC-025	{CBAF916B-F92D-46E5-B5EC-34BA79B7372A}	PushUP Dam/ Fish Screen
9	980018	097-240	{B18D8DD6-8980-4D17-8D93-AB16170A9AA6}	Culvert
10	980018	097-240	{074B055C-3C83-4936-B625-791D847DEF83}	Culvert
11	980018	097-240	{2EB1FDA3-2B29-42BE-9C3E-5589B0B24617}	Culvert
12	980024	SC-009	{1C828045-75EF-4D73-A2E2-98168E5624AB}	Ford
14	980039	SC-009	{550765DC-62F6-49AA-964B-5F9B88AB0C2E}	Culvert
15	980420	SC-069	{EB6C9EBB-02A1-4AF8-88CA-D359C1B7A795}	ODFW/ Ladder
18	990036	096-164/099-113	{ABE6B0DA-4E5D-4C29-AA28-4EE2BE476969}	Culvert
19	990037	098-137	{5FC95F9A-0F88-4DFC-8E50-41D73F7701A9}	Culvert
20	990038	099-113	{348C9B8D-F15C-444E-997C-2158ECE59A10}	Culvert
21	990039	098-137	{586A7860-C70A-45F4-A7AF-A7ABDDDB08FA}	Culvert
22	990042	097-075	{98E9B085-D353-49D6-807F-C8A0DC1AF8B1}	Culvert
23	990042	097-075	{3D031CA8-E2E5-42CB-9B62-BA29B5355D92}	Culvert
24	990044	097-067	{BDDDF441-9D91-4A19-8494-817BA9105979}	Bridge
26	990045	098-055	{8B5BCC7B-3055-424C-A1A8-4BDB850BD32D}	Culvert
27	990045	098-055	{7C7BAD7C-AB7B-43A1-B915-53016AE2419A}	Culvert
28	990045	098-055	{C7434D84-EC7B-483D-BF9C-4B2365C2BD8B}	Culvert
29	990045	098-055	{468E0823-26C7-424C-A11D-9529A3A48ADD}	Culvert
30	990045	098-055	{136B3B3C-7E32-4995-BADC-5CF8F20AA6A6}	Culvert
31	990045	098-055	{97A710B0-1DCC-41A8-A4F3-83B6B53C8EEF}	Culvert
32	990045	098-055	{18CCD5B0-6F0F-46BF-89ED-2F89DC564E45}	Culvert
33	990046	097-067/099-070	{06EE480C-F8C2-40A8-8FD6-447164025950}	Bridge
34	990046	097-067/099-070	{D83E9C59-35CD-4AAE-B3D0-422772E2FD81}	Ford/Fencing
35	990046	097-067/099-070	{F5FDB369-104C-43E2-9E0E-A179E251F53F}	Bridge
36	990046	097-067/099-070	{685AEC4E-7F5B-44D9-ACB2-A7482C4D4725}	Culvert
43	20000001	099-311	{61E88F0C-C642-4A6C-B18D-7F3FE4F140B4}	Bridge
44	20000003	099-311	{2F0A04A3-B33B-447B-BE54-1F88E3AEF818}	Bridge
45	20000004	099-310	{803470C4-DD23-4D65-A883-48030283CB32}	Culvert
46	20000004	099-310	{F60192B3-858F-4F4D-B6C9-50E0B265BFB9}	Culvert
47	20000004	099-310	{53429621-1090-4ABF-99AE-CF1956C9F9B5}	Culvert
48	20000008	099-466	{0C0059E0-9205-4A80-B3AD-4DFFE415D9EB}	Culvert
50	20000010	099-113	{F5C53840-5FDB-483A-824B-68649601AA98}	Culvert
52	20000013	099-461	{489EEC1F-BB77-4C18-99CB-51A205CF0969}	Culvert
54	20000043	097-096/099-488	{BECC1BAE-4597-45E6-9CD0-5655905D46F2}	Bridge
55	20000051	097-096	{FBEA94C3-8F30-4BAA-A9E8-92D52F3510A7}	Bridge
56	20000057	097-096	{25B024B3-0DDC-4F5F-B1BB-79C7A2469B80}	Bridge
57	20000058	097-096	{4A469318-6CB7-424F-8F6E-F17CEE1723FA}	Bridge
58	20000063	097-096	{6BFD4335-F3EB-43E5-A4A8-747DFBE6575A}	Culvert
66	20001062	098-071	{C89E3D4C-5DED-46EC-8900-3D7075715C13}	Bridge
67	20010590	099-466	{05FA8C57-A44B-4DB1-B373-C212057D31A8}	Culvert
68	20010590	099-466	{8FDF695B-4363-4118-A567-48ABDBDF6529}	Culvert

UNIQUE_ID	PROJNUM	OWEB grant #	GlobalID	Crossing Description
69	20011069	099-461	{58F6BE3B-087C-4619-907B-156A94BF72A0}	Culvert
70	20011070	098-137/099-461	{528D59E0-0BE6-4497-92B7-FCCD920FFE4A}	Bridge
71	20011073	099-461	{694EBC51-F089-4FE3-A3EC-20D1D25099FB}	Culvert
72	20011074	099-461	{F788C489-7673-4BA7-ABE3-6DDB08153576}	Culvert
73	20011075	098-137/099-461	{E417396F-B24B-4442-A052-2BF379EE32B5}	Culvert
74	20011076	098-137/099-461	{34043612-61B7-4D05-B972-95B190D411FB}	Culvert
75	20011138	200-056	{FF5B51AC-9AD9-4E33-B3D2-698D191DA77E}	Culvert
76	20020439	200-058A	{C44FCC35-2A3D-4363-97E5-7905A69F8D24}	Bridge
77	20020440	200-058A	{C005335E-5BCD-4D48-826F-070F3ECC3622}	Bridge
80	20040864	SC-017	{69CCC79E-859A-46E3-9D33-7A4EAE2BBB1D}	Culvert
82	20040884	SC-017	{F1FDBD45-9D83-4672-8B21-E829687EDC72}	Culvert
84	20040891	099-466	{551CE0F7-D6F5-46C7-B3A9-7908F0959D16}	Culvert
85	981209	SC-016	{30568198-A57A-458C-8022-8747030F80B1}	Fish Ladder
86	608	SC-007	{508E40FC-A13C-4D9F-B541-2FD36CB83B73}	Instream Wood
131	980035	SC-009	{0269012B-F095-4BC6-B870-F09CECE8D1A4}	Culvert
132	980035	SC-009	{0269012B-F095-4BC6-B870-F09CECE8D1A4}	Culvert

Methods

Field Survey

In order to evaluate the various fish passage projects, we needed to deploy basic stream channel survey methods that have been adapted for the various circumstances we encountered at culverts, bridges, dams, and fish ladders/screens.

Culverts

At culverts we generally followed the protocols explained in the “National Inventory and Assessment Procedure for Identifying Barriers to Aquatic Organisms Passage at Road-Stream Crossings” (Clarkin, et, al. 2005). Our measurements included a longitudinal survey of the stream channel and culvert. The longitudinal survey sought to capture the channel gradient and morphology beginning upstream of the culvert and extending downstream to a point where the channel was outside of the area affected by the culvert. Typically, we began measurement of the longitudinal profile 30-35 meters upstream of the culvert and ended the survey approximately 30-35 meters downstream of the culvert. This distance proved adequate for capturing the length of stream affected by a particular crossing. It is worth mentioning that several of the surveyed culverts had outlets within the active width of a larger order stream. We did not alter protocol to address this fact. At each culvert, specific measurements were taken and incorporated into the longitudinal profile. These measurements included:

- the inlet gradient control point
- the culvert inlet invert
- the culvert outlet invert
- the pool bottom (if present)
- the water surface elevation at the outlet pool
- the tail water control (if present)

We also surveyed channel cross sections. If there was an identifiable tail water control of an outlet pool, we measured the channel cross section at that point. If there was no outlet pool, and by extension no tail water control, we measured the cross section within 1 meter downstream of the culvert. We considered the water surface elevation to be the tail water elevation if no actual tail water control existed. Additional data taken at the culvert included both quantitative and qualitative assessments such as

- culvert dimensions
- culvert structural integrity
- average bankfull width upstream of the culvert
- culvert material type
- dimension of culvert corrugations
- substrate particle size of the channel and substrate size within the culvert

We also determined if there were internal structures within the culvert such as baffles. If present, we measured the dimension and sketched the baffles to provide an illustration of their form.

Bridges

Several of the upgraded fish passage projects involved installing bridges over the channels. At each bridge crossing, we conducted a longitudinal profile through the channel starting approximately 30 - 35 meters upstream of the bridge and extending downstream of the bridge to a point where the structure appeared to have no effect on the downstream portion of channel. If a confluence was within approximately 35 meters of the bridge crossing, we surveyed to the confluence. We also collected information on the type and dimensions of the bridge, the bridge material, the channel substrate, and we made sketches of the site. We present longitudinal profiles at bridges in the report as figures that illustrate channel gradient and channel bed form within the surveyed area.

Fords

We encountered one ford during this survey. There, the crossing had been completely removed. We treated this site as if it were a bridge and collected the information as such.

Dams

We only encountered one push-up dam in this study. There we measured the longitudinal profile upstream and downstream and through the push-up dam. We also characterized the channel in terms of gradient, jump over the dam, and substrate composition.

Fish Ladders and Fish Screens

We did encounter a couple of fish ladders and fish screens. These were difficult to assess. One fish ladder we encountered (downtown Medford) was completely behind a locked fence. We were only able to photograph the ladder there. The second ladder at Crowfoot Falls on Big Butte Creek was visited, but we weren't sure of the best methodology to use to assess the ladder. Luckily, the Rogue Watershed District of the Oregon Department of Fish and Wildlife (ODFW) had written a comprehensive study on fish passage and abundance above the falls in 2009. The methods used in the ODFW study went beyond any methods we were prepared to carry out in terms of survey intensity and the level of survey sophistication. Therefore, the ODFW report, "Rogue River Spring Chinook Salmon Conversation Plan" has been included in this report as Appendix A.

We visited several drum fish screens. Typically, we simply checked to ensure that the paddle wheels turned properly and checked to see if the drum screen could function as designed.

Snorkeling

We snorkeled pools upstream of the stream crossings to determine if juvenile fish were present. Typically, we searched for juvenile salmonids in pools within the first 135 meters upstream of a crossing. If no fish were found in the first pool upstream of a crossing, we extended the snorkel survey to all pools within 330 meters upstream of the crossing. At each pool we collected data on weather, visibility, pool depth, pool width and pool length. We used ODFW's criteria for determining the type of pool. Ten pool types were possible;

- glides, plunge pools
- straight scour pools
- lateral scour pools
- trench pools
- damned pools
- beaver dam pools
- alcoves
- backwater pools
- isolated pools.

We followed standard operating procedures when snorkeling. We counted juvenile salmonids (< 5 cm long) by species. We had to group juvenile steelhead and cutthroats into the same category due to our inability to tell these species apart when they were this size.

Photography

We took digital photographs at each site we visited. Photographs are presented in a separate photo log. We tried to capture the essence of a particular site. We photographed culvert inlets, outlets, tail waters and the stream channel both upstream and downstream.

Office Data Processing and Reporting

FishXings

FishXings is a free interactive software package used to design and assess culverts for fish passage. The model has built in information pertaining to various fish species and their ability and speed in terms of jumping and swimming. Users enter culvert, hydraulic, discharge and fish data into the model to acquire results pertaining to fish passage. The model typically provides a range of discharge rates that a particular fish (species, size) could pass through a culvert. For example, to determine if juvenile Coho could pass through a certain culvert, we need to provide a range of flows for the model to evaluate. If we sought to determine if this fish could pass at a low flow of 0.01 cubic meters second⁻¹ to a high flow of 3.5 cubic meters second⁻¹ (cms), that data would be entered for a particular model run. The model could potentially return a result that claimed the either the culvert was a barrier at the full range of flows, the culvert fully passable at the full range of flows, or the culvert was a partial barrier at a sub-range of flows. In this example, a partial barrier could occur from 0.35 cms to 3.5 cms while the culvert may be fully passable from 0.01 cms to 0.349 cms. In addition to providing information on a range of passable or barrier flows, the model predicts the type of barrier; outlet drop, velocity, or depth.

Discharge Rates

Since stream flow was so slight and shallow to measure at the majority of sites, and the results would only be a snap shot of the stream flows we were interested in, we first decided to model stream flow using the Low and Peak Flow Regression Equations provided by USGS for western Oregon.

The FishXings model requires the input of peak (Q_H) and low (Q_L) stream flow data to model if a fish may pass through a certain culvert. The road stream crossings analyzed in this study are typically on ungauged streams and lack (Q_H) or (Q_L) stream flow data. Therefore, we used published regression equations to determine Q_H and Q_L at the individual road stream crossings. Cooper (2005) developed peak discharge regression equations for unregulated streams in western Oregon. We set out to use the 10% exceedence flow peak discharge equations for Region 1, coastal watersheds. We found that these calculated peak discharge equations returned flow values that exceeded the flows that many of the culverts were designed to accommodate. Using these high discharge values in the FishXings model resulted in under estimating the percentage of flows which a juvenile salmonid may pass through the culvert. For example if we model flows from 0.2 cms to 100 cms, FishXings could predict that only 1% of all possible flows with the range specified are passable. However, if the culvert was designed to handle a maximum peak discharge of 10 cms and we chose 10 cms as our Q_H , we may have found that 10% of all flows between 0.2 cms and 10 cms were passable by juvenile fish. We decided that instead of using the peak discharge equations, we would use the maximum flow that a particular culvert could accommodate. We obtained maximum flow

values that a particular culvert (embedded and not embedded) could accommodate from Oregon Department of Forestry Forest Practices Technical Note Number 5, Version 1.0, 2002.

For Q_L we chose the $7Q_2$ (the annual minimum mean discharge for 7 consecutive days which has a 2% chance of not being exceeded (98% exceedence) in any one year). The $7Q_2$ that we used as reported by Risley et. al., (2008) for Region 10 is:

$$7Q_2 = 1.25873 * 10^{-13.0178} * (DA)^{1.1547} * (SC)^{-2.7595} * (JXT - 20) + 6.5151$$

Where DA = the drainage area flowing to a particular site

Where SC = Soil Capacity of the Drainage Area

Where JXT = January Maximum Air Temperature

Drainage Areas for each site were determined using HydroTools in ArcInfo. Mean Soil Capacity was determined for each drainage area from SSURGO Soil Database. January Maximum Temperature was obtained from Arc Grids provided by the Oregon Climate Data Center.

Maximum Velocity, Maximum Outlet Drop, Minimum Depth

Before FishXings can model a particular culvert, certain parameters must be set. First, we have the issue of fish size which relates directly to swim speed. Since one of the primary objectives for this study was to determine if juvenile salmonids can pass through these culverts, we chose a fish length of 5 cm (~2 inches). We were primarily interested in Coho, Steelhead, and Coastal Cutthroats juvenile swim speeds. FishXings provides data on two types of swim speeds; prolonged and burst. Unfortunately, for fish of this size data were only available for Coho salmon prolonged speeds. The calculated speed of a 5 cm Coho was 0.33 meters/second. After a literature review on juvenile salmonid swim speeds, we verified that this speed is often used for modeling water velocity at culverts when considering juvenile salmonid passage. In the National Marine Fisheries Service's "Guidelines for Salmonid Passage at Stream Crossings" (2001) it states that for juvenile upstream passage the maximum average water velocity should not exceed 1 foot/second. We therefore modeled all culverts using the Hydraulic Criteria option with a maximum water velocity for all culverts at 0.33 meters/second. Since we do not have data on juvenile leaping capabilities nor burst speeds, we had to choose the maximum outlet drop that a culvert could have. We chose a maximum outlet drop of 0.1 meters for juveniles based on communication with FishXings developers (Michael Love, personal communication). We chose a minimum water depth of 3 centimeters for our modeling parameter.

Results

Snorkel Surveys

We surveyed and analyzed 42 culverts and 14 bridge stream crossings and 8 other restoration type projects. Many of these sites were also surveyed by snorkeling to determine if juvenile salmonids were present upstream of the projects.

We found juvenile salmonids present upstream of the grand majority of these restoration project sites ([Figure 1](#), [Figure 1](#)). Juvenile salmonids were absent on a relatively small percentage of surveyed reaches. At each crossing where we did not observe juvenile salmonids, we also noted a general lack of in-stream habitat in terms of sustained gradients less than 10%, available pools (wet or dry), and flowing water. Essentially, if juveniles were not observed, suitable rearing habitat was lacking. Sites rated as “Unknown” typically mean that snorkelers could not verify juvenile presence because of low visibility while snorkeling.

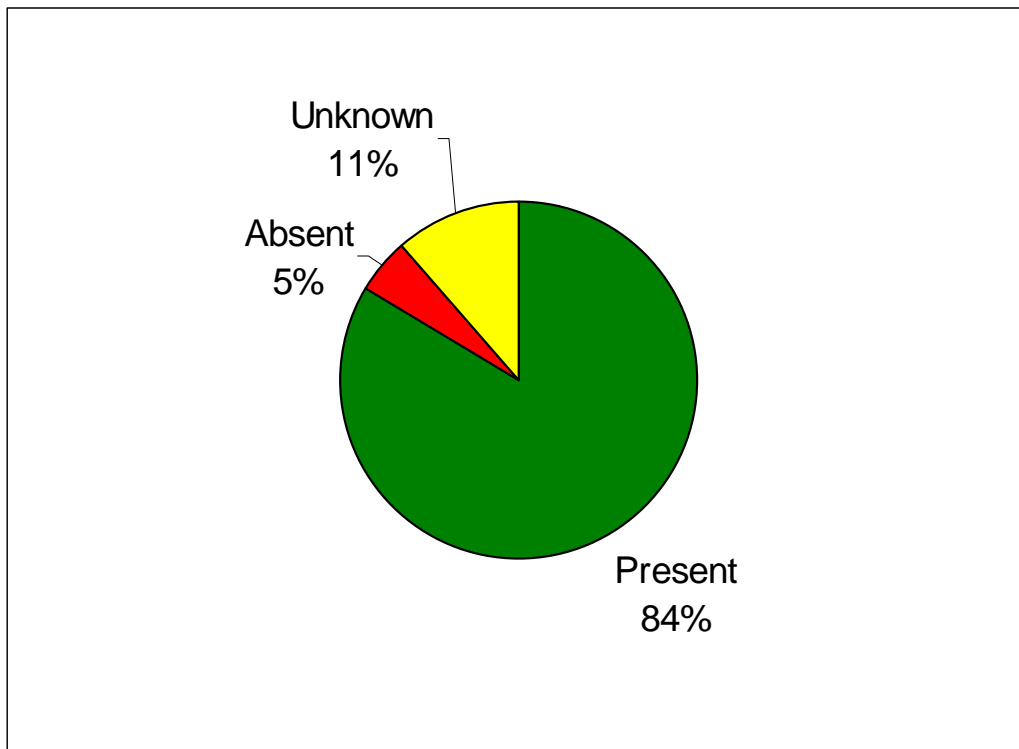


Figure 21. Relative percentages of juvenile salmonids either present, absent, or unknown (inability to determine) upstream of the restoration project sites investigated in this study.

Table 2 lists the juvenile salmonid counts made during the 2009 snorkel surveys. The greatest numbers of juvenile Coho were found at Site 19 (233) while Site 56 had the

highest number of Steelhead/Cutthroat (61). Not all surveyed sites are listed because we only snorkeled the most upstream site on a particular stream.

Table 2. Juvenile fish (~5 centimeters and less) abundance counts from 2009 snorkel surveys. Steelhead and cutthroat trout were grouped together because of the inability to tell the two apart at a size of approximately 5 centimeters and less. This list includes both culverts and bridge stream crossings.

UNIQUE_ID	OWEB grant #	Coho	Steelhead/Cutthroat	UNIQUE_ID	OWEB grant #	Coho	Steelhead/Cutthroat
3	SC-009	161	0	48	099-466	2	3
5	SC-009	188	0	52	099-461	0	1
10	097-240	174	0	54	097-096/099-488	0	17
12	SC-009	0	30	56	097-096	0	61
17		0	11	68	099-466	78	4
18	096-164/099-113	86	0	69	099-461	0	5
19	098-137	233	0	70	098-137/099-461	39	0
20	099-113	46	1	71	099-461	50	0
21	098-137	0	2	72	099-461	39	0
26	098-055	4	0	73	098-137/099-461	0	6
31	098-055	39	2	74	098-137/099-461	0	17
33	097-067/099-070	155	0	75	200-056	0	11
35	097-067/099-070	0	2	76	200-058A	230	0
43	099-311	64	0	77	200-058A	77	0
44	099-311	85	0	80	SC-017	0	8
45	099-310	40	0	82	SC-017	50	0
47	099-310	5	0	84	099-466	55	40
				86	SC-007	0	51

FishXings

When using FishXings to determine if culverts were passable by juvenile salmonids, we found that found that none of the culverts were predicted to be 100% passable using the modeled flow rates (flow rates (

| [Table 3](#)~~Table 3~~). FishXings returned results that indicated 16 culverts were 100% impassable by juveniles. Of the 16 rated as impassable, all were velocity barriers, 3 were combined velocity/outlet drop barriers, and 3 were rated as velocity/depth barriers. The remaining 26 culverts were considered to be passable through varying percentages of modeled flows ([Figure 3](#)~~Figure 2~~).

Table 3. Results from FishXings analysis for 42 culverts. Culverts are organized by their Unique_ID, culvert length (meters), modeled low and high discharge rate (cubic meters second⁻¹), the predicted percent of passable flow for juvenile salmonids (5 centimeter long), and the type of barrier to passage predicted by FishXings.

Unique_ID	OWEB grant #	Culvert Length	Modeled Low Flow	Modeled Peak Flow	Predicted % Passable of Modeled Flows	Barrier Type
2.1	SC-007	4.8 m	.002 cms	3.11 cms	69.30%	Velocity
3	SC-009	12.3 m	.01 cms	3 cms	2.20%	Velocity
4	SC-009	10.3 m	.001 cms	.311 cms	0.00%	Velocity
6	097-067	12.4 m	.001 cms	.311 cms	18.60%	Velocity
9	097-240	16.7 m	.001 cms	4.8 cms	1.20%	Velocity
10	097-240	25.5 m	.001 cms	4.8 cms	0.00%	Velocity
11	097-240	13.8 m	.08 cms	25 cms	1.80%	Velocity
13.1	SC-009	24 m	.1 cms	18.4 cms	0.00%	Velocity, Outlet Drop
13.2	SC-009	24 m	.1 cms	18.4 cms	0.00%	Velocity, Outlet Drop
14	SC-009	8.2 m	.001 cms	4.81 cms	2.40%	Velocity
18	096-164/099-113	22.9 m	.07 cms	7 cms	0.00%	Velocity
19	098-137	22.9 m	.001 cms	8 cms	0.20%	Velocity
20	099-113	19 m	.001 cms	7.3 cms	0.00%	Velocity
21	098-137	20 m	.001 cms	3.7 cms	0.00%	Velocity, Depth
22	097-075	20.1 m	.004 cms	18.4 cms	3.60%	Velocity
23	097-075	25.4 m	.08 cms	2.0 cms	2.80%	Velocity
26	098-055	12.2 m	.002 cms	3.11 cms	0.10%	Velocity
27	098-055	11.2 m	.003 cms	.85 cms	0.00%	Velocity
28	098-055	7.8 m	.001 cms	.85 cms	0.00%	Velocity
29	098-055	8.7 m	.001 cms	7 cms	3.90%	Velocity
30	098-055	8.5 m	.001 cms	7 cms	3.10%	Velocity
31	098-055	11.2 m	.001 cms	1.8 cms	6.10%	Velocity
32	098-055	8.7 m	.001 cms	5 cms	3.90%	Velocity
36	097-067/099-070	16 m	.001 cms	10 cms	3.40%	Velocity
45	099-310	12.5 m	.004 cms	1.98 cms	17.90%	Velocity
46	099-310	6.2 m	.0004 cms	2 cms	41.20%	Velocity
47	099-310	12.5 m	.001 cms	1.98 cms	37.80%	Velocity
48	099-466	21 m	.001 cms	9.34 cms	1.20%	Velocity
50	099-113	16 m	.01 cms	9.34 cms	0.00%	Velocity, Depth
52	099-461	11.5 m	.001 cms	3.68 cms	6.50%	Velocity
58	097-096	6.3 m	.08 cms	.85 cms	29.30%	Velocity

Unique ID	OWEB grant #	Culvert Length	Modeled Low Flow	Modeled Peak Flow	Predicted % Passable of Modeled Flows	Barrier Type
67	099-466	8 m	.001 cms	6.8 cms	5.20%	Velocity, Outlet Drop
68	099-466	8.5 m	.001 cms	6.8 cms	3.10%	Velocity
69	099-461	18.5 m	.01 cms	5.09 cms	0.40%	Velocity
71	099-461	20.4 m	.001 cms	14 cms	0.80%	Velocity
72	099-461	21 m	.001 cms	9.3 cms	0.00%	Velocity
73	098-137/099-461	14.8 m	.002 cms	1.98 cms	0.00%	Velocity, Outlet Drop
74	098-137/099-461	9.7 m	.001 cms	11 cms	0.00%	Velocity
75	200-056	15.3 m	.01 cms	4.8 cms	0.00%	Velocity
80	SC-017	12.2 m	.1 cms	5 cms	0.00%	Velocity
82	SC-017	12.3 m	.001 cms	3.7 cms	0.00%	Velocity, Depth
84	099-466	22.2 m	.22 cms	10 cms	3.90%	Velocity

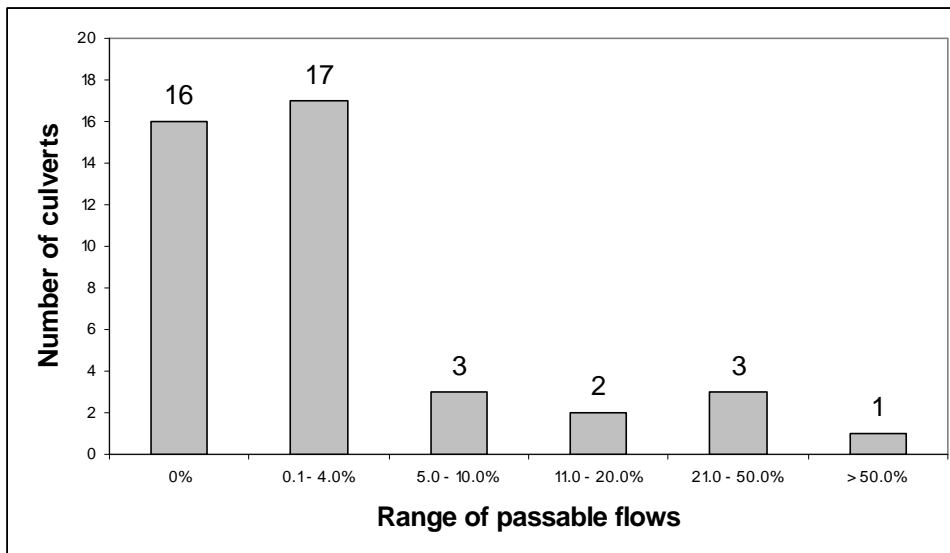


Figure 32. The number of culverts analyzed using FishXings broken down into classes of the percent of modeled flows considered passable by juvenile salmonids.

Table 4 lists the 14 bridge crossings surveyed for this study. We predict that all of the bridge stream crossings will be passable by juvenile salmonids. We determined this by conducting longitudinal profiles to determine channel slope and bed form. We typically found that channel slope at the bridge site was less than the overall channel gradient. Often, there was pool-like slow-water through the bridge site that creates potential refuge for migrating fish. In addition, we observed juveniles above all the bridge sites that we snorkeled.

Table 4. List of 14 bridge stream crossings surveyed in 2009. All bridge/stream crossings surveyed were characterized as to be 100% passable by juvenile salmonids.

UNIQUE_ID	OWEB grant #	Crossing_Description
5	SC-009	Bridge
24	097-067	Bridge
33	097-067/099-070	Bridge
35	097-067/099-070	Bridge
43	099-311	Bridge
44	099-311	Bridge
54	097-096/099-488	Bridge
55	097-096	Bridge
56	097-096	Bridge
57	097-096	Bridge
66	098-071	Bridge
70	098-137/099-461	Bridge
76	200-058A	Bridge
77	200-058A	Bridge

|

Table 5 list culvert sites and the predicted percentage of passable modeled flows along with presence and absence information about juvenile salmonids. We rated a particular culvert as having either fish present upstream (yes/no), unknown (UNK) due to poor visibility when snorkeling, or no viable habitat found within 135 meters upstream of a culvert (NOHAB). Twenty culverts were categorized as stream simulated awhile 11 culverts contained baffles.

Table 5. Culverts analyzed with FishXings showing the percent of passable modeled flows for juvenile salmonids and the results of field snorkel surveys for juvenile salmonids. Yes = juveniles observed, UNK = too low of visibility to determine and NOHAB = surveys could not find viable habitat within 330 meters upstream of culvert.

Unique ID	OWEB grant #	Predicted % Passable of Modeled Flows	Juvenile Salmonids Observed Above Culvert	Unique ID	OWEB grant #	Predicted % Passable of Modeled Flows	Juvenile Salmonids Observed Above Culvert
2.1	SC-007	69.30%	UNK	31	098-055	6.10%	Yes
3	SC-009	2.20%	Yes	32	098-055	3.90%	Yes
4	SC-009	0.00%	UNK	36	097-067/099-070	3.40%	Yes
6	097-067	18.60%	UNK	45	099-310	17.90%	Yes
9	097-240	1.20%	Yes	46	099-310	41.20%	Yes
10	097-240	0.00%	Yes	47	099-310	37.80%	Yes
11	097-240	1.80%	Yes	48	099-466	1.20%	Yes
131	SC-009	0.00%	Yes	50	099-113	0.00%	Yes
132	SC-009	0.00%	Yes	52	099-461	6.50%	Yes
14	SC-009	2.40%	Yes	58	097-096	29.30%	Yes
18	096-164/099-113	0.00%	Yes	67	099-466	5.20%	Yes
19	098-137	0.2%	Yes	68	099-466	3.10%	Yes
20	099-113	0.00%	Yes	69	099-461	0.40%	Yes
21	098-137	0.00%	Yes	71	099-041	0.80%	Yes
22	SC-009097-075	3.60%	UNK	72	099-041	0.00%	Yes
23	097-075	2.80%	UNK	73	098-137/099-461	0.00%	Yes
26	098-055	0.10%	Yes	74	098-137/099-461	0.00%	Yes
27	098-055	0.00%	NOHAB	75	200-056	0.00%	Yes
28	098-055	0.00%	NOHAB	80	SC-017	0.00%	Yes
29	098-055	3.90%	Yes	82	SC-017	0.00%	Yes
30	098-055	3.10%	Yes	84	099-466	3.90%	Yes

Table 6 illustrates the breakdown of 3 categories of fish survey results compared with 6 categories of the percentage of passable flows. Thirteen sites had juveniles present upstream of a culvert while the culvert was predicted to be a 100% barrier to juvenile passage. One culvert was rated as being 100% juvenile barrier and fish presence was rated as unknown (UNK). Two no habitat culverts were identified and FishXings predicted that these culverts would be a 100% barrier to juveniles. Culverts with a range of passable flow from 0.1 – 4.0% totaled seventeen. Fifteen of the culverts had juveniles upstream, and two culverts were rated as unknown for fish presence. All three of the culverts rated as allowing juveniles to pass through a range of flows from 5.0 – 10% had fish present upstream. Two culverts had 11.0 -20.0% range of passable flows; one had fish present and the other was unknown.

Table 6. Breakdown of number of sites where fish presence was positive (yes) and unknown or no habitat existed compared with the range of passable modeled flows.

Range of Passable Flows	Juveniles Present		
	Yes	Unknown	No habitat
0%	13	1	2
0.1 - 4.0%	15	2	0
5.0 - 10.0%	3	0	0
11.0 - 20.0%	2	1	0
21.0 - 50.0%	2	0	0
> 50.0%	0	1	0

Discussion

Our field study showed that juvenile salmonids utilize the habitat upstream of the grand majority of the restoration projects (culverts, bridges) surveyed in this study. Our modeling exercise predicted that juvenile passage at culverts would be limited to a small percentage of flow rates.

Even though only small percentages of total modeled flows are considered passable on many of these culverts, those predicted flows are in a range that would probably occur from early to late spring through the summer to early to late fall. These flows would coincide with the migration times of many juvenile salmonids. It is beyond the scope of this study to determine the seasons when the predicted passable flows occur at each site. However, because FishXings predicted that juveniles have a range of flows available to pass through a certain culvert (no matter how small the range), and we found juvenile fish upstream of the certain culvert, we assume that juvenile fish are successfully passing through the culvert.

The results presented here seem to conflict. On one hand, we have culverts that are considered juvenile barriers, yet juveniles were found to utilize the habitat upstream of the said barrier. Additionally, we determined that at least 20 culverts were designed specifically to simulate streams and were also predicted to be partial barriers to juvenile salmonid passage. Those same 20 stream simulated culverts also have juvenile salmonids rearing upstream. We also must recognize that the juveniles may not have migrated through these predicted barriers. We may be seeing fish that are rearing in their natal habitat prior to heading downstream out to sea.

It seems doubtful that a stream simulated culvert would prevent passage to juvenile fish. Stream simulated design seeks to create conditions where a wide variety of fish are able to pass through a culvert at a variety of gradients. The concept involves using a roughened culvert bottom composed of natural bed material that mimics the slope and often exceeds the width of the channel. For example, Site 11 (Photo 1) is a bottomless arch culvert with stream simulated design. The mean stream gradient within 100 meters upstream and downstream of the culvert was 2%. The gradient through the culvert was a -0.43%. This culvert was countersunk. The inlet width to channel gradient width was 0.39. The tail water control was .06 meters above the invert inlet and 0.10 meters below the outlet invert. This structure was predicted to allow juvenile salmonids to pass through 1.8% of modeled flows. Modeled passable flows ranged from 0.0800 to 0.5390 cms (2.85 to 19.03 cubic feet per second). That is a wide range of flows in terms of volume and potential temporal variation. Again, it is beyond the scope of this study to determine when the predicted passable flows would occur at each site. But that range of flows would provide juvenile salmonids ample opportunity to pass through the culvert.



Photo 1. Site 11 bottomless arch rated as allowing juvenile to pass through only 1.8% of the modeled flows.

We discussed the conflicting results with people familiar with stream simulated design. Keith Mills, State Forests Engineer for the Oregon Department of Forestry believes stream simulated culvert design should allow juvenile fish to pass (personal communication). Michael Love co-designer of FishXings stated that the FishXings software may fall short of predicting barriers on stream simulated design culverts (personal communication).

To look at the issue of stream simulated design analysis for juvenile crossings using FishXings, we went to the example data provided in the software package. The Quarry Road Crossing on Marsh Creek is used in FishXings as an example of modeling stream simulated design on a culvert arch culvert. Modeled fish passage flows range from 2 cfs to 34.5 cfs. The culvert slope is 0.78%. The outlet invert elevation equals the minimum tail water elevation. Maximum water velocity is set for 4 feet per second. This implies the model is run for an adult fish passage. When running the model at these settings, FishXings predicts 100% success for fish passage. However, we reset the maximum water velocity to 1 foot per second (mimic juvenile speed) and the model predicts that 0% of the modeled flows will be passable by fish. In this example, we see that FishXings predicts a 100% passable culvert for adults and a 100% barrier for juveniles. It seems that the model may be too conservative at predicting results for stream simulated culverts.

We also used FishXings to model culverts with baffles. Baffles generally increase roughness in culverts and reduce the internal water velocity to a level acceptable for fish

passage. Washington State Department of Fish and Wildlife (2003) states that baffles need to satisfy certain velocity requirements, and the turbulence they generate must not be so much that it creates a barrier to fish passage. FishXings has a function for reducing velocity factors within the 3 areas of a culvert; the outer and inner zone and the barrel zone. We wanted to apply the velocity reduction factors to culverts with baffles. However, the software model developers discouraged the use of the velocity reduction factors (Michael Love, personal communication). Hence, they were set to 1. Furthermore, our literature search found that FishXings may not work well for evaluating culverts with baffles. Cahoon et al. (2007) stated that hydraulic modeling with FishXings was inappropriate with baffled culverts.

Furthermore, Cahoon et al. (2007) conducted thorough field research on fish passage and FishXings on warm water fishes in Eastern Montana. Researchers found that 52% of the predictions by FishXings were incorrect when compared with actual field observations. In this study there were three instances where FishXings did not correctly predict field observations;

- a. FishXings predicted a range of flows (window) where fish could pass and the field study showed that fish passed outside of the window
- b. FishXings predicted a window of flows in which fish would pass, but field observation showed fish did not pass through that flow window
- c. FishXings predicted that a culvert was a barrier, yet fish were observed passing through the culvert.

The authors of the study concluded that FishXings has shortcomings in predicting the barrier status of existing culverts. They also state that the model has good success for predicting when a fish can pass through a culvert. In other words, if the model predicts that the culvert is passable by a certain fish, it usually is. This led the researchers to determine that FishXings successfully predicts fish passage but is very conservative and falls short of predicting barriers. The authors do believe that the software can assist in designing a future successful stream crossing.

The conclusions of Cahoon et al. (2007) directly relate to our study. We found fish above many of the culverts that FishXings predicted to be full and partial barriers. Even if we can explain the presence of juveniles upstream of these predicted barriers (juvenile fish rearing in their natal streams), we still have the issue of stream simulated culverts predicted as barriers.

Many of the culverts in our study are rated as partial barriers. That means that some percentages of the flows we modeled are passable by juveniles. Since we have found juvenile salmonids upstream of those culverts, we assume that juveniles are passing through these culverts. How do we explain culverts predicted to be 100% barrier to juveniles that had juveniles present upstream of the predicted total barriers?

To try and answer that question, we qualitatively considered barriers that FishXings predicted to block juveniles 100% of the time.

Table 7 list the 15 culverts predicted to be 100% barriers to juvenile passage and those culverts are reviewed below.

Table 7. A list of 15 culverts predicted to be 100% barriers to juvenile passage and qualitative notes explaining the culvert condition. 3 of these barrier culverts are on non-fish bearing streams. 8 of these culverts are most likely barriers (italicized). 4 of these culverts do not appear to be barriers (Sites 18, 20, 50 and 21). The 8 italicized culverts are a priority for re-inspection and consideration for repairing or replacing.

Unique ID	OWEB grant #	Predicted % Passable of Modeled Flows	Juvenile Salmonids Observed Above Culvert	Qualitative Notes
4	SC-009	0.00%	UNK	Concrete culvert on marginal stream, probably not fish bearing stream
<i>10</i>	<i>097-240</i>	<i>0.00%</i>	<i>Yes</i>	<i>> 0.1 meter outlet drop</i>
<i>131</i>	<i>SC-009</i>	<i>0.00%</i>	<i>Yes</i>	<i>> 0.1 meter outlet drop</i>
<i>132</i>	<i>SC-009</i>	<i>0.00%</i>	<i>Yes</i>	<i>> 0.1 meter outlet drop</i>
18	096-164/099-113	0.00%	Yes	Baffled, 4.8% slope
20	099-113	0.00%	Yes	2% slope Sediment filled
21	098-137	0.00%	Yes	Stream simulated design
27	098-055	0.00%	NOHAB	Ephemeral and steep, probably not fish bearing stream
28	098-055	0.00%	NOHAB	Ephemeral and steep, probably not fish bearing stream
50	099-113	0.00%	Yes	3% Channel, 7.8% culvert slope, Stream simulated design
<i>72</i>	<i>099-461</i>	<i>0.00%</i>	<i>Yes</i>	<i>5% culvert with little velocity reduction, but some stream simulation</i>
<i>73</i>	<i>098-137/099-461</i>	<i>0.00%</i>	<i>Yes</i>	<i>Clear with no obstruction, velocity unimpeded</i>
<i>75</i>	<i>200-056</i>	<i>0.00%</i>	<i>Yes</i>	<i>Clear with no obstruction, velocity unimpeded</i>
<i>80</i>	<i>SC-017</i>	<i>0.00%</i>	<i>Yes</i>	<i>Very steep with baffles</i>

Unique ID	OWEB grant #	Predicted % Passable of Modeled Flows	Juvenile Salmonids Observed Above Culvert	Qualitative Notes
82	SC-017	0.00%	Yes	<i>Clear with no obstruction, velocity unimpeded</i>



Photo 2 . Site 10 predicted to be a 100% barrier to juveniles. The culvert has a > 0.1 meter outfall drop.

Site 10 (Photo 2) clearly illustrates a greater than 0.1 meter outlet drop indicating a juvenile barrier.

Both Sites 131 and 132 had greater than 0.1 meter outlet drops, but juveniles were observed upstream of the culvert. These culverts may be barriers to juveniles. (See Photolog and Site Reports)

Site 18 is a 4.8 percent culvert with baffles on a ~ 4% gradient channel. It is rated a velocity barrier, but juveniles were found above the culvert and juveniles were seen in the culvert at the time of survey. It does not look like a barrier.

Site 20 seems to be designed properly and is acting as stream simulation, yet it is predicted to be a velocity barrier to juveniles. It is probably not a barrier.

Similarly Site 21 (Photo 3) was predicted to be a juvenile barrier, yet it is clear that this culvert is stream simulated and probably not a barrier.



Photo 3. Site 21, stream simulated design predicted to be a 100% juvenile barrier because of velocity.

Site 50 seems to be designed properly (although it has a 7.8% slope) and is acting as stream simulation, yet it is predicted to be a velocity barrier to juveniles. It is probably not a barrier.

Site 72 had a 5% slope and little velocity reduction factors available. This culvert needs to be monitored, but juvenile fish were present upstream.

| *Site 73 had a significant outlet drop ([Photo 4](#)) and is clearly a barrier to fish passage.*

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Photo 4. Site 73, a clear barrier due to the outlet jump.

| Site 75 (~~Photo 5~~~~Photo 5~~), a recently installed culvert was so clear and free in terms of a lack of velocity reduction factors, it would seem very likely to be a juvenile barrier.

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Site 80 had a series of baffles installed. Yet the culvert had a 7% gradient while the channel gradient was only 1.1%. This seemed to be a clear juvenile barrier. (see photo log and site reports)

| Site 82 (~~Photo 6~~~~Photo 6~~) was very similar to Site 75 in that it was free and clear with no obstruction to lower velocity.

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Sites 4, 27, and 28 do not appear to be on fish bearing streams. FishXings seems to have predicted these barriers correctly (Please see the site notes for the reason why these culvert were surveyed).



Photo 5. Site 75 predicted to be a 100% velocity barrier to juveniles; notice no objects present to retard velocity.



Photo 6. Site 82, velocity barrier, clear with no obstructions.

Recommendations

The recommendations presented here are based solely on observations made during this study.

- Revisit the 8 sites highlighted above and in Table 7 that appear to be juvenile barriers and evaluate if repairing the culverts is possible. If not, consider the cost benefit of replacing the culverts.
- Expand this study to look at the time of year that the expected passable flow range predicted by FishXings would occur at each site. This could be carried out using the regional regression equations in conjunction with ArcHydro. Then link those results to when juvenile species are expected to be migrating. This would help determine if the percentage of passable flows coincides with juvenile migration patterns.
- Consider further monitoring of juvenile passage using a sophisticated study design similar to the study ODFW conducted at Crowfoot Falls (Appendix A).

We recognize that upgrading stream crossings requires engineering and must be considered in terms of channel dynamics, safety, and cost; however, this study leads us to suggest that when upgrading a stream crossing, the first consideration should be removing the crossing completely. This was done at Site 12 (McNight Creek). Next consider replacing the crossing with a bridge. If removing the crossing or installing a bridge is impossible, consider installing a stream simulated bottomless arch. When possible, strive for reducing the overall gradient at the stream crossing. Countersinking a culvert seems to work best.

Conclusion

This study used both field analysis and software modeling to make predictions about whether juvenile salmonids are able to pass through stream crossings that have been upgraded within the last ~ 20 years. Field analysis included channel and culvert measurements and snorkel surveys. Software modeling consisted of modeling low flow rates at specific locations using regional regression equations and FishXings software.

We found several different types of upgrades present on the landscape:

- 42 Culverts
- 14 Bridges
- 1 Ford (removed crossing, decommissioned road)
- 1 Push-up dam
- 1 log placement survey
- 2 fish ladders
- 3 fish screens

The channel morphology in terms of slope and bed form at bridges does not impair juvenile fish passage. Juvenile salmonids were found above all of the bridge crossings.

In terms of culverts, FishXings predicted that none of the structures would allow juvenile salmonids to pass 100% of the time. However, there are limitations to the FishXings model predictions. We estimate, that of the 42 culverts surveyed, 8 are probable barriers to juvenile passage, 3 were not on fish bearing streams, and the remainder are passable by juveniles at certain flow conditions. We are not certain that the flow conditions suitable for passage coincide with juvenile migration patterns, but we suspect that there is a positive relationship between predicted passable flows and the seasons when juveniles migrate.

The ford and push-up dam we surveyed had a gradient and channel form that would easily allow juvenile passage. One fish ladder was completely fenced off, so we were not able to determine if it allowed passage. The other fish ladder, was at a steep waterfall. ODFW had conducted intense fish surveys at this location and have deemed the falls to be a partial barrier to migration. The fish screens were difficult to assess; however, we determined they were in good repair and mechanically sound. The log placement survey showed that logs were acting to accumulate sediment, provide habitat cover, and force pool formation.

The snorkel survey used ODFW protocol to determine juvenile salmonid (5 cm or less) presence upstream of the various projects. We found fish upstream of the grand majority of upgraded crossings. We cannot say whether those fish migrated through the various crossings, or if we observed them in their natal habitat.

Site Surveys

Coquille Sub-basin Site Reports

Site # 1 2009 Restoration Effectiveness Monitoring Summary

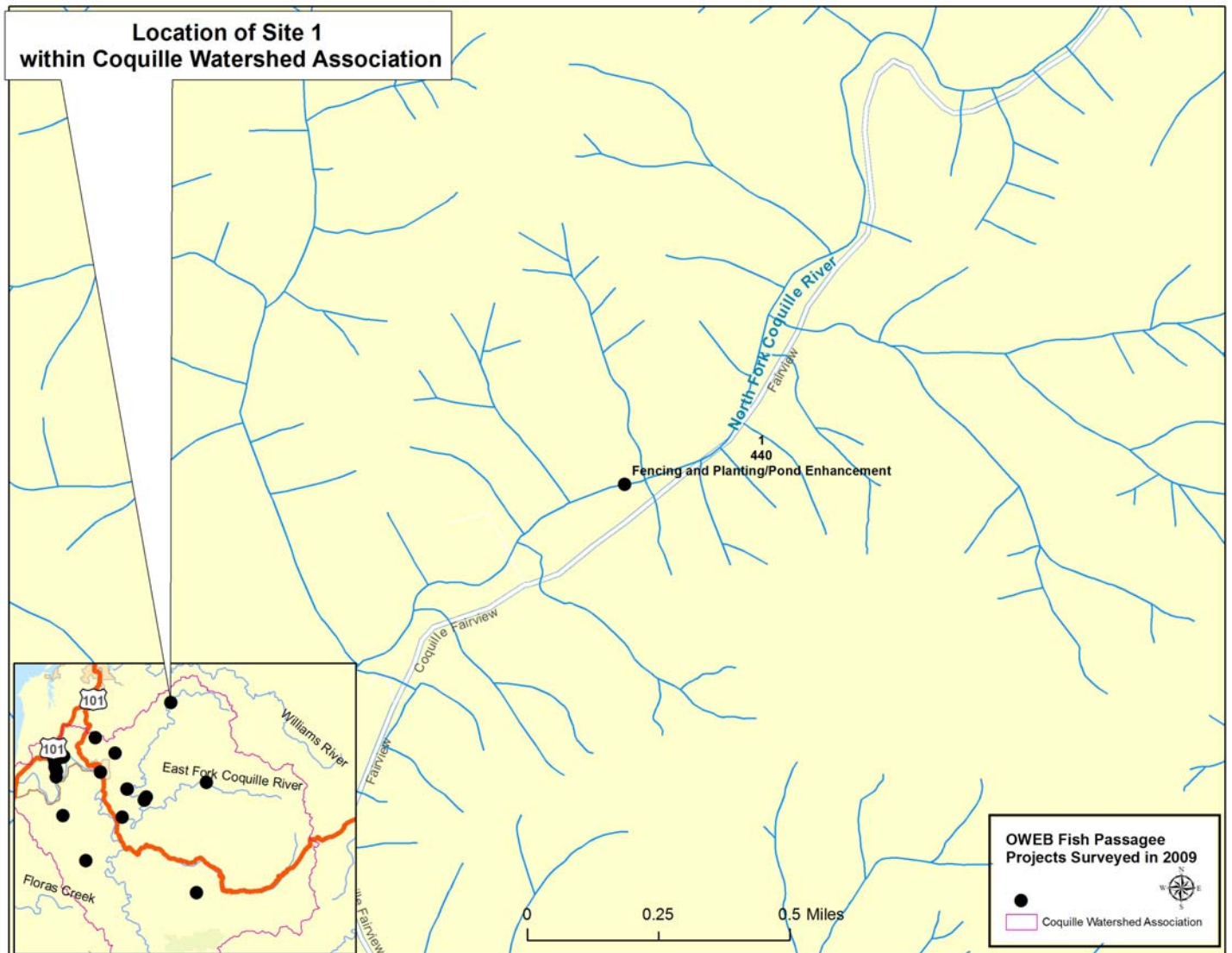
OWEB Project Name - Fencing and Planting/Pond Enhancement

OWEB Grant Number – SC-007

OWRI Project Number – 440

Owner – Multiple Owners, Manske Construction Corporation (current) J. Dooley (past) and Doug Perry (helpful neighbor)

OWEB Description – Combined



Map 2. Location of Site 2 within the region of the Coquille Sub-basin.

Site Notes

We arrived in the area and began to search for this project. We met a neighbor, Doug Perry, who stated that he remembered some work being done on the north side of the river (he lives on the south side). He took us to a fenced pasture that Mr. Perry claimed had not been utilized for some time.

We photographed the area that Mr. Perry said the State of Oregon fenced a while back. Photos of the fencing project can be seen in photolog. While photographing the riparian fence, we came upon a plate labeled J. Dooley, ODF, 11-30-1994. Mr. Perry said that J. Dooley was the previous owner of the land at that the fence was installed to keep cows out of the creek. The fence is in disrepair, but Mr. Perry says that no one has run cows on that pasture for at least 5 years.

We were never completely satisfied with this location, but this is where the OWEB point took us. We then asked Mr. Perry about a wetland/pond enhancement. He said he was unaware of anything like that in the area.

We continued our search for the wetland/pond. We did find a wetland very close to the riparian fence. It was the only wetland complex anywhere near the OWEB point. We took a series of photographs to validate our presence. However, this did not seem to be a wetland that would concern OWEB. We tried to make this work, but I think this site is lost.

Site # 2 2009 Restoration Effectiveness Monitoring Summary

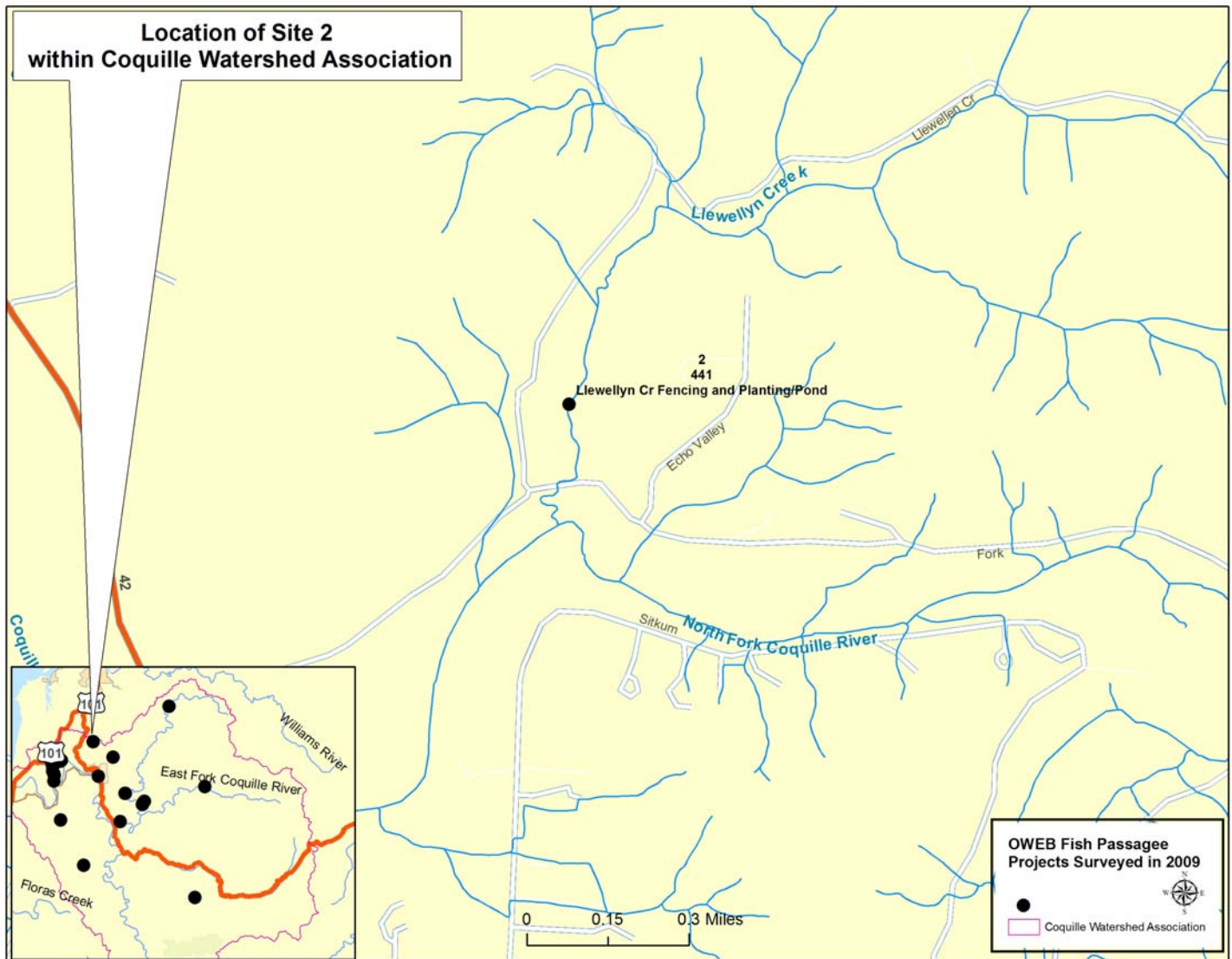
OWEB Project Name – Llewellyn Cr Fencing and Planting/Pond

OWEB Grant Number - SC-007

OWRI Project Number – 441

Owner – Private, Gary Larsen

OWEB Description – Fish Passage



Map 3. Llewellyn Creek Fencing and Planting Pond, Coquille Sub-basin.

Site Notes

This is an enclosure consisting of a riparian area surrounding a pond. The immediate area, within the enclosure around the pond, had been recently grazed. Water flows into the pond from a stream, but the stream is channelized and forced to stay within its current banks. Interestingly, the longitudinal profile indicates that the stream downslope of the pond had a higher elevation than the outlet of the pond. This means that the pond must overflow before downstream flow occurs. Reed canary grass and blackberries dominate the riparian area, but grazing seems to keep those invasive species in check as it does the willows as well. This is not an effective enclosure. The land owner, Mr. Larsen wanted to know if an enclosure functioned better if it is taken over by invasive species like blackberries and reed canary grass or if it would be better to let cattle occasionally graze to control invasive species. We cannot be sure, but an enclosure is meant by definition to exclude cattle. This enclosure was not functioning to exclude cattle.

Longitudinal and Cross-sectional Surveys

The longitudinal profile illustrates that the channel functions as a control of the outflow of the pond. Since the lowest point along the channel is the pond outlet, the pond must overflow and begin to flow into the channel to initiate flow downstream of the pond. Any water moving down the channel from upstream is funneled into the pond unless the pond is full. If the pond is full, that water will keep flowing down the channel.

Table 8. Longitudinal profile data for Site 2

Station	Elevation	Remarks
0	100.01	Begin Survey
6.5	99.76	
14.5	99.62	
30	99.60	Confluence with pond outlet
39	99.54	
45	99.57	
55	99.71	End Survey

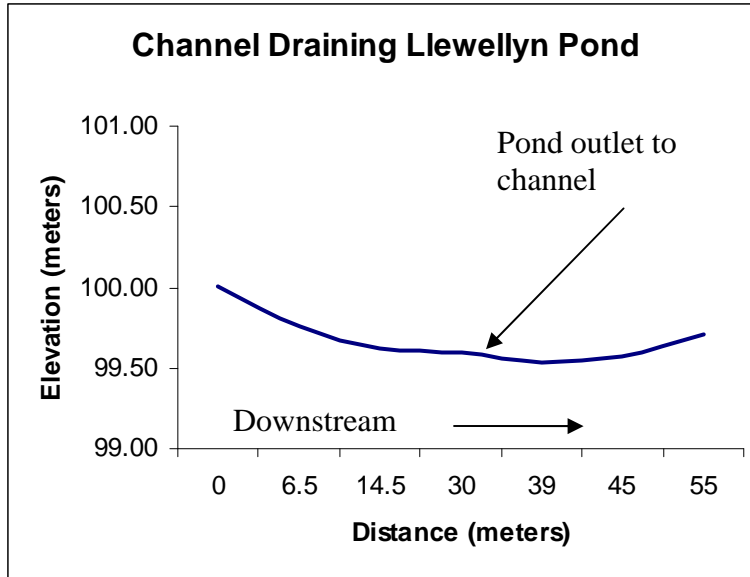
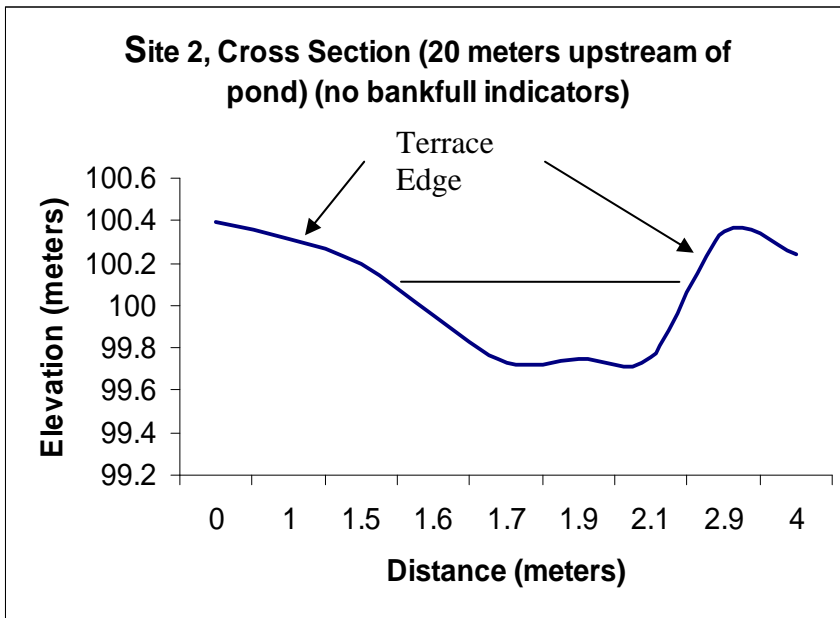


Figure 43. Longitudinal profile for Site 2.

The cross sectional data is less informative than the longitudinal survey data. From this we can only see that there were not bankfull indicators. This is actually a man-made ditch.

Table 9. Cross section data from Site 2.

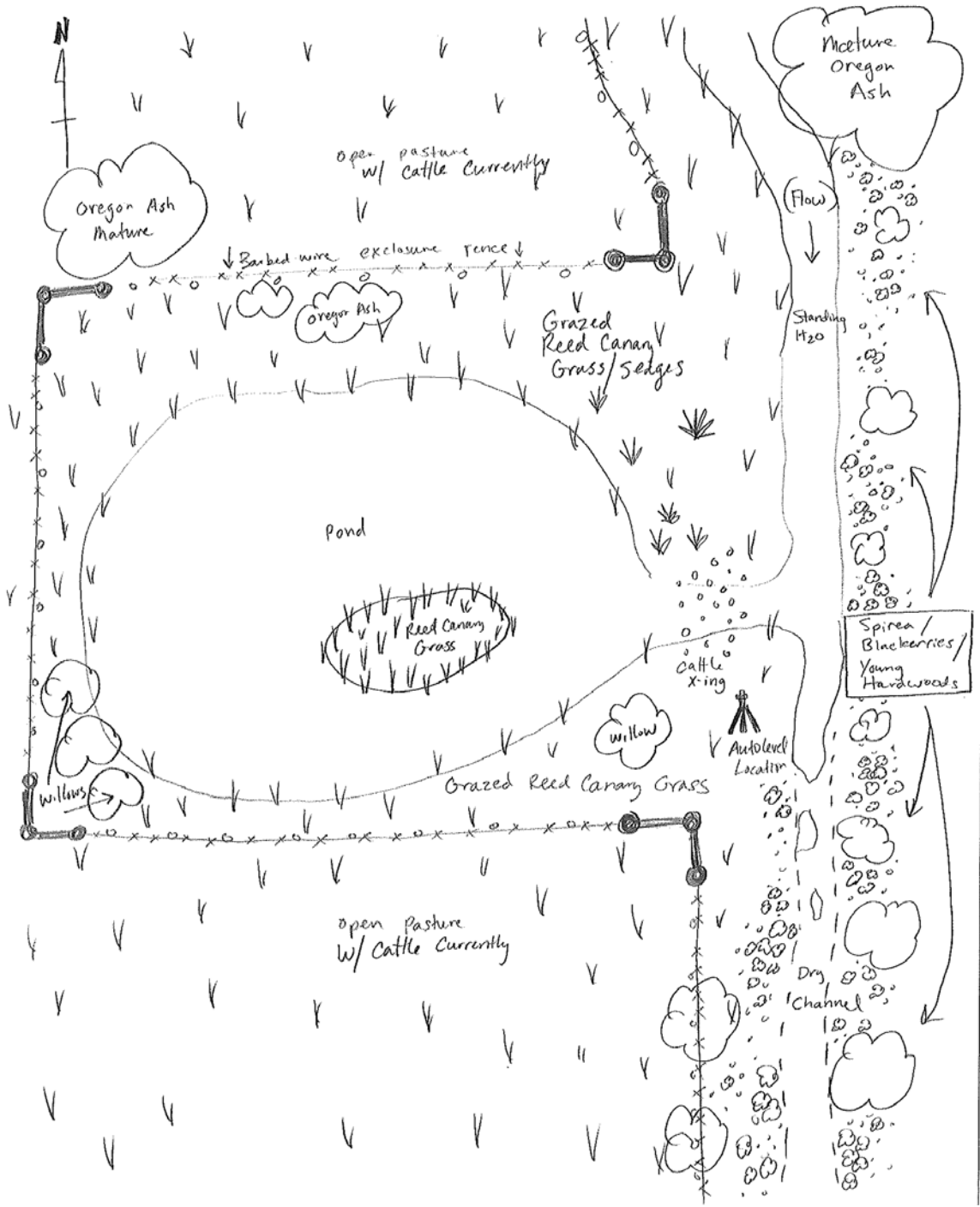
Station	Elevation	Remarks
0	100.39	Right Terrace
1	100.31	
1.5	100.2	Water Edge
1.6	99.95	
1.7	99.73	Thalweg
1.9	99.75	
2.1	99.76	Begin left Terrace
2.9	100.35	
4	100.24	



| Figure 54. Cross sectional diagram from Site 2

Site Sketch

ID #2(a) 1 of 2



Site # 2.1 2009 Restoration Effectiveness Monitoring Summary

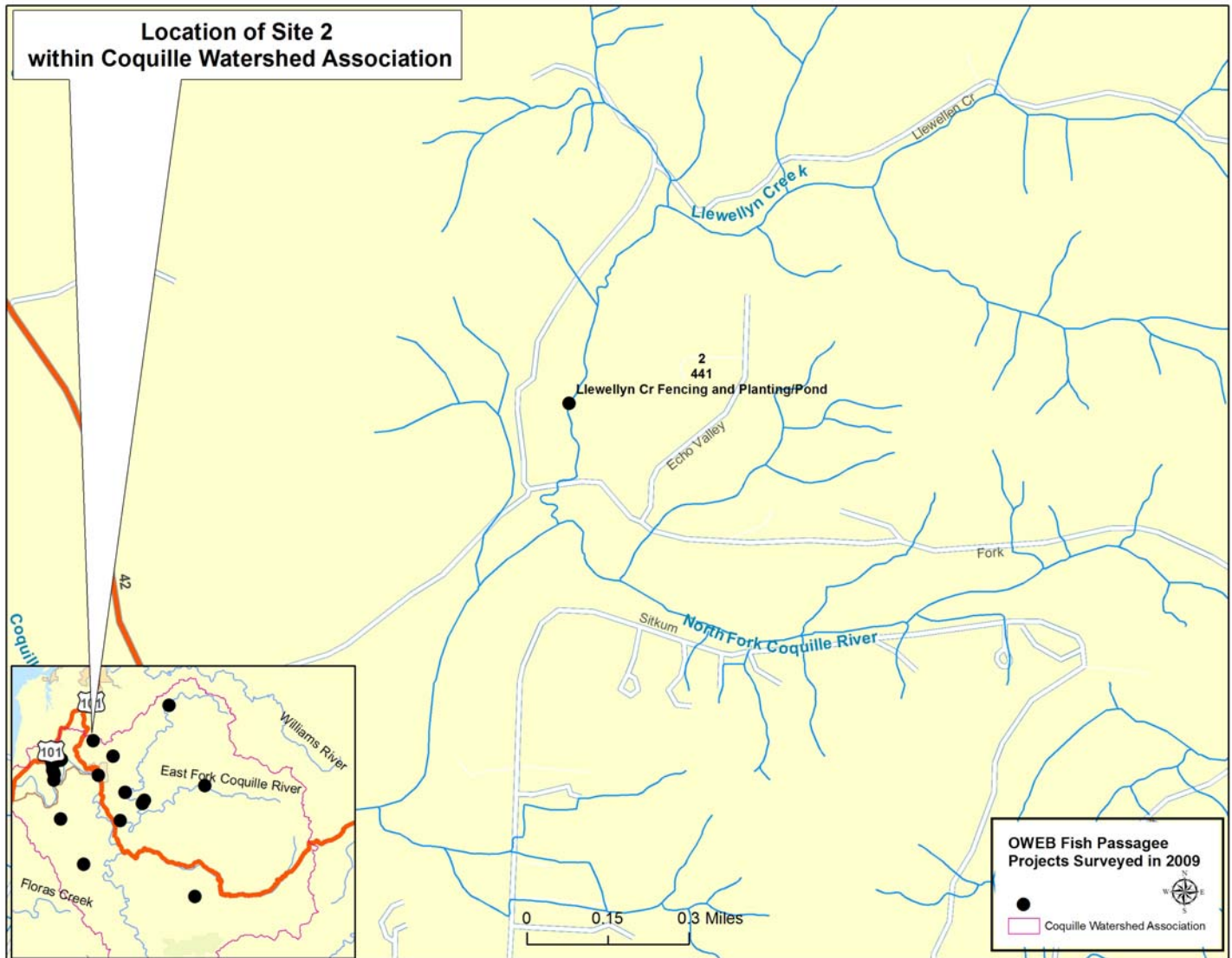
OWEB Project Name – Llewellyn Cr Fencing and Planting/Pond

OWEB Grant Number – SC-007

OWRI Project Number – 441

Owner – Private, Gary Larsen

OWEB Description – Fish Passage



Map 4. Location of Site 2.1 wetland/pond enhancement project where an additional culvert was located. The culvert surveyed in this report is approximately 200 meters upstream from the point on the map.

Site Summary Notes

This culvert was found ~200 meters upstream of the pond described in Site #2 while looking for water deep enough to snorkel. Since this looked like a relatively new culvert, and the fencing seemed to indicate that it was done as an enclosure, we thought that this may have been where we were supposed to go originally. Unlike the enclosure downstream and discussed in the report for Site 2, this enclosure functioned to keep cattle out of the creek. This is a moderately incised valley type channel. Channel gradient near the culvert was determined to be 1% while the culvert gradient was measured at -3.6%. This was a circular culvert with a diameter of 1.2 meters. We determined bankfull width upstream of the culvert to be 1.8 meters. This translates to an inlet width to channel width ratio of 0.67. Channel substrate was characterized as silt/sand/gravel while the substrate in the culvert was exclusively silt. The culvert was embedded throughout its entire length. Substrate depth at the inlet was 0.25 meters and at the outlet it was 0.46 meters. There was no outfall at the outlet. Water was relatively deep upstream of the culvert (0.4 meters deep) while it was shallow below the culvert (0.02 meters deep). The culvert was partially plugged by debris.

FishXings predicts that 69.3% of modeled flows would be passable at this culvert. These flows occur in summer at or near low flow.

Snorkel Notes

There was only one pool directly above the culvert; it was a 40 meter trench that was intensely covered by blackberries and reed canary grass. The visibility was extremely poor due to the vegetation cover and silt/detrital matter. We did not find any fish in this pool. We continued upstream for an additional 300 meters and only encountered puddles. We did not observe fish in any of these puddles.

FishXings Notes

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 10. Fish Passage Summary Site 2.1.

Fish Passage Summary	
Low Passage Design Flow	0.0020 cms
High Passage Design Flow	3.1100 cms
Percent of Flows Passable	69.3 %
Passable Flow Range	0.0020 to 0.2160 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.22 cms and Above
Pool Depth Barrier	None

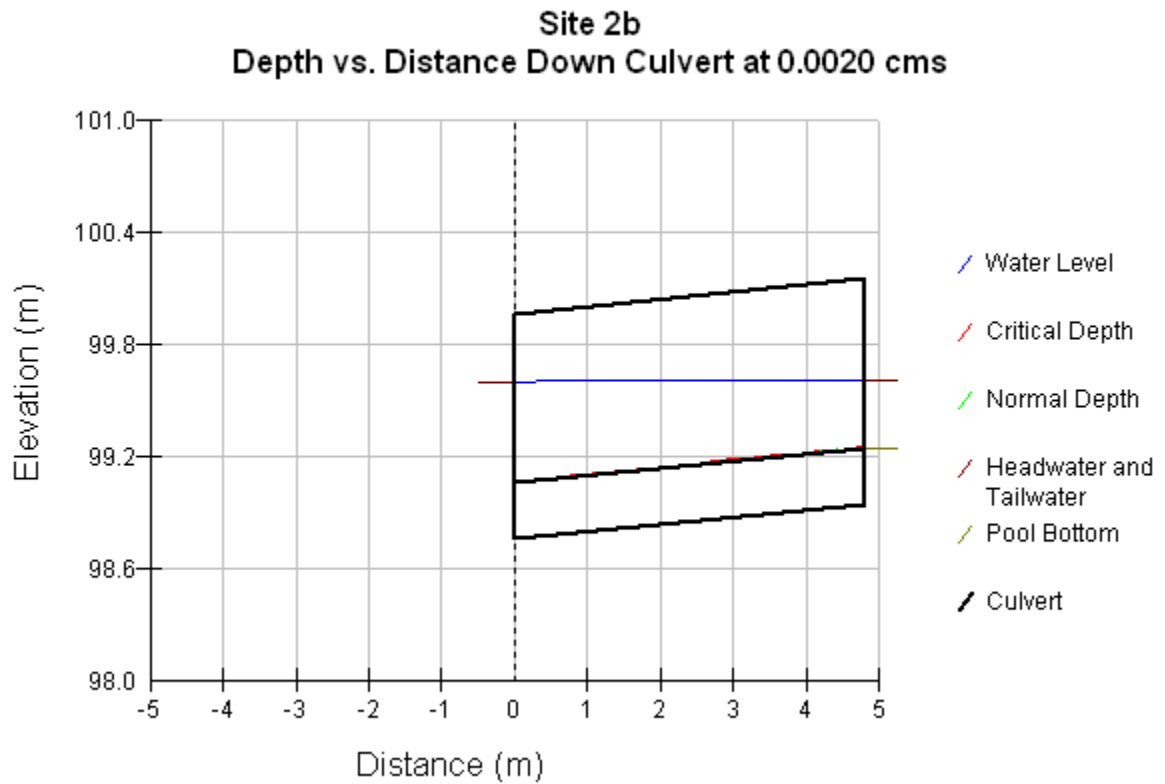


Figure 65. Water Surface Profile at 0.002 cms, Site 2a, illustrating water level at low flow.

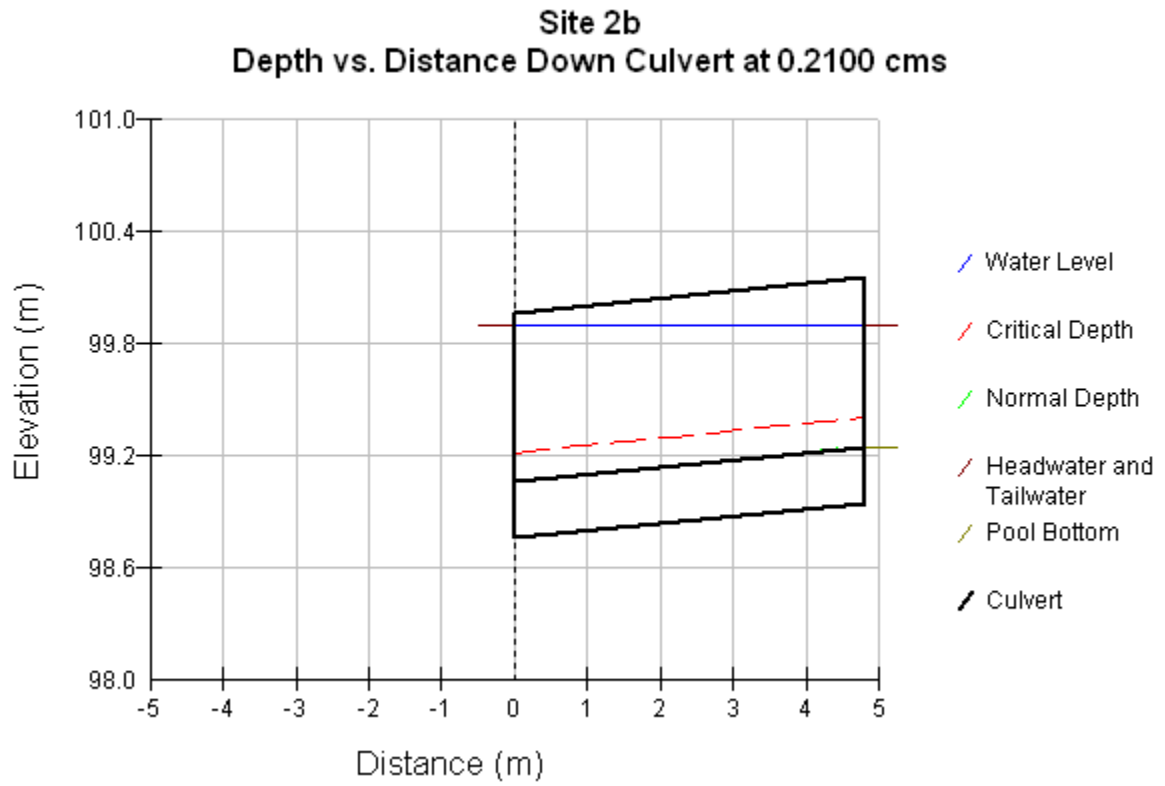


Figure 76. Water surface profile at 0.21 cms, Site 2a, illustrating water level when culvert becomes impassable for juvenile salmonids.

Site Sketch

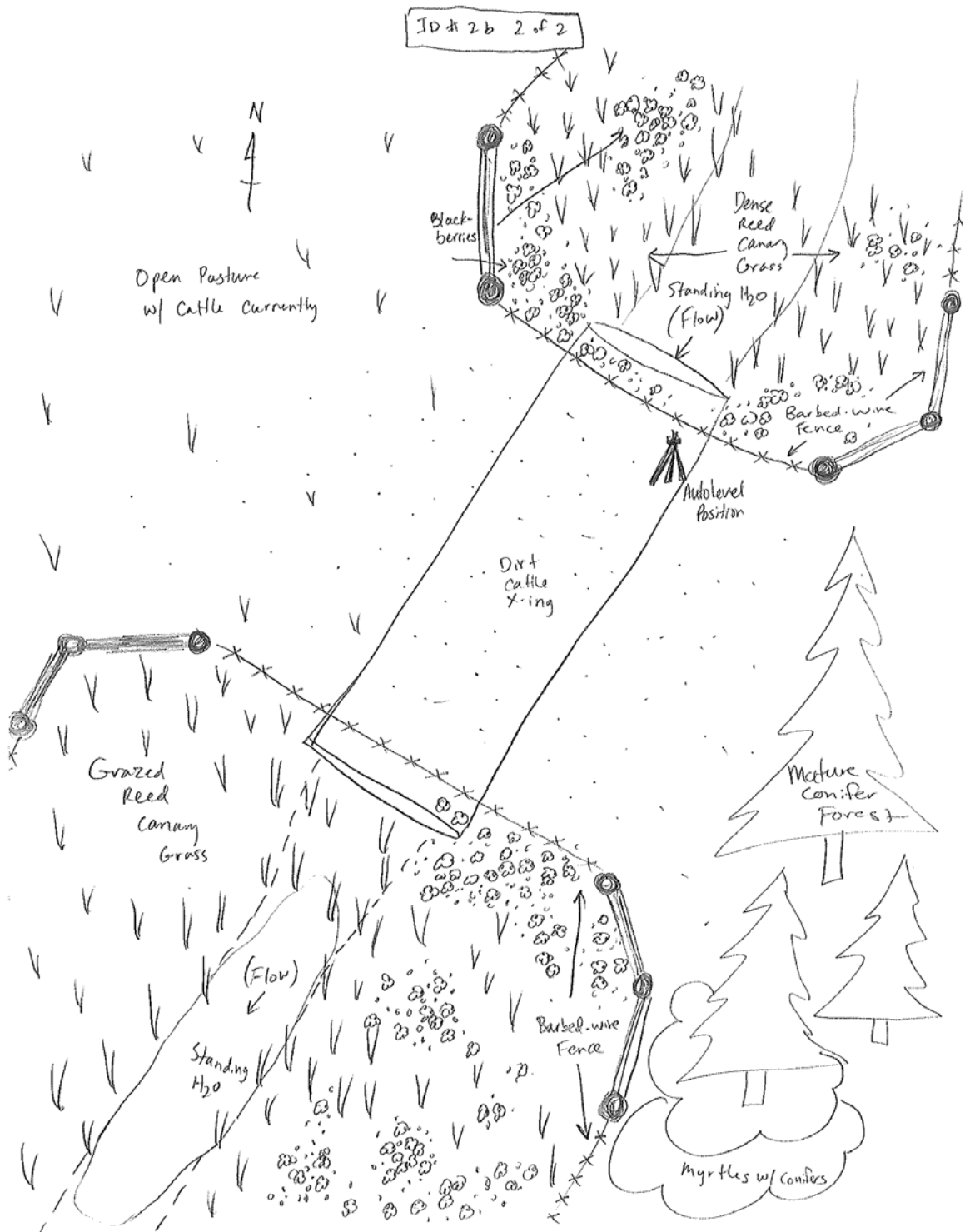


Figure 87. Site sketch of culvert on Llewellyn Creek.

Site # 6 2009 Restoration Effectiveness Monitoring Summary

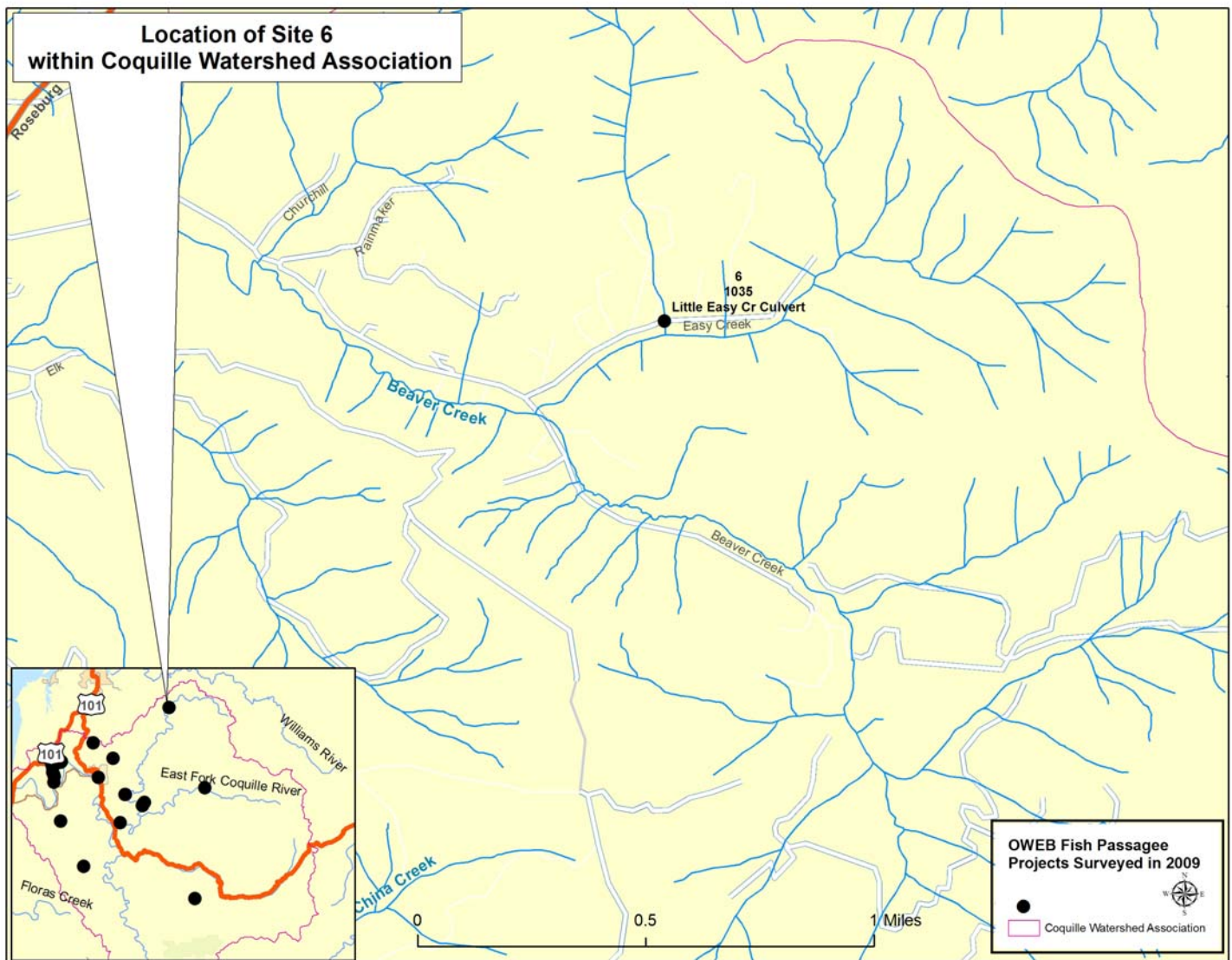
OWEB Project Name – Little Easy Creek Culvert

OWEB Grant Number – 097-067

OWRI Project Number – 1035

Owner – Private, Lucas Martin

OWEB Description – Fish Passage



Map 5. Site 6 at Little Easy Creek, Coquille sub-basin.

Site Notes

This is a low gradient channel that drains in a braided fashion and ends at a wetland just downstream of the main culvert outlet. The wetland is dominated by reed canary grass with cattails, willows, and red alder playing a subordinate role. Due to the fact that the culvert has a wetland both upstream and downstream of the culvert, bankfull indicators were lacking. Channel substrate was dominated by silt/sand/gravel upstream of the culvert. Downstream of the culvert silt and sand dominate the substrate, Channel gradient was 0.85% in the vicinity of the culvert, while the culvert gradient was -0.7% (countersunk).

This does not look like an OWEB culvert upgrade; it is a 36" plastic culvert, yet questioning the landowner, Mrs. Martin, she insisted that this is where the upgrades occurred nearly 10 years ago. In addition, the OWEB coordinates for this sight led us to this culvert.

The culvert has a flare at the culvert outlet that is 44" in diameter. A couple of wood duck boxes have been installed near the creek on both sides of the road. Approximately 70 meters above the inlet of the surveyed culvert is another plastic culvert 18" in diameter.

FishXings predicts that 19% of the flows at this culvert will be passable to juveniles. Velocity would become a block at .06 cms. See FishXings Results section for details.

Snorkel Results

We attempted to snorkel by surveying upstream some 300 meters. There were no pools and the mean water depth of the trickling stream was under 0.1 meters. However, the land owner Mrs. Martin told us that she had seen fish in this creek. The habitat may well improve upstream of the surveyed area, but this survey was not able to substantiate the claim that this stream supports salmonids.

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 1 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = .1 m

Table 11. Fish Passage Summary, Site 6.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	0.3110 cms
Percent of Flows Passable	18.60 %
Passable Flow Range	0.0010 to 0.0579 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.06 cms and Above
Pool Depth Barrier	None

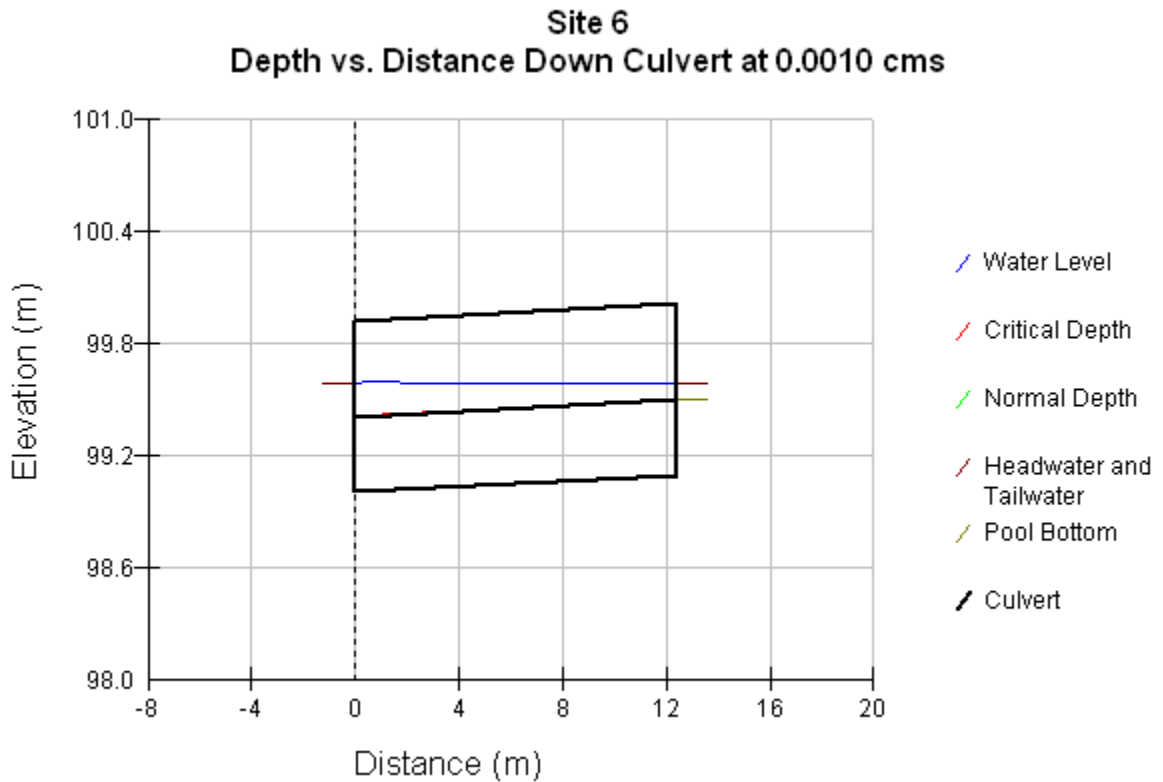


Figure 98. Water Surface Profile at 0.001 cms, at Site 6, passable.

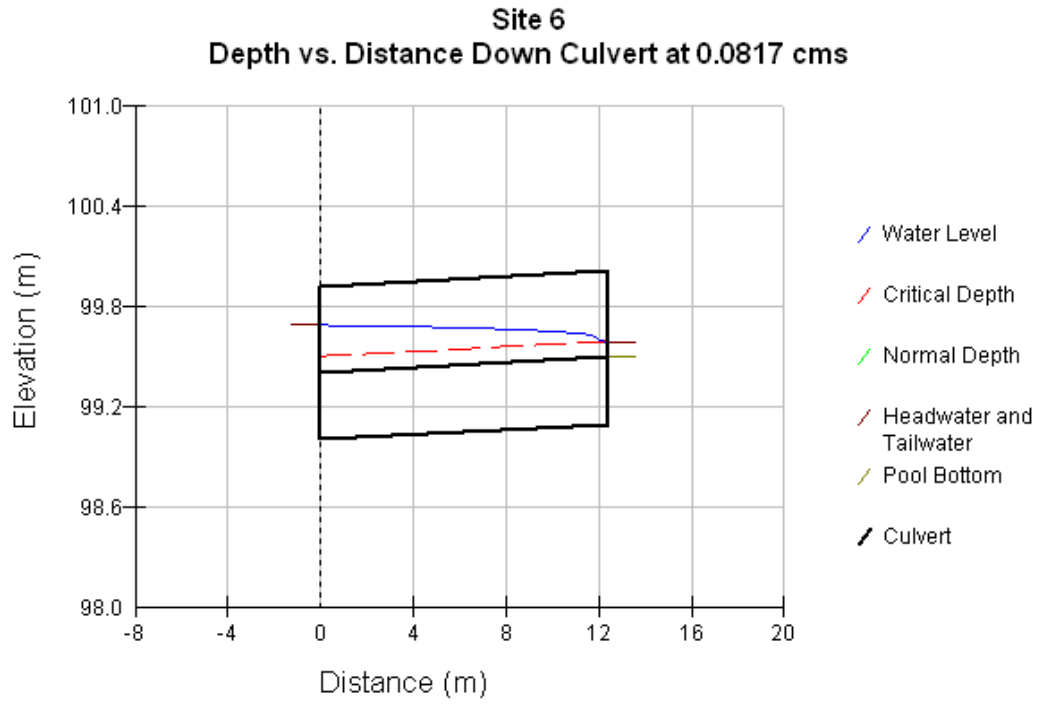
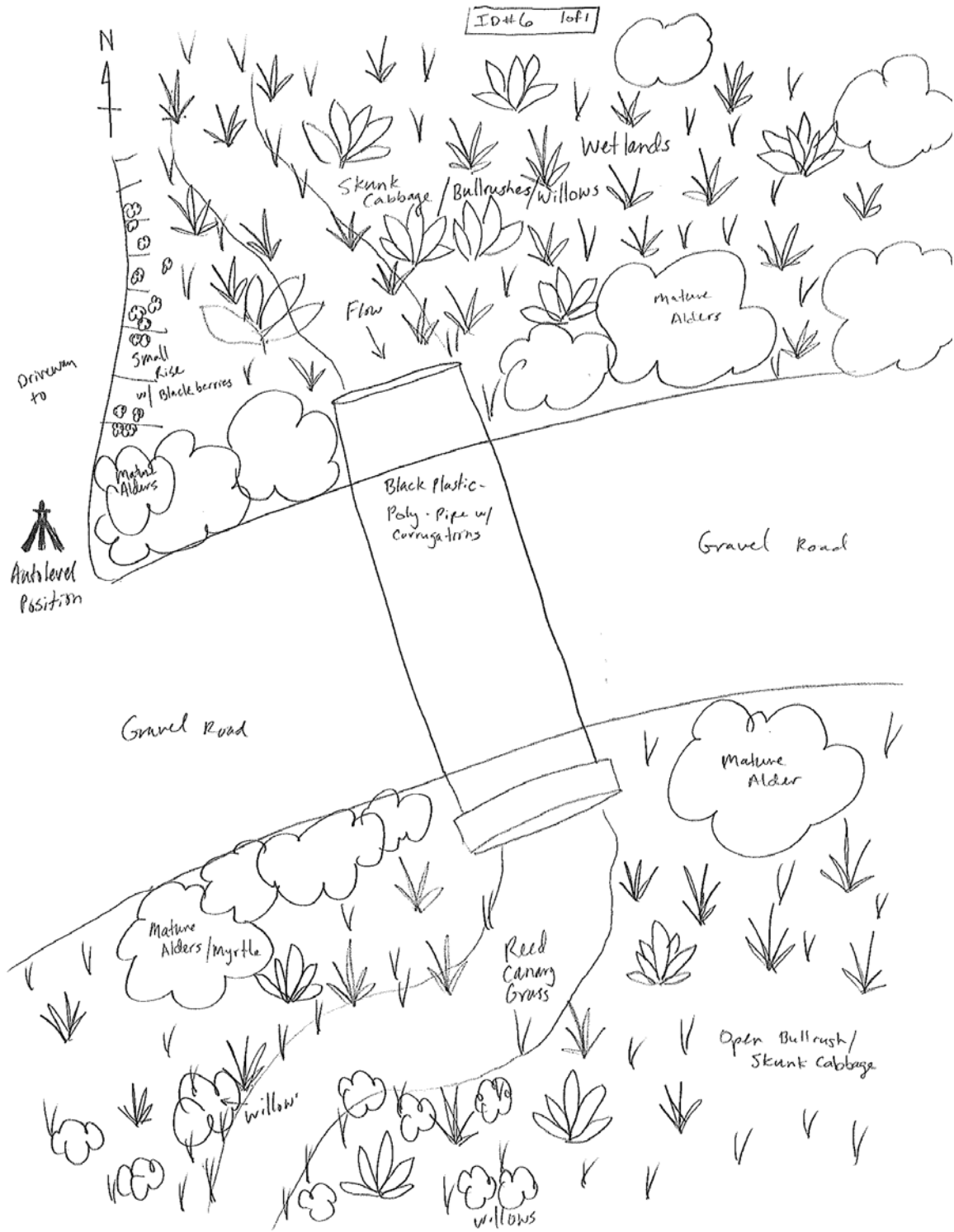


Figure 109. Water Surface Profile at 0.0817 cms at Site 6, velocity block.

Site Sketch



Site # 22 2009 Restoration Effectiveness Monitoring Summary

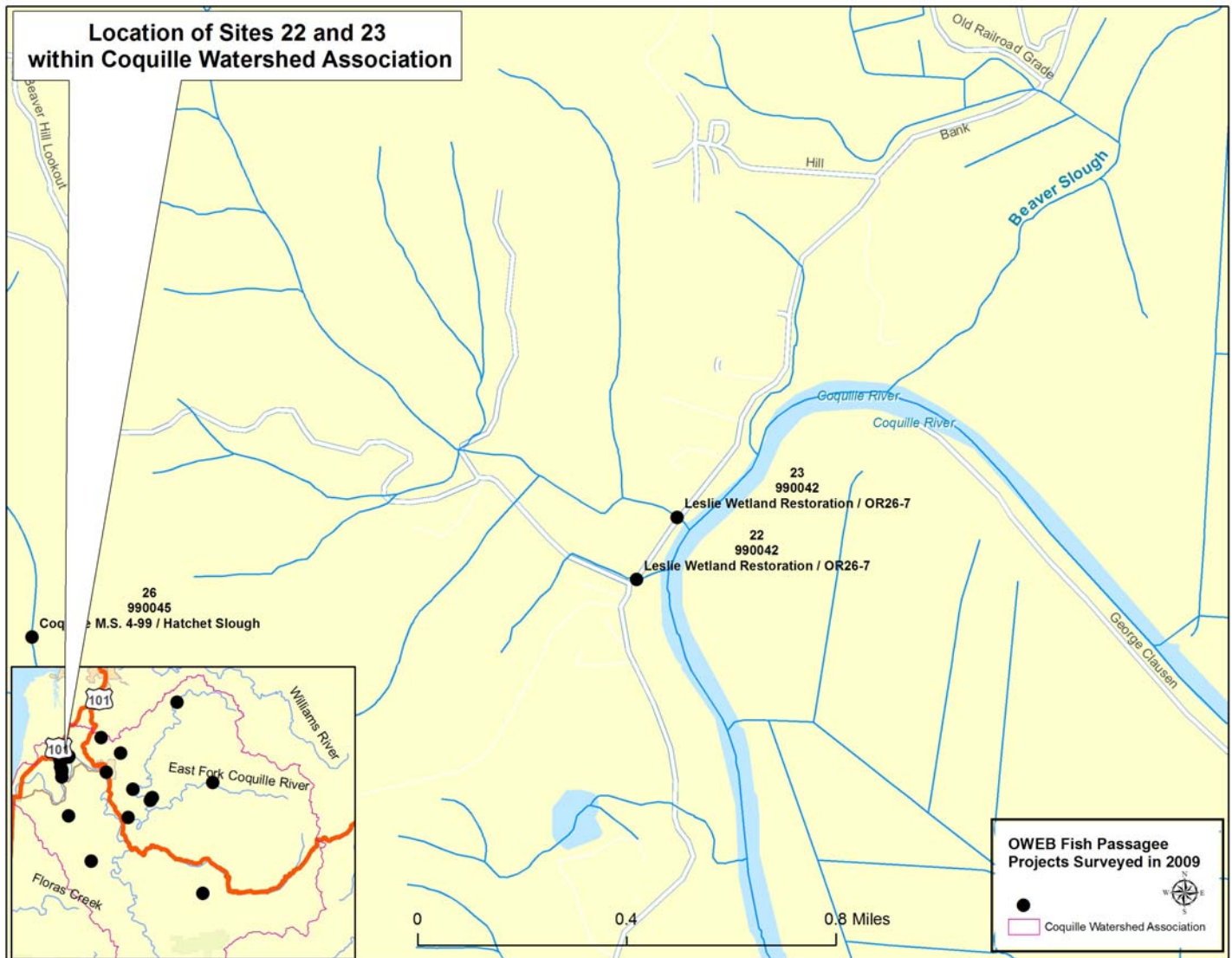
OWEB Project Name – Leslie Wetland Restoration / OR26-7

OWEB Grant Number – 097-075

OWRI Project Number – 990042

Owner – Private, Edith Leslie

OWEB Description – Fish Passage



Map 6. Location of Sites 22 and 23, Coquille sub-basin.

Site Notes

This is a very low gradient channel characterized by deep silt sediments and reed canary grass covered banks. It was incredible difficult to hold stadia on the substrate because it consistently sank into the muck. Most the sediment seems to accumulate inside of and just downstream of the culverts. There are two identical culverts here; one acts as an overflow culvert. The overflow culvert has very deep intense muck and small puddles that are extremely difficult to measure because of sediment depth. These culverts are affected by tidal water in the Coquille River. When the tide is up and the tide gates are open, brackish water certainly makes its way to these culverts. Snorkeling was impossible because of the intense detrital clouds that formed immediately upon moving the water. There is 0% visibility.

Substrate extended all the way through the culverts at an undetermined depth estimated at .3 meters. The bankfull widths taken upstream of culvert indicate a narrow channel at 1.9 meters; however, the flood prone width exceeded 100 meters and the channel is intensely incised. This bankfull measurement is misleading. Channel gradient was measured at 0.9% and culvert slope was measured at a -2.0%. Culvert slope measurements are misleading because of the depth and softness of the substrate within the culvert. There were no outlet drops.

FishXings predicts that 6.2% of the modeled flows will be passable.

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = .1 m

Table 12. Fish Passage Summary, Site 22.

Fish Passage Summary	
Low Passage Design Flow	0.0040 cms
High Passage Design Flow	18.4000 cms
Percent of Flows Passable	3.6 %
Passable Flow Range	0.0040 to .6741 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	.67 cms and Above
Pool Depth Barrier	None

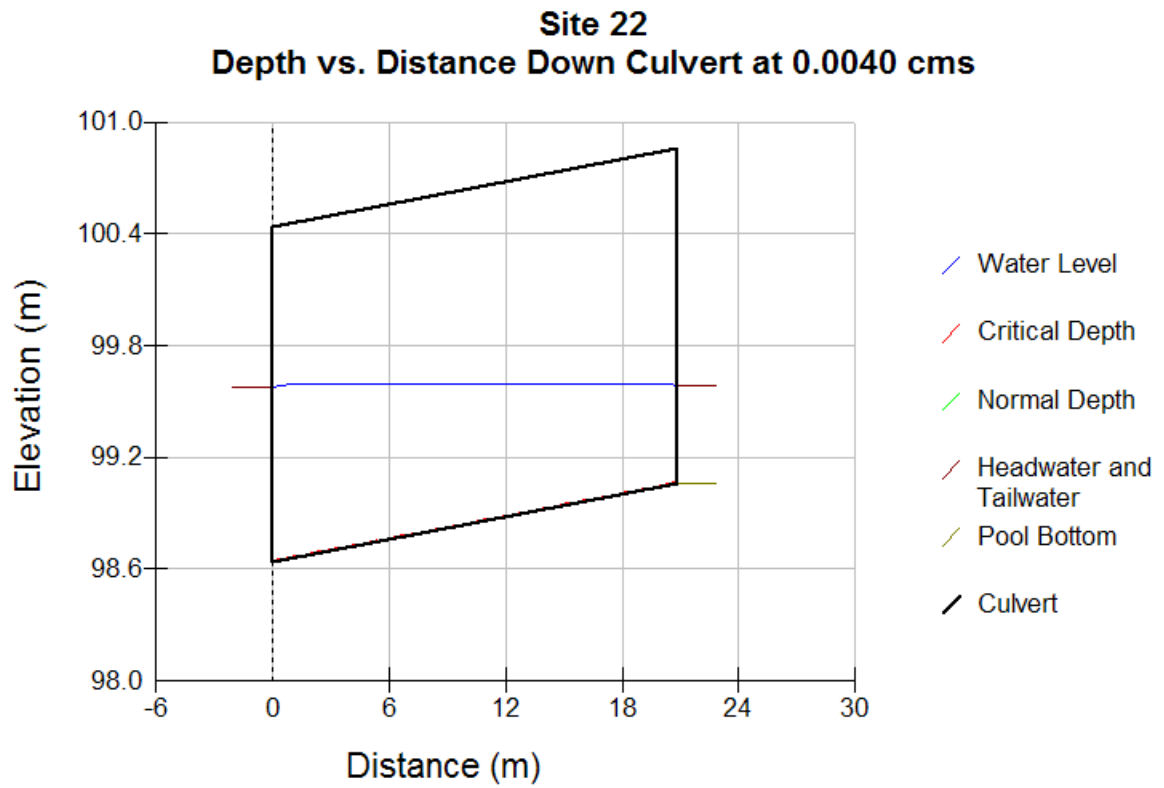


Figure 1140. Water Surface Profile at 0.004 cms, passable flow.

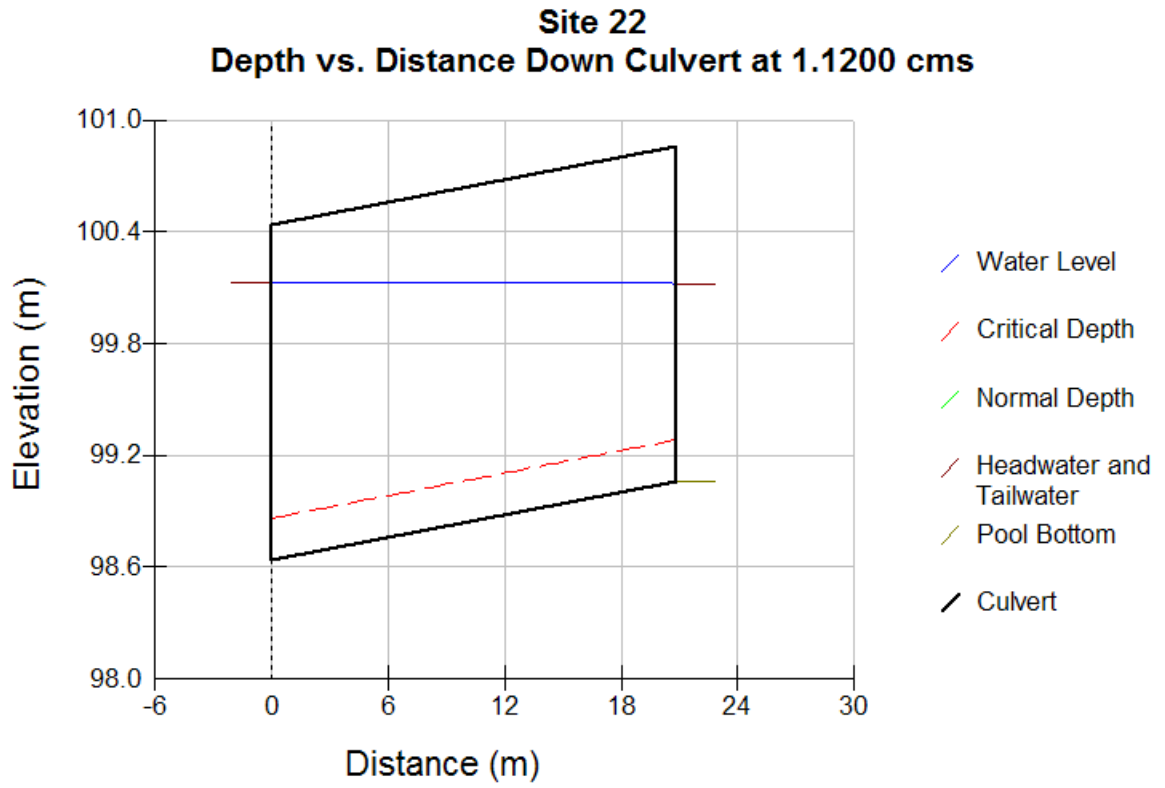
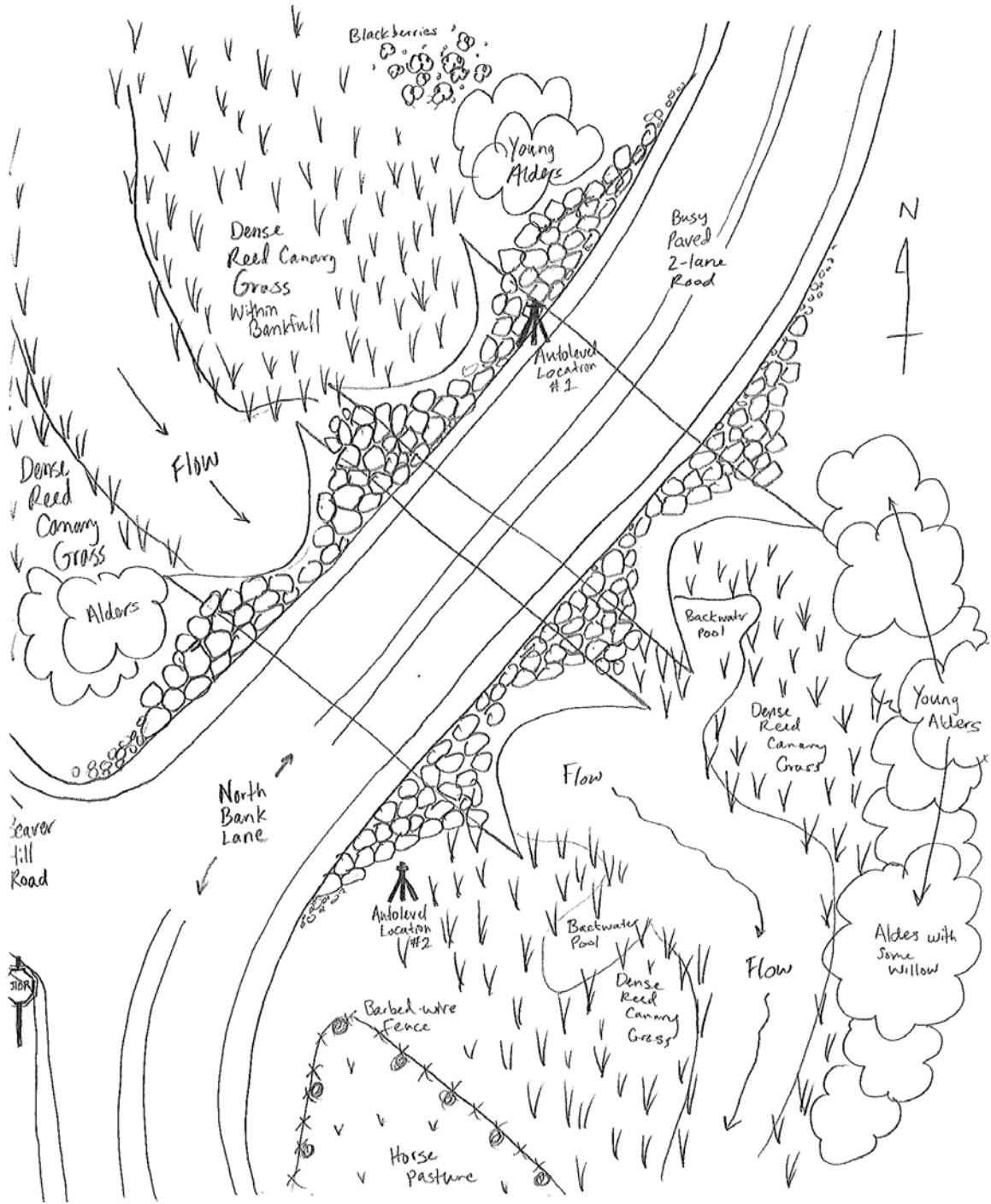


Figure 1211. Water Surface Profile at 1.12 cms, velocity barrier.

Site Sketch

T.D.# 22 1 of 1



Site # 23 2009 Restoration Effectiveness Monitoring Summary

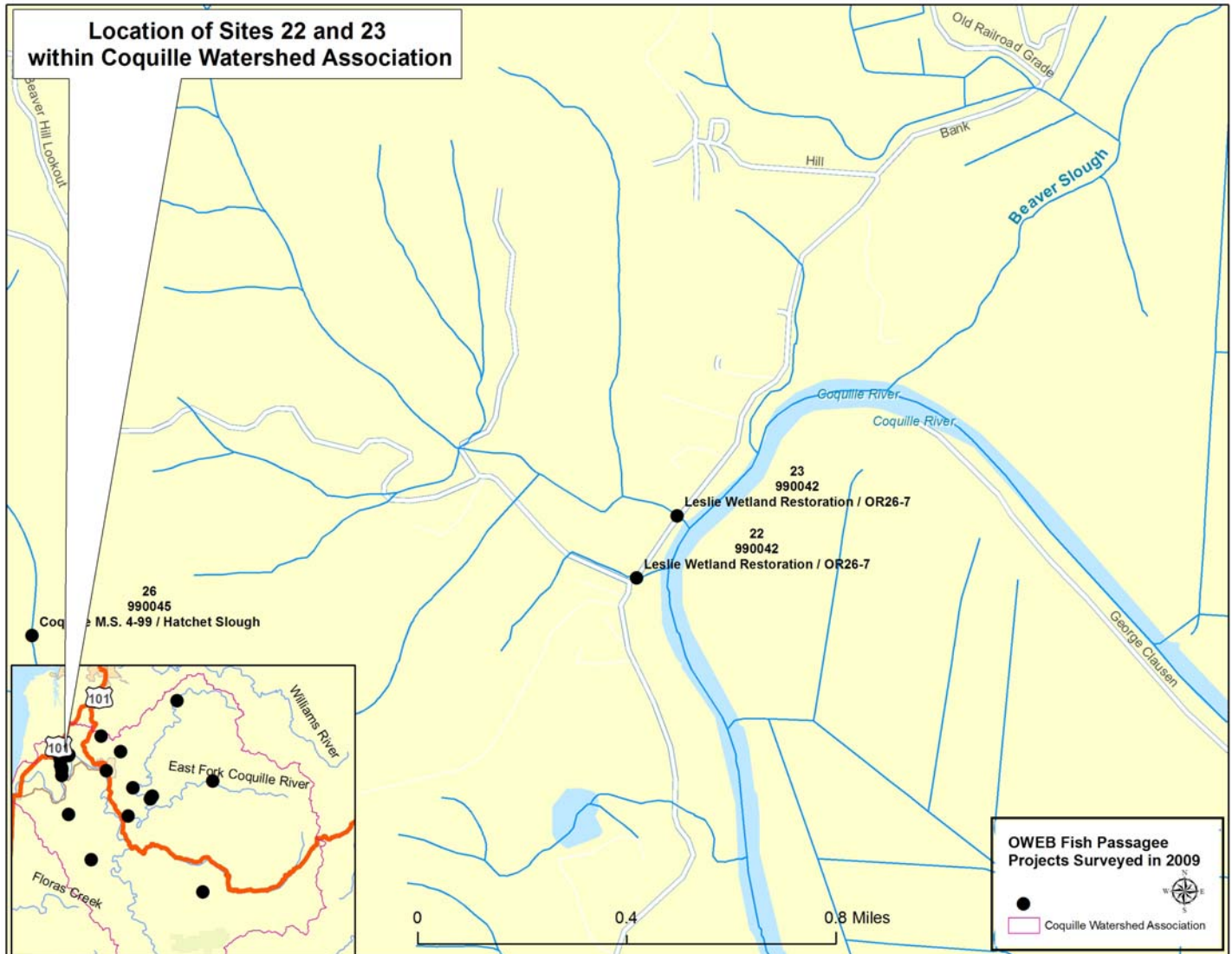
OWEB Project Name – Leslie Wetland Restoration / OR26-7

OWEB Grant Number – 097-075

OWRI Project Number – 990042

Owner – Private, Edith Leslie

OWEB Description – Fish Passage



Map 7. Location of Site 23, the 2nd culvert at the Leslie Wetland in the region of the Coquille sub-basin.

Site Notes

This appears to be a dredged channel that is characterized by deep fine sediments and regular tide influence. There is a tide gate at the outlet. The riparian area upstream of the culvert is healthy with alders, willows and sedges dominating.

The circular culvert measured 1.5 meters in diameter. Substrate in the culvert mirrored substrate in the channel; it was 100% silt. Upstream channel gradient was measured at 2.4%. Downstream gradient was nearly impossible to measure because of the very deep outlet pool (0.9 meters) and the short stretch to the confluence with the Coquille River. Upstream bankfull width was measured at 2.4 meters. Bankfull is confined to a deep dredged channel. Ratio of the inlet width to channel width was 0.62. The residual pool depth (no outfall) was 1.52 meters.

This channel could not be snorkeled. We surveyed as far as possible (~ 300 meters) looking for pools to snorkel, but we did not find any. What puddles we did find, were so muddy that visibility was considered 0%.

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 13. Fish Passage Summary, Site 23.

Fish Passage Summary	
Low Passage Design Flow	0.0800 cms
High Passage Design Flow	2.0000 cms
Percent of Flows Passable	2.8 %
Passable Flow Range	0.0800 to 0.1331 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.18 cms and Above
Pool Depth Barrier	None

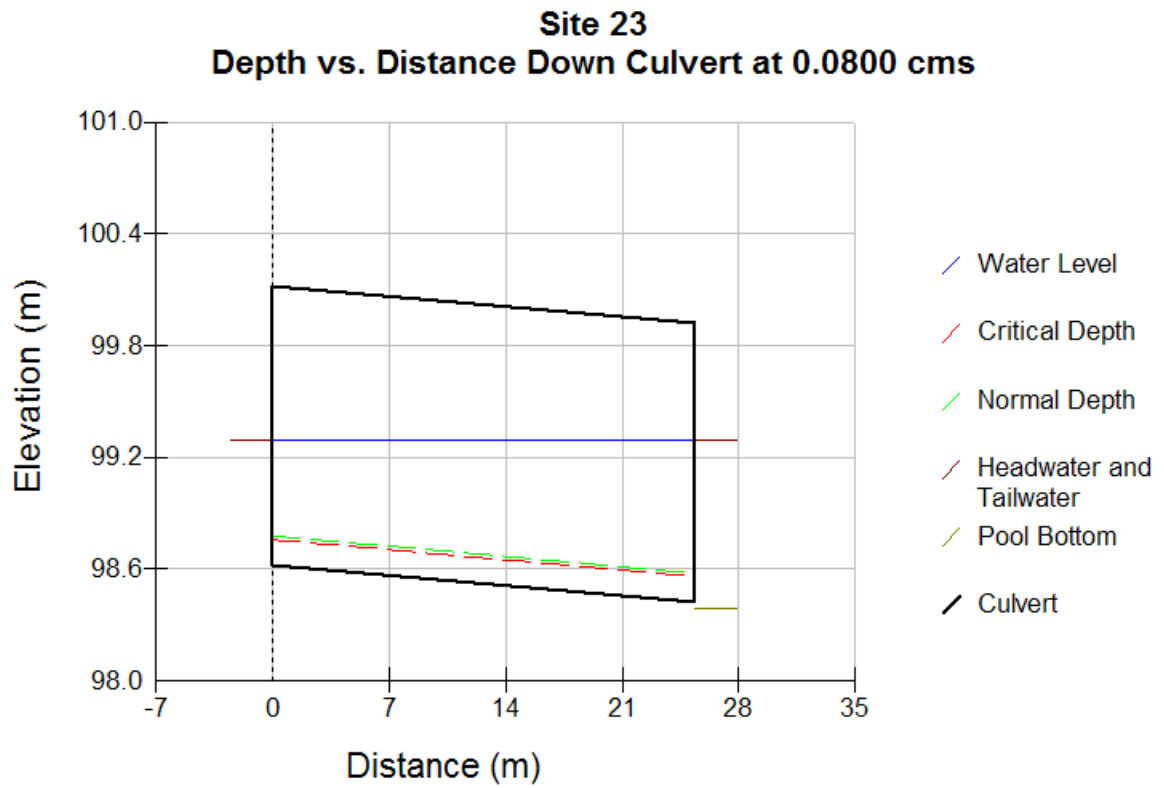


Figure 1312. Water Surface Profile at 0.08 cms, full passage.

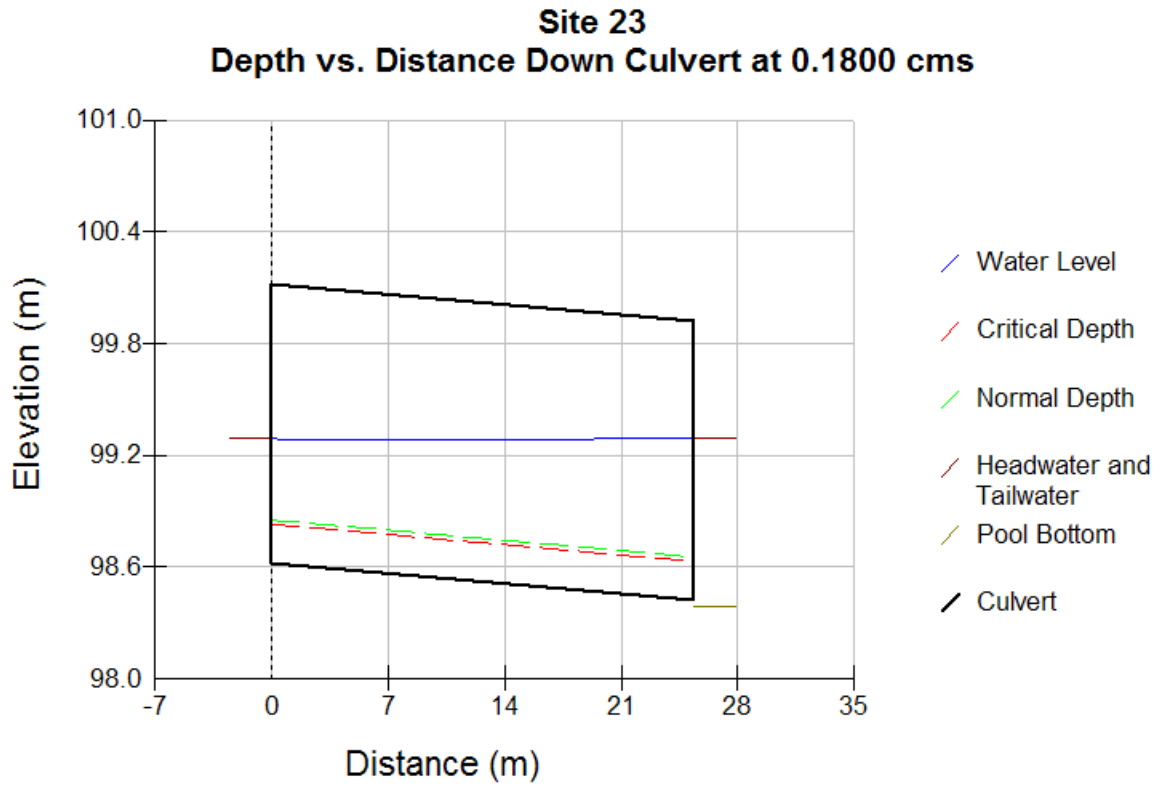
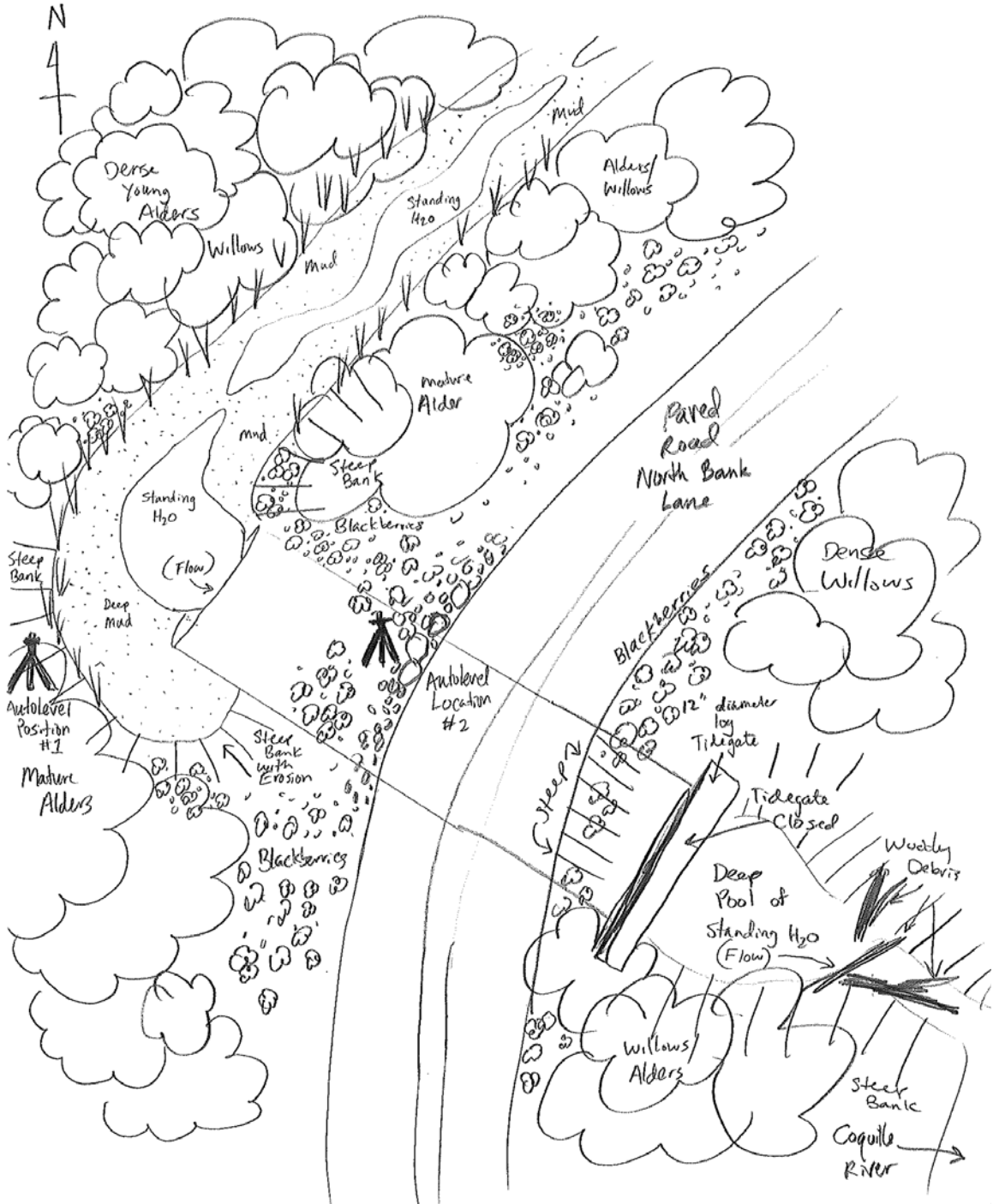


Figure 1413. Water Surface Profile at 0.18 cms, velocity block.

Site Sketch

ID # 23 / of 1



Site # 26 2009 Restoration Effectiveness Monitoring Summary

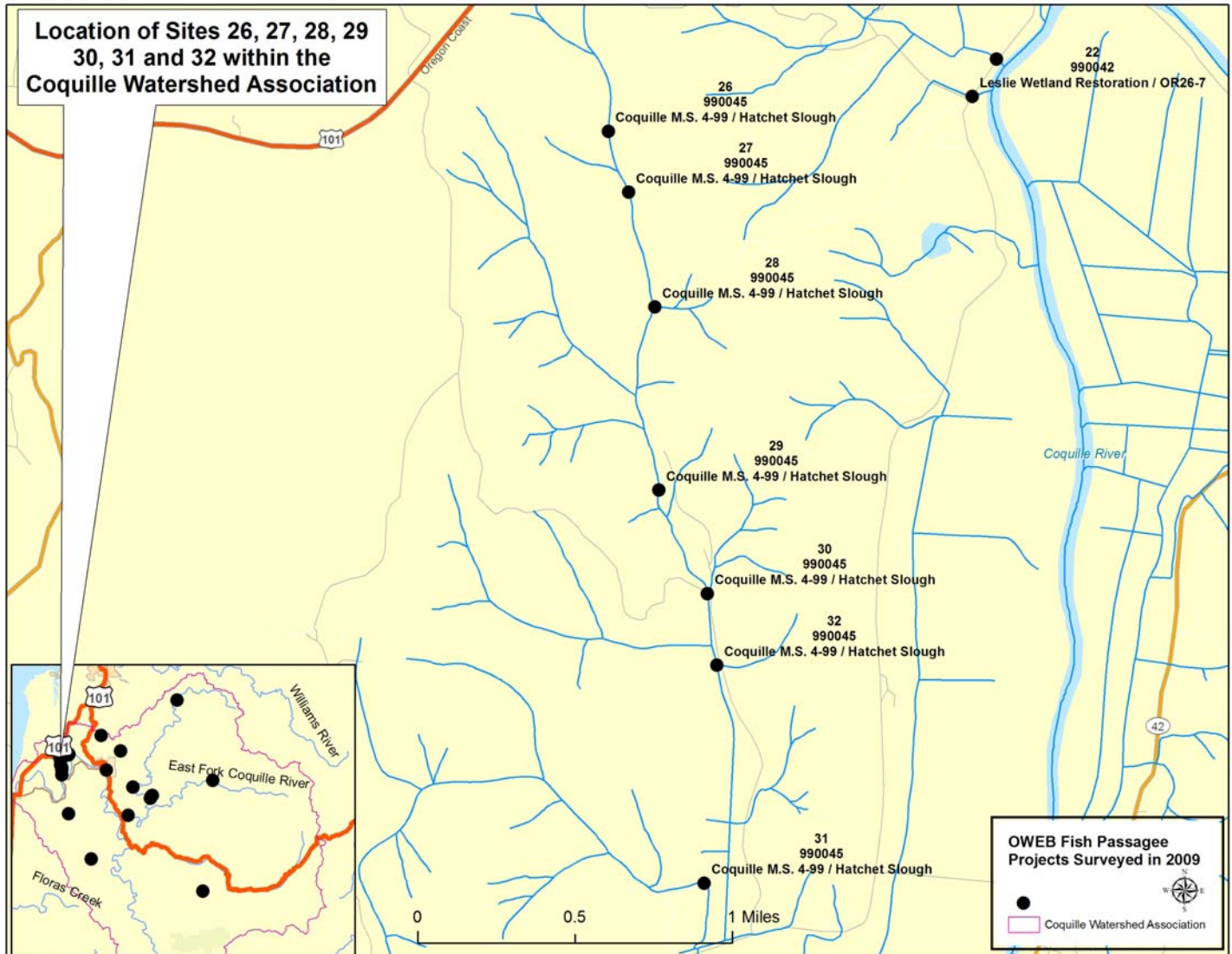
OWEB Project Name - Coquille M.S. 4-99 / Hatchet Slough

OWEB Grant Number – 098-055

OWRI Project Number – 990045

Owner – Private, Pearce

OWEB Description – Fish Passage



Map 8. Site 26 on Hatchet Slough, Coquille sub-basin.

Site Notes

This is a classic head-water mountain stream bordered by 20-50 year old alders and mixed conifers. Immediately adjacent to creek the riparian area is composed of skunk cabbage, horsetails, salmon berry, and bulrush. The culvert had a black tar inside lining that showed signs of being scraped off by bear (or so we suspected). The large outlet pool is frequented by elk for drinking, as elk sign was ubiquitous near this culvert.

This was a 1.5 meter diameter circular culvert. There was no substrate in the structure. Substrate downstream near the tail water control substrate was dominated by silt with boulders and gravels, respectively. The culvert lacked baffles to reduce velocity. In contrast, there was a black tar lining on the culvert that covered many of the corrugations thereby reducing roughness. The channel gradient in the vicinity of the culvert was measured at 0.17%, while the culvert gradient was 1.0%. The upstream bankfull width was estimated at ~ 6.0 meters. This occurred because upstream of the culvert is a wetland complex that floods regularly. This wetland illustrated surprising complexity with carex, rush, Cascara, and other riparian species. The ratio of the inlet width to channel width was 0.25. There was an outlet drop of 0.02 meters and an outlet pool that was relatively deep (0.6 meters). Pool residual depth was 0.15 meters. The outlet pool was created by placed boulders acting as a dam rather than the pool being formed by a plunge. The road to this culvert is rarely used; we could not get a vehicle to the site and walked over 2 miles.

Results from FishXings predict that only 0.1% of flows will be passable by juvenile salmonids at this culvert. This would occur at the lowest of flows only; otherwise this is a velocity barrier for juvenile salmonids. Snorkel survey results showed that juvenile Coho in very low numbers utilize the habitat above the culvert.

Snorkel Survey

Table 14 lists the number of juvenile Coho found above the culvert at Site 26. There were very few fish observed.

Table 14. Site 26 snorkel survey results. Only a small number of juvenile Coho were found above the culvert.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1242960431538	1	Glide	3.7	1.8	0.4		0
1242960431538	2	Glide	7.2	1.1	0.39	Coho	2
1242960431538	3	Plunge	2	1.2	0.65		0
1242960431538	4	Glide	10	1.1	0.4		0
1242960431538	5	Glide	6.1	1.6	0.55	Coho	2

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 15. Fish Passage Summary, at Site 26.

Fish Passage Summary	
Low Passage Design Flow	0.0020 cms
High Passage Design Flow	3.1100 cms
Percent of Flows Passable	0.10 %
Passable Flow Range	0.0020 to 0.0062 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.01 cms and Above
Pool Depth Barrier	None

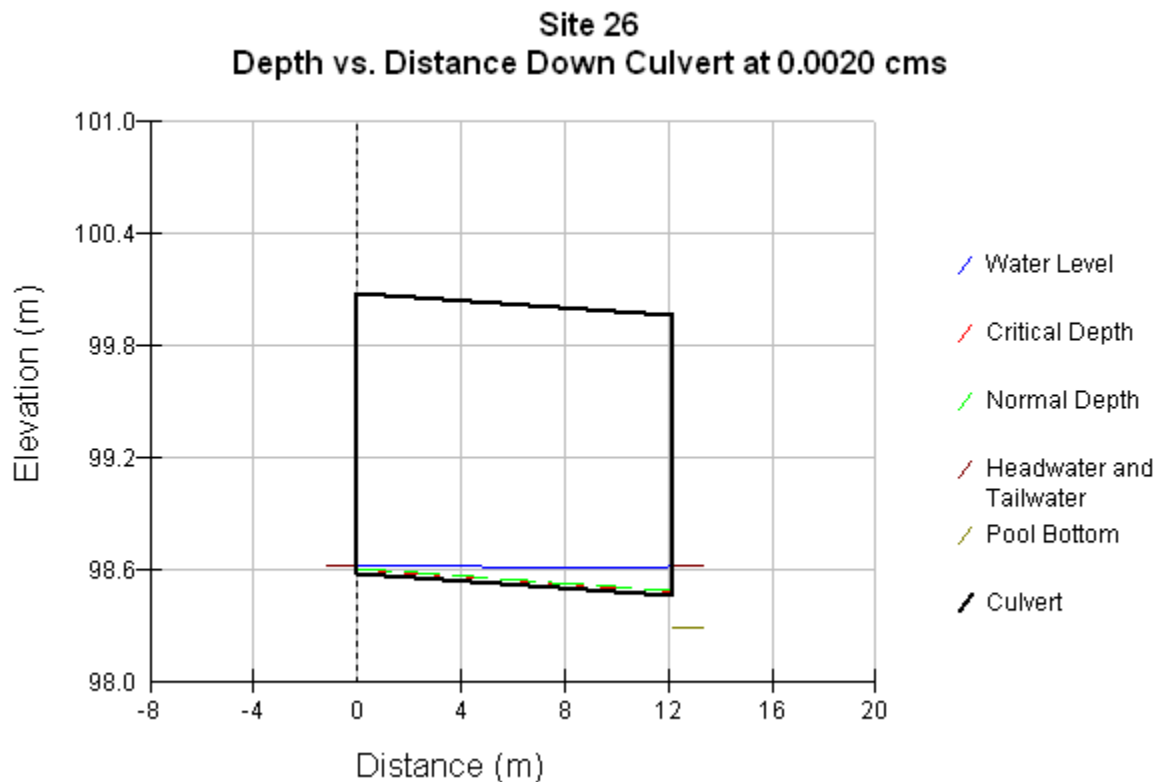
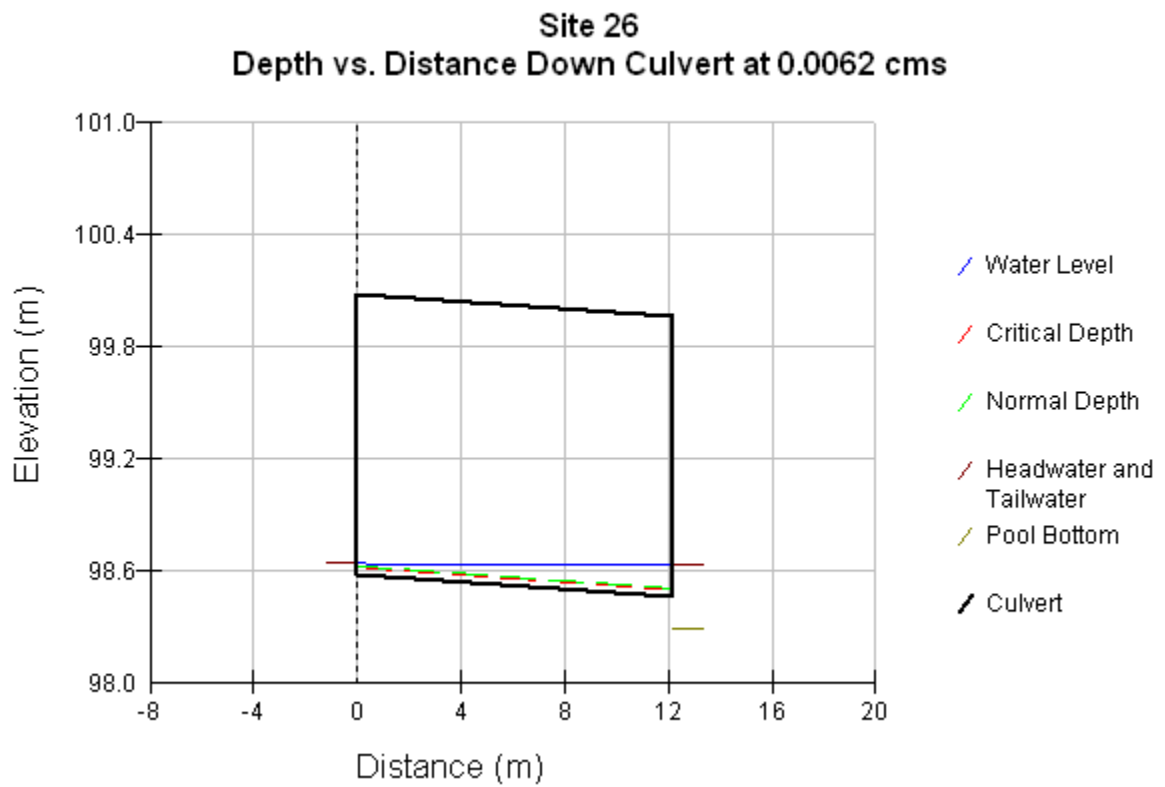


Figure 1514 . Water Surface Profile at 0.002 cms at Site 26, Passable.



| Figure 1615. Water Surface Profile at 0.0062 cms at Site 26, velocity block.

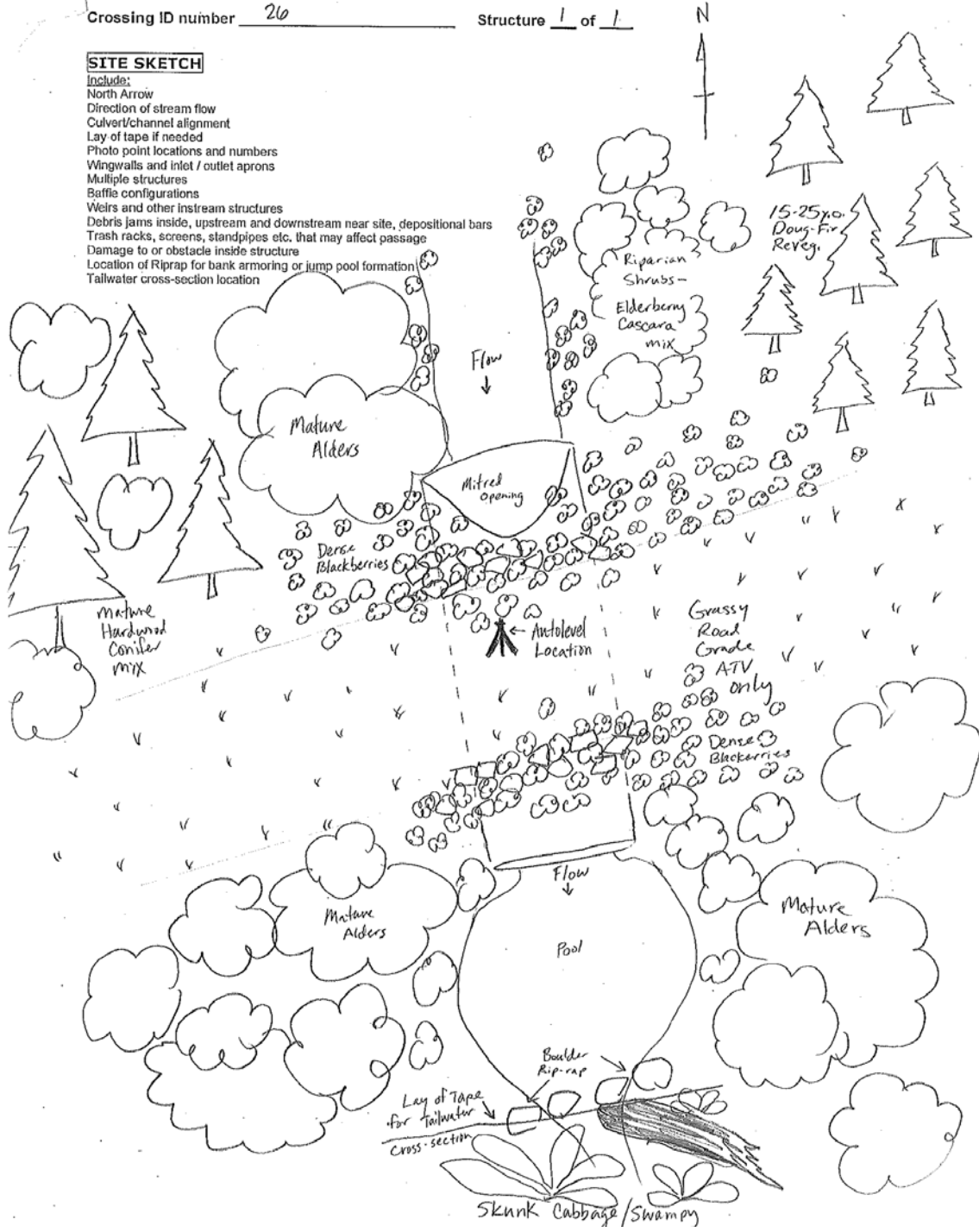
Site Sketch

Crossing ID number 26 Structure 1 of 1

SITE SKETCH

Include:

- North Arrow
- Direction of stream flow
- Culvert/channel alignment
- Lay of tape if needed
- Photo point locations and numbers
- Wingwalls and inlet / outlet aprons
- Multiple structures
- Baffle configurations
- Weirs and other instream structures
- Debris jams inside, upstream and downstream near site, depositional bars
- Trash racks, screens, standpipes etc. that may affect passage
- Damage to or obstacle inside structure
- Location of Riprap for bank armoring or jump pool formation
- Tailwater cross-section location



Site # 27 2009 Restoration Effectiveness Monitoring Summary

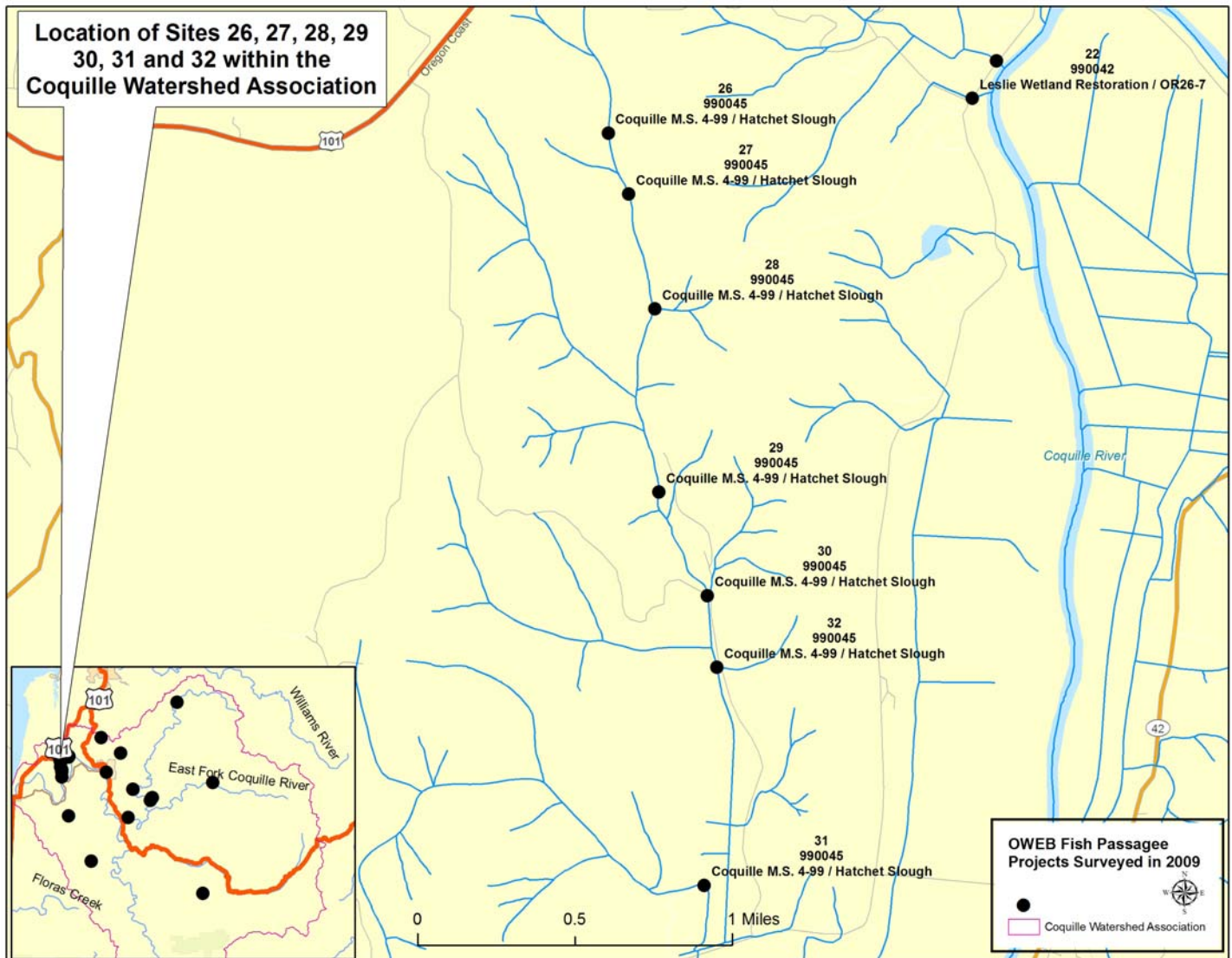
OWEB Project Name - Coquille M.S. 4-99 / Hatchet Slough

OWEB Grant Number – 098 - 055

OWRI Project Number – 990045

Owner – Private, Pearce

OWEB Description – Fish Passage



Map 9. Location of Site 27 on the Hatchet Slough drainage within the region of the Coquille sub-basin.

Site Notes

This is a small ephemeral channel that was dry at the time of the survey. We were not convinced that this stream was meant to be surveyed because it appeared to us to have a non-fish bearing nature. But the culvert lined up with OWEB coordinates and the landowner said that this culvert had been replaced when the other fish passage improvements were made on his land. The channel was extremely difficult to delineate along the first 30 – 40 meters above the culvert. There was little evidence of scour. Approximately 35 meters above the culvert is a slope break; upstream of the slope break there was a defined channel with slow moving water. Just downstream of the slope break, gradient flattened and the area was covered with fine sediment up to the culvert area where the channel became defined again. Essentially the creek runs at a 10-20% gradient where it is defined, then it hits the flat region the slope breaks from ~15% to less than 5%. Here is where fine sediments have been and continue to be deposited that form the sediment wedge. The landowner said he never had seen fish at this site.

We classified the area where the sediment wedge was found as having sheet flow. There were no bankfull indicators in this indeterminate floodplain that measured 7 – 9 meters wide. The channel gradient in the vicinity of the culvert was 8% and the culvert slope was 6.3%. No outlet drop was found and the channel was dry.

FishXings predicts this culvert is a 100% velocity block for juvenile fish at all flows.

Snorkel Survey

This channel was not snorkeled due to lack of water. We did walk the channel up some 300 meters and found some slow moving water. No pools exceeded 0.25 meters depth. They were essentially puddles.

FishXings

Hydraulic Evaluation Criteria

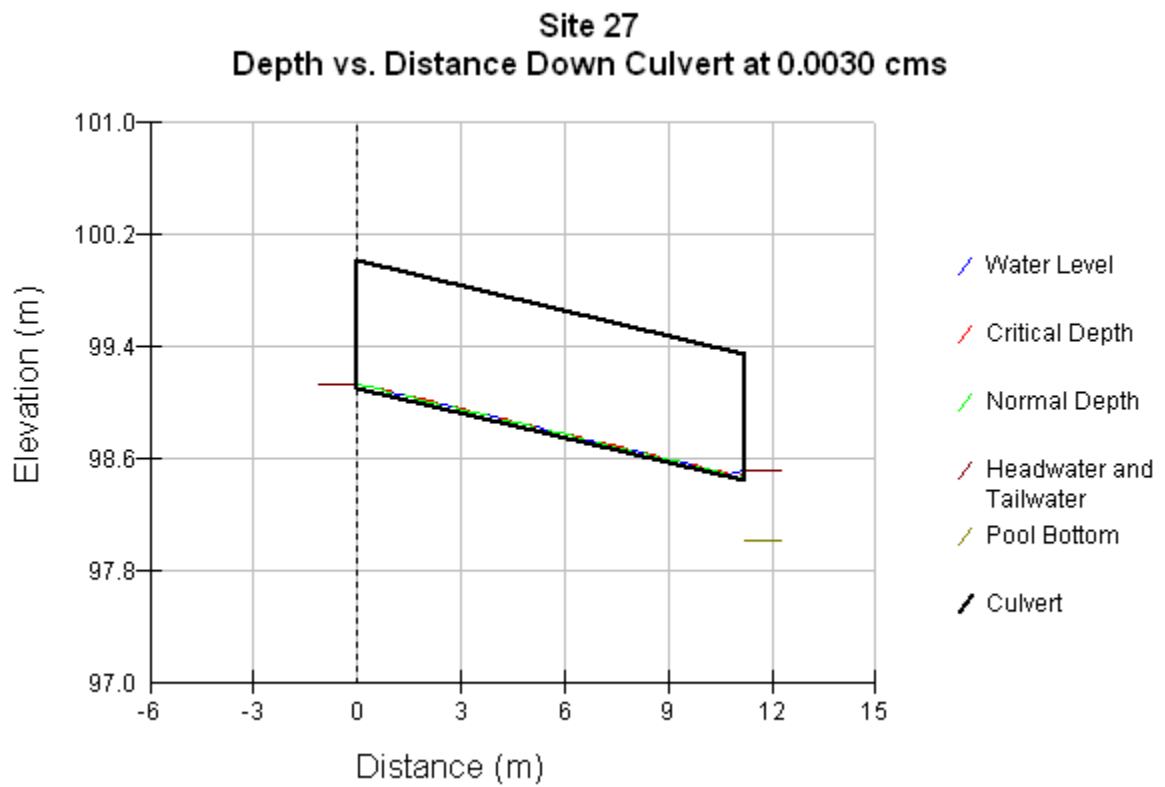
Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

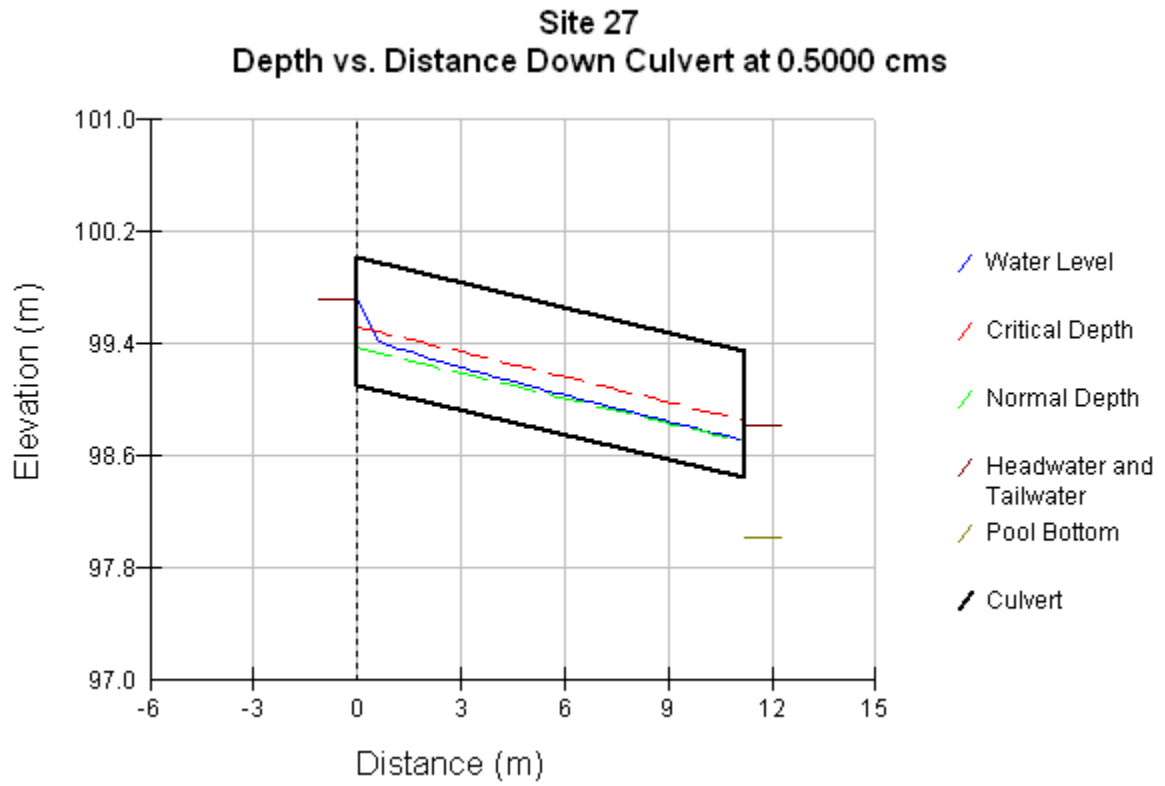
Maximum Allowed Outlet Drop = 0.1 m

Table 16. Fish Passage Summary, Site 27, Hatchet Slough.

Fish Passage Summary	
Low Passage Design Flow	0.0030 cms
High Passage Design Flow	0.8500 cms
Percent of Flows Passable	0.0 %
Passable Flow Range	None
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.0 cms and Above
Pool Depth Barrier	None



| Figure 1746. Water Surface Profile at 0.003 cms, Site 27, velocity block.



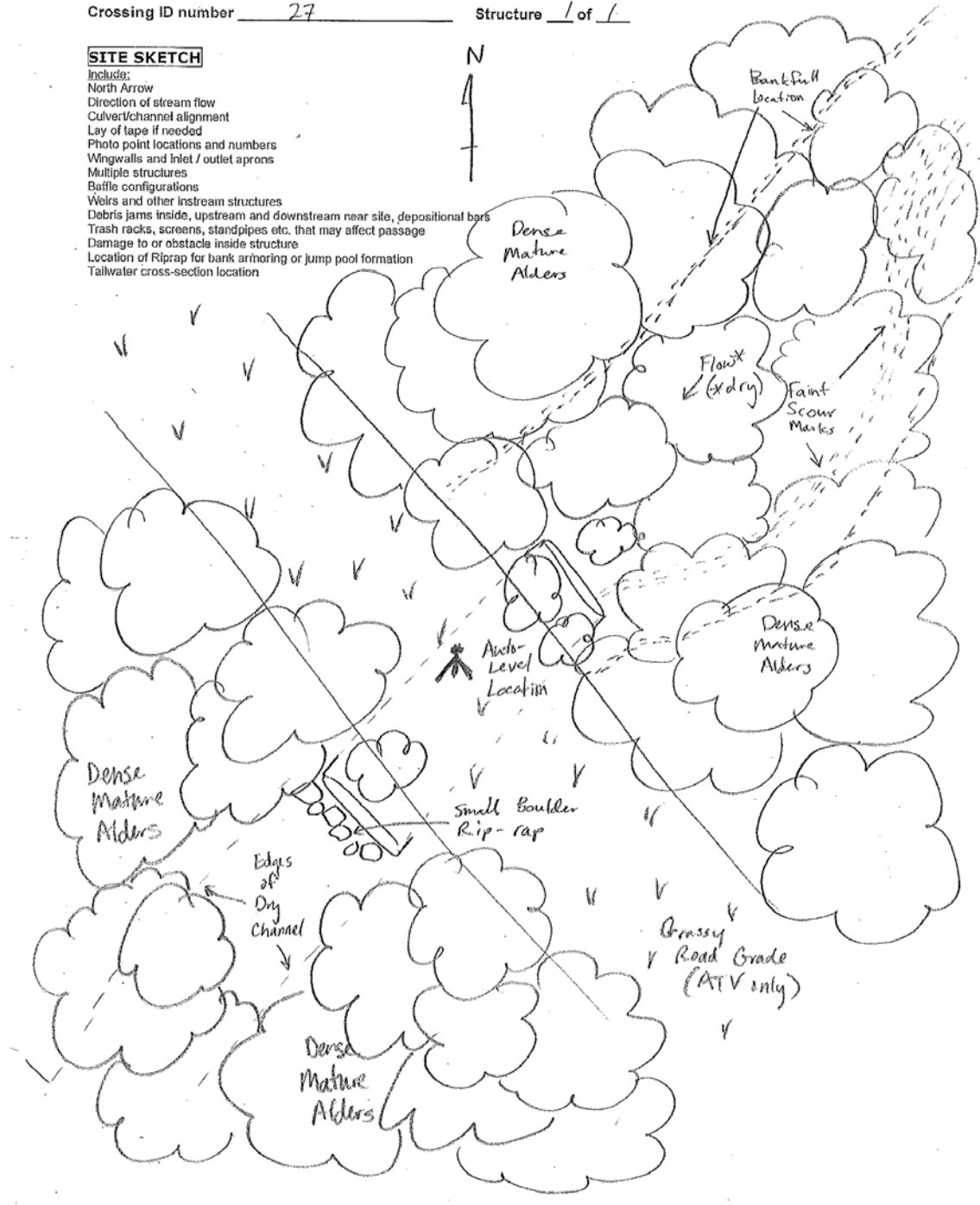
| Figure 1847. Water Surface Profile at 0.5 cms, Site 27, velocity block.

Site Sketch

Crossing ID number 27 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 28 2009 Restoration Effectiveness Monitoring Summary

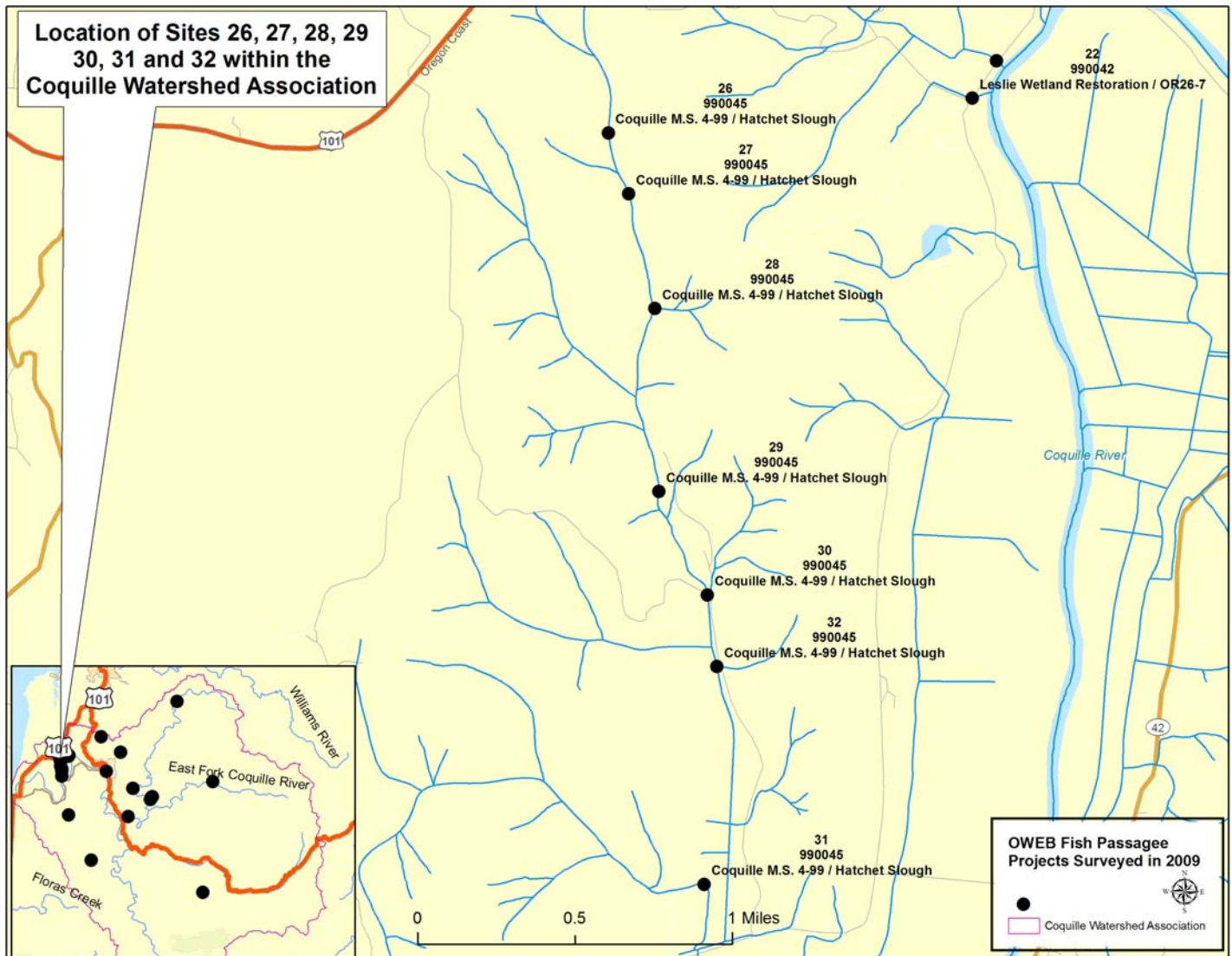
OWEB Project Name - Coquille M.S. 4-99 / Hatchet Slough

OWEB Grant Number – 098 - 055

OWRI Project Number – 990045

Owner – Private, Pearce

OWEB Description – Fish Passage



Map 10. Site 28 along the Hatchet Slough drainage within the Coquille sub-basin.

Site Notes

This is a small ephemeral channel that was dry at the time of the survey (tributary to Hatchet Slough). We were not convinced that this stream was meant to be surveyed because of its non-fish bearing nature. But the culvert lined up with OWEB coordinates and the landowner said that this culvert had been replaced when the other fish passage improvements were made to the culverts on his land. The site is heavily infested by blackberries. The landowner said he never had seen fish at this site.

The circular culvert was 0.9 meters in diameter. Bankfull width was measured at 1.2 meters. The ratio of inlet width to channel width was 1.3. Channel gradient was measured at ~ 5.7% while the culvert gradient was measured at 3.8%.

FishXings predicted this culvert to be a velocity barrier at 100% of the modeled flows.

Snorkel Survey

This channel was not snorkeled at the time of the survey because it was dry. The landowner said that he had never seen fish in this channel.

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 17. Fish passage summary, Site 28, Hatchet Slough.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	0.8500 cms
Percent of Flows Passable	0.0 %
Passable Flow Range	None
Depth Barrier	None
Outlet Drop Barriers	0.06 cms to 30.02 cms
Velocity Barrier - V	0.0 cms and Above
Pool Depth Barrier	0 to 0.85 cms

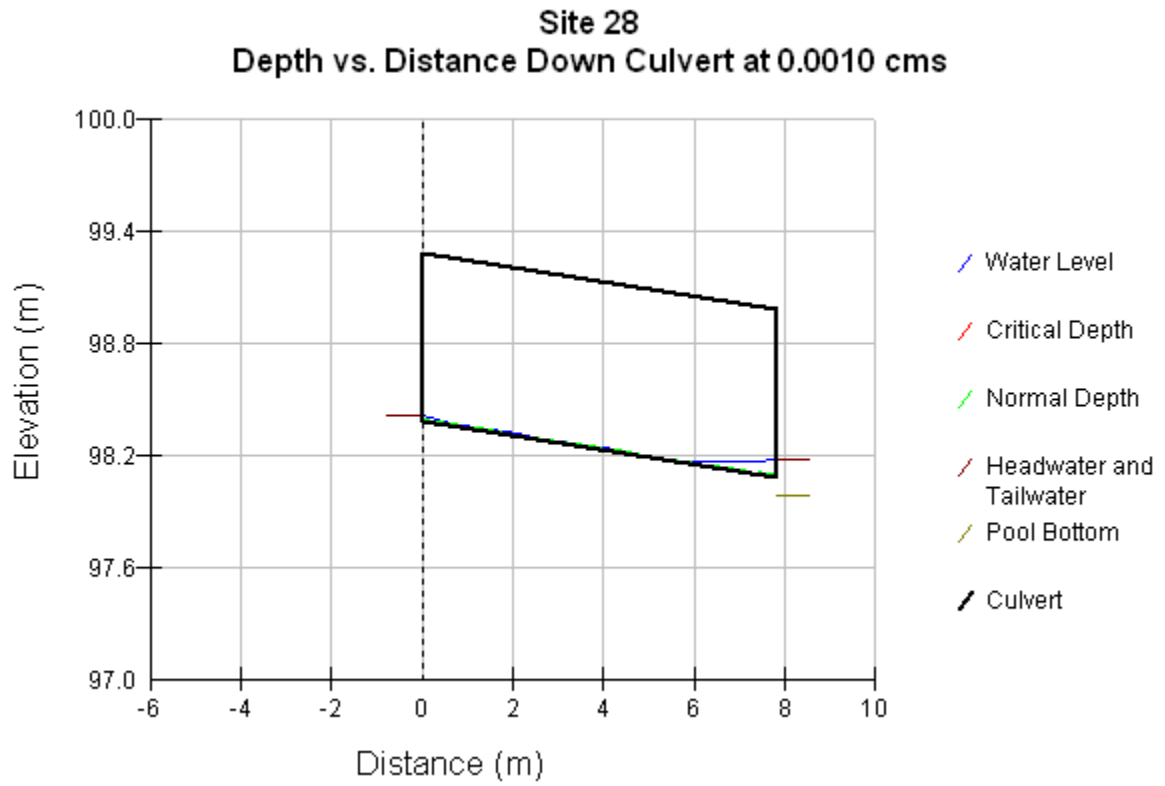


Figure 1918. Water Surface Profile at 0.001 cms, Site 27, velocity block.

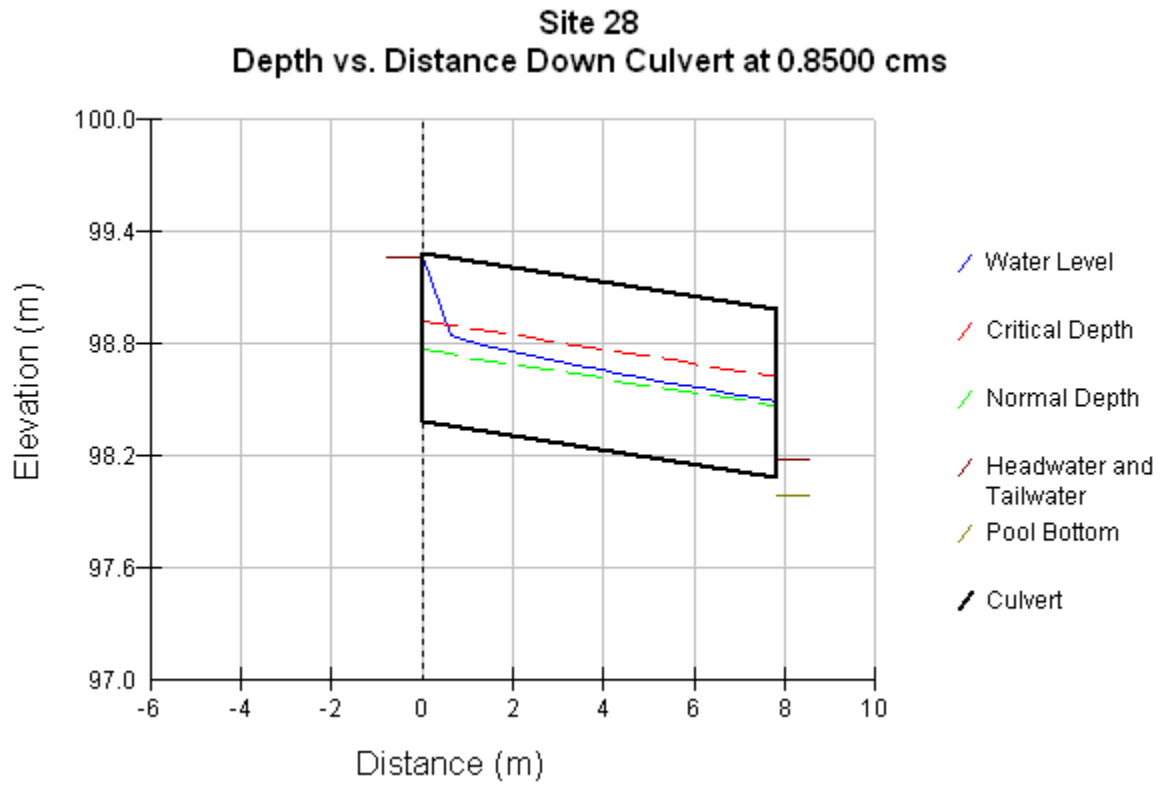


Figure 2019. Water Surface Profile at 0.85 cms, Site 27, velocity block.

Site Sketch

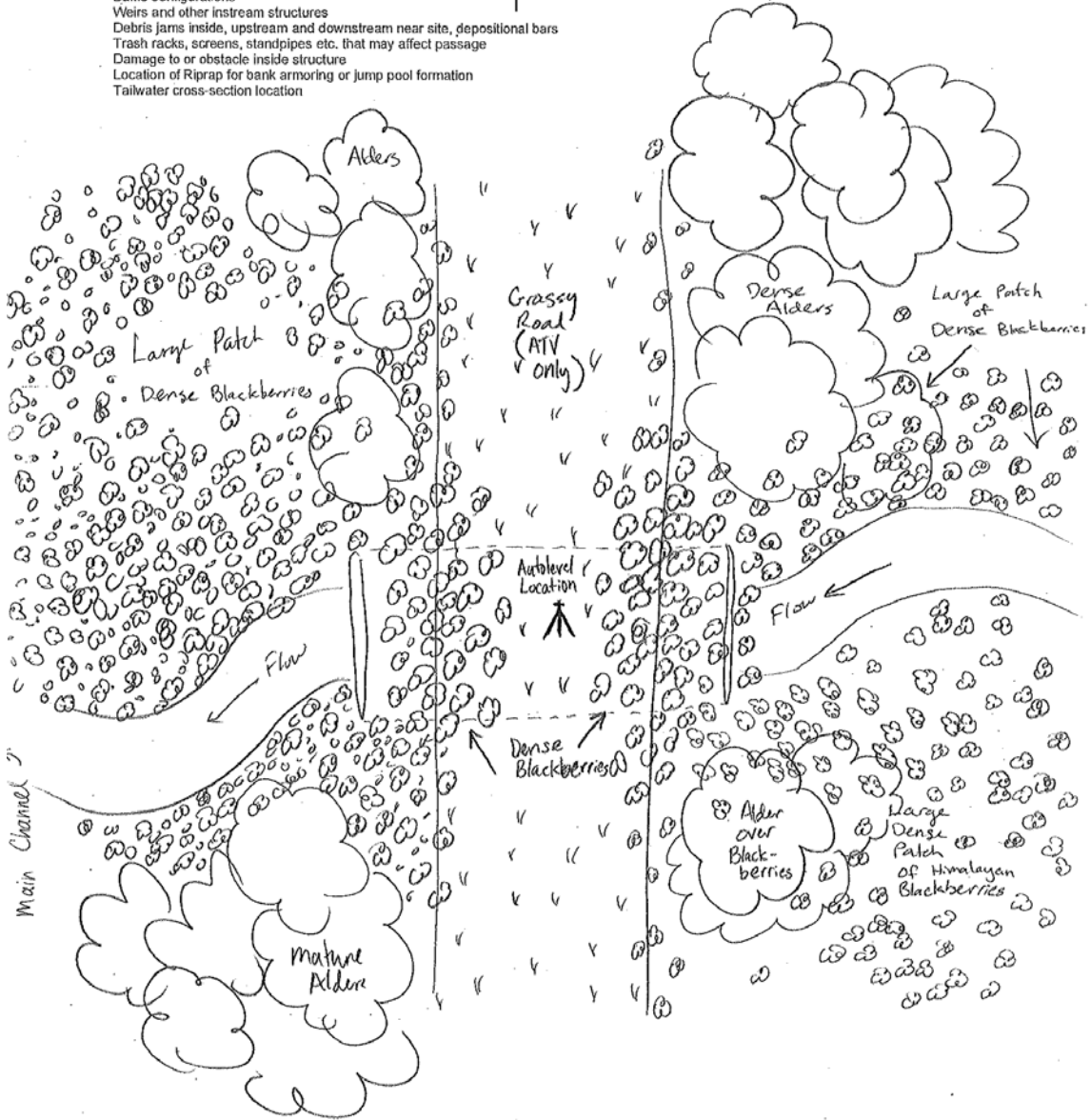
Crossing ID number 28

Structure 1 of 1

SITE SKETCH

Include:

- North Arrow
- Direction of stream flow
- Culvert/channel alignment
- Lay of tape if needed
- Photo point locations and numbers
- Wingwalls and inlet / outlet aprons
- Multiple structures
- Baffle configurations
- Weirs and other instream structures
- Debris jams inside, upstream and downstream near site, depositional bars
- Trash racks, screens, standpipes etc. that may affect passage
- Damage to or obstacle inside structure
- Location of Riprap for bank armoring or jump pool formation
- Tailwater cross-section location



Site # 29 2009 Restoration Effectiveness Monitoring Summary

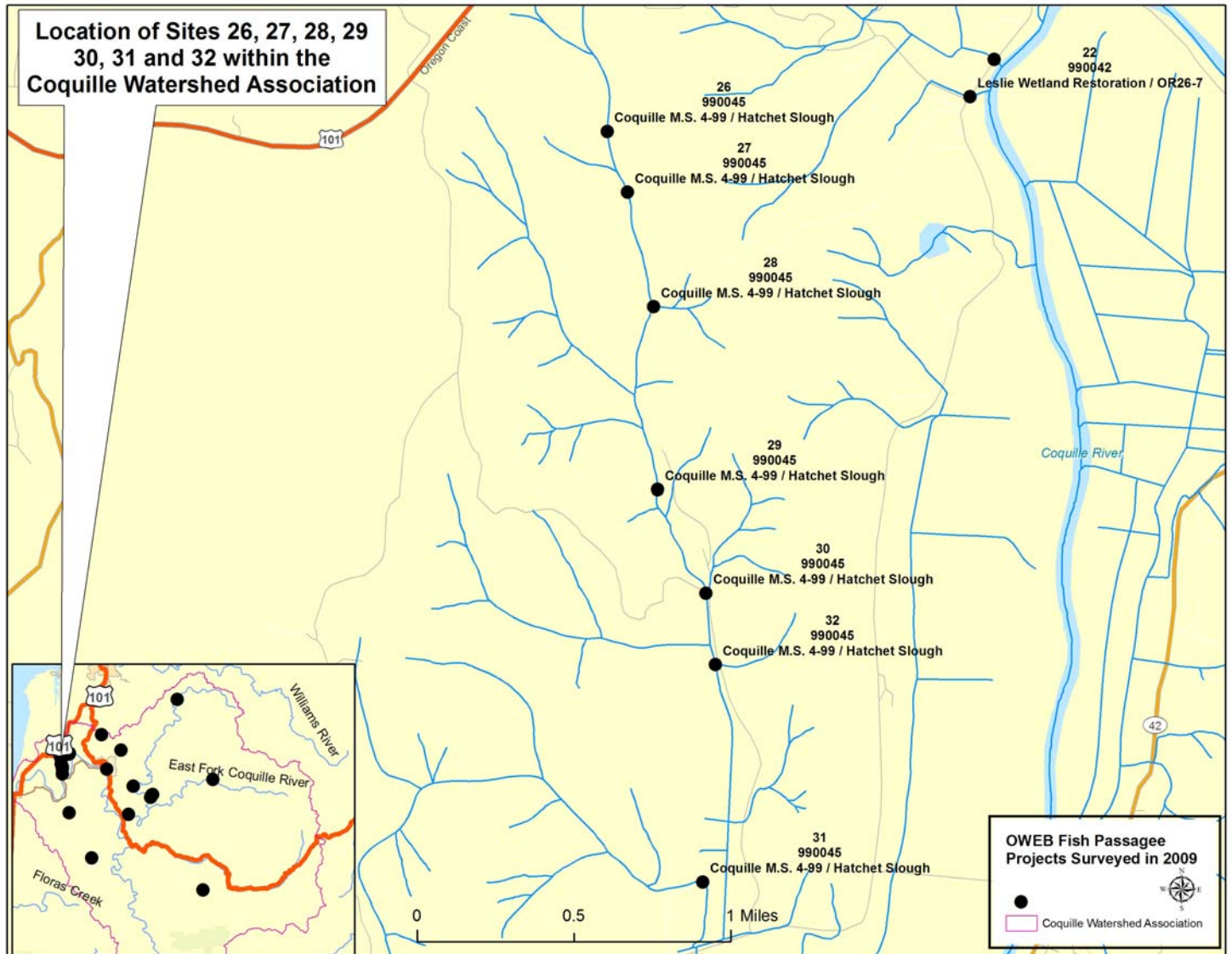
OWEB Project Name - Coquille M.S. 4-99 / Hatchet Slough

OWEB Grant Number – 098 - 055

OWRI Project Number – 990045

Owner – Private, Pearce

OWEB Description – Fish Passage



Map 11. Location of Site 29 on the Hatchet Slough drainage within the Coquille sub-basin.

Site Notes

At one-time, this classic pool-riffle channel probably exhibited a high-degree of sinuosity; now it is confined to a dredged ditch that is forced along the toe slope to avoid interfering with the pasture and other agricultural activities. The channel had very low sinuosity and was deeply incised (~2 meters). Channel substrate was composed of 100% silt. Efforts are being made by the land owner to keep cattle out of the creek, yet the channelized nature of the stream prevents it from reaching its full hydrologic potential. There is little hydrologic connectivity with the remnant floodplain that is now a pasture. Stream banks remain stable and fully vegetated; although, they are deeply incised. Log structures below the culvert are providing minor instream diversity (at time of survey a 0.2 meter pool was noted at the structure).

The culvert arch culvert here measure 2.1 meters wide by 1.7 meters wide. Bankfull width averaged 4.5 meters. The ratio of inlet width to channel width was 0.47. Channel gradient was 0.9% and the culvert was countersunk with a gradient of -0.9%. There was substrate located throughout the culvert, and the substrate depth ranged from 0.09 meters deep at the inlet and 0.01 meters deep at the outlet. There was a slight drop at the outlet (0.06 meters), but the water depth was 0.1 meters which translated into no outfall.

FishXings predicts that 4% of the modeled flows would be passable to juvenile salmonids. Velocity blocks passage at 0.28cms.

Snorkel Survey Results

Please refer to Site 26 snorkel survey data for this site. Juvenile salmonids were observed above this culvert.

Fish Xings Results

Hydraulic Evaluation Criteria

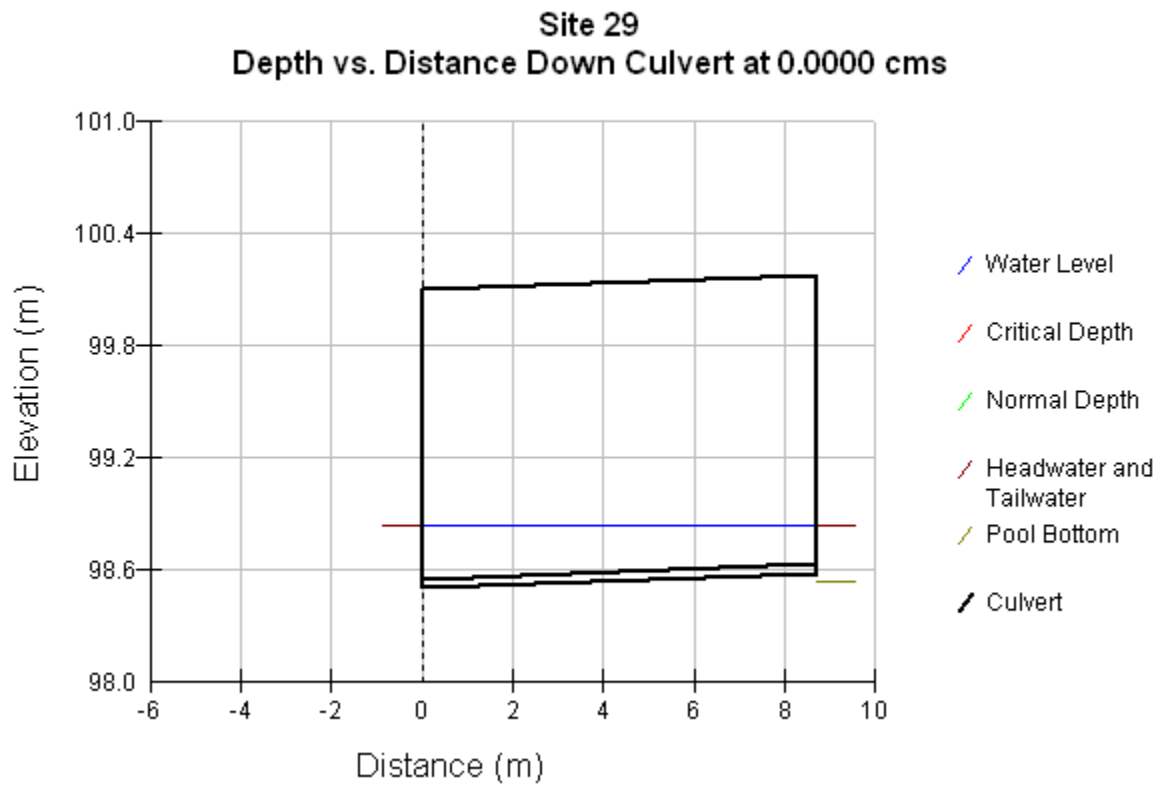
Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 18. Fish Passage Summary., Site 29.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	7.0000 cms
Percent of Flows Passable	3.9 %
Passable Flow Range	0.0000 to 0.2753 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.28 cms and Above
Pool Depth Barrier	None



| Figure 2120. Water Surface Profile at .0001 cms, Site 29, full passage.

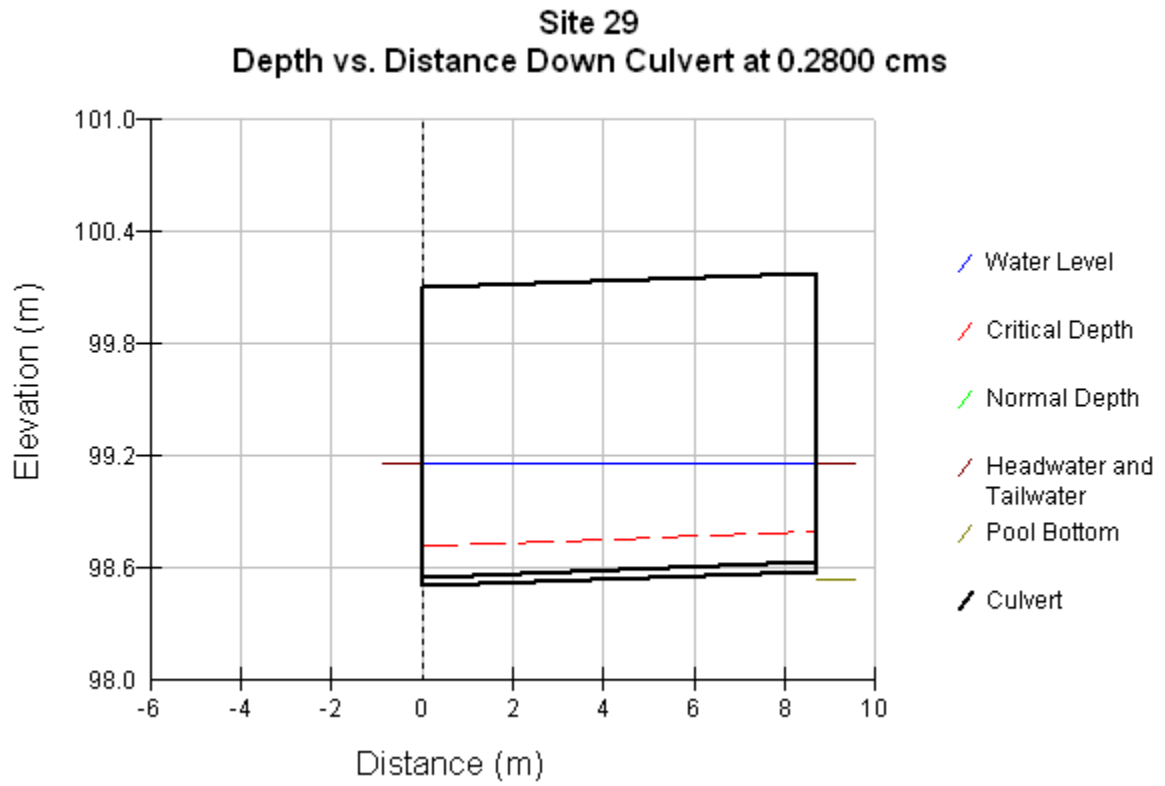


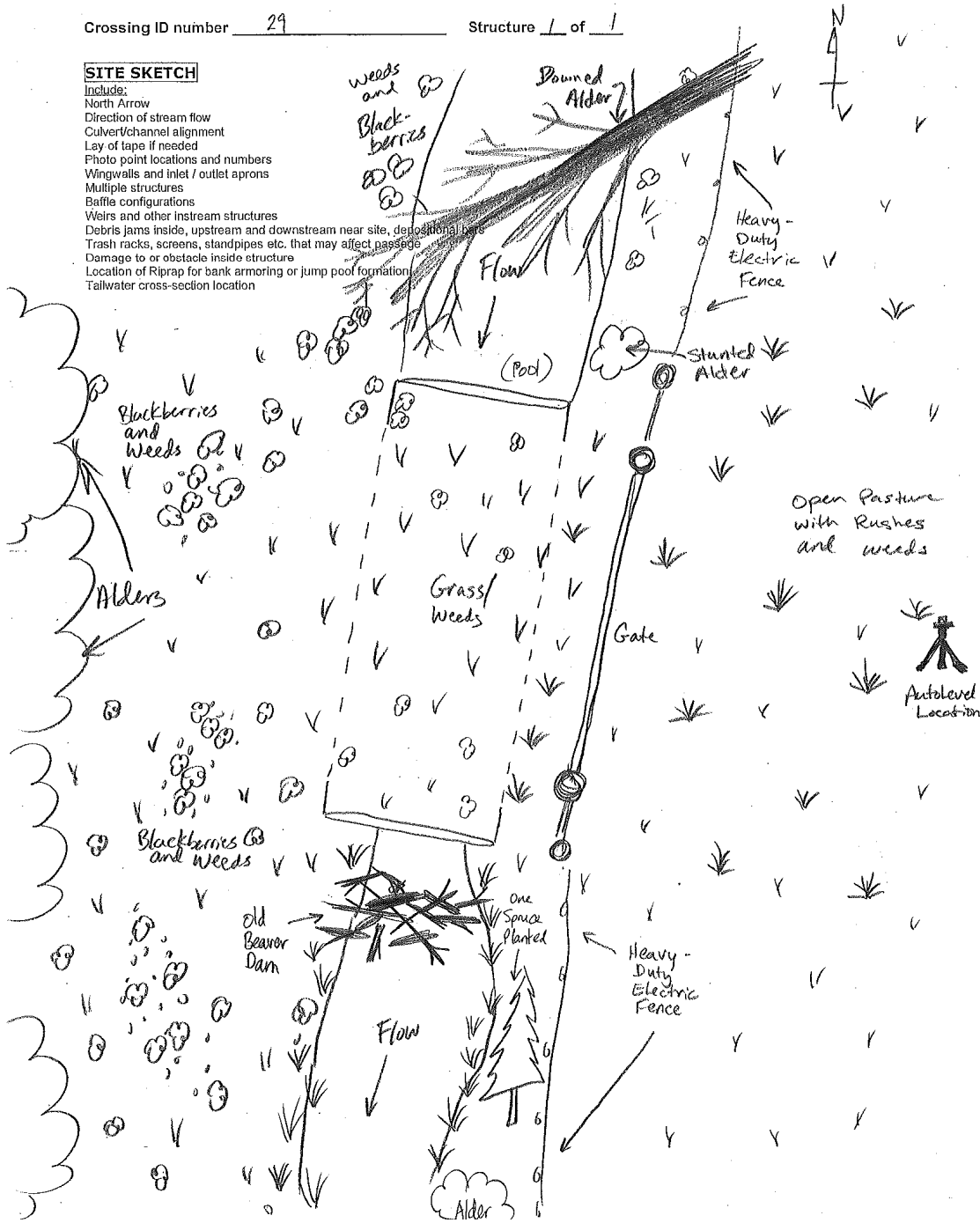
Figure 2221. Water Surface Profile at 0.28 cms, Site 29, velocity block.

Site Sketch

Crossing ID number 29 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other in-stream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 30 2009 Restoration Effectiveness Monitoring Summary

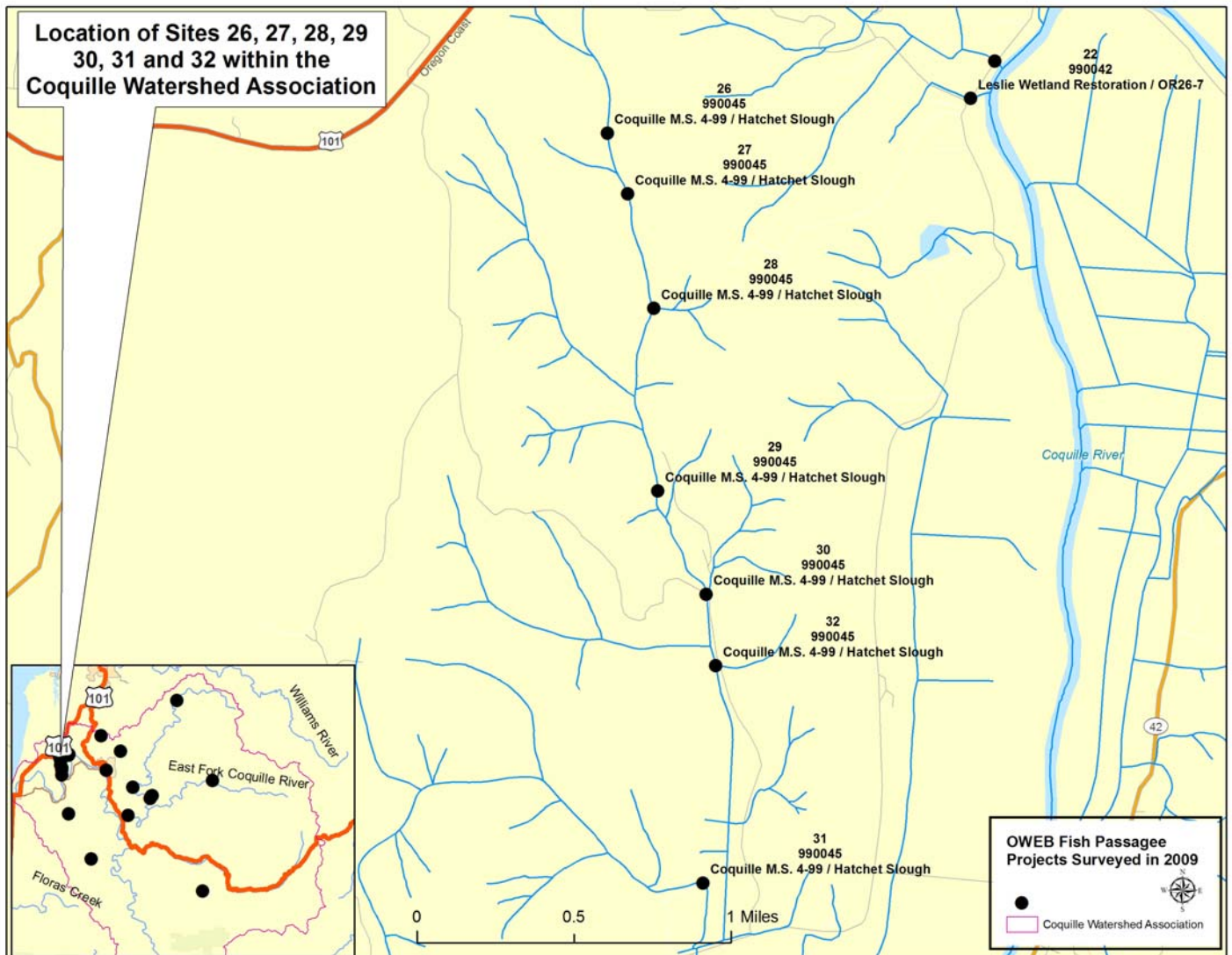
OWEB Project Name - Coquille M.S. 4-99 / Hatchet Slough

OWEB Grant Number – 098 - 055

OWRI Project Number – 990045

Owner – Private, Pearce

OWEB Description – Fish Passage



Map 12. Location of Site 30 on Hatchet Slough within the Coquille sub-basin.

Site Notes

The culvert is located where the channel was re-routed across field to the west of the toe slope. This is a deeply incised trench with virtually no sinuosity. The adjacent field is actively grazed along side the narrow riparian enclosure. Invasive species dominate within the enclosure primarily consisting of blackberry and thistle. The dredged and incised nature of the channel limits floodplain connectivity by keeping water at most flow levels within the dredged channel. Hence, the riparian community is limited to immediate adjacency to the channel (and dominated by invasive species).

This pipe-arch culvert was 2.1 meters wide by 1.5 meters tall. Bankfull width was within the trench and measure 3.7 meters. This resulted in a ratio of inlet width to channel width of 0.56. The culvert was countersunk and had a negative slope of 2.2%. The channel gradient was 0.90%. Substrate was continuous throughout the culvert and it was composed of sand/silt/gravels, respectively. The inlet substrate depth was 0.14 meters and the outlet depth was 0.09 meters.

FishXings predicts that approximately 3% of modeled flows are passable. Velocity blocks juvenile migration at 0.22 cms.

Snorkel Survey Results

Please see snorkel survey results from Site 26, the most upstream point along this creek. Juvenile salmonids were found above this culvert.

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 19. Fish Passage Summary, Site 30.

Fish Passage Summary	
Low Passage Design Flow	0.0001 cms
High Passage Design Flow	7.000 cms
Percent of Flows Passable	3.1 %
Passable Flow Range	0.0001 to 0.2171 cms
Depth Barrier	None
Outlet Drop Barriers	2.23 cms to 247 cms
Velocity Barrier - V	0.22 cms and Above
Pool Depth Barrier	None

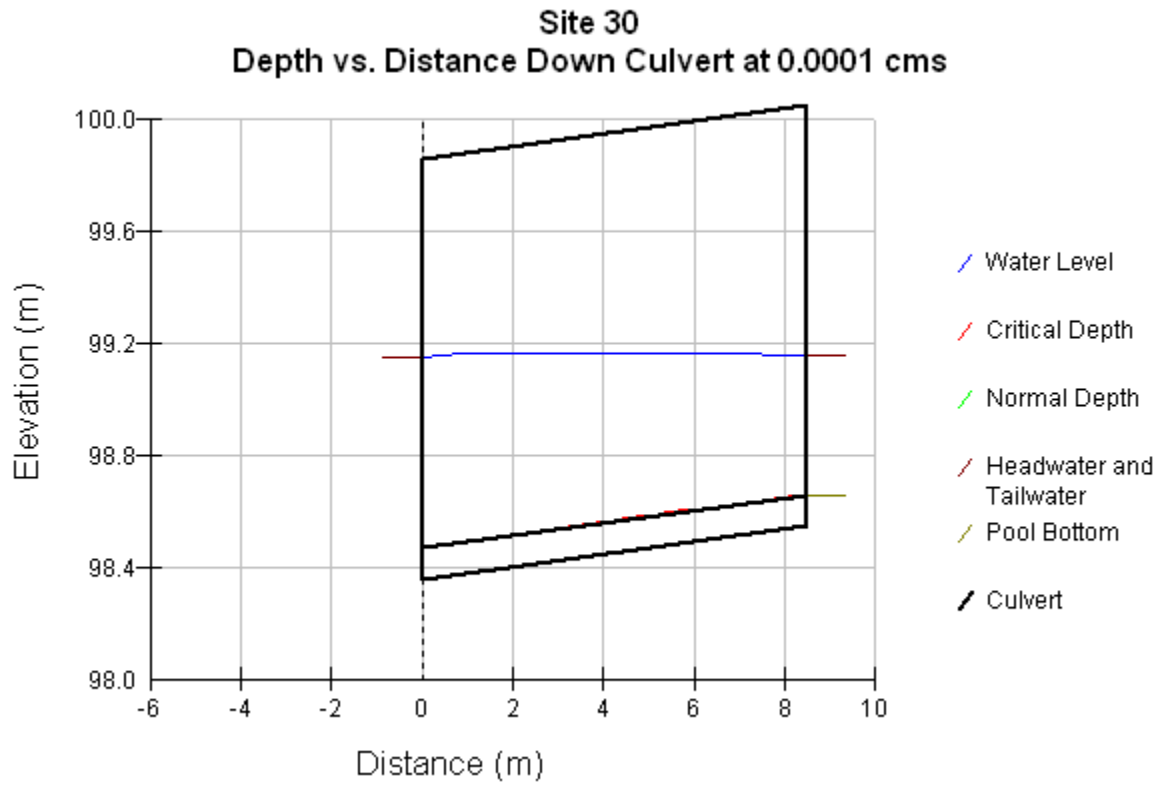


Figure 2322. Water Surface Profile at 0.0001 cms, Site 30, passable.

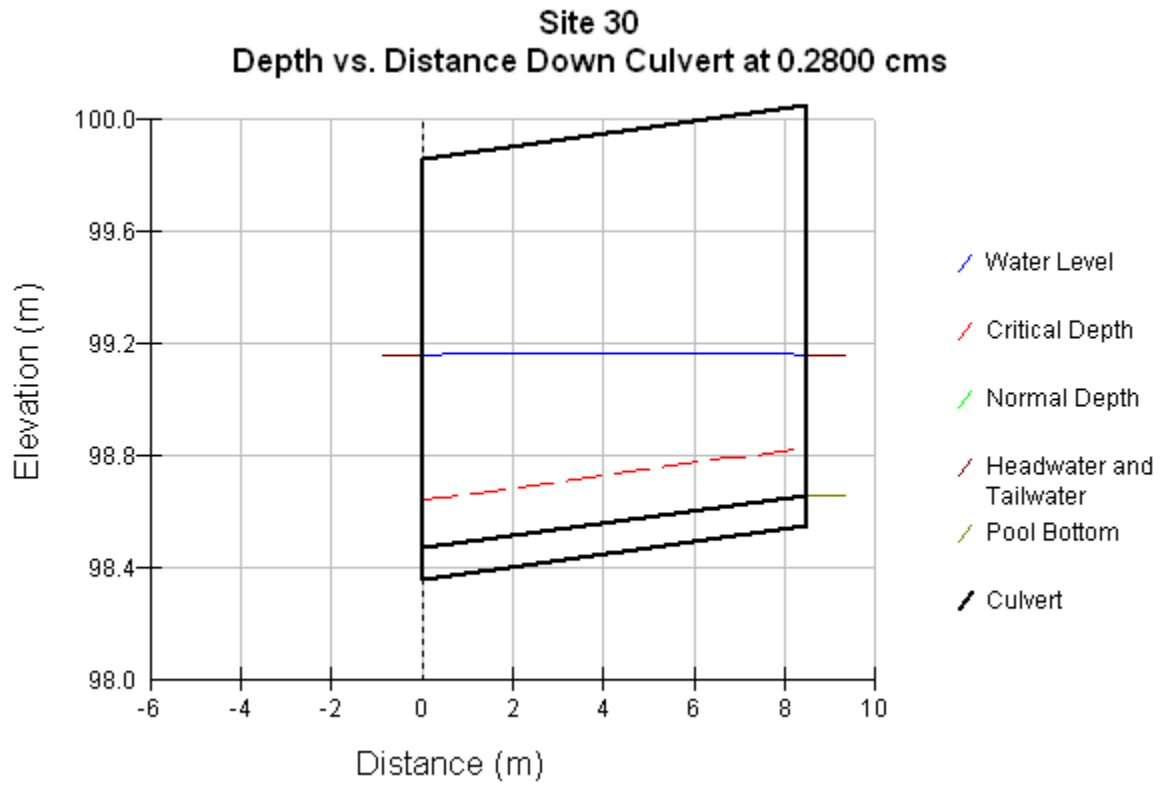


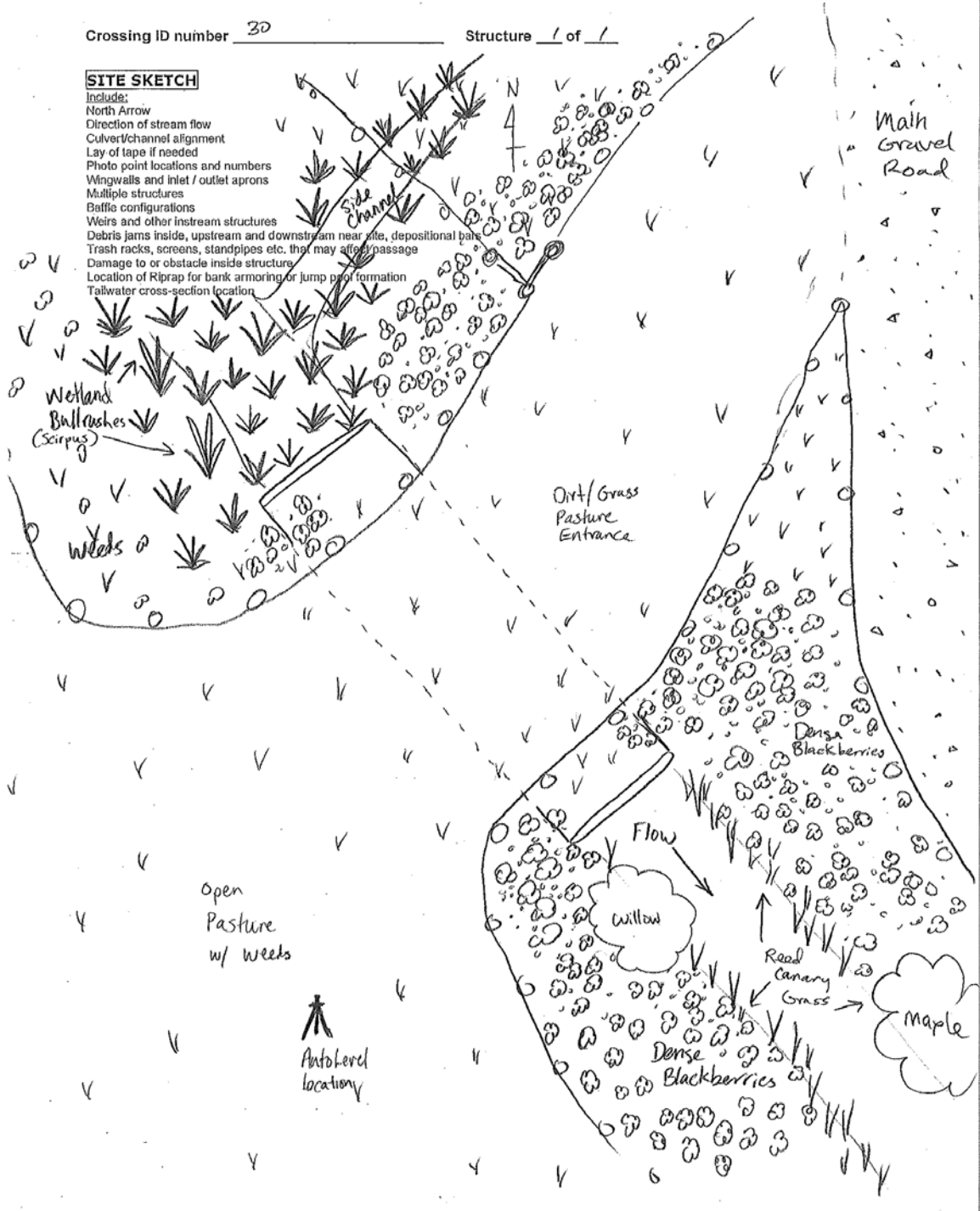
Figure 2423. Water Surface Profile at 0.28 cms, Site 30, velocity block.

Site Sketch

Crossing ID number 30 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structures
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 31 2009 Restoration Effectiveness Monitoring Summary

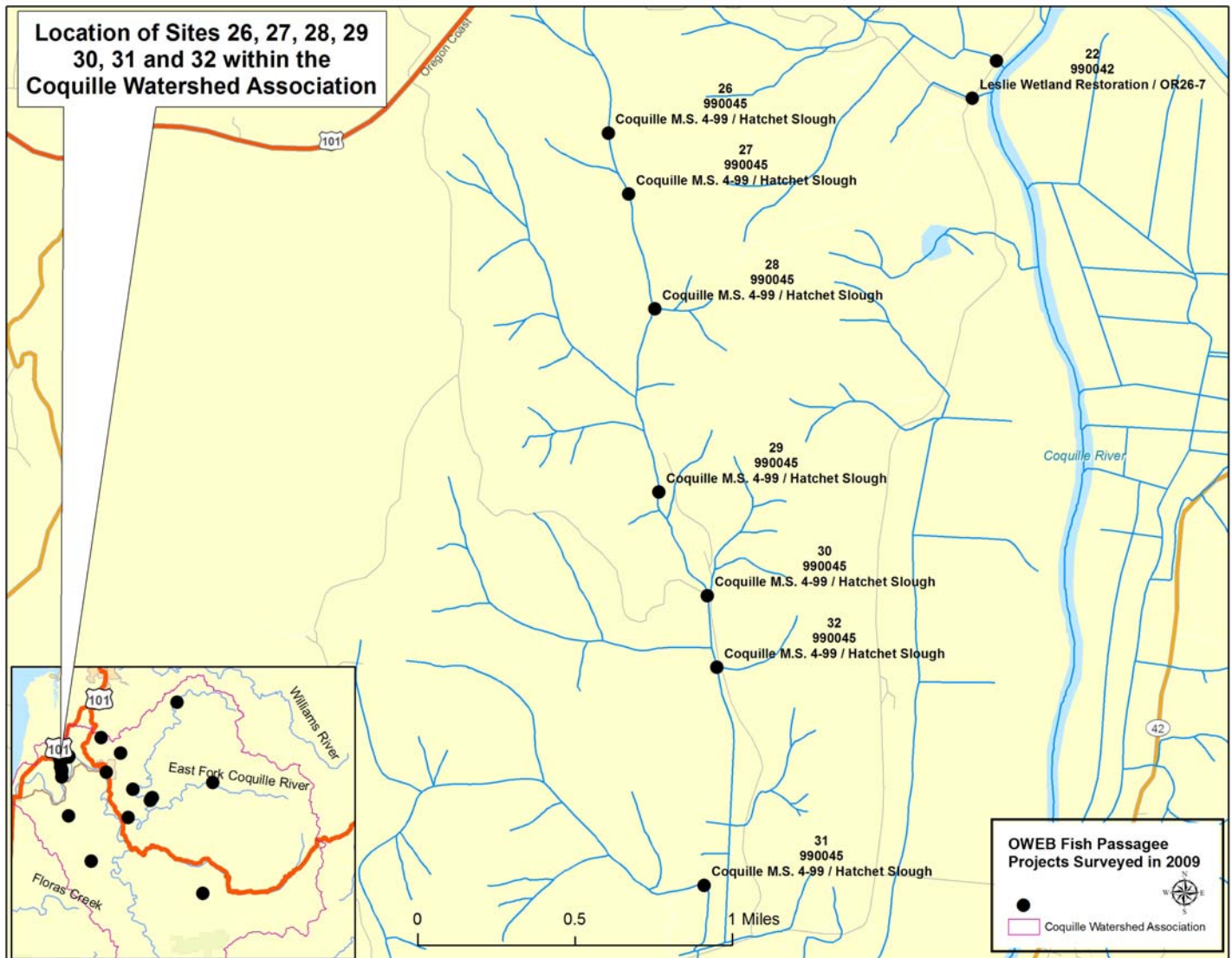
OWEB Project Name - Coquille M.S. 4-99 / Hatchet Slough

OWEB Grant Number – 098 - 055

OWRI Project Number – 990045

Owner – Private, Pearce

OWEB Description – Fish Passage



Map 13. Site 31 on the Hatchet Slough drainage within the Coquille sub-basin.

Site Notes

This stretch of creek has been engineered to prevent the creek from flooding the adjacent field. It is channelized, incised and lined with rip-rap. Invasive species (blackberry and reed canary grass) dominate the riparian area. A beaver dam near the culvert has been recently removed. This channel is heavily impacted by agricultural activities. Water flows over the culvert at peak flows.

This circular 1.2 meter diameter culvert lies in an area where bankfull was indeterminate. The culvert is overtopped by water annually. The water then floods the field. Channel substrate was composed of silt/cobbles/boulders; respectively. However, silt dominated the substrate composition; we estimated substrate to be 99% silt. Culvert slope was measured at 0.4% while channel slope around the culvert was ~1.0%. There was no substrate visible in the culvert.

FishXings predicts that 6% of all modeled flows are passable with a velocity block occurring at 0.11 cms.

During the snorkel survey juvenile salmonids were identified in each pool snorkeled above the culvert.

Snorkel Survey

Juvenile fish were found in all pools within 135 meters upstream of the culvert at Site 31.

Table 20. Snorkel survey results for Site 31, Hatchet Slough Tributary.

Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1	Straight Scour	4.2	0.9	0.4	Steelhead/Cutthroat	2	0	0
2	Straight Scour	5.2	2.2	0.45	Coho	17	0	0
3	Lateral Scour	6.2	2.1	0.45	Coho	12	Steelhead/Cutthroat	1
4	Glide	5.5	1.5	0.4	Coho	10	0	0

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 21. Fish Passage Summary, Site 31.

Fish Passage Summary	
Low Passage Design Flow	0.0001 cms
High Passage Design Flow	1.8000 cms
Percent of Flows Passable	6.1 %
Passable Flow Range	0.0001 to 0.1099 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.11 cms and Above
Pool Depth Barrier	None

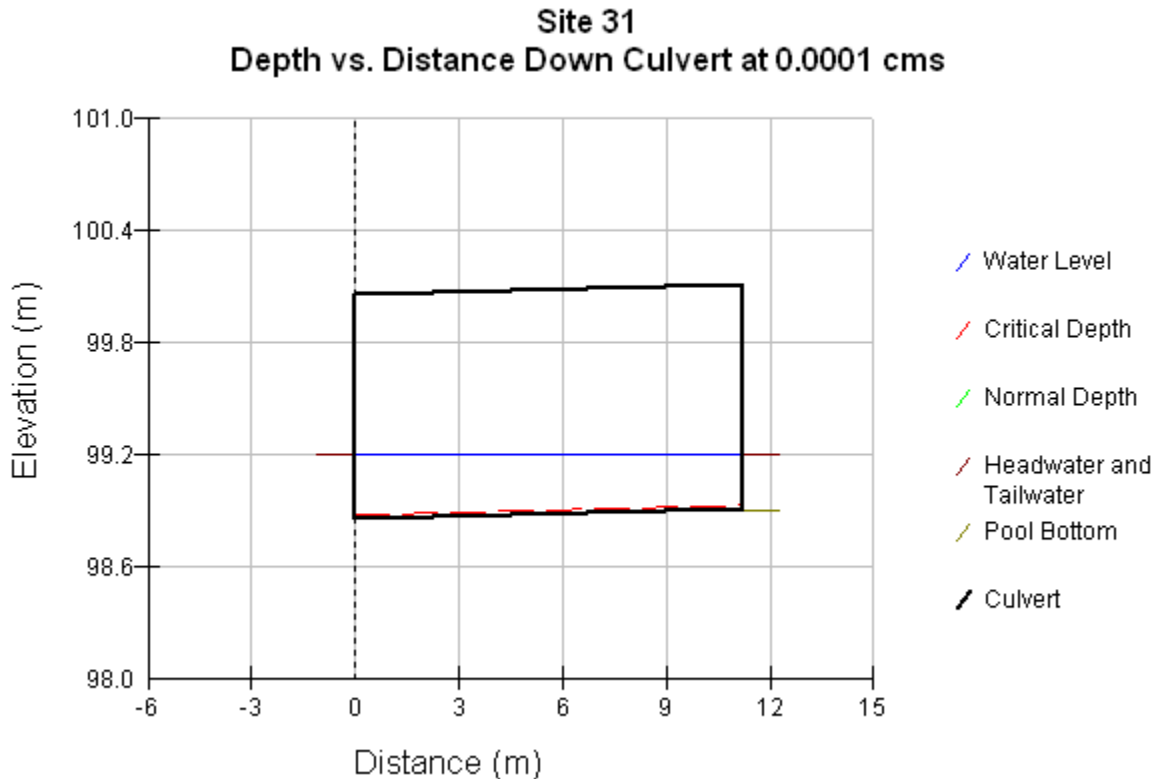


Figure 2524. Water Surface Profile at 0.0001 cms, passable.

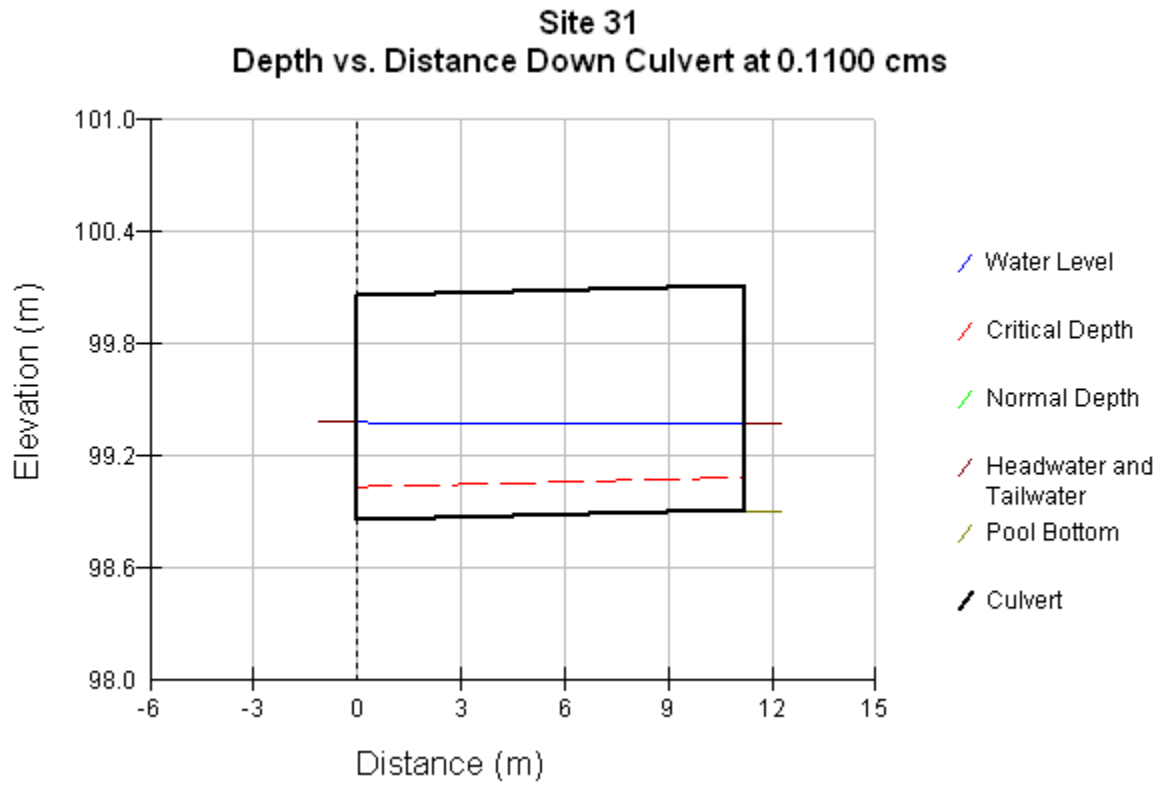


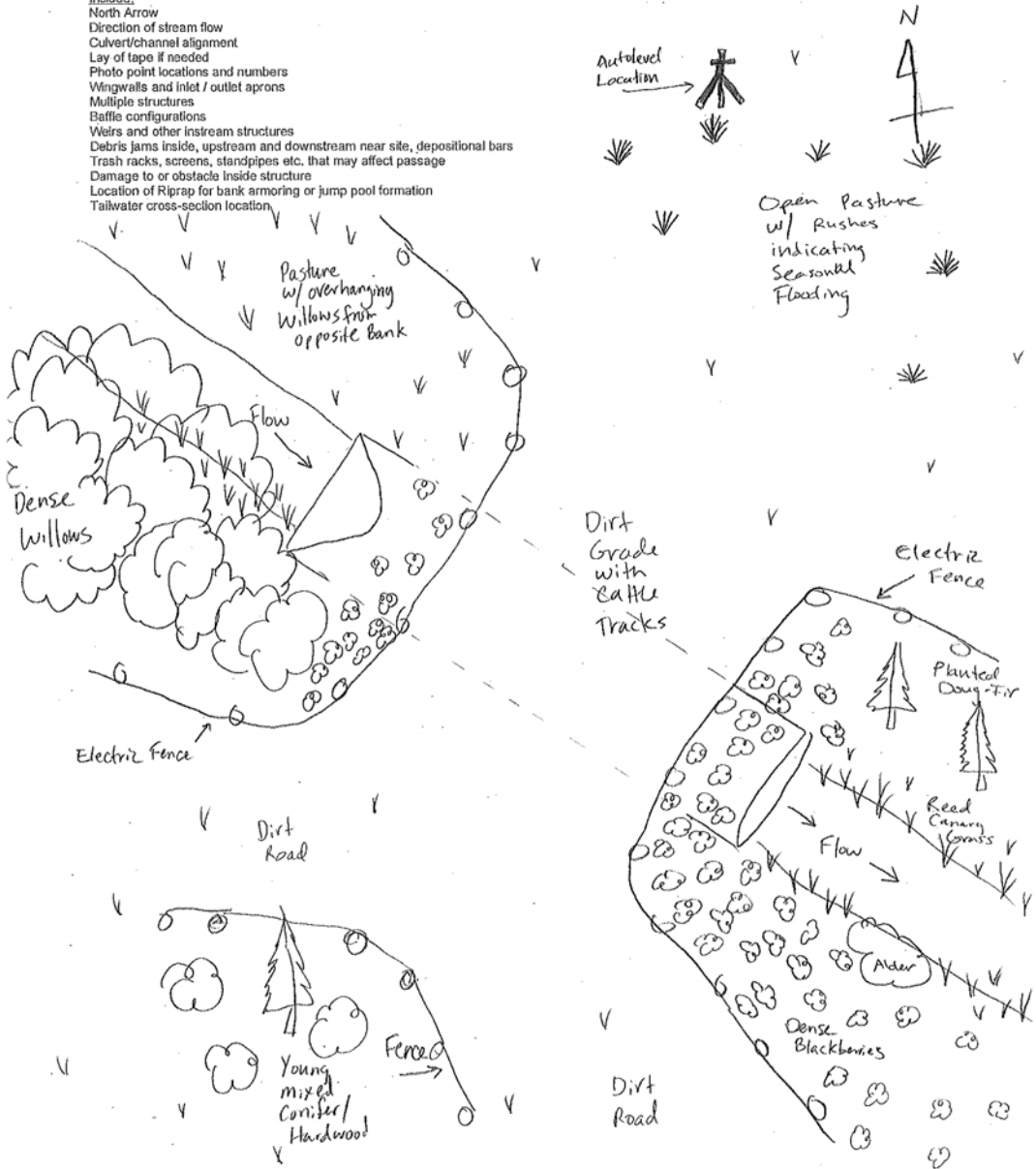
Figure 2625. Water Surface Profile at 0.11 cms, velocity block.

Site Sketch

Crossing ID number 31 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 32 2009 Restoration Effectiveness Monitoring Summary

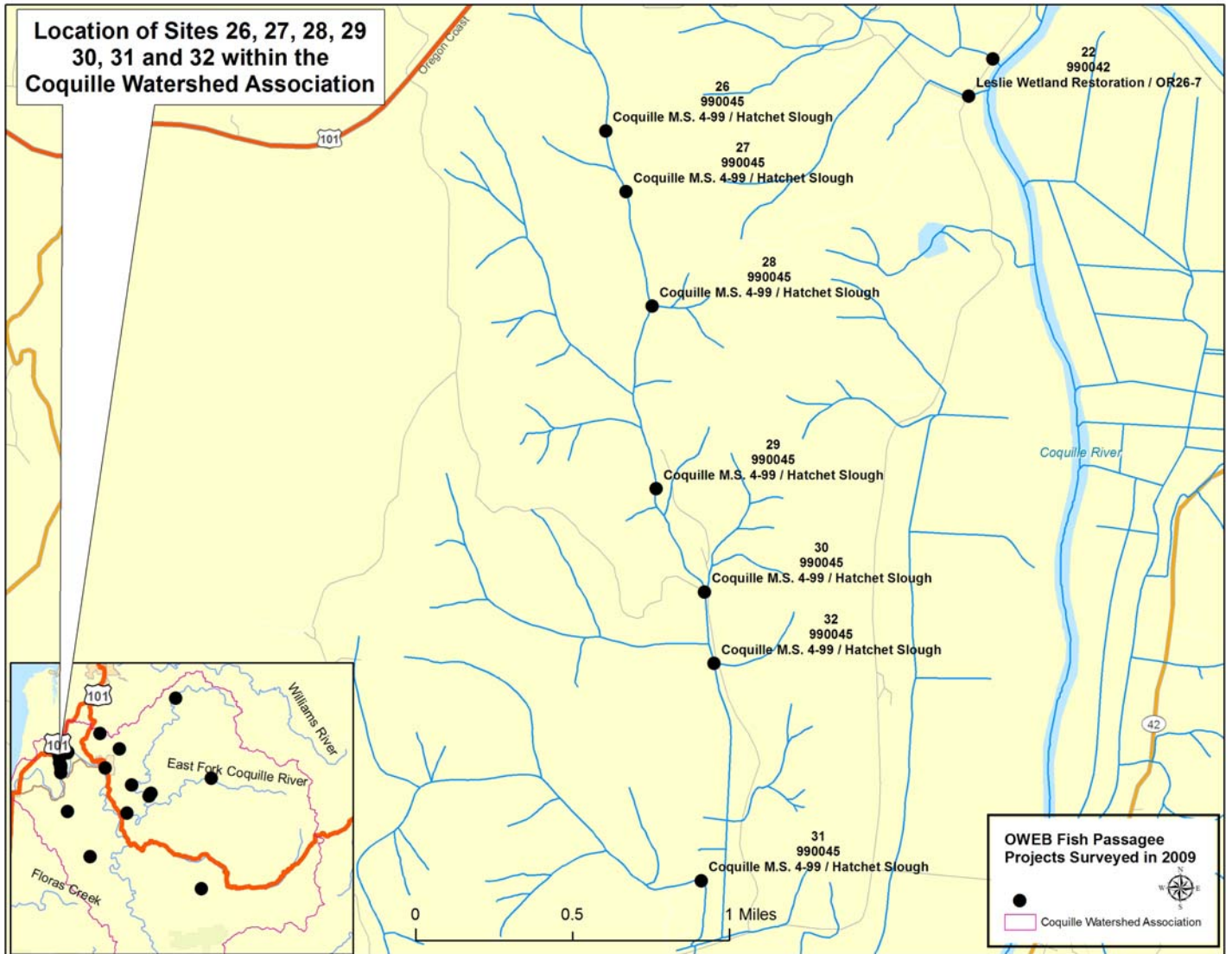
OWEB Grant Number – 098 - 055

OWEB Project Name - Coquille M.S. 4-99 / Hatchet Slough

OWRI Project Number – 990045

Owner – Private, Pearce

OWEB Description – Fish Passage



Map 14. Location of Site 32 along Hatchet Slough in the region of the Coquille sub-basin.

Site Notes

The culvert is located along the road where it has been forced to the edge of the pasture. It is incised and very deep (~3 meters). The substrate is 100% silt and riparian area is nearly 100% reed canary grass. This channel appears to be a roadside ditch. The channel gradient in the vicinity of the culvert was 1.6%. The culvert slope was ~1%. Bankfull width averaged 3.6 meters. The ratio of inlet width to channel width was 0.58. There was no outlet drop and no outlet pool. The entire channel section above and below the culvert was a glide.

FishXings predicts that 4% of modeled flows would be passable by juvenile salmonids. A velocity block is expected to occur at 0.19 cms. Juvenile salmonids were observed above the culvert upstream at Site 26.

Snorkel Survey Results

Please see the most upstream point on this channel for snorkel survey results; Site 26. Juvenile salmonids were found above this culvert.

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 22. Fish Passage Summary, Site 32.

Fish Passage Summary	
Low Passage Design Flow	0.0001 cms
High Passage Design Flow	5.0000 cms
Percent of Flows Passable	3.9 %
Passable Flow Range	0.0001 to 0.1941 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.19 cms and Above
Pool Depth Barrier	None

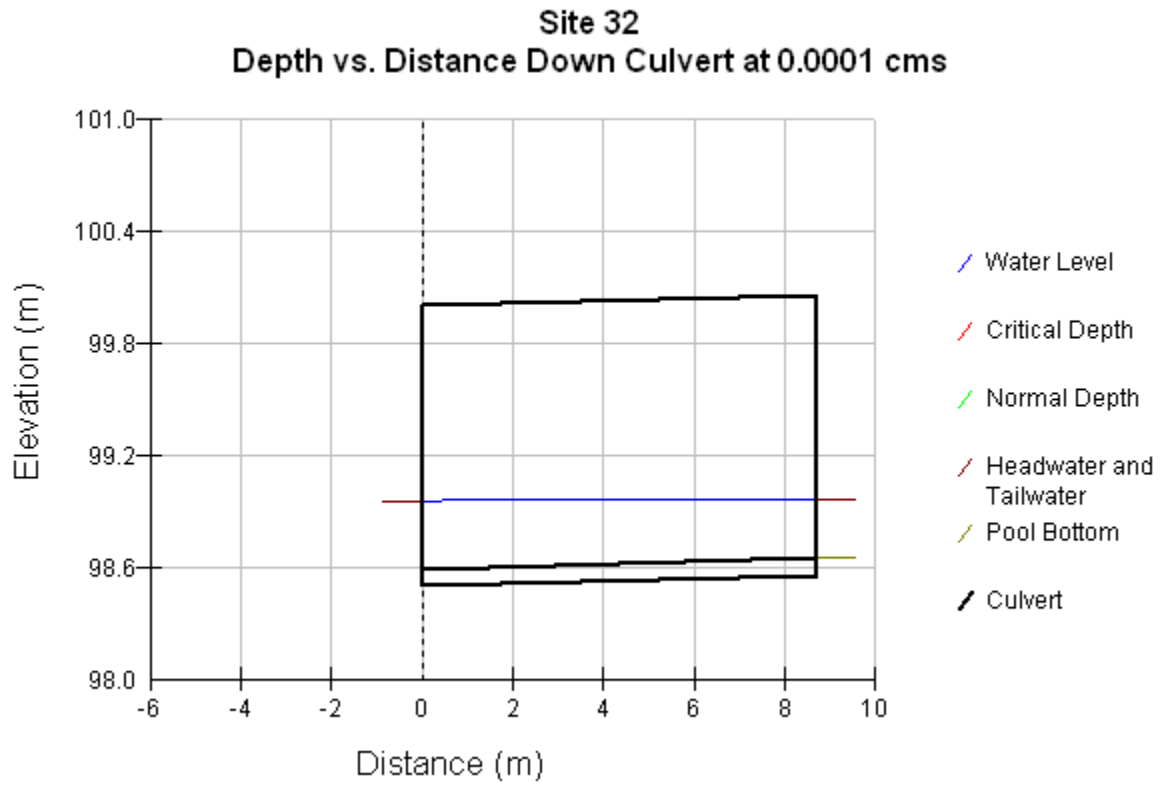
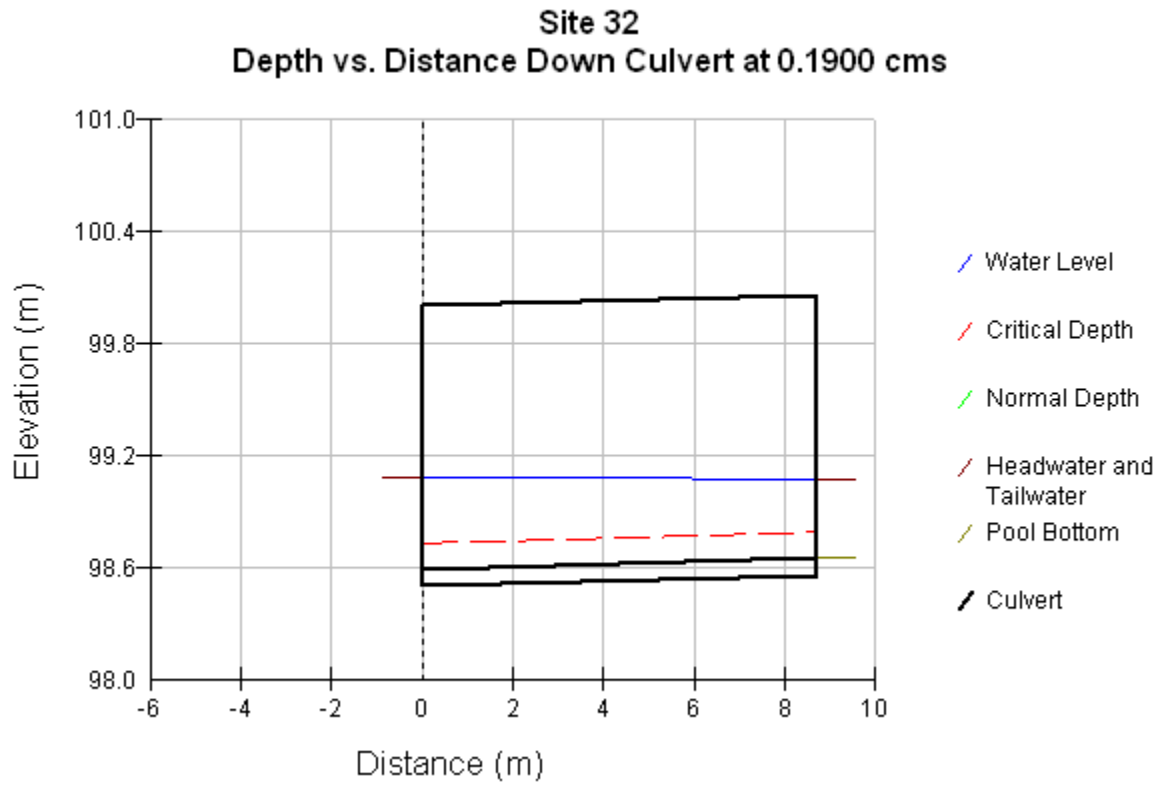


Figure 2726. Water Surface Profile at 0.0001 cms, Site 32, passable at this stage.



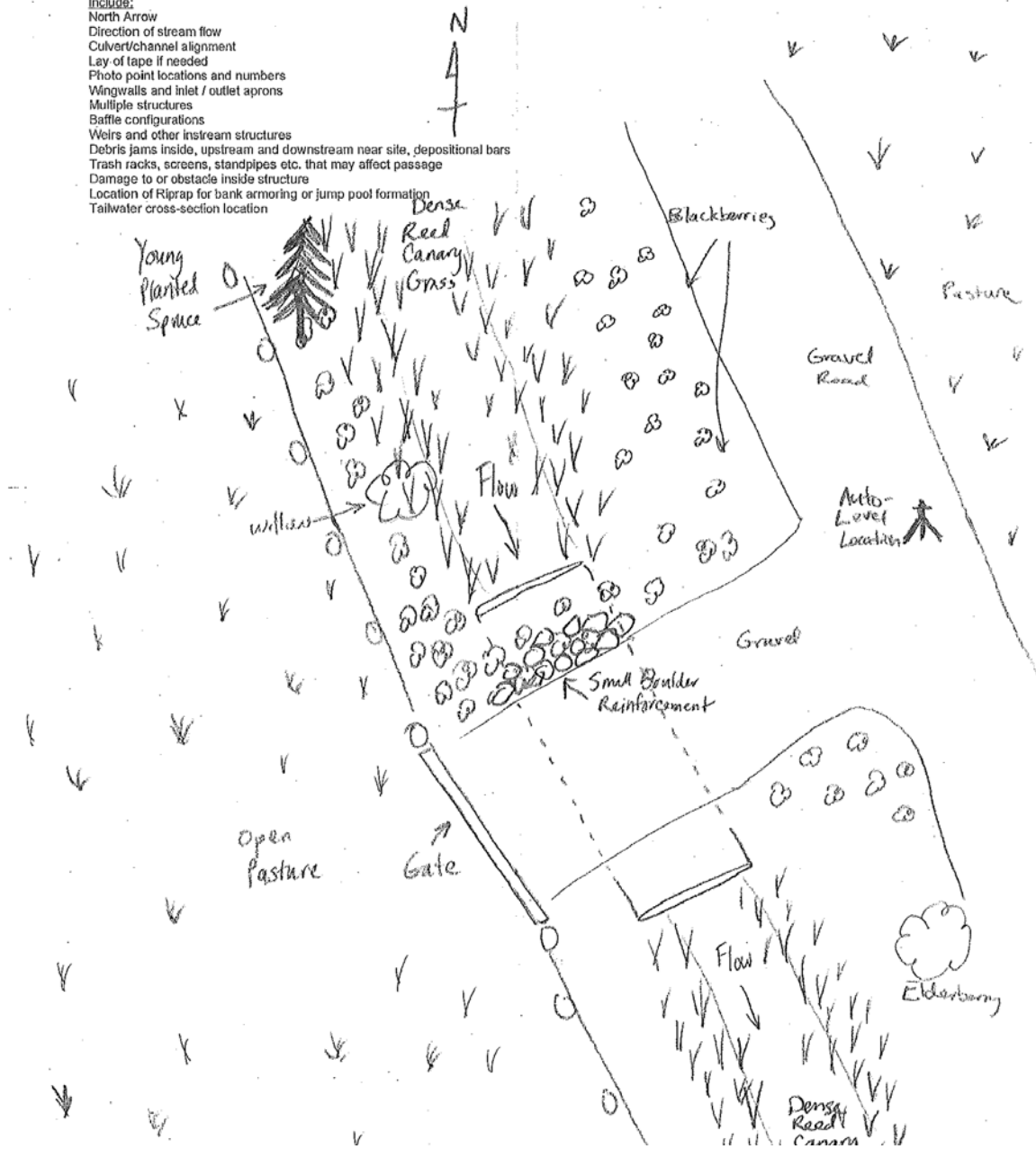
| **Figure 2827.** Water Surface Profile at 0.19 cms, Site 32, velocity block occurs at 0.19 cms.

Site Sketch

Crossing ID number 32 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 33 2009 Restoration Effectiveness Monitoring Summary

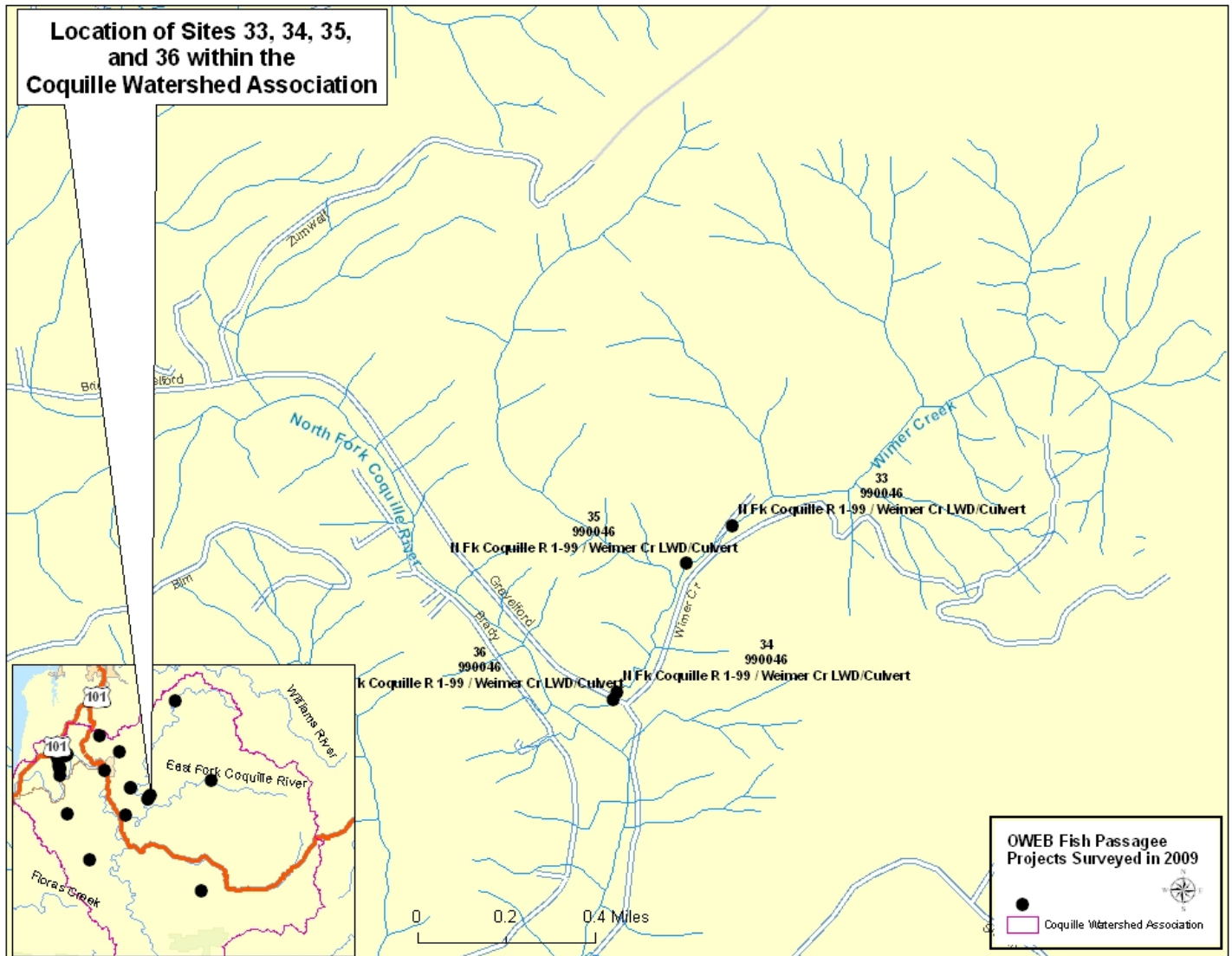
OWEB Project Name - N Fk Coquille R 1-99 / Weimer Cr LWD/Culvert

OWEB Grant Number - 097-067/099-070

OWRI Project Number - 990046

Owner - Private, Roland

OWEB Description - Fish Passage



Map 15. Location of Site 33, the most upstream culvert, along Weimer Creek within the region of the Coquille sub-basin.

Site Notes

This was a forested reach which conforms to the basic description of a plane-bed channel. The channel substrate was composed of gravel/cobble/silt. There were abundant relatively clean gravels with lots of point bars dominated by gravel. Banks were stable and well vegetated by salmon berry, blackberry, and other shrubs and forbs. Well shaded and cool; the rail car bridge is allowing fish to pass and the channel appeared to be functioning appropriately. Based on juvenile fish counts and the slope of the channel through the restoration area, juvenile pass through this area.

Snorkel Survey Results

Juvenile Coho were found in every pool snorkeled above the project area.

Table 23. Snorkel survey of Site 33.

Stream LLID	Pool Id	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1240743431230	1	Lateral Scour	8.6	2.3	0.25	Coho	21	Steelhead/Cutthroat	2
1240743431230	2	Lateral Scour	6	2.3	0.28	Coho	16	0	0
1240743431230	3	Lateral Scour	7	3.1	0.41	Coho	33	0	0
1240743431230	4	Lateral Scour	6	2.4	0.28	Coho	46	0	0
1240743431230	5	Lateral Scour	10.5	3.3	0.35	Coho	39	Steelhead/Cutthroat	3

Longitudinal and Cross Section Profiles

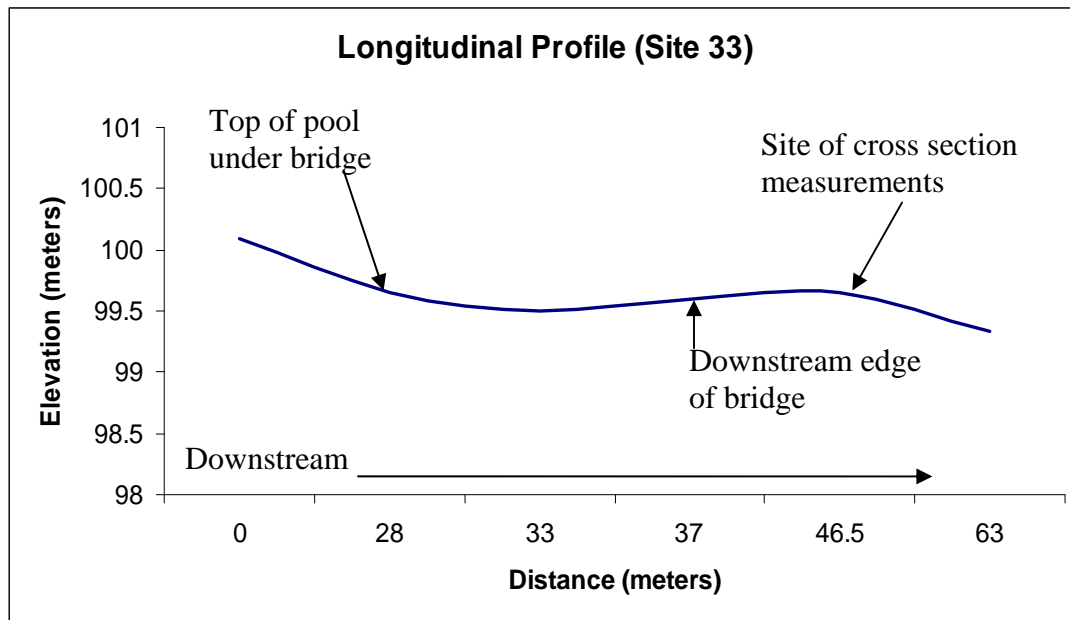


Figure 2928. Logitudinal Profile for Site 33, Coquille sub-basin.

The longitudinal profile was 68 meters long and captured the area of channel affected by the stream crossing upgrade from a culvert to a bridge. Overall the channel slope was 2.7%, while the slope immediately under the bridge was a -2.5%. As the profile illustrates, a pool was formed just under the bridge. The pool is a scour pool and is formed by large boulders forcing scour. The cross section illustrates a region at the pool tail crest (Figure 30Figure 29). Bedload evidence was found at the cross section in the form of stacked cobbles.

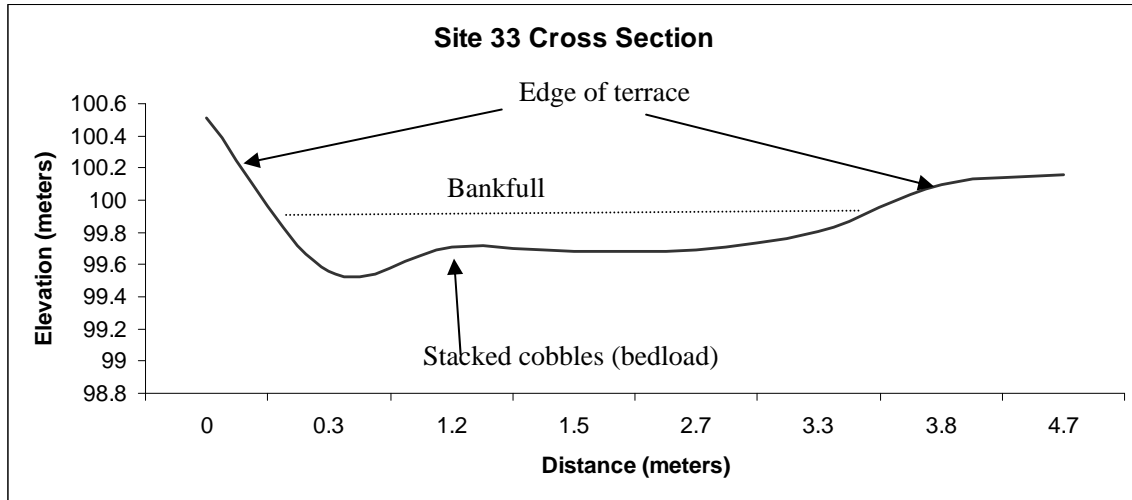
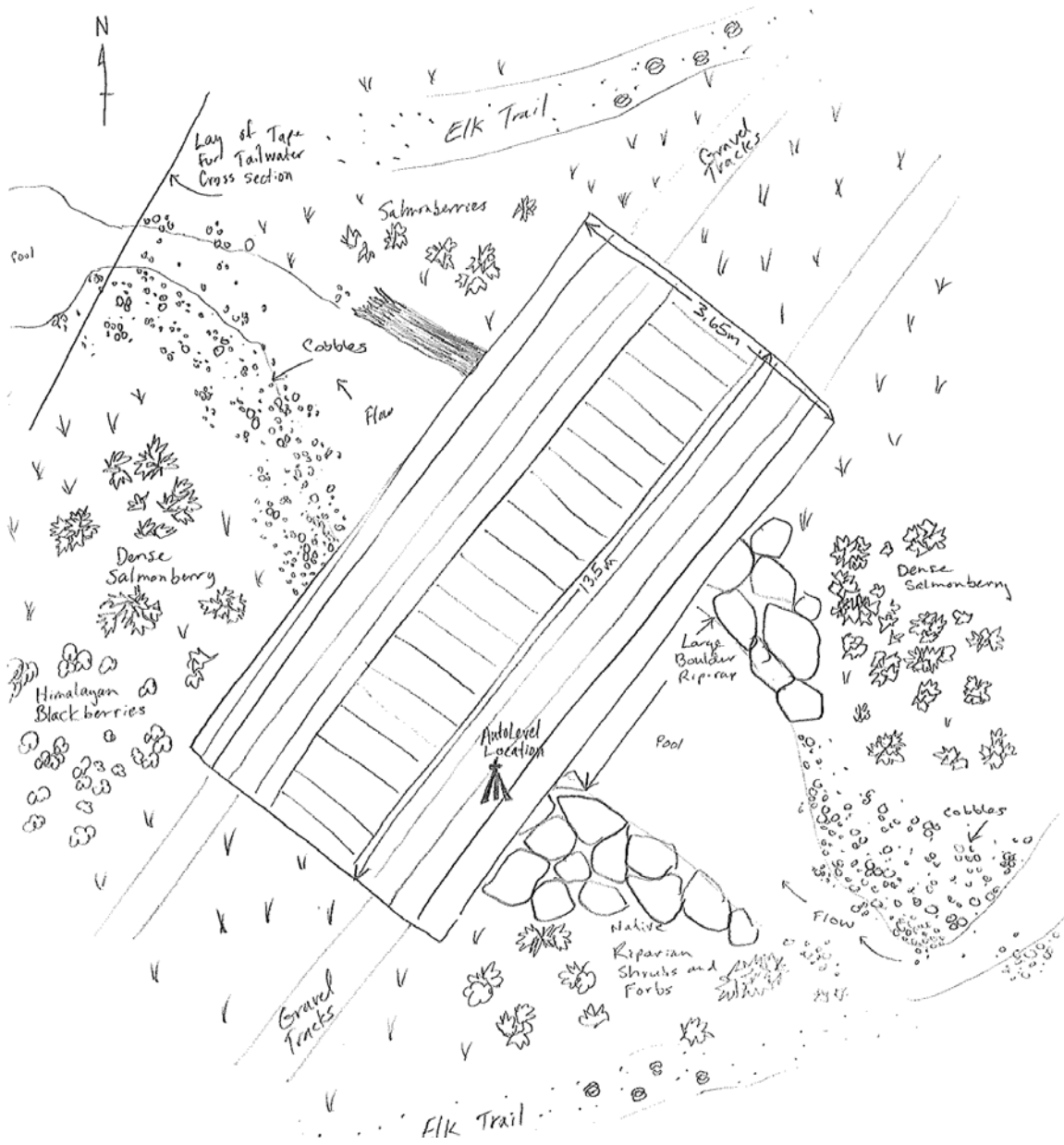


Figure 3029. Cross section of area just downstream of bridge and project area.

Site Sketch



Site # 34 2009 Restoration Effectiveness Monitoring Summary

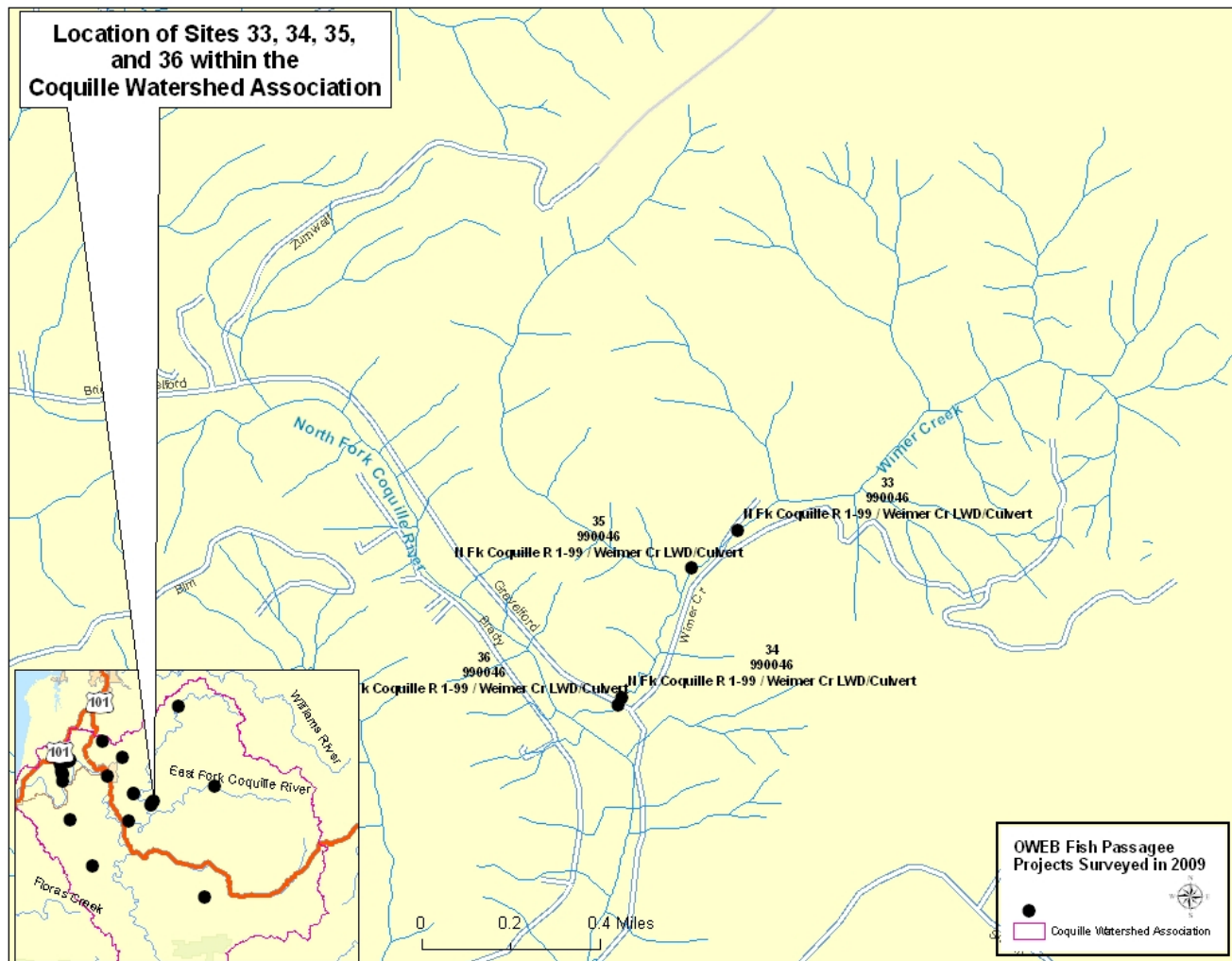
OWEB Project Name - N Fk Coquille R 1-99 / Weimer Cr LWD/Culvert

OWEB Grant Number - 097-067/099-070

OWRI Project Number - 990046

Owner - Private, Roland

OWEB Description - Fish Passage



Map 16. Location of Site 34 along Weimer Creek within the region of the Coquille sub-basin.

Site Notes

This was a very unusual site. First, this did not appear to be a restoration site, but this was where OWEB's coordinates took us. After, close inspection, the area seemed to have been one-time fenced and part of a live-stock enclosure that, at the time of survey, had been completely degraded. The channel is filled with sediment and reed-canary grass. The channel was completely lost for ~30 meters. This is part of the same channel that is Site 33, 35, and 36. What happened here?

We speculate that before the original restoration effort, the channel was degraded. Riparian fencing was installed here and at least 3 other sites on Donald Roland's property. Sometime thereafter, the fencing failed upstream of the main road crossing allowing cows to access this area freely. Cows then trampled the creek, wore down the banks and destroyed the channel where there was little riparian vegetation. Interestingly, we found fish above this degraded ford. That fact suggests that fish pass through the degraded channel section.

The landowner, Donald Roland, was extremely cooperative in terms of allowing us access to this property. He is an elderly gentleman, a WWII Veteran, and a long-time Oregon resident. Apparently, he does not manage the land any longer; although, he does live on the property. Someone other than Mr. Roland runs livestock here and is responsible for fencing.

Longitudinal Profile

The longitudinal profile illustrates the longitudinal profile of Site 34. This is a highly degraded site. There is no defined channel for nearly 30 meters as the channel is consistently grazed by livestock. The banks have been denuded of all riparian vegetation here and the banks are non-existent. This section of the channel now acts as a wetland.

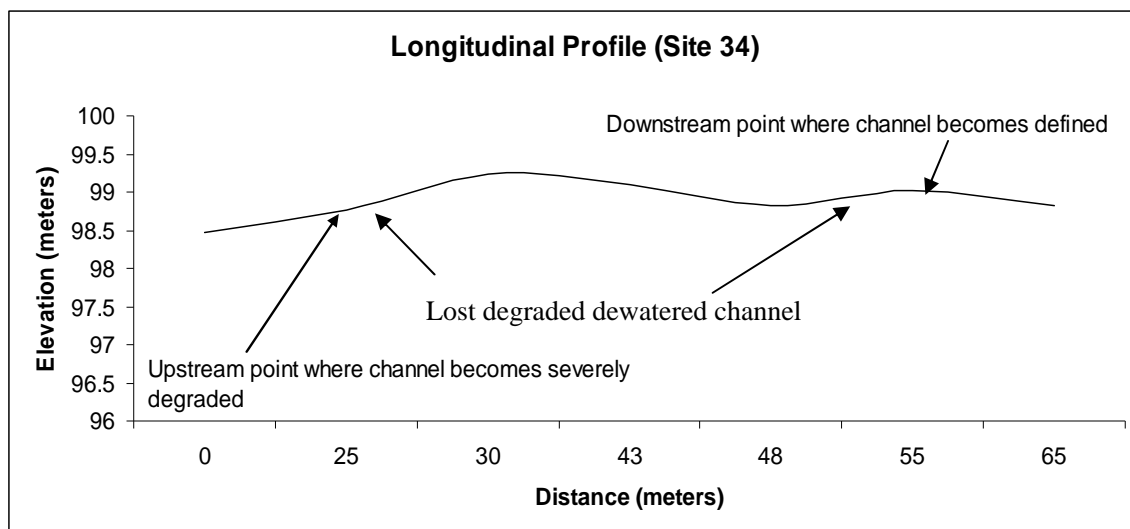
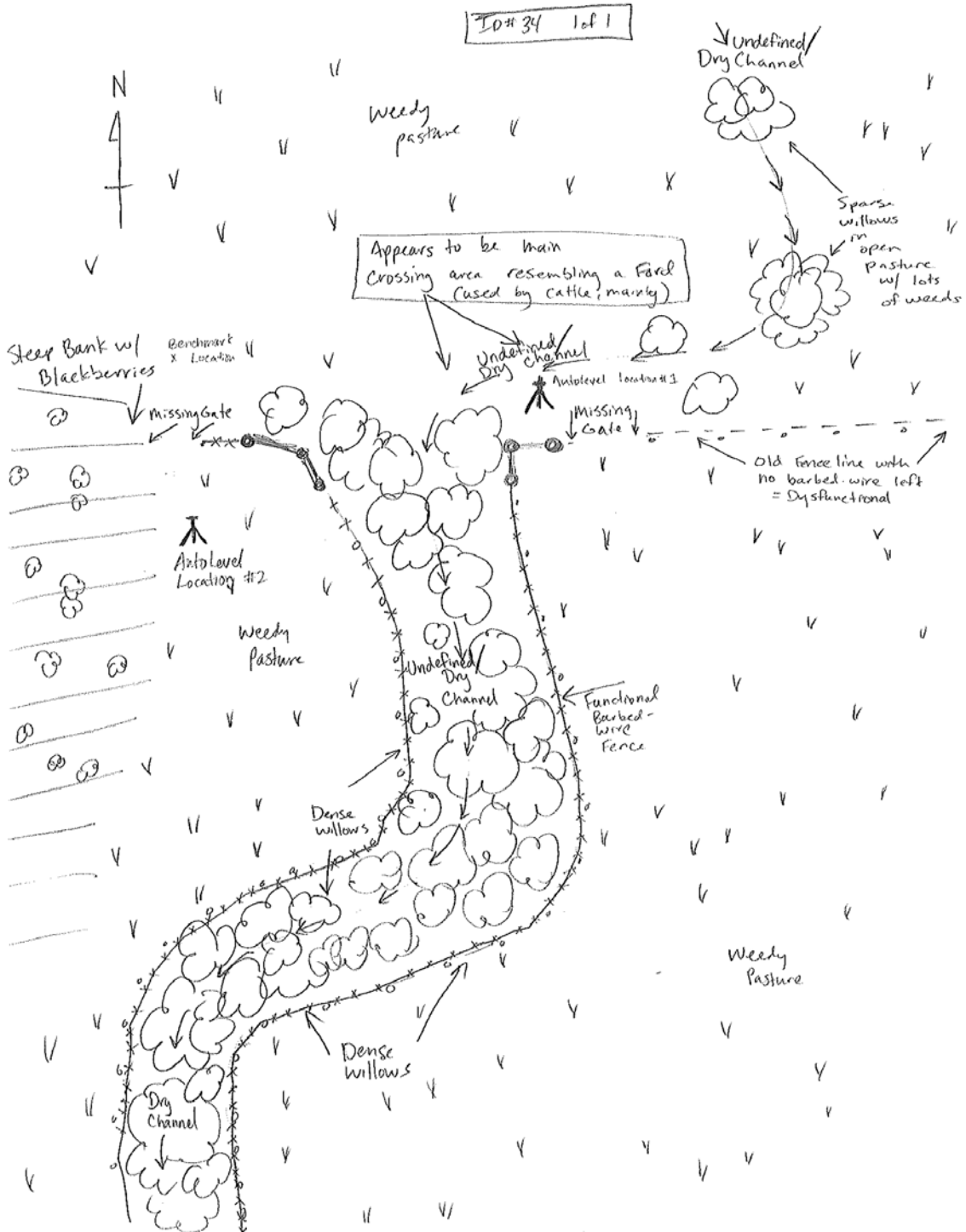


Figure 3130. Longitudinal profile of the channel at Site 34, Wimer Creek, Coquille sub-basin.

Site Sketch



Snorkel Survey Results

See snorkel results for Sites 33 and 35. Both 33 and 35 are upstream of this point. Juvenile salmonids were observed above this point.

Site # 35 2009 Restoration Effectiveness Monitoring Summary

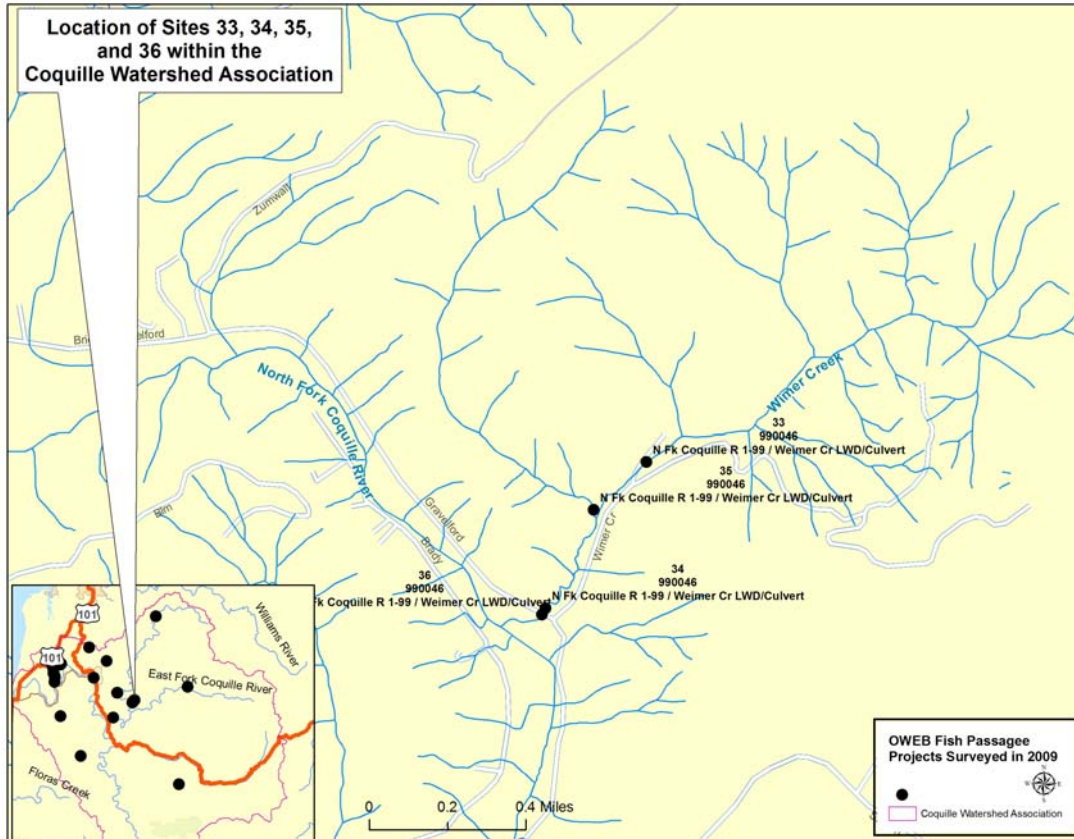
OWEB Project Name - N Fk Coquille R 1-99 / Weimer Cr LWD/Culvert

OWEB Grant Number 097-067/099-070

OWRI Project Number -990046

Owner - Private, Roland

OWEB Description - Fish Passage



Map 17. Location of Site 35, on a tributary to Weimer Creek, Coquille sub-basin.

Site Notes

This is a step pool channel on a tributary to Weimer Creek. The point is the site of a railcar bridge crossing that is on an older spur that may occasionally be crossed to access timber lands. No active logging was noted in the area. Approximately 30 meters below the crossing the channel floods into a wide wetland comprised primarily of reed canary grass. Juvenile salmonids were found above the crossing.

Longitudinal Profile

Figure 32 illustrates the longitudinal profile at the railcar bridge. The channel slope through this area was 1.3% while the slope through the immediate project area was 0.5%. The channel through the restoration area did not have a pool. Since the slope through the project area was less than the overall channel, juvenile fish should have no problem moving through this area.

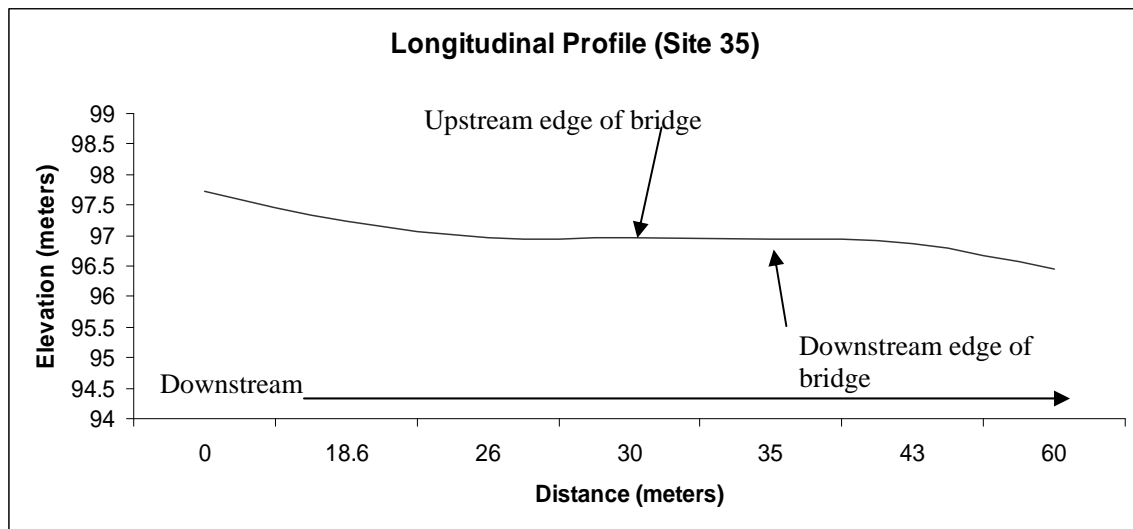


Figure 32. Longitudinal Profile of channel at Site 35, a tributary to Weimer Creek.

Snorkel Survey Results

Table 24. Snorkel survey results for Site 35.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1240696431276	1	Lateral Scour	3.3	2.3	0.32	0	0
1240696431276	2	Lateral Scour	3.23	1.11	0.3	Steelhead/Cutthroat	2
1240696431276	3	Lateral Scour	3.6	2.44	0.29	Steelhead/Cutthroat	1

There were few pool habitat units found within 300 meters upstream of the project area. Pools were shallow. Only 3 juvenile fish were found above this bridge.

Site # 36 2009 Restoration Effectiveness Monitoring Summary

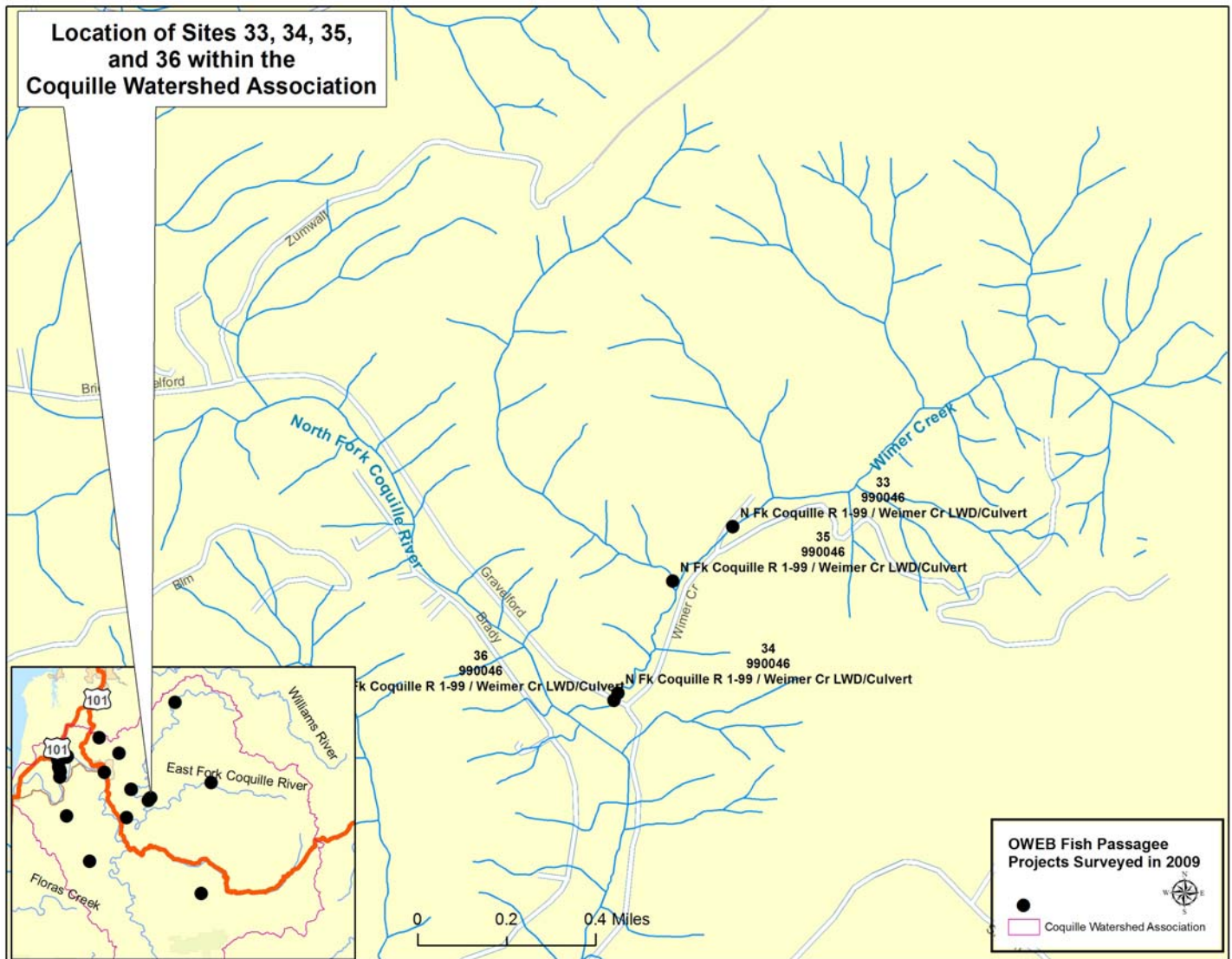
OWEB Project Name - N Fk Coquille R 1-99 / Weimer Cr LWD/Culvert

OWEB Grant Number 097-067/099-070

OWRI Project Number – 990046

Owner – Private, Roland

OWEB Description – Fish Passage



Map 18. Location of Site 36, the most downstream point surveyed along Weimer Creek.

Site Notes

This is a fenced and dense riparian area dominated by salix, blackberry, and reed canary grass. The channel is a low-gradient incised channel dominated by glide/trench pools primarily regulated by beaver. The slow moving murky water was nearly stagnant. Anaerobic decomposition was obvious while surveyors worked in the channel. This was detected by an intense sulfur stench when surveyors slogged through the muck that is 100% silt.

The overall channel gradient at this site was 1.3%, while the culvert slope was 0.1%. Bankfull width above the culvert was very difficult to determine owing to the intense beaver activity in the area. We estimated bankfull to be 13 meters. This culvert was embedded and extremely difficult to measure for depth because the sediment filled the culvert and water was backed up through the culvert because of the beaver ponds.

Snorkel Survey Results

Please see the snorkel results for Sites 33 and 35; both of these sites are upstream of Site 36. Juvenile salmonids were observed upstream of this culvert.

FishXings Results

Hydraulic Evaluation Criteria

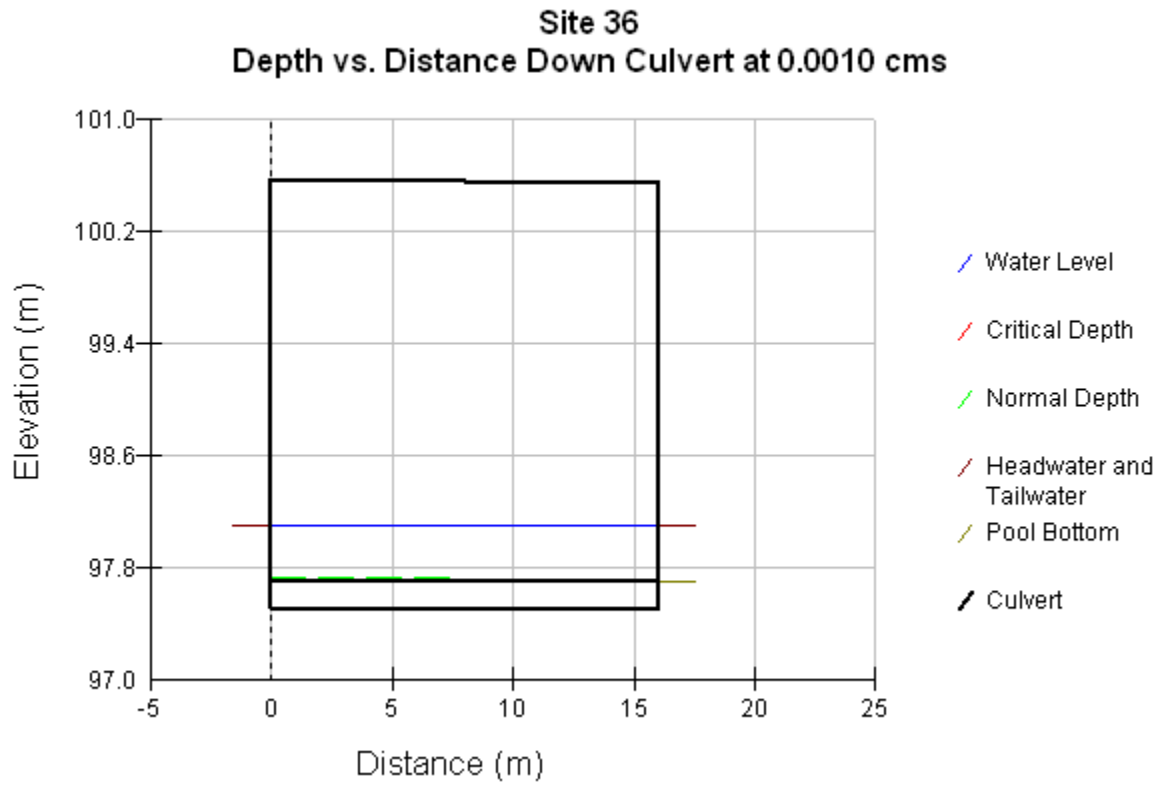
Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 25. Fish Passage Summary, Site 36.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	10.0000 cms
Percent of Flows Passable	3.4 %
Passable Flow Range	0.0010 to 0.3366 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.34 cms and Above
Pool Depth Barrier	None



| **Figure 3332.** Water Surface Profile at 0.001 cms, juveniles can pass at this low flow.

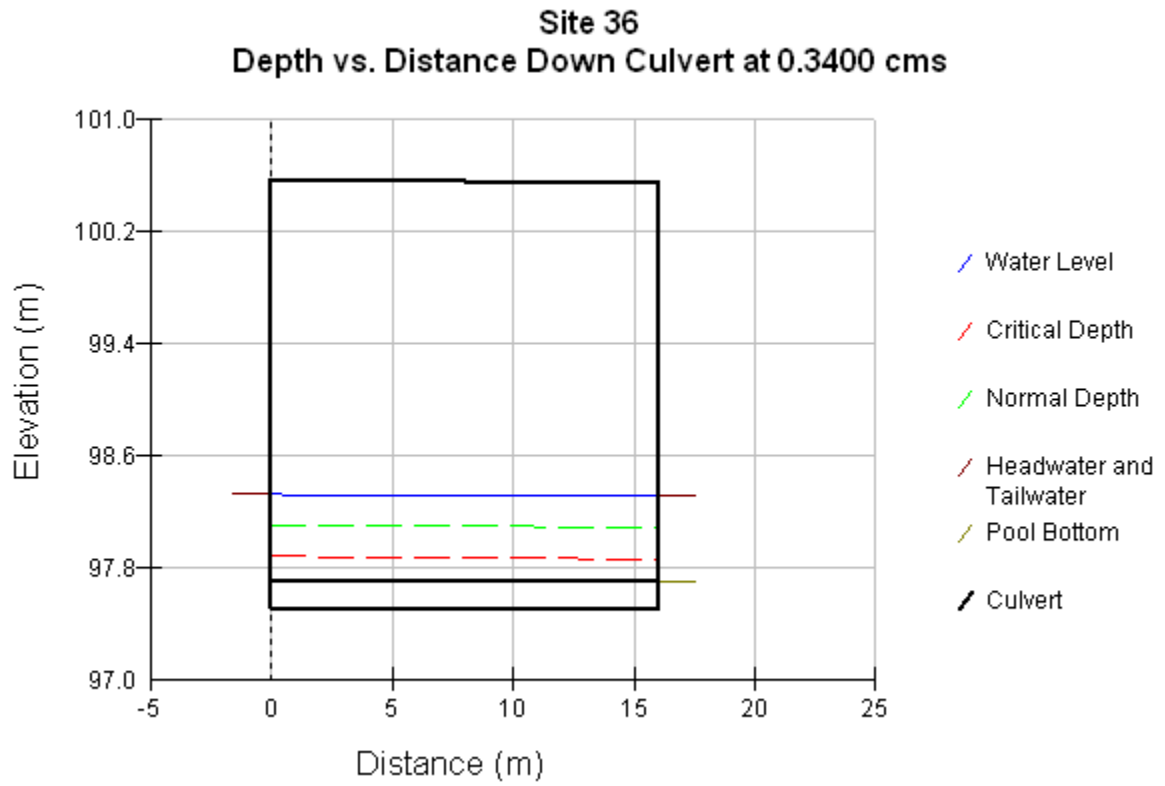
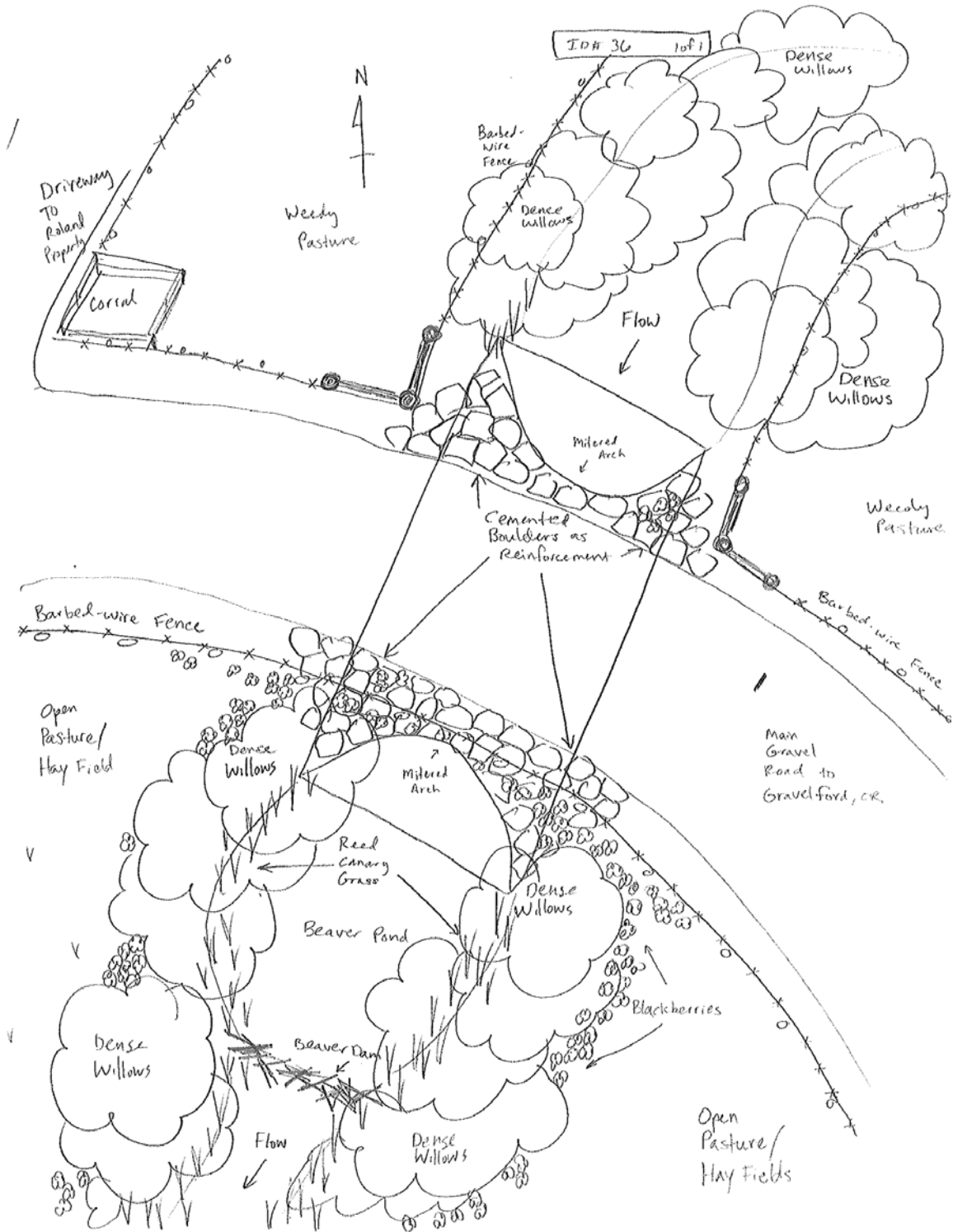


Figure 3433. Water Surface Profile at 0.34 cms, this is the point when a velocity barrier begins for juvenile salmonids.

Site Sketch



Site # 68 2009 Restoration Effectiveness Monitoring Summary

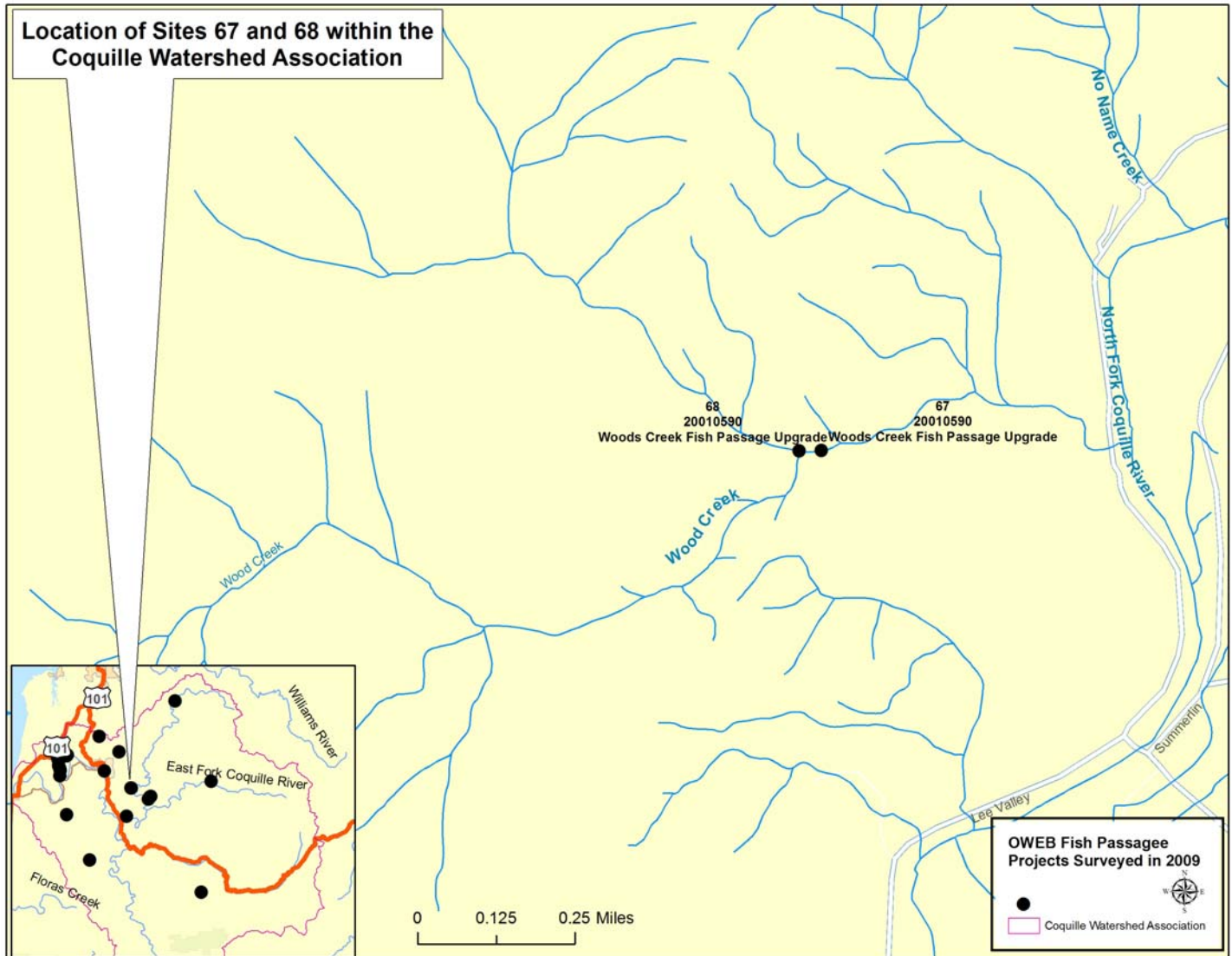
OWEB Project Name - Woods Creek Fish Passage Upgrade

OWEB Grant Number – 099-466

OWRI Project Number – 20010590

Owner – Roseburg Forest Products

OWEB Description – Fish Passage



Map 19. Location of Sites 67 and 68 on Woods Creek within the region of the Coquille sub-basin.

Site Notes

Two culverts (68-67) placed one after the other at a junction on a forest road. Culvert 68 is the most upstream of the two culverts. It was unobstructed and drains a creek that has a 1.8 meter bank full width. Sites 67 and 68 had the same size culverts; 2.5 meters wide and 1.8 meters high open bottom arches. The ratio of inlet width to channel width was 0.72. Channel gradient was measured at 2.1% and culvert gradient for Site 68 was 3.1% and Site 67 was 0.1%. Both culverts acted as stream simulation and had substrate continuous throughout culverts. Channel substrate was composed of sand/silt/gravel and substrate within the culverts was composed of gravel/sand/silt.

This section of the channel is highly disturbed because it is positioned between two roads. A side tributary also flows into the channel at the road crossing area. Culvert 67 (lowest downstream culvert) has a significant debris jam partially blocking the inlet that forms a large pool there. This partial block could potentially, under an intense peak flow event, act to cause a washout at the road. Debris transported from upstream does not flow through the culverts.

FishXings predicts that juvenile salmonids will pass through this culvert at 3.1% of the flows. At 0.23 cms a velocity barrier is formed.

Snorkel Survey Results

Table 26. Snorkel survey results for Sites 68 and 67. Juvenile salmonids were observed in every upstream pool.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1241066431427	1	Trench	7.5	1.5	0.35	Steelhead/Cutthroat	2	0	0
1241066431427	2	Trench	4.5	1.5	0.4	Steelhead/Cutthroat	2	Coho	2
1241066431427	3	Trench	4	1.6	0.29	Coho	22	0	0
1241066431427	4	Lateral Scour	11	1.7	0.3	Coho	39	Steelhead/Cutthroat	1
1241066431427	5	Straight Scour	5	1.8	0.4	Coho	17	0	0

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 27. Fish Passage Summary, Site 68.

Fish Passage Summary	
Low Passage Design Flow	0.001 cms
High Passage Design Flow	6.8000 cms
Percent of Flows Passable	3.1 %
Passable Flow Range	0.0001 to 0.2272 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.23 cms and Above
Pool Depth Barrier	None

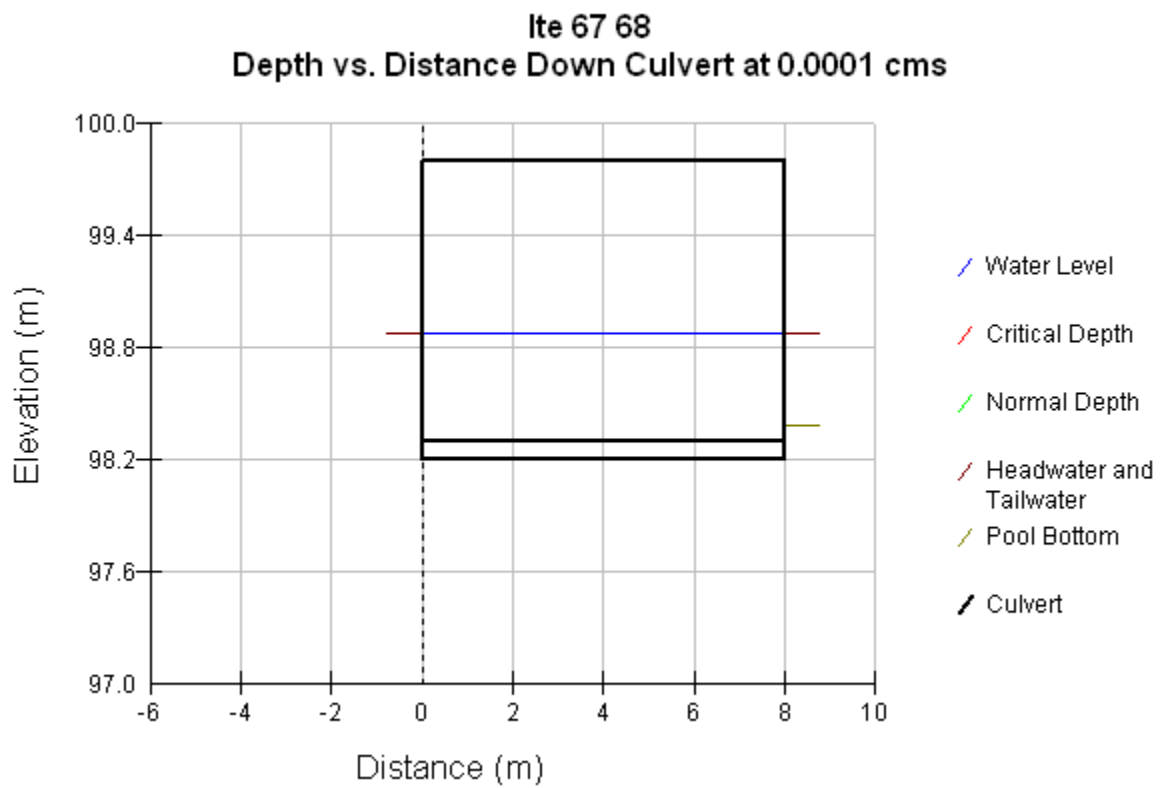


Figure 3534. Water Surface Profile at 0.0001 cms, Site 68, fish pass at very low flows.

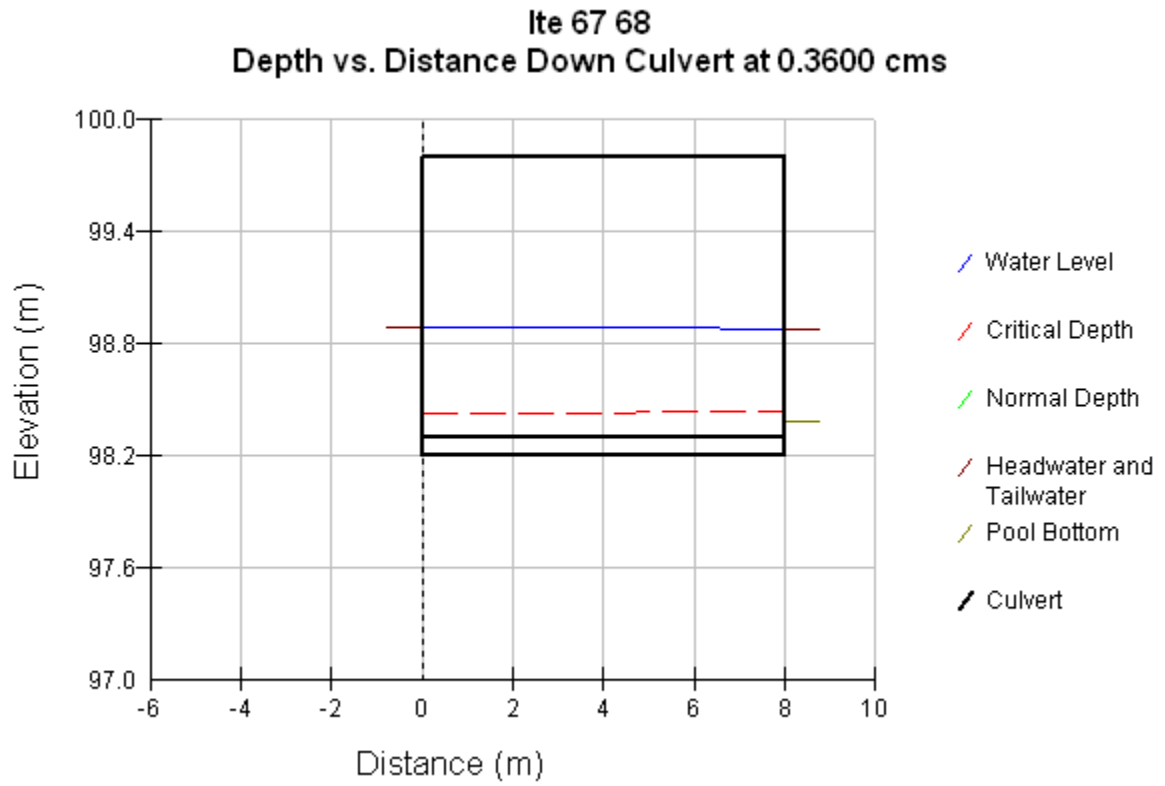
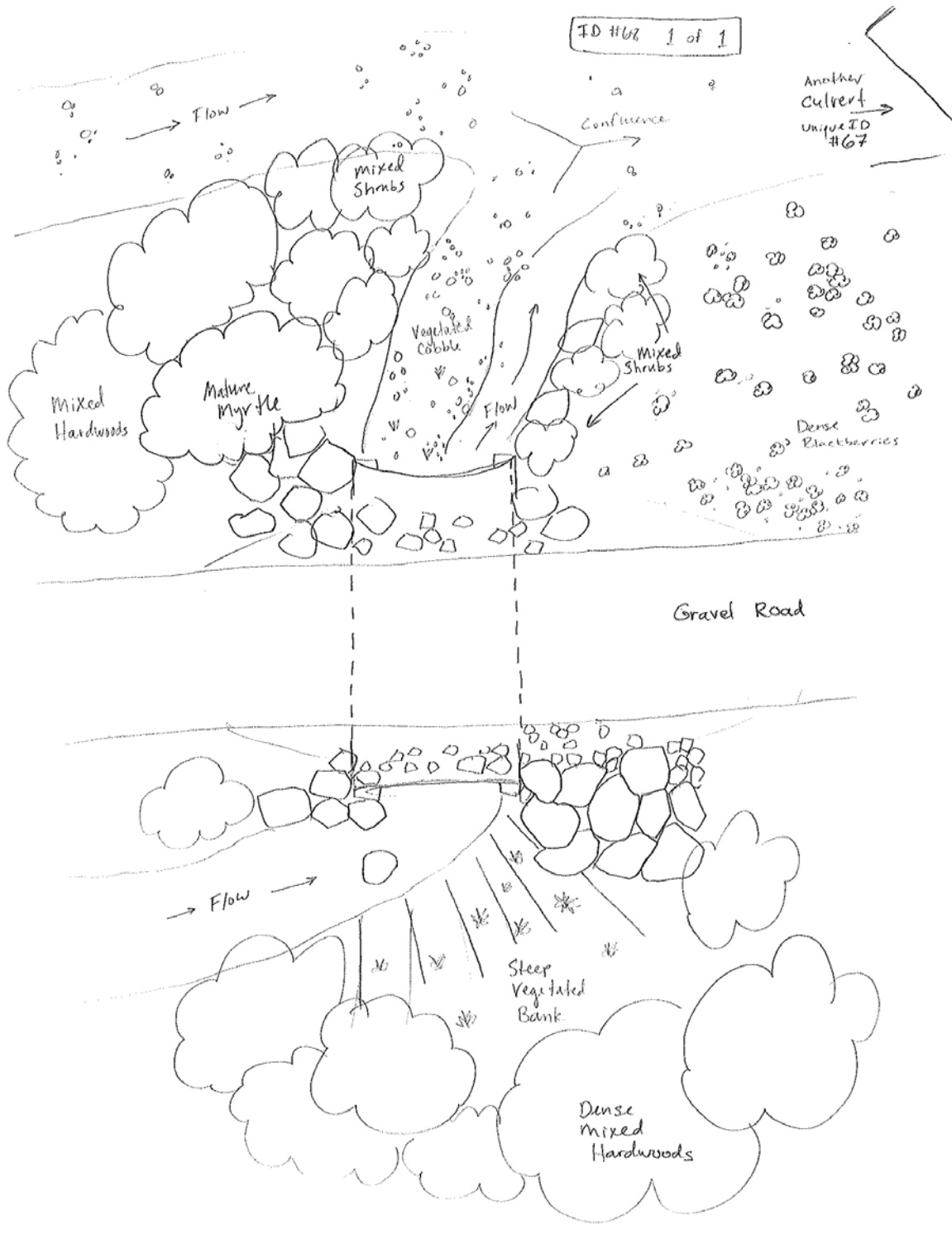


Figure 3635. Water Surface Profile at 0.36 cms, at this flow and greater, juvenile fish are blocked by velocity.

Site Sketch



Site # 67 2009 Restoration Effectiveness Monitoring Summary

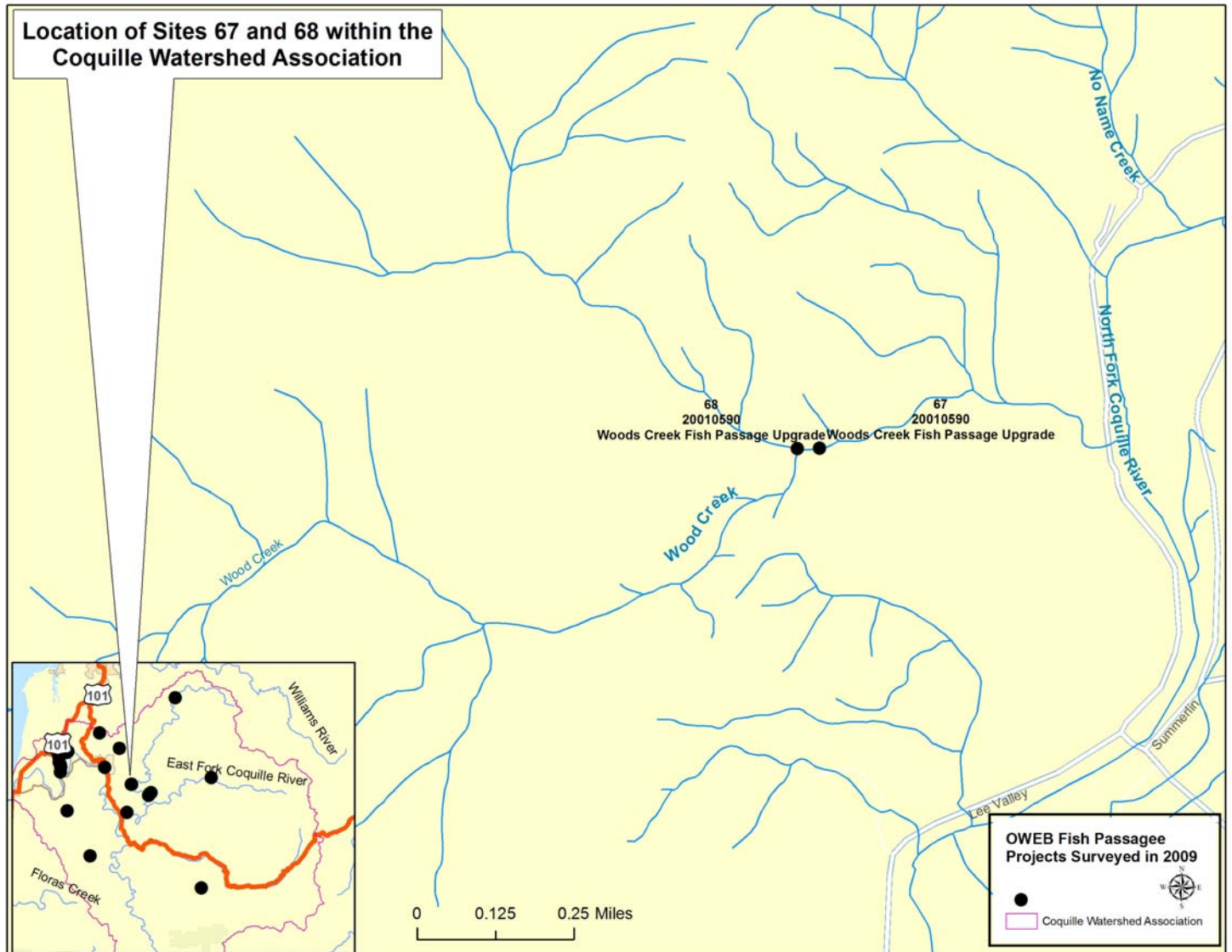
OWEB Project Name - Woods Creek Fish Passage Upgrade

OWEB Grant Number – 099-466

OWRI Project Number – 20010590

Owner – Roseburg Forest Products

OWEB Description – Fish Passage



Map 20. Location of Sites 67 and 68 on Wood Creek within the region of the Coquille sub-basin.

Site Notes

Two culverts (68-67) placed one after the other at a junction on a forest road. Culvert 68 is the most upstream of the two culverts. It was unobstructed and drains a creek that has a 1.8 meter bank full width. Sites 67 and 68 had the same size culverts; 2.5 meters wide and 1.8 meters high open bottom arches. The ratio of inlet width to channel width was 0.72. Channel gradient was measured at 2.1% and culvert gradient for Site 68 was 3.1% and Site 67 was 0.1%. Both culverts acted as stream simulation and had substrate continuous throughout culverts. Channel substrate was composed of sand/silt/gravel and substrate within the culverts was composed of gravel/sand/silt.

This section of the channel is highly disturbed because it is positioned between two roads. A side tributary also flows into the channel at the road crossing area. Culvert 67 (lowest downstream culvert) has a significant debris jam partially blocking the inlet that forms a large pool there. This partial block could potentially, under an intense peak flow event, act to cause a washout at the road. Debris transported from upstream does not flow through the culverts.

Snorkel Survey Results

Please see snorkel survey results for Site 68.

FishXings Results

Hydraulic Evaluation Criteria

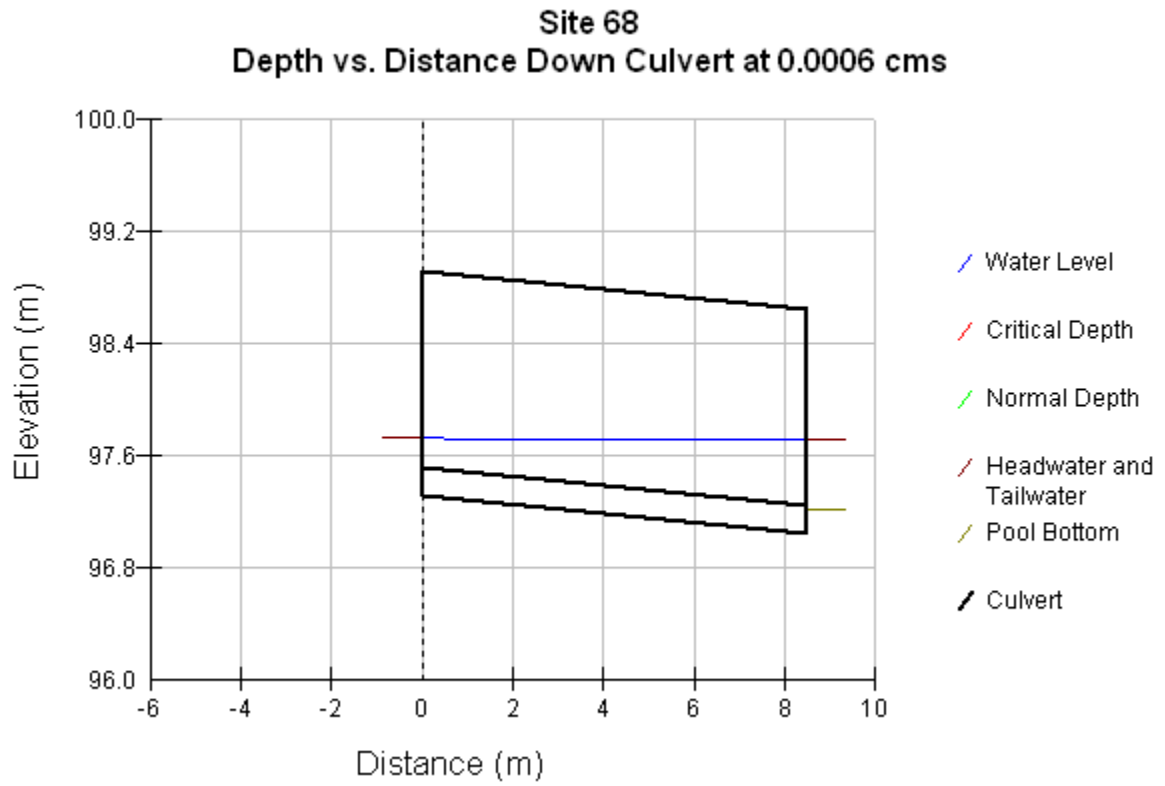
Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 28. Fish Passage Summary, Site 67.

Fish Passage Summary	
Low Passage Design Flow	0.0006 cms
High Passage Design Flow	6.8000 cms
Percent of Flows Passable	3.1 %
Passable Flow Range	0.0006 to 0.2130 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.21 cms and Above
Pool Depth Barrier	None



| **Figure 3736.** Water Surface Profile at 0.0006 cms, Site 67, passable at very low flows.

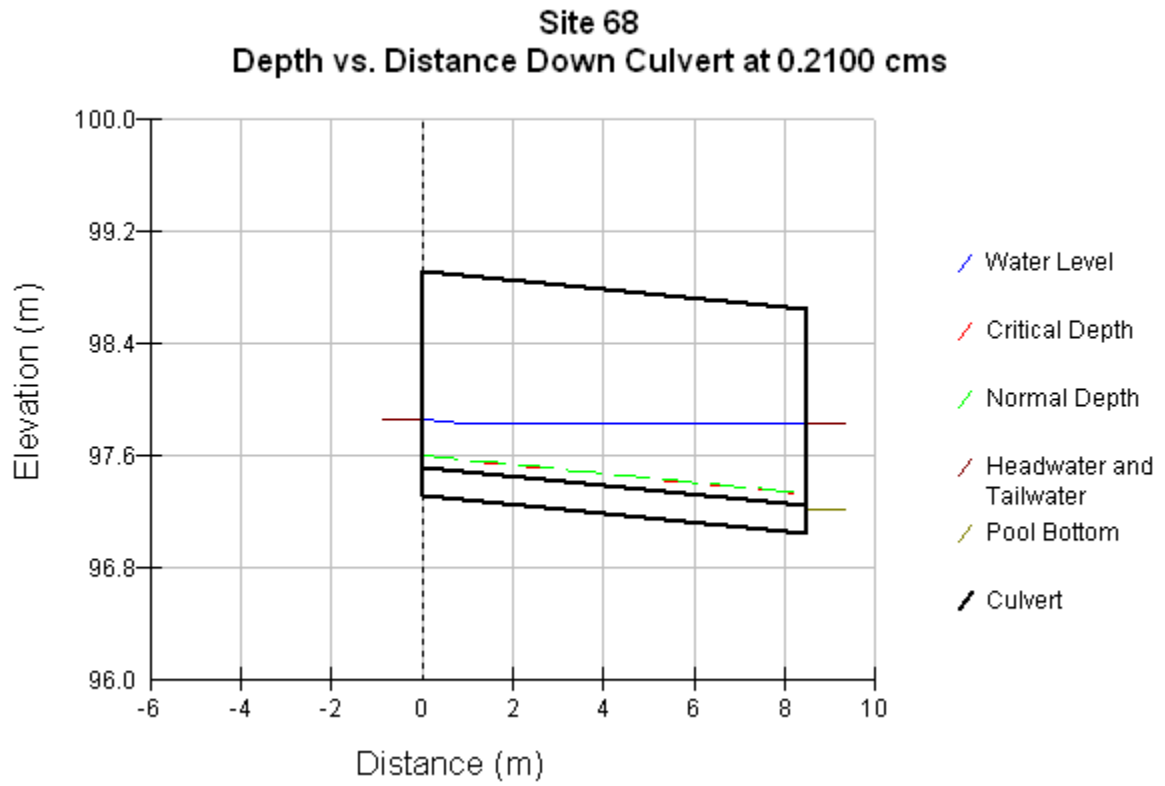
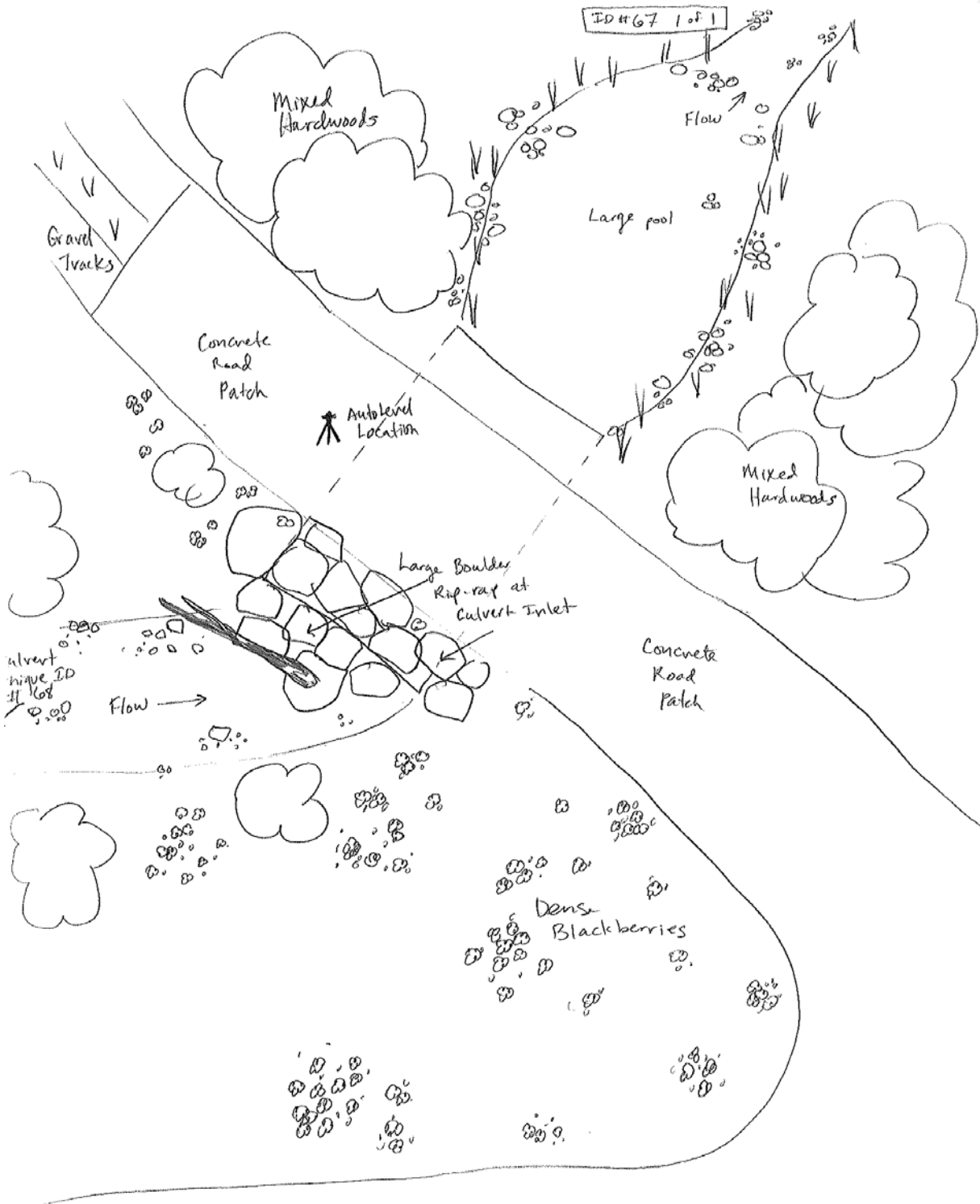


Figure 3837. Water Surface Profile at 0.21 cms, the point at which a velocity barrier forms at Site 67.

Site Sketch



Site # 80 2009 Restoration Effectiveness Monitoring Summary

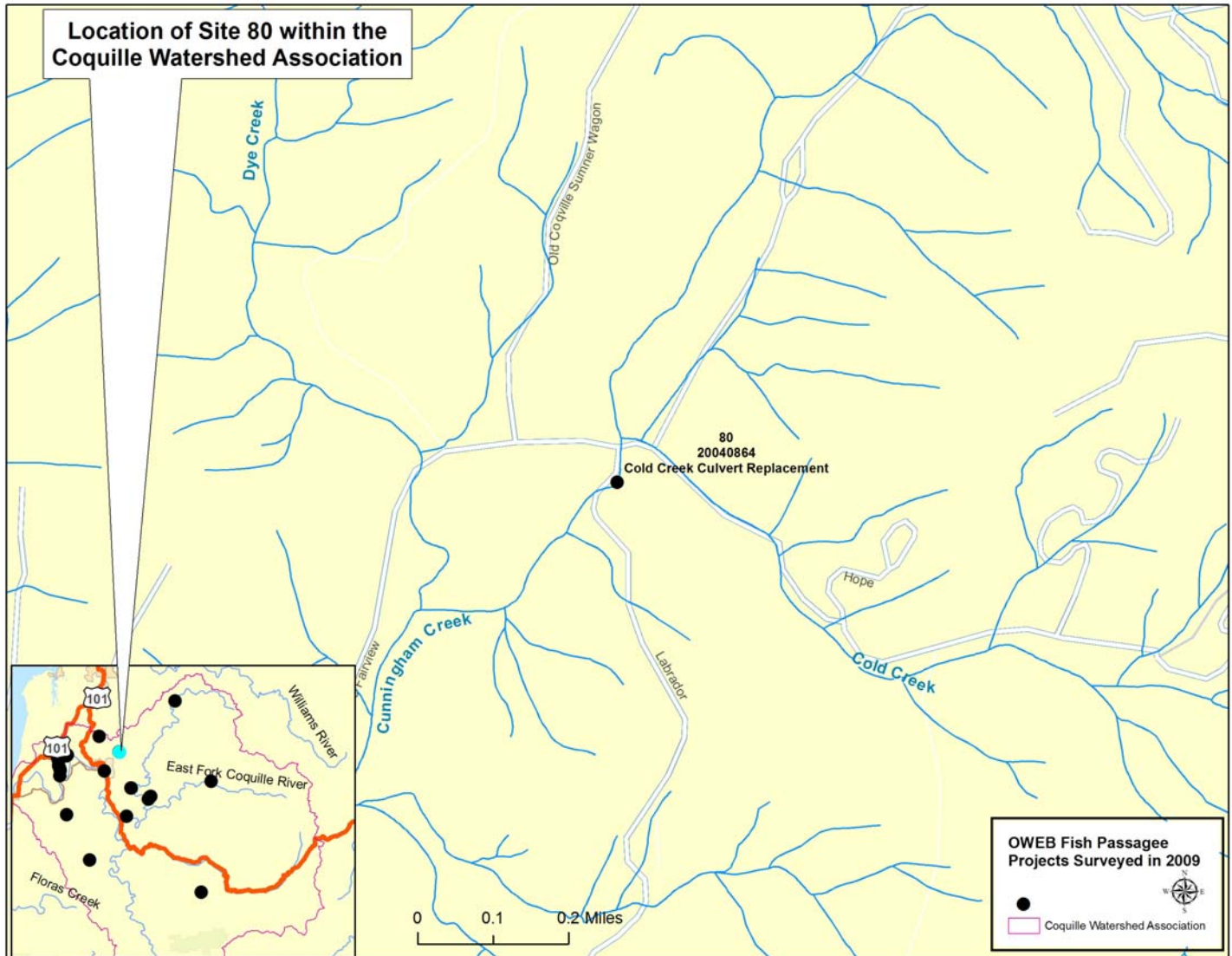
OWEB Project Name – Cold Creek Culvert Replacement

OWEB Grant Number – SC-017

OWRI Project Number – 20040864

Owner – Private, George Domenighini

OWEB Description – Fish Passage



Site Notes

This is a deeply incised channel (2-3 meters deep). The culvert is a circular culvert measuring 1.9 meters in diameter. The culvert has baffles throughout to slow velocity. Bankfull width averaged 2 meters. The ratio of the culvert inlet width to the channel width was 0.95. Channel slope was 1.1% while the culvert slope was 6.9%. There was scant substrate within the culvert. There is a jump from the culvert inlet to the channel causing an unusual inlet gradient of 83%.

The substrate of the surveyed section of this channel was dominated by silt/sand/gravel. Blackberry and reed canary grass dominated the riparian area with red alder, myrtle, cherry, and willow being the dominant woody species. This channel has deep undercut banks.

The original OWEB coordinates were almost 0.5 miles off from this location. After considerable investigation, we verified the current and correct location by talking to local property owners.

FishXings predicts that this culvert is a total block to juvenile salmonids. Yet, we did find a few juveniles above the culvert at Site 80.

Snorkel Survey

Ten pools were snorkeled in this survey and five contained juvenile salmonids in relatively low numbers.

Table 29. Snorkel survey results for Site 80.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1242026431787	1	Trench	3.5	1.5	0.34		0
1242026431787	2	Trench	6	1.3	0.31		0
1242026431787	3	Trench	11	1.5	0.4		0
1242026431787	4	Trench	6.5	0.99	0.31		0
1242026431787	5	Trench	5	1.1	0.3	Steelhead/Cutthroat	3
1242026431787	6	Trench	6.5	1.6	0.56	Steelhead/Cutthroat	1
1242026431787	7	Trench	3.5	1	0.75	Steelhead/Cutthroat	2
1242026431787	8	Trench	4.5	2.1	1.03	Steelhead/Cutthroat	2
1242026431787	9	Trench	4	2.2	0.39	Steelhead/Cutthroat	4
1242026431787	10	Trench	2.2	1.6	0.31		0

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 30. Fish Passage Summary for Site 80.

Fish Passage Summary	
Low Passage Design Flow	0.1000 cms
High Passage Design Flow	5.0000 cms
Percent of Flows Passable	0.0 %
Passable Flow Range	None
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.1 cms and Above
Pool Depth Barrier	None

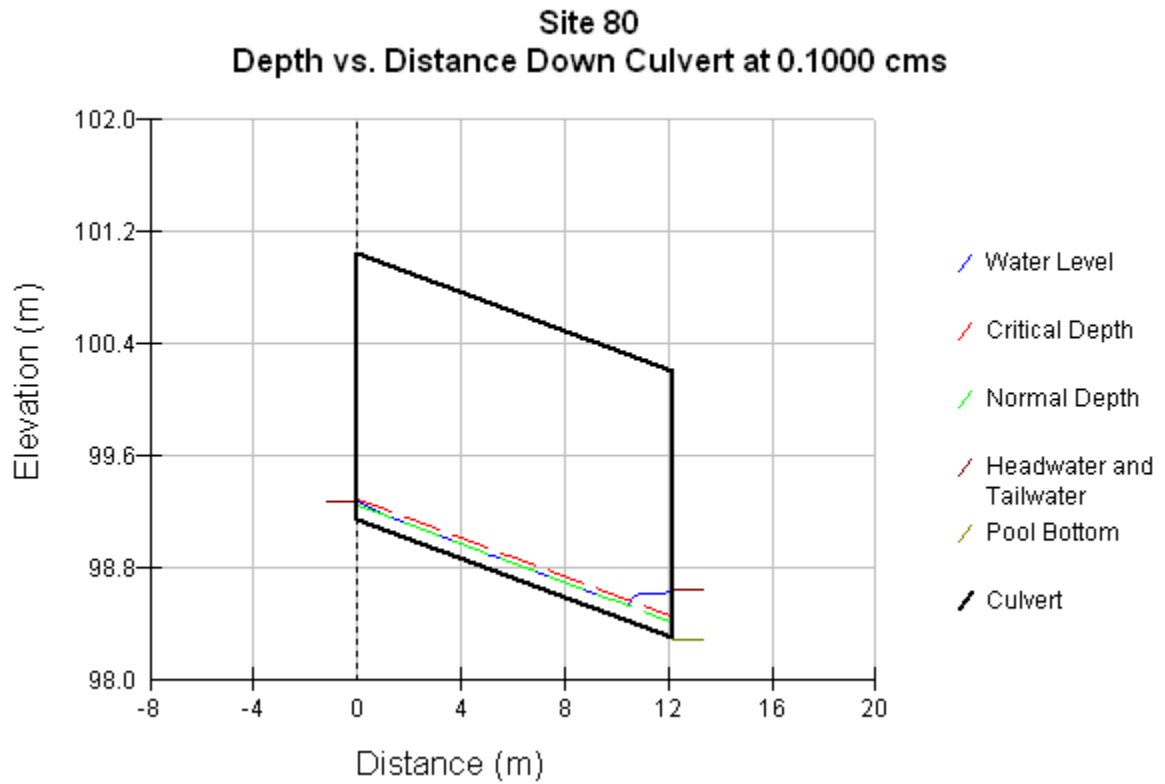


Figure 3938. Water Surface Profile at 0.1 cms, velocity block.

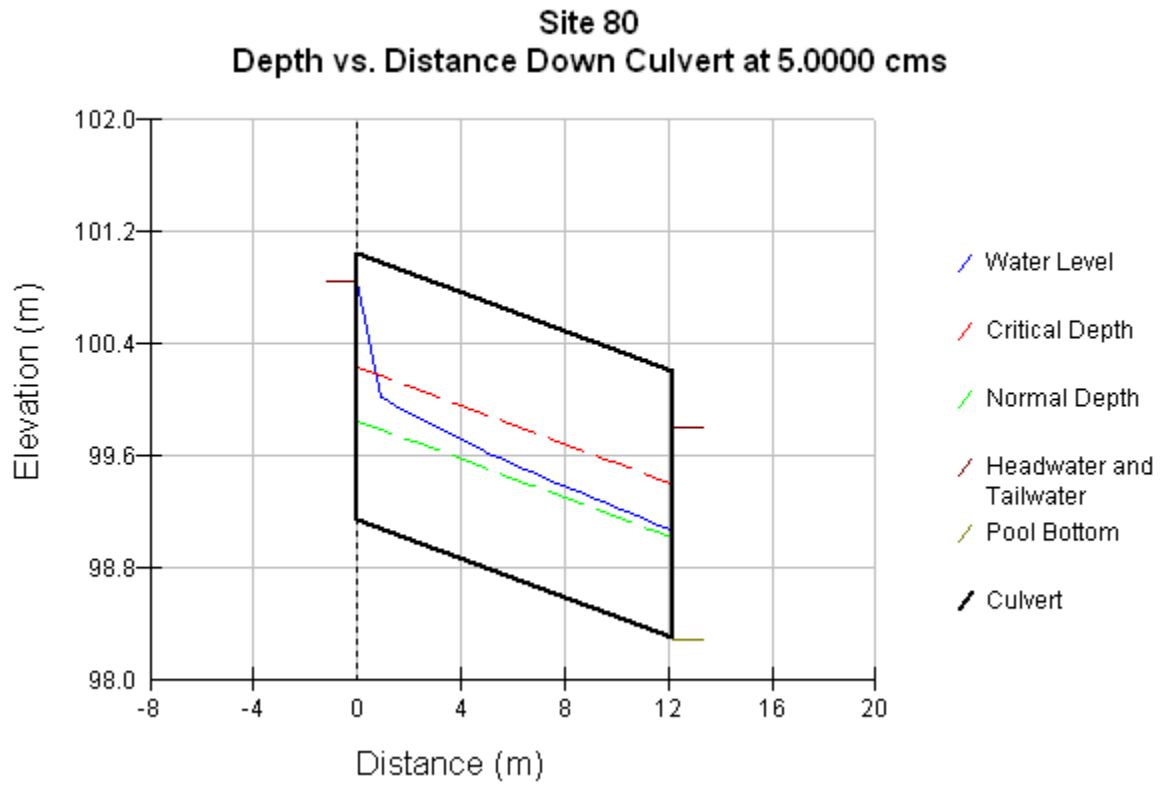
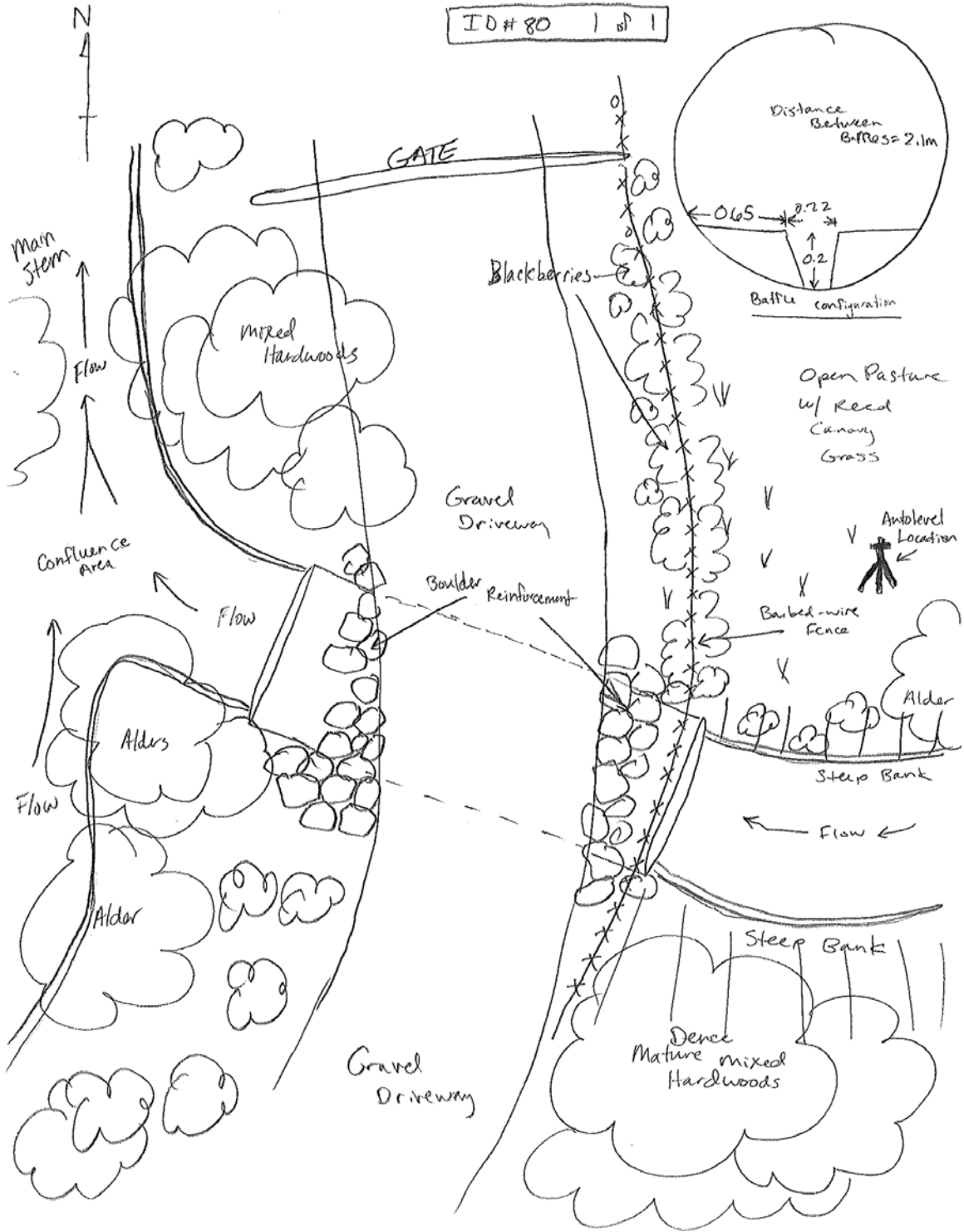


Figure 4039. Water Surface Profile at 5 cms, velocity block.

Site Sketch



Site # 82 2009 Restoration Effectiveness Monitoring Summary

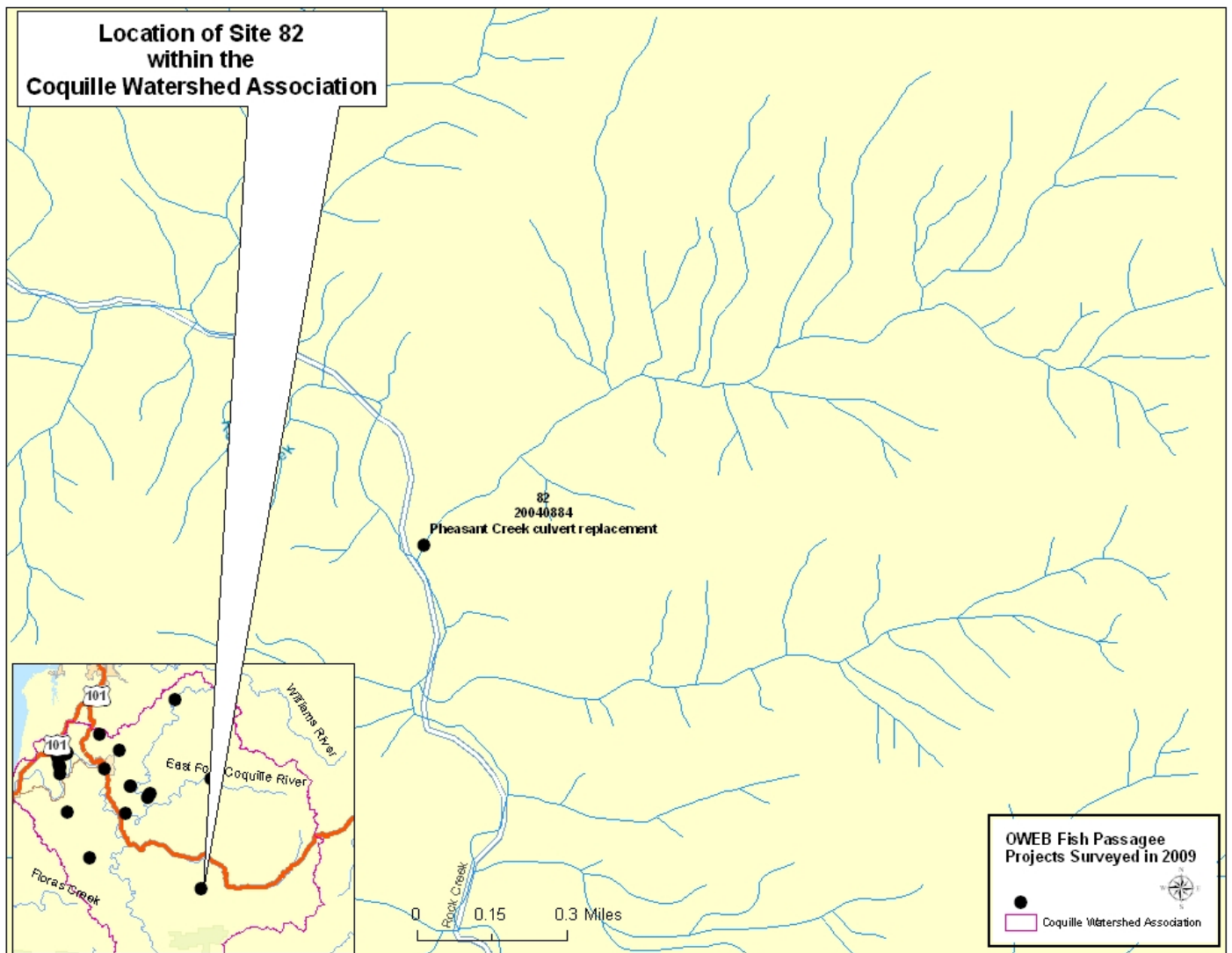
OWEB Project Name – Pheasant Creek culvert replacement

OWEB Grant Number – SC-017

OWRI Project Number – 20040884

Owner – Private, Neil Westfall

OWEB Description – Fish Passage



Map 22. Location of Site 82, on a tributary to Rock Creek, within the Coquille sub-basin.

Site Notes

This is a mountain stream step/pool channel dominated by a boulder/cobble substrate. Many small pocket pools provide for refugia for resting fish. Excellent spawning gravels found throughout surveyed section of stream. An actively managed commercial forest borders this creek with no negative impact on the aquatic environment visible.

The culvert was a 1.9 meter wide by 1.2 meter high pipe-arch. Channel slope was 7.5% while the culvert gradient was 1.2%. There were no baffles or substrate located within the culvert. Bankfull width was 4.1 meters and the ratio of inlet width to channel width was 0.46. There is a 0.25 meter jump into the culvert. The outlet is armored with cobble and boulder so little opportunity of scouring exists to form a pool. The outlet free-falls on to rip-rap. Many juvenile fish were seen within the step pools and pocket pools above the culvert.

FishXings predicts that this is a 100% block to juveniles. It is always a velocity block and sometimes it acts as a outfall jump block as well (at 0.44 cms).

Snorkel Survey Results

Juvenile salmonids were found in all snorkeled pools above the culvert at Site 82.

Table 31. Snorkel survey results for Site 82.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1239324429574	1	Plunge	2.1	2.5	0.35	Coho	8		0
1239324429574	2	Straight Scour	4.2	2.4	0.3	Coho	15		0
1239324429574	3	Straight Scour	2.6	2.5	0.32	Coho	4	Steelhead/Cutthroat	1
1239324429574	4	Lateral Scour	3.2	1.2	0.48	Coho	12		0
1239324429574	5	Straight Scour	3.1	1.6	0.3	Coho	11	Steelhead/Cutthroat	1

FishXings Results

Hydraulic Evaluation Criteria

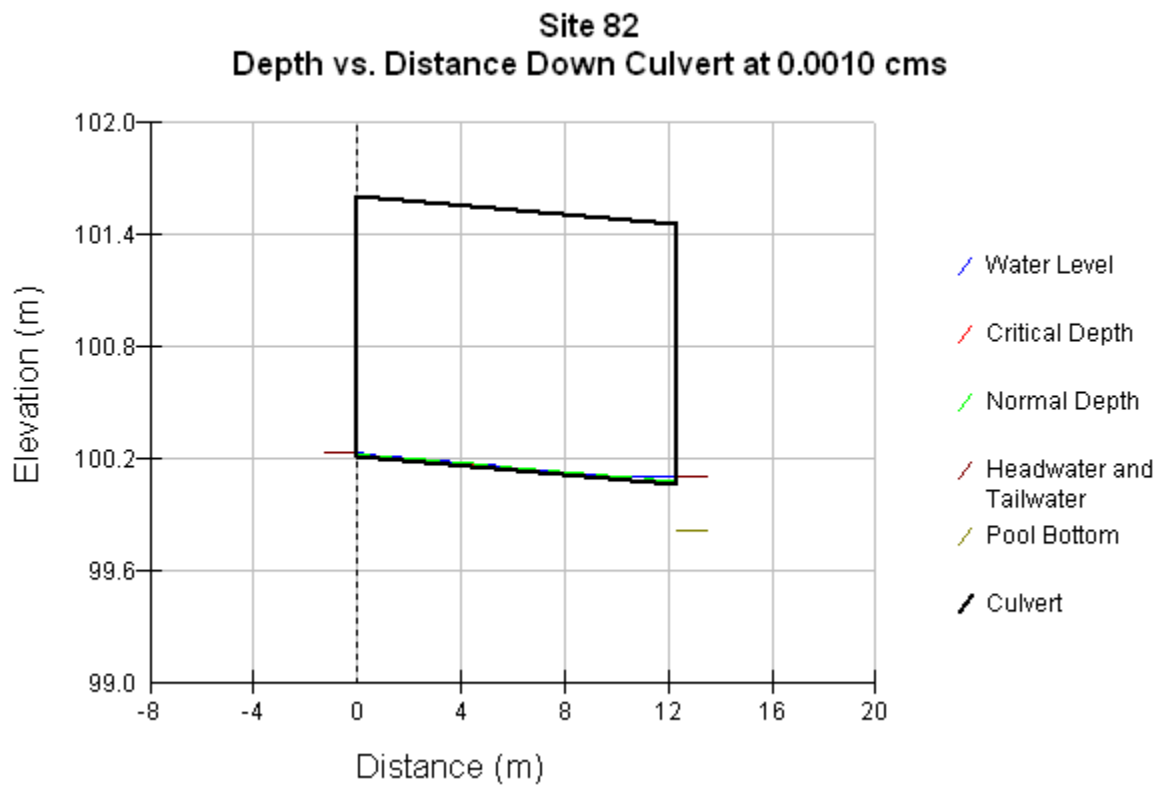
Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 32. Fish Passage Summary, Site 82.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	3.7000 cms
Percent of Flows Passable	0.0 %
Passable Flow Range	0.0010 to 0.0014 cms
Depth Barrier	None
Outlet Drop Barriers	0.44 to 0.44 cms
Velocity Barrier - V	0.0 cms and Above
Pool Depth Barrier	None



| Figure 4140. Water Surface Profile at 0.001 cms, velocity block.

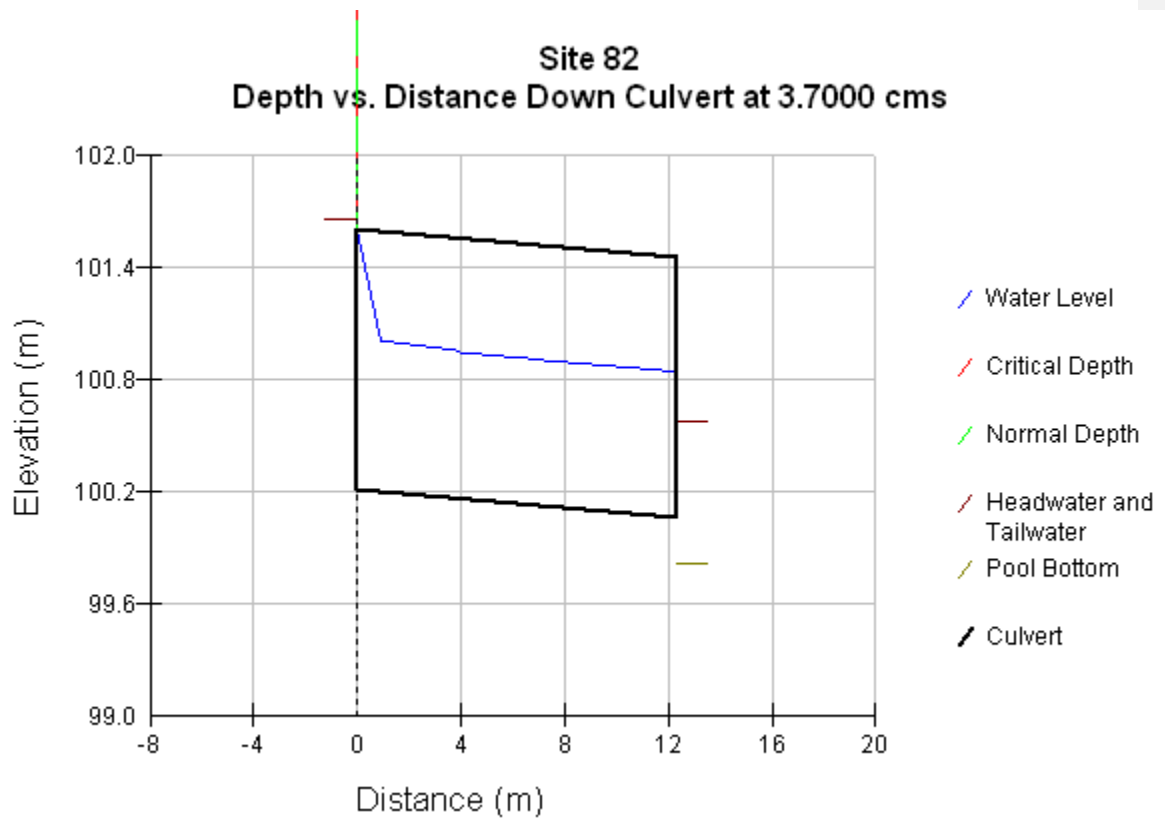
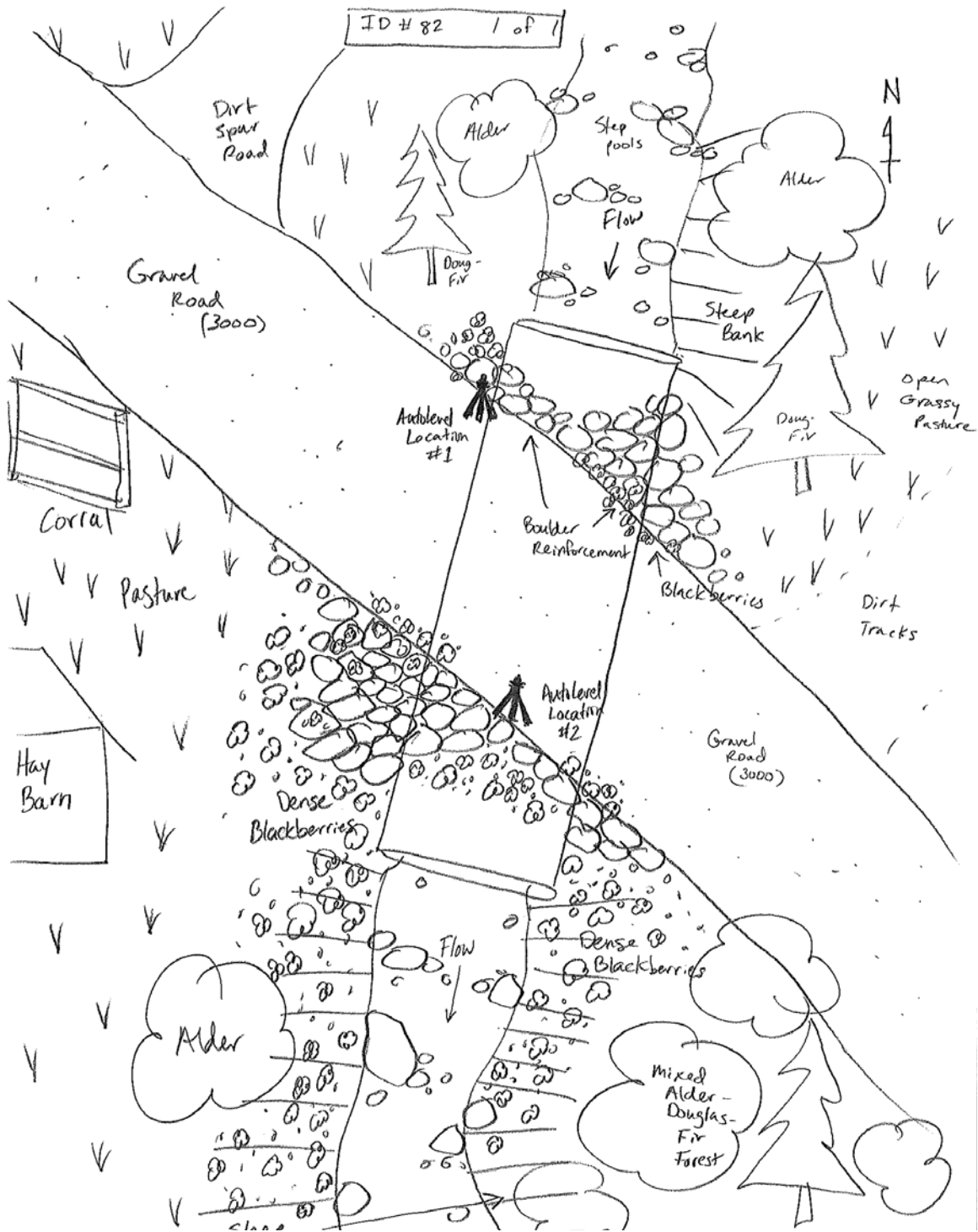


Figure 4241. Water Surface Profile at 3.7 cms, velocity block.

Site Sketch



Site # 84 2009 Restoration Effectiveness Monitoring Summary

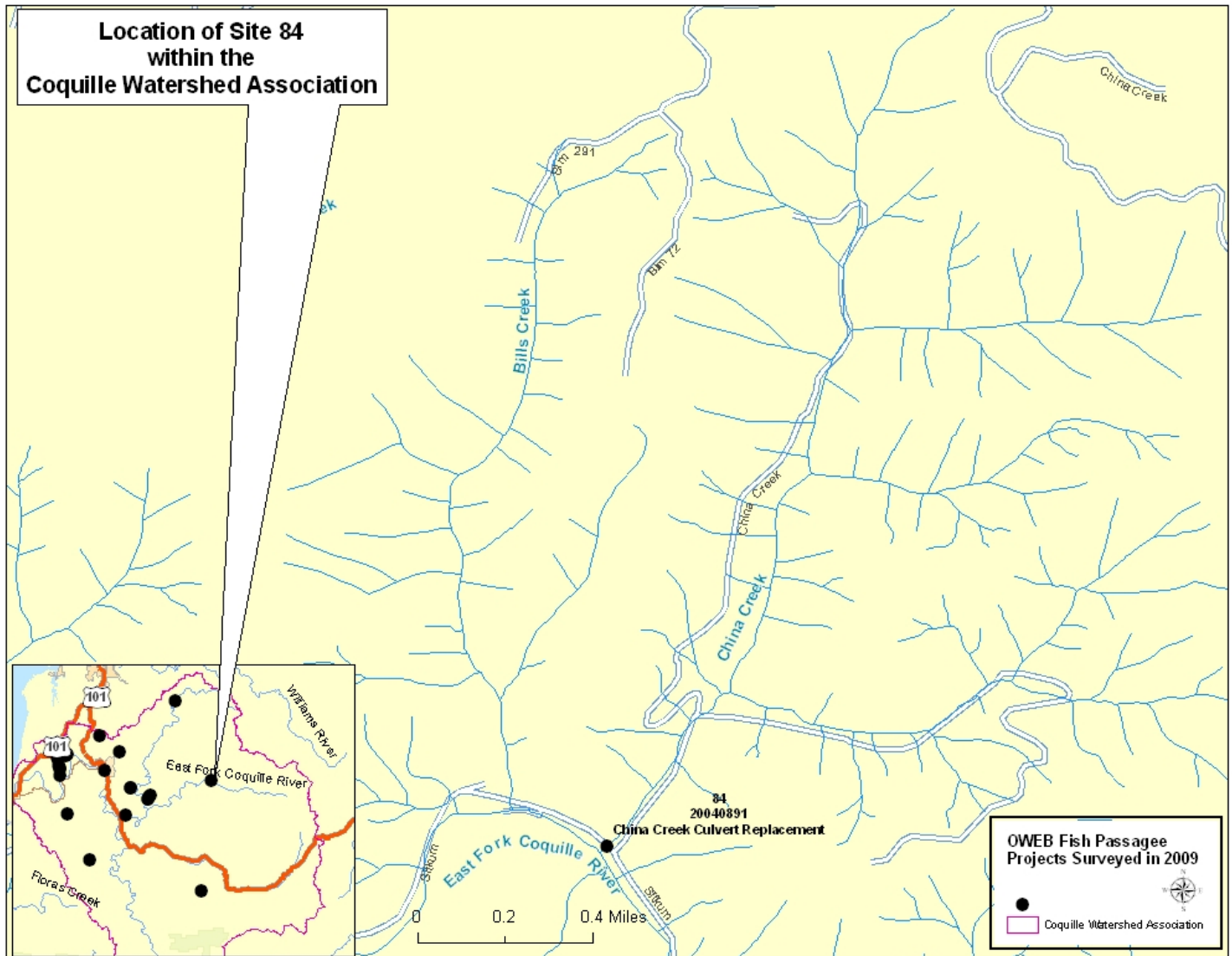
OWEB Project Name - China Creek Culvert Replacement

OWEB Grant Number – 099-466

OWRI Project Number – 20040891

Owner – Bureau of Land Management

OWEB Description – Fish Passage



Map 23. Location of Site 84 on China Creek within the region of the Coquille sub-basin.

Site Notes

This is a classic boulder step pool channel. This is an excellent spawning stream with perfect stream simulation throughout the culvert. Substrate is primarily composed of boulder and bedrock. Abundant juvenile fish were seen throughout survey area and well upstream of the survey at the time of survey.

This culvert is an open bottom arch measuring 6 meters wide by 2.75 meters high. Substrate was continuous throughout the entire length of the culvert. Substrate was composed of boulders/bedrock/cobbles. Channel gradient was 6.4% and the channel inside the culvert was 4.5%. Bankfull width was 6.4%, and the ratio of inlet width to channel width was 0.94. The outlet is within the active channel width of the East Fork Coquille River.

FishXings predicts that 3.9% of all modeled flows will be passable by juveniles. The program also predicts that a velocity barrier will begin at 0.6 cms.

Snorkel Survey Results

As noted in the Site Notes, many juvenile fish were seen during the culvert survey. In addition, the snorkel survey also found relatively strong numbers of juveniles above the culvert.

Table 33. Snorkel survey results for Site 84 on China Creek.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1239185431607	1	Plunge	4.5	4.1	0.61	Coho	44	Steelhead/Cutthroat	3
1239185431607	2	Plunge	2.5	4	0.45	Coho	11	Steelhead/Cutthroat	6
1239185431607	3	Plunge	2.1	3.3	0.39	Steelhead/Cutthroat	8		0
1239185431607	4	Plunge	4	4.2	0.41	Steelhead/Cutthroat	12	Coho	1
1239185431607	5	Plunge	4.3	2.1	0.3	Steelhead/Cutthroat	5		0
1239185431607	6	Plunge	5.2	2.2	0.41	Steelhead/Cutthroat	15	Coho	6

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 34. Fish Passage Summary, Site 84 China Creek.

Fish Passage Summary	
Low Passage Design Flow	0.0200 cms
High Passage Design Flow	10.0000 cms
Percent of Flows Passable	3.9 %
Passable Flow Range	0.2200 to 0.5999 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.60 cms and Above
Pool Depth Barrier	None

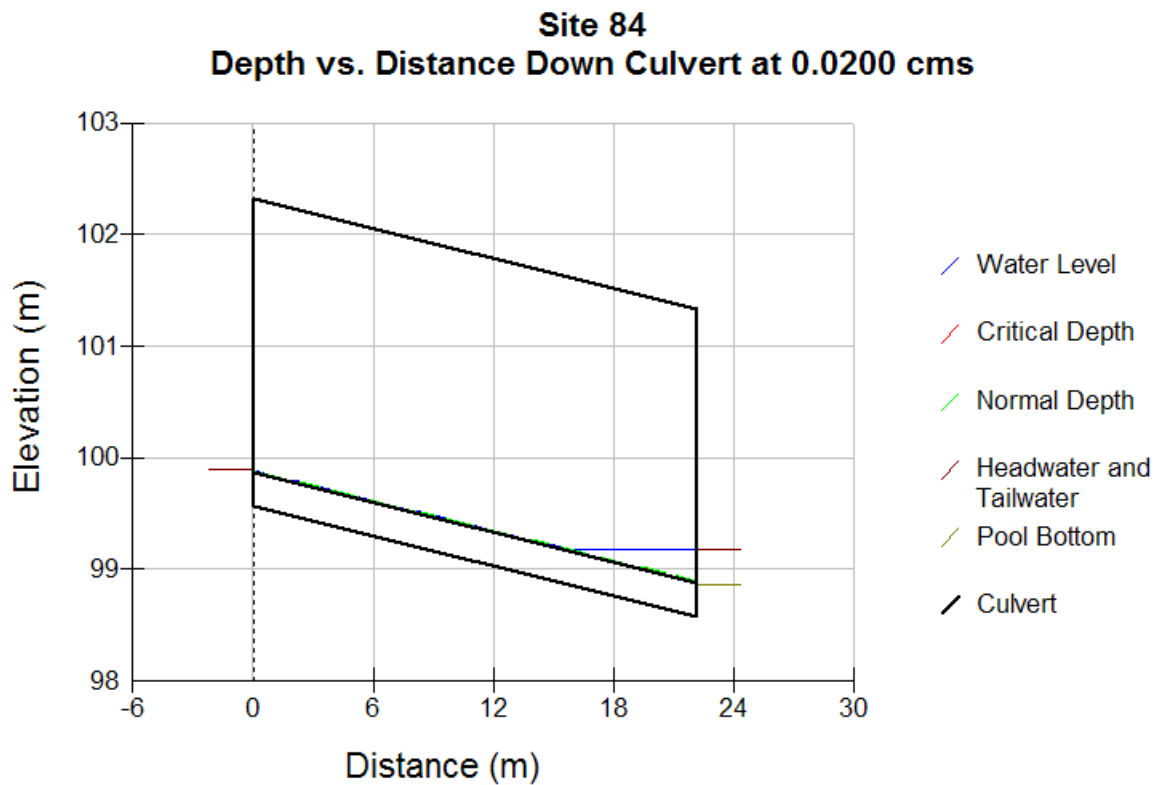


Figure 4342. Water Surface Profile at 0.02 cms

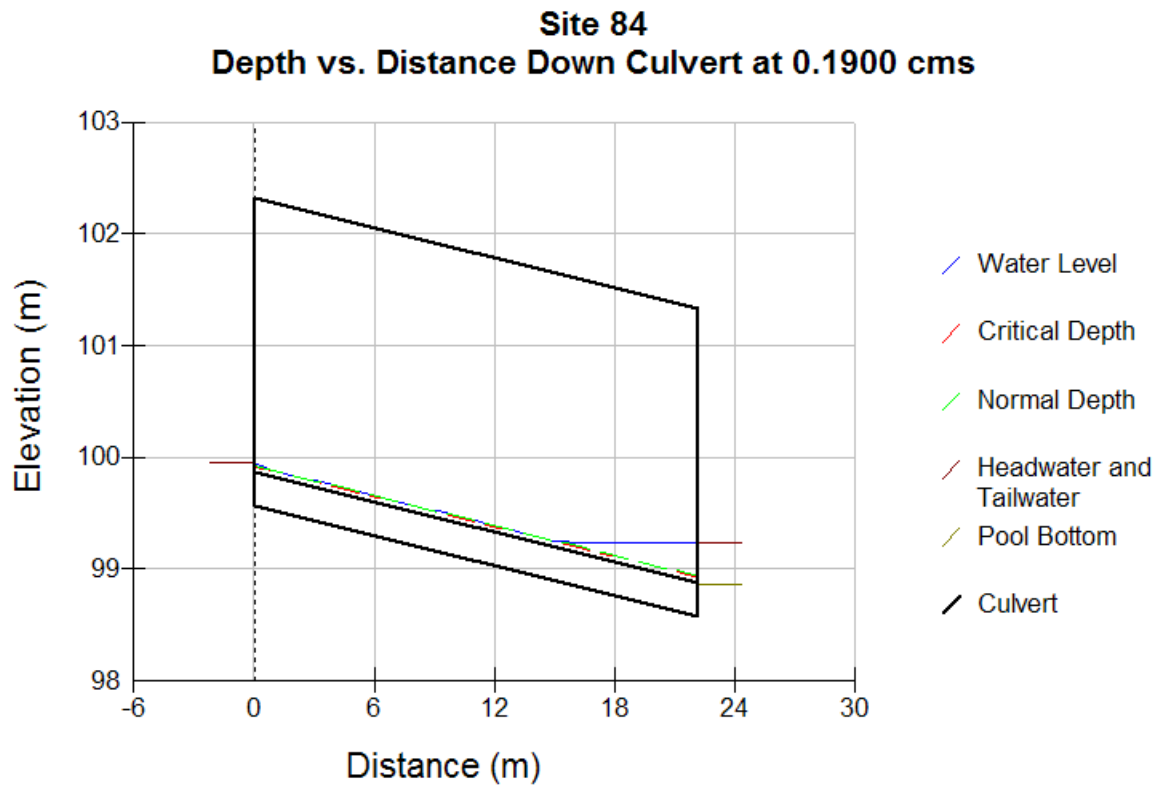
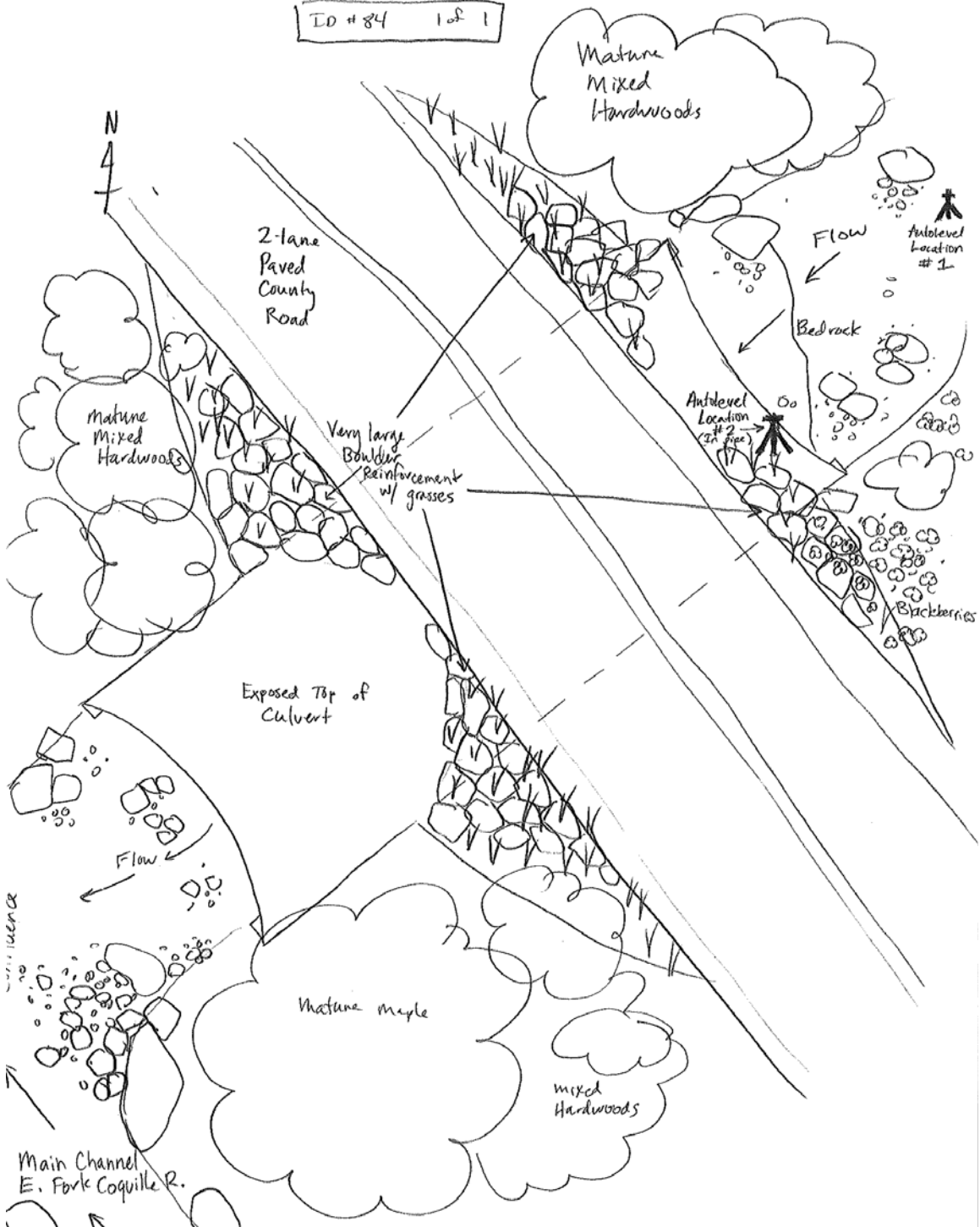


Figure 4443. Water Surface Profile at 0.19 cms

Site Sketch

ID # 84 1 of 1



Site #86 608 2009 Restoration Effectiveness Monitoring Summary

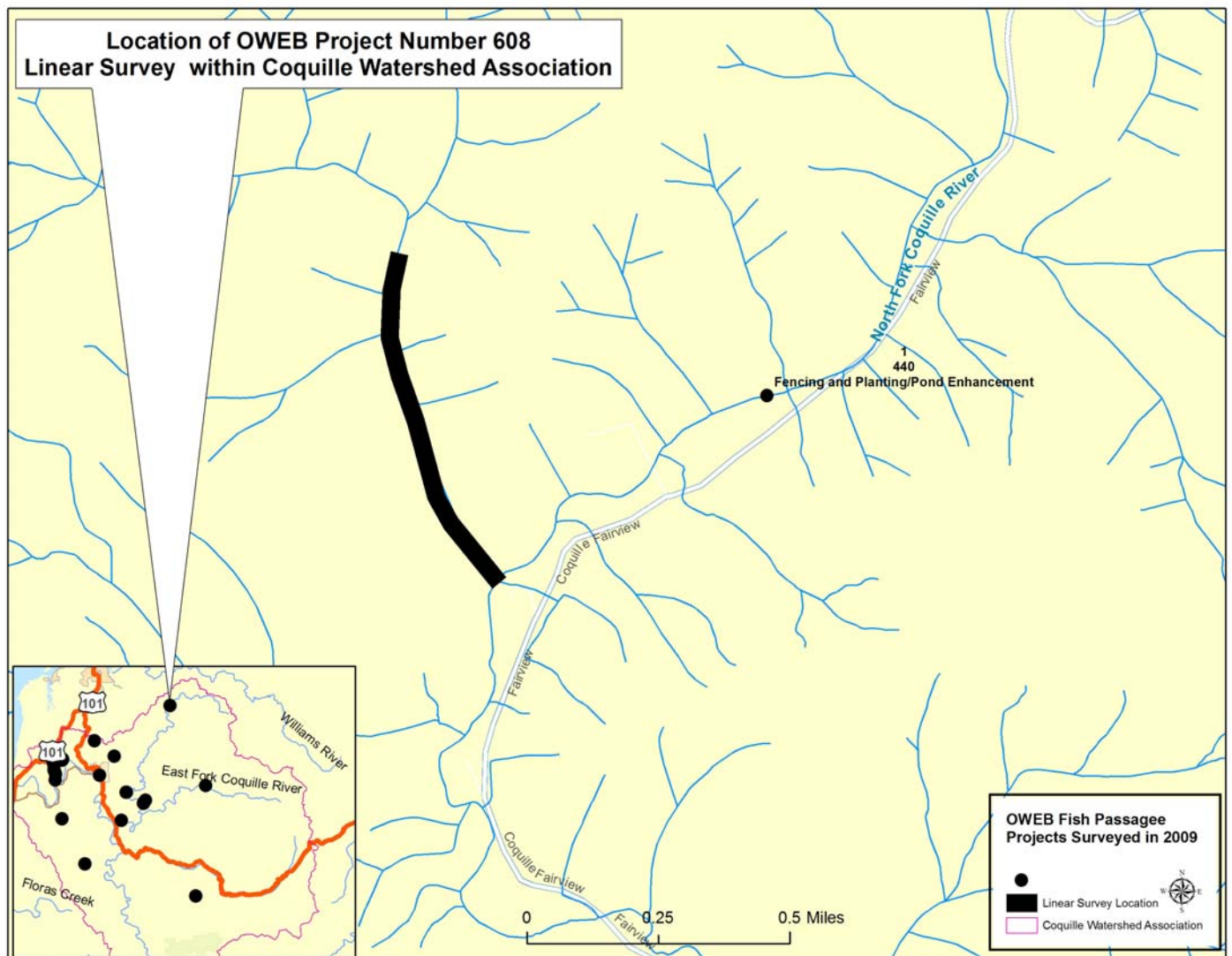
OWEB Project Name – Giles Creek 94

OWEB Grant Number – SC-007

OWRI Project Number – 608

Owner – Menasha Corporation

OWEB Description – Wood Placement, Brush Bundles



Map 24. Location of OWEB linear Project 608, Coquille sub-basin.

Site Notes

This survey began at the confluence of the North Fork of the Coquille River and Giles Creek and consisted of walking over 1100 meters up Giles Creek and making a qualitative assessment of the effect that log structures are having on the creek. The creek is a mountain stream bordered by second and third growth commercial forests. The 100 meter stretch ranged in gradient from 3% -10%. Bankfull width measurements average 6.2 meters. Sometime in the past (1994?) large loads of wood were dropped into this creek. This wood is functioning in one of three ways; forcing pools, providing habitat cover, or accumulating sediment. We observed that wood primarily functioned to accumulate sediment. Secondly the wood provided habitat cover, and lastly the wood forced pool formation. Meander, boulder, and bedrock scour pools were more plentiful than wood scour or wood dam pools. Please see the photo series for examples of how the wood functioned in 2009.

Snorkel Survey Results

The results of the snorkel survey showed that juvenile salmonids were utilizing the habitat up to 1300 meters above the confluence with the North fork of the Coquille River.

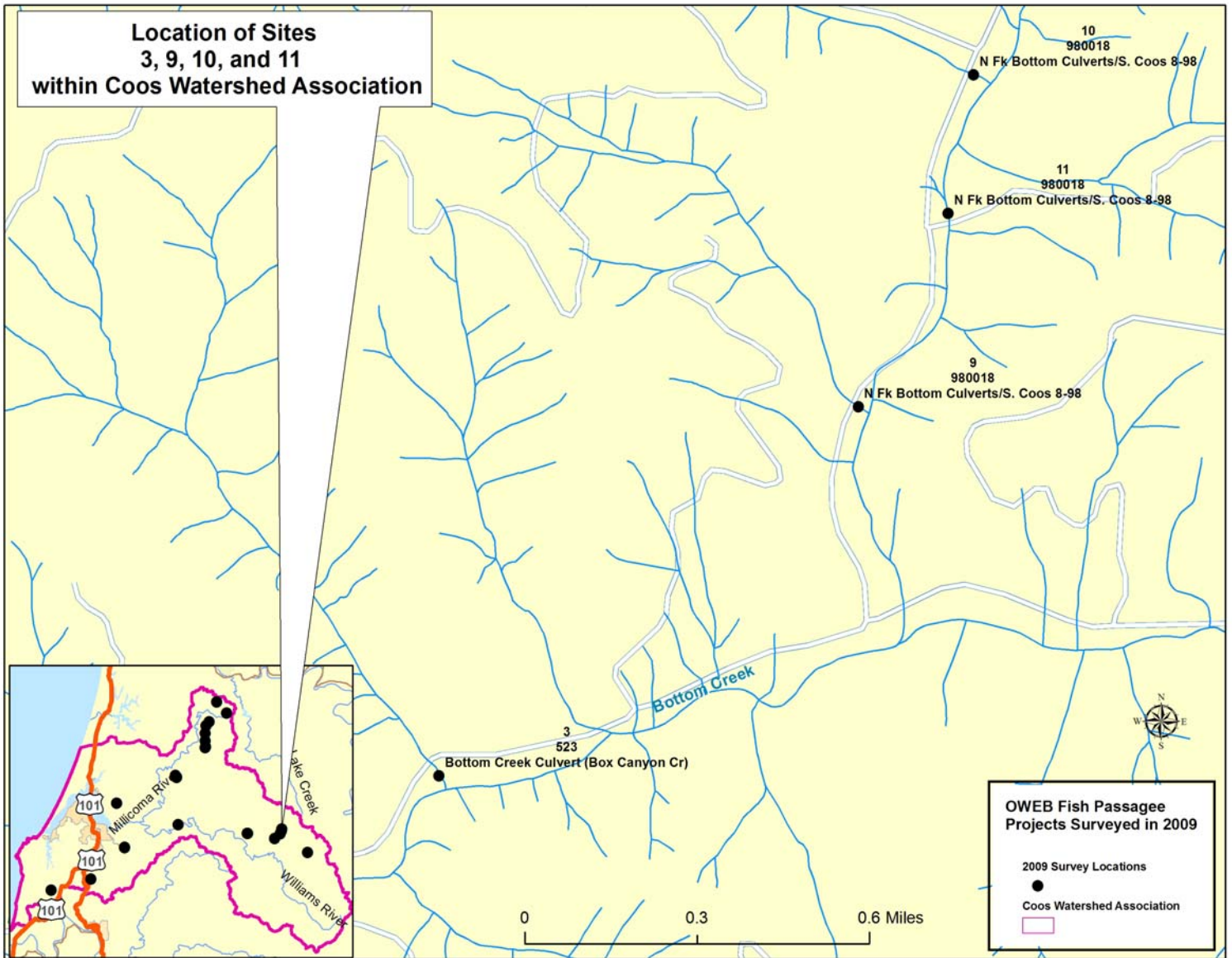
Table 35. Project Number 608 snorkeling results.

Stream LLID	Unique ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1240263432997	608	Plunge	20	2.5	1.1	Steelhead/Cutthroat	31
1240263432997	608	Plunge	8.5	2.2	0.55	Steelhead/Cutthroat	14
1240263432997	608	Straight scour	12	3.9	1.05	Steelhead/Cutthroat	24
1240263432997	608	Plunge	12.5	3.5	0.51	Steelhead/Cutthroat	6
1240263432997	608	Straight scour	8.5	2.6	0.55	Steelhead/Cutthroat	10

Coos Sub-basin Site Reports

Site # 3 2009 Restoration Effectiveness Monitoring Summary

OWEB Project Name - Bottom Creek Culvert (Box Canyon Cr)
OWEB Grant Number – SC-009
OWRI Project Number – 523
Owner – Weyerhaeuser Corporation
OWEB Description – Fish Passage



Map 25. The four sites located along Bottom Creek within the Coos sub-basin.

Site Notes

The channel at Site 10 illustrated elements of a plane-bed channel type in terms of having a stream gradient of 2.5% and having a substrate composed of cobbles and boulders. The one caveat being that this channel is highly impacted by beaver, so the substrate composition consists of a layer of fine silt covering cobbles and gravel. Beaver have constructed dams at both ends of the culvert. The inlet is partially blocked; although, this does not seem to be a problem for fish, it could lead to a future wash-out or at least the stream could overtop the culvert. Culvert slope was 0.9%. Bankfull width upstream of the culvert was determined to be 3.5 meters. The diameter of this circular culvert was 1.52 meters. The inlet width to channel gradient width was 0.42. There was no outlet drop, but there was a dam pool at the outlet that had a residual pool depth of 1.5 meters. This dam pool was quite long and did not exhibit a classic tail water control. Instead, the pool shallows slightly, and then a new pool begins immediately. Beaver activity has defined this stretch of the channel (Photo-series).

The substrate was very light and fluffy (decomposing beaver dung?). Any movement in the water would result in a dense cloud making visibility almost impossible. Yet, we saw many fish. Both juvenile Coho and juvenile trout were observed above and below the culvert during the culvert survey.

FishXings predicts that 2% of all modeled flows will be passable by juvenile salmonids. Velocity blocks passage at all flows greater than 0.08 cms. However, the snorkel survey found strong numbers of juveniles above the culvert.

Snorkel Survey Results

Juvenile fish (3" and less) were observed in all pool habitats snorkeled within 500 feet upstream of the culvert at Site 3. Rainbow and cutthroat are not differentiated because identifying juveniles from those two species is extremely difficult. Visibility was very poor here. This is definitely an undercount of the fish present.

Table 36. Snorkel survey results for Site 10.

Stream_LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1237563433581	1	Beaver Dam	12	2	0.52	Coho	20		0
1237563433581	2	Plunge	3	5	0.49	Coho	5	Steelhead/Rainbow	2
1237563433581	3	Beaver Dam	1	2.4	0.46	Coho	4		0
1237563433581	4	Lateral Scour	6.1	1.97	0.52	Coho	46		0
1237563433581	5	Beaver Dam	8	2	0.6	Coho	86		0

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 37. Fish Passage Summary, Site 3.

Fish Passage Summary	
Low Passage Design Flow	0.0100 cms
High Passage Design Flow	3.0000 cms
Percent of Flows Passable	2.8 %
Passable Flow Range	0.0100 to 0.0759 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.08 cms and Above
Pool Depth Barrier	None

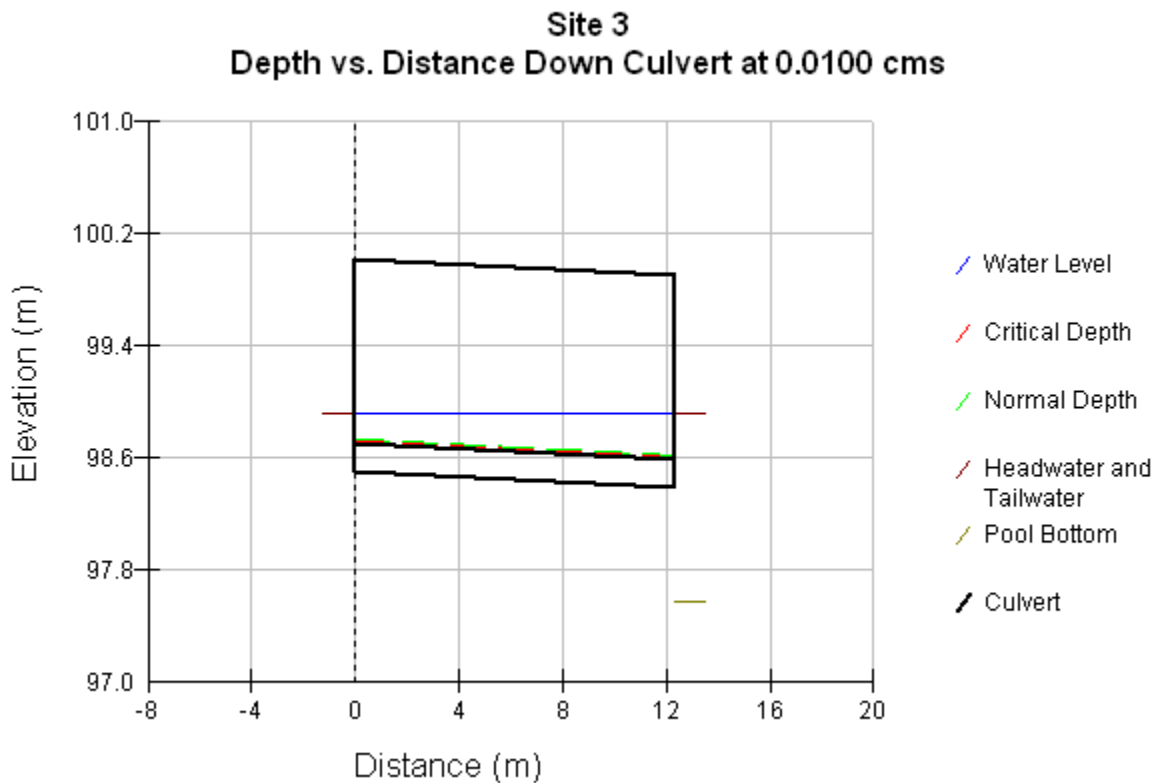


Figure 4544. Water surface profile at 0.01 cms. This is a passable flow.

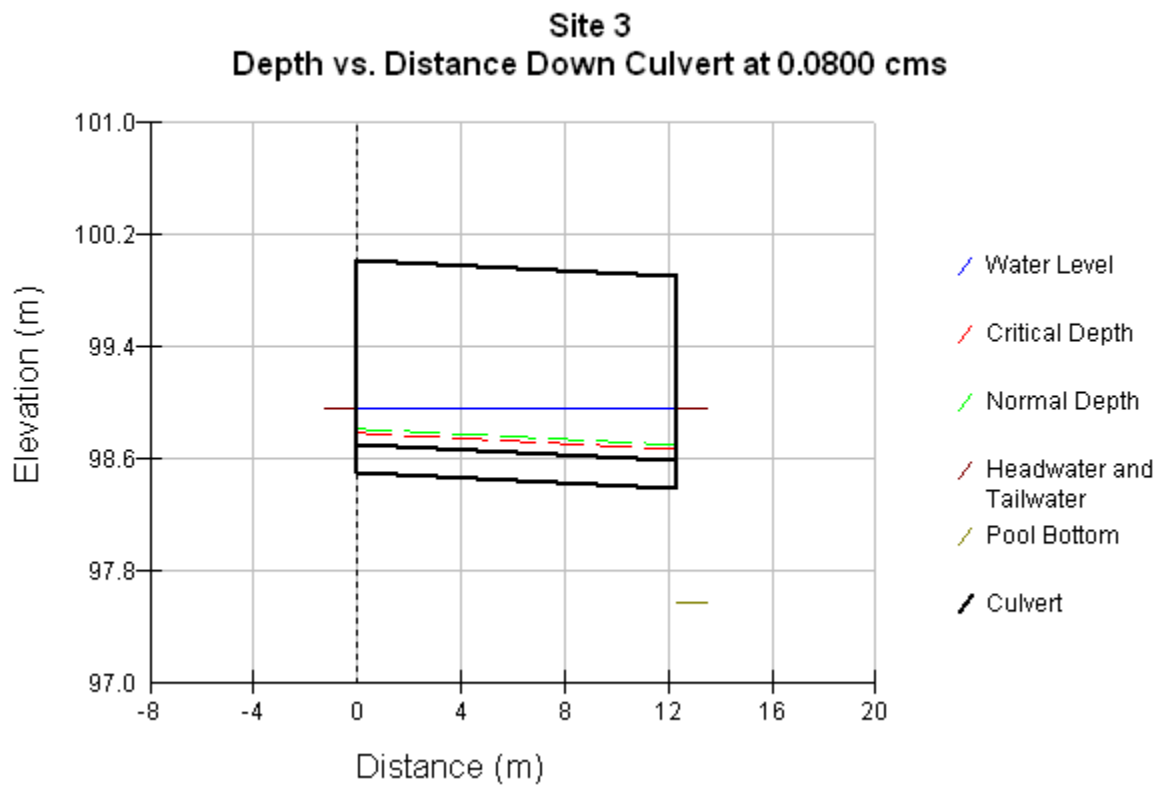


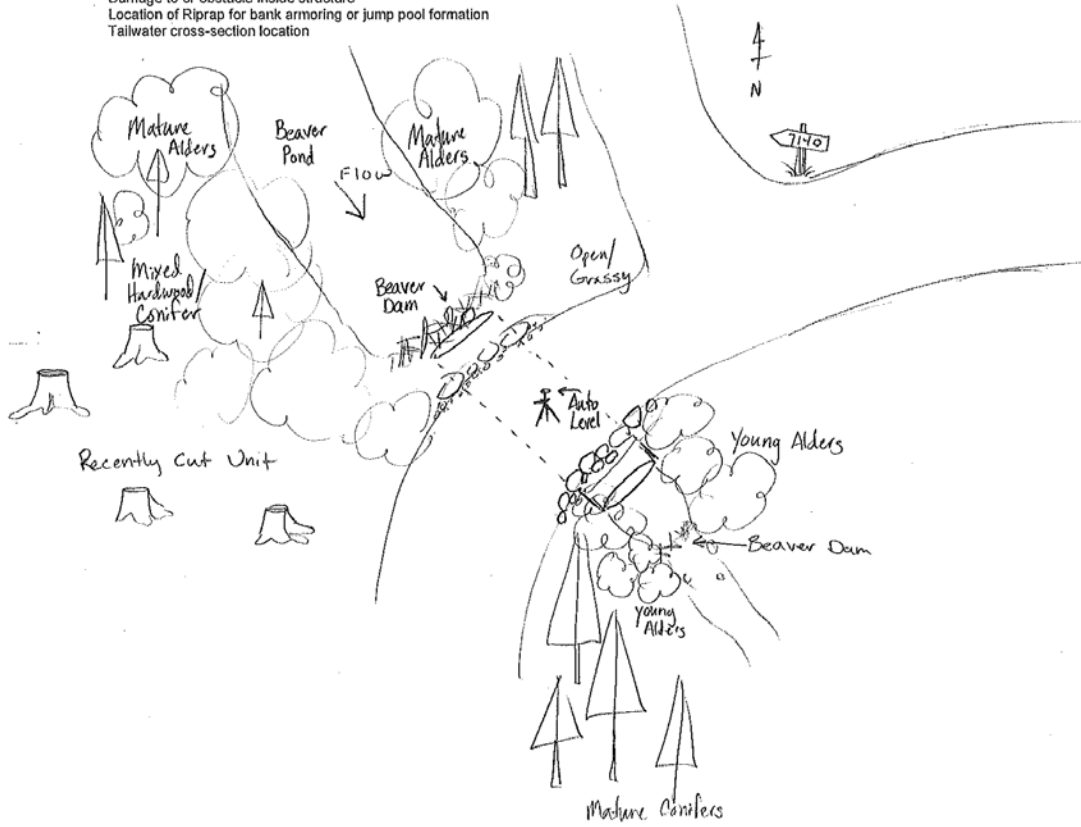
Figure 4645. Water Surface Profile at 0.08 cms, at this point and above flow become impassable due to velocity.

Site Sketch

Crossing ID number 3 / 523 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 4 2009 Restoration Effectiveness Monitoring Summary

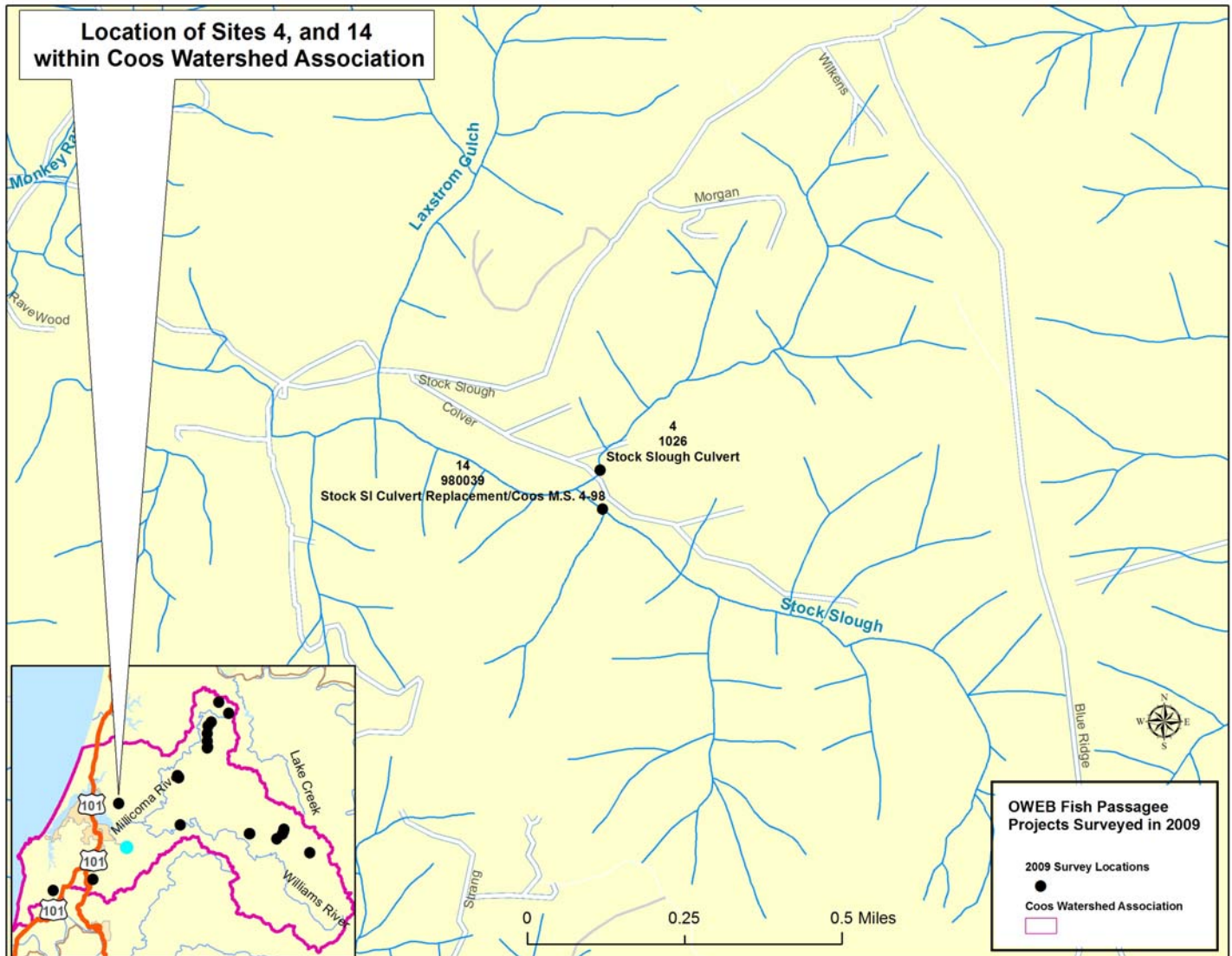
OWEB Project Name - Stock Sl Culvert Replacement/Coos M.S. 4-98

OWEB Grant Number – SC-009

OWRI Project Number – 980039

Owner – Private, Scoville

OWEB Description – Fish Passage



Map 26. Location of Sites 4 and 14 at Stock Slough in the region of the Coos sub-basin.

Site Notes

This very small stream is heavily impacted by urbanization. Substrate composition was composed of sand/silt/gravels, respectively. The culvert is a cement culvert and there was not any substrate in the culvert. The channel gradient near the culvert was 1.0%. The culvert gradient was 3.2%. The bankfull width of the channel upstream of the culvert was 1.5 meters on average while the circular culvert had a diameter of 0.48 meters. The ratio of inlet width to channel width was 0.32. The culvert lacked baffles. There was a small outlet pool that had an artificial tail crest made of small boulders to create a dam pool used for small hobby farm irrigation. Culvert inlet is buttressed by rip-rap boulders and marked by highway cones, while the culvert outlet invert was 0.5 meters below the outlet invert. Water depth in the pool was 0.2 meters while the residual pool depth was 0.19 meters.

Upstream channel riparian area was dominated by ivy, blackberry, and Japanese knotweed. OWEB fence (or so it appears) surrounds the creek downstream of the culvert and it appears intact. However, the riparian area is dominated by invasive shrubs with a couple of Douglas firs and Red alders present. It is doubtful that this culvert is part of an OWEB restoration effort, but the coordinates provided by OWEB led us to this site.

The channel extremely murky and visibility was nearly 0%. The channel began to puddle up about 20 meters above the culvert. There were no pools that exceeded 0.3 meters between the culvert inlet and 300 meters upstream. No fish observed.

FishXings Results

FishXings predicts that this culvert is a velocity block at all flows. This makes sense from a qualitative standpoint based on the type of stream and the design of the culvert.

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

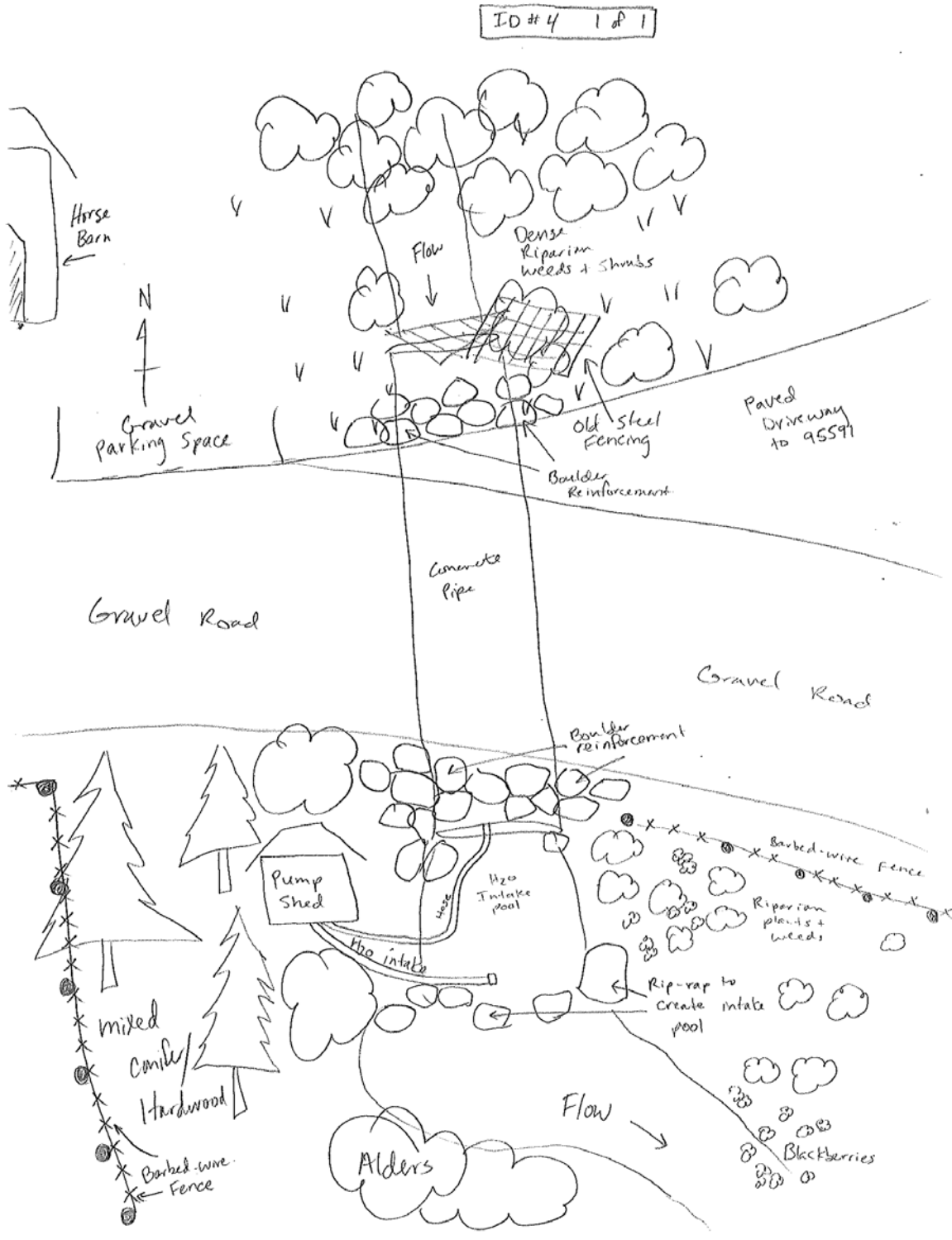
Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 38. Fish Passage Summary, Site 4.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	0.3110 cms
Percent of Flows Passable	0.0 %
Passable Flow Range	None
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.0 cms and Above
Pool Depth Barrier	None

Site Sketch



Site # 5 2009 Restoration Effectiveness Monitoring Summary

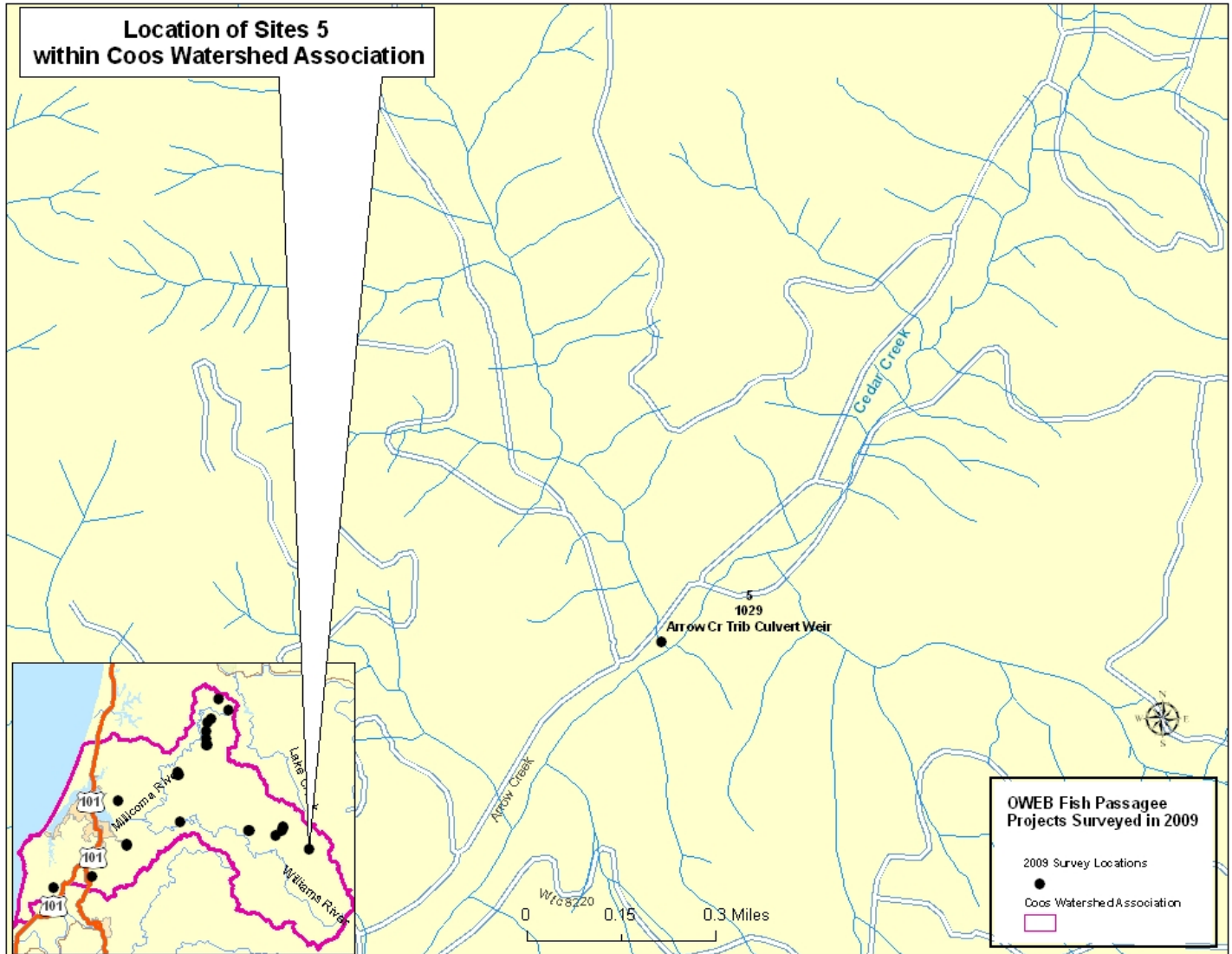
OWEB Project Name - Arrow Cr Trib Culvert Weir

OWEB Grant Number – SC-009

OWRI Project Number – 1029

Owner – Weyerhaeuser Corporation

OWEB Description – Fish Passage



Map 27. Location of Site 5 on a tributary to Arrow Creek within the region of the Coos Watershed Association.

Site Notes

This culvert is on a mountain stream with stable and well vegetated banks. The bridge is located approximately 50 meters above the confluence with Arrow Creek. The channel is dominated by cobble upstream of the bridge and a mixture of cobble and angular boulders downstream of the bridge. The angular boulders are most likely a result of placed boulders used during the bridge reinforcement phase of the project (resembles rip-rap). These boulders force scouring and create some deeper pool-like sections near bridge.

OWEB describes this as a culvert weir. It looks to us as though the culvert was replaced by a bridge and large boulders were placed in stream to create scour pools.

Longitudinal Profile

Figure 47 illustrates the shape of the longitudinal profile at Site 5. The channel gradient upstream of the project area was 2.8%, while the gradient downstream of the project area was 1.8%. We calculated the gradient within the project at 0.9%. When the previous structure was removed, the gradient was lessened and boulders were placed in the channel. This has caused some minor scouring within the channel, but most importantly the project area's slope is less than that of the channel. This ensures that fish including juveniles can pass through the area of restoration.

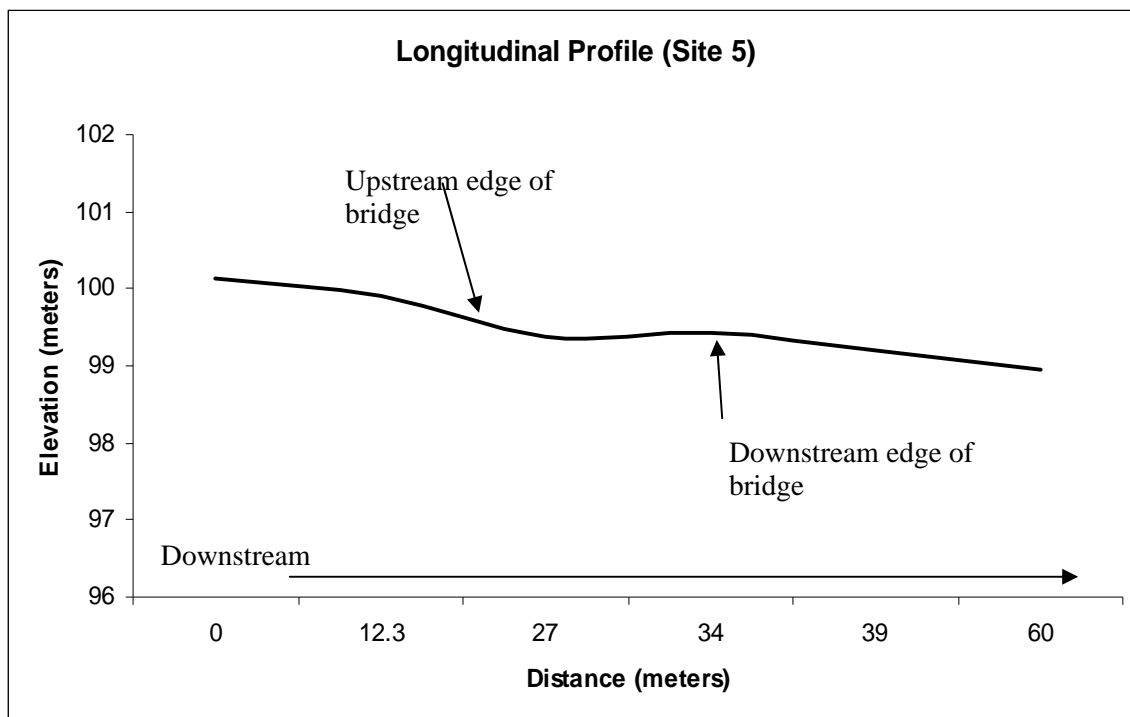


Figure 4746. Longitudinal profile for Site 5 on a tributary of Arrow Creek.

Snorkel Survey Results

Table 39 lists the number and species found in the snorkeled pools above the restoration area at Site 5. Relatively high numbers of juvenile salmonids were found in all the pools snorkeled at Site 5.

Table 39. Snorkel survey results for Site 5.

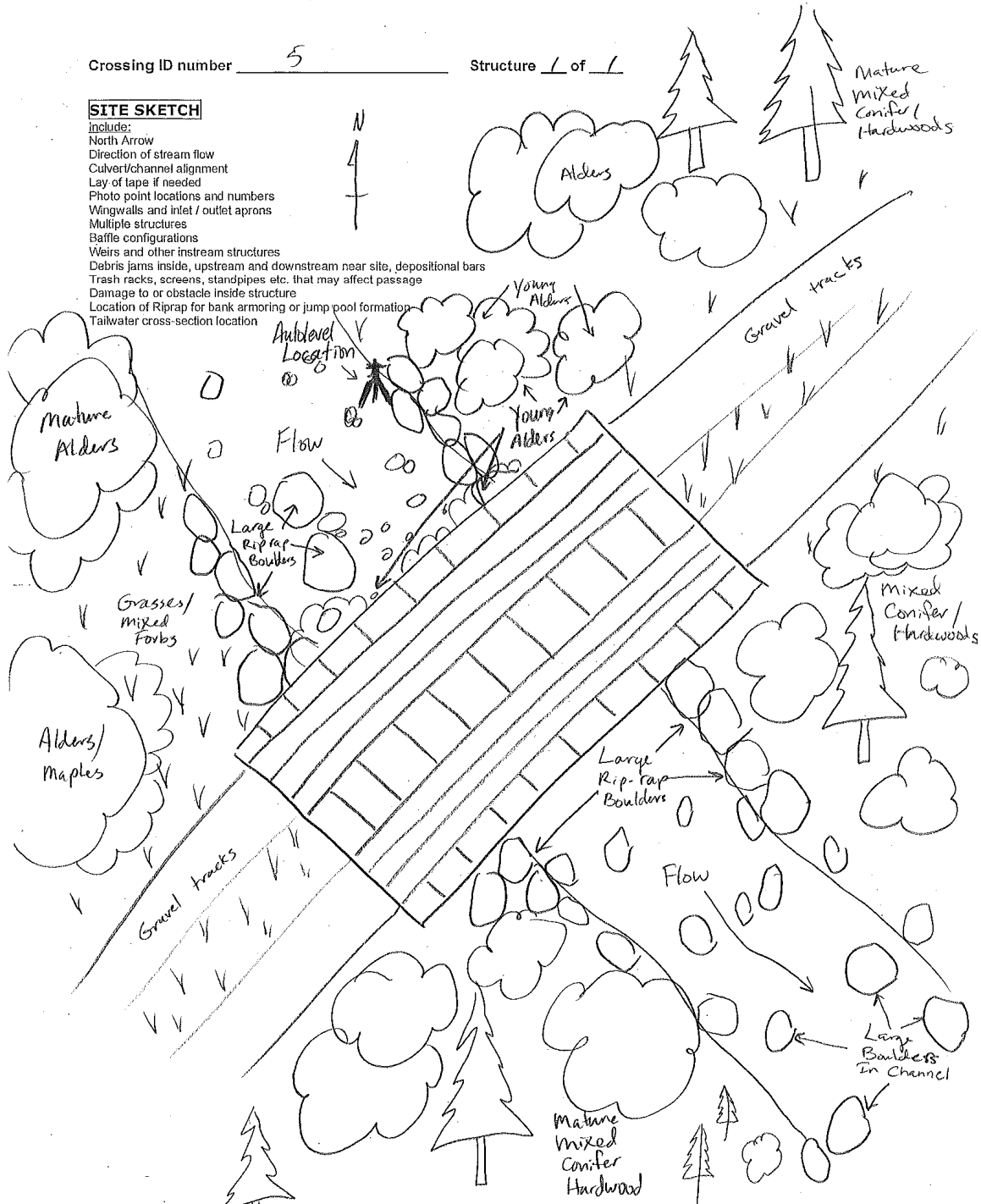
Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1236716433361	1	Lateral Scour	7.2	3.3	0.38	Coho	64	Steelhead/Cutthroat	9
1236716433361	2	Lateral Scour	5.5	2.3	0.32	Coho	55	Steelhead/Cutthroat	4
1236716433361	3	Lateral Scour	7.5	1.7	0.3	Coho	33	Steelhead/Cutthroat	2
1236716433361	4	Lateral Scour	8.5	2.1	0.43	Coho	36	Steelhead/Cutthroat	4

Site Sketch

Crossing ID number 5 Structure 1 of 1

SITE SKETCH

- include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 9 2009 Restoration Effectiveness Monitoring Summary

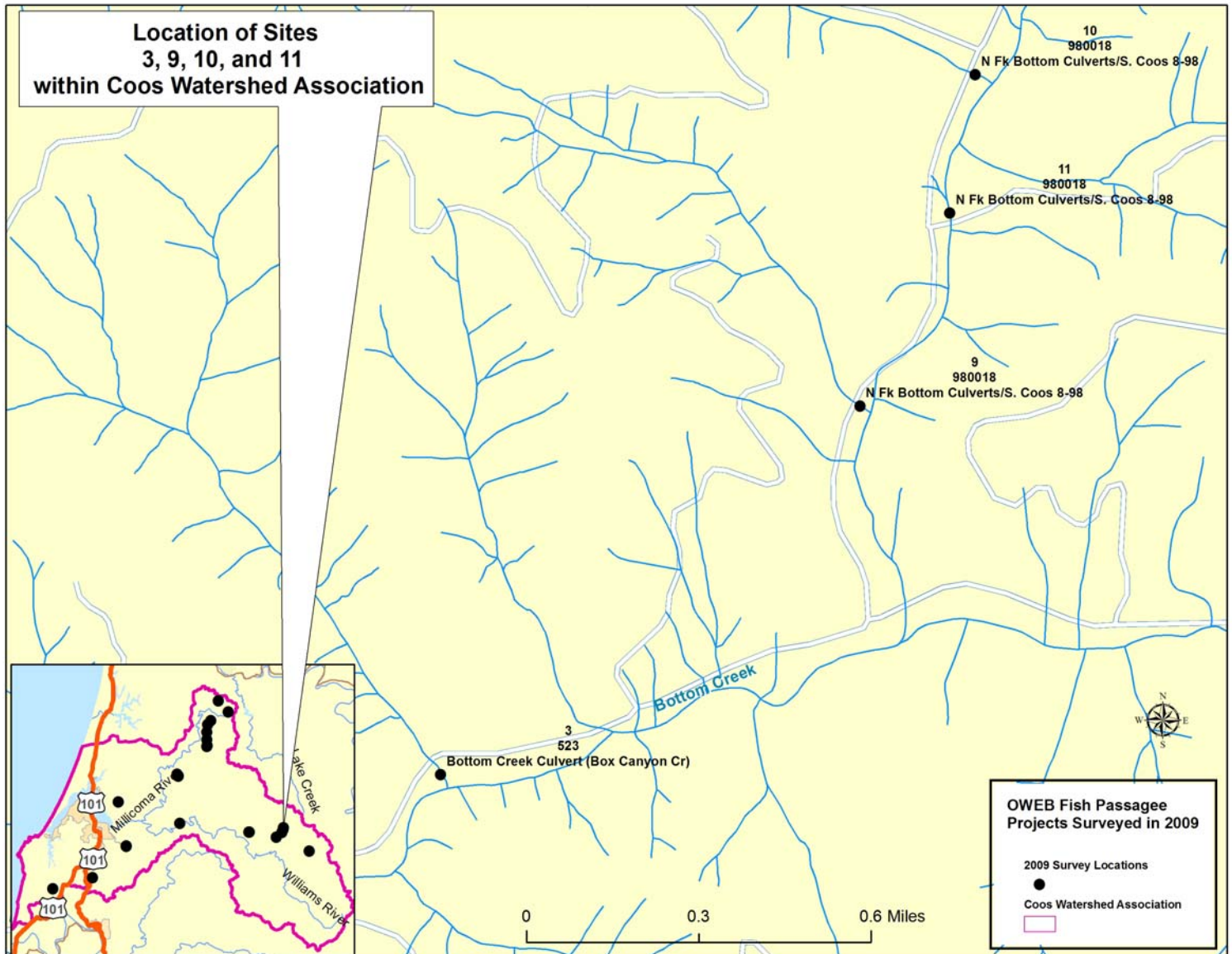
OWEB Project Name - N Fk Bottom Culverts/S. Coos 8-98

OWEB Grant Number – 097-240

OWRI Project Number – 980018

Owner – Weyerhaeuser Corporation

OWEB Description – Fish Passage



Map 28. The four sites located along Bottom Creek within the Coos sub-basin.

Site Notes

The channel at Site 9 illustrated elements of both a plane-bed and step/pool type channel. The mean stream gradient within 100 meters upstream and downstream of the culvert was 2.5%. Culvert slope was 2.9%. Bankfull width upstream of the culvert was determined to be 3.0 meters. The pipe-arch culvert width was recorded at 2.10 meters and the height was 1.60 meters. The inlet width to channel gradient width was 0.70. There was no outlet drop at the time of survey.

Substrate forms a discontinuous layer throughout the culvert, as the baffles act to hold sediment in place. Still the entire length of the culvert is not covered by sediment; sediment depth ranged from 0.28 meters at the outlet and none at the inlet. Large wood pieces have been placed downstream of the culvert, while substantial quantities of blowdown are creating habitat upstream of the culvert.

Snorkeling became impossible owing to the abnormal quantity of wasps ground nest. Surveyors suffered dozens of stings and had to cancel the snorkel survey for safety reasons. Many juvenile Coho and juvenile trout were observed above and below the culvert during the culvert survey.

FishXings Results

FishXings predicts that only 1.2% of modeled flows would be passable by juveniles. The model predicts that the velocity blocks begin at 0.06 cms. These results are suspect because this culvert is essentially a stream simulated design. Good amounts of substrate line the bottom of the culvert, and the culvert is the same gradient as the channel. Perhaps the only improvement possible would be to have countersunk the outlet to create a negative gradient.

Hydraulic Evaluation Criteria

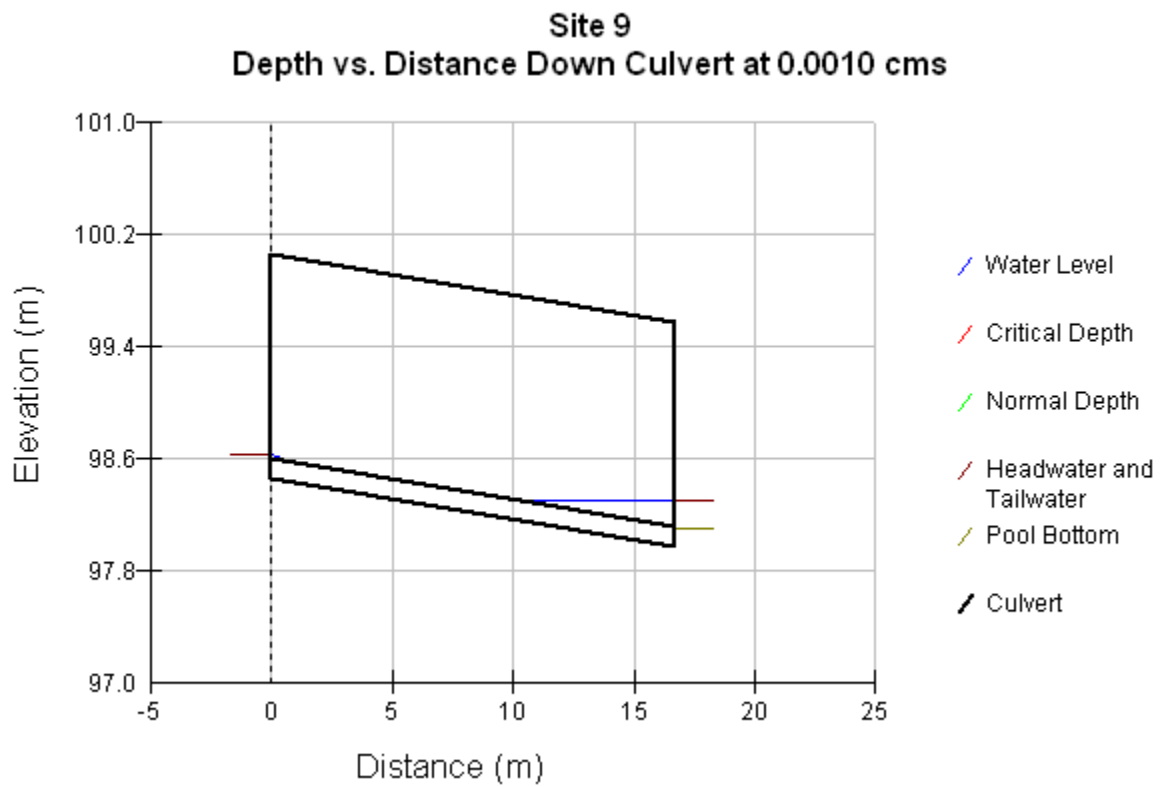
Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 40. Fish Passage Summary, Site 9.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	4.8000 cms
Percent of Flows Passable	1.2 %
Passable Flow Range	0.0010 to 0.0609 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.06 cms and Above
Pool Depth Barrier	None



| Figure 4847. Surface water profile at 0.001 cms; passable.

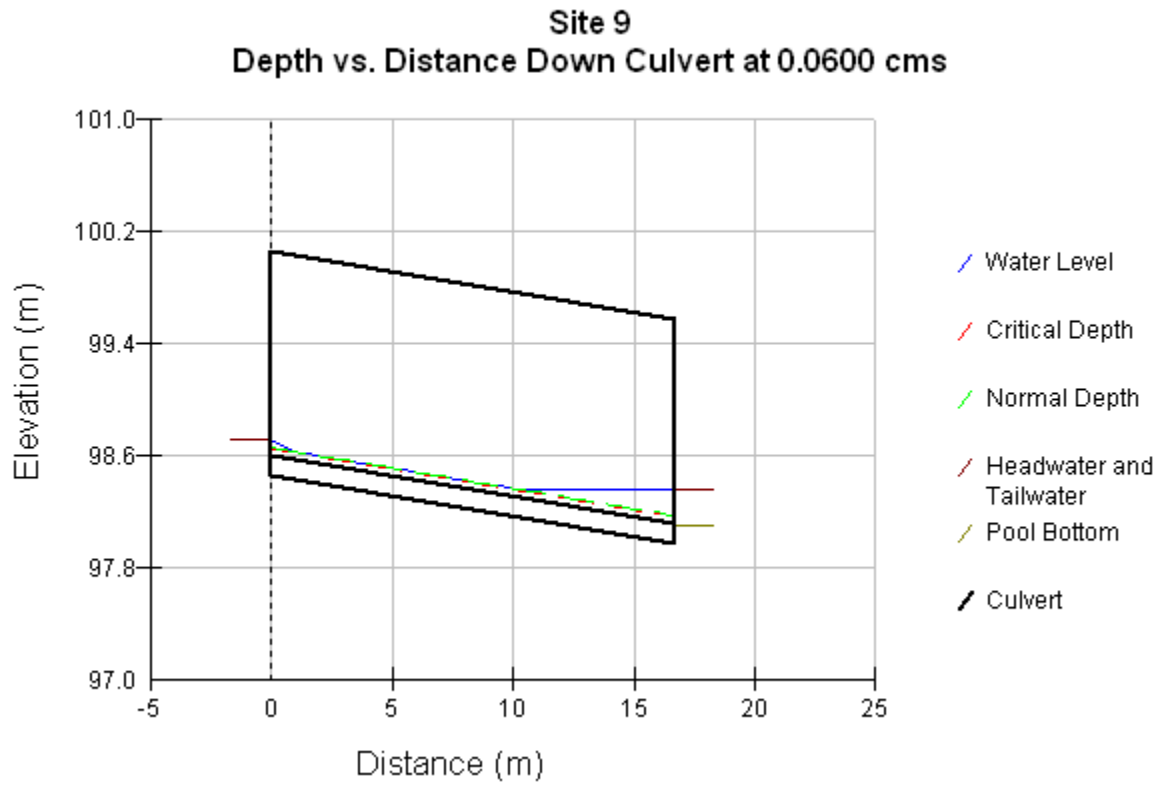


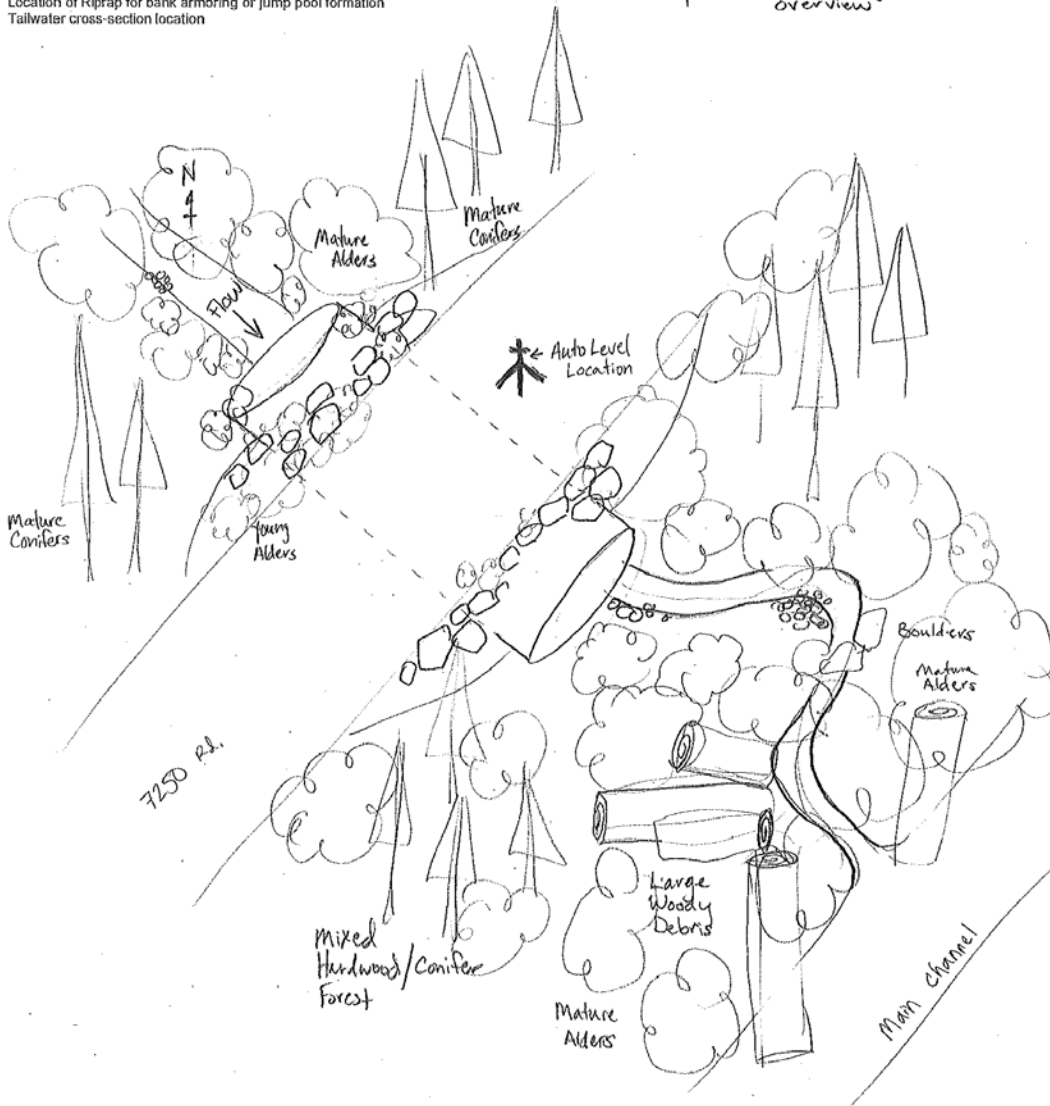
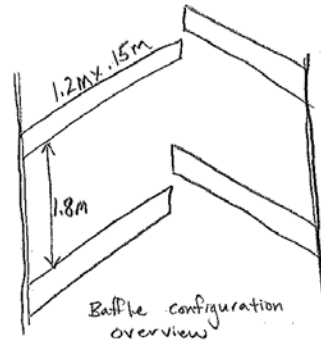
Figure 4948. Water Surface Profile at 0.06 cms, velocity block.

Site Sketch

Crossing ID number 9/980018 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and Inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 10 2009 Restoration Effectiveness Monitoring Summary

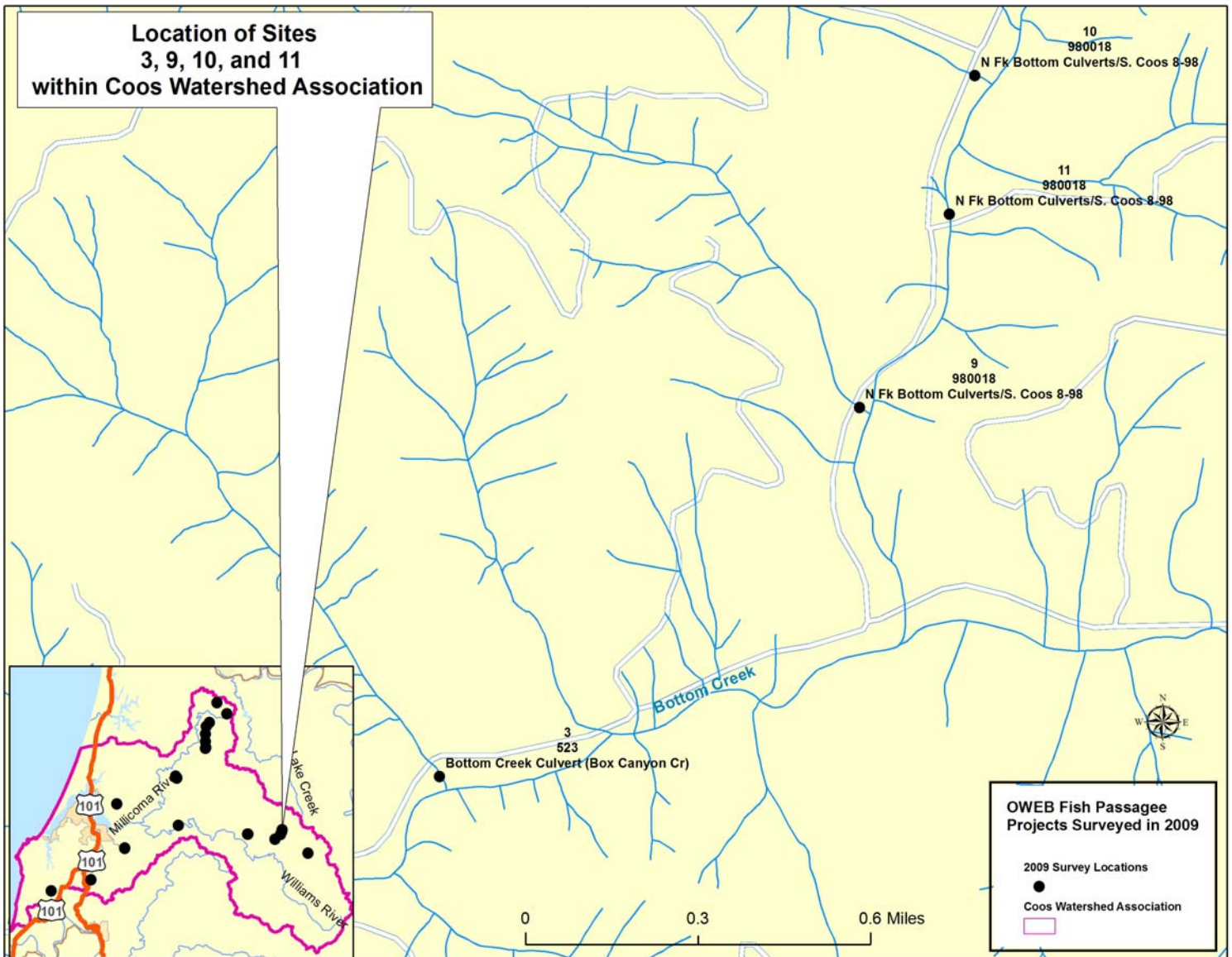
OWEB Project Name - N Fk Bottom Culverts/S. Coos 8-98

OWEB Grant Number – 097-240

OWRI Project Number – 980018

Owner – Weyerhaeuser Corporation

OWEB Description – Fish Passage



Map 29. The four sites located along Bottom Creek within the Coos sub-basin.

Site Notes

The channel at Site 10 illustrated elements of both a plane-bed and step/pool type channel. The mean stream gradient within 100 meters upstream and downstream of the culvert was 5%. Bankfull width upstream of the culvert was determined to be 4.1 meters. This pipe-arch culvert width was recorded at 2.30 meters and the height was 1.60 meters. The inlet width to channel gradient width was 0.56. There was an ~ 0.1 meter outlet drop at time of survey. The deepest point within 1 meter of the outlet was 0.46 meters below the outlet invert. The pool was 0.32 meters deep to the water line (see Photo-series). The residual pool depth for the outlet pool was .33 meters. There was a series of baffles within the culvert that occupied the inlet, barrel, and outlet zones; however, these baffles did not act to hold enough sediment to create a stream simulated crossing (see Site Sketch).

The culvert inlet is not currently aligned with the position of the stream channel. The stream channel flows ~ 2 meters to the right bank of the inlet. This resulted in down cutting of up to 1.5 meters in depth and the boulder fill reinforcement collapsing and damaging the inlet on the right lower half of culvert (see Photo-series). There is a substantial log jam within the culvert at ~ 7 meters downstream from inlet (see Photo-series).

Many juvenile Coho and juvenile trout were observed above and below the culvert during the culvert survey.

Snorkel Survey Results

Juvenile fish (3" and less) were observed in all pool habitats snorkeled within 500 feet upstream of the culvert at Site 10. Steelhead and cutthroat are not differentiated because identifying juveniles from those two species is extremely difficult.

Table 41. Snorkel survey results from Site 10.

Stream_LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1237369433765	1	Plunge	3.2	2.6	0.36	Coho	36	Steelhead/Rainbow	0
1237369433765	2	Lateral Scour	10.5	1.2	0.4	Coho	57	Steelhead/Rainbow	1
1237369433765	3	Plunge	4.3	2.7	0.55	Coho	81	Steelhead/Rainbow	1

FishXings Results

FishXings predicts that the outlet drop is a barrier to all juveniles. A velocity barrier would begin at 0.02 cms.

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 42. Fish Passage Summary, Site 10.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	4.8000 cms
Percent of Flows Passable	0.0 %
Passable Flow Range	None
Depth Barrier	None
Outlet Drop Barriers	All Flows
Velocity Barrier - V	0.02 cms and Above
Pool Depth Barrier	None

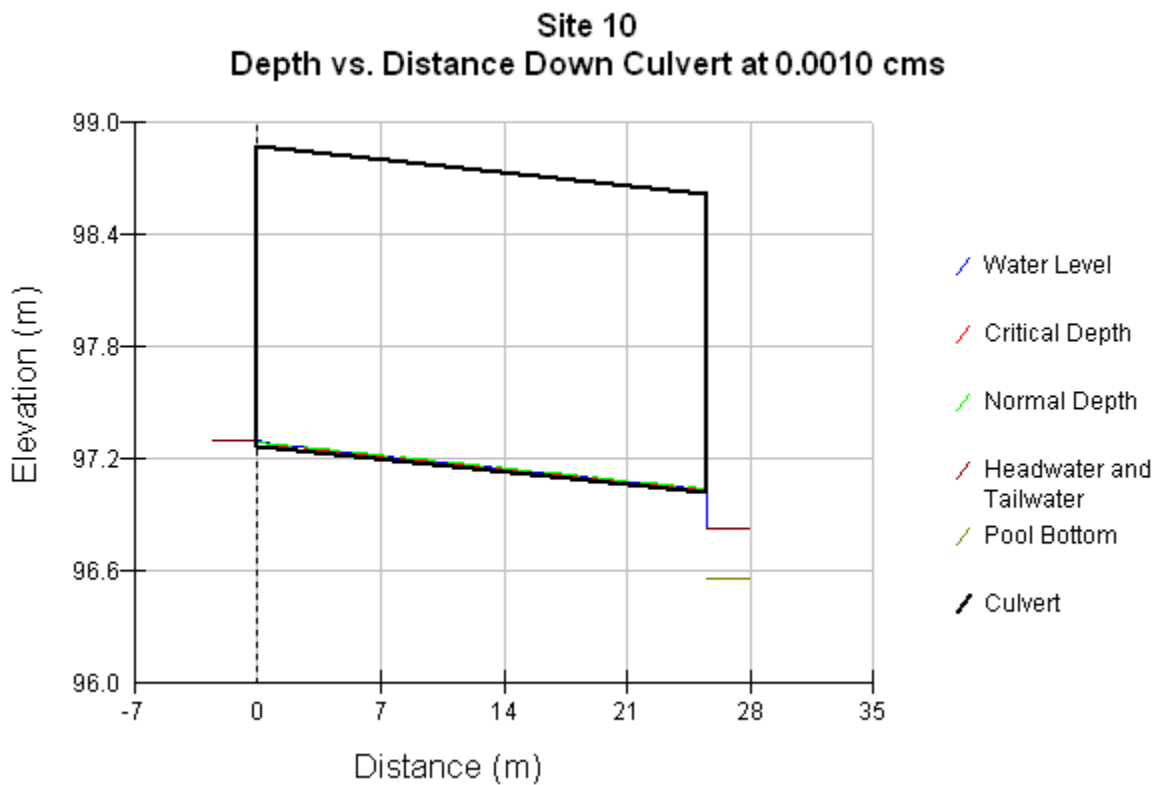
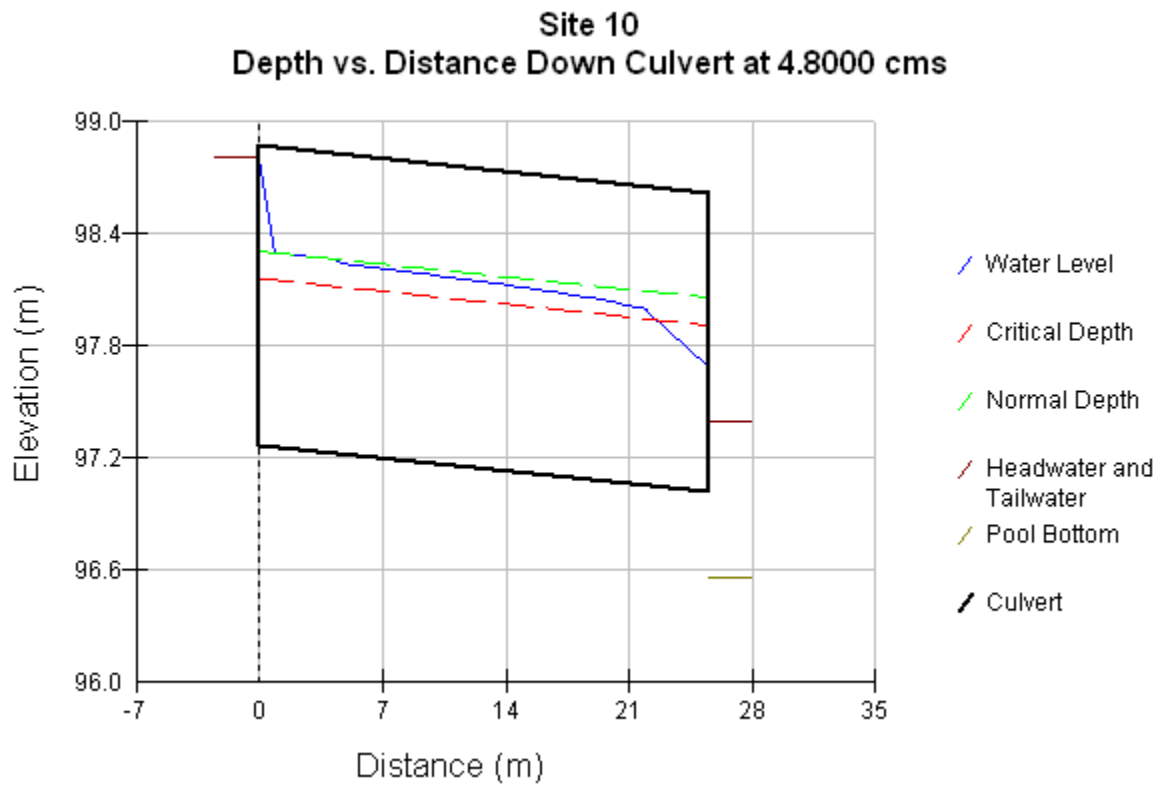


Figure 5049. Water Surface Profile at 0.001 cms, not a velocity barrier but an outlet drop barrier.



| Figure 5150. Water Surface Profile at 4.8 cms; both a velocity barrier and an outlet drop barrier.

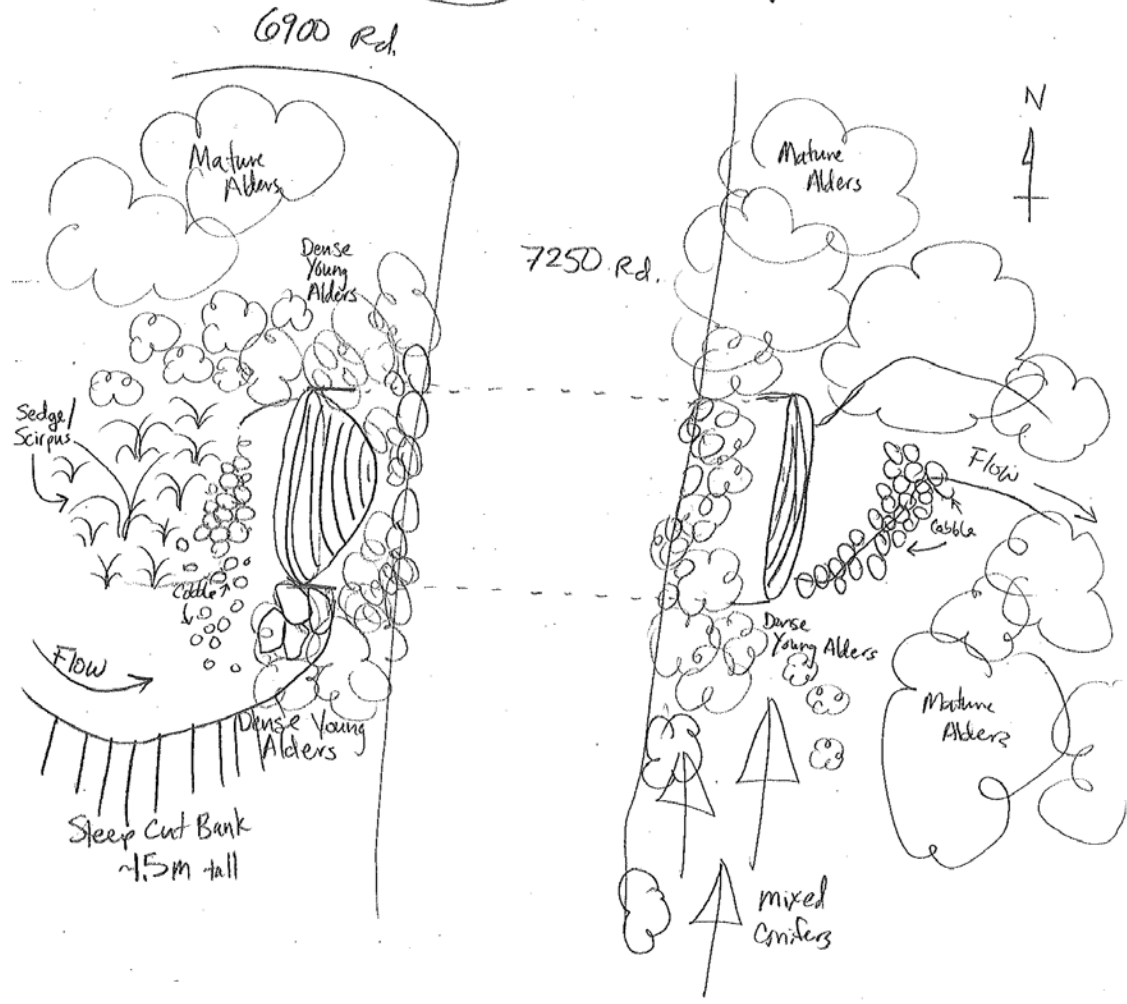
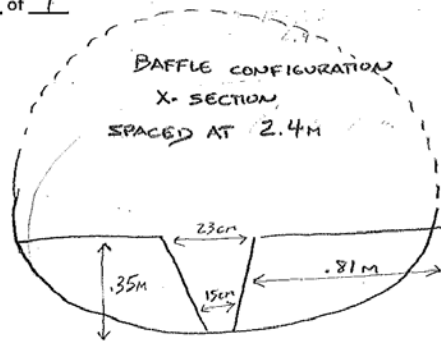
Site Sketch

Crossing ID number 10/980018 Structure 1 of 1

SITE SKETCH

Include:

- North Arrow
- Direction of stream flow
- Culvert/channel alignment
- Lay of tape if needed
- Photo point locations and numbers
- Wingwalls and inlet / outlet aprons
- Multiple structures
- Baffle configurations
- Weirs and other instream structures
- Debris jams inside, upstream and downstream near site, depositional bars
- Trash racks, screens, standpipes etc. that may affect passage
- Damage to or obstacle inside structure
- Location of Riprap for bank armoring or jump pool formation
- Tailwater cross-section location



Site # 11 2009 Restoration Effectiveness Monitoring Summary

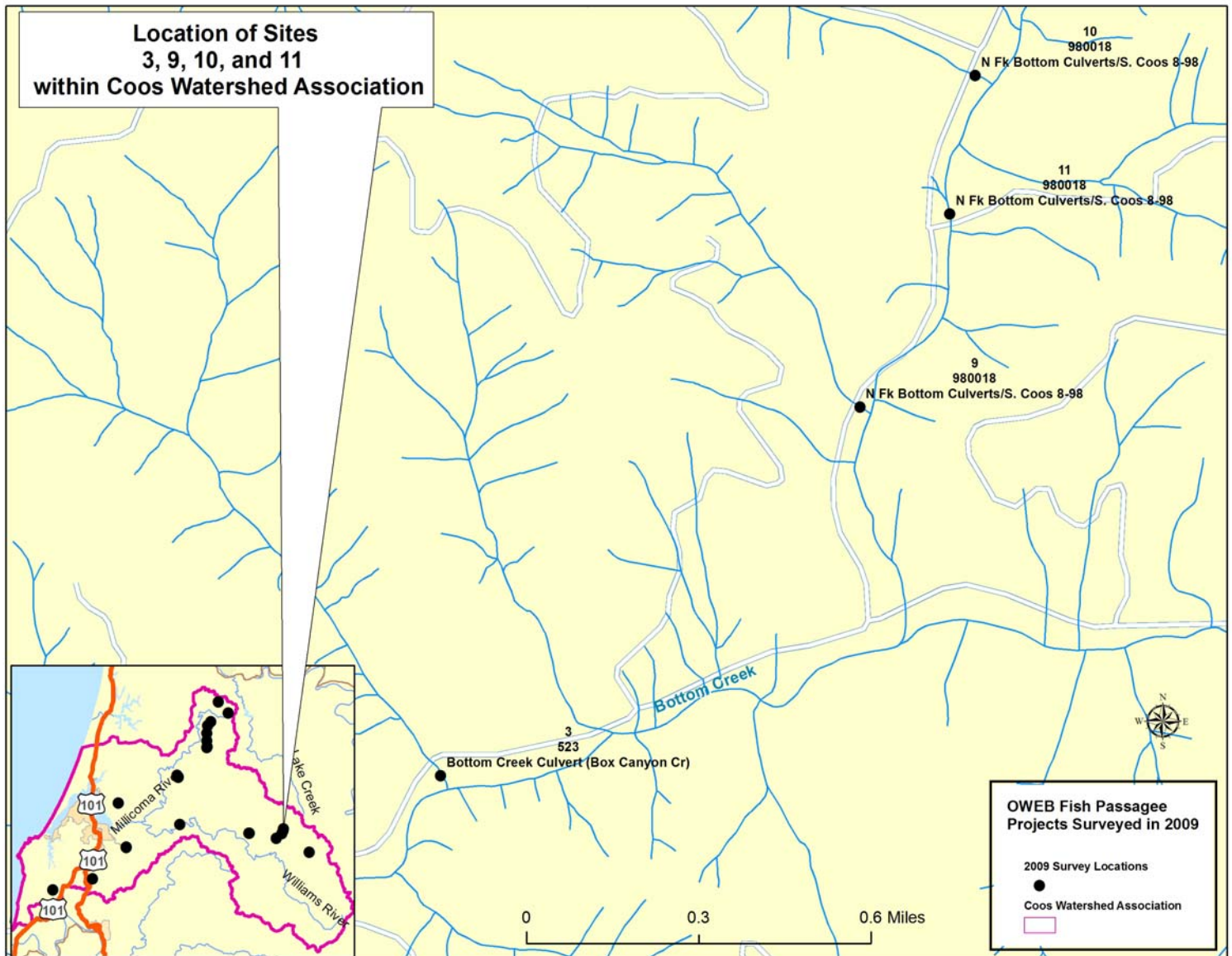
OWEB Project Name - N Fk Bottom Culverts/S. Coos 8-98

OWEB Grant Number – 097-240

OWRI Project Number – 980018

Owner – Weyerhaeuser Corporation

OWEB Description – Fish Passage



Map 30. The four sites located along Bottom Creek within the Coos sub-basin.

Site Notes

The channel at Site 11 illustrated elements of both a mountain plane-bed and type channel. The mean stream gradient within 100 meters upstream and downstream of the culvert was 2%. The gradient through the culvert was a negative -0.43%. It was a countersunk culvert. Bankfull width upstream of the culvert was determined to be 12.7 meters. This bottomless arch culvert had a width of 5.00 meters and the height was 2.50 meters. The inlet width to channel gradient width was 0.39. There was no outlet drop at this crossing. It was designed as stream simulation (see Photo-series). The tail water control was .06 meters above the invert inlet and 0.10 meters below the outlet invert illustrating the countersunk nature of the crossing. The bottomless arch simulates a stream bottom by way being dominated by bedrock/silt/and gravel.

Many juvenile Coho and juvenile trout were observed above and below the culvert during the culvert survey.

Snorkel Survey Results

Snorkel data are presented here for Site 10. Site 10 was upstream of Site 11. Juvenile fish (3" and less) were observed in all pool habitats snorkeled within 500 feet upstream of the culvert at Site 11. Therefore, fish probably pass through this downstream crossing. Rainbow and cutthroat are not differentiated because identifying juveniles from those two species is extremely difficult.

Table 43. Snorkel survey results for Site 11.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1237369433765	1	Plunge	3.2	2.6	0.36	Coho	36	Steelhead/Rainbow	0
1237369433765	2	Lateral Scour	10.5	1.2	0.4	Coho	57	Steelhead/Rainbow	1
1237369433765	3	Plunge	4.3	2.7	0.55	Coho	81	Steelhead/Rainbow	1

FishXings Results

FishXings predicts that nearly 1.8% of all flows will be passable at this culvert by juvenile salmonids.

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 44. Fish Passage Summary, Site 11.

Fish Passage Summary	
Low Passage Design Flow	0.0800 cms
High Passage Design Flow	25.0000 cms
Percent of Flows Passable	1.8 %
Passable Flow Range	0.0800 to .53900 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	.54 cms and Above
Pool Depth Barrier	None

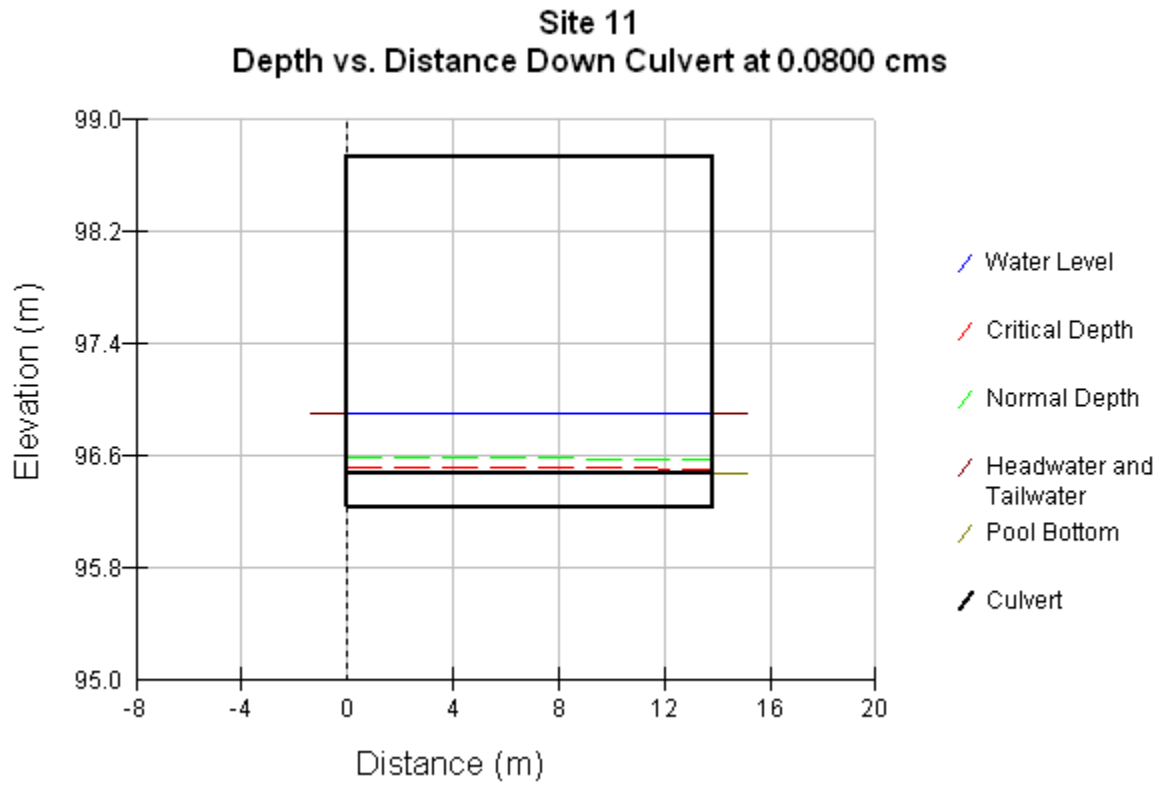
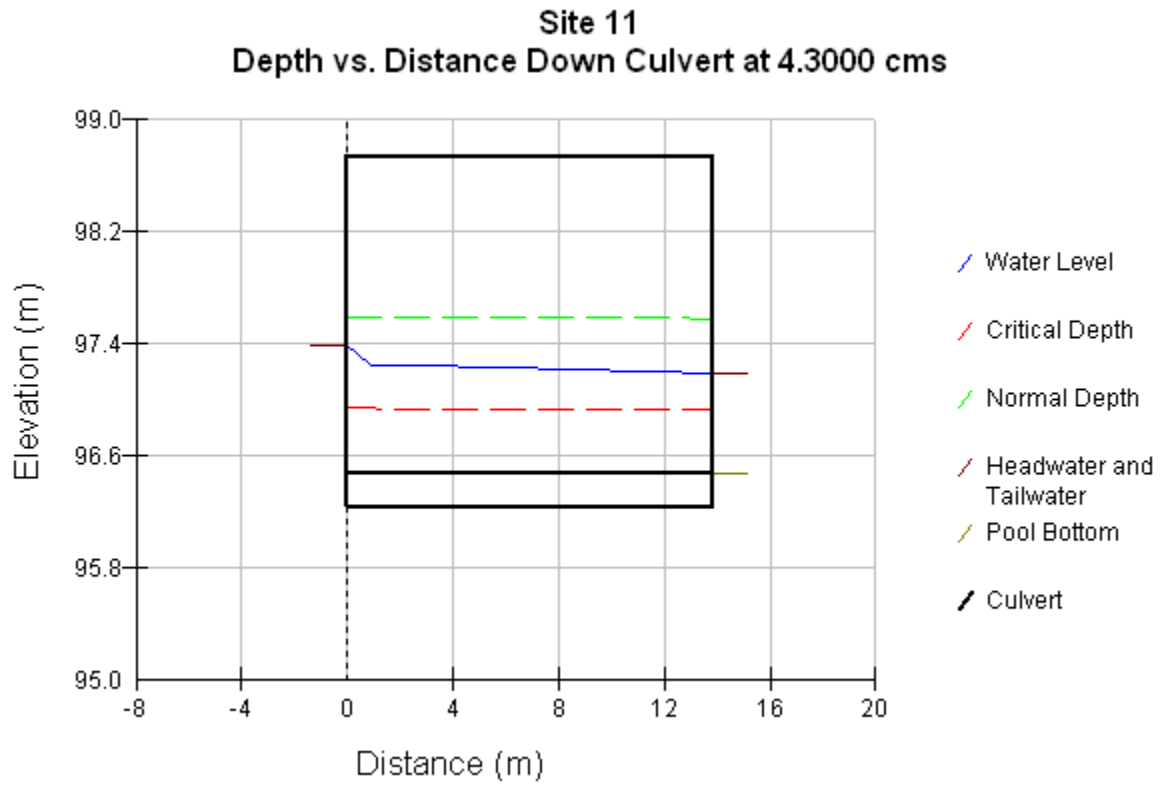


Figure 5251. Water Surface Profile at 0.08 cms, passable.



| Figure 5352. Water Surface Profile at 4.3 cms, velocity block.

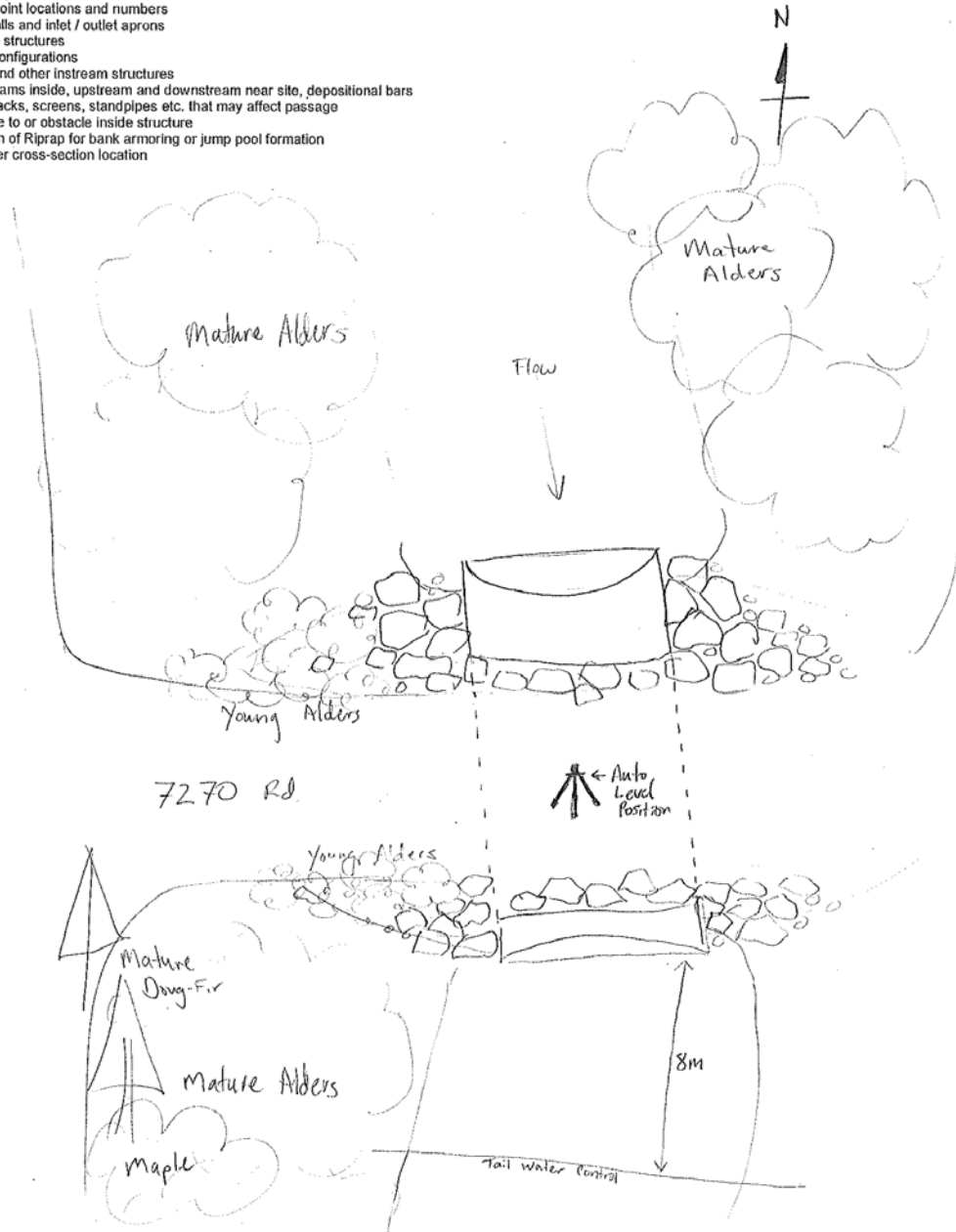
Site Sketch

Crossing ID number 11/980018 Structure 1 of 1

SITE SKETCH

Include:

- North Arrow
- Direction of stream flow
- Culvert/channel alignment
- Lay of tape if needed
- Photo point locations and numbers
- Wingwalls and inlet / outlet aprons
- Multiple structures
- Baffle configurations
- Weirs and other instream structures
- Debris jams inside, upstream and downstream near site, depositional bars
- Trash racks, screens, standpipes etc. that may affect passage
- Damage to or obstacle inside structure
- Location of Riprap for bank armoring or jump pool formation
- Tailwater cross-section location



Site # 12 2009 Restoration Effectiveness Monitoring Summary

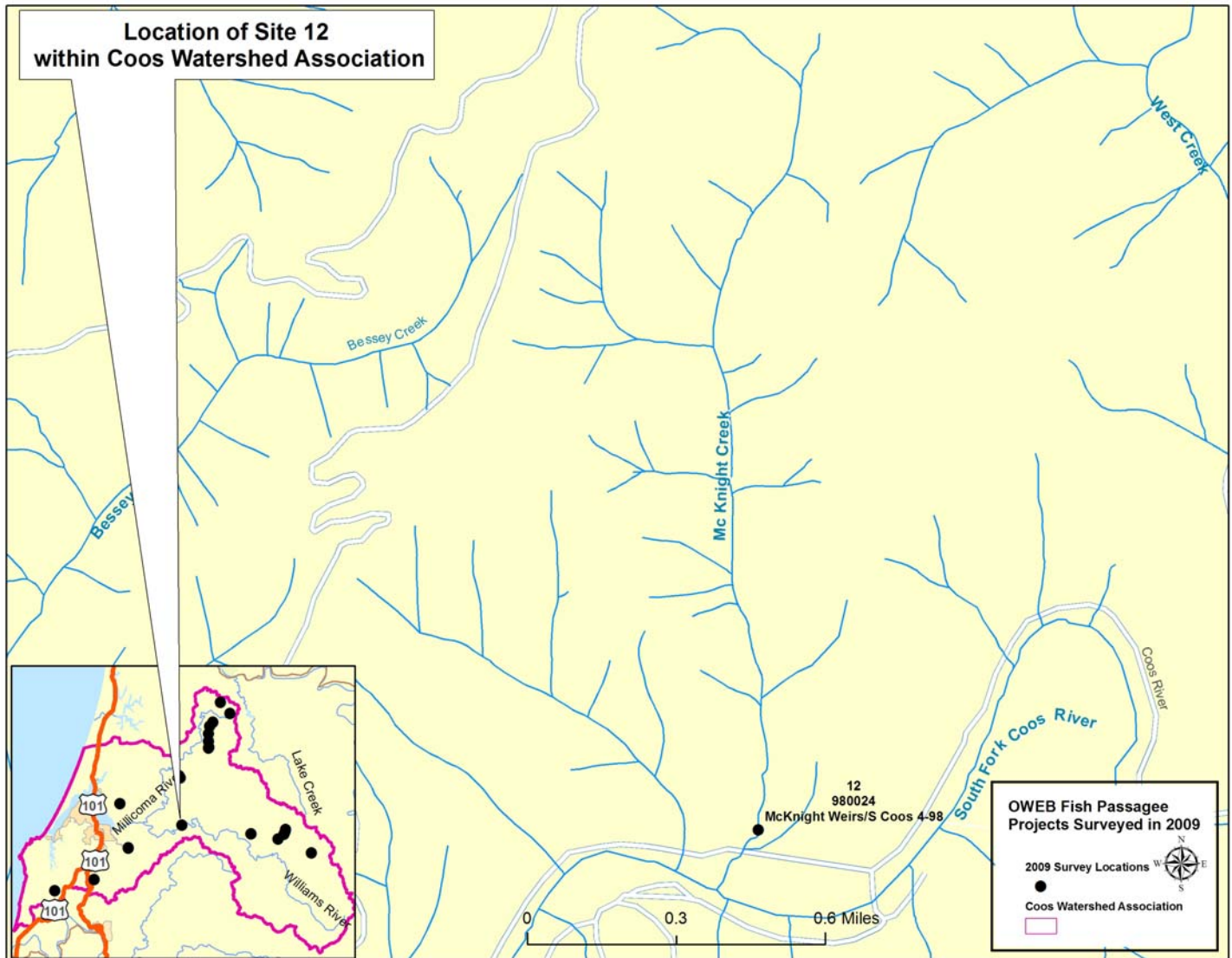
OWEB Project Name - McKnight Weirs/S Coos 4-98

OWEB Grant Number – SC-009

OWRI Project Number – 980024

Owner – Weyerhaeuser Corporation

OWEB Description – Fish Passage



Map 31. Location of Site 12 on McKnight Cree within the region of the Coos sub-basin.

Site Notes

This is a mountain stream channel dominated by cobble/gravel/boulder throughout the surveyed portion of the channel; except in the immediate project area. Here a pre-existing stream crossing had been removed, the channel slope was lessened, and boulders were set in place. The immediate project area substrate now is primarily composed of silt. This phenomena is a result of reducing the channel gradient at the area where boulders were placed; a deposition zone has been created where it was once quite probably a transport zone.

Overall channel slope for the survey area was 3%. The immediate project area channel slope was 0.7%. Bankfull width above the immediate project area averaged 5.8 meters.

During the channel survey, juvenile salmonids were seen in the boulder scour pool.

Snorkel Survey Results

Snorkel data are presented here for Site 12. We found juvenile trout in every pool over the 155 meter snorkel survey. Visibility was generally good. Steelhead and cutthroat are not differentiated because identifying juveniles from those two species is extremely difficult.

Table 45. Snorkel survey data from Site 12.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1239992433743	1	Straight Scour	7.2	3.2	0.4	Steelhead/Cutthroat	8
1239992433743	2	Lateral Scour	4.8	2.7	0.3	Steelhead/Cutthroat	4
1239992433743	3	Lateral Scour	5.7	2.6	0.37	Steelhead/Cutthroat	11
1239992433743	4	Straight Scour	6.3	1.5	0.3	Steelhead/Cutthroat	1
1239992433743	5	Straight Scour	4	2.3	0.3	Steelhead/Cutthroat	3
1239992433743	6	Lateral Scour	5.5	5.6	0.44	Steelhead/Cutthroat	3

Longitudinal Profile

The longitudinal profile for the McKnight project illustrates the channel slope breaks and inflection points. Focus on the stretch between 27 and 36 meters; this was the area where the boulder weirs were placed. The effect of removing the pre-existing structure, breaking the gradient, and placing the boulders can be seen in the graph. A pool has formed here and this region has been converted from a transport channel section to a response channel section. That was determined not only because of the scour pool formed by the boulders and the reduction/reversal of slope, it was also the location of fine sediment build-up in a reach of stream dominated by cobbles and gravels.

Table 46. Survey measurements for the longitudinal profile at Site 12.

Station	Elevation	Remarks
0	100.8	Upstream extent of longitudinal survey
10	100.31	Gradient break
27	99.65	Upstream end of project area influence
30	99.58	
36	99.71	Downstream end of project influence
42	99.44	Side channel
60	99.29	Downstream extent of longitudinal survey

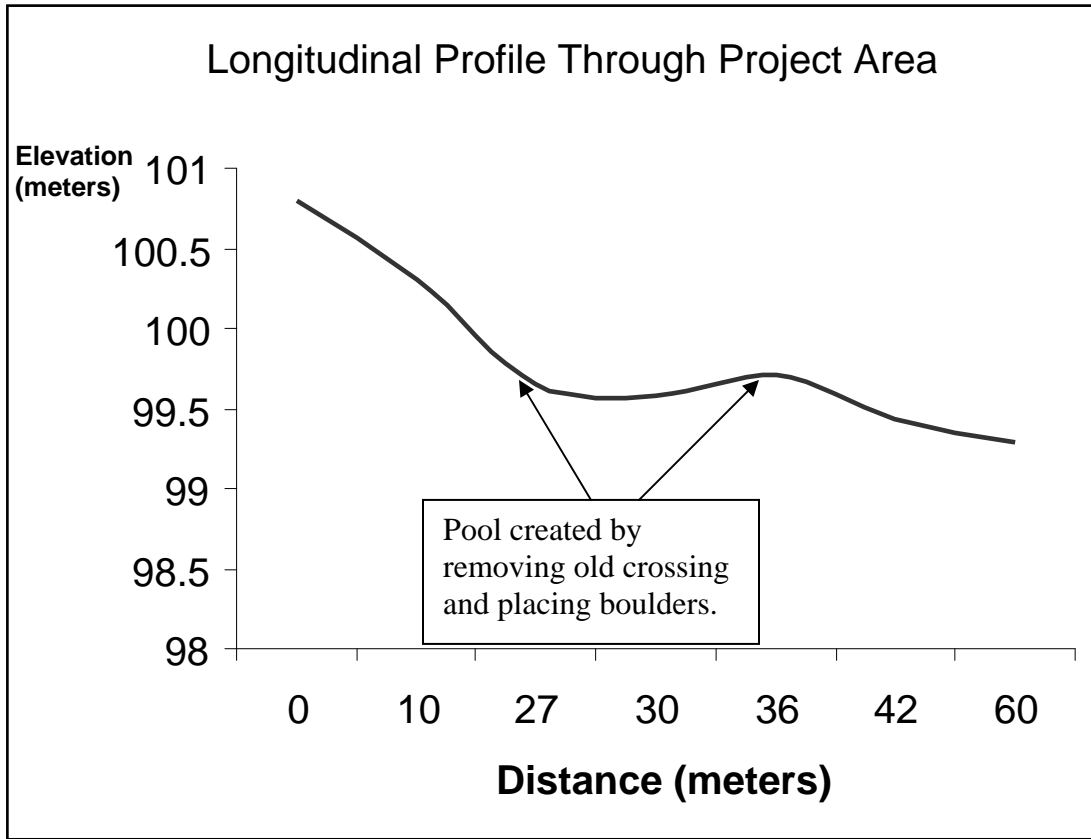


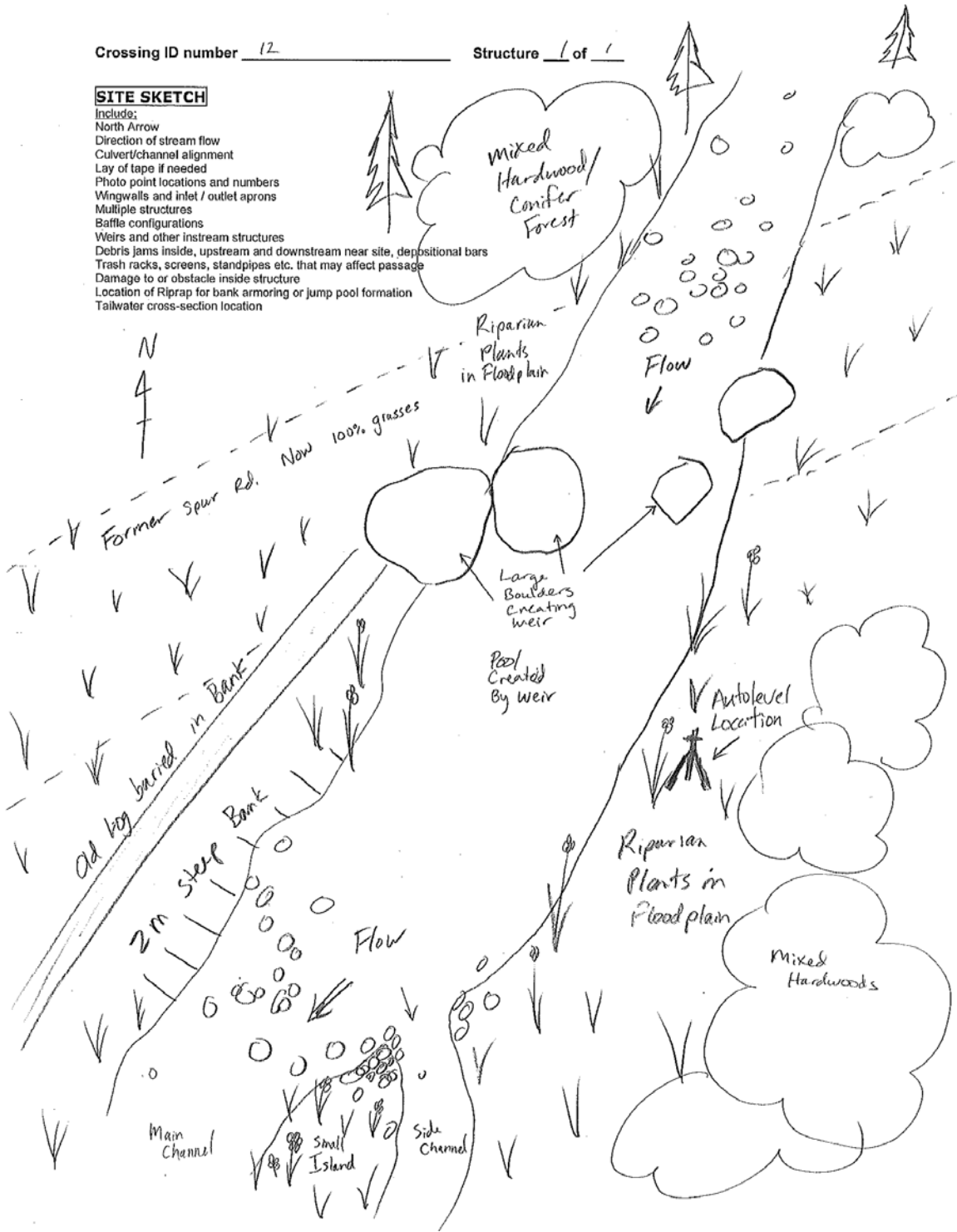
Figure 5453. Longitudinal profile of surveyed section at Site 12.

Site Sketch

Crossing ID number 12 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 14 2009 Restoration Effectiveness Monitoring Summary

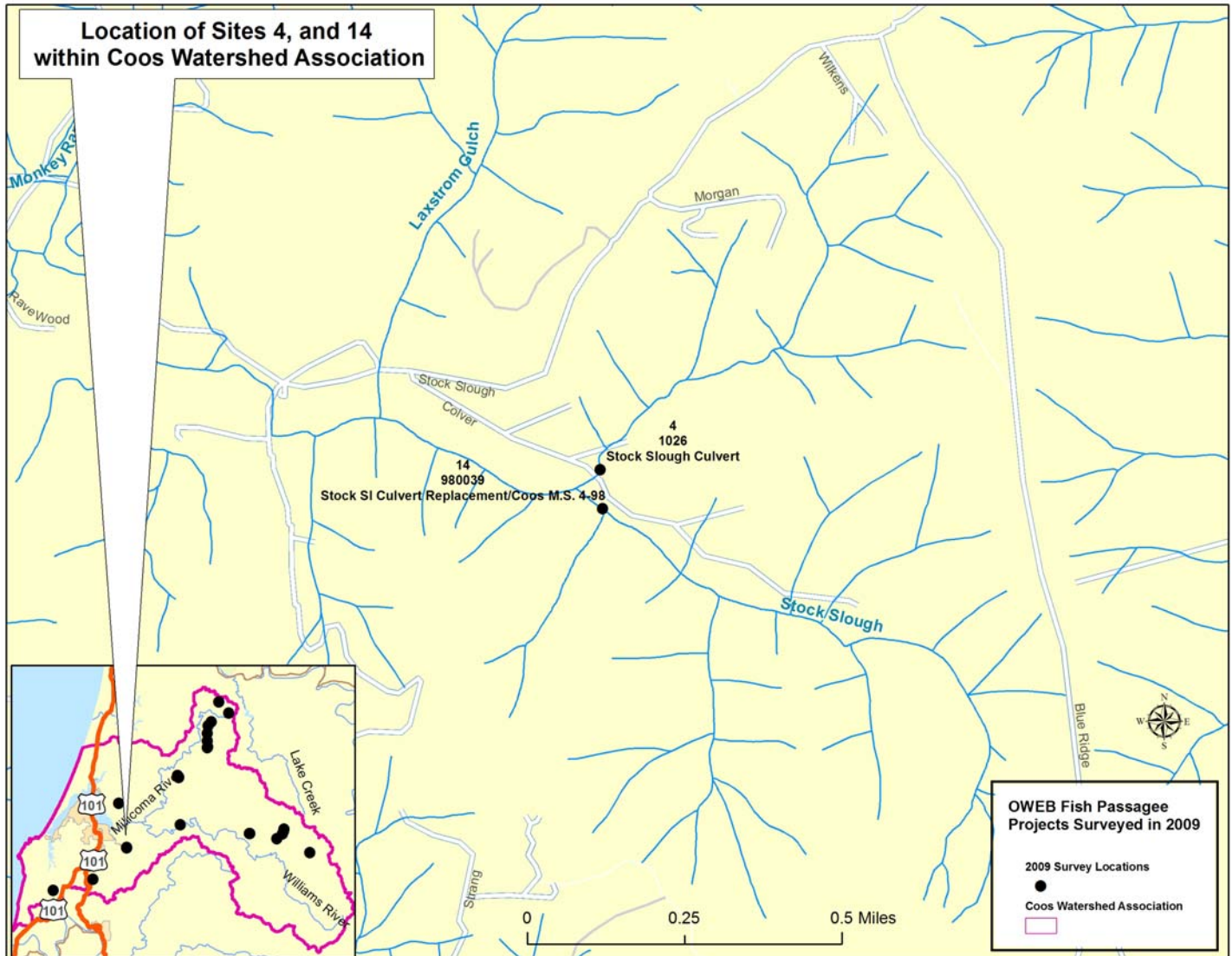
OWEB Project Name - Stock Sl Culvert Replacement/Coos M.S. 4-98

OWEB Grant Number – SC-009

OWRI Project Number – 980039

Owner – Private, Scoville

OWEB Description – Fish Passage



Map 32. Location of Sites 4 and 14 near Stock Slough in the region of the Coos sub-basin.

Site Notes

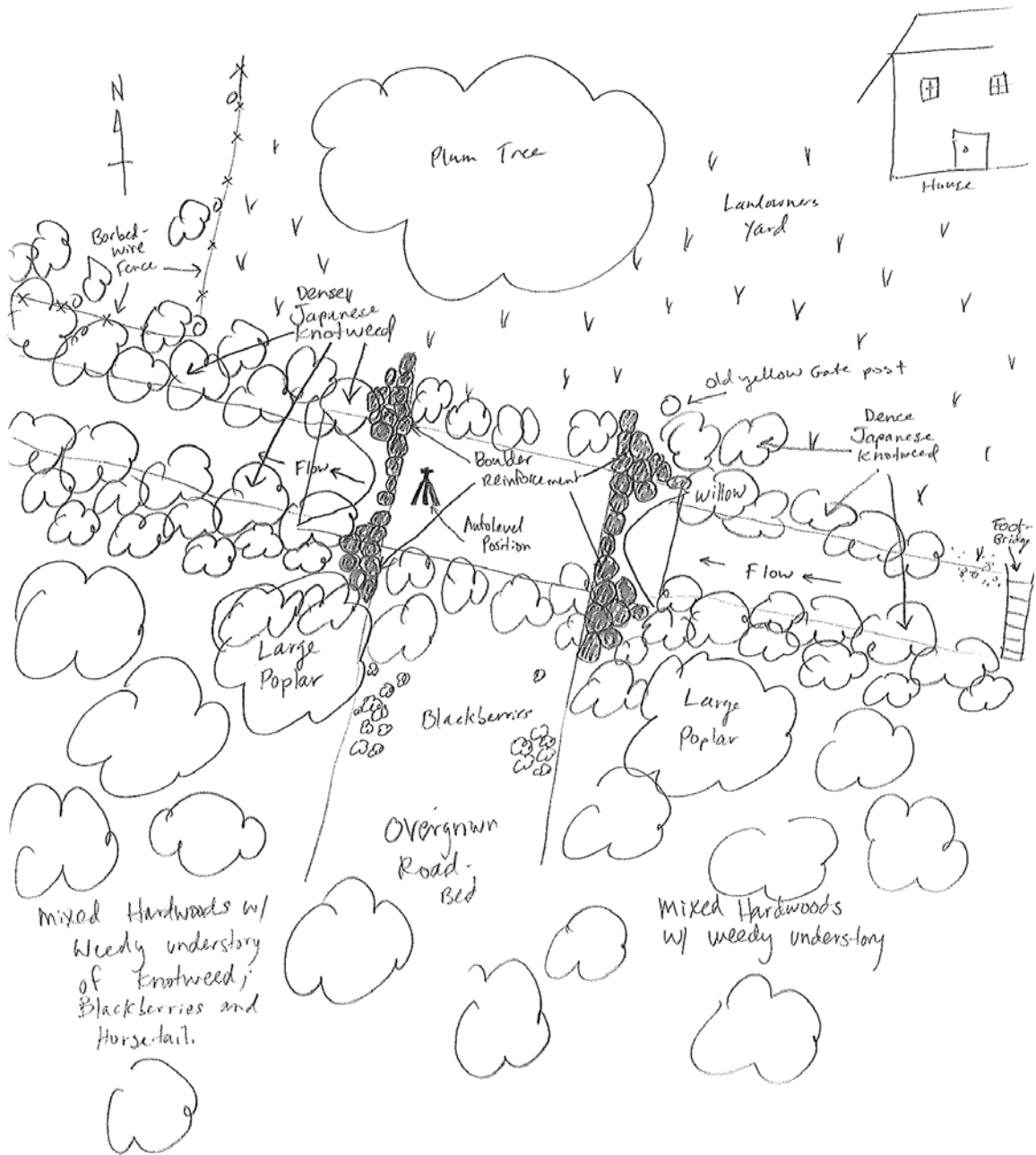
This is a narrow low gradient plane-bed channel with the substrate composed of gravel/sand/silt, respectively. The pipe arch culvert was filled with fine sediment that was composed of silt/gravels/sand, respectively as well. The channel gradient near the culvert was 1.4%. The culvert gradient was 0.9%. The bankfull width of the channel upstream of the culvert was 1.9 meters on average while the culvert had a dimensions of 1.9 meters width by 1.07 meters tall. The height measurement is from the sediment to the top of the culvert. Sediment depth was estimated at 0.43 meters. The ratio of inlet width to channel width was 1. The culvert lacked baffles, but it was difficult to determine with the sediment being so deep in the culvert. There was not any outlet pool.

The banks for the surveyed reach are lined with an intense cover of Japanese knotweed and blackberries. Upstream of the culvert a house and yard border the creek which leads to some brush clearing and bank sloughing. In reality, other than the yard traffic causing some bank instability, banks are stable. The combination of the extremely thick brush and fine sediments made visibility impossible above the culvert for snorkeling. Hence, we did not snorkel. We did notice Coho juveniles just above and below the culvert while we conducted the culvert survey.

FishXings predicts that 2.4% of modeled flows are passable by juvenile salmonids. Once the rate of discharge hits 0.12 cms, a velocity barrier forms.

Site Sketch

10 # 14 1 of 1



FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 47. Fish Passage Summary, Site 14.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	4.8100 cms
Percent of Flows Passable	2.4 %
Passable Flow Range	0.0010 to 0.1158 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.12 cms and Above
Pool Depth Barrier	None

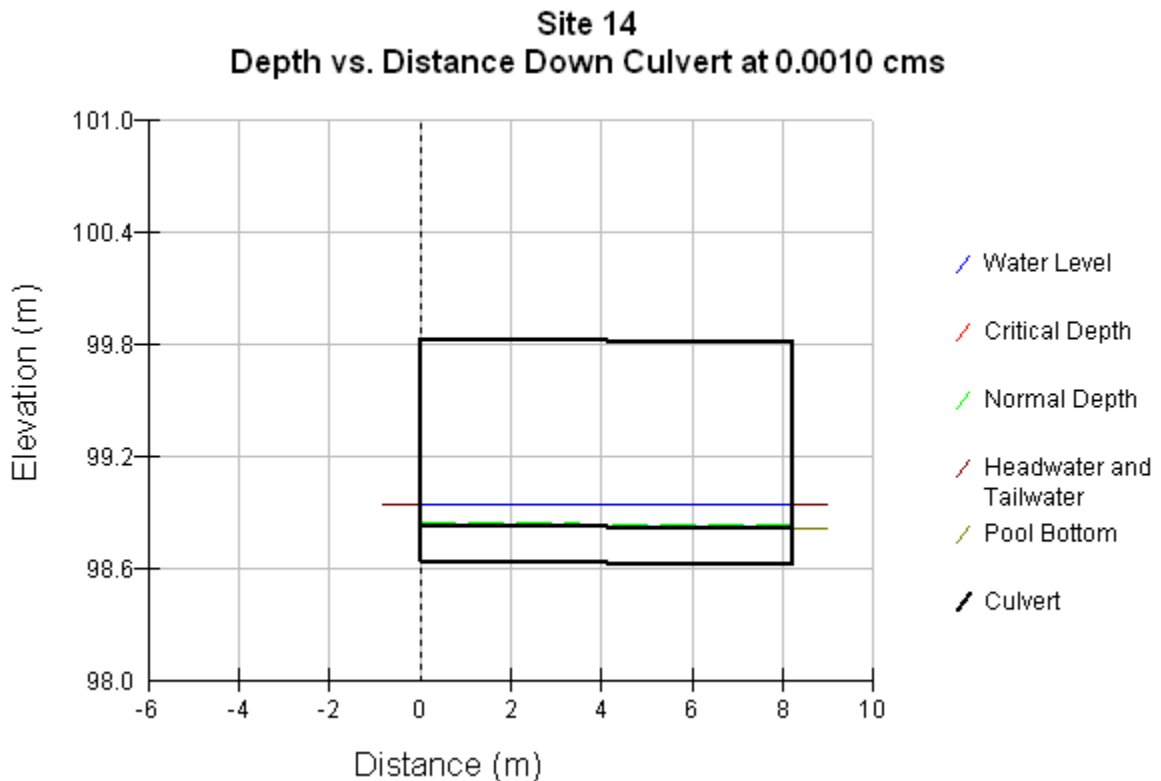
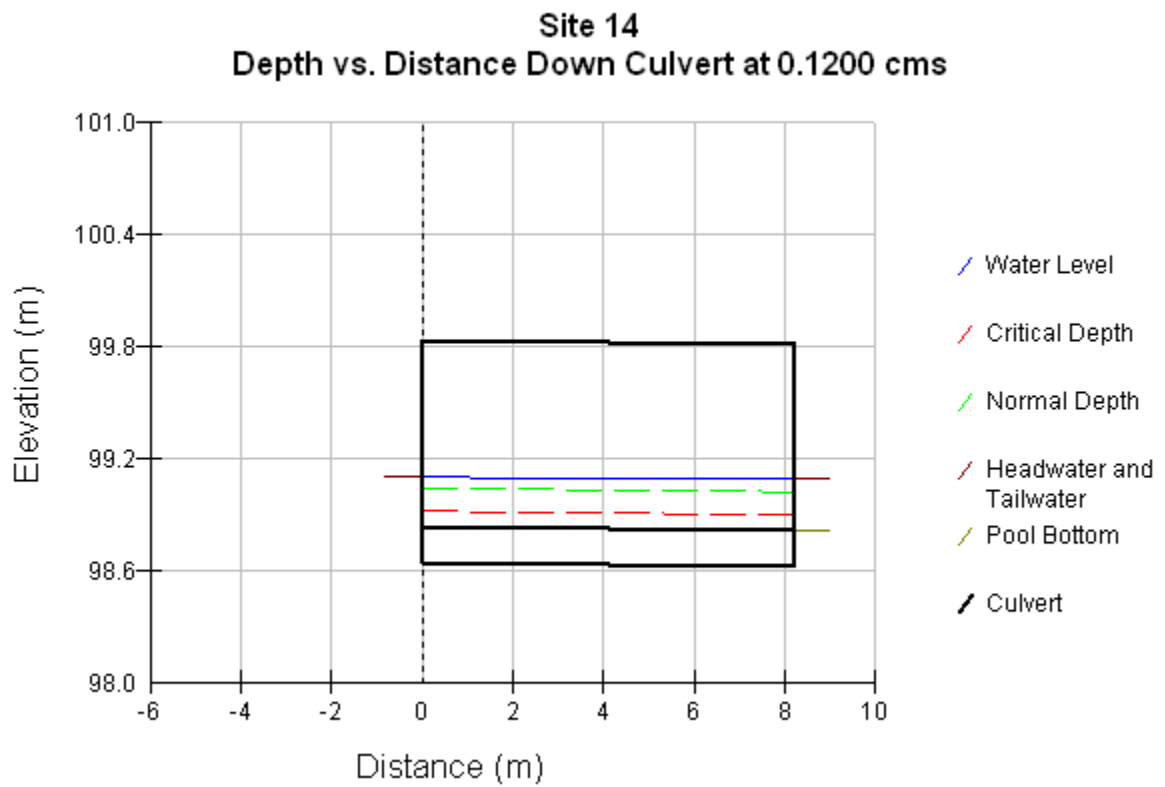


Figure 5554. Water Surface Profile at 0.001 cms, passable flow.



| Figure 5655. Water Surface Profile at 0.12 cms, velocity block.

Site # 18 2009 Restoration Effectiveness Monitoring Summary

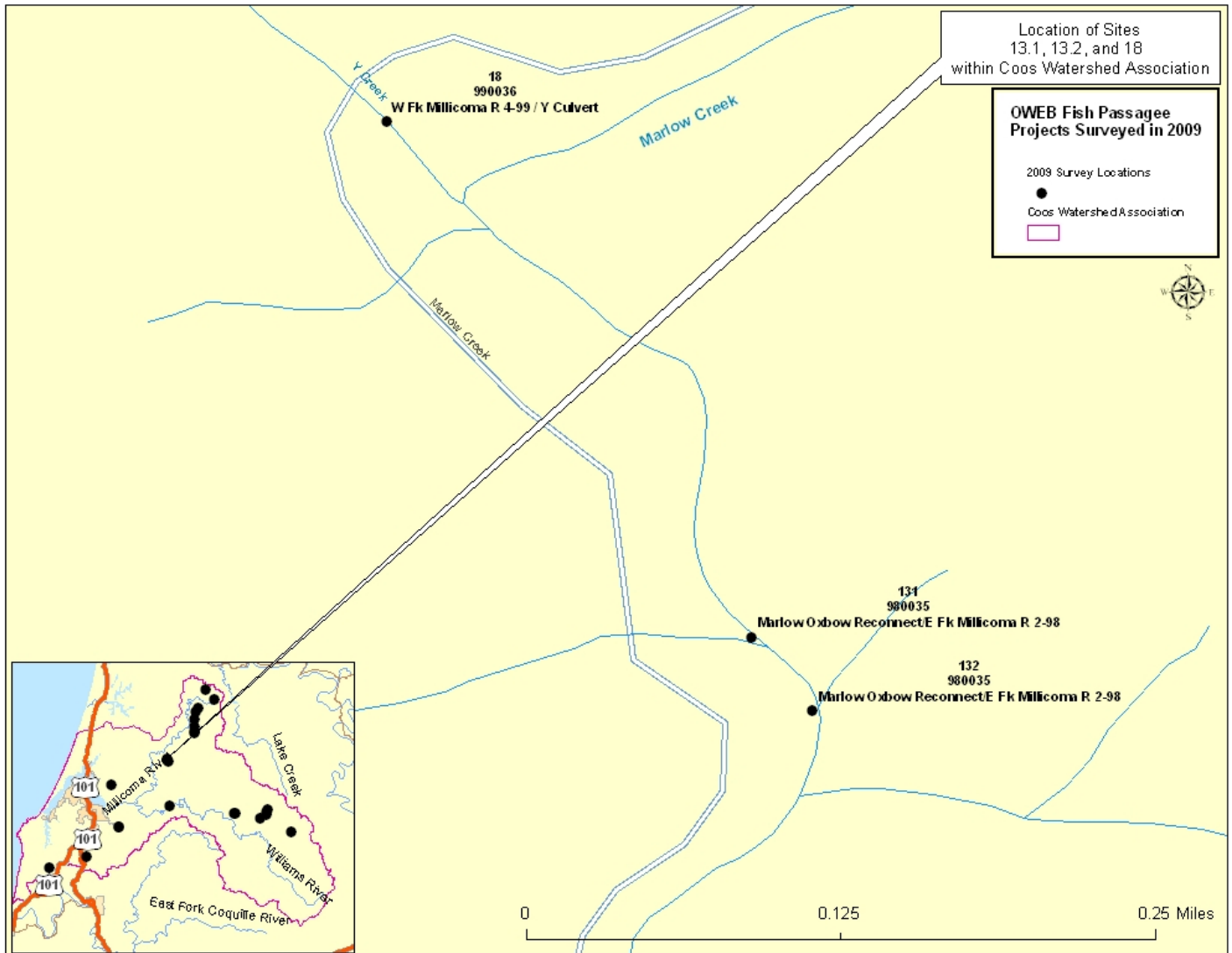
OWEB Project Name - W Fk Millicoma R 4-99 / Y Culvert

OWEB Grant Number – 096-164/099-113

OWRI Project Number – 990036

Owner – State of Oregon, Oregon Department of Forestry

OWEB Description – Fish Passage



Map 33. Site 18, 13.1, and 13.2 within the Coos sub-basin. Site 18, OWEB Project Number 990036 (Change to OWEB Grant Number), is the furthest upstream site of these three crossings. Of these three sites, only Site 18 was snorkeled. This report applies to Site 13.1.

Site Notes

Site 18 illustrated elements of both a plane-bed and step/pool type channel. The mean stream gradient within 100 meters upstream and downstream of the culvert was 4%. Bankfull width upstream of the culvert was determined to be 4.1 meters. This pipe-arch culvert width was recorded at 2.44 meters and the height was 1.83 meters. The inlet width to channel gradient width was 0.58. The deepest point within 2 meter of the outlet was 0.06 meters below the outlet invert. Although there was no pool present at the outlet, there was a discernable tail water control that allowed for a cross-sectional measurement. Water depth 2 meters out from the culvert was 0.25 meters (see Photo-series). There were a series of baffles within the culvert that occupied the inlet, barrel, and outlet zones. These baffles did act to accumulate sediment (see Site Sketch). The baffles did not collect enough sediment to consider this culvert a stream simulation design.

Many juvenile Coho and juvenile trout were observed above and below the culvert during the culvert survey.

FishXings predicts that this culvert would be a block to juveniles at all modeled flows.

Snorkel Survey Results

Site 18 represents the most upstream crossing along section of surveyed streams. Site 18 snorkel survey results are presented here to illustrate that juvenile fish were observed above the crossings of Site 18, 13.1, and 13.2.

Juvenile fish (3" and less) were observed in all pool habitats snorkeled with 500 feet upstream of the culvert at Site 18. Rainbow and cutthroat are not differentiated because identifying juveniles from those two species is extremely difficult.

Table 48. Snorkel survey results, Site 18.

Stream_LLID	Pool ID	Poll Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1240094434663	1	Plunge	2	1.1	0.31	Coho	11	Rainbow/Cutthroat	3
1240094434663	2	Straight Scour	5	2	0.36	Coho	31	Rainbow/Cutthroat	17
1240094434663	3	Plunge	2.2	2.1	0.3	Coho	33	Rainbow/Cutthroat	1
1240094434663	4	Plunge	1.7	1.6	0.25	Coho	11		

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 49. Fish Passage Summary, Site 18.

Fish Passage Summary	
Low Passage Design Flow	0.0700 cms
High Passage Design Flow	7.0000 cms
Percent of Flows Passable	0.0 %
Passable Flow Range	None
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.07 cms and Above
Pool Depth Barrier	None

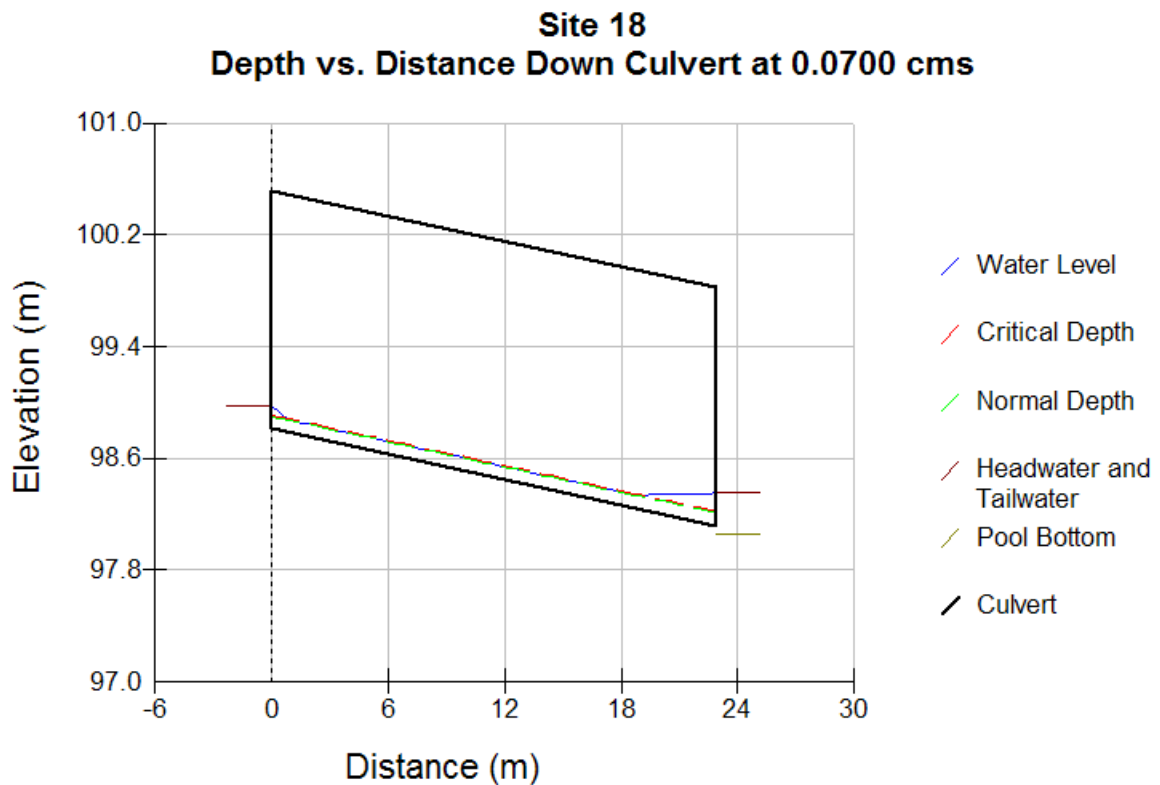
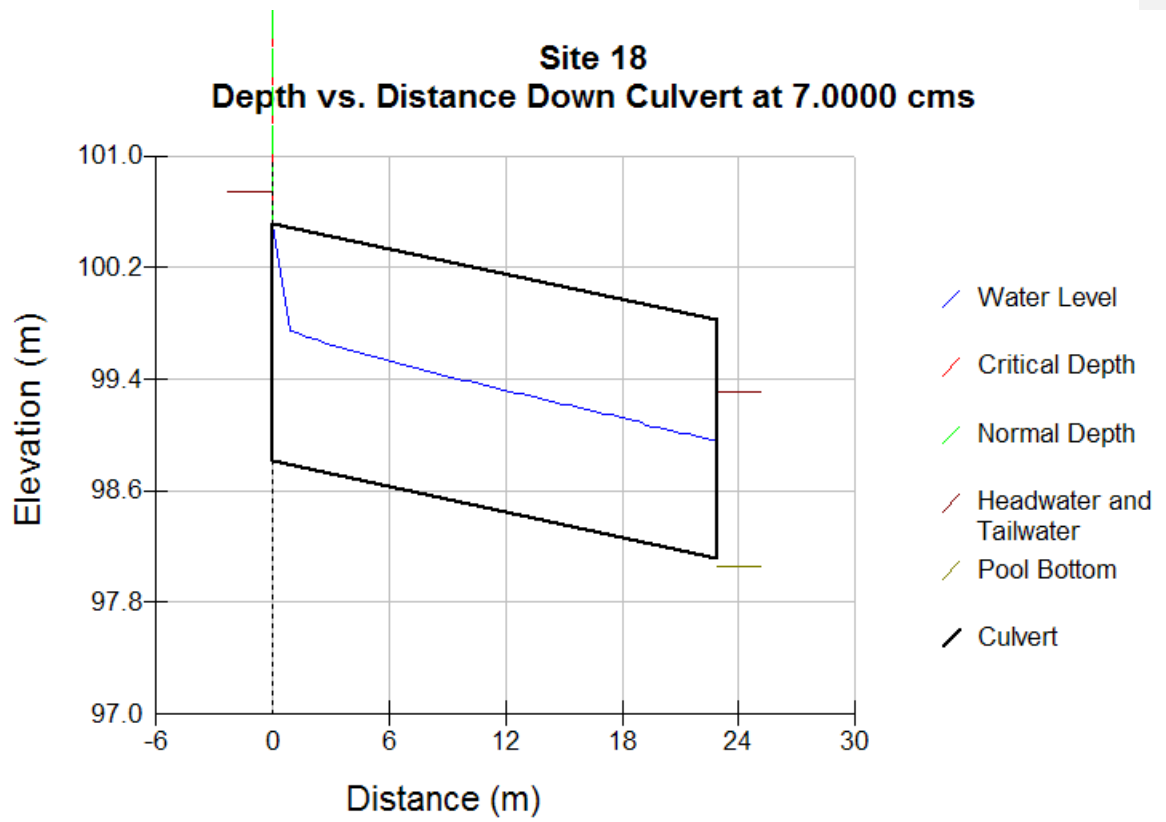


Figure 5756. Water Surface Profile at 0.07 cms, velocity block.



| Figure 5857. Water Surface Profile at 7 cms , velocity block.

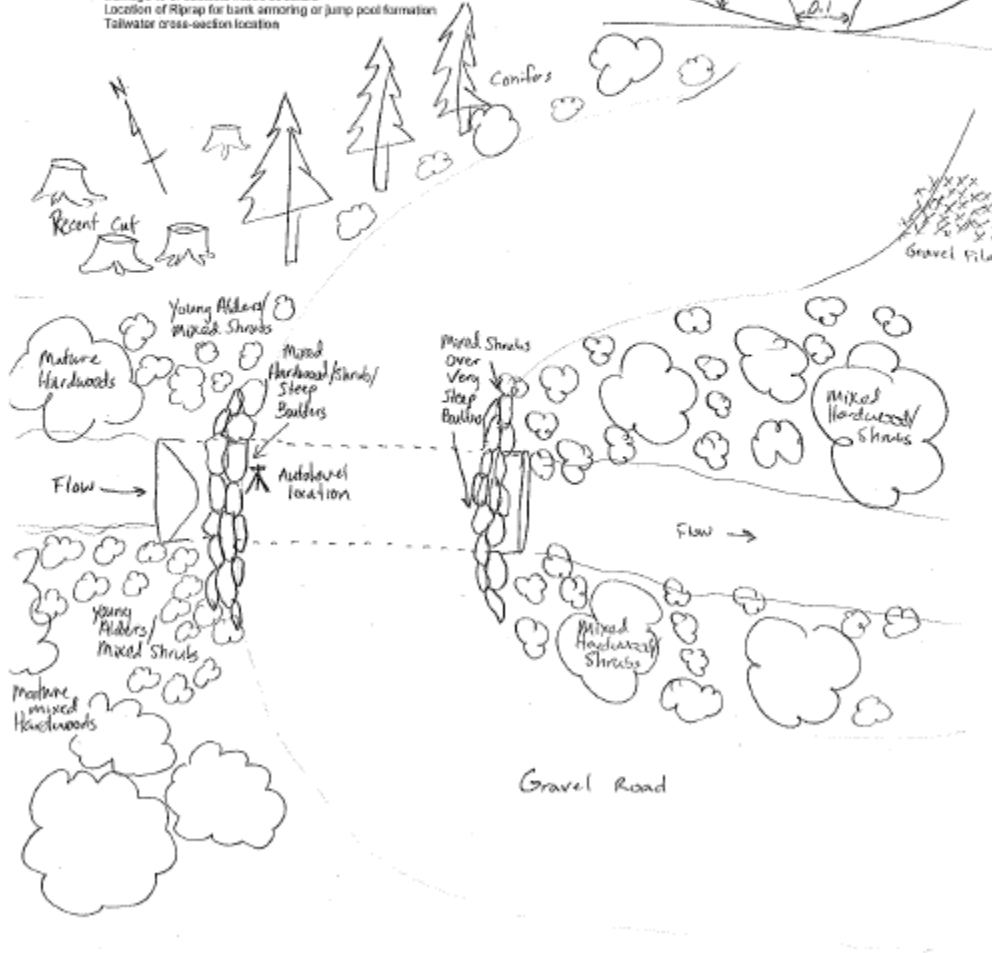
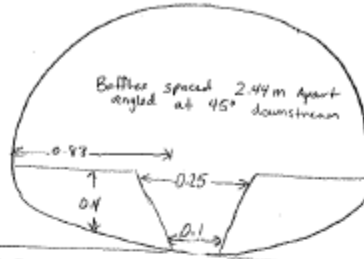
Site Sketch

Crossing ID number 13 Structure 1 of 1

Baffle configurations

SITE SKETCH

- Includes:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tops if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 19 2009 Restoration Effectiveness Monitoring Summary

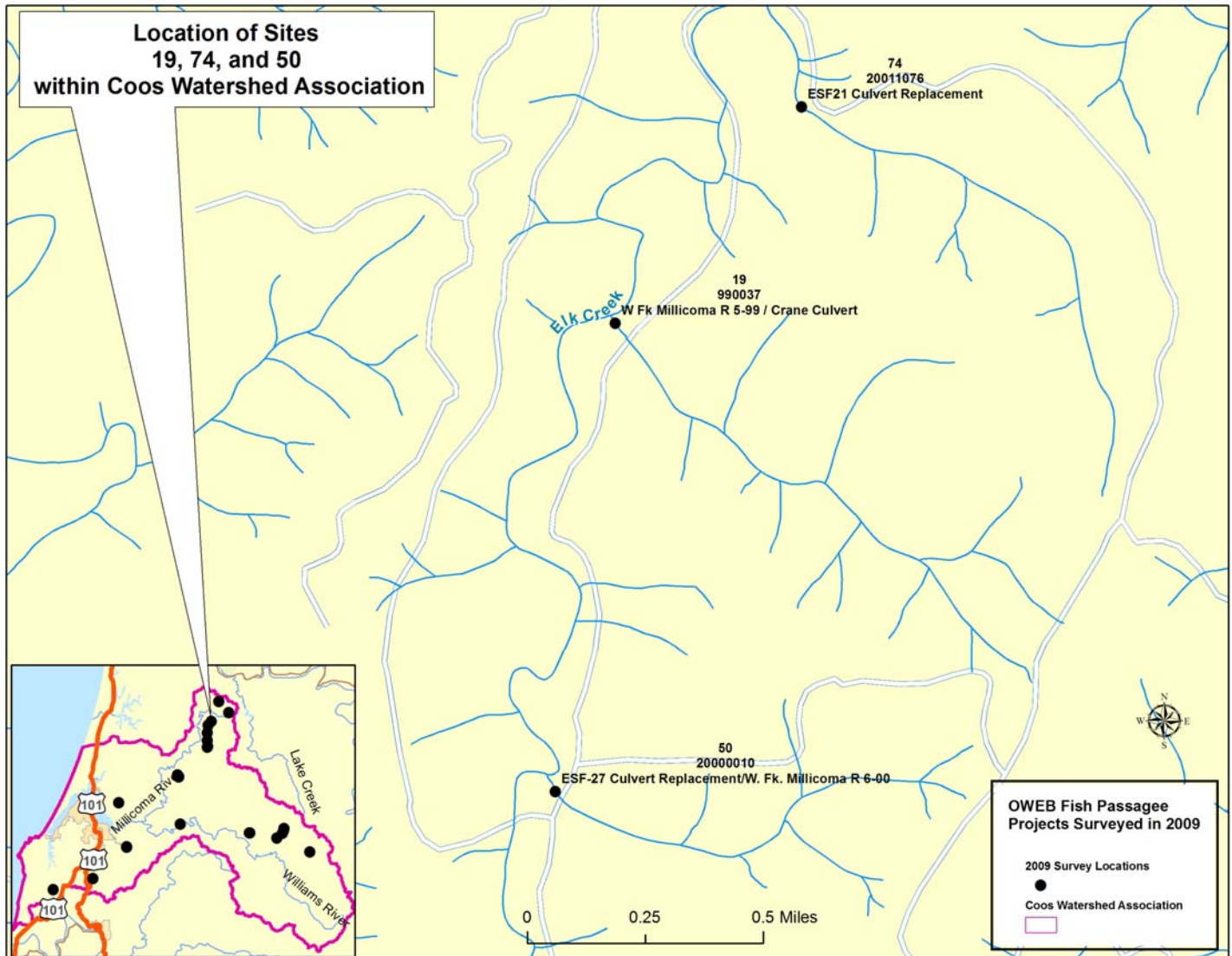
OWEB Project Name - W Fk Millicoma R 5-99 / Crane Culvert

OWEB Grant Number – 098-137

OWRI Project Number – 990037

Owner – State of Oregon, Oregon Department of Forestry

OWEB Description – Fish Passage



Map 34. Locations of Sites 19, 50, and 74 with the region of the Coos sub-basin.

Site Notes

This is a mountain stream tending towards a step-pool channel with the substrate composed of cobbles/gravels/sand, respectively. There was a discontinuous layer of substrate within the culvert that began approximately 10 meters from the inlet and continued to the outlet. The culvert substrate was dominated by cobbles/gravel/sand respectively. Substrate depth at the culvert outlet was 0.50 meters. The channel gradient near the culvert was 4%. The culvert gradient was 1.8% gradient. The bankfull width of the channel upstream of the culvert was 3.8 meters on average while the pipe arch culvert had a width of 3.1 meters and a height of 1.85 meters. There were baffles present in the culvert, and they acted to gather sediment and slow velocity. There wasn't any pool at the outlet; the riffle from the outlet is short (7 meters) and drains immediately to the mainstem Elk Creek. Minimum flow was observed at the time of survey. The culvert outlet is within the bankfull width of the mainstem Elk Creek.

FishXings predicts that the culvert will be passable by juvenile salmonids from the lowest flows to 0.19 cms. That equates to 10.6% of all modeled flows. Snorkeling survey data suggests that juveniles are using the habitat upstream of the culvert. Juvenile salmonids were found in each pool snorkeled.

Snorkel Survey Results

Six pools were snorkeled within 155 meters of the culvert inlet. Relatively high numbers of Coho and trout were found in each pool.

Table 50. Snorkel survey results from Site 19.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1239399435600	1	Lateral Scour	10.4	2.7	0.4	Coho	42	Steelhead/Cutthroat	1
1239399435600	2	Lateral Scour	2.1	1.5	0.3	Coho	12	Steelhead/Cutthroat	6
1239399435600	3	Lateral Scour	6.3	2.8	0.45	Coho	59	Steelhead/Cutthroat	2
1239399435600	4	Lateral Scour	12.2	2.3	0.35	Coho	64	Steelhead/Cutthroat	3
1239399435600	5	Lateral Scour	9.4	3.3	0.35	Coho	31	Steelhead/Cutthroat	12
1239399435600	6	Lateral Scour	6.4	3.5	0.3	Coho	25	Steelhead/Cutthroat	6

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 51. Fish Passage Summary, Site 19.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	8.0000 cms
Percent of Flows Passable	0.2 %
Passable Flow Range	0.0010 to 0.0184 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.0185 cms and Above
Pool Depth Barrier	None

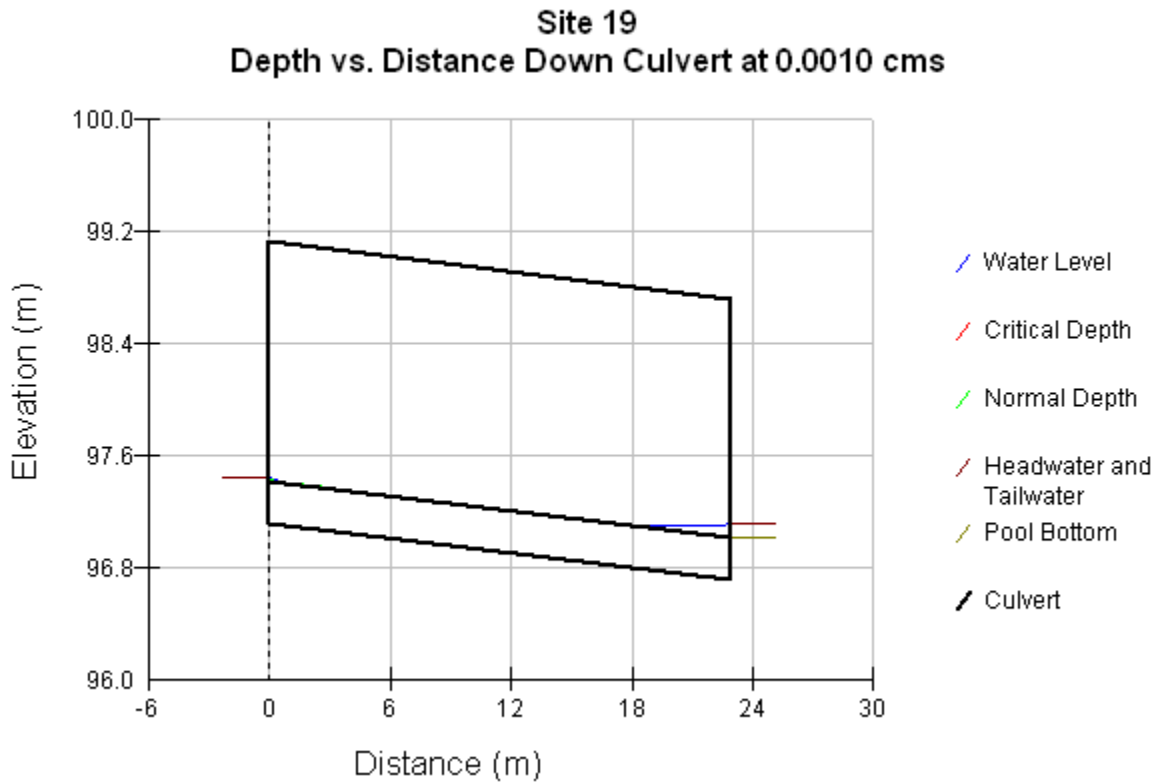


Figure 5958. Water Surface Profile at 0.001 cms, fully passable.

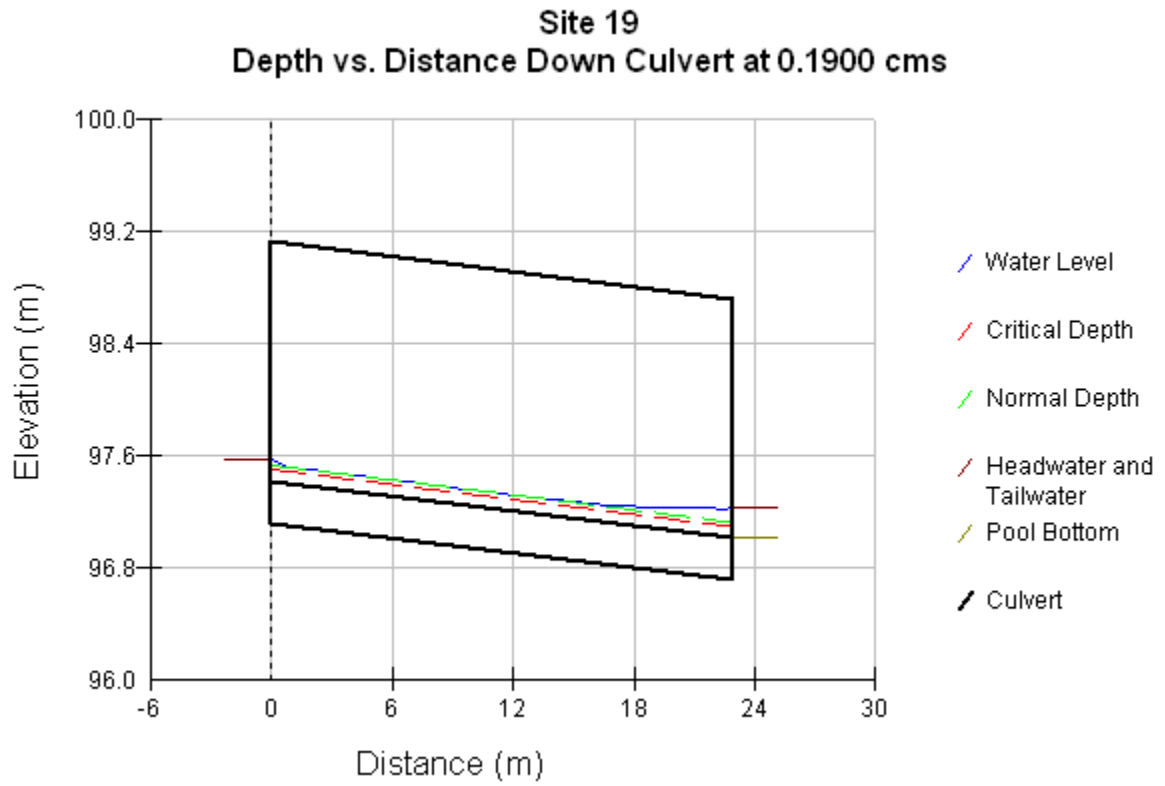


Figure 6059. Water Surface Profile at 0.19 cms, velocity block.

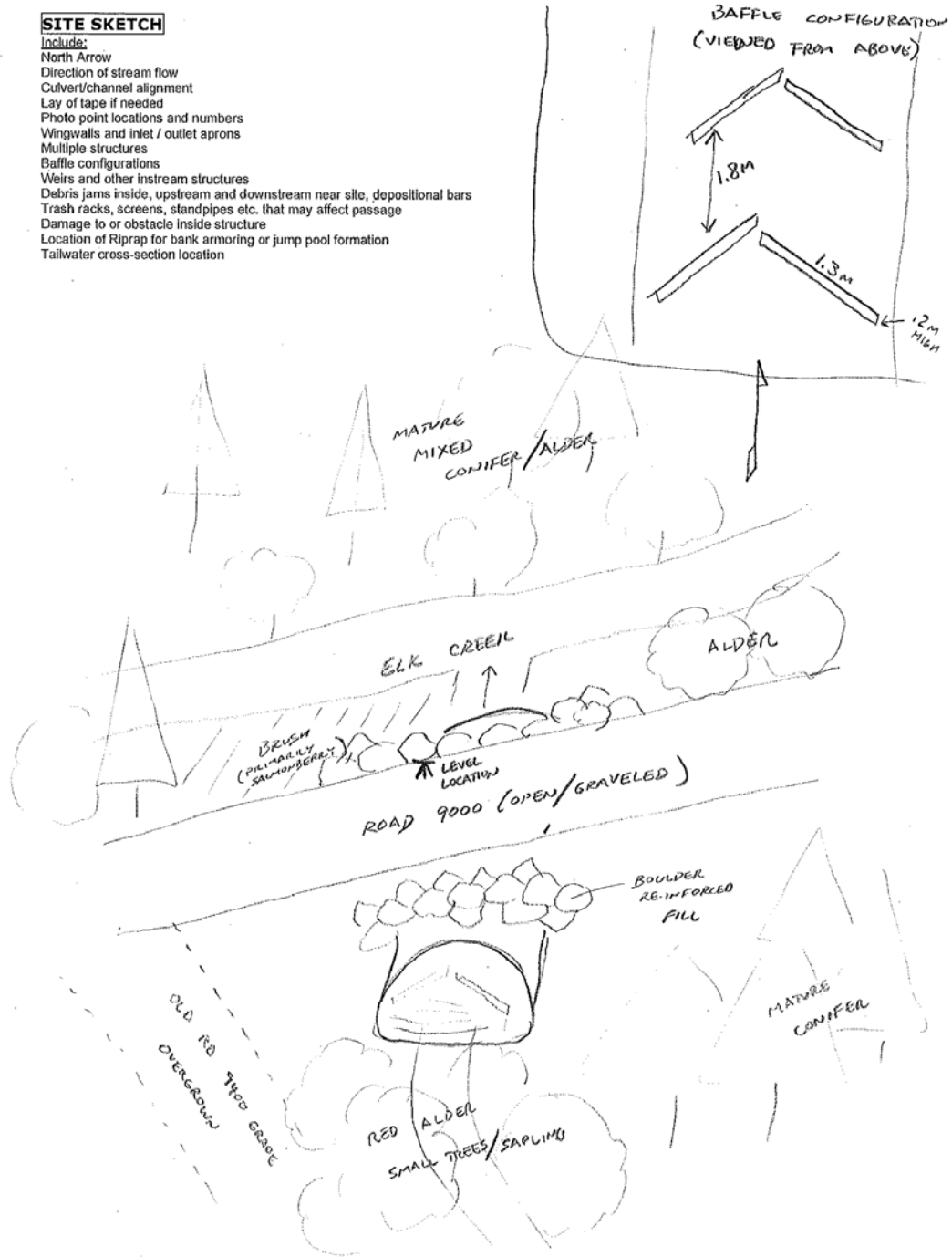
Site Sketch

Crossing ID number 19/990037 Structure 1 of 1

SITE SKETCH

include:

- North Arrow
- Direction of stream flow
- Culvert/channel alignment
- Lay of tape if needed
- Photo point locations and numbers
- Wingwalls and inlet / outlet aprons
- Multiple structures
- Baffle configurations
- Weirs and other instream structures
- Debris jams inside, upstream and downstream near site, depositional bars
- Trash racks, screens, standpipes etc. that may affect passage
- Damage to or obstacle inside structure
- Location of Riprap for bank armoring or jump pool formation
- Tailwater cross-section location



Site # 20 2009 Restoration Effectiveness Monitoring Summary

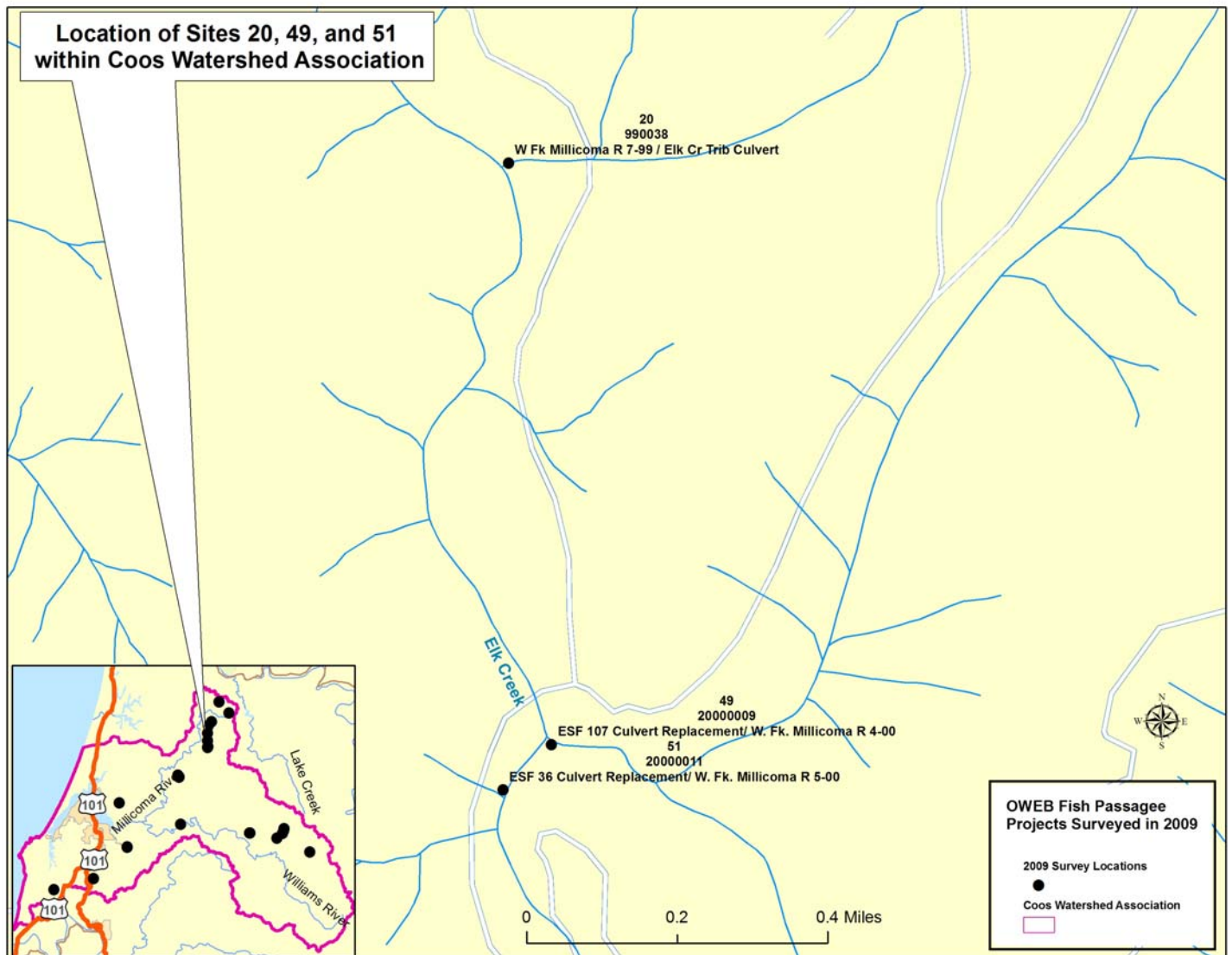
OWEB Project Name - W Fk Millicoma R 7-99 / Elk Cr Trib Culvert

OWEB Grant Number – 099-113

OWRI Project Number – 990038

Owner – State of Oregon, Oregon Department of Forestry

OWEB Description – Fish Passage



Map 35. Location of Site 20 on a tributary to Elk Creek on Oregon Department of Forestry Road 9000 with the region of the Coos sub-basin.

Site Notes

This is a mountain stream tending towards a step-pool channel composed of cobbles/gravels/sand, respectively. There was a discontinuous layer of substrate within the culvert that began approximately 13.0 meters from the inlet and continued to the outlet. The culvert substrate was dominated by cobbles/gravel/sand respectively. Substrate depth at the culvert outlet was 0.44 meters deep. The channel gradient near the culvert was 4.5%. The culvert gradient was 2.05%. when the substrate at the outlet is included in the measurement. The bankfull width of the channel upstream of the culvert was 3.3 meters on average while the circular culvert had a diameter of 2.13 meters. The ratio of inlet width to channel width was 0.64. The culvert lacked baffles. There wasn't any pool at the outlet; the riffle from the outlet (~33 meters) drains immediately to the mainstem Elk Creek. Minimum flow was observed at the time of survey. The outlet of the culvert is within the active channel of Elk Creek.

There was excellent shading noted by red alder saplings and the saplings have also helped stabilize the boulder dominated road fill.

FishXings predicts that 0% of the modeled flows will be passable by juvenile salmonids. Yet, the snorkel survey found juvenile salmonids in 4 of the 6 pools snorkeled.

Snorkel Survey Results

Six pools were snorkeled over 155 meters of channel upstream of the culvert. Unknown trout juveniles and Coho were observed in 4 of the 6 pools snorkeled; although, they were never found together in the same pool.

Table 52. Snorkel survey results from Site 20.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1239394435321	1	Plunge	2.7	1.8	0.41	Steelhead/Cutthroat	1
1239394435321	2	Lateral Scour	9.8	2.1	0.35	Coho	26
1239394435321	3	Plunge	2.7	3.1	0.45	Coho	17
1239394435321	4	Plunge	2.7	2.1	0.4	0	0
1239394435321	5	Plunge	2.7	2.1	0.4	0	0
1239394435321	6	Plunge	2.7	1.2	0.3	Coho	3

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 53. . Fish Passage Summary, Site 20.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	7.3000 cms
Percent of Flows Passable	0.0 %
Passable Flow Range	0.0010 to 0.0046 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.0 cms and Above
Pool Depth Barrier	None

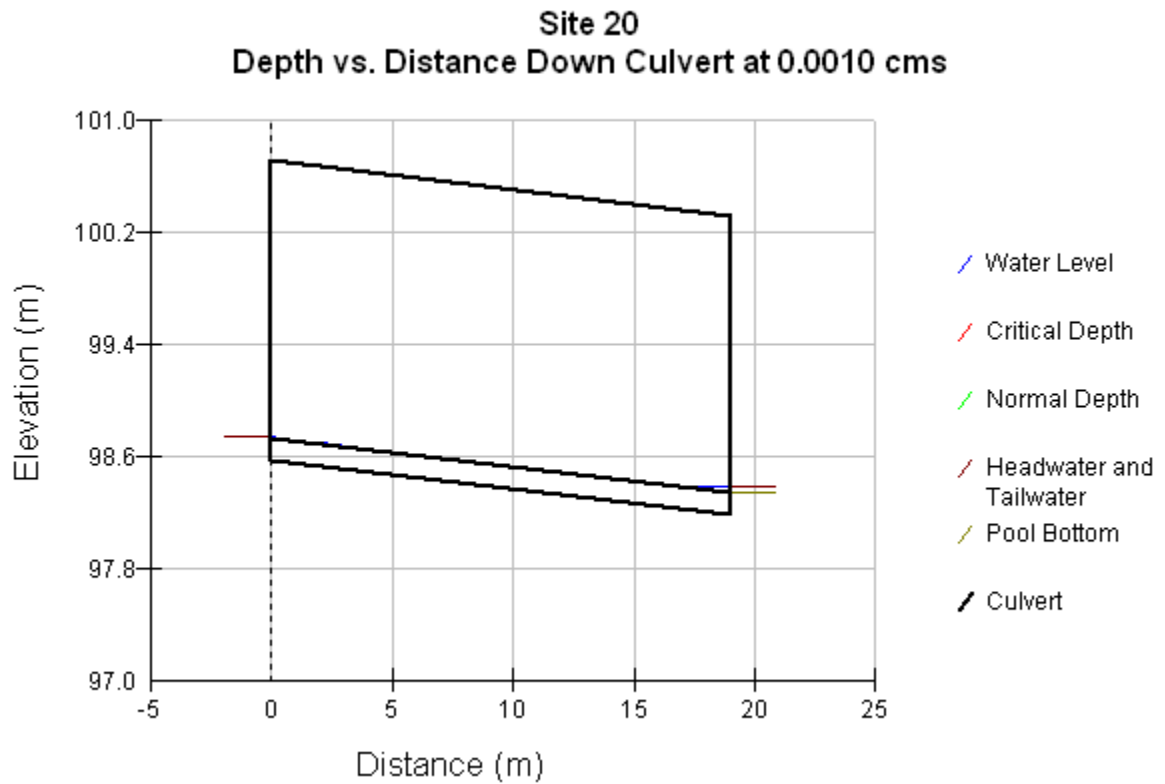
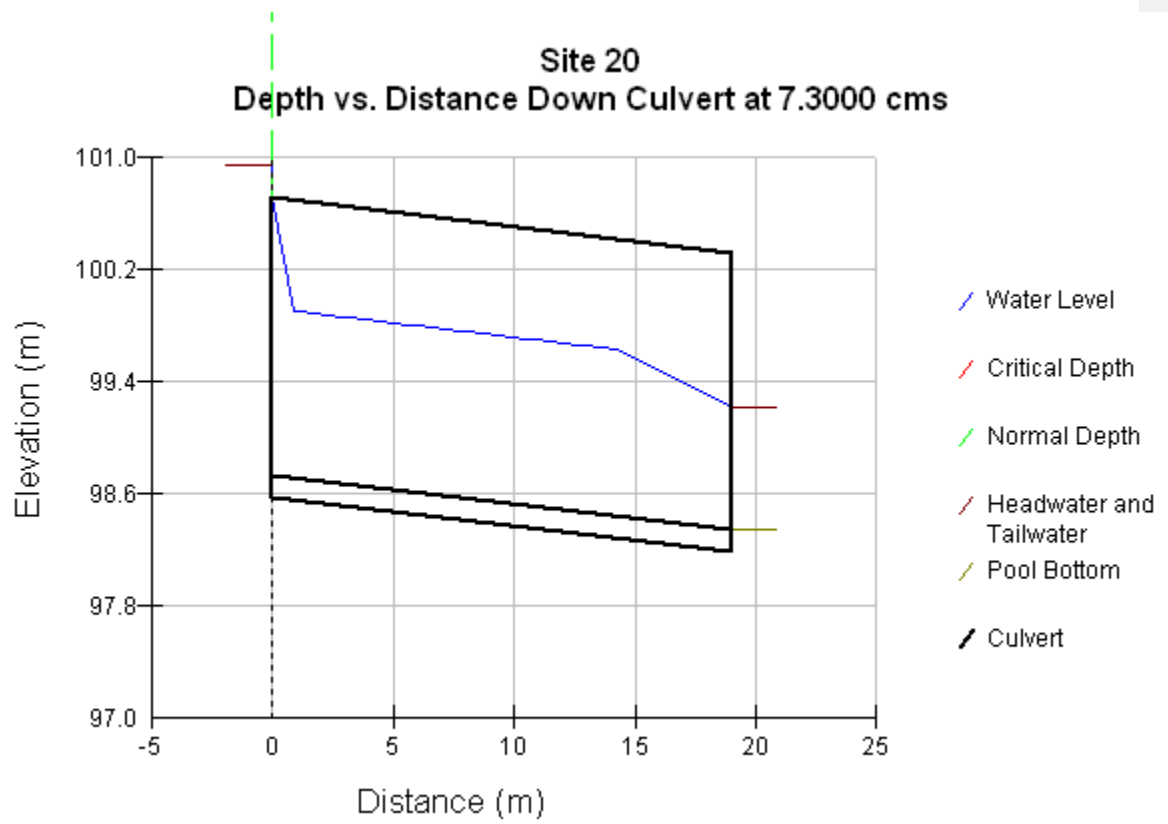


Figure 6160. Water Surface Profile at 0.001 cms, Site 20, velocity block.



| Figure 6261. Water Surface Profile at 7.3 cms, Site 20, velocity block.

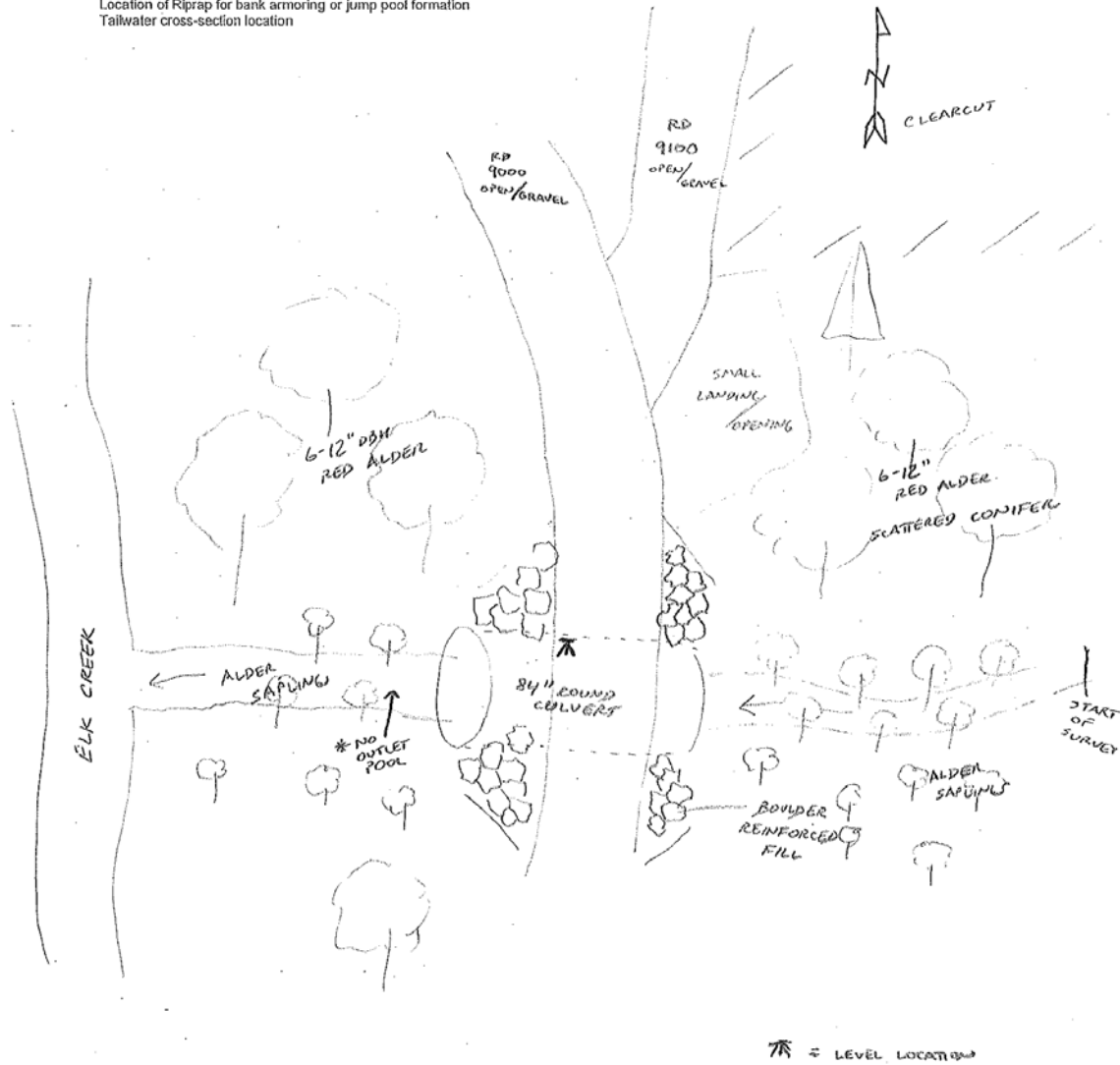
Site Sketch

Crossing ID number 20/990038 Structure 1 of 1

SITE SKETCH

Include:

- North Arrow
- Direction of stream flow
- Culvert/channel alignment
- Lay of tape if needed
- Photo point locations and numbers
- Wingwalls and Inlet / outlet aprons
- Multiple structures
- Baffle configurations
- Weirs and other instream structures
- Debris jams inside, upstream and downstream near site, depositional bars
- Trash racks, screens, standpipes etc. that may affect passage
- Damage to or obstacle inside structure
- Location of Riprap for bank armoring or jump pool formation
- Tailwater cross-section location



Site # 21 2009 Restoration Effectiveness Monitoring Summary

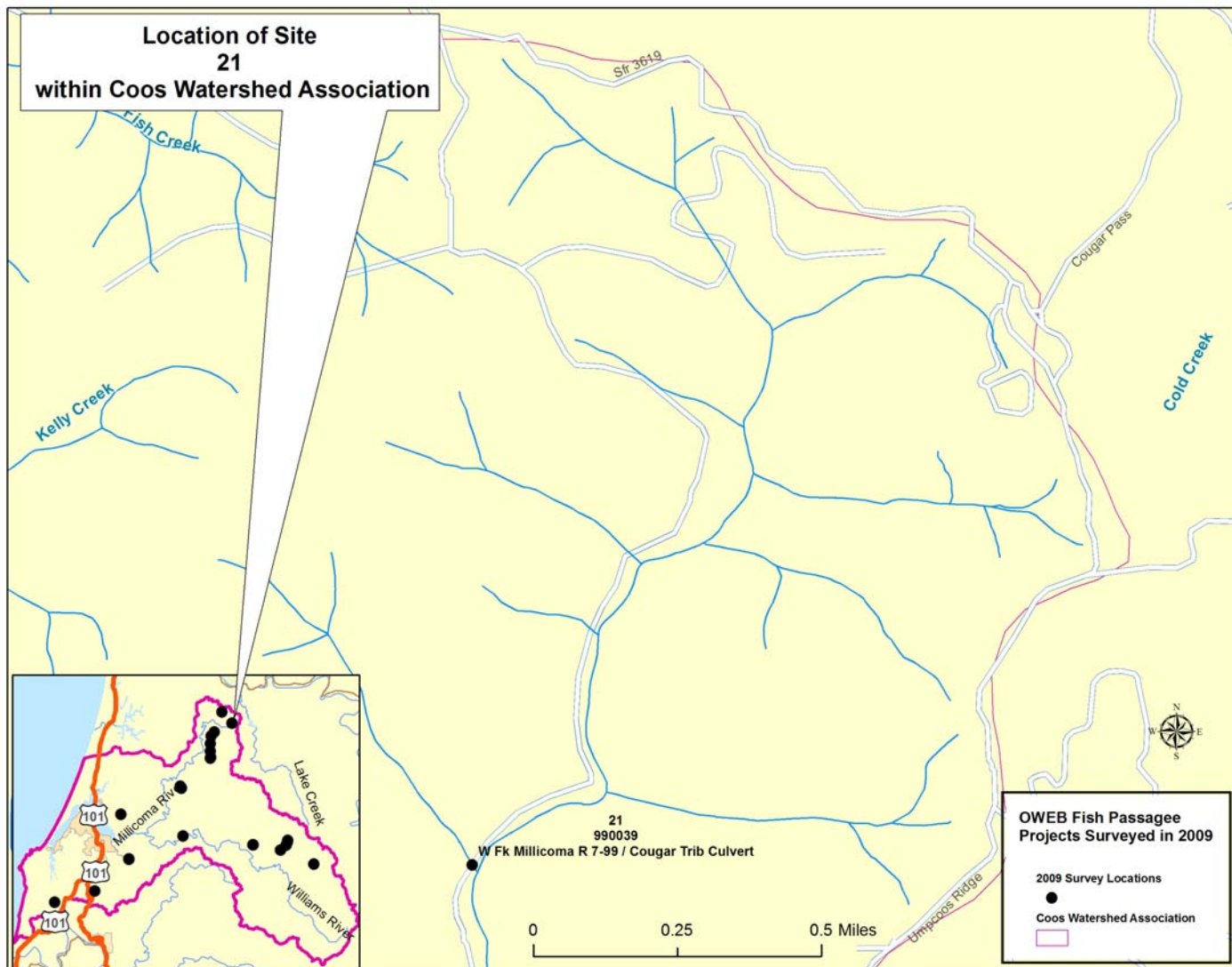
OWEB Project Name - W Fk Millicoma R 7-99 / Cougar Trib Culvert

OWEB Grant Number – 098-137

OWRI Project Number – 990039

Owner – State of Oregon, Oregon Department of Forestry

OWEB Description – Fish Passage



Map 36. Location of Site 21 within the Coos sub-basin region.

Site Notes

This is a mountain stream tending towards a step-pool channel dominated by gravels/cobbles/sand, respectively. There was a discontinuous layer of substrate within the culvert that began approximately 2 meters from the inlet and continued to the outlet. The culvert substrate was dominated by cobbles/gravel/sand respectively. Substrate depth at the culvert outlet was 0.38 meters. The channel gradient near the culvert was 4%. The culvert gradient was also 4% gradient. The bankfull width of the channel upstream of the culvert was 2.3 meters on average while the pipe arch culvert had a width of 1.93 meters and a height of 1.42 meters. There were no baffles present in the culvert. There wasn't any pool at the outlet; the riffle from the outlet is short (2.2 meters) and drains immediately to the mainstem Cougar Creek. The inlet of the surveyed culvert is within the active channel of the mainstem Cougar Creek. Water was flowing into the culvert inlet, but it went subsurface in the culvert. No flow was detected from the outlet. Intense bedloading was noted at the culvert outlet.

There was a boulder weir placed in Cougar Creek just downstream of the outlet of the culvert. It was not creating a scour pool.

FishXings predicts that this culvert is a velocity block at all flows. This does not seem accurate. We found some fish upstream of the culvert, but the culvert was designed stream simulation at the same gradient as the stream. FishXings may be too conservative in estimating passage through stream simulation culverts.

Snorkel Survey Results

Only three pools were encountered within 155 meters upstream of the culvert. Fish counts were relatively low; we only found lone trout in two pools. We did notice excellent spawning gravels as illustrated in the photo-series.

Table 54. Snorkel survey results Site 21.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1238882435847	1	Lateral Scour	2.4	1.9	0.45	Steelhead/Cutthroat	1
1238882435847	2	Straight Scour	4.8	2.1	0.45	Steelhead/Cutthroat	1
1238882435847	3	Lateral Scour	1.8	2.1	0.46	0	0

FishXings

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s
 Minimum Required Depth = 0.03 m
 Maximum Allowed Outlet Drop = 0.1 m

Table 55. Fish Passage Summary, Site 21.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	3.7000 cms
Percent of Flows Passable	0.00 %
Passable Flow Range	None
Depth Barrier	0.04 to 0.02 cms
Outlet Drop Barriers	None
Velocity Barrier - V	0.01 cms and Above
Pool Depth Barrier	None

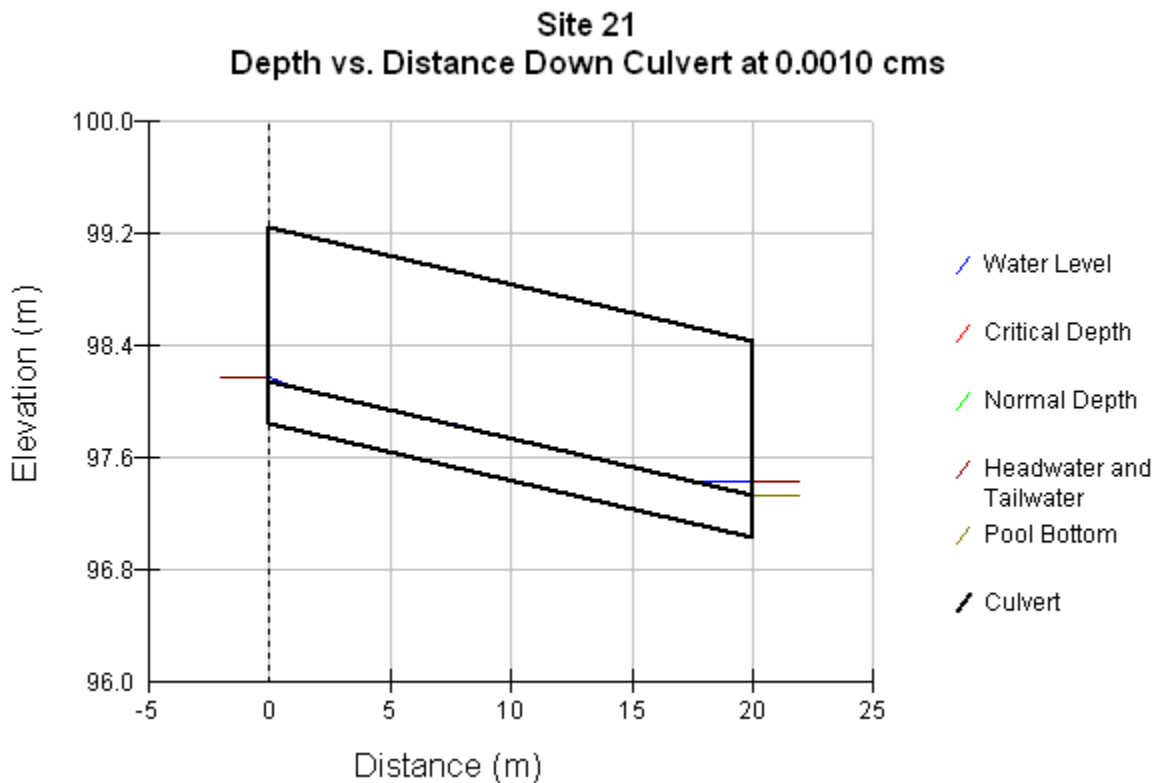


Figure 6362. Water Surface Profile at 0.001 cms, velocity block.

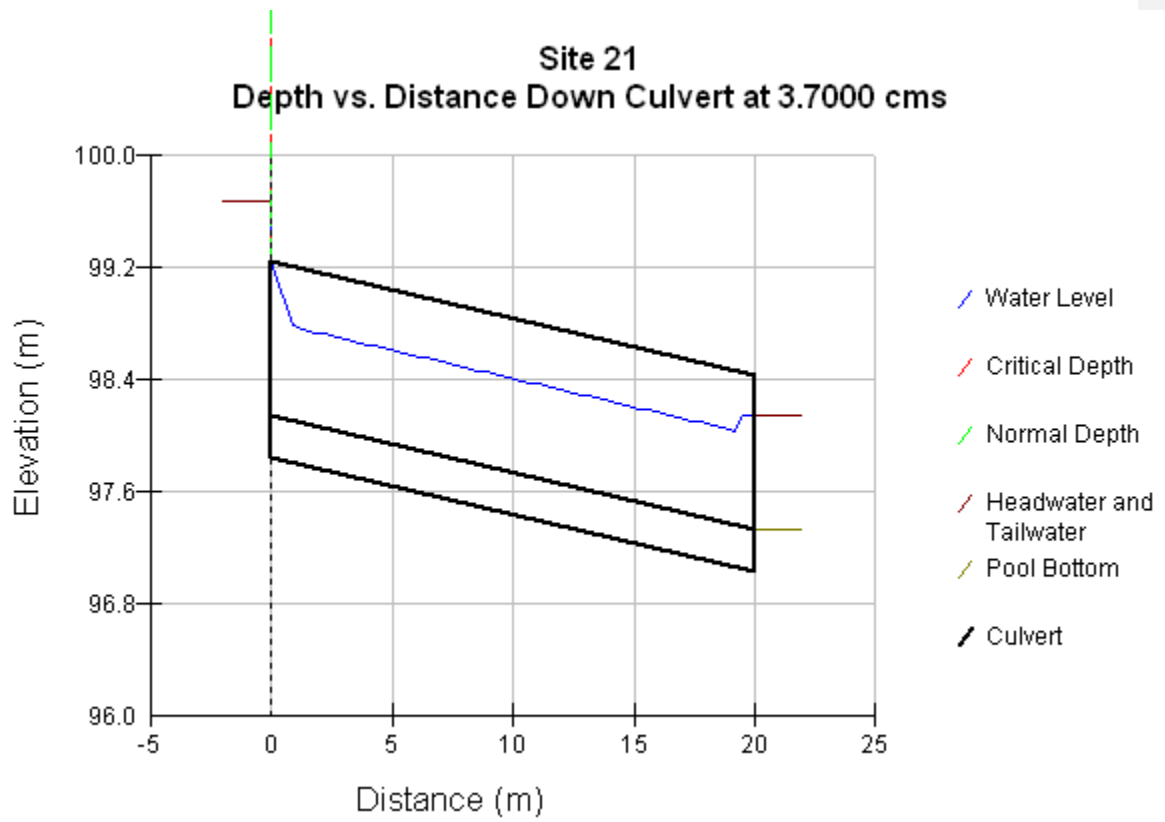


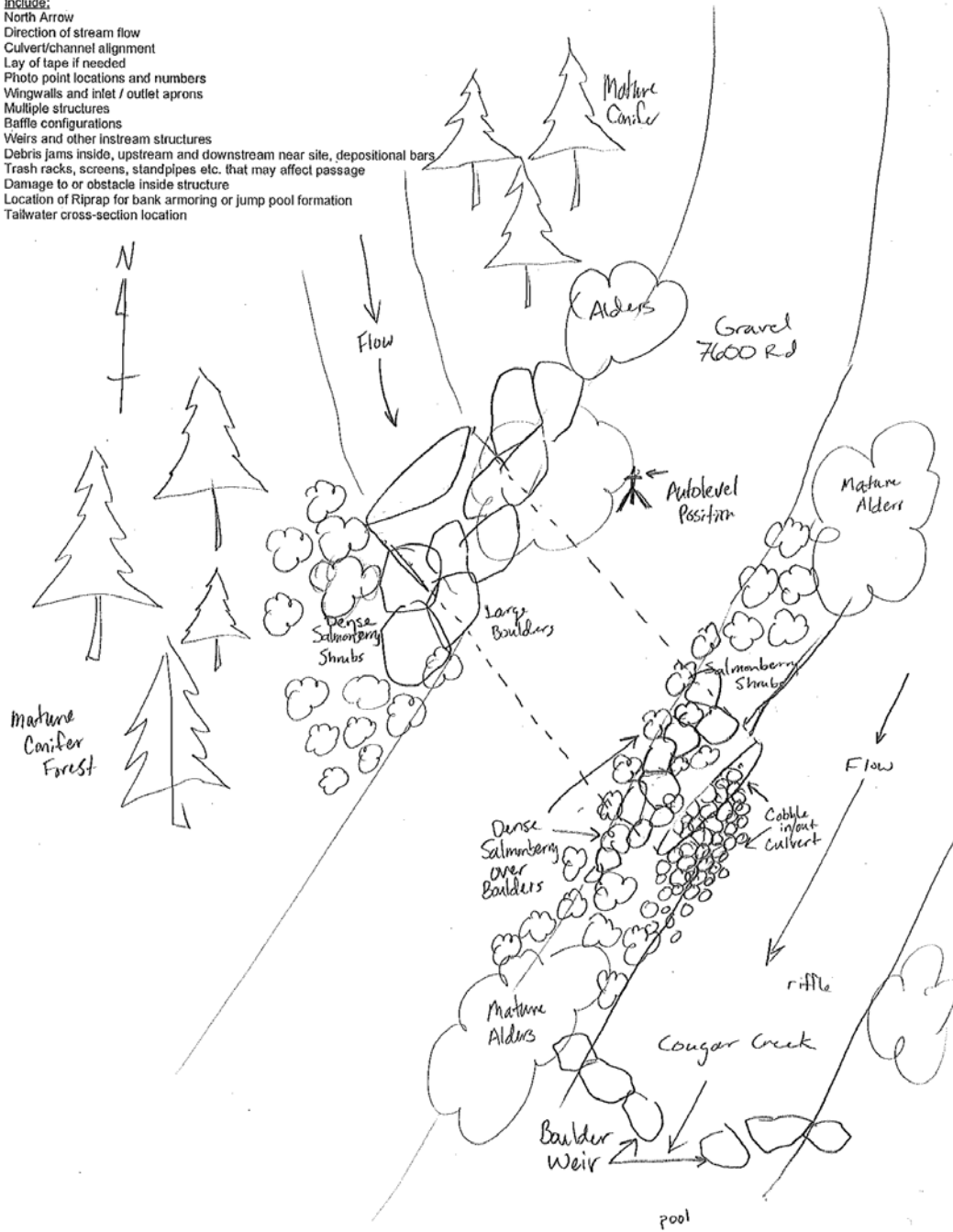
Figure 6463. Water Surface Profile at 3.7 cms, velocity block.

Site Sketch

Crossing ID number 21 Structure 1 of 1

SITE SKETCH

- include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 50 2009 Restoration Effectiveness Monitoring Summary

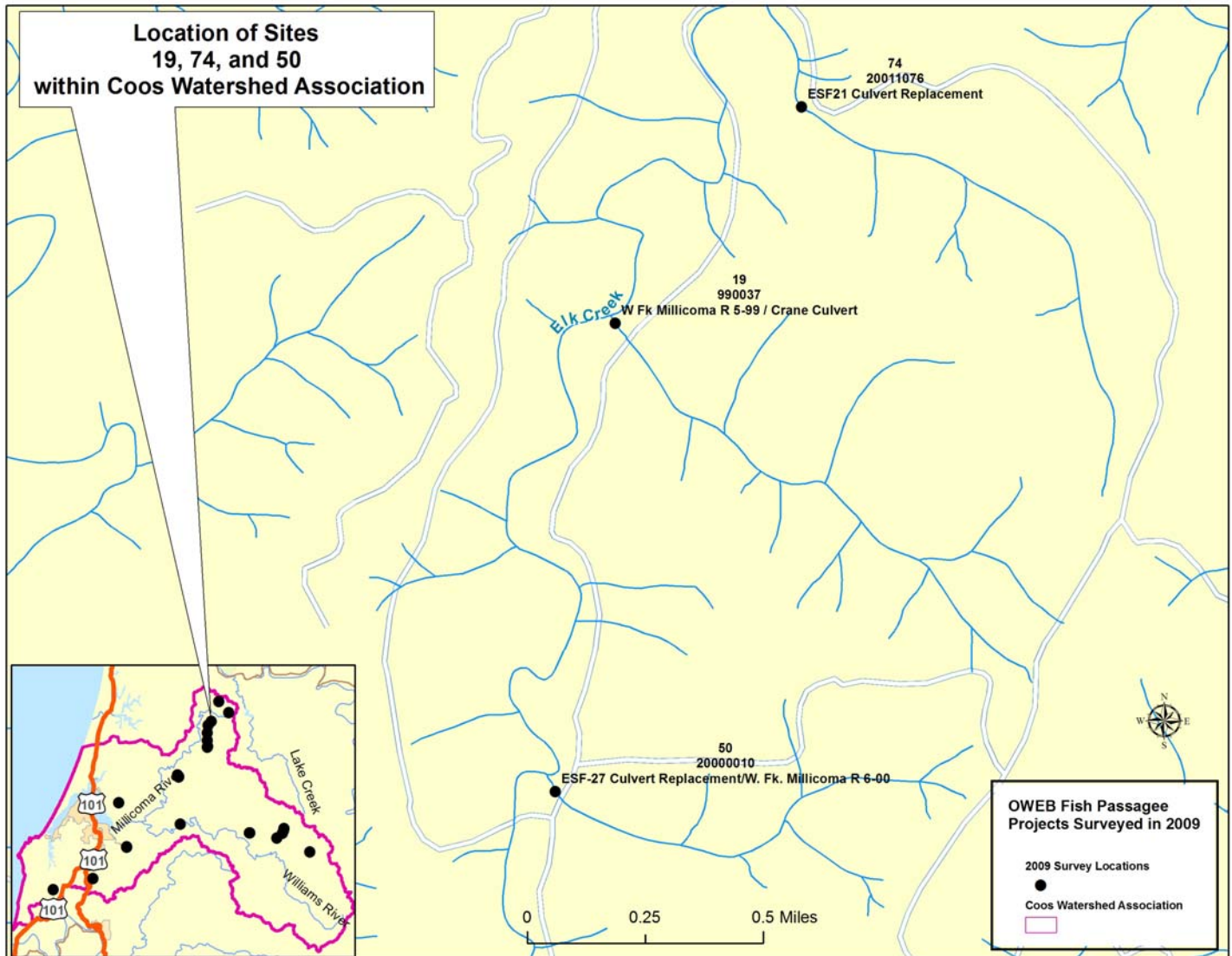
OWEB Project Name - ESF-27 Culvert Replacement/W. Fk. Millicoma R 6-00

OWEB Grant Number – 099 -113

OWRI Project Number – 20000010

Owner – State of Oregon, Oregon Department of Forestry

OWEB Description – Fish Passage



Map 37. Locations of Sites 19, 50, and 74 with the region of the Coos sub-basin.

Site Notes

This is a mountain stream tending towards a step-pool channel composed of cobbles/gravels/sand, respectively. There was a discontinuous layer of substrate within the culvert that began approximately 10.8 meters from the inlet and continued to the outlet. The culvert substrate was dominated by cobbles/gravel/sand respectively. Substrate depth at the culvert outlet was 0.60 meters. The channel gradient near the culvert was 3%. The culvert gradient was 7.8%. The bankfull width of the channel upstream of the culvert was 4.4 meters on average while the culvert arch culvert had a width of 3.0 meters and a height of 1.8 meters. There were baffles spaced evenly in the culvert at 1.2 meter intervals, and they gathered some sediment. There wasn't any pool at the outlet; the riffle from the outlet (~30 meters) drains immediately to the mainstem Elk Creek. Minimum flow was observed at the time of survey.

We also noted that the baffle design (See Site Sketch) makes each baffle slotted at the center. This slot has the effect of making a jump that is ~ 25 cm in height with a take-off pool at each of ~10 cm deep.

FishXings predicts that 0.0% of all modeled flows for this culvert will be passable by juvenile salmonids. Even though there were juvenile fish observed above this culvert, the culvert was considerably steeper than the channel, yet it was stream simulated.

Snorkel Survey Results

Information pertaining to fish counts for this site was supposed to have been provided by ODFW. However, when the data were obtained from ODFW, we found that the data pertained to Elk Creek proper and not this tributary. Therefore there is no fish data to report on. However, we observed juvenile fish throughout the culvert in eddies behind each baffle at the time of the survey.

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 56. Fish Passage Summary, Site 50.

Fish Passage Summary	
Low Passage Design Flow	0.0100 cms
High Passage Design Flow	9.3400 cms
Percent of Flows Passable	0.00%
Passable Flow Range	0.0100 to 0.1603 cms
Depth Barrier	.35 to 0.04 cms
Outlet Drop Barriers	None
Velocity Barrier - V	0.01 cms and Above
Pool Depth Barrier	None

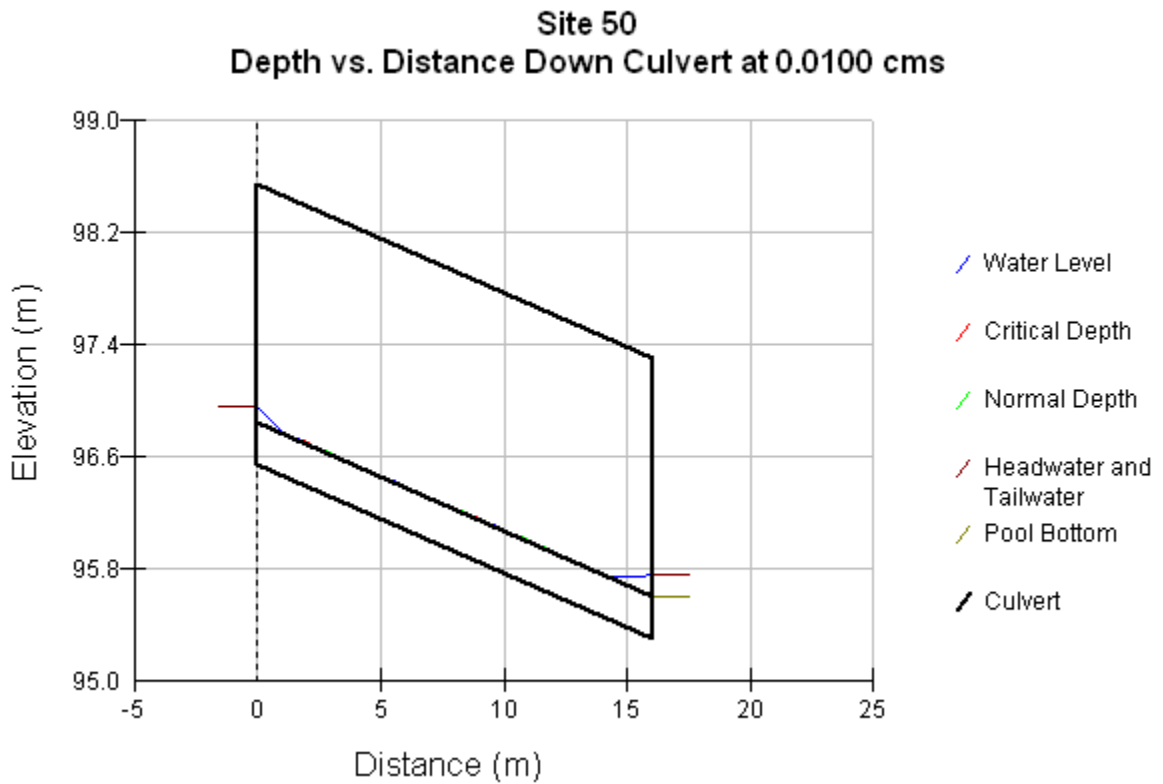


Figure 6564. Water Surface Profile at 0.01 cms, passable.

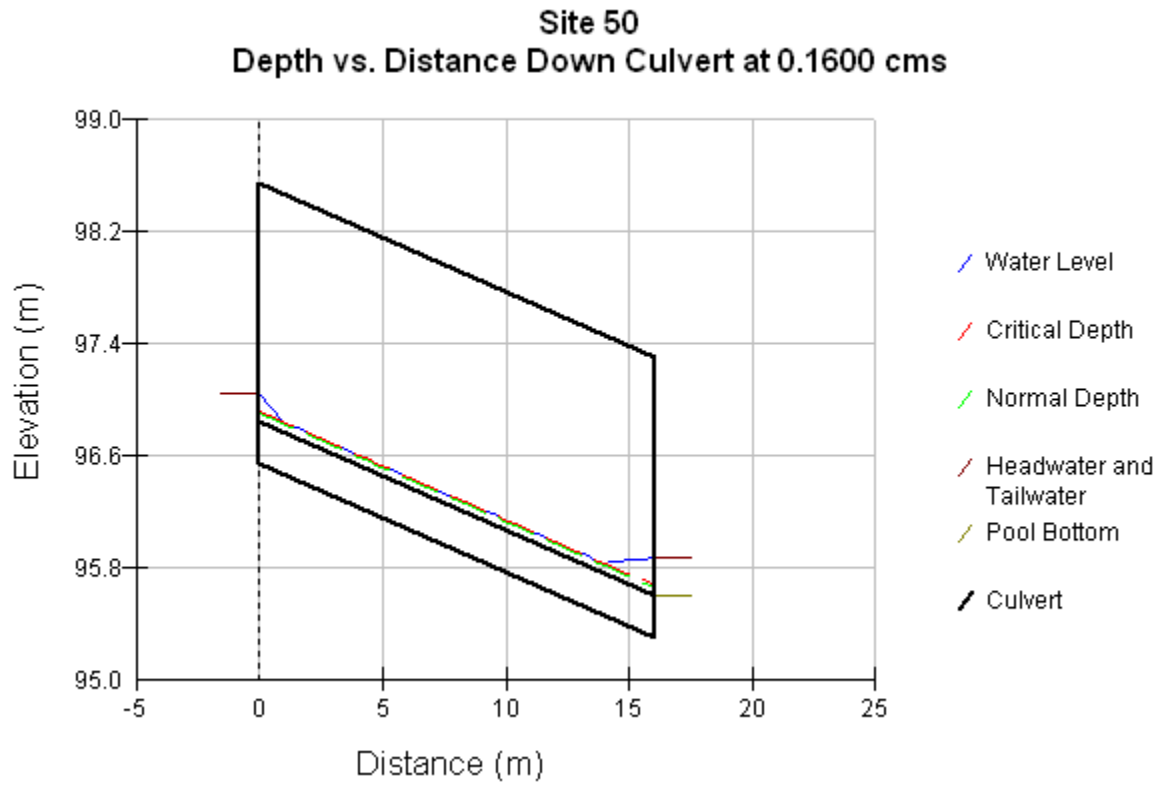


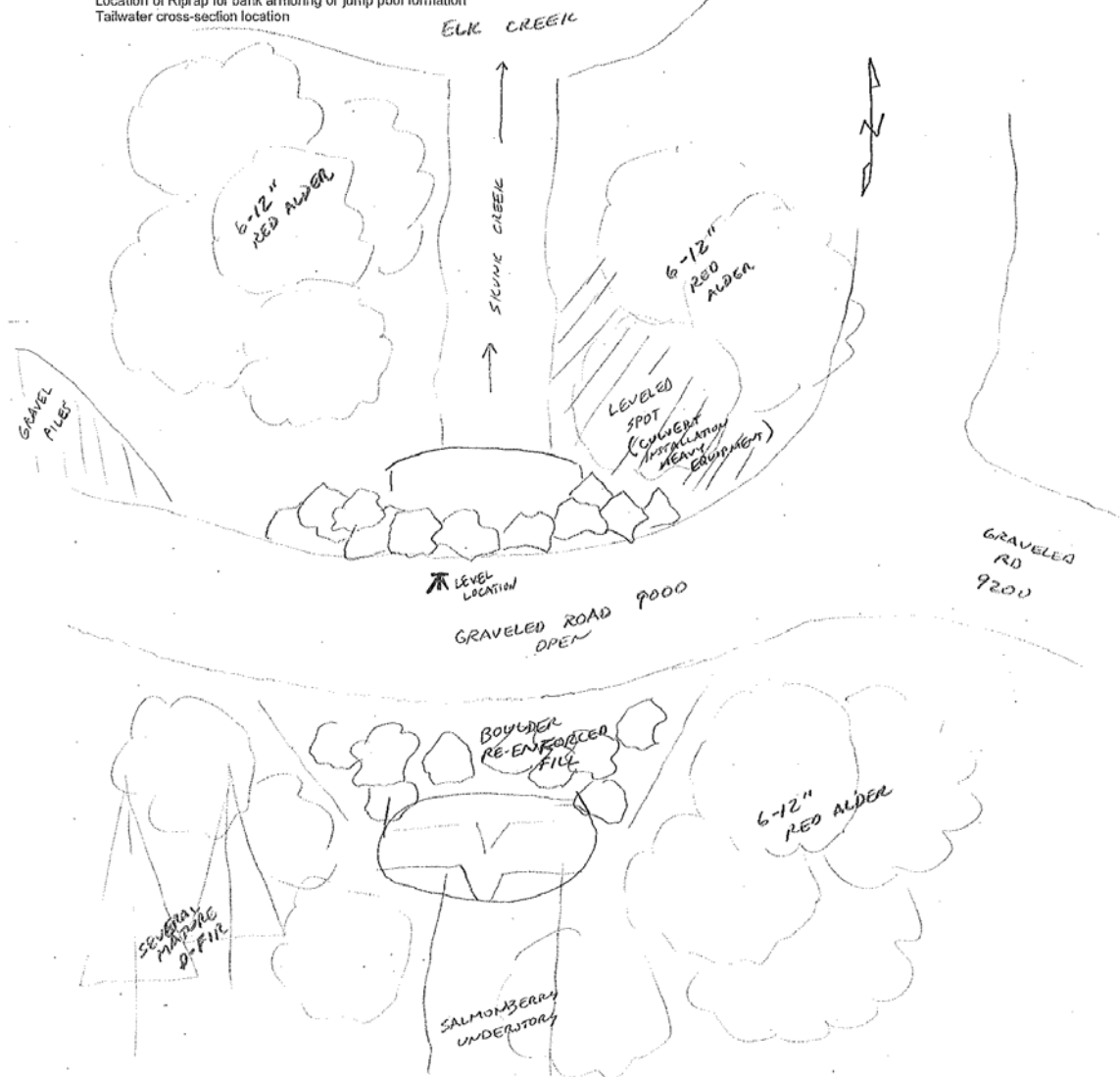
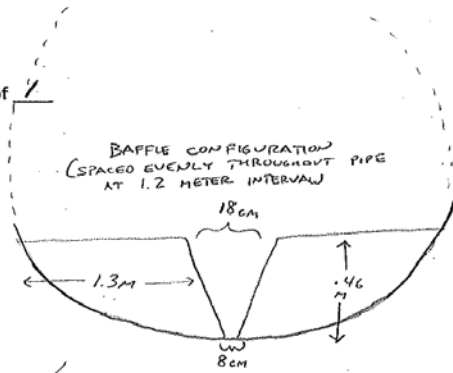
Figure 6665. Figure 2. Water Surface Profile at 0.16 cms, velocity block.

Site Sketch

Crossing ID number 50/2000010 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 52 2009 Restoration Effectiveness Monitoring Summary

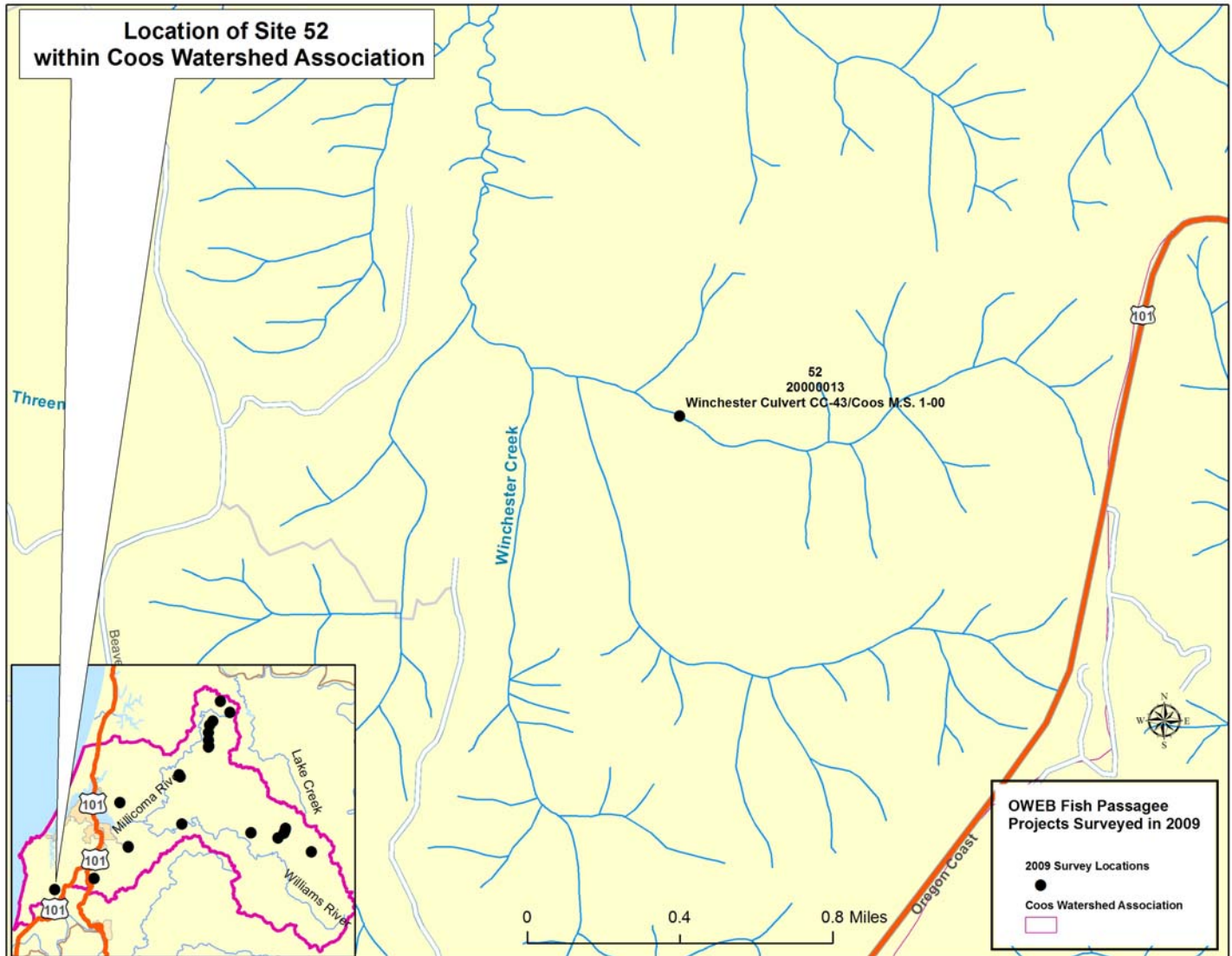
OWEB Project Name - Winchester Culvert CC-43/Coos M.S. 1-00

OWEB Grant Number – 099-461

OWRI Project Number –20000013

Owner – Coos County Forestry

OWEB Description – Fish Passage



Map 38. Site 52 on a tributary to Winchester Creek in the region of the Coos sub-basin.

Site Notes

This was a very low gradient channel that dissects a large wetland/wet meadow. The substrate was composed of 100% silt. There was a continuous layer of substrate within the culvert comprised of silt. Substrate depth at the culvert outlet was 0.3 meters. The channel gradient near the culvert was 1.5%. The culvert gradient was 1.6% when the substrate at the outlet is included in the measurement. The bankfull width of the channel is considered indeterminate because the channel dissects a wetland and actually becomes braided throughout the surveyed area.

Excellent in stream diversity was present with lots of wood, side channels and back waters. Kingfishers were numerous. The wetland complex is dominated by *Carex obnupta*. Few invasive plants have taken hold here. Beaver activity was visible downstream of culvert.

FishXings predicts that 6.5% of modeled flows are passable by juvenile salmonids. A velocity block forms at 0.24 cms.

Snorkel Survey Results

Five pools were snorkeled over 155 meters of channel upstream of the culvert. Only 1 juvenile trout was observed; however, visibility was extremely poor owing to fine sediment clouds. This is surely an undercount.

Table 57. Snorkel survey results from Site 52.

Stream_LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1243176432485	1	Glide	10	4	0.4	0	0
1243176432485	2	Glide	3	2.2	0.42	0	0
1243176432485	3	Plunge	1.6	1.2	0.35	Steelhead/Cutthroat	1
1243176432485	4	Beaver Dam	6	4.2	0.5	0	0
1243176432485	5	Beaver Dam	5	3.9	0.52	0	0

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s
Minimum Required Depth = 0.03 m
Maximum Allowed Outlet Drop = 0.1 m

Table 58. Fish Passage Summary, Site 52.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	3.6800 cms
Percent of Flows Passable	6.5%
Passable Flow Range	0.0010 to 0.2389 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.24 cms and Above
Pool Depth Barrier	None

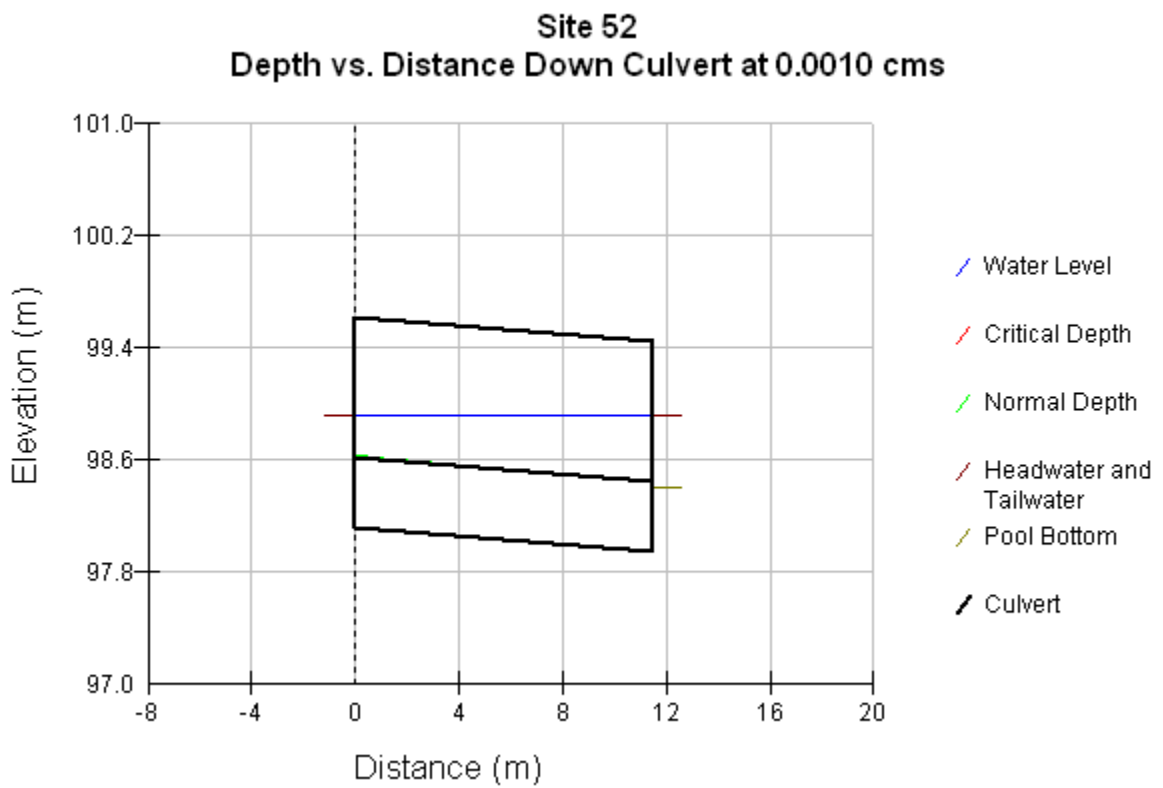


Figure 6766. Water Surface Profile at 0.001 cms, passable.

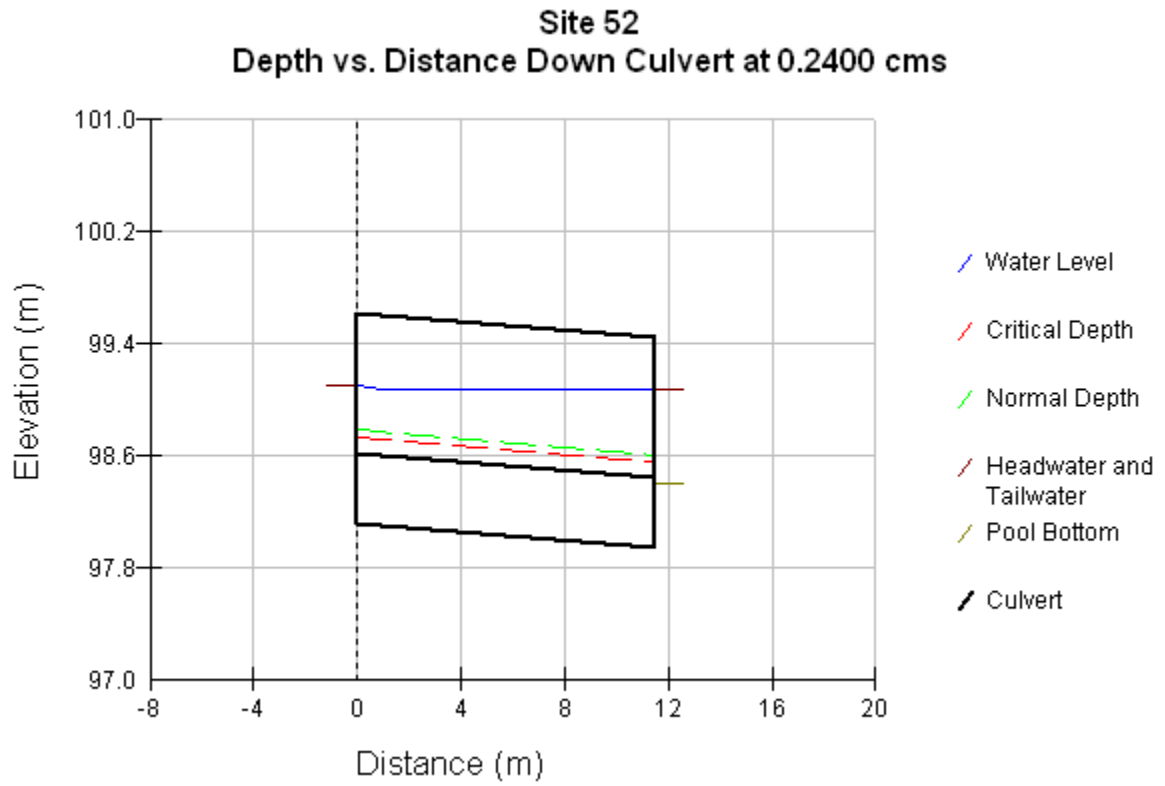


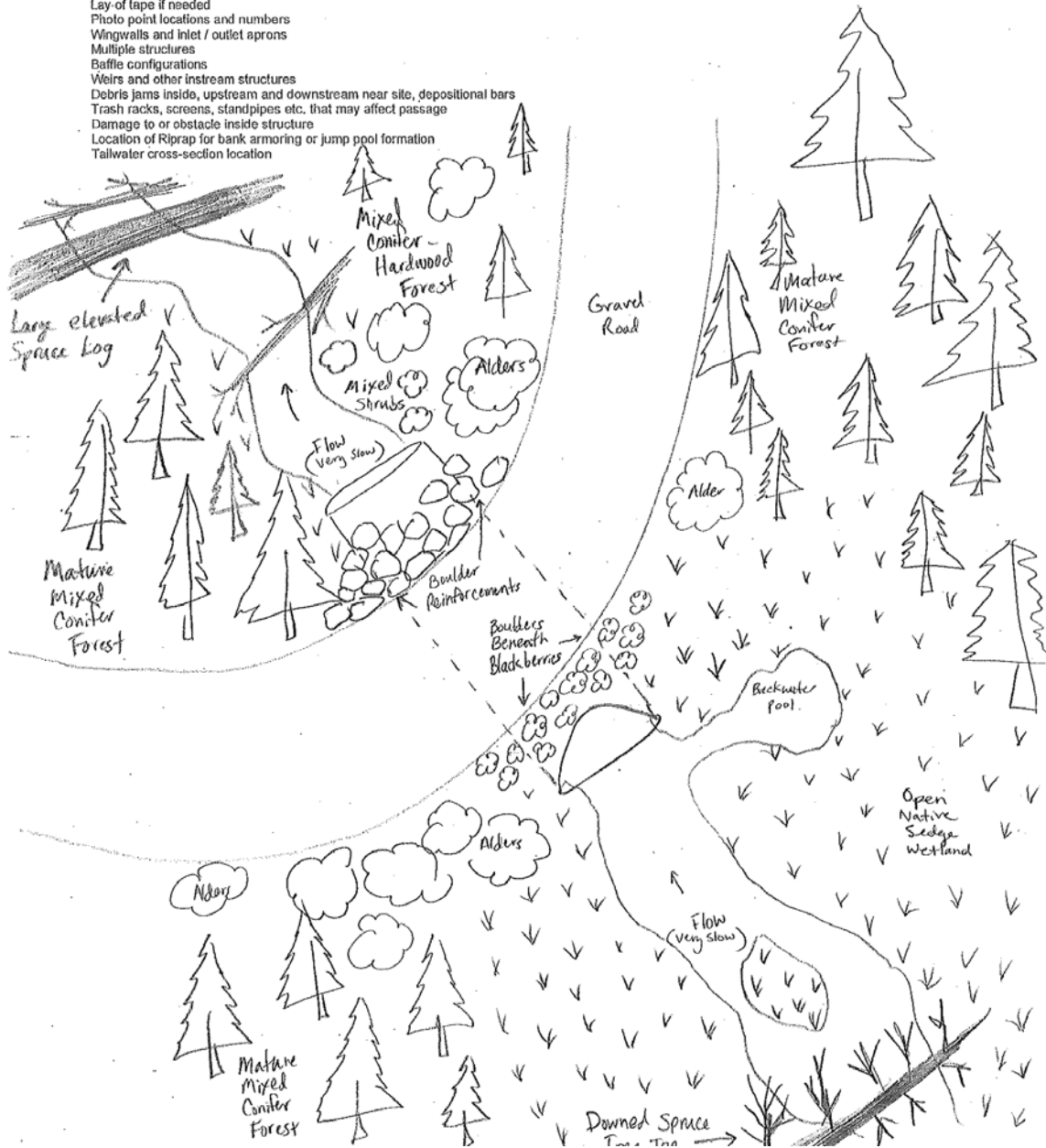
Figure 6867. Water Surface Profile at 0.24 cms, velocity block.

Site Sketch

Crossing ID number 52 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 69 2009 Restoration Effectiveness Monitoring Summary

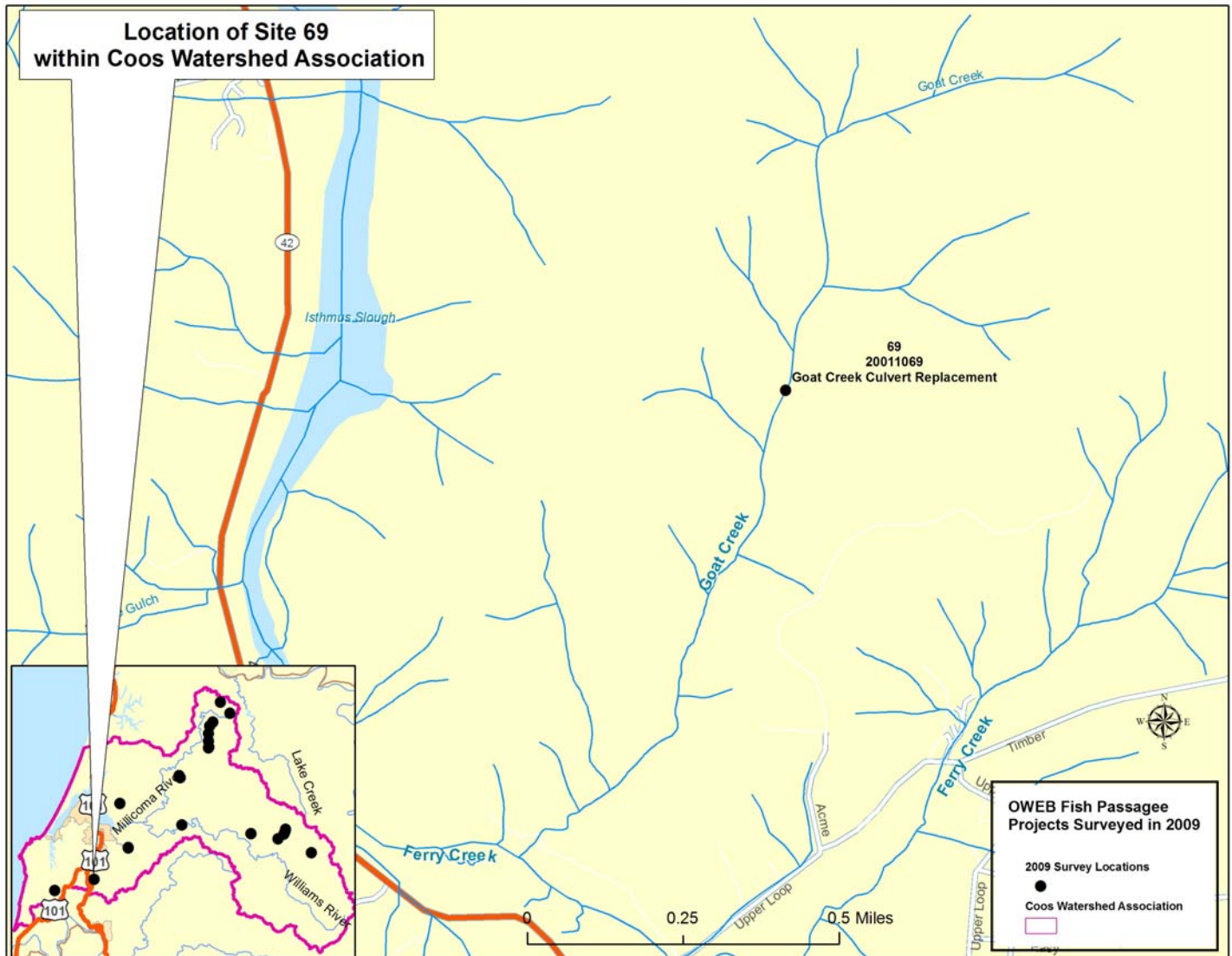
OWEB Project Name - Goat Creek Culvert Replacement

OWEB Grant Number – 099-461

OWRI Project Number – 20011069

Owner – Menasha

OWEB Description – Fish Passage



Map 39. Location of Site 69 on Goat Creek within the region of the Coos sub-basin.

Site Notes

This is a mountain stream tending towards a step-pool channel composed of gravels/silts/cobbles, respectively. There was a discontinuous layer of substrate within the culvert that began approximately 12.0 meters from the inlet and continued to the outlet. The culvert substrate was dominated by gravels/silts/cobbles, respectively. Substrate depth at the culvert outlet was 0.15 meters. The channel gradient near the culvert was 3.0%. The culvert gradient was 1.1%, when the substrate at the outlet is included in the measurement. The bankfull width of the channel upstream of the culvert was 2.9 meters on average while the circular culvert had a diameter of 1.8 meters. The ratio of inlet width to channel width was 0.63. The culvert lacked baffles, but some large rip rap boulders were in the culvert. There wasn't any pool at the outlet; the riffle from the outlet (~10 meters) ran to a winged weir structure where the first downstream pool was found.

There was a very dense vegetation community in and along the creek banks comprised mainly of red alder overstory and a blackberry/salmon berry understory. There is a roadside ditch that takes off from the culvert inlet and flows (marginally) along the road.

FishXings predicts that only 0.4% of all modeled flows are passable by juvenile salmonids. Flows exceeding 0.03 cms are predicted to be a velocity block. However, it does not seem like a block.

Snorkel Survey Results

Four pools were snorkeled over 155 meters of channel upstream of the culvert. Unknown trout juveniles were observed in 4 of the 4 pools snorkeled; although, the number of individuals observed was low.

Table 59. Snorkel survey results from Site 69.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1242195432594	1	Straight Scour	3.1	2.1	0.4	Steelhead/Cutthroat	1
1242195432594	2	Straight Scour	5.5	1.9	0.3	Steelhead/Cutthroat	1
1242195432594	3	Straight Scour	4.6	1.7	0.3	Steelhead/Cutthroat	2
1242195432594	4	Straight Scour	4.9	2.4	0.38	Steelhead/Cutthroat	1

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 60. Fish Passage Summary, Site 69.

Fish Passage Summary	
Low Passage Design Flow	0.0100 cms
High Passage Design Flow	5.0900 cms
Percent of Flows Passable	0.40 %
Passable Flow Range	0.0100 to 0.0316 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.03 cms and Above
Pool Depth Barrier	None

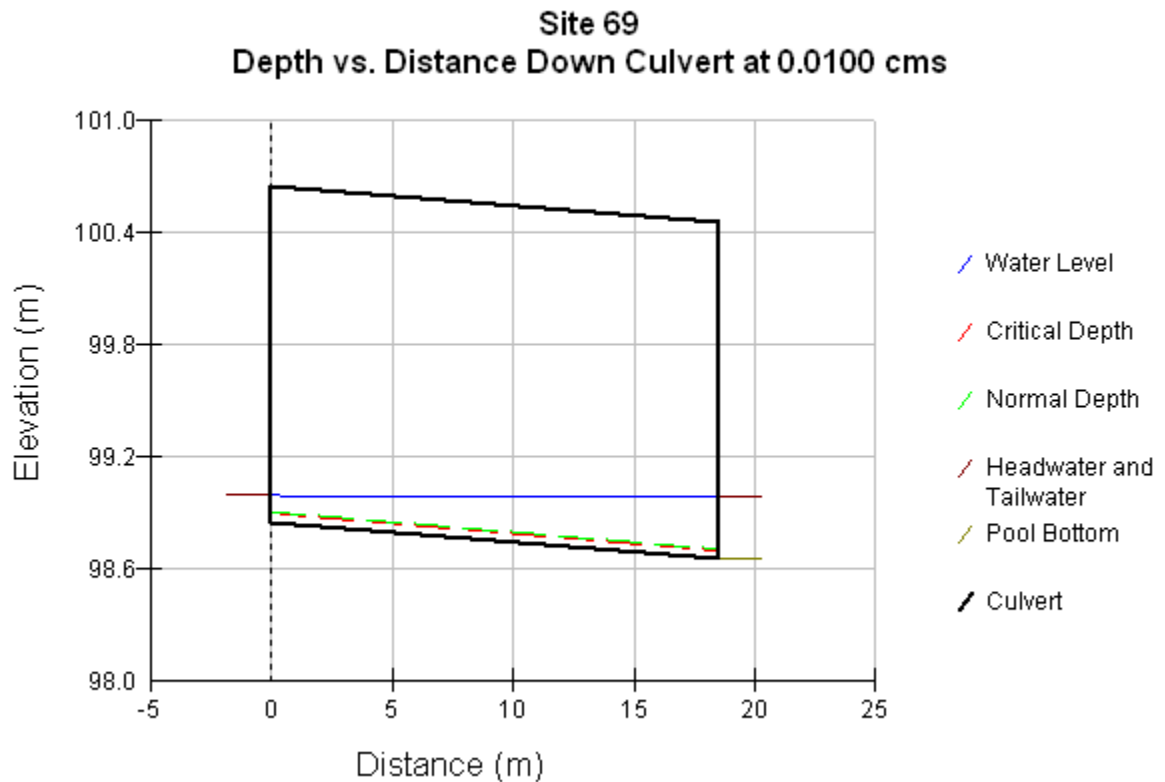


Figure 6968. Water Surface Profile at 0.01 cms, passable flow.

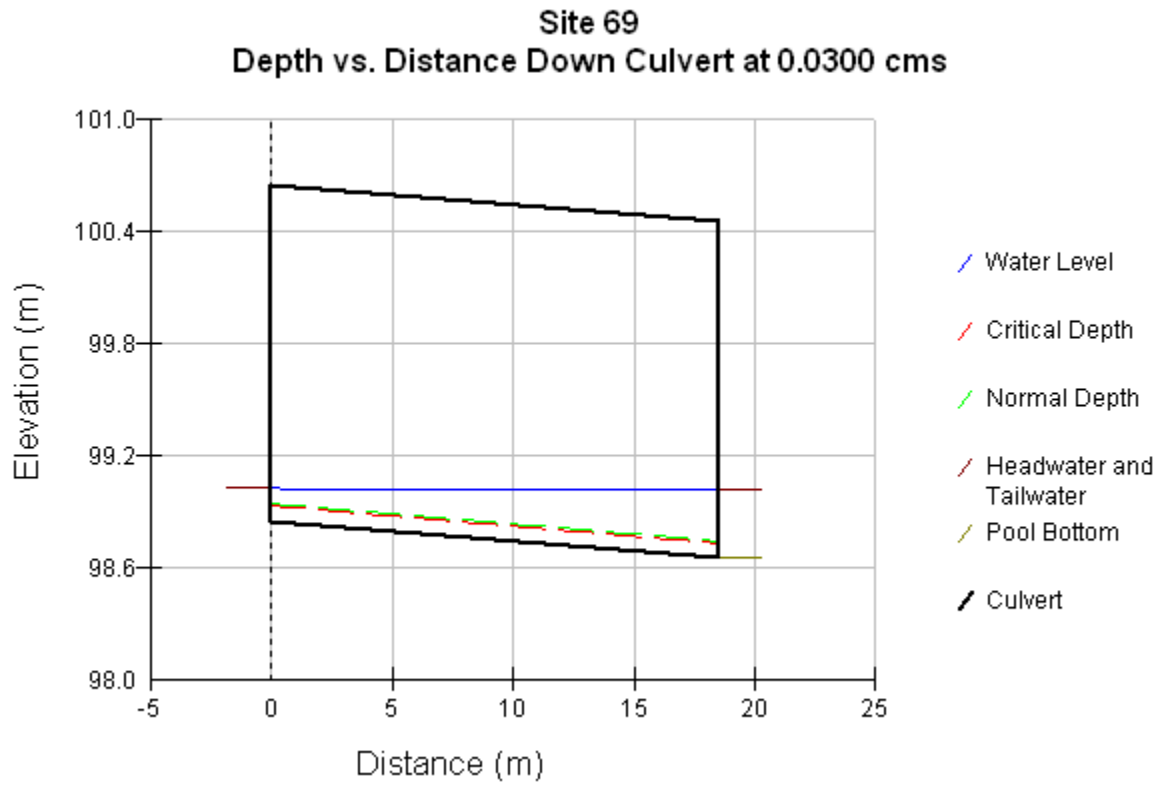


Figure 7069. Water Surface Profile at 0.03 cms, velocity block.

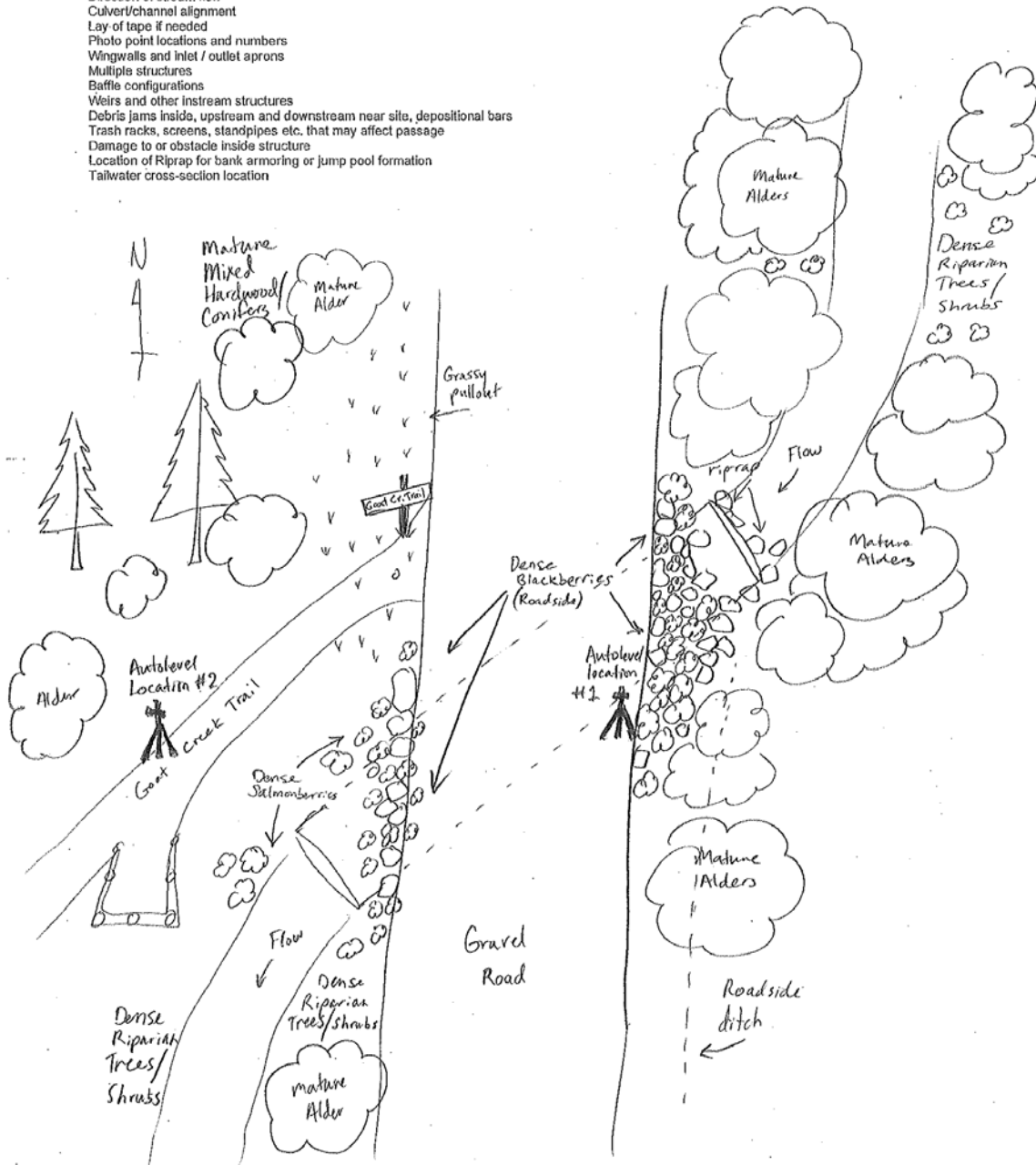
Site Sketch

Crossing ID number 69

Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 70 2009 Restoration Effectiveness Monitoring Summary

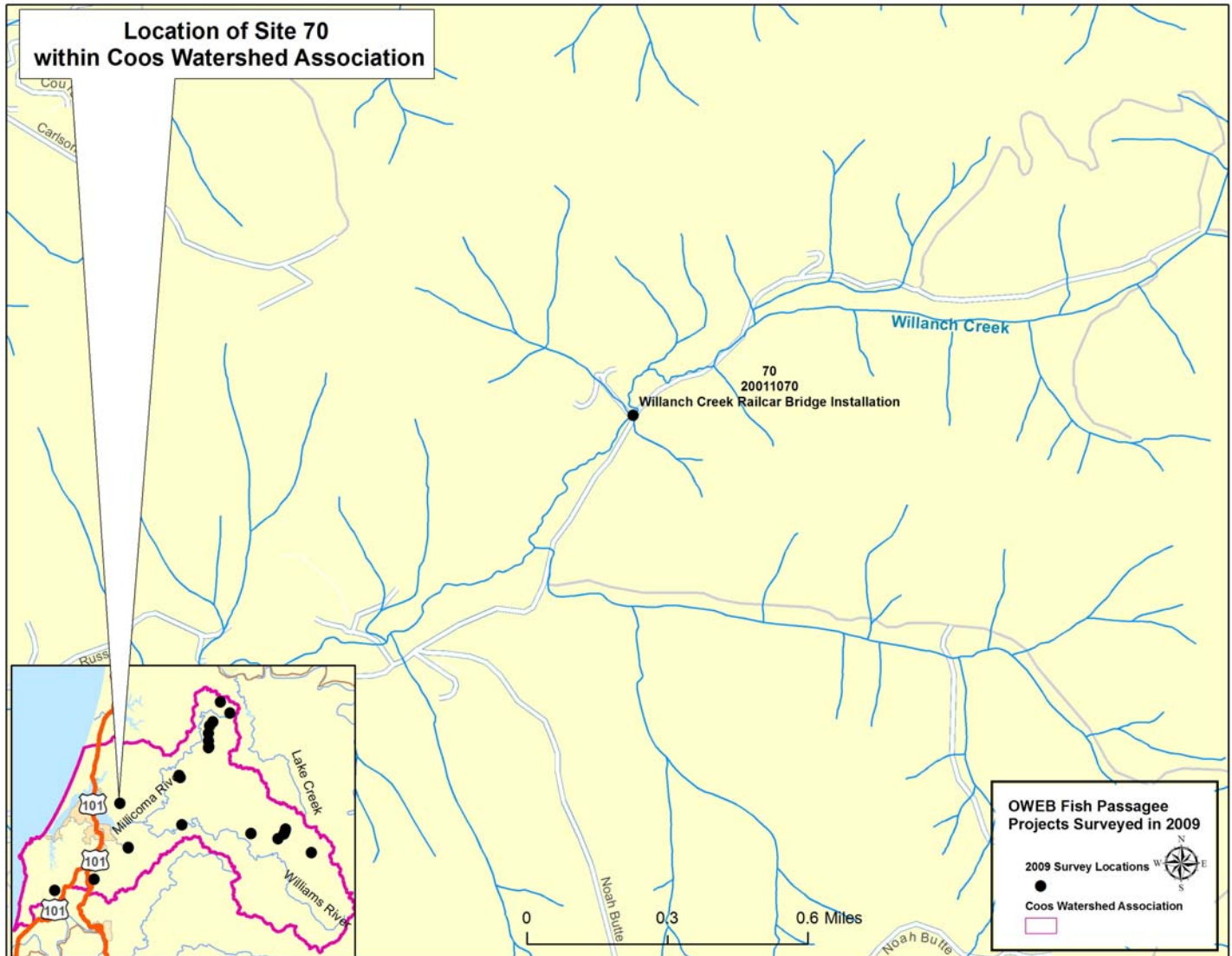
OWEB Project Name – Willanch Creek Railcar Bridge

OWEB Grant Number – 098-137/099-461

OWRI Project Number – 20011070

Owner – Lone Rock Timber

OWEB Description – Fish Passage



Map 40. Location of culvert removal and bridge installation at Site 70 in the Coos sub-basin.

Site Notes

This is a very low gradient channel that without beaver influence would most likely be considered a pool-riffle type. However, beaver have successfully erected several dams thereby changing the character of the reach. The channel consists of 100% sand/silt substrate and long trench/pools or glides. The surveyed reach is clearly acting as a depositional system. The riparian area is well vegetated, but invasive species dominate. Blackberries and reed-canary grass are abundant with planted willow and alder playing less of a role. The banks seem to be stable.

Many juvenile salmonids were observed during the snorkel survey and the creation of a depression in the channel at the bridge point has lowered the slope. Fish will easily pass this area.

Longitudinal and Cross-sectional Profile

The longitudinal profile presented below illustrates the channel shape after the stream crossing was removed and the bridge was installed. The overall gradient over the surveyed area was 0.13%. The main effect of removing the previous structure was the creation of a shallow depression which functions as a pool. However, there was intense impact by beaver and the channel continues to undergo changes that may be more related to beaver activity than the culvert removal. The cross section taken at the tail pool under the bridge illustrated a bankfull width of 3.4 meters. That stands in contrast to the average bankfull measured 30 meters upstream of the bridge which was 5 meters. This indicates that the channel is highly variable. This is most likely the result of the beaver activity.

Table 61. Longitudinal profile data for Site 70.

Station	Elevation	Remarks
0	97.3	Upstream extent of longitudinal survey
15	97.25	
30	96.66	1 meters upstream of bridge
34	96.87	4 meters downstream from bridge
60	97.27	
80	97.21	Downstream extent of longitudinal survey

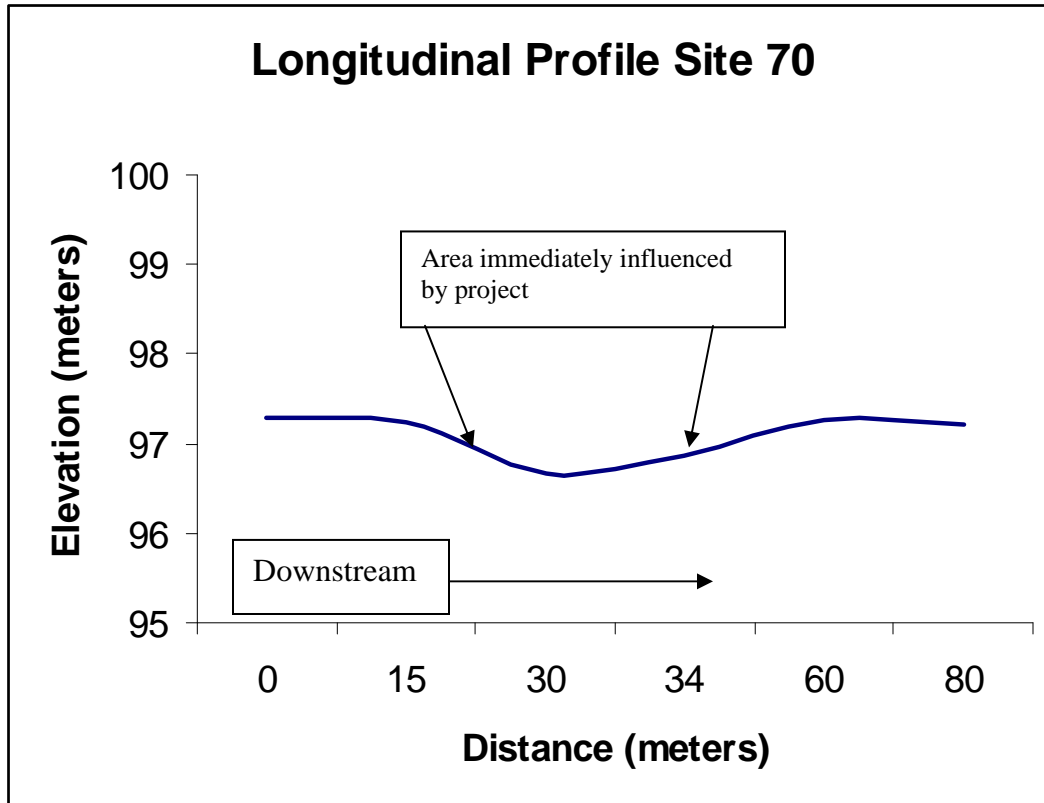


Figure 7170. Diagram of longitudinal profile for Site 70.

Table 62. Cross section data for pool tailwater under bridge at Site 70.

Distance	Elevation	Remarks
0	97.74	Top of Terrace
0.8	97.65	Right bank full height
1	97.53	Water Edge
1.4	96.76	
2.3	96.79	Thalwag
3.7	96.95	
4.2	97.59	Left bankfull height
5.5	97.91	Left Top of Terrace

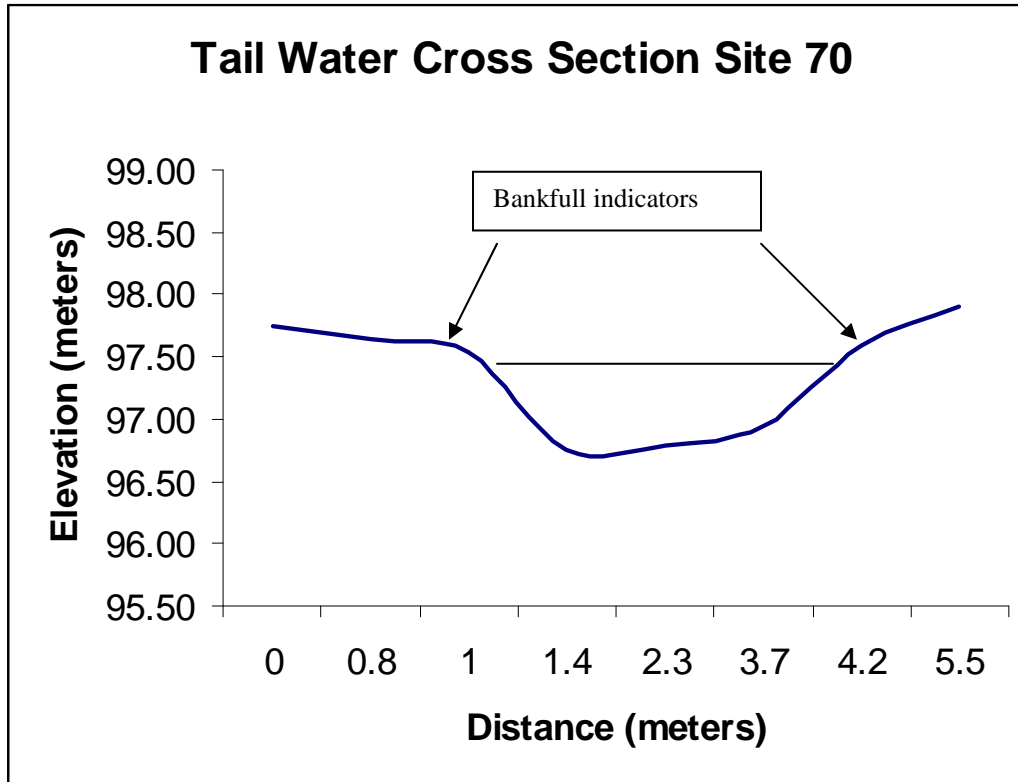


Figure 7271. Cross section diagram of tail water under bridge at Site 70.

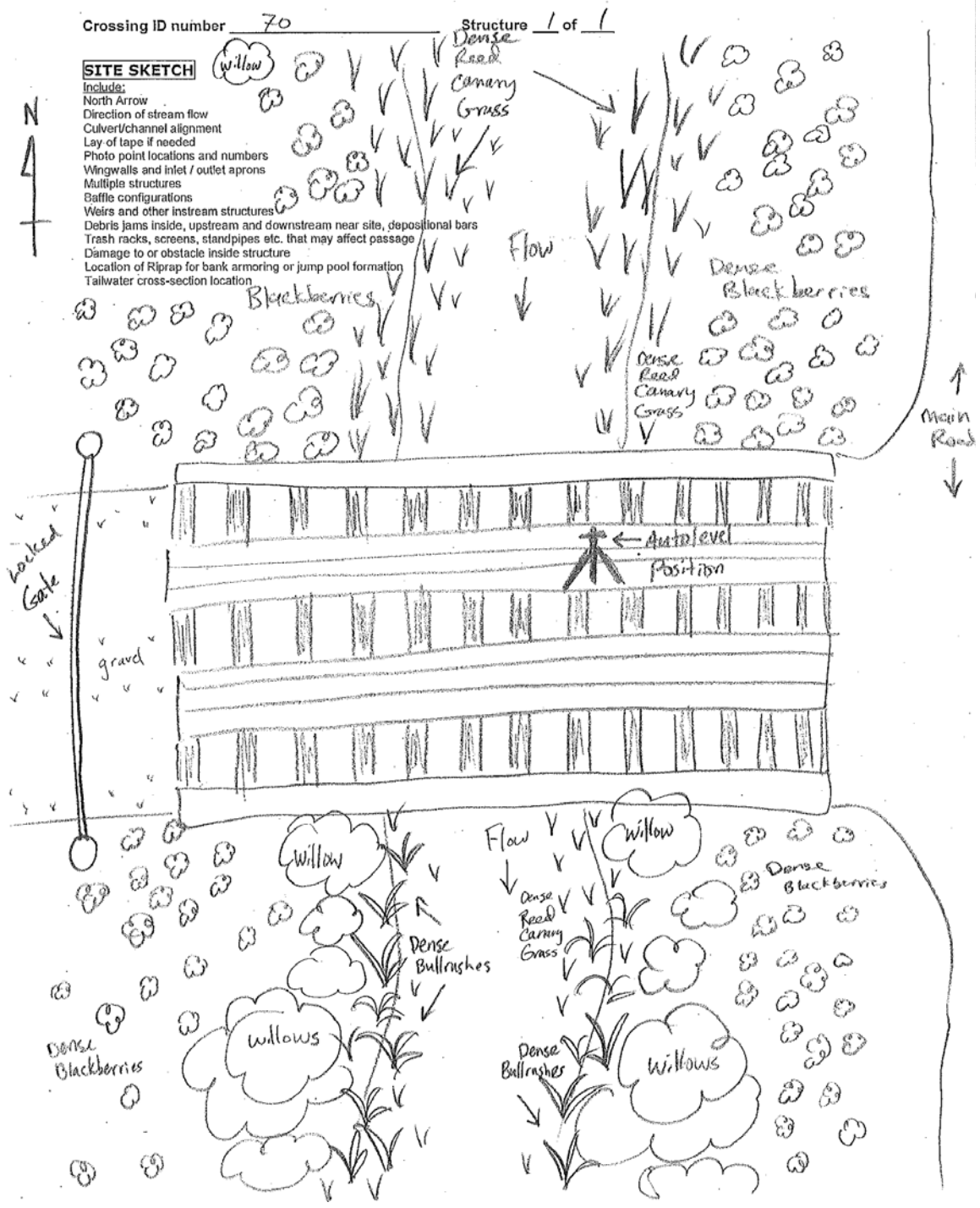
Snorkel Survey Results

We snorkeled 155 meters of stream upstream of the bridge installation and found 39 Coho and 6 trout juveniles. The water was extremely cloudy. Visibility was characterized as poor. This was classified as 1 entire trench pool.

Table 63. Snorkel survey results for Site 70.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1241601434067	1	Glide/Beaver Dam	155	4.4	0.52	Coho	39	Steelhead/Cutthroat	6

Site Sketch



Site # 71 2009 Restoration Effectiveness Monitoring Summary

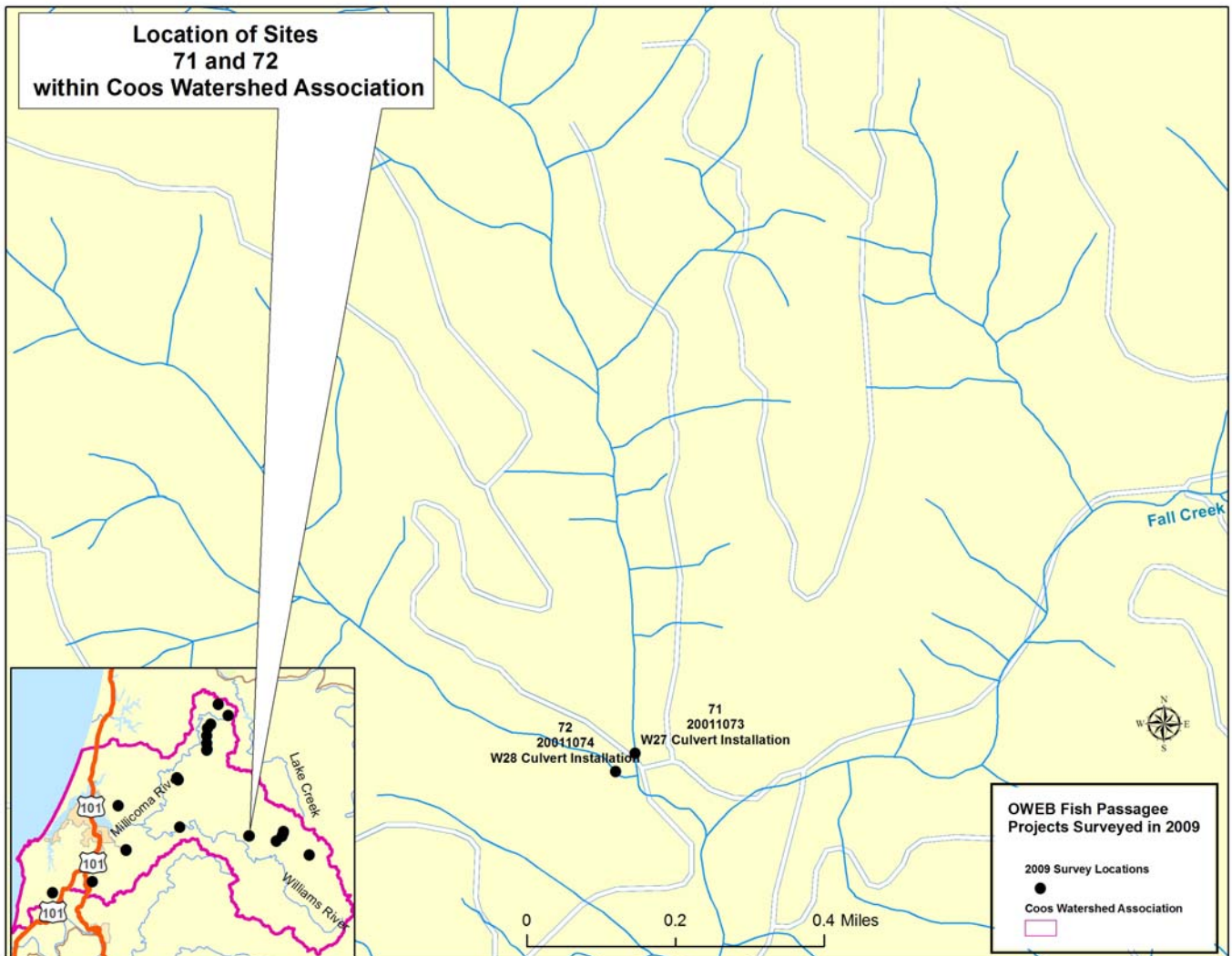
OWEB Project Name - W27 Culvert Installation

OWEB Grant Number – 099-461

OWRI Project Number – 20011073

Owner – Weyerhaeuser Corporation

OWEB Description – Fish Passage



Site Notes

This culvert appears to be designed to work as a stream simulation culvert; it is covered by substrate from end to end and it has baffles to slow water velocity. The channel substrate is composed of cobbles/gravels and boulders, respectively while the substrate in the culvert composed of sand/cobbles/ and gravels respectively. Channel slope is ~ 1.5% while the culvert slope is 1.1%. Bankfull width upstream of the culvert was determined to be 5.7 meters while the dimensions of the pipe-arch culvert were 3.8 meters wide and 2.6 meters high. The inlet width to channel gradient width was 0.67. The outlet invert equaled the deepest part of the channel immediately downstream of culvert indicating no outfall. Residual pool depth was 0.13 meters with the tailwater control being only 0.04 meters below the inlet invert.

Numerous juvenile salmonids were seen in the culvert at the time of the survey.

FishXings predicts that 0.8% of all modeled flows are passable by juvenile salmonids. Velocity begins to block passage at 0.11 cms. Many juveniles were observed during the snorkel survey. This does not seem to be a block.

Snorkel Survey Results

Juvenile fish (3" and less) were observed in all pool habitats snorkeled within 500 feet upstream of the culvert at Site 71. Rainbow and cutthroat are not differentiated because identifying juveniles from those two species is extremely difficult.

Table 64. Snorkel survey results from Site 71.

Stream_LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
12382222433648	1	Lateral Scour	8	3.9	0.38	Coho	27	Steelhead/Rainbow	13
12382222433648	2	Backwater	4	2.6	0.41	Coho	3	Steelhead/Rainbow	6
12382222433648	3	Lateral Scour	6	2.7	0.55	Coho	5	Steelhead/Rainbow	6
12382222433648	4	Straight Scour	7.5	1.5	0.32	Coho	5	Steelhead/Rainbow	5
12382222433648	5	Straight Scour	12	3.8	0.59	Coho	5	Steelhead/Rainbow	7
12382222433648	6	Lateral Scour	12	4.5	0.75	Coho	5	Steelhead/Rainbow	7

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 65. Fish Passage Summary, Site 71.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	14.0000 cms
Percent of Flows Passable	0.8 %
Passable Flow Range	0.0010 to 0.1130 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.11 cms and Above
Pool Depth Barrier	None

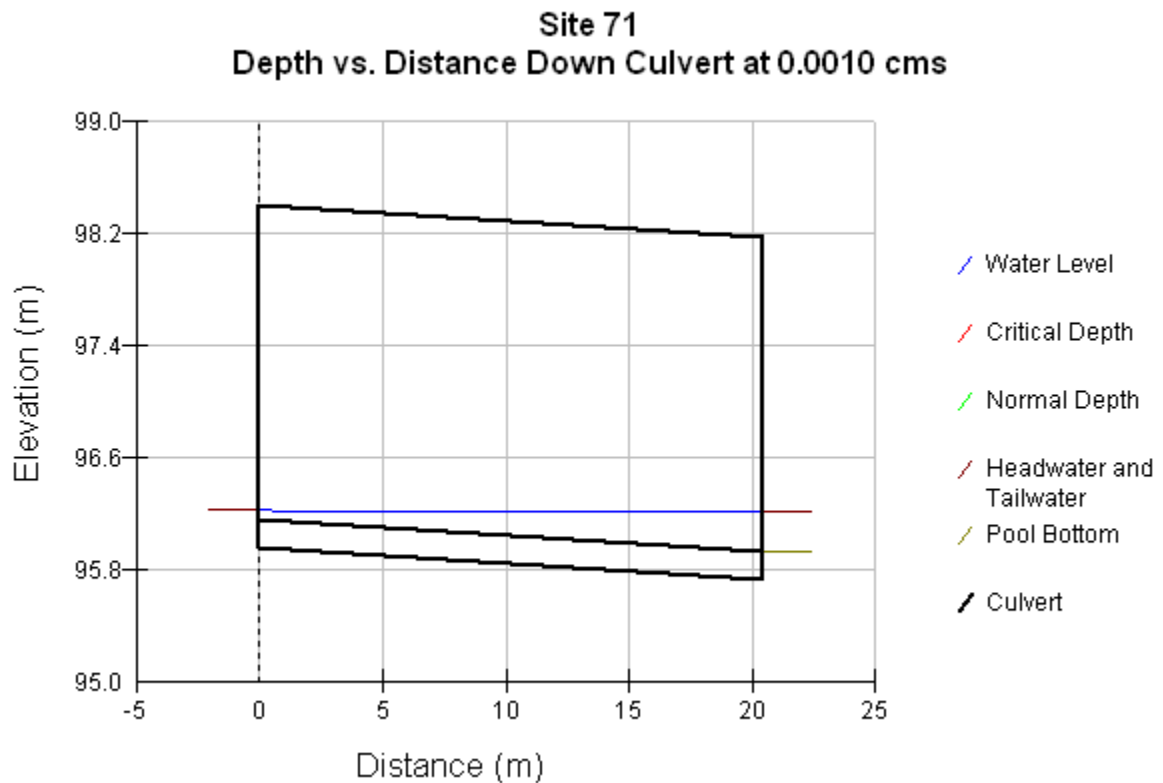
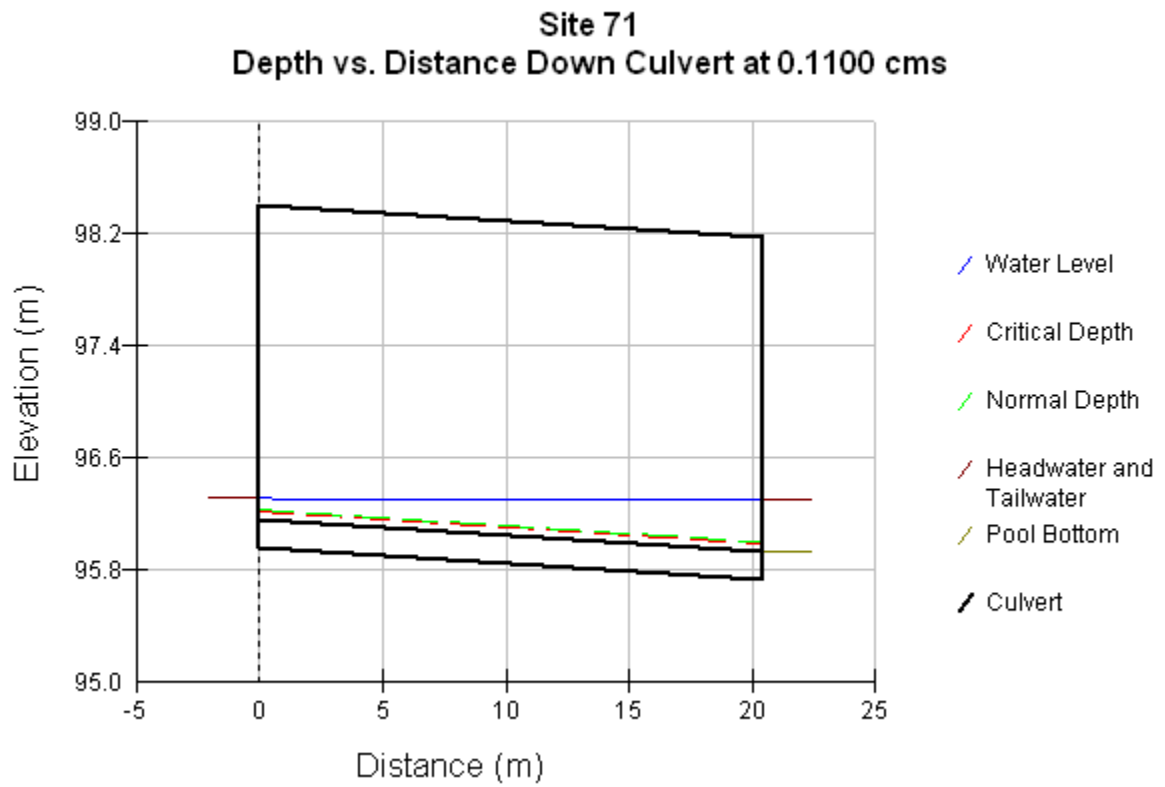


Figure 7372. Water Surface Profile at 0.001 cms, passable flow.



| Figure 7473. Water Surface Profile at 0.11 cms, velocity block.

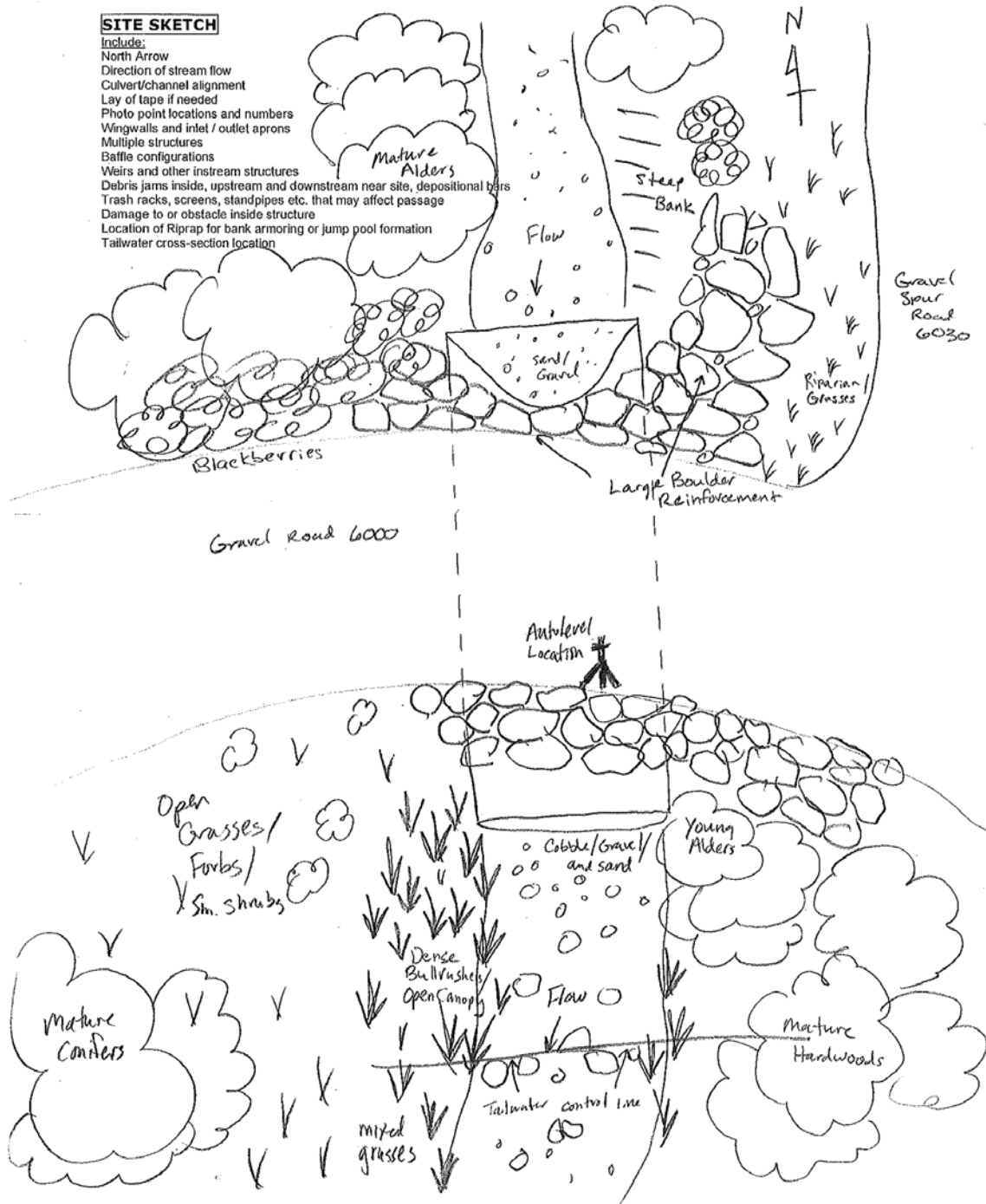
Site Sketch

Crossing ID number 71 Structure 1 of 1

SITE SKETCH

Include:

- North Arrow
- Direction of stream flow
- Culvert/channel alignment
- Lay of tape if needed
- Photo point locations and numbers
- Wingwalls and inlet / outlet aprons
- Multiple structures
- Baffle configurations
- Weirs and other instream structures
- Debris jams inside, upstream and downstream near site, depositional bars
- Trash racks, screens, standpipes etc. that may affect passage
- Damage to or obstacle inside structure
- Location of Riprap for bank armoring or jump pool formation
- Tailwater cross-section location



Site # 72 2009 Restoration Effectiveness Monitoring Summary

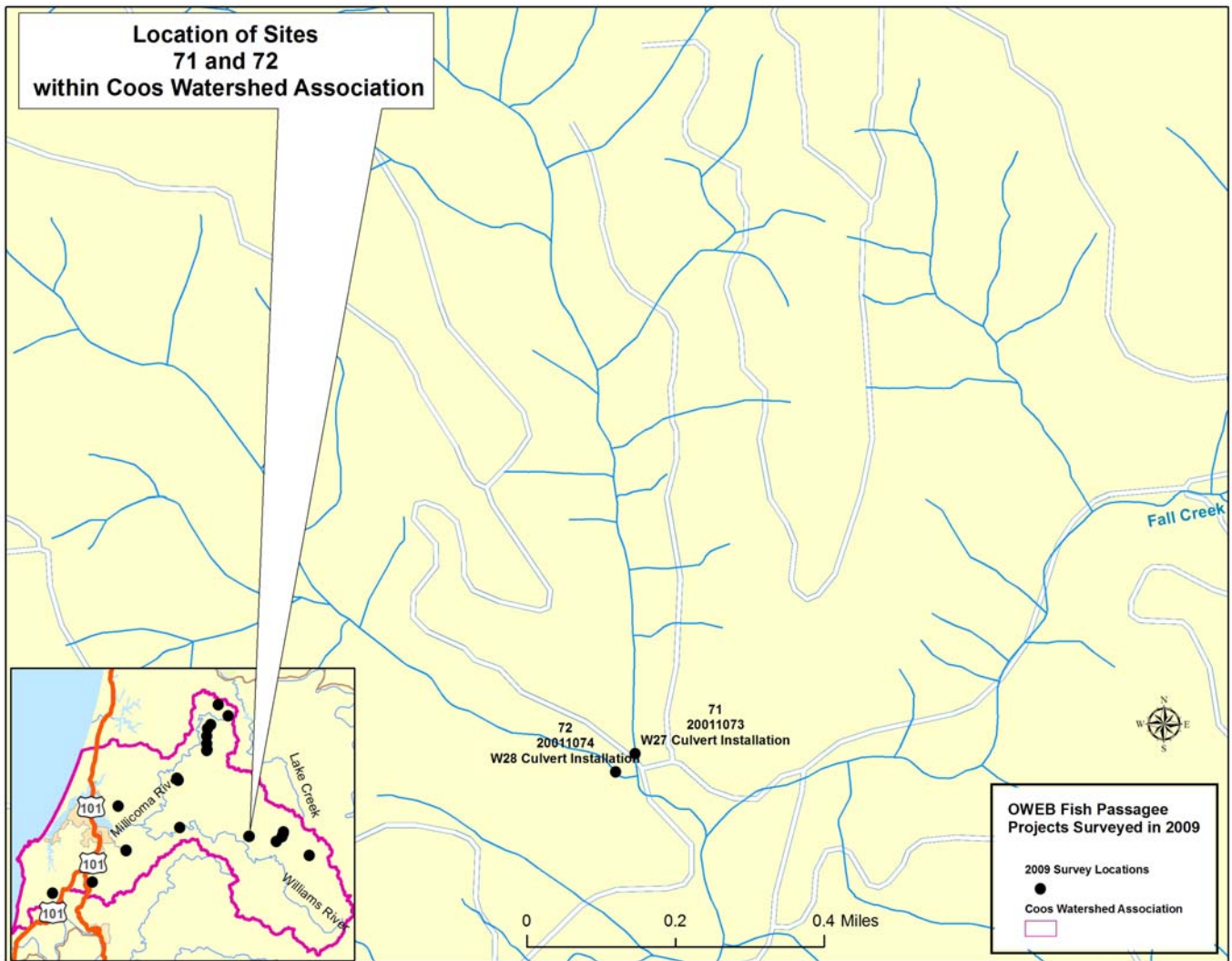
OWEB Project Name - W28 Culvert Installation

OWEB Grant Number – 099 - 461

OWRI Project Number – 20011074

Owner – Weyerhaeuser Corporation

OWEB Description – Fish Passage



Site Notes

This is a cobble dominated mountain stream with fully vegetated and relatively stable banks. Channel substrate is composed of cobble, gravel, and boulders, respectively. The culvert is a pipe-arch bolted together with 2-0.1 meter tall rigid plate connectors. These connect have the consequence of slowing velocity in the barrel zone. There was little channel substrate noted within the culvert. The channel gradient was 2.7% while the culvert gradient was 5%. Bankfull width averaged 4.0 meters while the pipe-arch culvert was 2.8 meters wide and 1.9 meters high. The ratio of inlet width to channel width was 0.7. There was no outlet drop and there was a very shallow pool at the outlet that had a residual depth of 0.07.

Numerous juvenile salmonids were seen above and below the culvert at the time of the survey.

FishXings predicts that 0.0% of all modeled flows will be passable by juvenile salmonids.

Snorkel Survey Results

Juvenile fish (3" and less) were observed in all pool habitats snorkeled within 500 feet upstream of the culvert at Site 72. Rainbow and cutthroat are not differentiated because identifying juveniles from those two species is extremely difficult.

Table 66. Snorkel survey results from Site 72.

Stream_LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1238228433659	1	Straight Scour	6.5	1.7	0.34	Coho	25	Steelhead/Rainbow	3
1238228433659	2	Lateral Scour	3.9	2.1	0.32	Coho	14	Steelhead/Rainbow	5

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 67. Fish Passage Summary, Site 72.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	9.3000 cms
Percent of Flows Passable	0.0 %
Passable Flow Range	0.0010 to 0.1189 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.001 cms and Above
Pool Depth Barrier	None

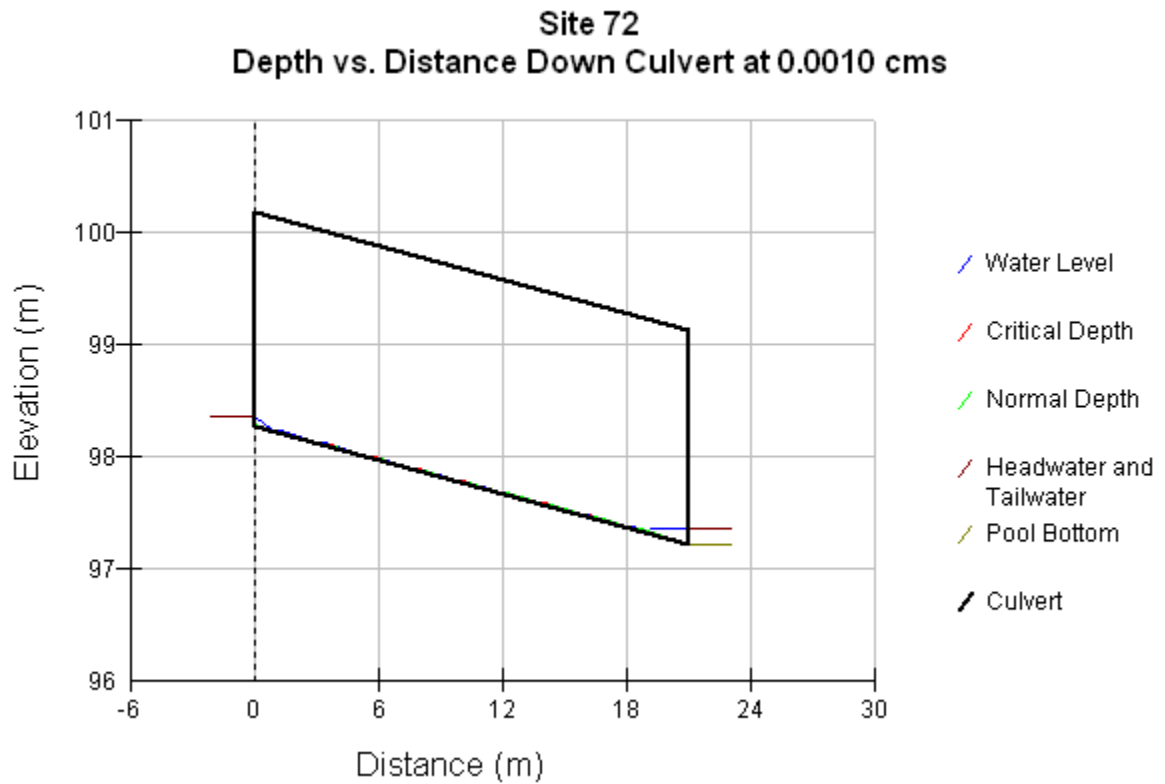


Figure 7574. Water Surface Profile at 0.001 cms, passable.

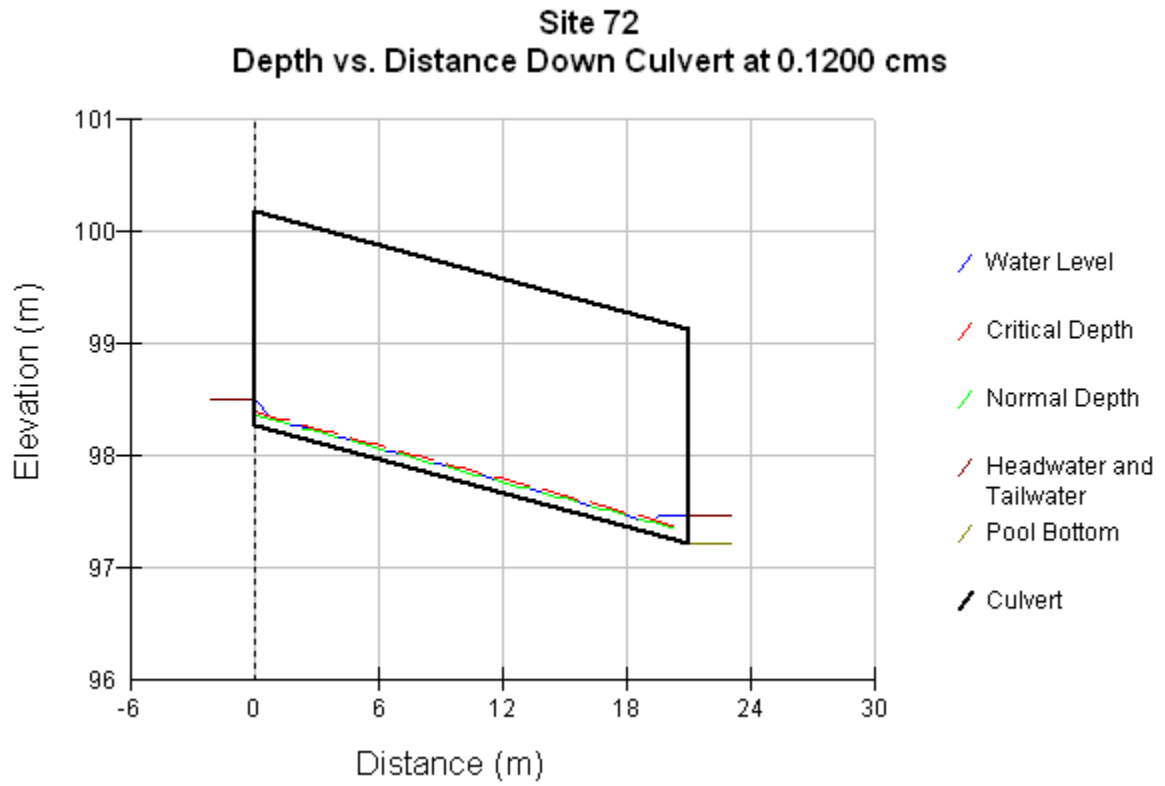


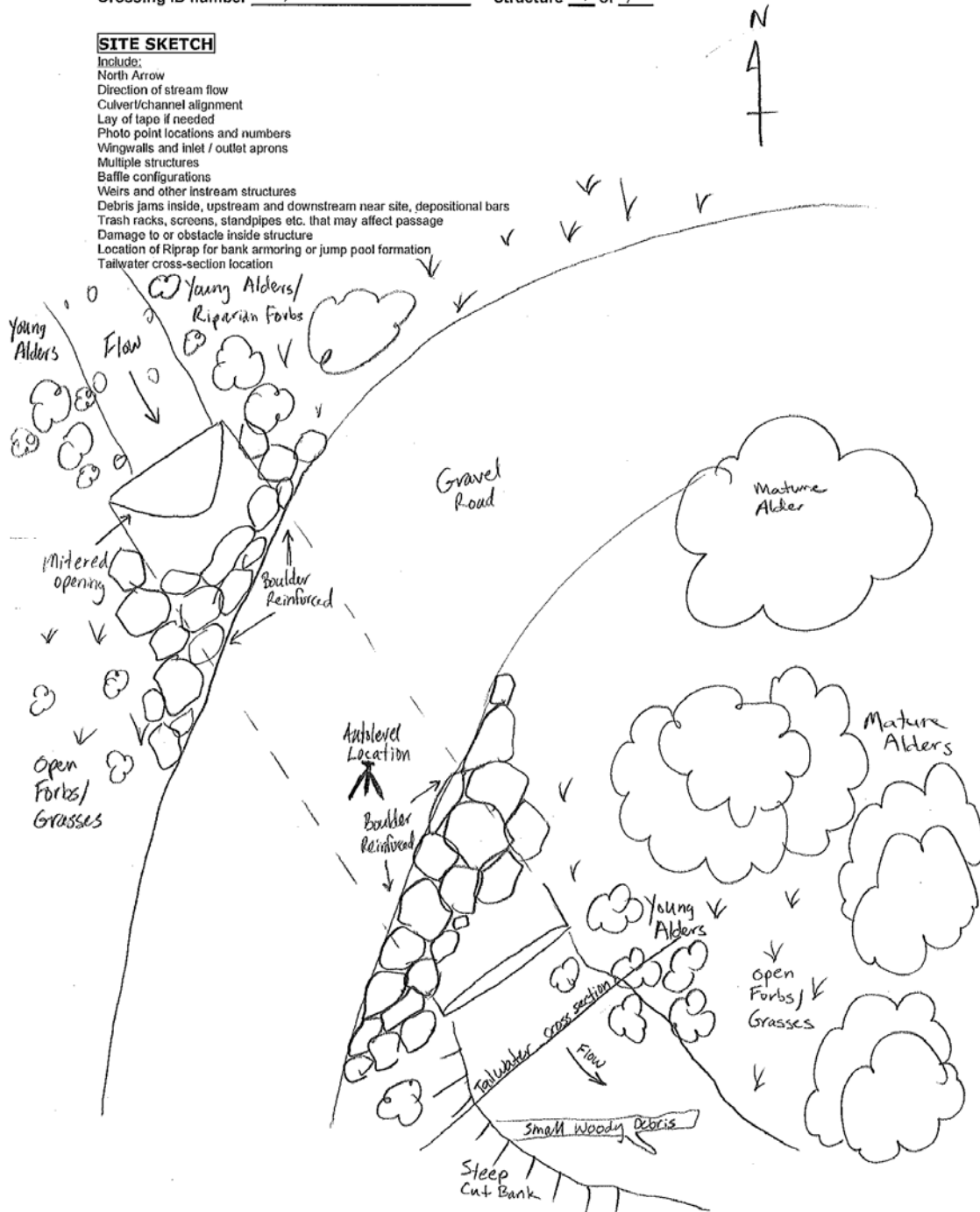
Figure 7675. Water Surface Profile at 0.12 cms, velocity barrier.

Site Sketch

Crossing ID number 72 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 73 2009 Restoration Effectiveness Monitoring Summary

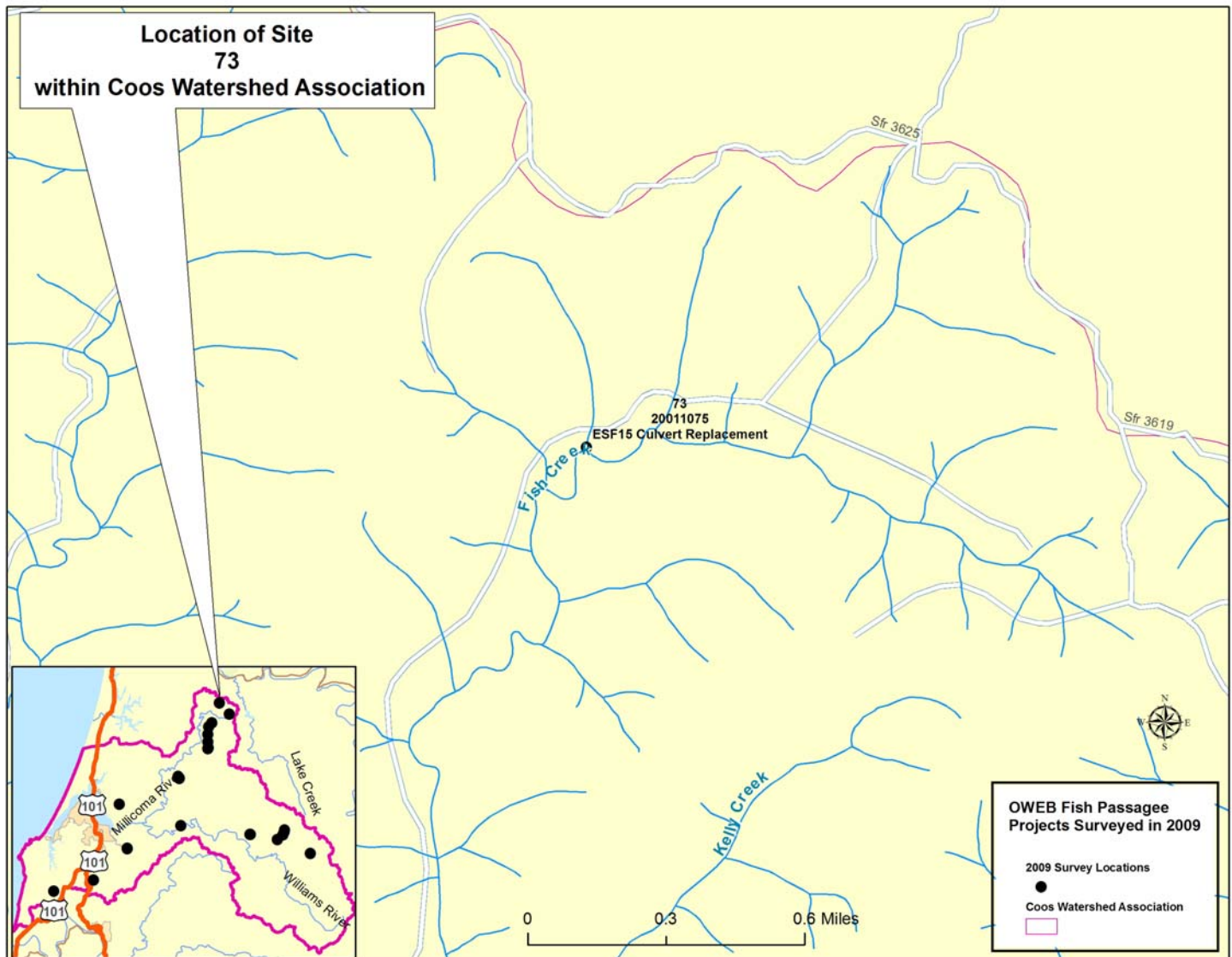
OWEB Project Name - ESF15 Culvert Replacement

OWEB Grant Number – 098 – 137/099 - 461

OWRI Project Number – 20011075

Owner – State of Oregon, Oregon Department of Forestry

OWEB Description – Fish Passage



Map 43. Location of Site 73 in the Coos sub-basin.

Site Notes

This is a mountain stream tending towards a step-pool channel with cobbles/gravels/boulders making up channel substrate. The culvert had nearly 0.5 meters deep of substrate at the inlet that continued along the bottom of the culvert for 13.2 meters (90% culvert length); yet, there was not any substrate at the outlet. The channel gradient near the culvert was steep; exceeding 12%. The culvert, however, lied at a 3.5% gradient. The bankfull width of the channel upstream of the culvert was 2.5 meters on average while the pipe arch culvert had a width of 1.63 meters and a height of 1.27 meters. There were no baffles present in the culvert. There was a shallow pocket pool (no real tail crest) that had a depth of 0.15 meters. The shallow take off pool provides little room to make the jump of 0.45 meters; this is a significant outfall. The calculated residual pool depth was 0.03 meters.

FishXings predicts that the 0.45 meter jump is a block to juvenile salmonids at all modeled flows.

Snorkel Survey Results

Juvenile fish were not numerous above this culvert. Pools were marginal and riffles were steep. We did not encounter Fish until the 6th pool; there we found three juvenile salmonids. At the last small pool, we found another 5 juvenile salmonids.

Table 68. Snorkel survey results for Site 73.

Stream_LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1239138436044	1	Lateral Scour	2.2	1.5	0.4		0
1239138436044	2	Lateral Scour	3	1.5	0.3		0
1239138436044	3	Lateral Scour	2.8	2	0.3		0
1239138436044	4	Straight Scour	2.1	2.2	0.3		0
1239138436044	5	Straight Scour	1	1.2	0.3		0
1239138436044	6	Straight Scour	1.5	1.3	0.2	Steelhead/Cutthroat	3
1239138436044	7	Straight Scour	1.8	1.4	0.3		0
1239138436044	8	Straight Scour	3	2.3	0.33	Steelhead/Cutthroat	5

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 69. Fish Passage Summary., Site 73.

Fish Passage Summary	
Low Passage Design Flow	0.0020 cms
High Passage Design Flow	1.9800 cms
Percent of Flows Passable	0.0 %
Passable Flow Range	None
Depth Barrier	None
Outlet Drop Barriers	All Flows
Velocity Barrier - V	0.01 cms and Above
Pool Depth Barrier	None

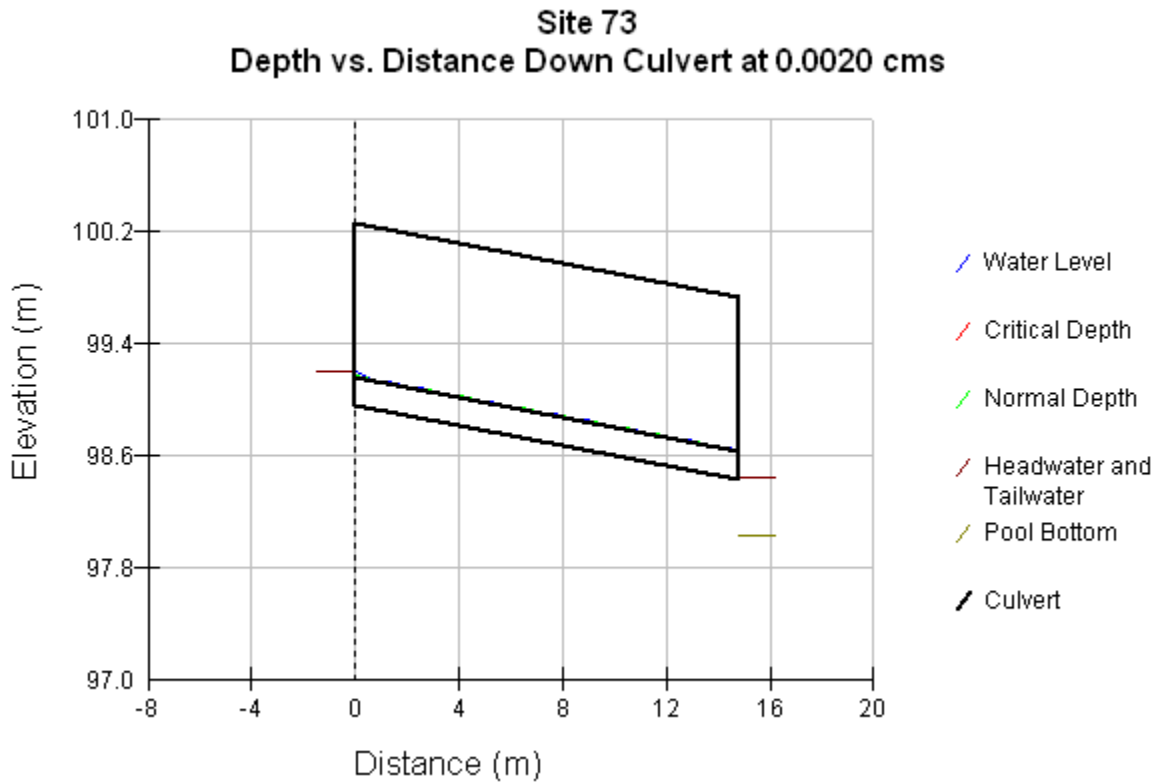


Figure 776. Water Surface Profile at 0.002 cms

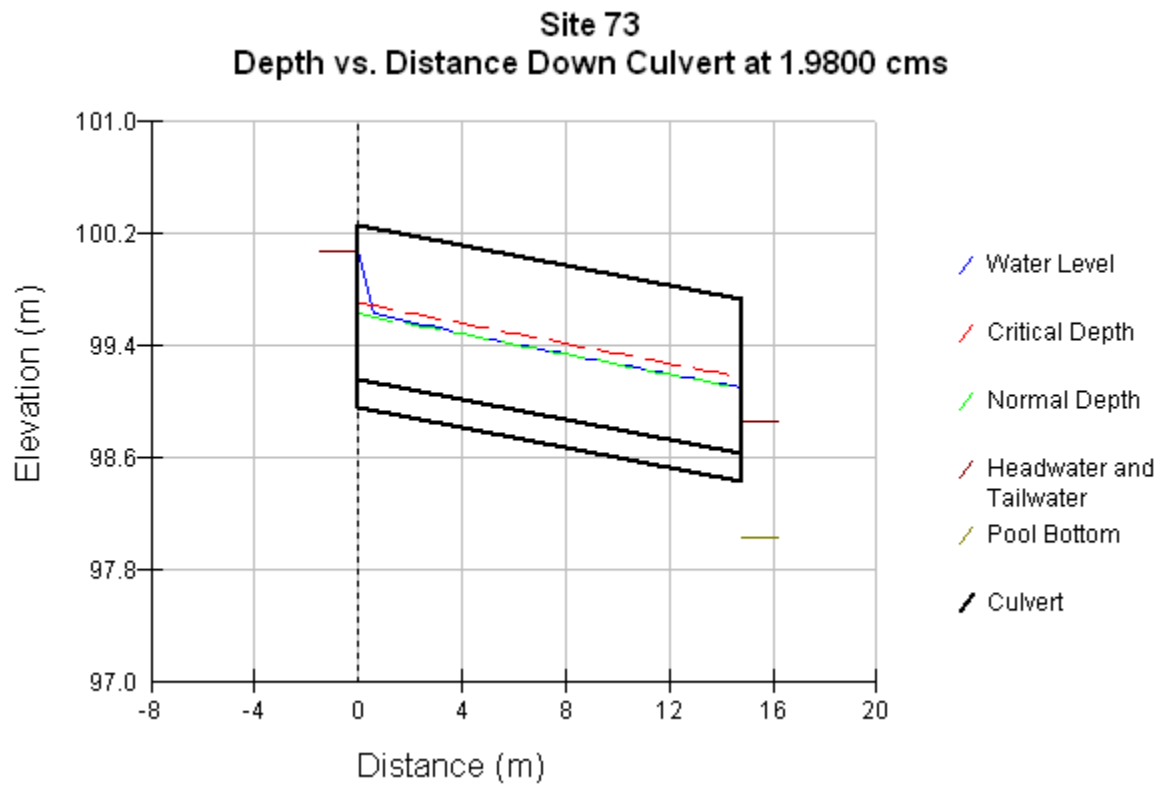


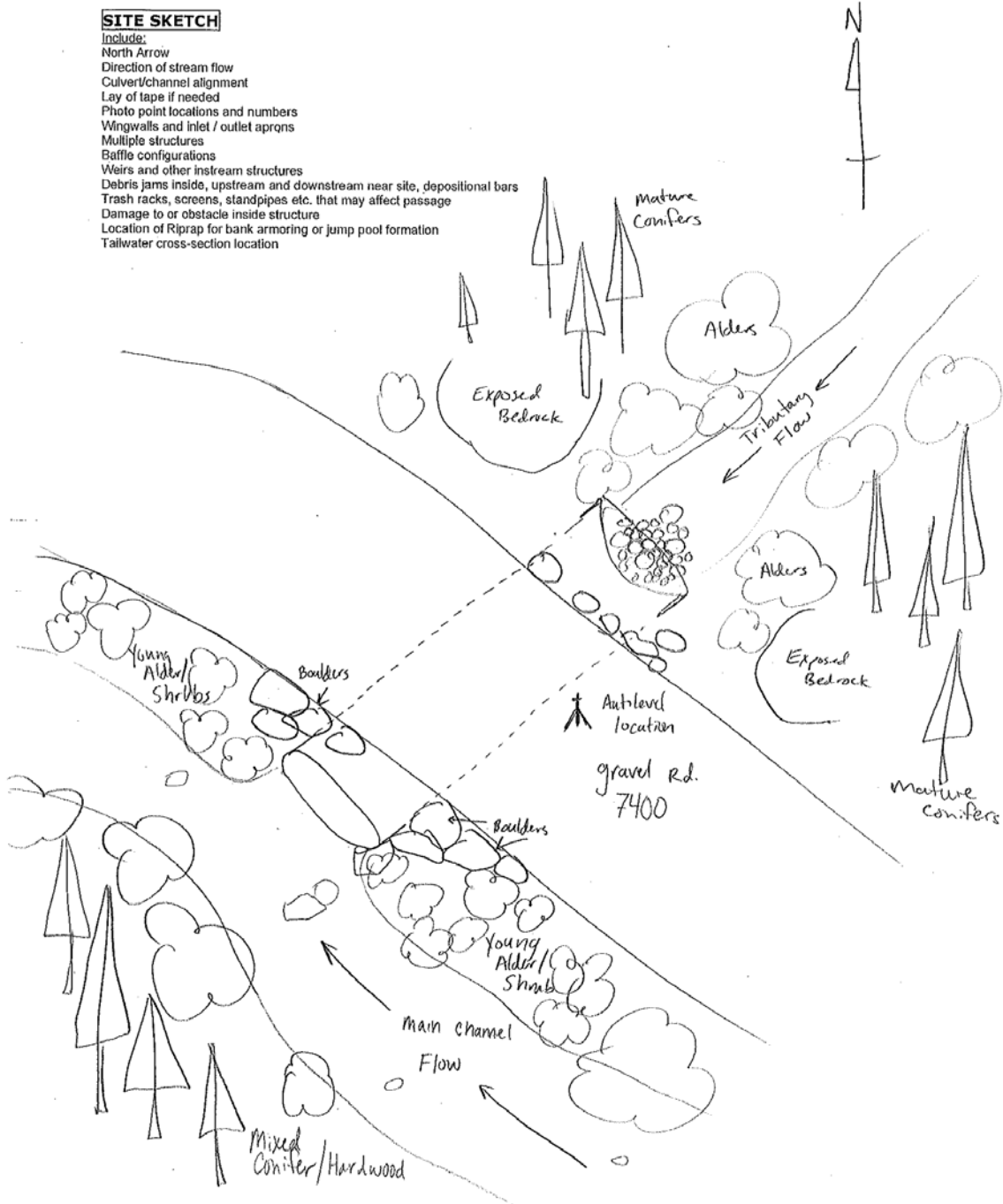
Figure 7877. Water Surface Profile at 1.98 cms

Site Sketch

Crossing ID number 73 Structure 1 of 1

SITE SKETCH

- Include:**
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 74 2009 Restoration Effectiveness Monitoring Summary

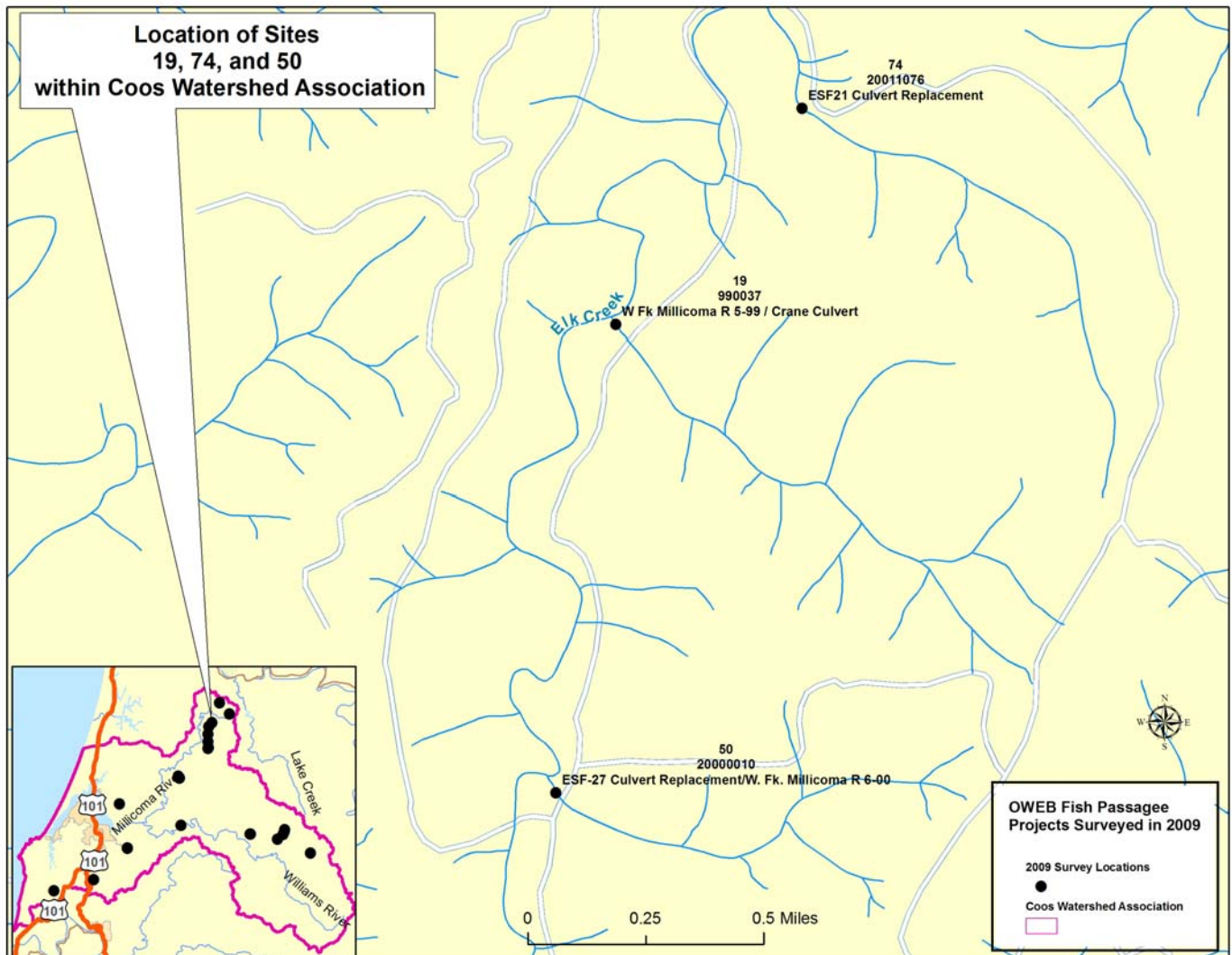
OWEB Project Name - ESF21 Culvert Replacement

OWEB Grant Number – 098-137/099-461

OWRI Project Number – 20011076

OWEB Description – Fish Passage

Owner – State of Oregon, Oregon Department of Forestry



Site Notes

This is a mountain stream tending towards a step-pool channel dominated by cobbles/gravels/sand, respectively. There was a continuous layer of substrate within the culvert that ranged from 0.79 meters deep at the inlet to 1.27 meters deep at the outlet. The culvert substrate mimicked the channel substrate in that it was also composed of was dominated by cobbles/gravel/sand respectively. The channel gradient near the culvert was 2%. The culvert gradient was also 0.1% gradient. The bankfull width of the channel upstream of the culvert was 4.4 meters on average while the circular culvert had a diameter of 2.4 meters. There were no baffles present in the culvert. There wasn't any pool at the outlet, and the riffle that ran from the outlet intersected placed large wood. The placed wood primary functions were to accumulate sediment and provide habitat cover rather than forcing pools. The channel was nearly dry at the time of survey.

Snorkel Survey Results

Five pools were snorkeled within 155 meters of the culvert inlet. Four of five pools held juvenile trout, no Coho were recorded.

Table 70. Snorkel survey results for Site 74.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1239344435699	1	Lateral Scour	6.3	4.2	0.35	Steelhead/Cutthroat	1
1239344435699	2	Lateral Scour	7.5	3.2	0.45	Steelhead/Cutthroat	4
1239344435699	3	Lateral Scour	4.2	2.4	0.96		0
1239344435699	4	Lateral Scour	4.5	2.6	0.33	Steelhead/Cutthroat	5
1239344435699	5	Lateral Scour	7.1	1.2	0.41	Steelhead/Cutthroat	7

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 71. Fish Passage Summary, Site 74.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	11.0000 cms
Percent of Flows Passable	1.50 %
Passable Flow Range	0.0010 to 0.1681 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.17 cms and Above
Pool Depth Barrier	None

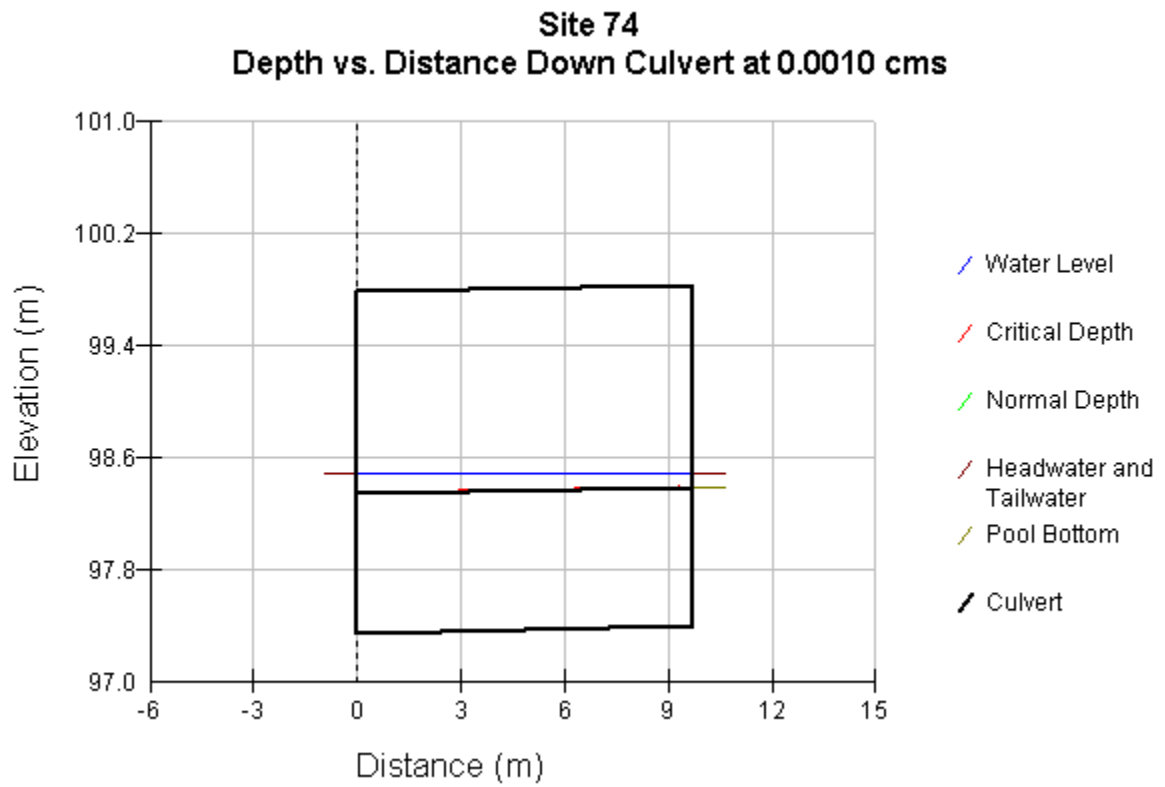


Figure 7978. Water Surface Profile at 0.001 cms, passable.

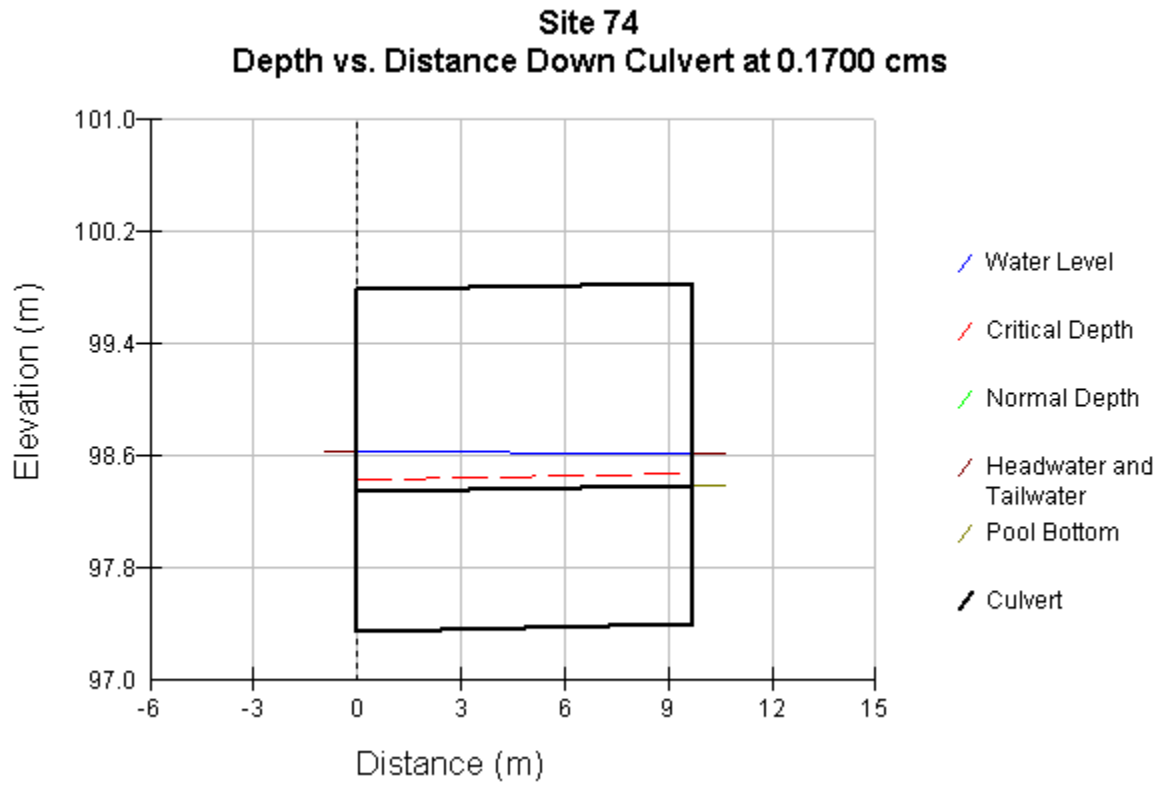


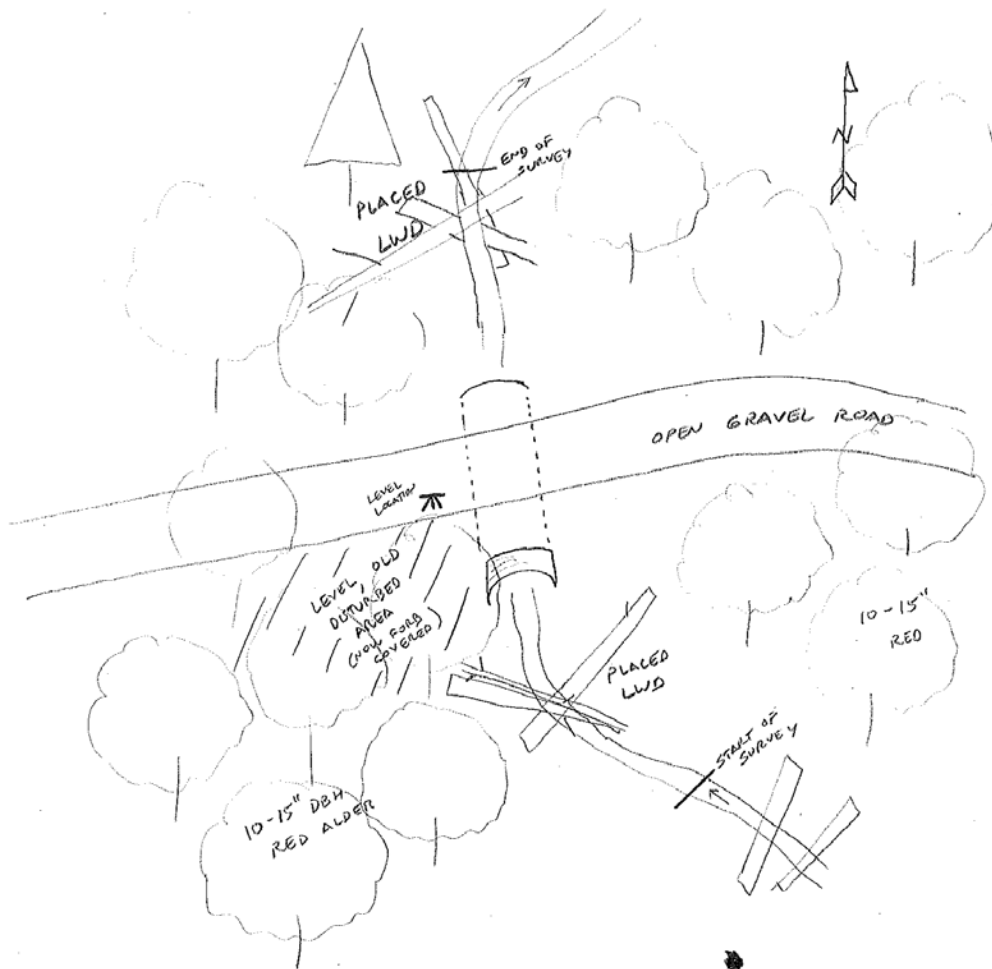
Figure 8079. Water Surface Profile at 0.17 cms, velocity block.

Site Sketch

Crossing ID number 74/20011076 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 131 2009 Restoration Effectiveness Monitoring Summary

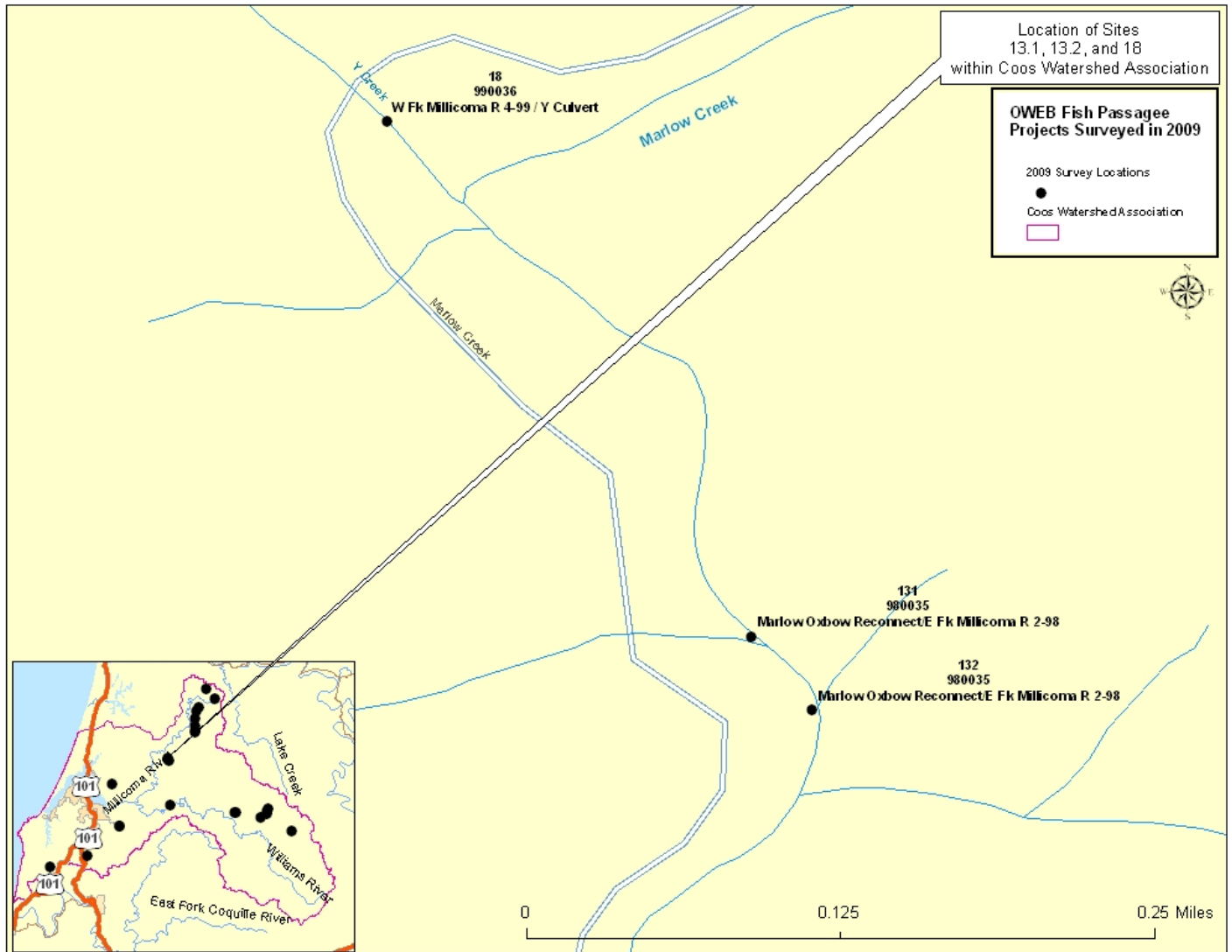
OWEB Project Name - Marlow Oxbow Reconnect/E Fk Millicoma R 2-98

OWEB Grant Number – SC-009

OWRI Project Number – 980035

Owner – State of Oregon, Oregon Department of Forestry

OWEB Description – Fish Passage



Map 45. Site 18, 13.1, and 13.2 within the Coos sub-basin. Site 18, OWEB Project Number 990036(Change to OWEB Grant Number) , is the furthest upstream site of these three crossings. Of these three sites, only Site 18 was snorkeled. This report applies to Site 13.1.

Site Notes

Site 13.1 illustrated elements of both a plane-bed and step/pool type channel. The mean stream gradient within 100 meters upstream and downstream of the culvert was 2.5%. Bankfull width upstream of the culvert was determined to be 8.1 meters. This pipe-arch culvert width was recorded at 3.66 meters and the height was 2.78 meters. The inlet width to channel gradient width was 0.45. There was an outlet drop of 0.30 meters. The outlet pool was forced by the constructed tailwater control. A series of boulders were placed to create the tail-water control (see Photo-series). A series of baffles were also installed within the culvert to increase roughness and reduce velocity (see Site Sketch). Many juvenile Coho and juvenile trout were observed above and below the culvert during the culvert survey.

FishXings predicts that the outfall jump will block juvenile salmon migration. Otherwise, juvenile could pass from the lowest flow to 0.21 cms when the culvert would become a velocity block.

Snorkel Survey Results

Site 18 represents the most upstream crossing along section of surveyed streams. Site 18 snorkel survey results are presented here to illustrate that juvenile fish were observed above the crossing at Site 13.1.

Juvenile fish (3" and less) were observed in all pool habitats snorkeled with 500 feet upstream of the culvert at Site 18. Rainbow and cutthroat are not differentiated because identifying juveniles from those two species is extremely difficult.

Table 72. Snorkel Survey Results for Site 18.

Stream_LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1240094434663	1	Plunge	2	1.1	0.31	Coho	11	Rainbow/Cutthroat	3
1240094434663	2	Straight Scour	5	2	0.36	Coho	31	Rainbow/Cutthroat	17
1240094434663	3	Lateral Scour	2.2	2.1	0.3	Coho	33	Rainbow/Cutthroat	1
1240094434663	4	Plunge	1.7	1.6	0.25	Coho	11		

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 73. Fish Passage Summary., Site 13.1.

Fish Passage Summary	
Low Passage Design Flow	0.0100 cms
High Passage Design Flow	18.4000 cms
Percent of Flows Passable	0.0 %
Passable Flow Range	None
Depth Barrier	None
Outlet Drop Barriers	0.01 to 2.89 cms
Velocity Barrier - V	0.21 cms and Above
Pool Depth Barrier	None

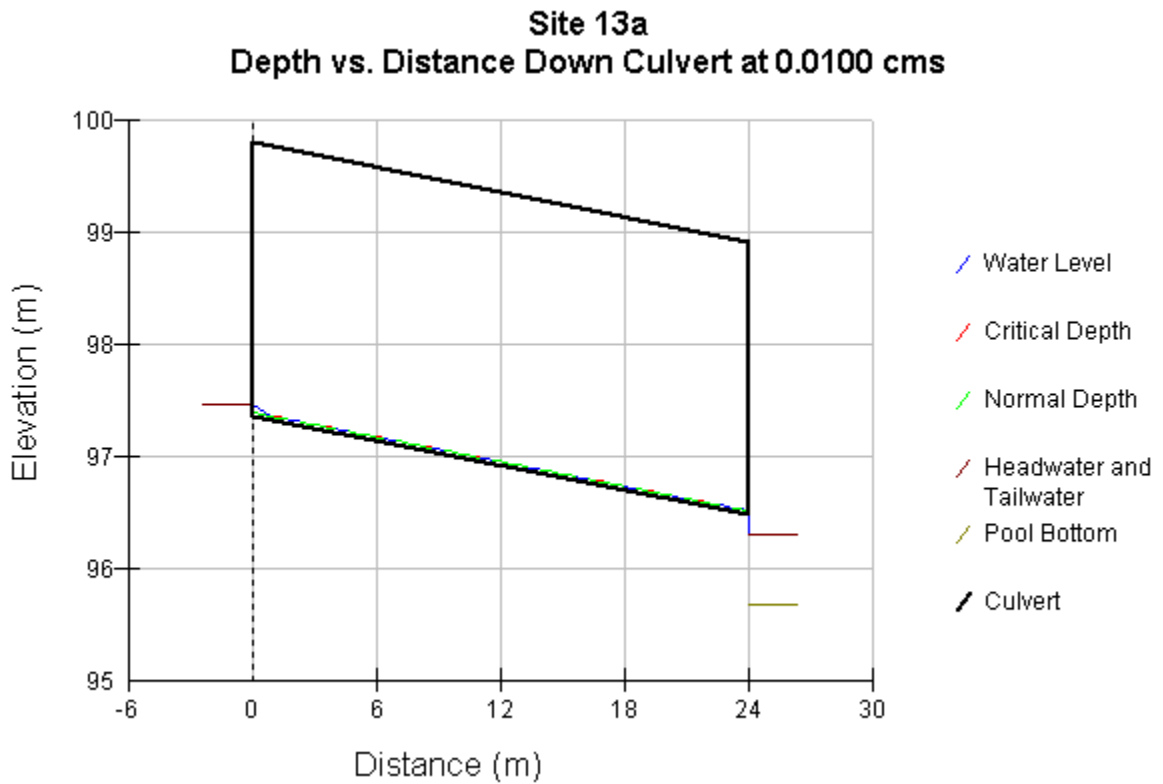


Figure 8180. Water Surface Profile at 0.01 cms, velocity is passable but outfall jump is not.

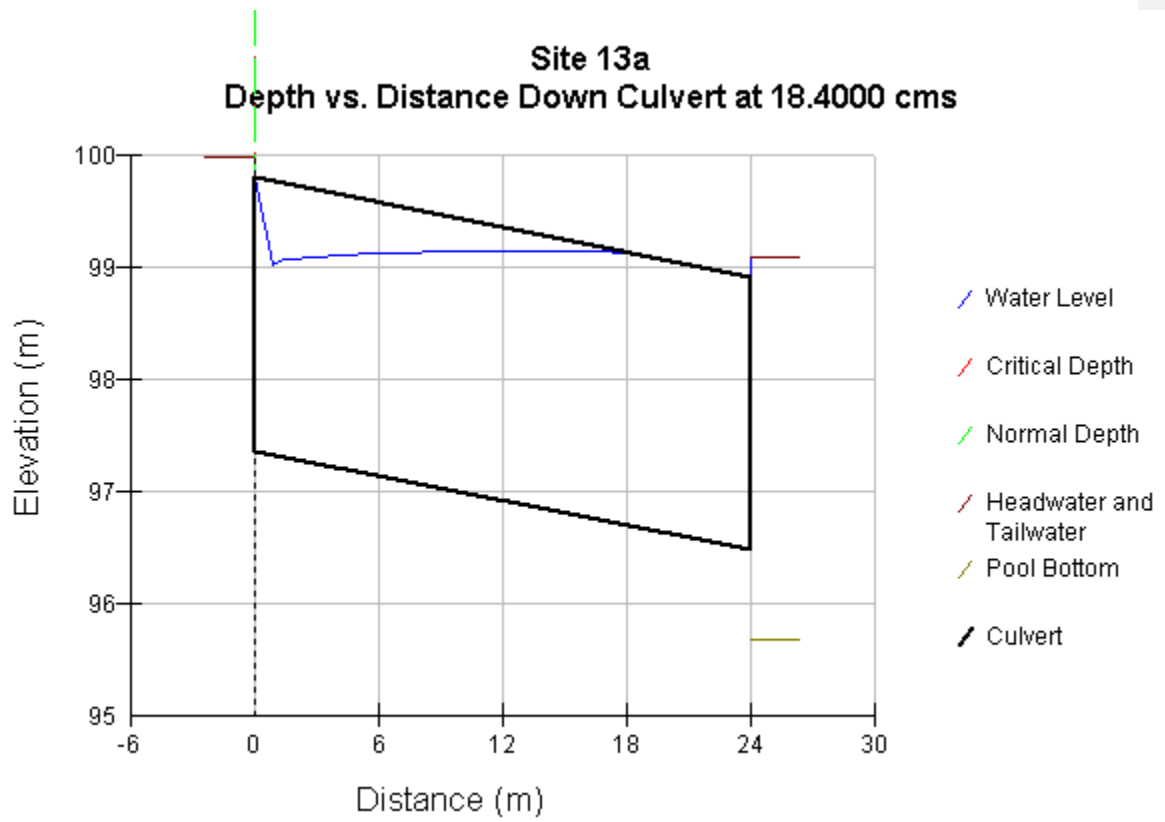


Figure 8281. Water Surface Profile at 18.4 cms, a velocity and outfall jump block.

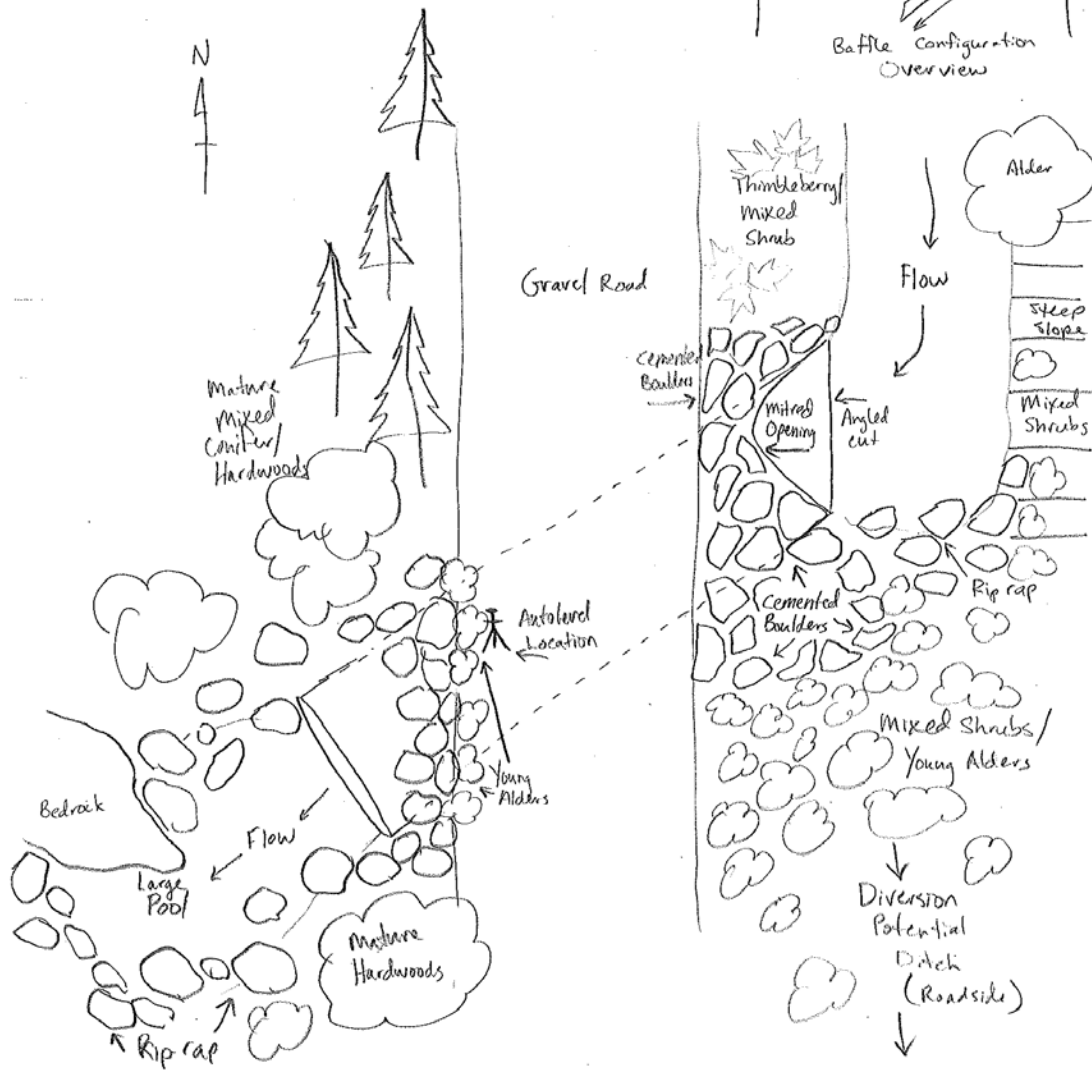
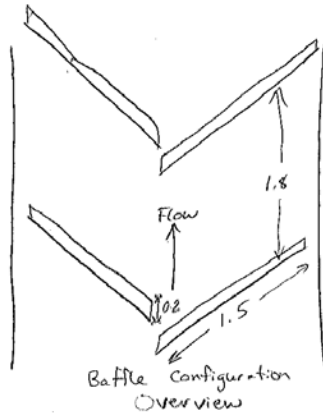
Site Sketch

Crossing ID number 13a

Structure 1 of 1

SITE SKETCH

- include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 132 2009 Restoration Effectiveness Monitoring Summary

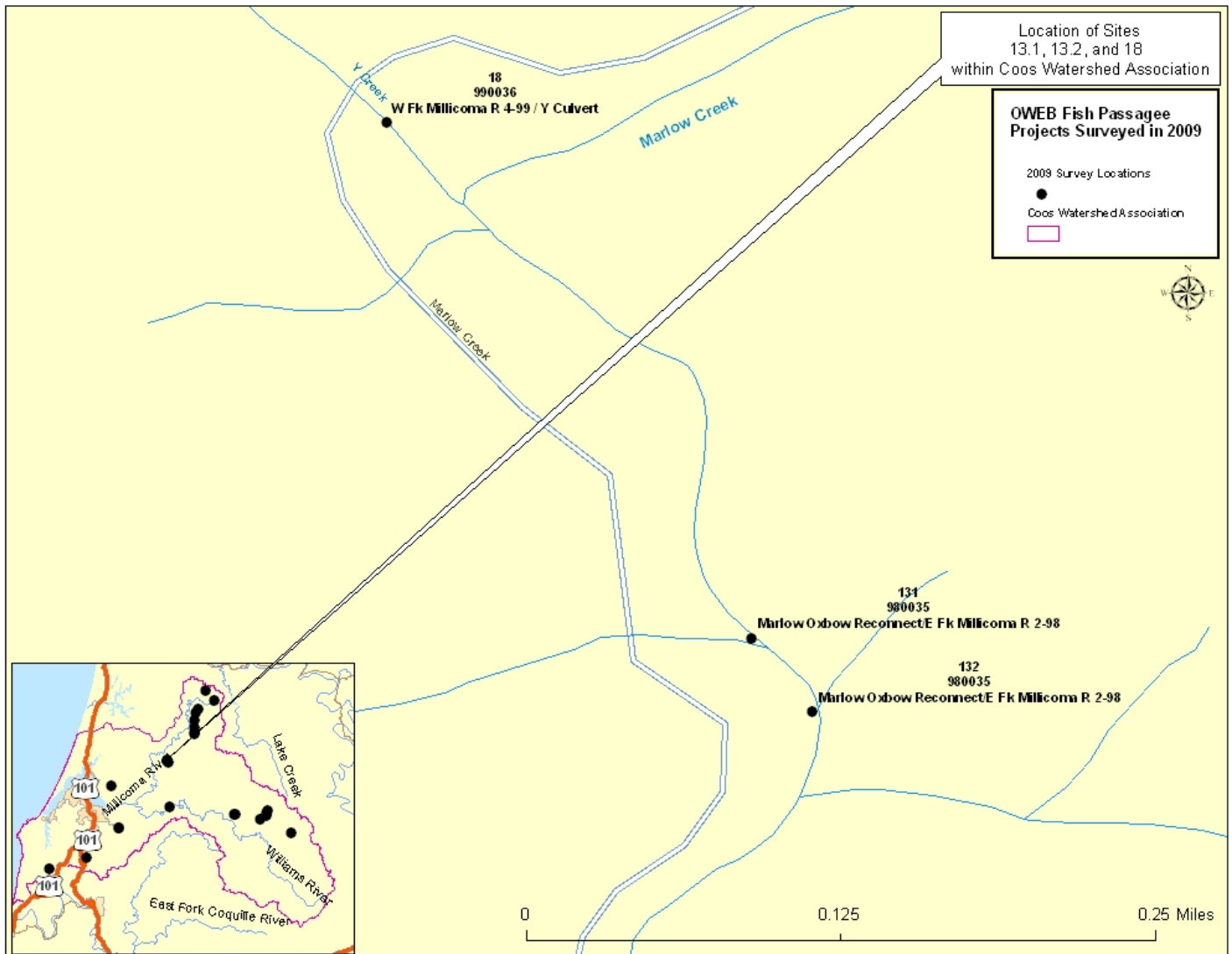
OWEB Project Name - Marlow Oxbow Reconnect/E Fk Millicoma R 2-98

OWEB Grant Number – SC-009

OWRI Project Number – 980035

Owner – State of Oregon, Oregon Department of Forestry

OWEB Description – Fish Passage



Map 46. Site 18, 13.1, and 13.2 within the Coos sub-basin. Site 18, OWEB Project Number 990036 (change to OWEB Grant Number), is the furthest upstream site of these three crossings. Of these three sites, only Site 18 was snorkeled. This report applies to Site 13.1.

Site Notes

Site 13.2 illustrated elements of both a plane-bed and step/pool type channel. The mean stream gradient within 100 meters upstream and downstream of the culvert was 2%. Bankfull width upstream of the culvert was determined to be 5.6 meters. This pipe-arch culvert width was recorded at 3.66 meters and the height was 2.31 meters. The inlet width to channel gradient width was 0.66. There was no outlet drop at time of survey. The deepest point within 1 meter of the outlet was 0.19 meters below the outlet invert. It was not a pool and there was no tail water control, but water depth 1 meter out from the culvert was 0.35 meters (see Photo-series). There were a series of baffles within the culvert that occupied the inlet, barrel, and outlet zones; however, these baffles did not act to accumulate sediment (see Site Sketch). There is a substantial log jam within the culvert at ~ 7 meters downstream from inlet (see Photo-series). The jam was not impeding flow or fish passage, but it may cause problems as more debris backs up behind it which could eventually lead to a wash-out.

This culvert was ~ 100 meters downstream of Site 13a. These culverts were replaced as part of an effort to restore the original channel which had been bypassed by a man-made channel. Although the man-made channel still carries a very small quantity of water, the newly constructed channel acts as the main channel and carries the grand majority of flow. Many juvenile Coho and juvenile trout were observed above and below the culvert during the culvert survey.

FishXings predicts that the outfall at this culvert is a total block to juvenile migration. FishXings also predicts that a velocity block would occur at 0.16cms.

Snorkel Survey Results

Site 18 represents the most upstream crossing along section of surveyed streams. Site 18 snorkel survey results are presented here to illustrate that juvenile fish were observed above the crossing at Site 13.1.

Juvenile fish (3" and less) were observed in all pool habitats snorkeled with 500 feet upstream of the culvert at Site 18. Rainbow and cutthroat are not differentiated because identifying juveniles from those two species is extremely difficult.

Table 74. Snorkel survey results from Site 18.

Stream_LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1240094434663	1	Plunge	2	1.1	0.31	Coho	11	Rainbow/Cutthroat	3
1240094434663	2	Straight Scour	5	2	0.36	Coho	31	Rainbow/Cutthroat	17
1240094434663	3	Plunge	2.2	2.1	0.3	Coho	33	Rainbow/Cutthroat	1
1240094434663	4	Plunge	1.7	1.6	0.25	Coho	11		

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 75. Fish Passage Summary, Site 13.2.

Fish Passage Summary	
Low Passage Design Flow	0.0700 cms
High Passage Design Flow	18.4000 cms
Percent of Flows Passable	0.0 %
Passable Flow Range	None
Depth Barrier	None
Outlet Drop Barriers	0.07 to 0.32 cms
Velocity Barrier - V	0.16 cms and Above
Pool Depth Barrier	None

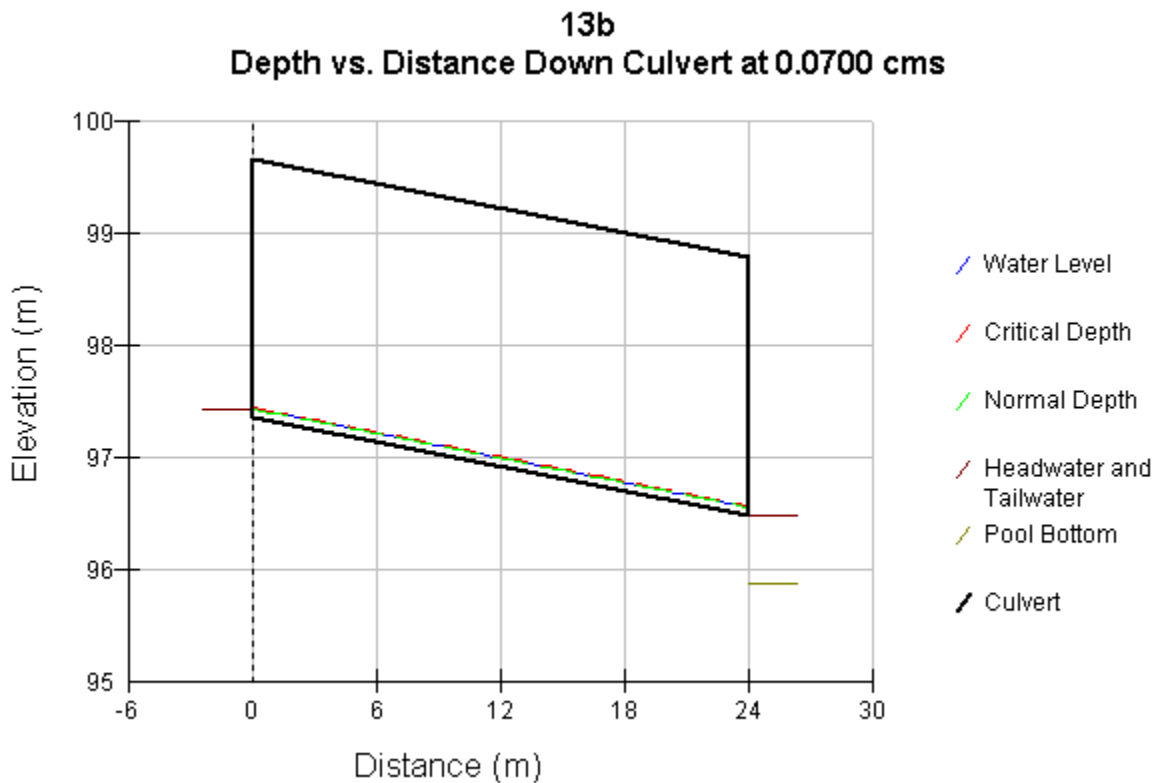


Figure 8382. Water Surface Profile at 0.07 cms, passable velocity.

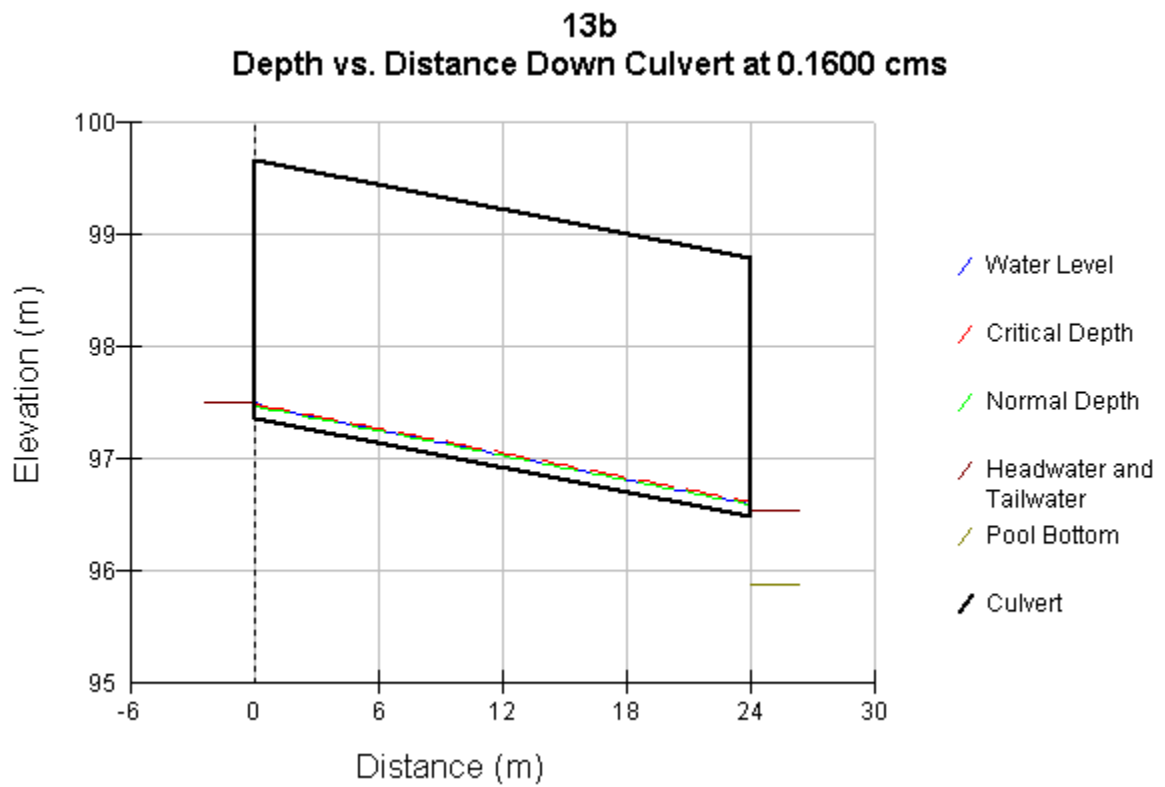


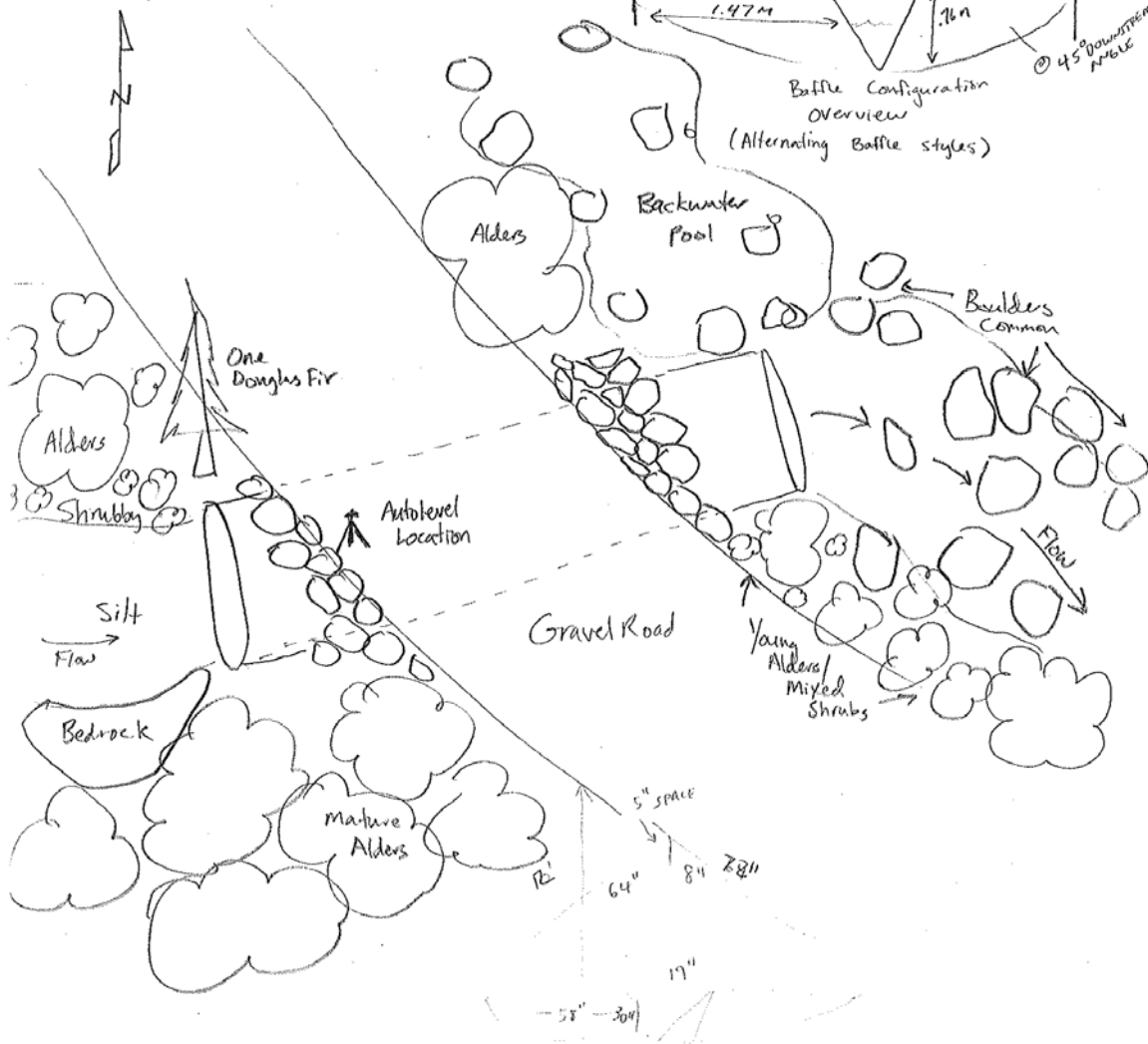
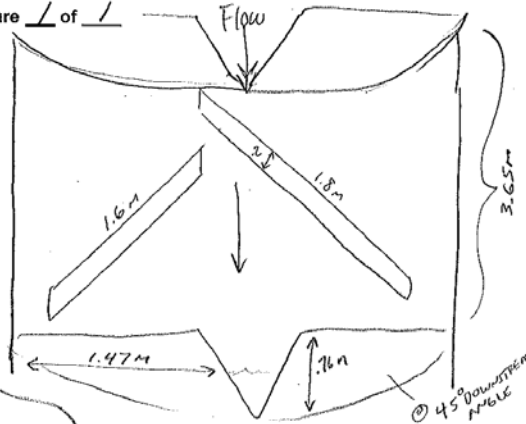
Figure 8483. Water Surface Profile at 0.16 cms, velocity block.

Site Sketch

Crossing ID number 13B Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 43 2009 Restoration Effectiveness Monitoring Summary

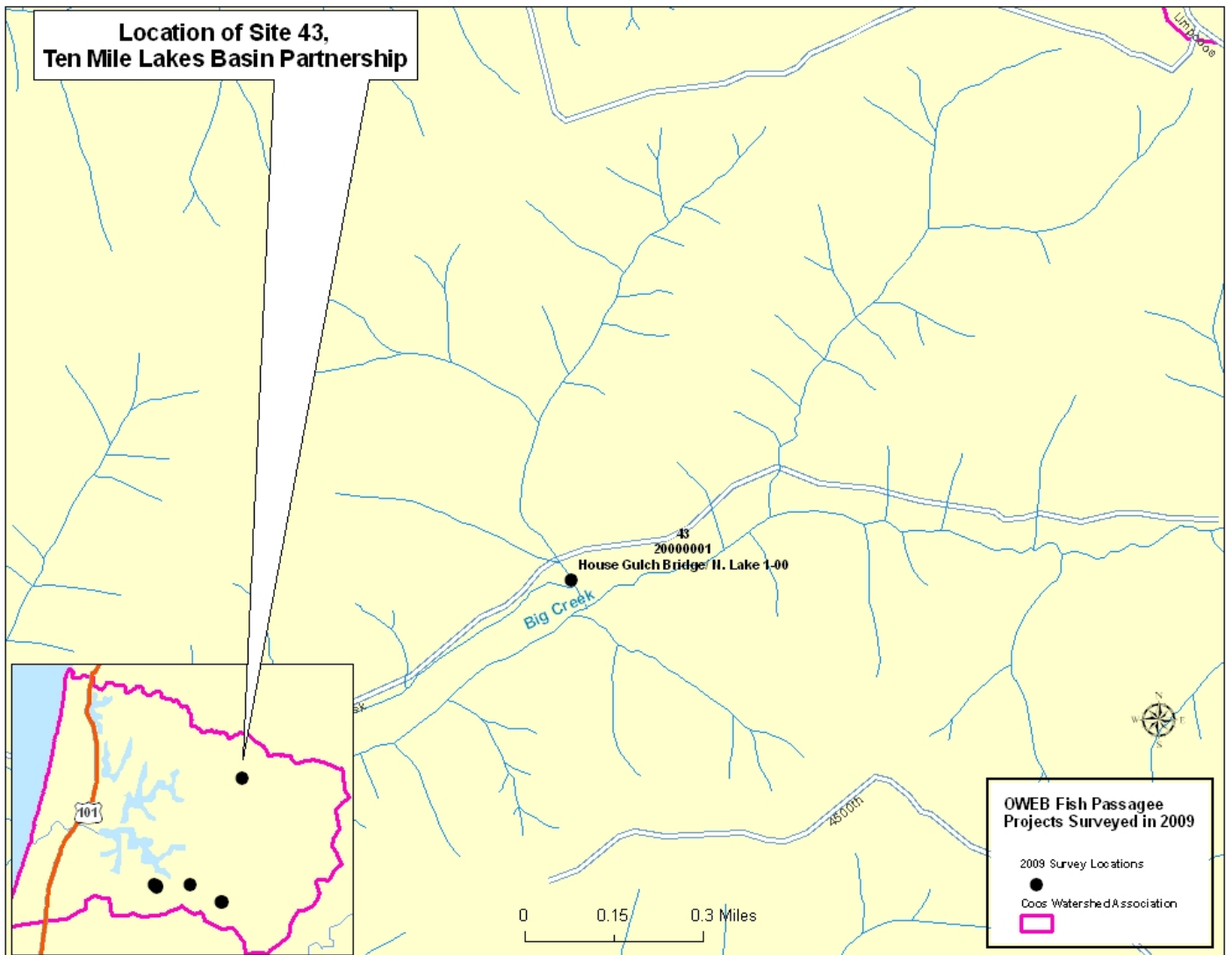
OWEB Project Name - House Gulch Bridge/ N. Lake 1-00

OWEB Grant Number – 099 - 311

OWRI Project Number – 20000001

Owner – Private, Restoration Work

OWEB Description – Fish Passage



Map 4753. Location of Site 43.

Site Notes

This was a 6.3 meter long by 3.7 meter wide pressure-treated bridge that was raised ~ 2.5 meters above the channel. The bridge crossed a moderately incised channel; banks were approximately 2 meters high. Channel cut through a field that was actively grazed. The channel was essentially a long trench pool dominated by silt substrate.

Bankfull width above the crossing was 2.0 meters. This appeared to be a depositional/response reach. Silts accumulated in the stretch under the bridge, but the substrate immediately beneath the bridge was dominated by cobbles that had been placed there.

Riparian vegetation within the fenced area consisted of a dense scirpus/reed canary grass cover with intermittent willows.

Due to heavy silt component of the substrate, visibility was very poor. Snorkeling was nearly impossible: however, we counted at least 50 juvenile Coho in a 0.30 meter deep pool 128 meters above the bridge. At 268 meters above the bridge the creek loses water and becomes puddled.

The longitudinal profile in [Figure 85](#)~~Figure 91~~ illustrates the channel gradient through the project area. This long and deep trench pool had an overall gradient of 2.0%. There was a slight depression at the upper end of the project area followed by a slight increase in elevation. This elevation rise was most likely caused by the collection of rip rap cobbles immediately under the bridge. There is nothing in this longitudinal profile to suggest that juvenile fish cannot swim past the project area.

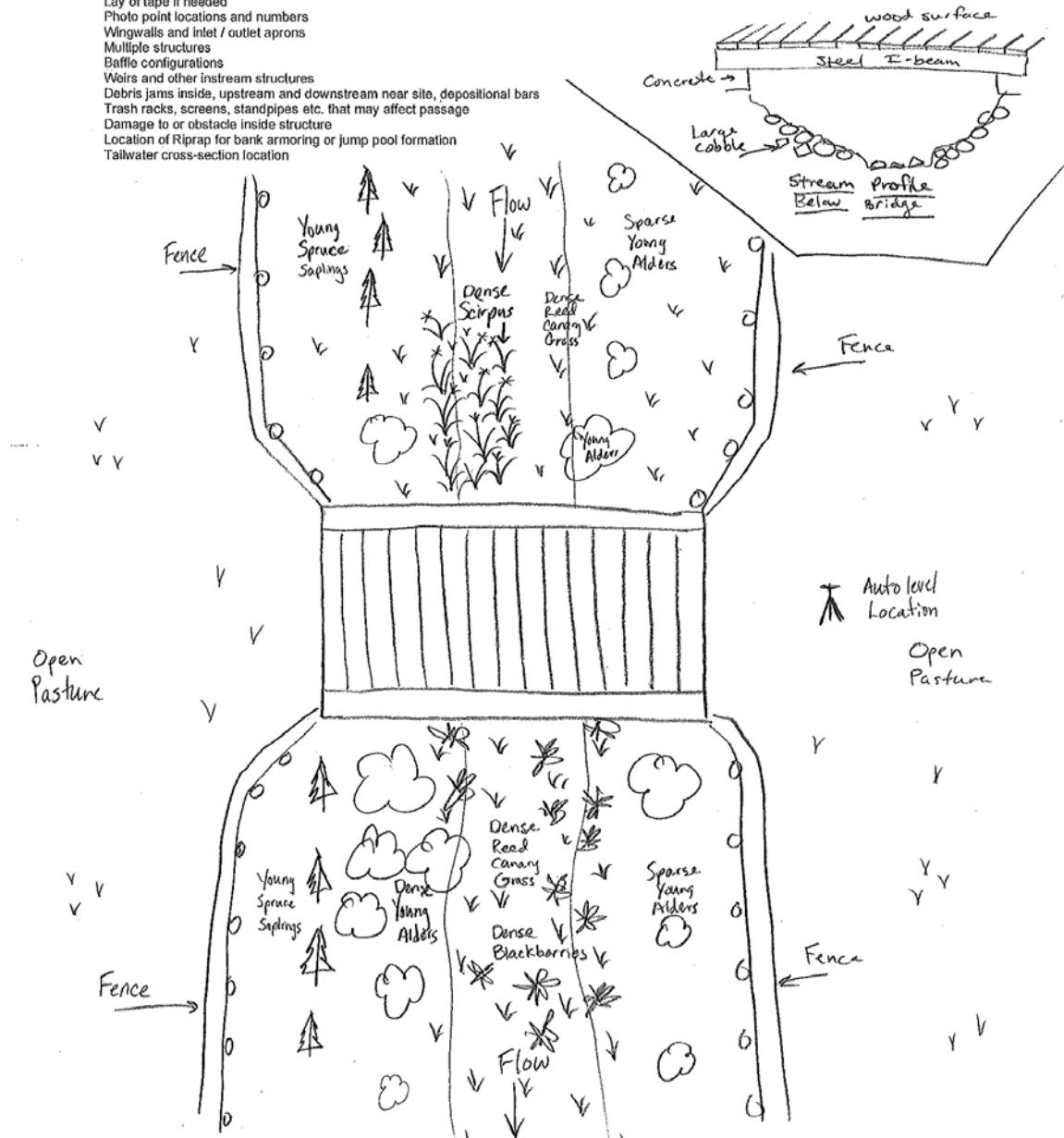
Site Sketch

Crossing ID number 43 Structure 1 of 1

SITE SKETCH

Include:

- North Arrow
- Direction of stream flow
- Culvert/channel alignment
- Lay of tape if needed
- Photo point locations and numbers
- Wingwalls and inlet / outlet aprons
- Multiple structures
- Baffle configurations
- Weirs and other instream structures
- Debris jams inside, upstream and downstream near site, depositional bars
- Trash racks, screens, standpipes etc. that may affect passage
- Damage to or obstacle inside structure
- Location of Riprap for bank armoring or jump pool formation
- Tailwater cross-section location



Longitudinal Profile

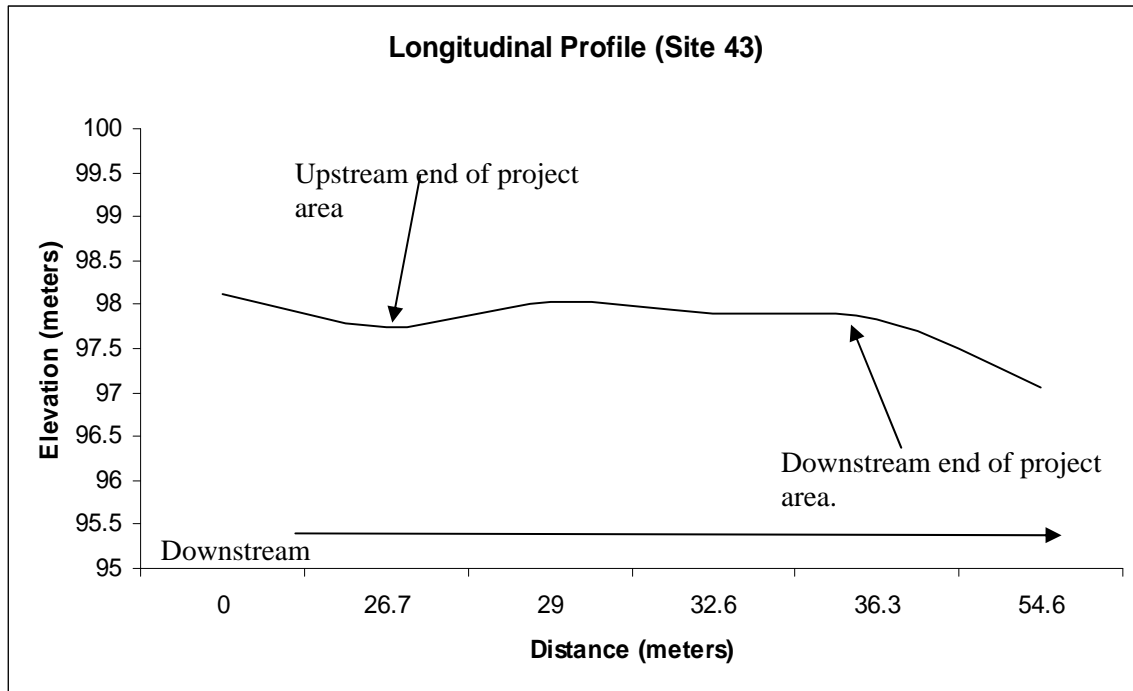


Figure 8584. Longitudinal profile of Site 43; a tributary to Big Creek.

Site # 44 2009 Restoration Effectiveness Monitoring Summary

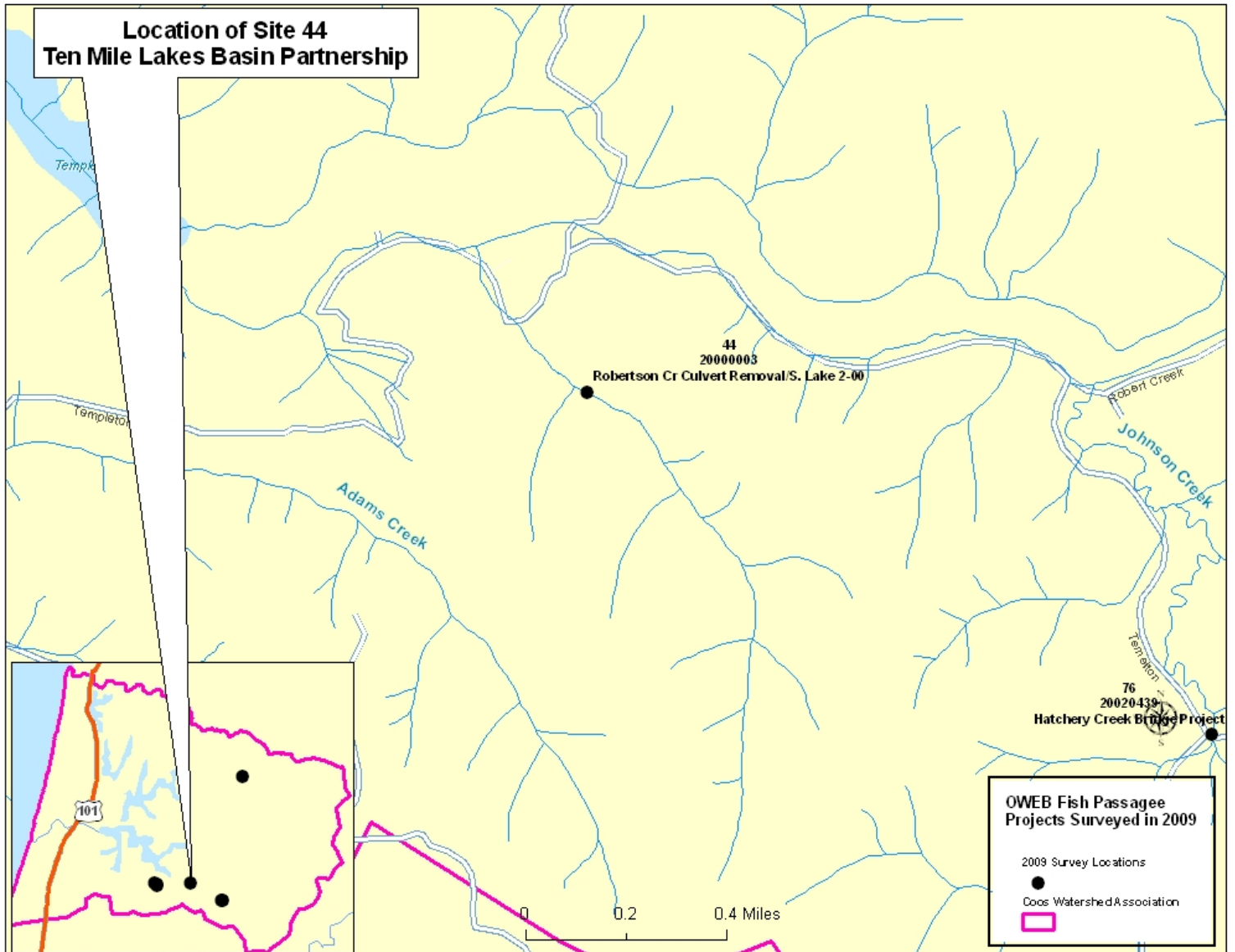
OWEB Project Name - Robertson Cr Culvert Removal/S. Lake 2-00

OWEB Grant Number – 099 - 311

OWRI Project Number – 20000003

Owner – Private, Restoration Work Overseen by Ten Mile Lakes Basin Partnership

OWEB Description – Fish Passage



Map 4854. Location of Site 44 on Robertson Creek.

Site Notes

This site was a bridge crossing made of wood decking supported by pressure treated round poles. The creek was fenced off with tall barbed wire fence. The creek had a dense cover of ~10 year old alder that completely covered the creek and provided excellent shade. Creek banks were vegetated and stable; vegetation component consisted of bulrush and reed canary grass.

The creek runs along the toe-slope which indicates that at one time it was dredged and forced into its current channel. This was likely done to prevent meandering through adjacent fields. The end result of this dredging was a deep incised trench pool system that appeared to be one long glide.

The longitudinal profile ([Figure 86](#)~~Figure-93~~) illustrates the slope of the channel through the project area. A slight depression was noted immediately under the bridge. Overall, the channel gradient within the project area was 0.8% and the bankfull width averaged 2.3 meters. Substrate was composed of gravel/sand/silts throughout the study reach.

Juvenile fish were seen throughout the study area. The slope of the channel through the project area would not impair juvenile salmonid migration.

Only 3 pools were snorkeled (Table 76) because the channel went dry within 150 meters of the bridge; however, relatively high numbers of juvenile salmonids were found in the pools that were snorkeled.

Snorkeling Survey Results

Table 76. Snorkel survey results for Site 44.

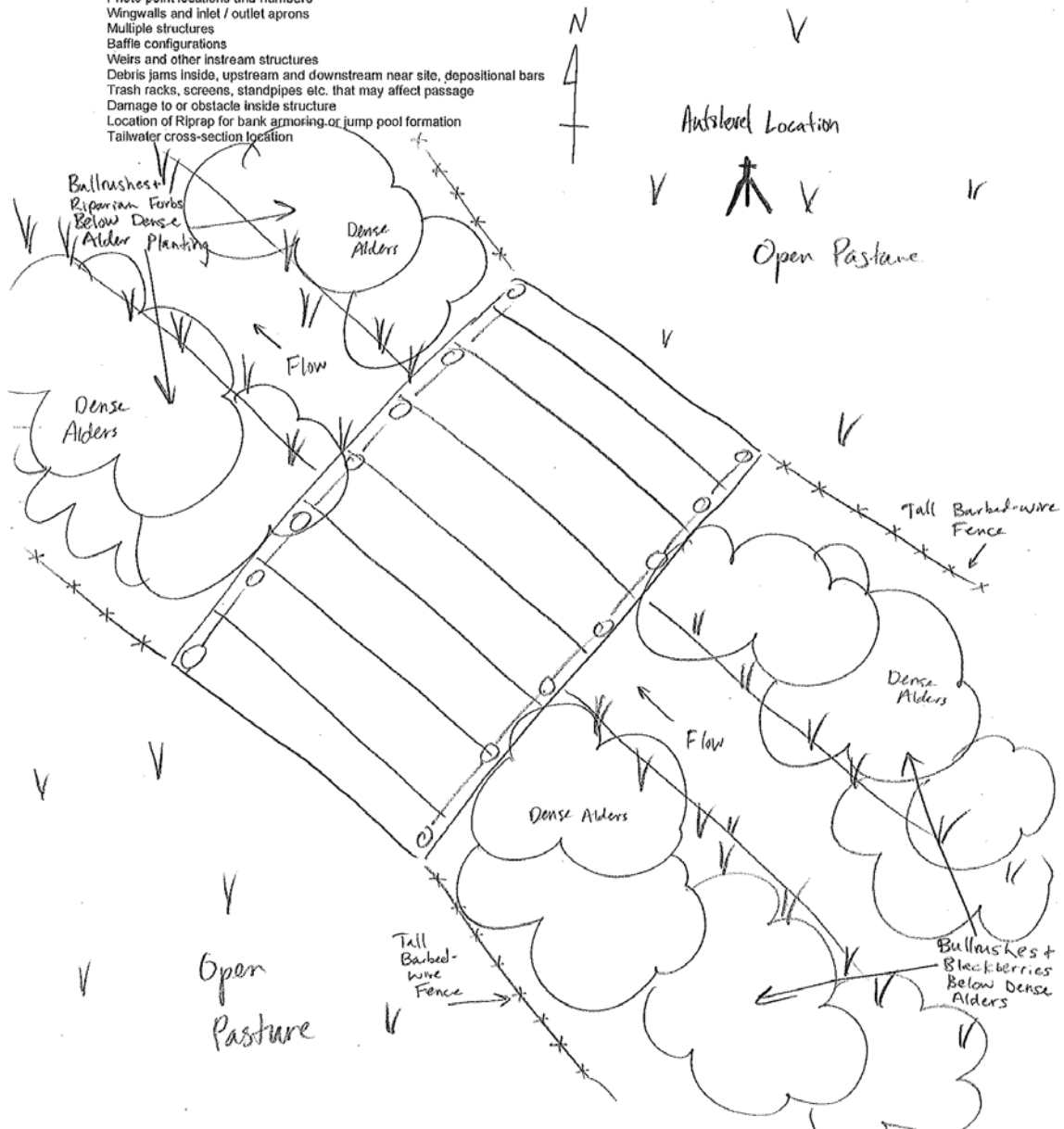
Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1241025435455	1	Straight Scour	4.3	1.4	0.45	Coho	35	Steelhead/Cutthroat	3
1241025435455	2	Straight Scour	5	1.4	0.35	Coho	31	Steelhead/Cutthroat	2
1241025435455	3	Plunge	5.7	4.2	0.38	Coho	19	0	0

Site Sketch

Crossing ID number 44 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Longitudinal Profile

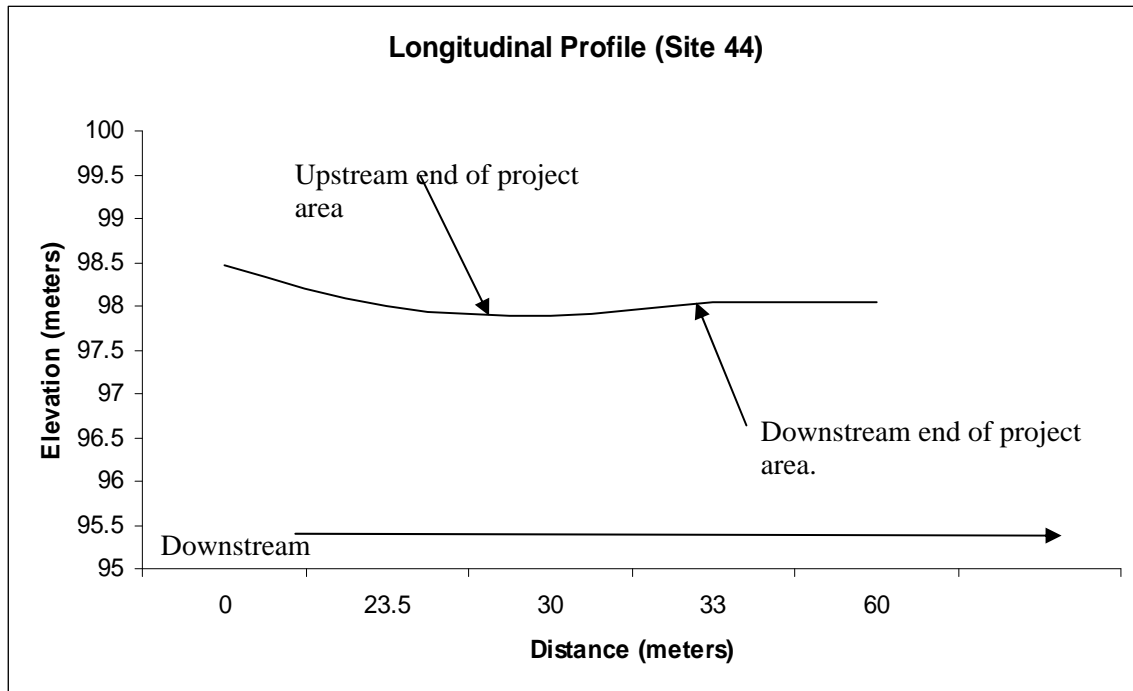


Figure 8685. Longitudinal profile of Site 44.

Site # 45 2009 Restoration Effectiveness Monitoring Summary

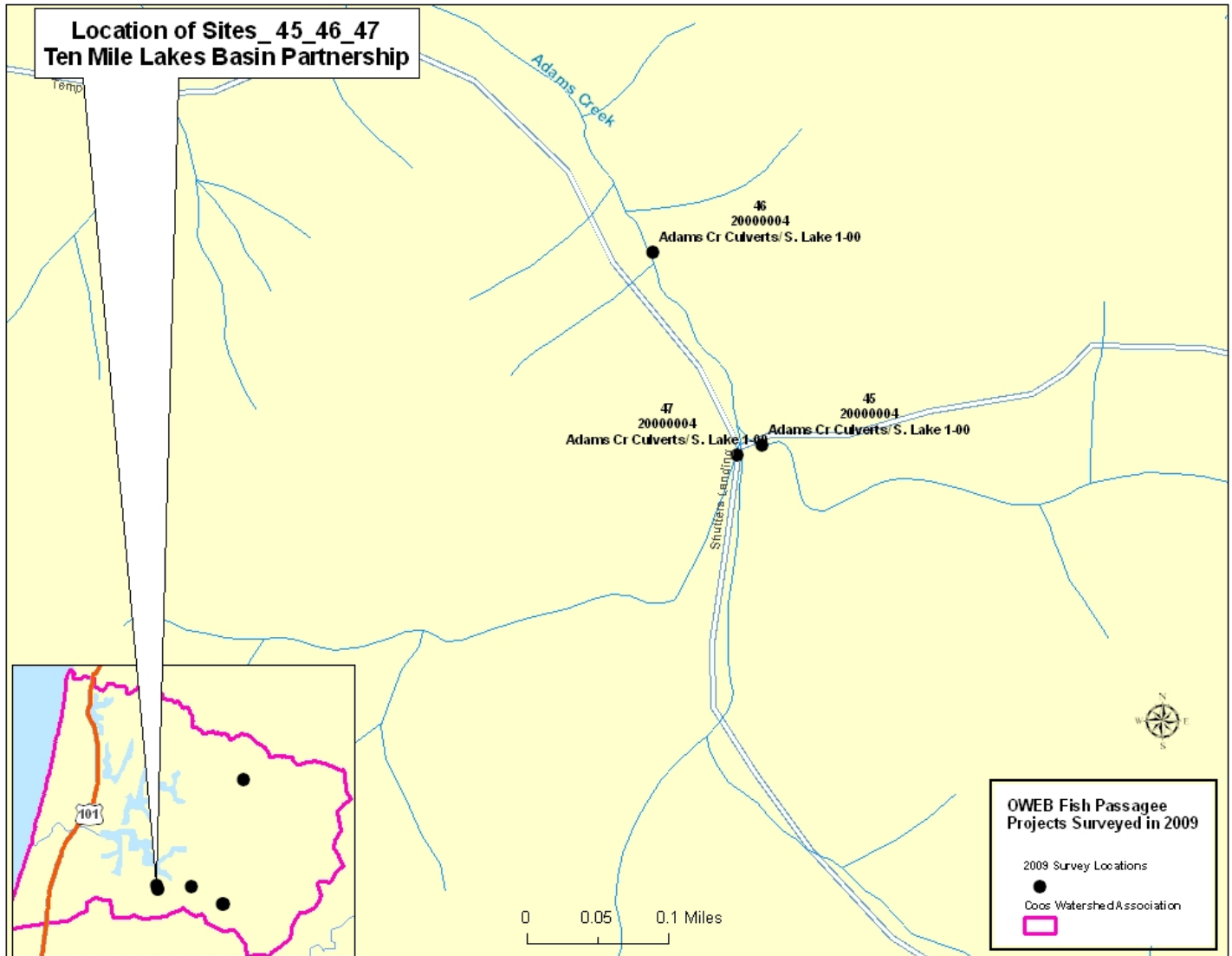
OWEB Project Name - Adams Cr Culverts/ S. Lake 1-00

OWEB Grant Number – 099 - 310

OWRI Project Number – 20000004

Owner – Private, Restoration Work Overseen by Ten Mile Lakes Basin Partnership

OWEB Description – Fish Passage



Map 4955. Location of Site 45 on Adam Creek.

Site Notes

This crossing in the Adams Creek drainage was a 1.6 meter wide by 1.2 meter tall pipe-arch. It was very difficult to get the size and determine the culvert type because of the depth of sediment and water in the culvert. The culvert was filled with at least 0.2 meters of silt. Average bankfull width above the culvert was 4.0 meters and the ratio of inlet width to channel width was 0.4. The channel gradient was 2.4% and the culvert gradient was 1.2%. There was a deep pool at the outlet (residual depth of 0.91 meters), but there was no outlet drop.

Generally speaking the channel was filled with slack water about 1 meter deep. There was a dense infestation of reed canary grass with blackberries and alder also present. There was a beaver dam 11.2 meters downstream of culvert; the dam was 0.8 meters tall and it was composed of small sticks, reed canary grass, and mud.

The snorkel survey found that juvenile Coho were present in every pool with 130 meters above the culvert ([Table 77](#)~~Table 81~~).

FishXings predicts that 14.2% of modeled flows would be passable by juvenile salmonids with a velocity barrier expected at 0.28 cms.

Snorkel Survey

Table 77. Snorkel survey results for Site 45 along the Adams Creek drainage.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1241631435695	1	Trench	12	1.4	0.8	Coho	9
1241631435695	2	Glide	0	0	0	Coho	9
1241631435695	3	Trench	3.9	1.5	0.33	Coho	6
1241631435695	4	Trench	6.5	1.7	0.39	Coho	14
1241631435695	5	Trench	9	1.4	0.37	Coho	2

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 78. Fish Passage Summary, Site 45..

Fish Passage Summary	
Low Passage Design Flow	0.0040 cms
High Passage Design Flow	1.9800 cms
Percent of Flows Passable	14.2 %
Passable Flow Range	0.0040 to 0.2839 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.28 cms and Above
Pool Depth Barrier	None

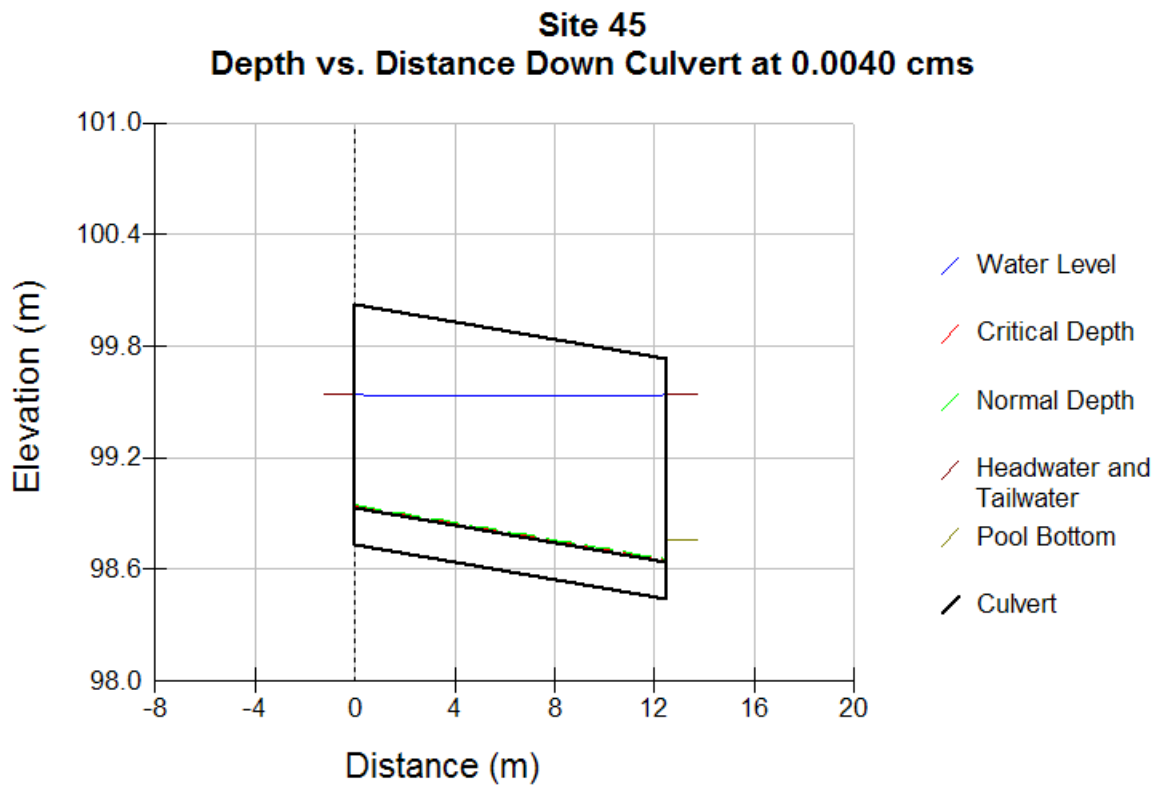


Figure 8786. Water Surface Profile at 0.004 cms, passable flow.

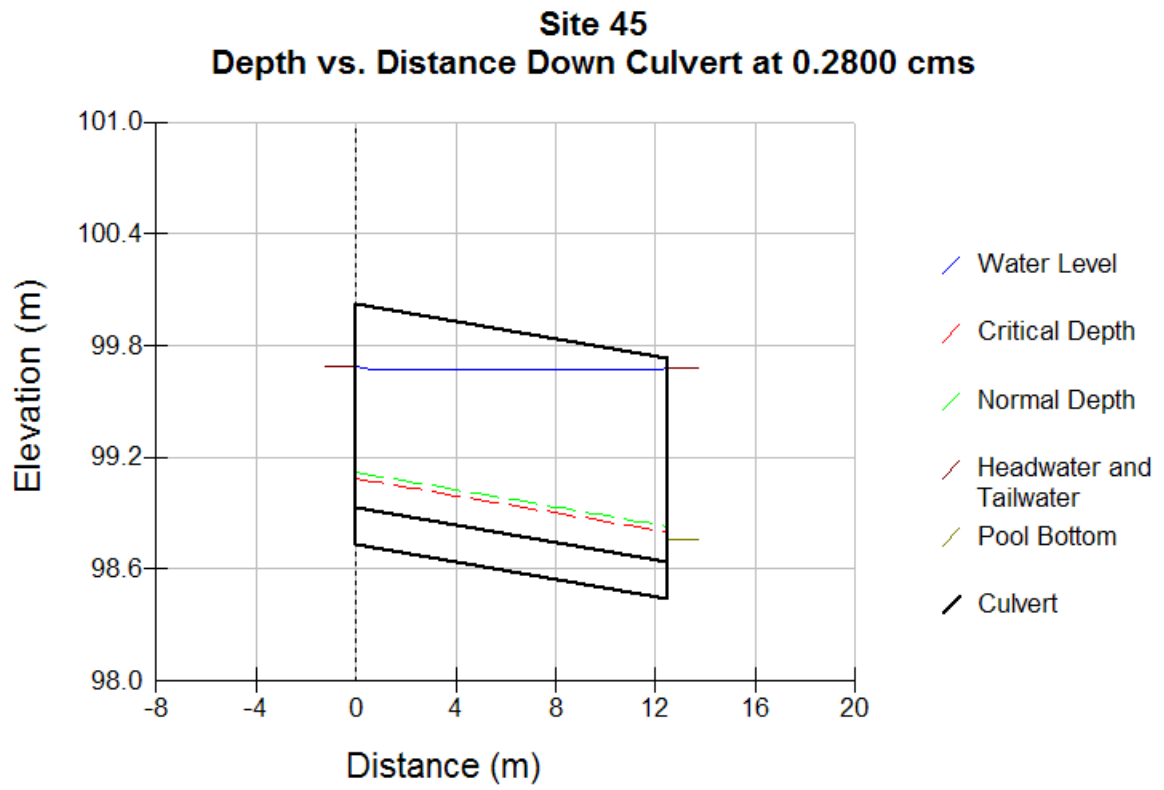


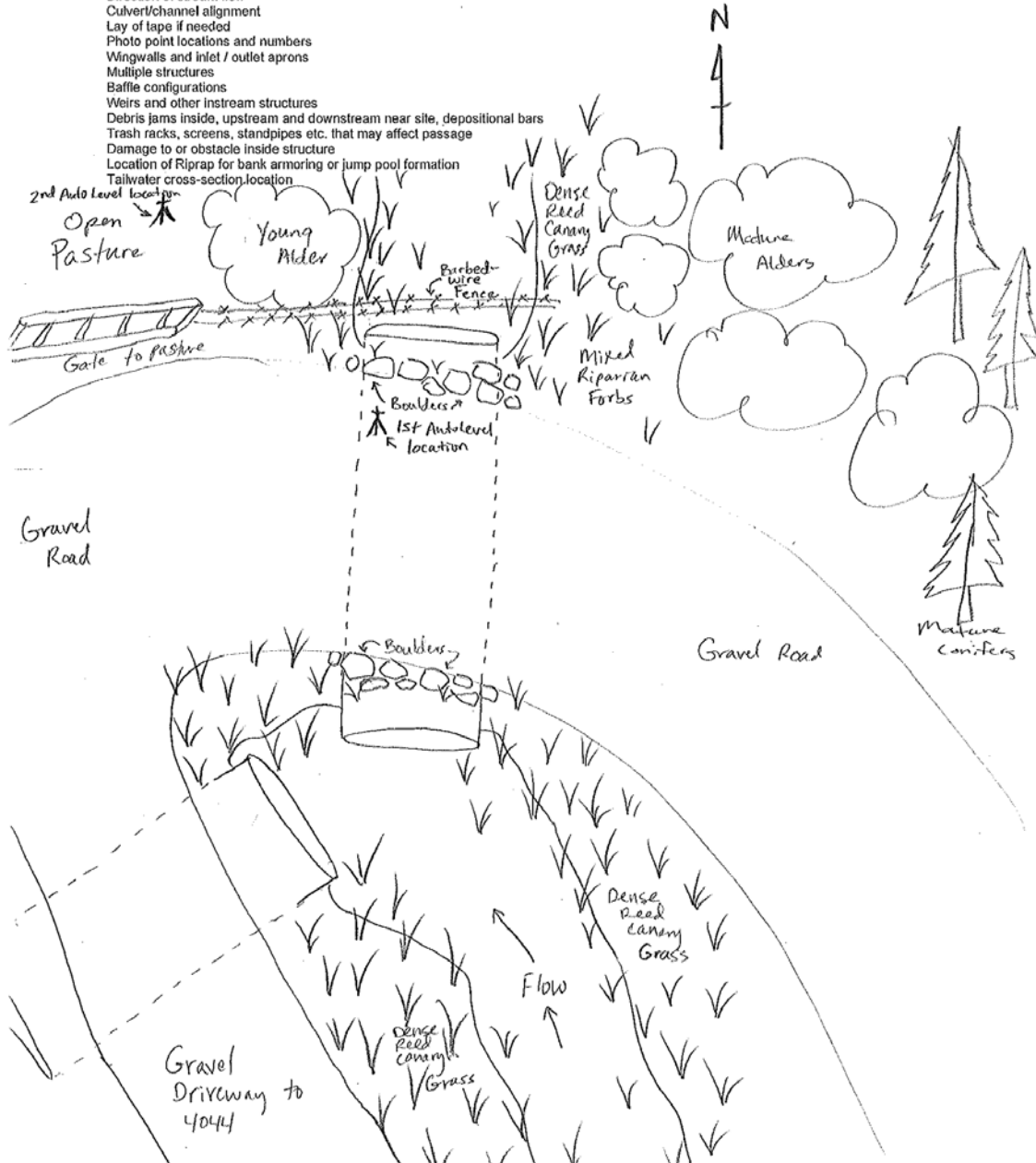
Figure 8887. Water Surface Profile at 0.28 cms, velocity block.

Site Sketch

Crossing ID number 2000004 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 46 2009 Restoration Effectiveness Monitoring Summary

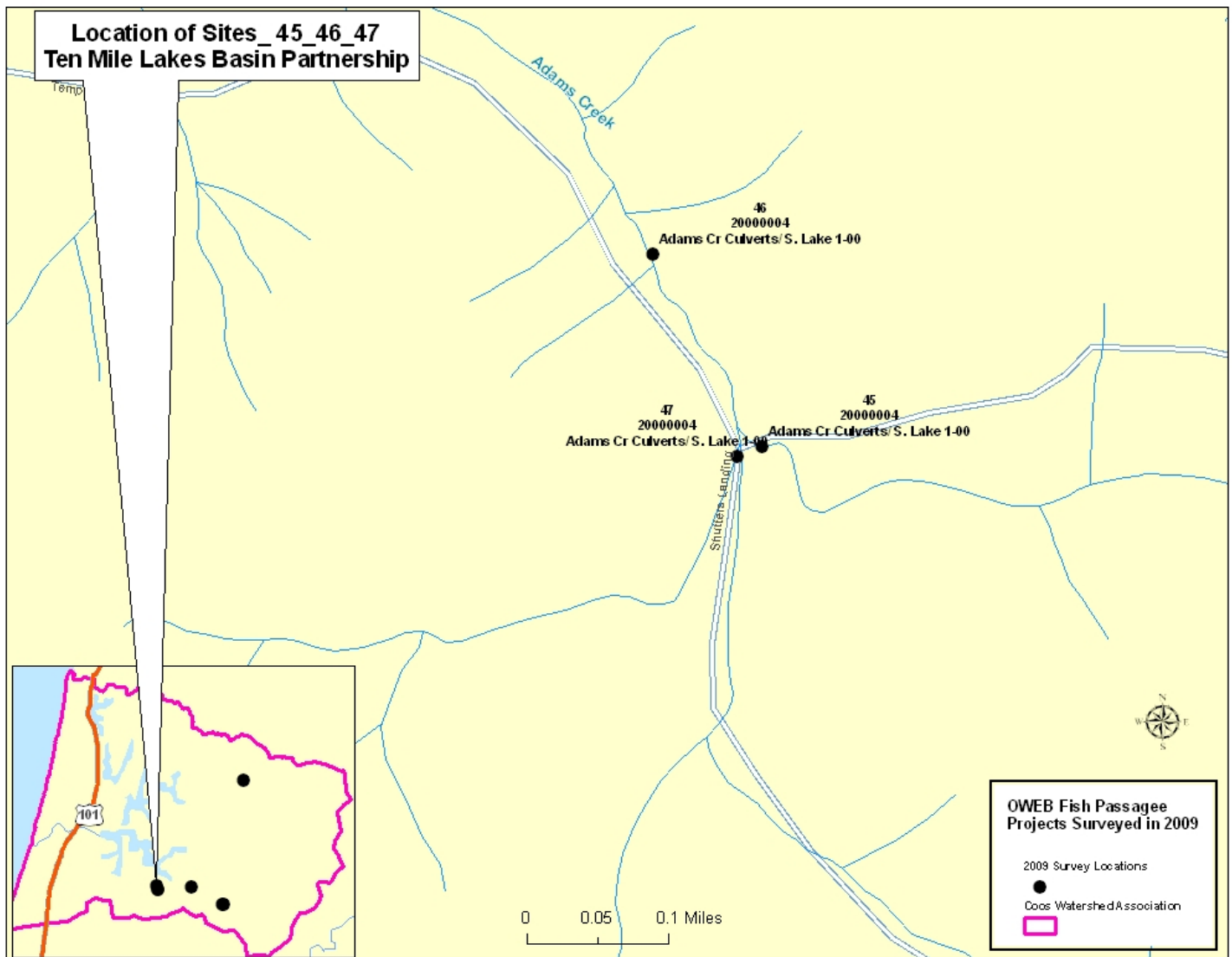
OWEB Project Name - Adams Cr Culverts/ S. Lake 1-00

OWEB Grant Number – 099 - 310

OWRI Project Number – 20000004

Owner – Private, Restoration Work

OWEB Description – Fish Passage



Map 5056. Location of Site 46 along Adams Creek.

Site Notes

The OWEB provided coordinates for this culvert took us to a small ephemeral stream. According to staff at the Ten Mile Lakes Basin Partnership, the OWEB location has never supported fish. We were able to identify this crossing nearby which is on Adams Creek, a fish bearing stream.

This site is a channelized ditch with undefined banks and no pools or tail water control in the vicinity of the culvert. Little water was found in channel with the exception of some standing water and puddles downstream of culvert and a 70 meter trench pool upstream of culvert. Upstream of the trench pool the channel was totally dry for at least 250 meters. There was also a lack of definable bank full indicators due to the fact the channel was filled in by sediment. When water flows through this site, it certainly overtops the culvert and floods a wider area. The entire valley here once functioned as a floodplain which supported a meandering channel. Now it is a highly constrained “ditch”.

The circular culvert was 0.9 meters in diameter. The channel gradient in the vicinity of the culvert was 1.2%, while the culvert slope was 3.9%. Silt covered the entire culvert length as was estimated to be 0.2 meters in depth. Standing water also filled the culvert. Although bankfull were lacking, we were able to estimate bankfull by assuming the width of the channel (ditch). Channel width was 1.1 meters resulting in a ratio of inlet width to channel width of 0.82.

Snorkeling was impossible due to intense silt and a general lack of water. We did see juvenile salmonids from the bank in the long trench pool upstream of the culvert. This channel is connected to and downstream of Sites 45 and 47 where juvenile salmonids were observed.

FishXings predicts that only 41.2% of flows will be passable by juveniles with a velocity barrier forming at 0.83 cms. This result makes sense because at that rate of discharge the culvert would be overtopped by fast moving water.

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = .03 m

Maximum Allowed Outlet Drop = .1 m

Table 79. Fish Passage Summary, Site 46.

Fish Passage Summary	
Low Passage Design Flow	0.0040 cms
High Passage Design Flow	2.0000 cms
Percent of Flows Passable	41.2 %
Passable Flow Range	0.0040 to 0.8255 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.83 cms and Above
Pool Depth Barrier	None

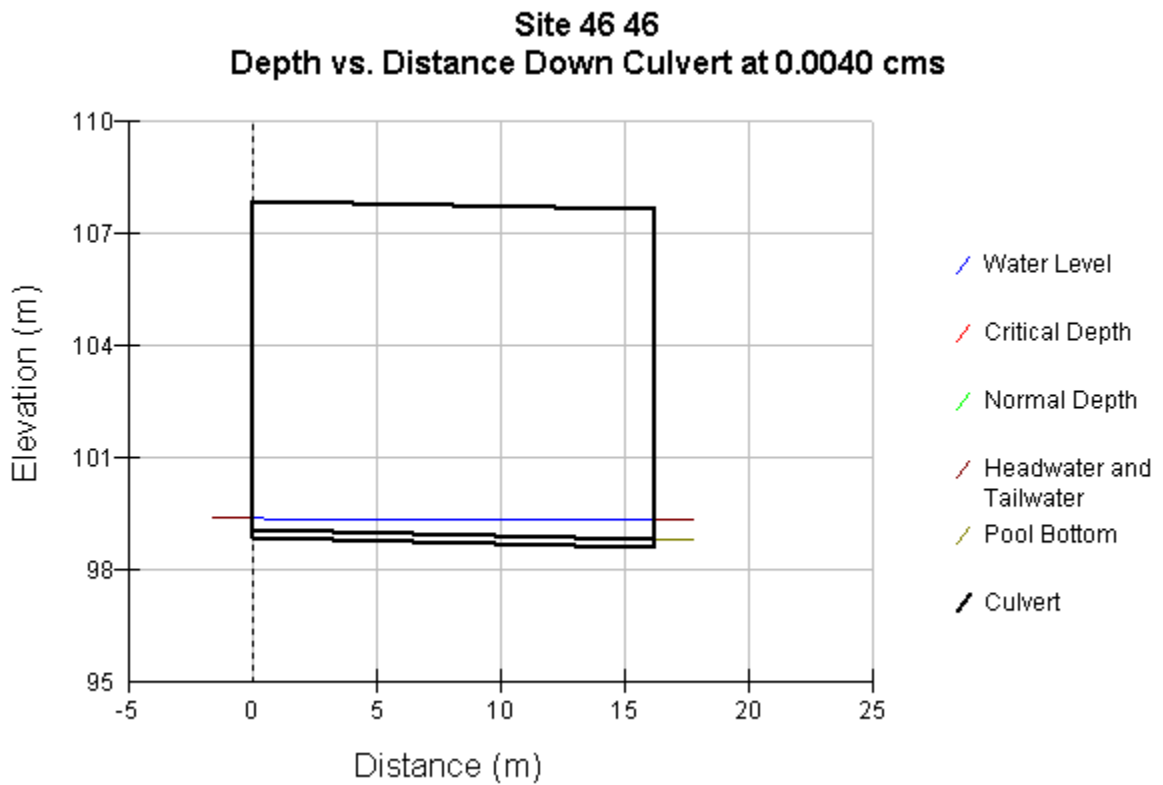
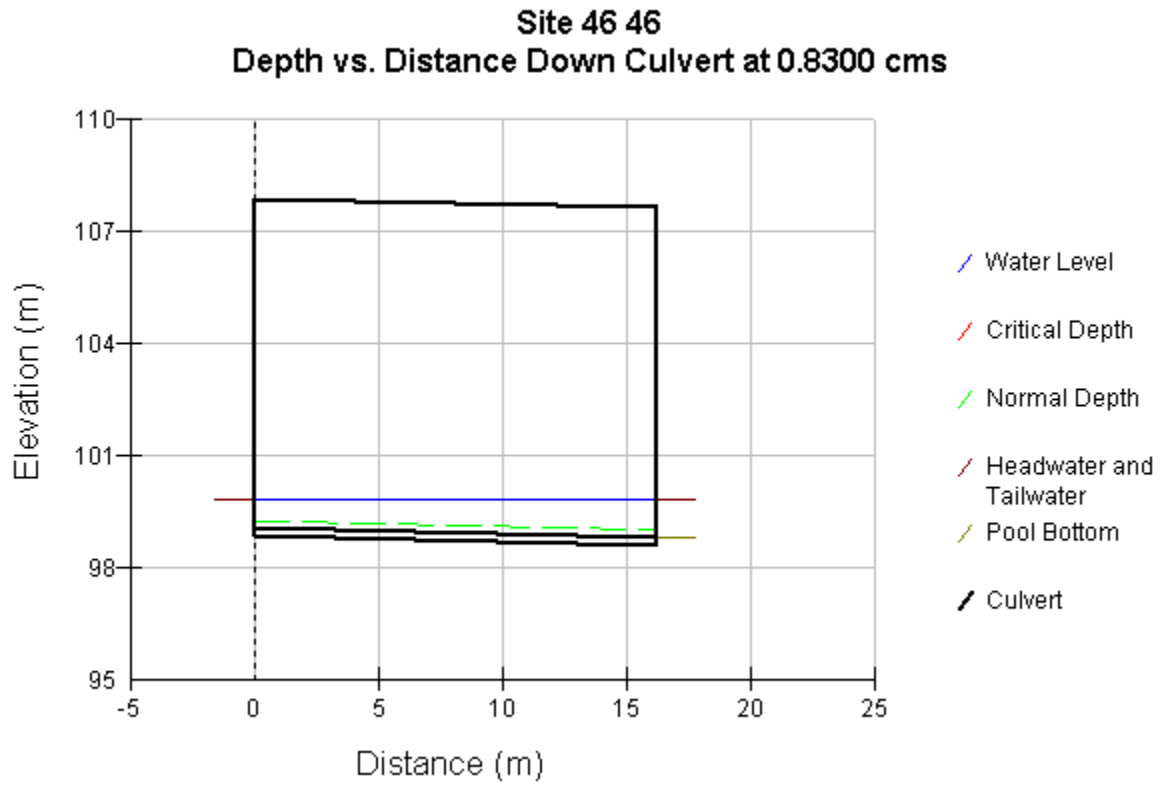


Figure 8988. Water Surface Profile at 0.004 cms, passable flow.



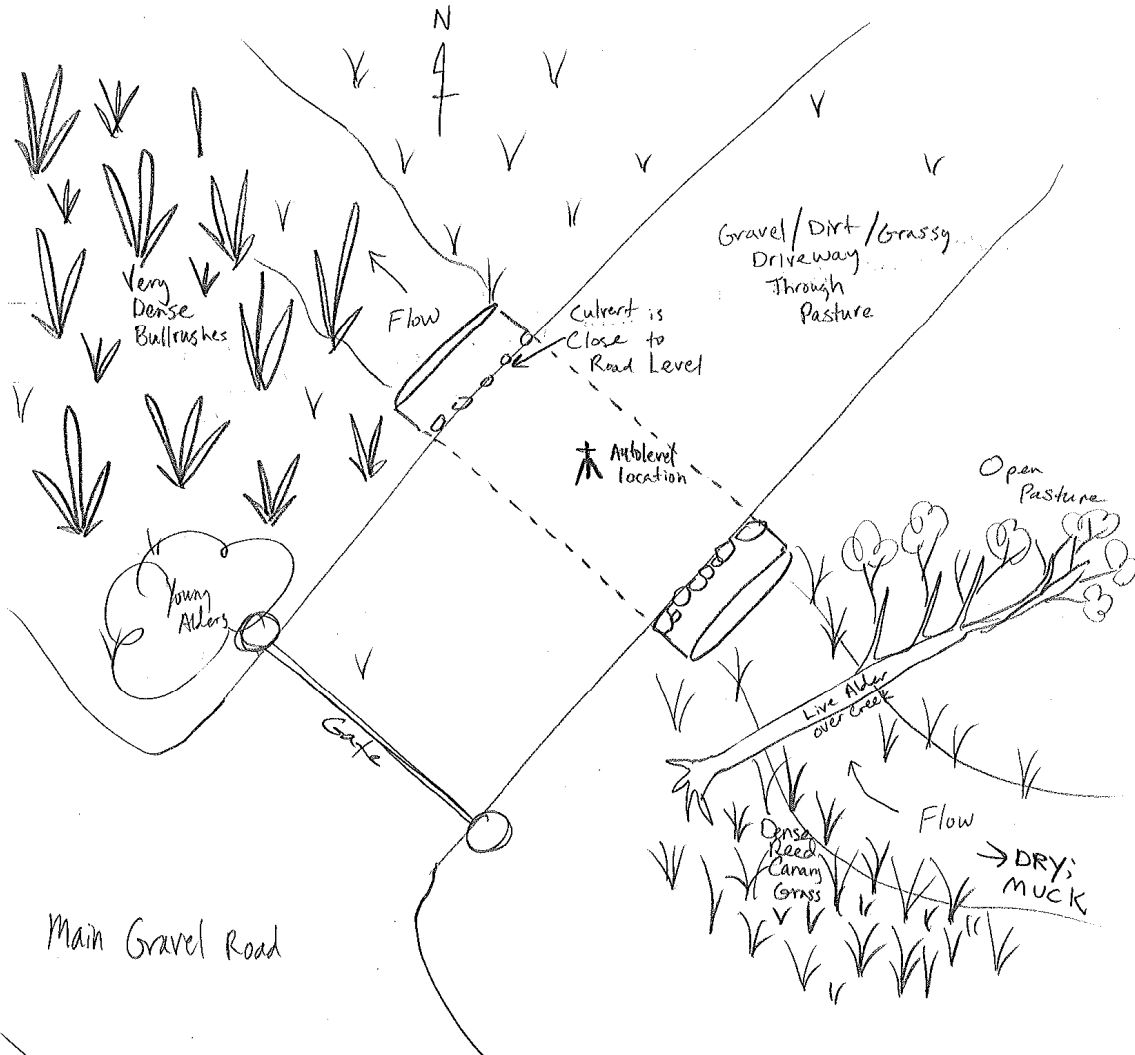
| Figure 9089. Water Surface Profile at 0.83 cms, velocity barrier.

Site Sketch

#3^d Crossing ID number 46/200004 Structure 1 of 1

SITE SKETCH

- include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 47 2009 Restoration Effectiveness Monitoring Summary

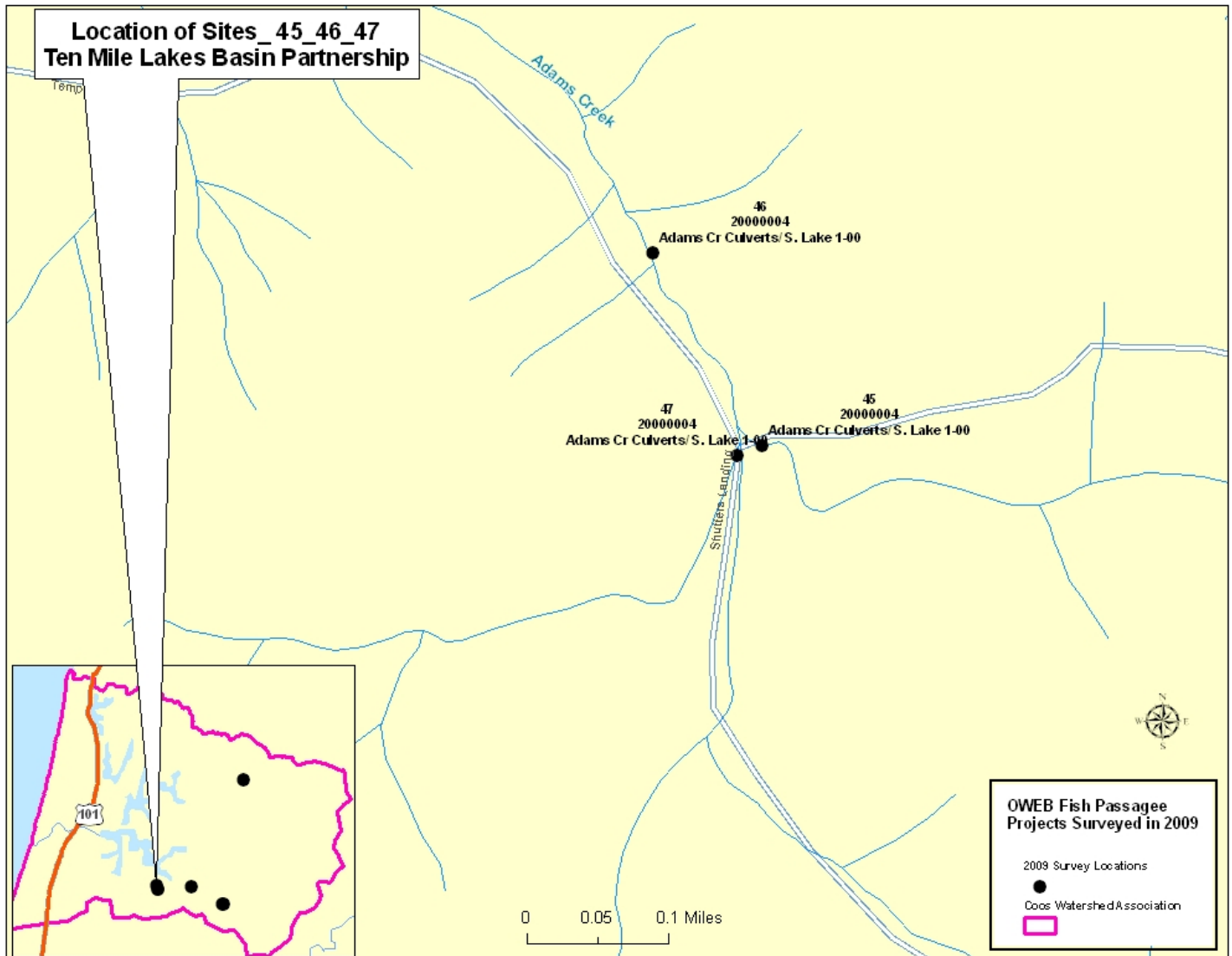
OWEB Project Name - Adams Cr Culverts/ S. Lake 1-00

OWEB Grant Number – 099 - 310

OWRI Project Number – 20000004

Owner – Private, Restoration Work

OWEB Description – Fish Passage



Site Notes

This site is one of three sites along Adams Creek. The crossing is a culvert (difficult to tell shape) that was filled with water. The culvert was approximately 1/3 full of silt. We tried to dig the sediment out to get an accurate measurement, but it continued to fill as we dug. We decided to rate the culvert as a circular 1.5 meter diameter culvert. Bankfull width at the site was determined to be 2.5 meters, and the ratio of inlet width to channel width was 0.6. The overall channel gradient at the site was 1.8%, and the culvert slope was 1.4%.

There was a dense mixture of reed canary grass and bull rushes and some young alders in the riparian community. No beaver activity in immediate survey area, but beaver sign was found nearby.

Snorkeling this site was extremely difficult because of the silted substrate and the intense blackberry. Visibility was poor. However, we were able to snorkel two trench pools (Table 80) and found 10 juvenile Cohos. We believe this to be an underestimate.

FishXings predicts that 37.8% of all modeled flows will be passable at this culvert by juveniles. Velocity blocks are predicted to occur at 0.75 cms.

Snorkel Survey Results

Table 80. Snorkel survey results for Site 47.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
12412544353394	1	4	35	2.5	1.1	Coho	5
12412544353394	2	4	30	2	0.5	Coho	5

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 81. Fish Passage Summary, Site 47.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	1.9800 cms
Percent of Flows Passable	12.4%
Passable Flow Range	0.0010 to 0.2472 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.25 cms and Above
Pool Depth Barrier	None

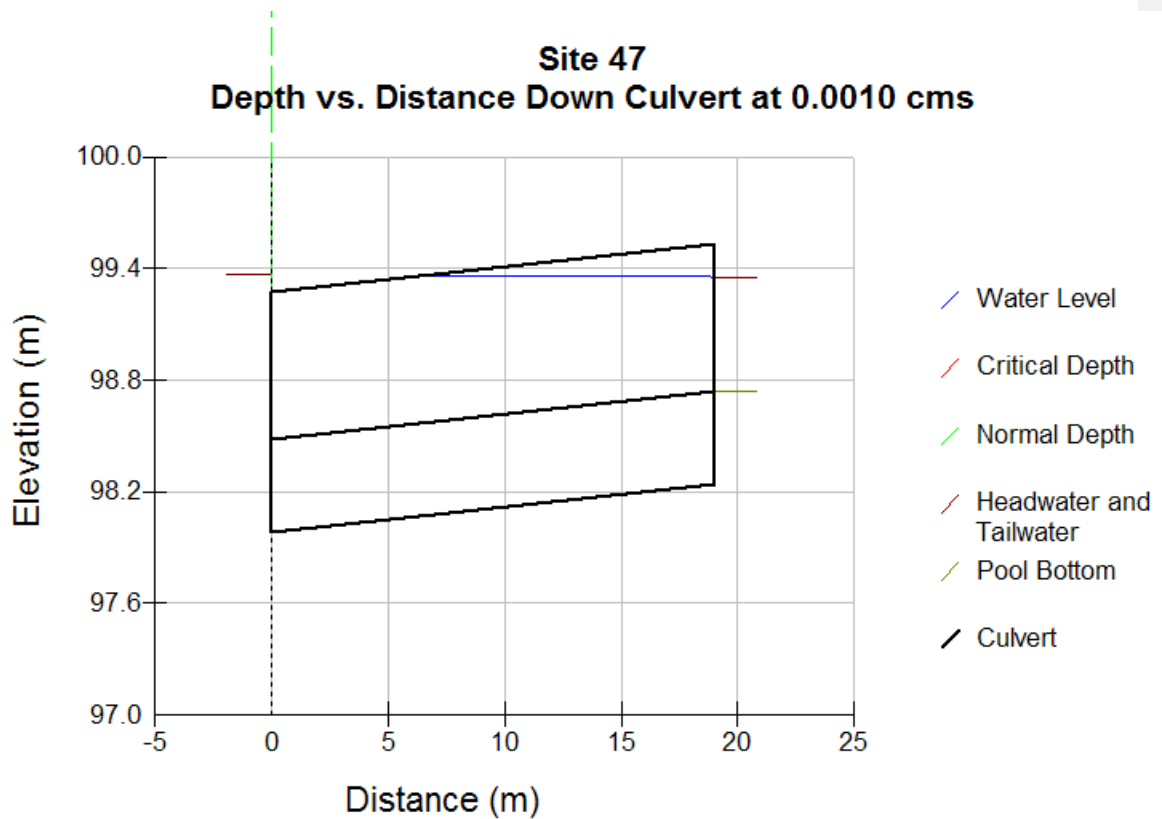


Figure 9190 . Water Surface Profile at 0.001 cms, passable flow.

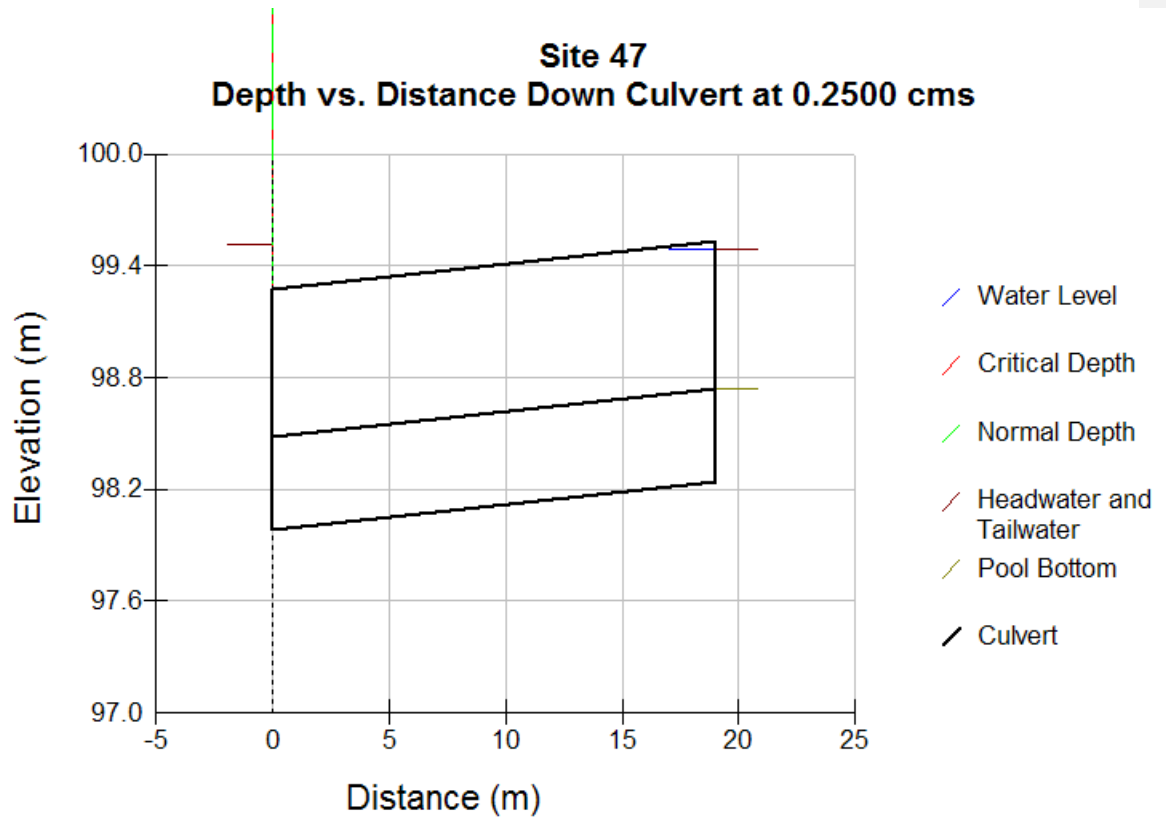


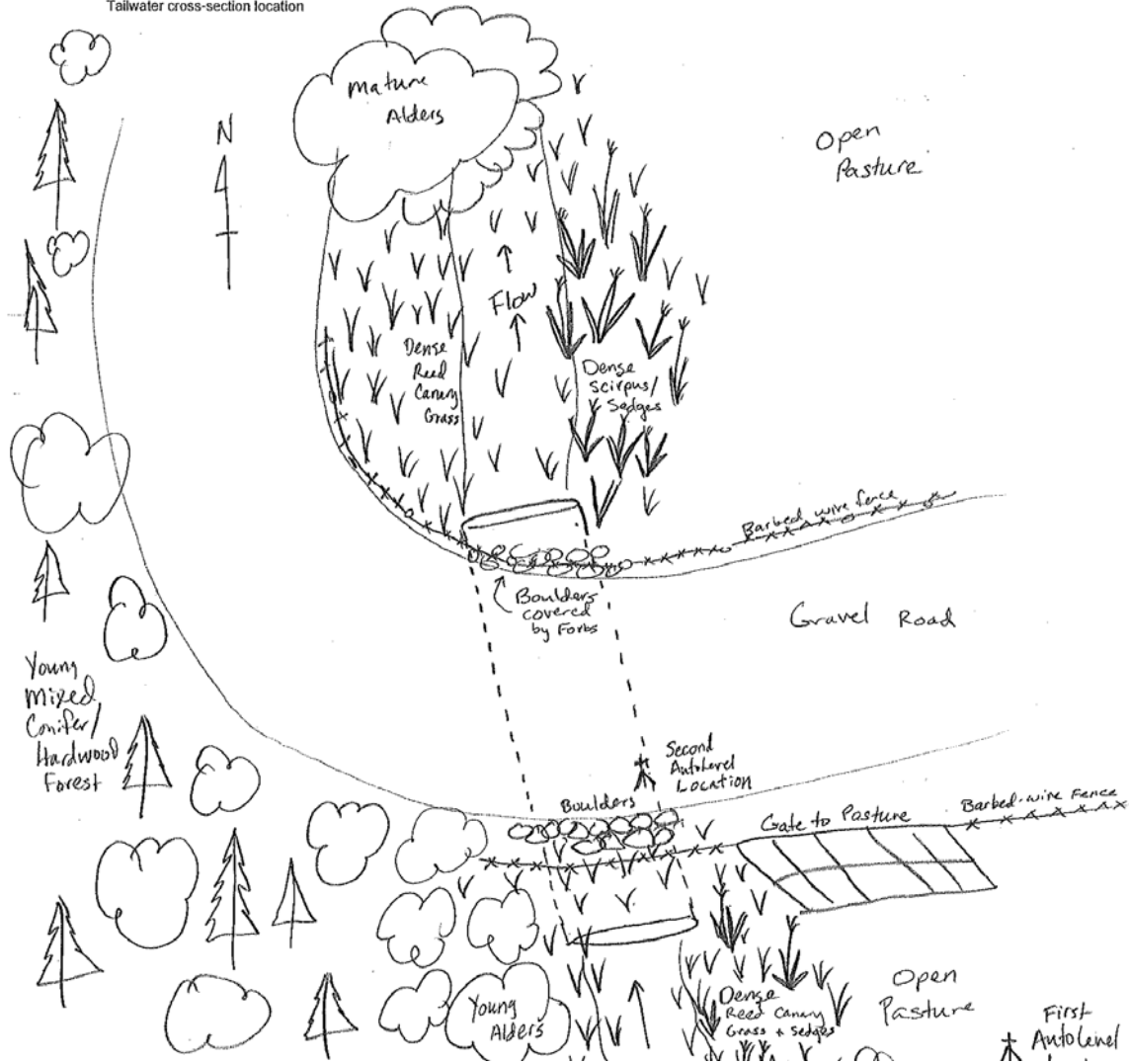
Figure 9291. Water Surface Profile at 0.75 cms, velocity barrier.

Site Sketch Site 47

Crossing ID number 45/2000004 Structure 1 of 1

SITE SKETCH

- Include:
 North Arrow
 Direction of stream flow
 Culvert/channel alignment
 Lay of tape if needed
 Photo point locations and numbers
 Wingwalls and inlet / outlet aprons
 Multiple structures
 Baffle configurations
 Weirs and other instream structures
 Debris jams inside, upstream and downstream near site, depositional bars
 Trash racks, screens, standpipes etc. that may affect passage
 Damage to or obstacle inside structure
 Location of Riprap for bank armoring or jump pool formation
 Tailwater cross-section location



Site # 76 2009 Restoration Effectiveness Monitoring Summary

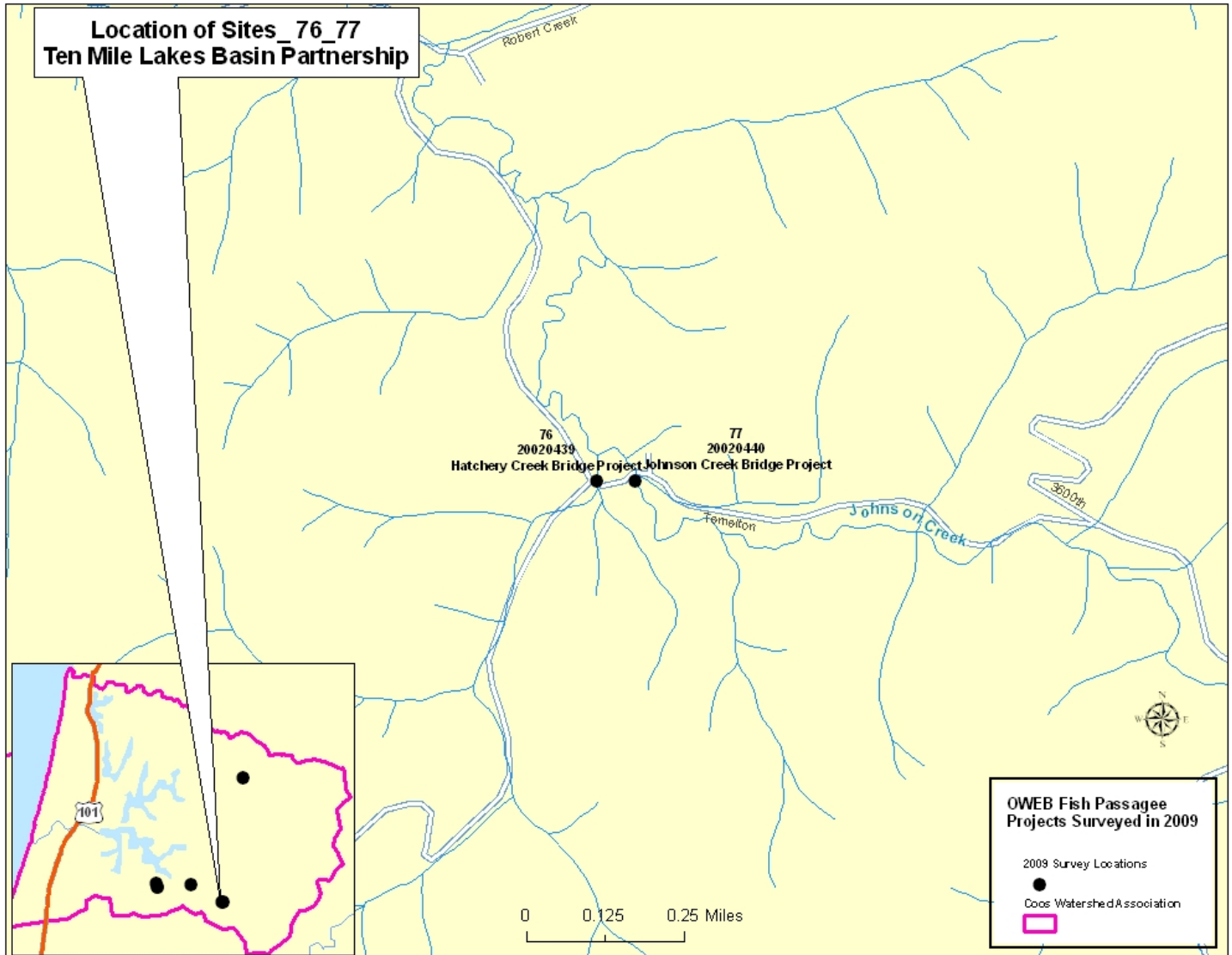
OWEB Project Name - Hatchery Creek Bridge Project

OWEB Grant Number – 200 – 058A

OWRI Project Number – 20020439

Owner – Private, Restoration Work

OWEB Description – Fish Passage



Map 5258. Location of Sites 76 and 77 along the Johnson Creek drainage.

Site Notes

This channel appeared to have been straightened and dredged to protect the adjacent pasture from flooding. The channel banks were fully vegetated with reed canary grass, while other riparian forbs and grasses were found in the channel as well.

Bankfull width was 2.7 meters. Substrate was composed primarily of silt with gravels and cobbles. The longitudinal profile ([Figure 93](#)~~Figure 100~~) illustrates that within the immediate project area, a slight depression exists and fits well with the overall channel characteristic of being a trench pool system. Channel gradient was determined to be 1.7% overall. There was nothing apparent to prevent juvenile salmonid fish passage at this crossing. In fact, our snorkel survey results ([Table 82](#)~~Table 86~~) found relatively strong numbers of juvenile salmonids above the project area.

Snorkel Survey

Table 82. Snorkel survey results for Site 76; a tributary to Johnson Creek.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1240725435322	1	Trench	3.9	2.4	0.5	Coho	9	0	0
1240725435322	2	Trench	4.7	1.6	0.5	Coho	53	0	0
1240725435322	3	Backwater	2.4	4.3	0.45	Coho	26	Steelhead/Cutthroat	1
1240725435322	4	Lateral Scour	11.2	2.5	0.46	Coho	75	Steelhead/Cutthroat	1
1240725435322	5	Lateral Scour	10.7	2.5	0.44	Coho	67	Steelhead/Cutthroat	1

Longitudinal Survey

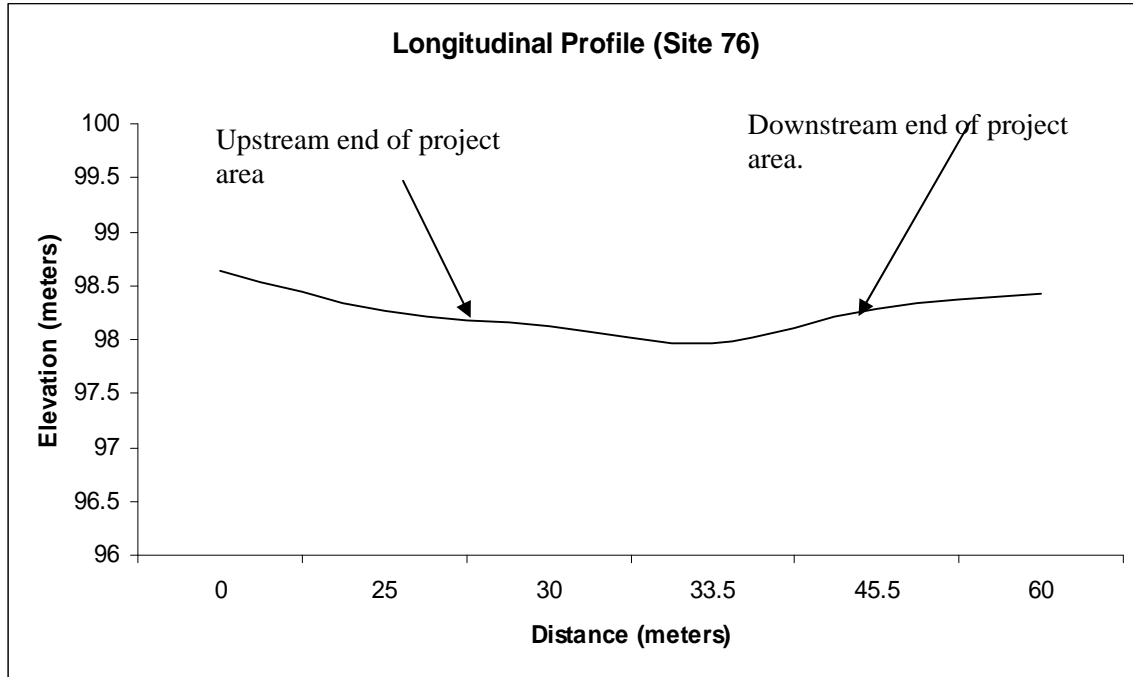


Figure 9392. Longitudinal profile of creek at bridge crossing on a tributary to Johnson Creek.

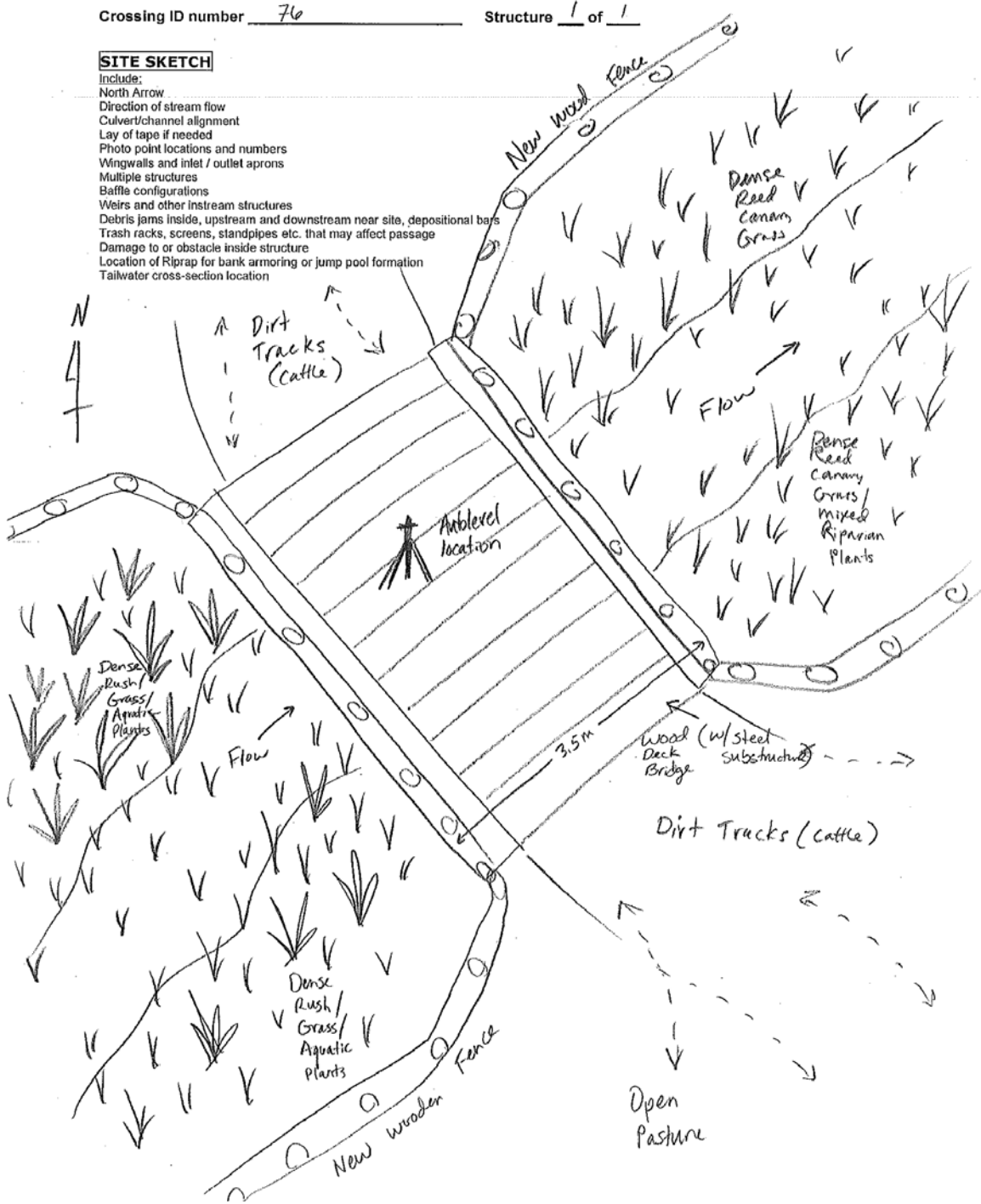
Site Sketch

Crossing ID number 76 Structure 1 of 1

SITE SKETCH

Include:

- North Arrow
- Direction of stream flow
- Culvert/channel alignment
- Lay of tape if needed
- Photo point locations and numbers
- Wingwalls and inlet / outlet aprons
- Multiple structures
- Baffle configurations
- Weirs and other instream structures
- Debris jams inside, upstream and downstream near site, depositional bars
- Trash racks, screens, standpipes etc. that may affect passage
- Damage to or obstacle inside structure
- Location of Riprap for bank armoring or jump pool formation
- Tailwater cross-section location



Site # 77 2009 Restoration Effectiveness Monitoring Summary

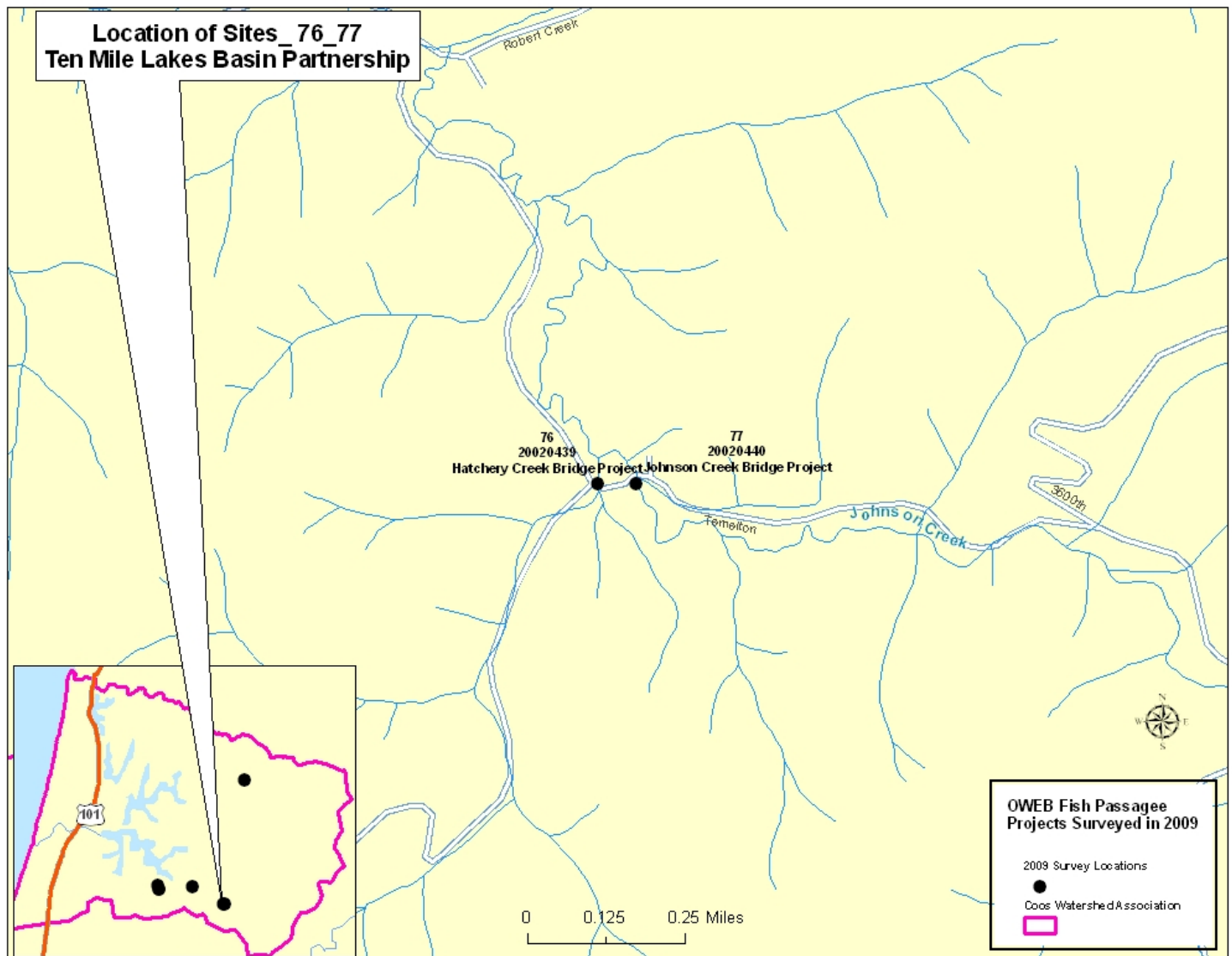
OWEB Project Name - Johnson Creek Bridge Project

OWEB Grant Number – 200 – 058A

OWRI Project Number – 20020440

Owner – Private, Restoration Work

OWEB Description – Fish Passage



Map 5359. Location of Sites 76 and 77 along the Johnson Creek drainage.

Site Notes

This is a bridge crossing the mainstem Johnson Creek. The bridge was 12.3 meters long and 3.8 meters wide. Staff at the Ten Miles Lakes Basin Partnership claimed that this is the highest producing Coho salmon stream in the area. The channel is a meandering trench with deep pools. The water seemed stagnant and large algal blooms were common in the stream. The water was warm, and rough skinned newts were common. Substrate was primarily composed of silt, while a few boulders (rip-rap) rested just below the bridge in the channel. The channel banks were steep and somewhat stable (although bank erosion was noted) and completely covered by reed canary grass. Bankfull width was 8.7 meters.

A longitudinal profile was taken (~~Figure 94~~~~Figure 101~~) that indicates gradient was reduced through the project area. Overall channel gradient was 1.2% while the gradient through the project area was 0.5%. Juvenile fish would have no trouble crossing this area. In fact, juvenile salmonids were found in all the pools snorkeled above the crossing (~~Table 83~~~~Table 87~~). We believe that our counts are extremely low because the visibility was extremely low.

Snorkel Survey Results

Table 83. Snorkel survey results for the crossing at Johnson Creek.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1241294435535	1	Lateral Scour	10.3	3.1	1.1	Coho	12	Steelhead/Cutthroat	15
1241294435535	2	Lateral Scour	4	2.5	1	Coho	10	Steelhead/Cutthroat	2
1241294435535	3	Lateral Scour	6	2.4	0.8	Coho	13	Steelhead/Cutthroat	1
1241294435535	4	Backwater	5	3.2	0.8	Coho	24	Steelhead/Cutthroat	2
1241294435535	5	Lateral Scour	3.8	2.5	0.7	Coho	12	0	0
1241294435535	6	Lateral Scour	3	2.3	0.8	Coho	6	0	0

Longitudinal Survey

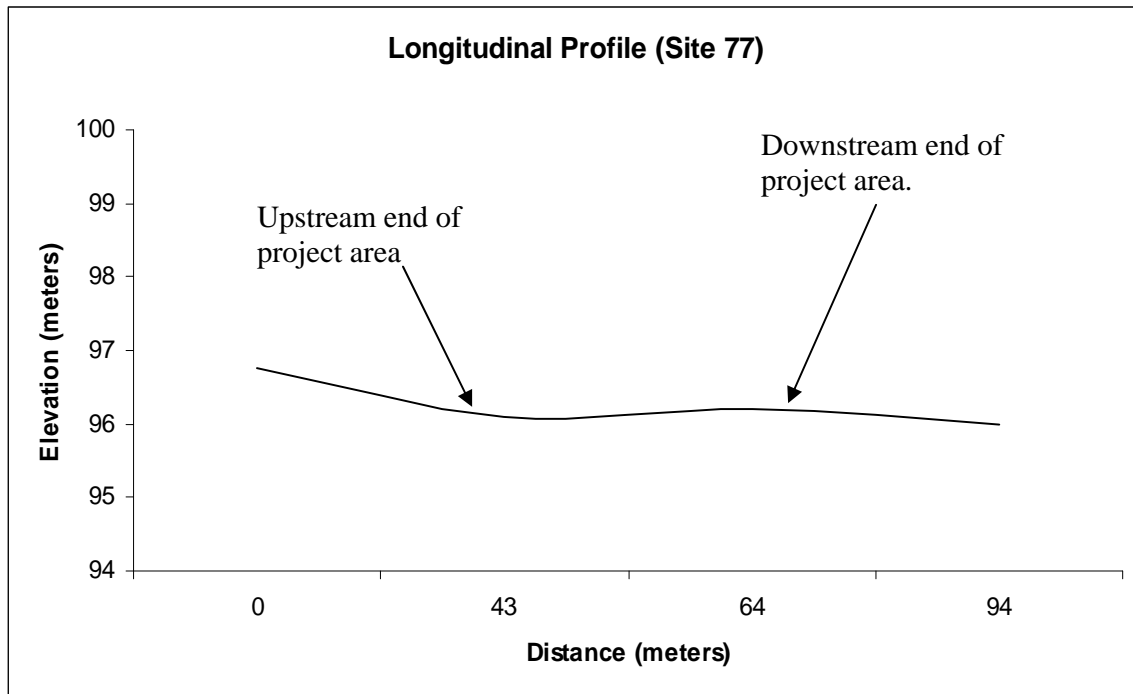


Figure 9493. Logitudinal profile of creek at bridge crossing at Johnson Creek.

Site Sketch

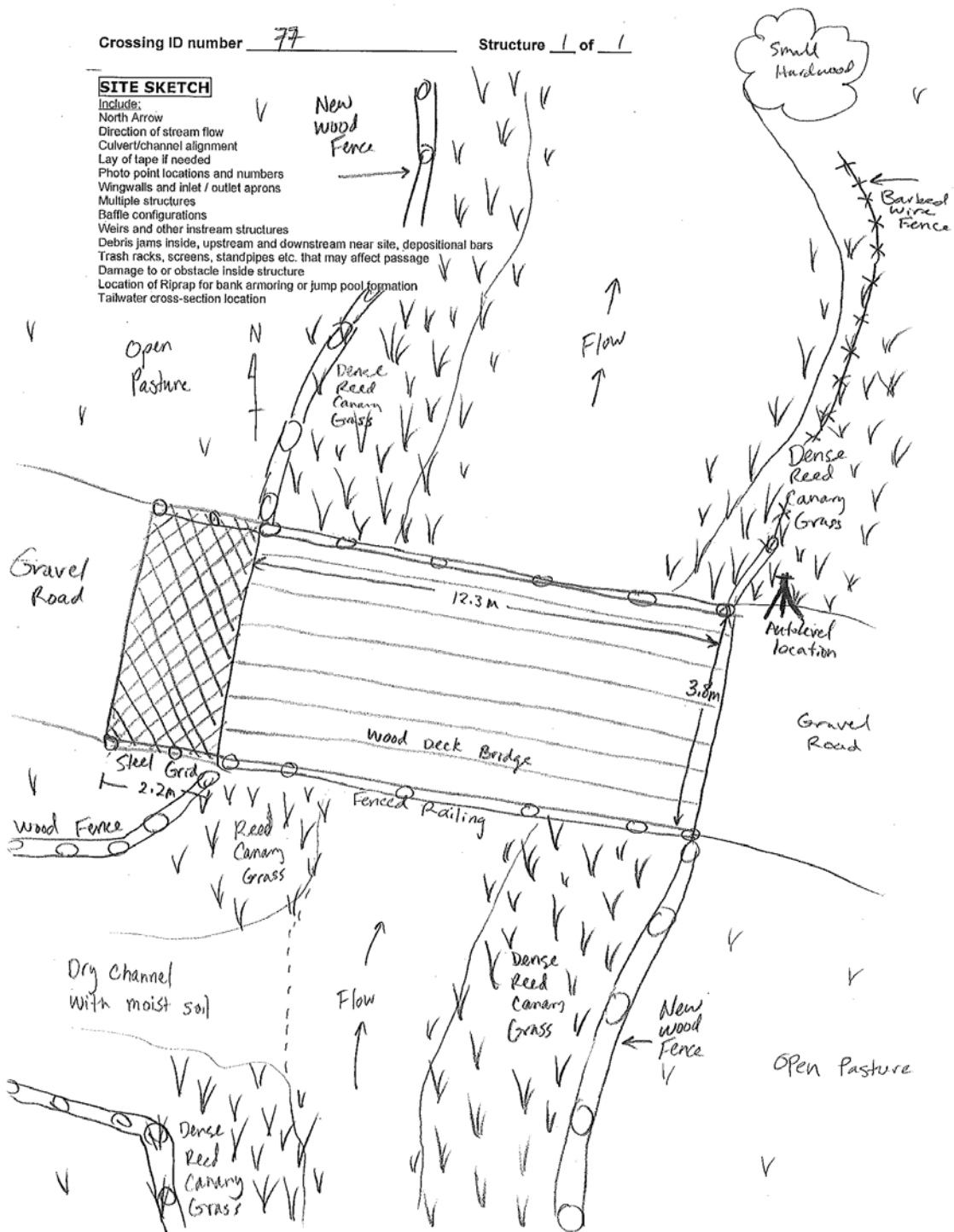
Crossing ID number 77

Structure 1 of 1

SITE SKETCH

Include:

- North Arrow
- Direction of stream flow
- Culvert/channel alignment
- Lay of tape if needed
- Photo point locations and numbers
- Wingwalls and inlet / outlet aprons
- Multiple structures
- Baffle configurations
- Weirs and other instream structures
- Debris jams inside, upstream and downstream near site, depositional bars
- Trash racks, screens, standpipes etc. that may affect passage
- Damage to or obstacle inside structure
- Location of Riprap for bank armoring or jump pool formation
- Tailwater cross-section location



Sixes Sub-basin Reports

Site # 48 2009 Restoration Effectiveness Monitoring Summary

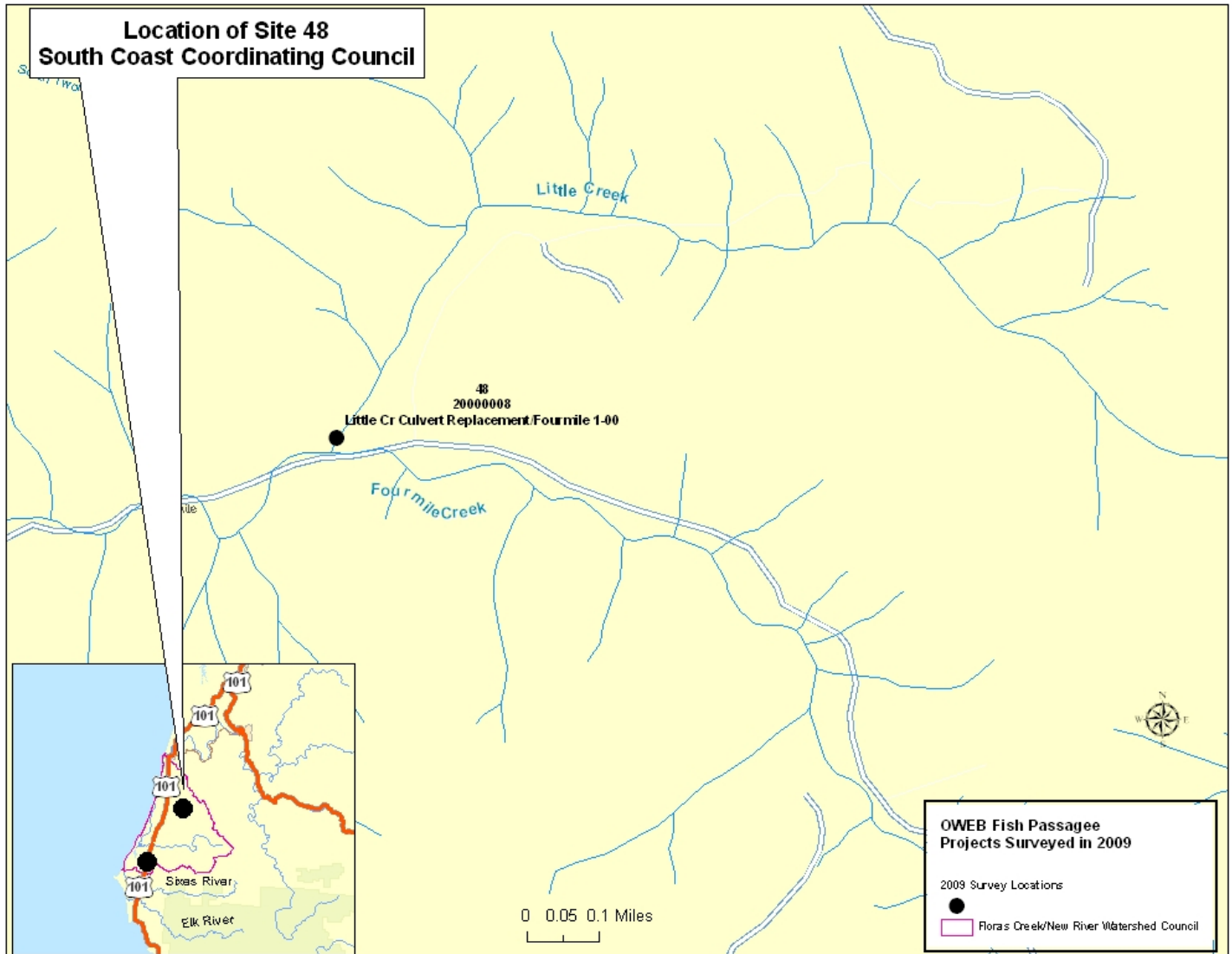
OWEB Project Name – Little Cr Culvert Replacement/Fourmile 1-00

OWEB Grant Number – 099 - 466

OWRI Project Number – 20000008

Owner – Private, Moore Mill Company

OWEB Description – Fish Passage



Map 5447. Location of Site 48 on a tributary to Four Mile Creek.

Site Notes

This crossing was a pipe-arch that was 3.1 meters wide and 2.03 meters tall. The culvert had 3 sets of baffles installed. The culvert had a noticeable sag in the center. This sag looks as though it could compromise the structural integrity of the culvert.

Bankfull width was determined to be 3.6 meters, while the ratio of the inlet width to channel width was 0.81. Channel gradient was 2.2% while the culvert gradient was 2.5%. The culvert bottom was nearly covered by sediment; the 1st meter from the culvert inlet lacked sediment, but the remaining 22 meters were covered. Sediment depth was estimated to be 0.17 meters. Sediment was composed of boulders/cobbles and gravels; respectively.

There was a pool associated with the outfall of this culvert, yet there was not outlet jump. The pool was formed by a log acting as a dam at the tailcrest. There was a short plunge at the tailcrest. Downstream of the tailcrest, the channel becomes dominated by excellent looking clean graves until the confluence with Four Mile Creek (about 30 meters downstream from culvert outlet). We estimate that the culvert outlet was within the bankfull width of Four Mile Creek.

The creek is bordered by both forest lands and hobby farms. The stream banks are lushly vegetated and they appeared relatively stable.

Snorkel Survey Results

Juvenile salmonids were observed during the snorkel survey in the first 3 pool. The number of fish observed was relatively low.

Table 84. Snorkel survey results for Site 48, on a tributary to Four Mile Creek.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1243620429972	1	Straight Scour	3.5	1.7	0.31	Coho	2
1243620429972	2	Straight Scour	2	1.5	0.3	Steelhead/Cutthroat	2
1243620429972	3	Plunge	3.5	1.8	0.35	Steelhead/Cutthroat	1
1243620429972	4	Lateral Scour	2.9	1.7	0.37	0	0
1243620429972	5	Plunge	4.3	2.6	0.44	0	0

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 85. Fish Passage Summary, Site 48.

Fish Passage Summary	
Low Passage Design Flow	0.0010 cms
High Passage Design Flow	9.3400 cms
Percent of Flows Passable	1.20 %
Passable Flow Range	0.0010 to 0.1147 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.11 cms and Above
Pool Depth Barrier	None

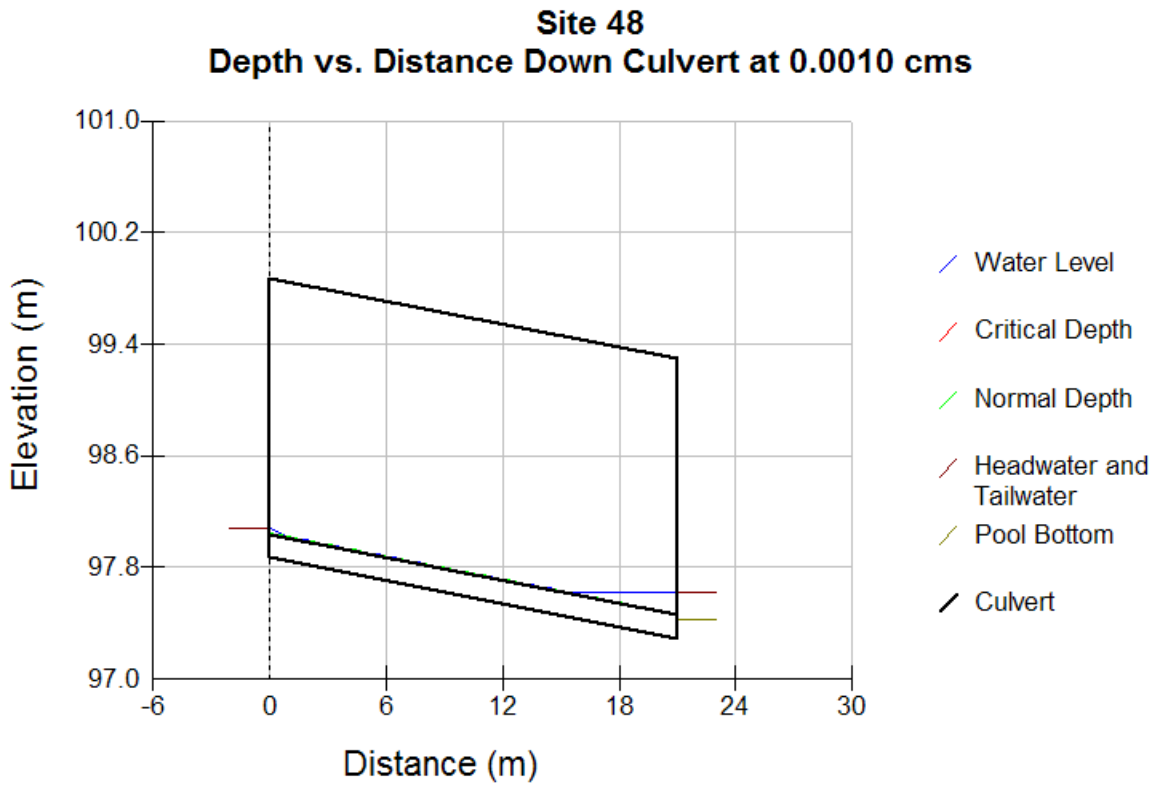


Figure 9594. Water Surface Profile at 0.001 cms, passable flow.

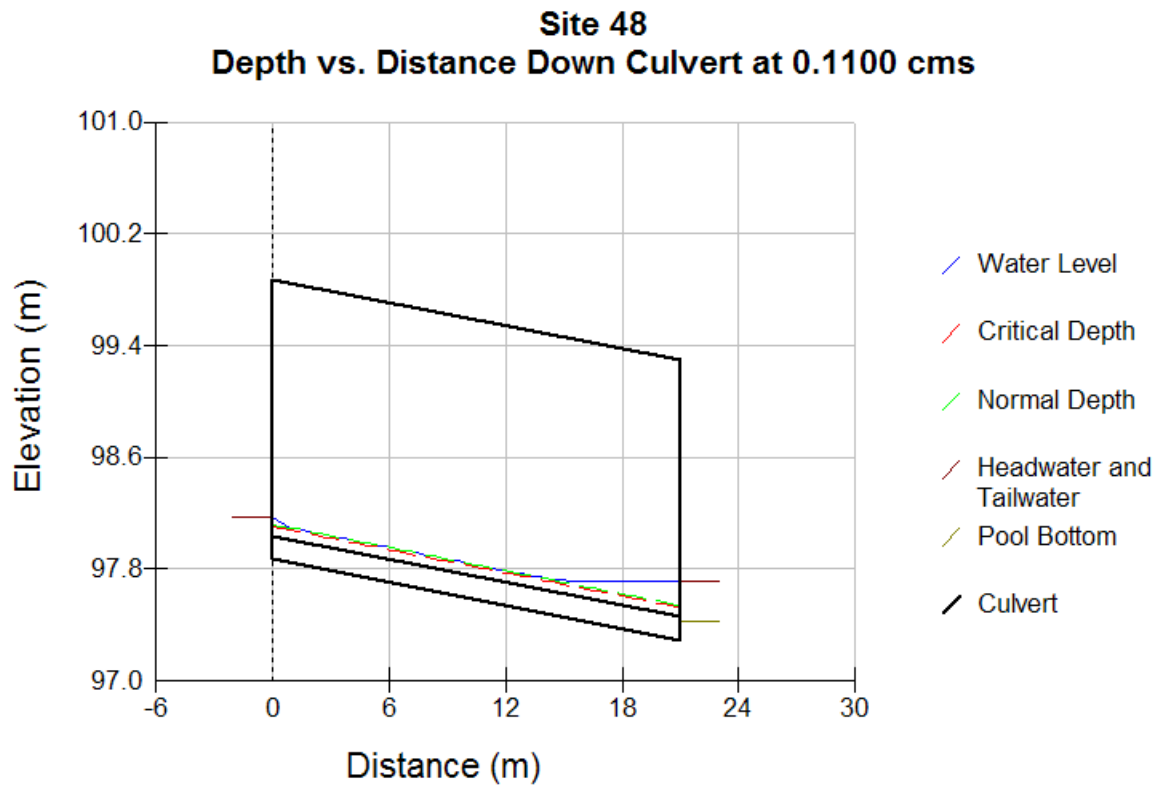


Figure 9695. Water Surface Profile at 0.11 cms, velocity block begins at this rate of discharge.

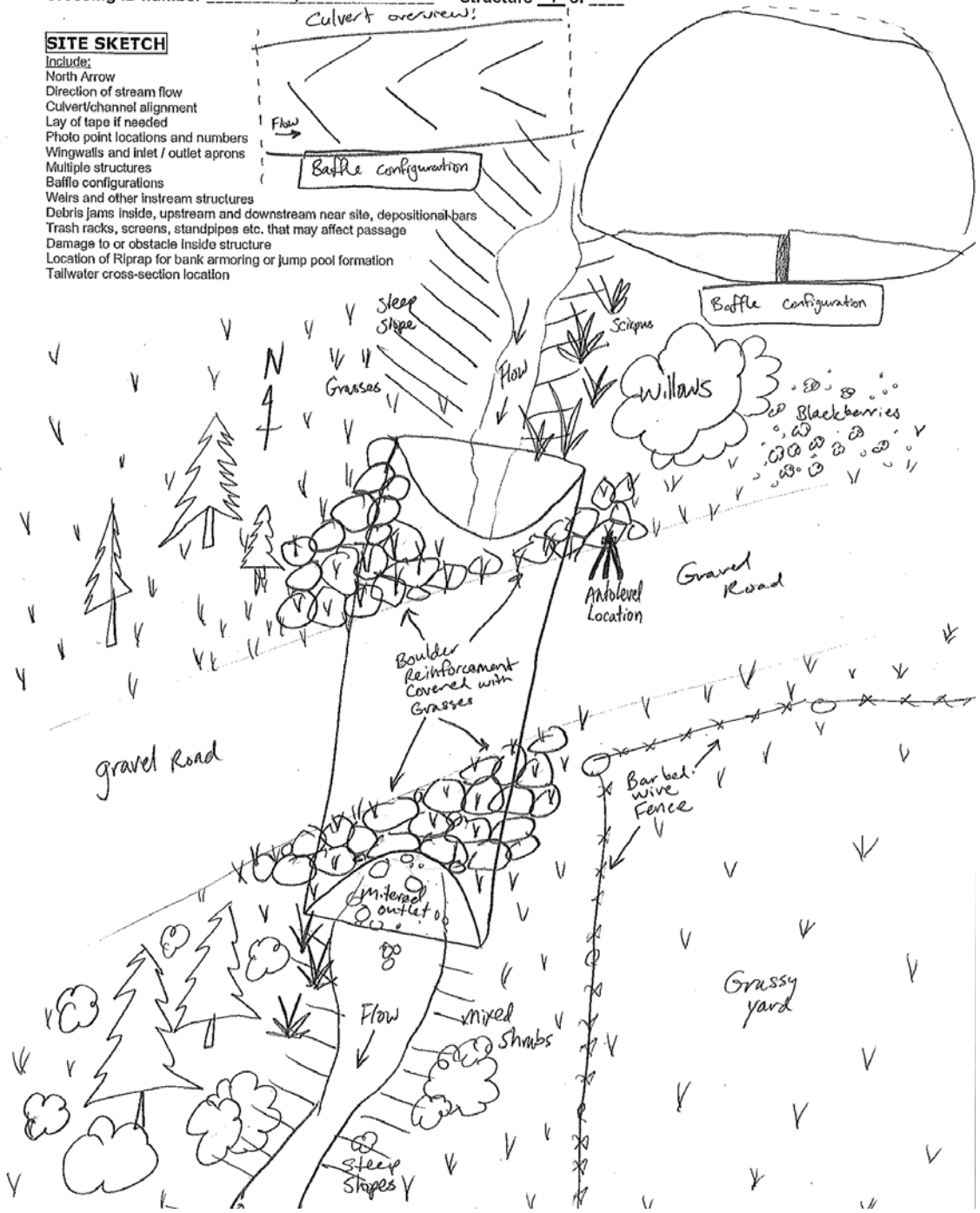
Site Sketch

Crossing ID number 48 Structure 1 of 1

Culvert Cross-section:

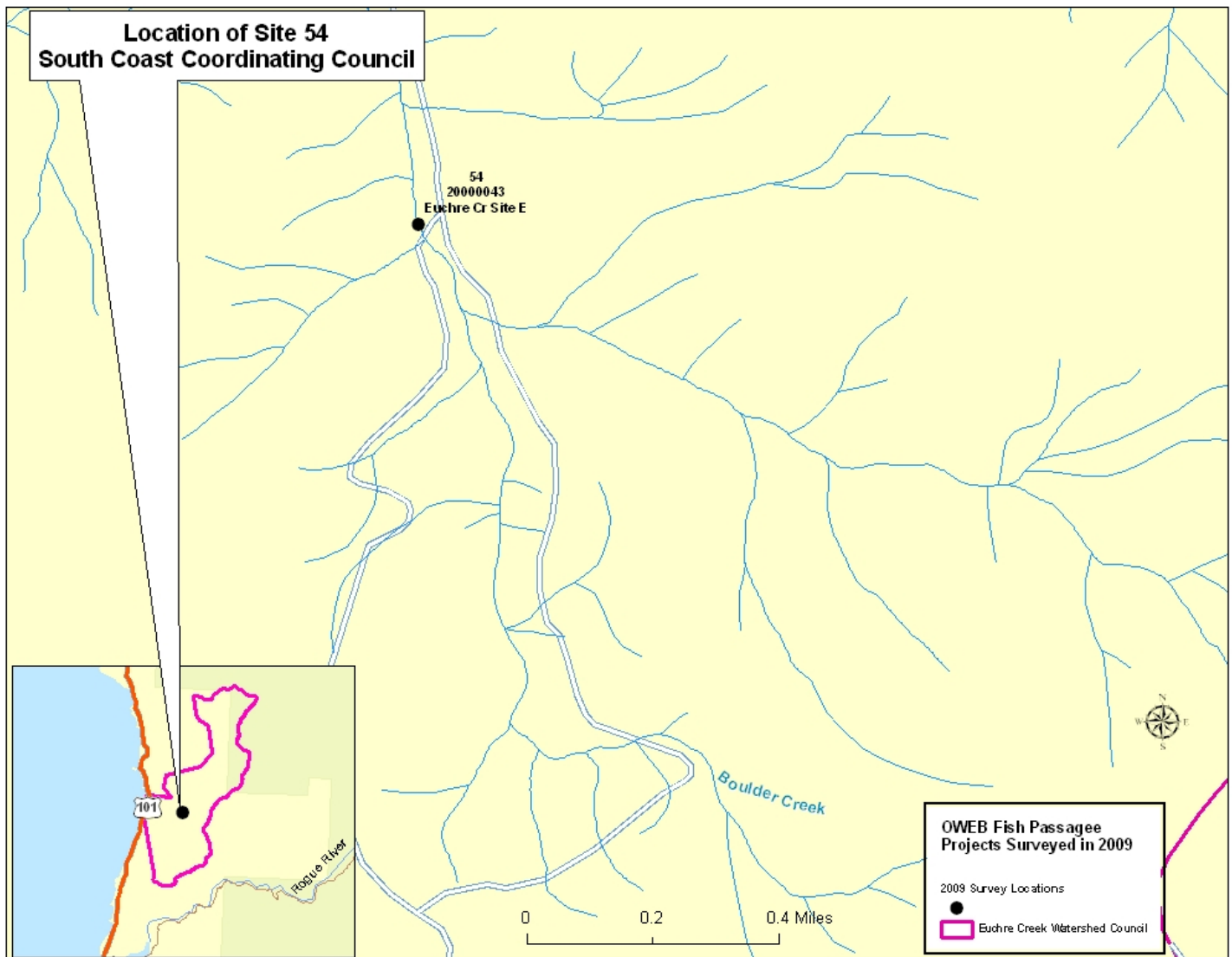
SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 54 2009 Restoration Effectiveness Monitoring Summary

OWEB Project Name – Euchre Cr Site E
OWEB Grant Number – 097 – 096/099-488
OWRI Project Number – 20000043
Owner – Private, South Coast Lumber
OWEB Description – Fish Passage



Map 5548. Location of Site 54 along Boulder Creek, a tributary to Euchere Creek.

Site Notes

This crossing was a large railcar bridge that was 6 meters wide and 16.5 meters long. It was composed of beam decking made of pressure treated timbers with very large quantities of rip-rap reinforcement along the stream banks under bridge. Some of the large boulder rip rap have found their way into the creek. There it has created a nice boulder scour pool.

Bankfull width was 7.2 meters and the channel gradient averaged 2.6%. Substrate composition under the bridge was dominated by boulders with gravel and cobbles and some fines. Outside of the bridge area, the channel substrate was dominated by cobbles/gravel/boulders.

This forested mountain channel has the characteristics of a plain-bed channel tending towards a step-pool system. Surprisingly, it had strong flow at this late in the season (mid-September 2009). The channel was much steeper above the bridge than it was below the bridge, and there was a relatively deep boulder scour pool under the bridge. Logs were placed with root-wads intact above and below the bridge. These structures functioned to accumulate sediment and provide habitat cover; they do not force pool creation as do the boulders under the bridge.

Snorkel Survey Results

The snorkel survey (Table 86) found juvenile salmonids in every pool snorkeled: although, only trout were identified. We had expected to find Coho.

Table 86. Snorkel results from Site 54, Boulder Creek.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1243454425588	1	Plunge	2.6	3.1	0.41	Steelhead/Cutthroat	4
1243454425588	2	Straight Scour	6.4	2.9	0.41	Steelhead/Cutthroat	3
1243454425588	3	Lateral Scour	1.9	1.5	0.31	Steelhead/Cutthroat	3
1243454425588	4	Plunge	2.8	1.7	0.61	Steelhead/Cutthroat	4
1243454425588	5	Lateral Scour	8.5	1.6	0.3	Steelhead/Cutthroat	3

Longitudinal profile

The longitudinal profile below illustrates the effect of lowering gradient and placing large boulders in the vicinity of the project area. The channel is now scouring near the bridge and becoming a pool as well as a deposition zone for finer sediment. Juveniles can easily pass through the restored area.

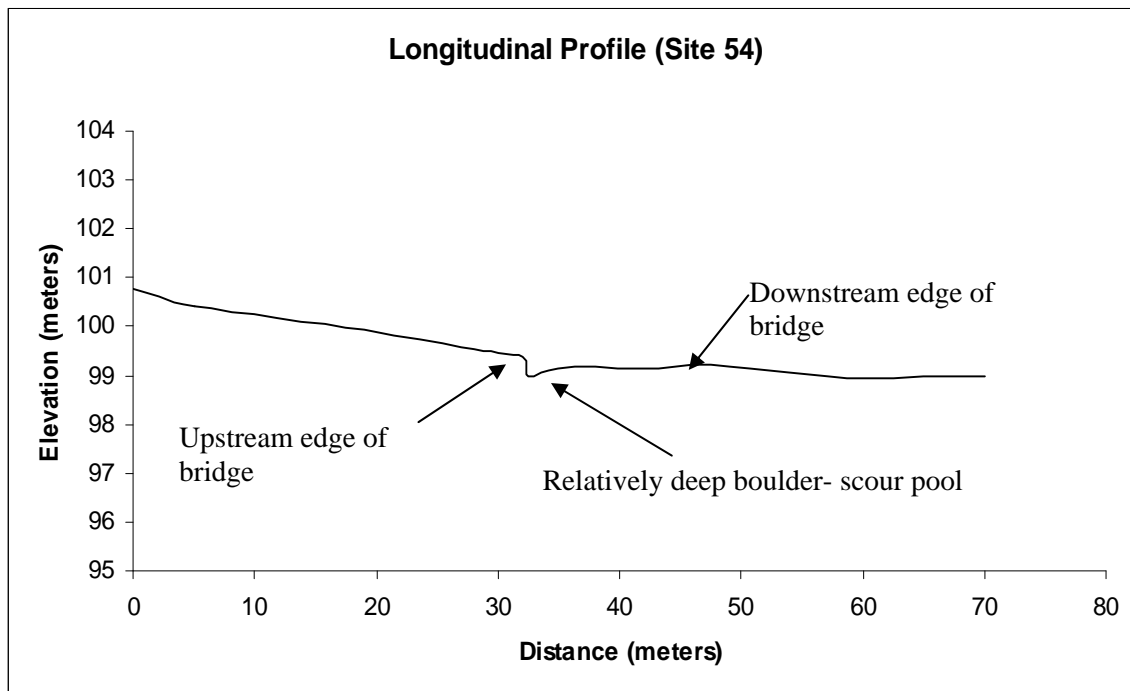


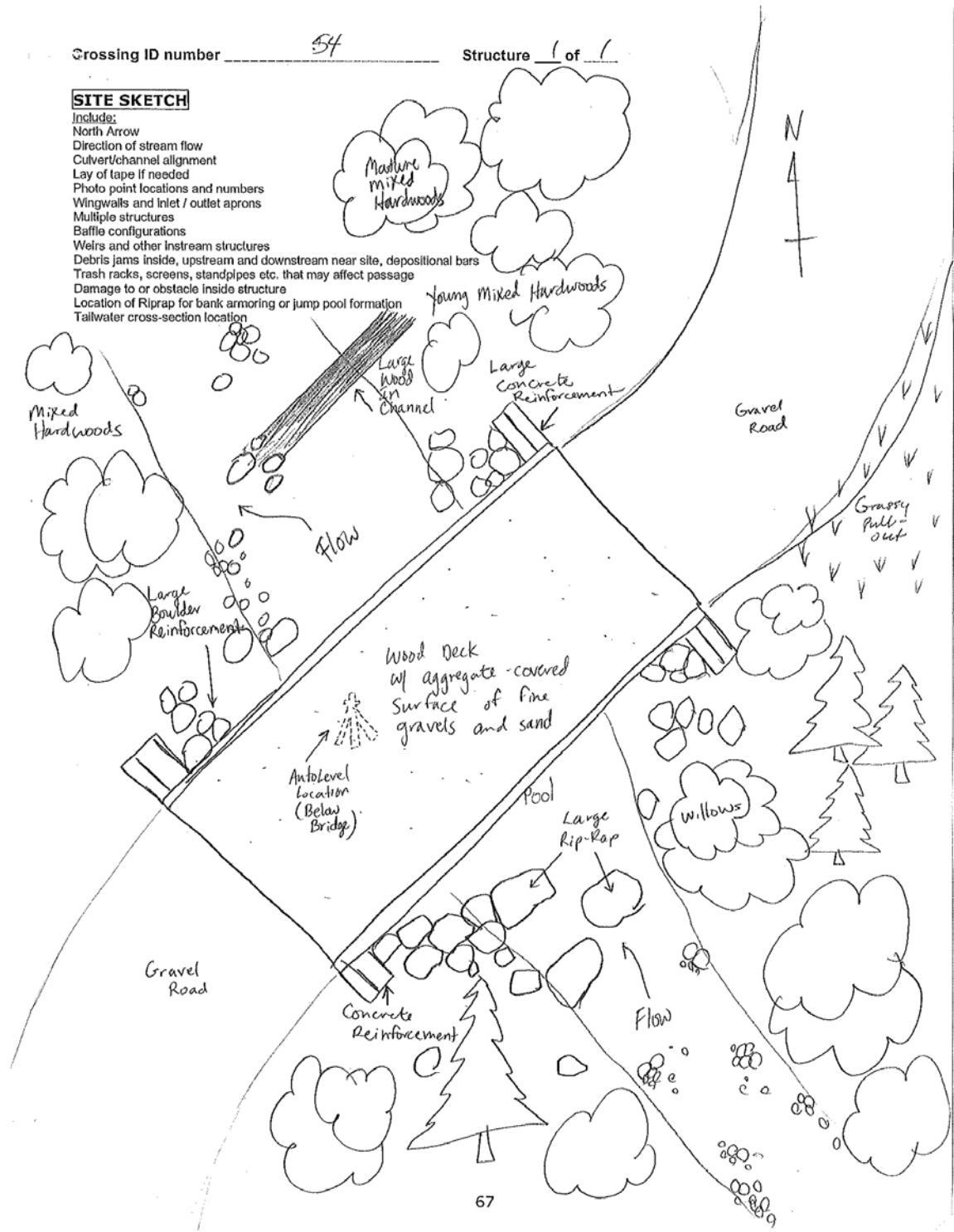
Figure 9796. Longitudinal profile of boulder scour pool on Boulder Creek, a tributary to Euchere Creek, South Coast Coordinating Group.

Site Sketch

Crossing ID number 54 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 55 2009 Restoration Effectiveness Monitoring Summary

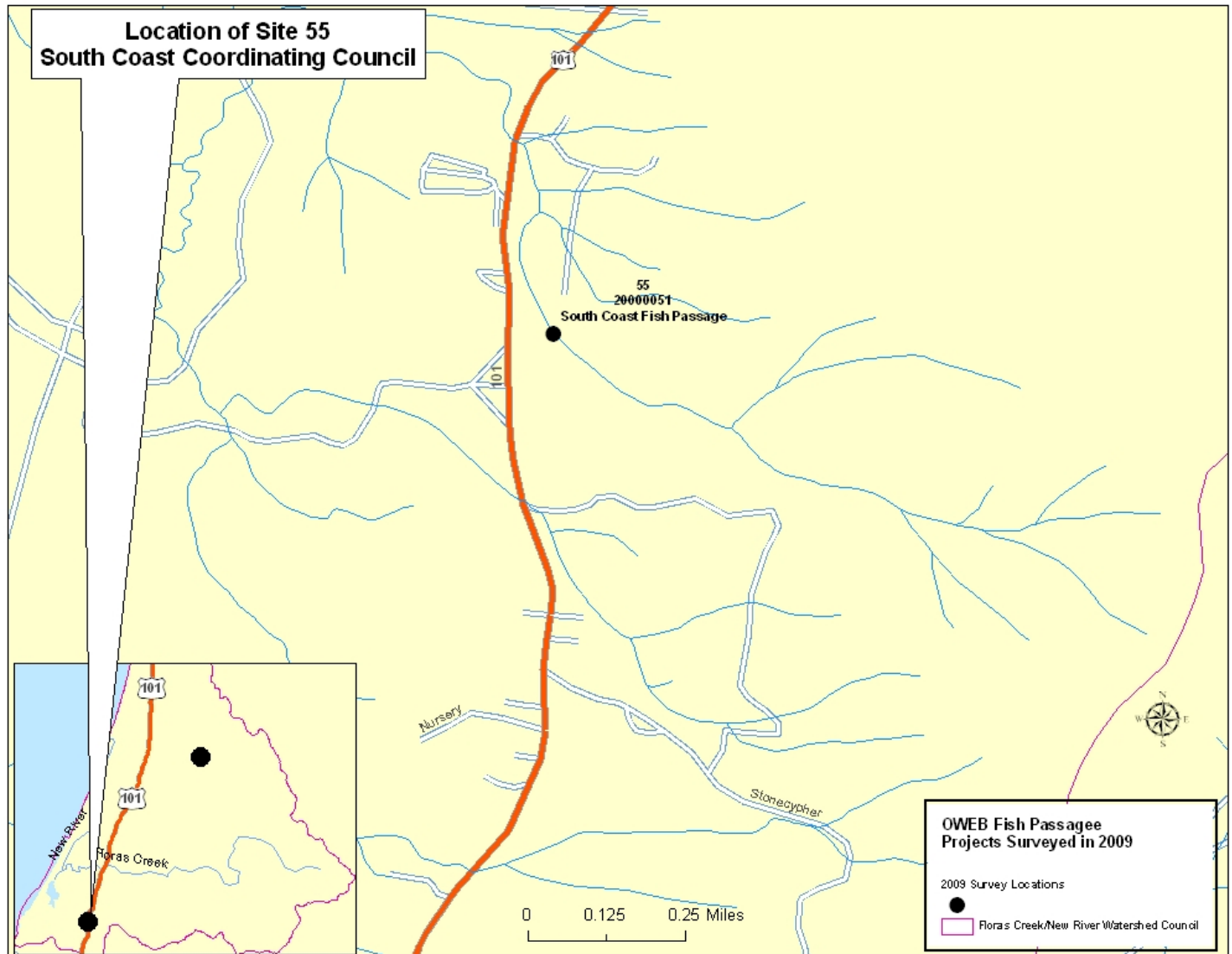
OWEB Project Name – South Coast Fish Passage

OWEB Grant Number – 097 - 096

OWRI Project Number – 20000051

Owner – Private

OWEB Description – Fish Passage



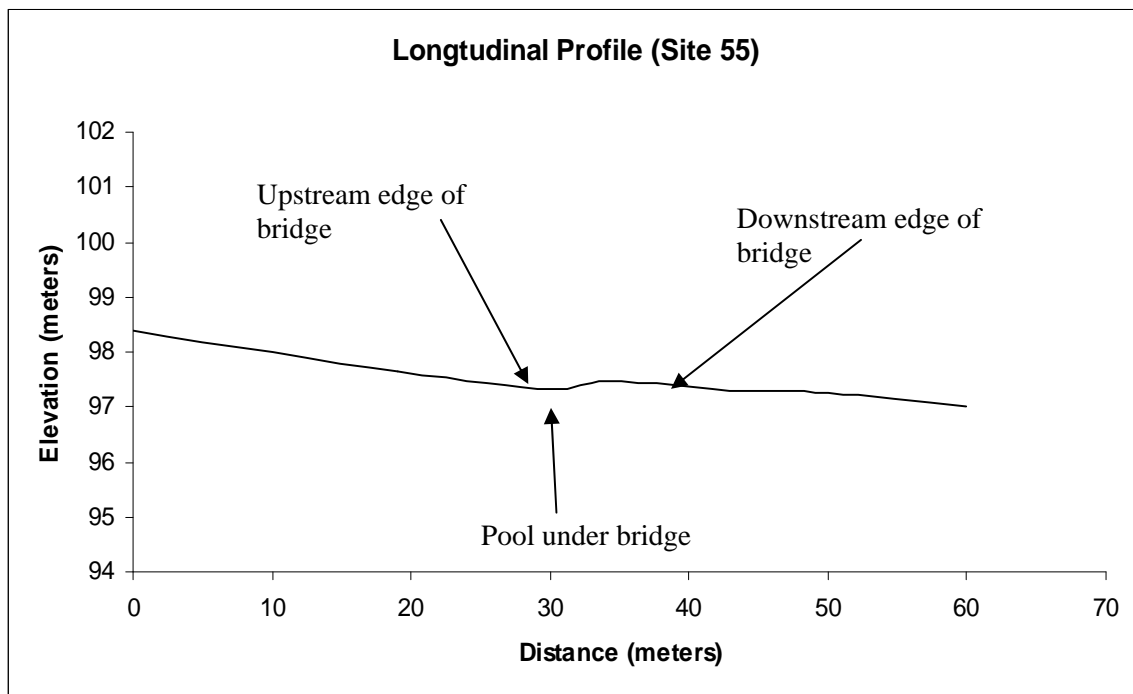
Map 5649. Location of Site 55 along Swanson Creek.

Site Notes

This crossing was a rail car bridge 12.5 meters long by 3.8 meters wide with a pressure treated wood deck. The channel was completely dry for the entire survey area and at least 300 meters upstream of the bridge. The channel substrate was dominated by cobbles with gravels and boulders also present. Bankfull width was 2.5 meters, and the slope of the surveyed portion of the channel was 3.7%. Three logs have been placed on opposing banks ~ 20 meters downstream of bridge. These logs are providing a vital function by adding to the habitat diversity by forcing scour pools, accumulating sediment, and providing habitat cover. The riparian area is composed of a mixed hardwood/conifer component with native shrubs abundant. Blackberries were making their presence known.

[Figure 98](#)~~Figure 97~~ illustrates the longitudinal profile at Site 55. In addition to placing the logs in the creek, the restoration effort has led to a depression immediately under the bridge creating a pool. Although the creek was dry at the time of survey, this pool was easily distinguishable. Juvenile fish should have no problem migrating past this crossing. We were unable to substantiate the presence of fish. We hiked 330 meters above the bridge, the channel remained dry.

Longitudinal Profile



[Figure 98](#)~~97~~. Longitudinal profile

Site Sketch

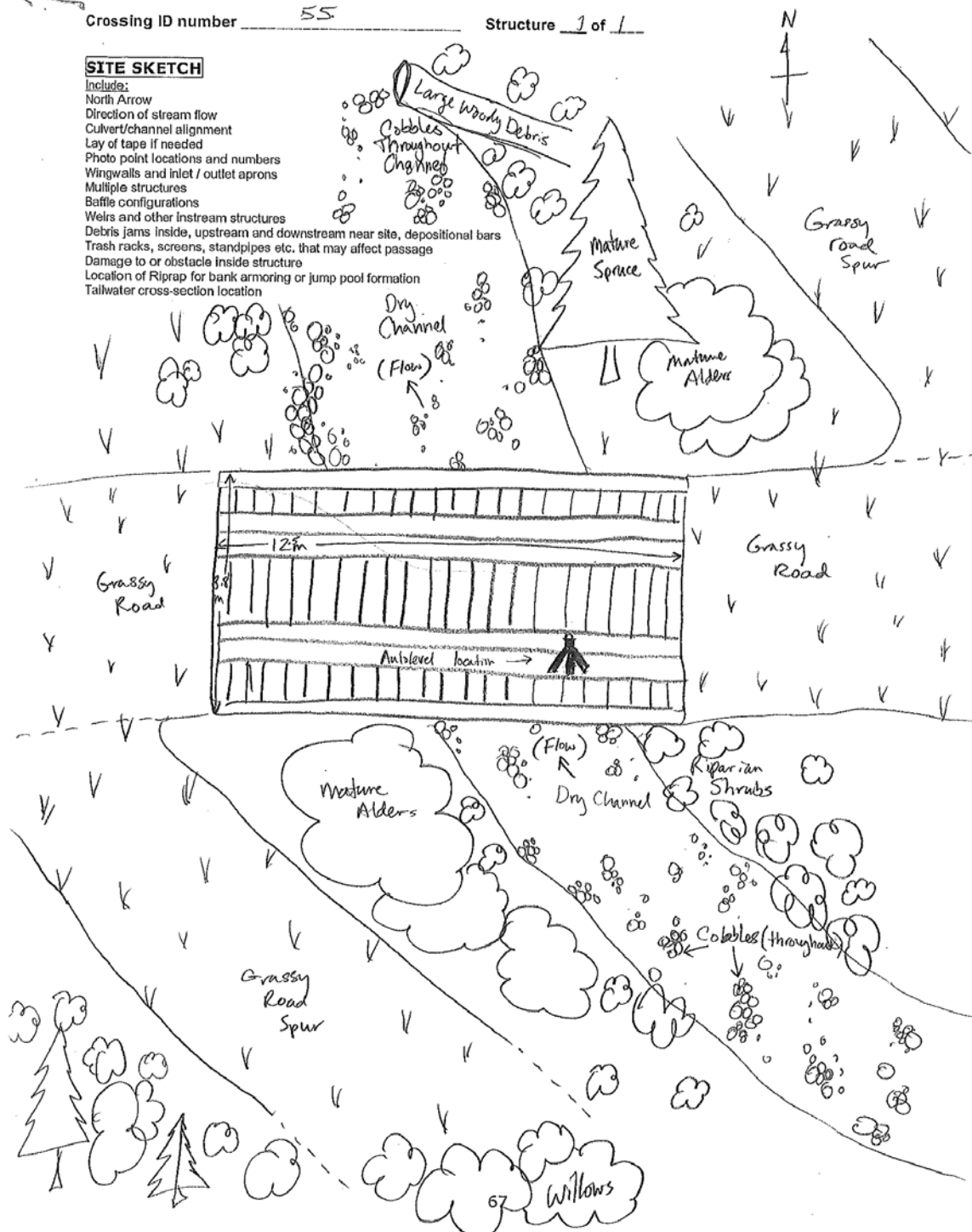
Crossing ID number 55

Structure 1 of 1

SITE SKETCH

Include:

- North Arrow
- Direction of stream flow
- Culvert/channel alignment
- Lay of tape if needed
- Photo point locations and numbers
- Wingwalls and inlet / outlet aprons
- Multiple structures
- Baffle configurations
- Weirs and other instream structures
- Debris jams inside, upstream and downstream near site, depositional bars
- Trash racks, screens, standpipes etc. that may affect passage
- Damage to or obstacle inside structure
- Location of Riprap for bank armoring or jump pool formation
- Tailwater cross-section location



Site # 56 2009 Restoration Effectiveness Monitoring Summary

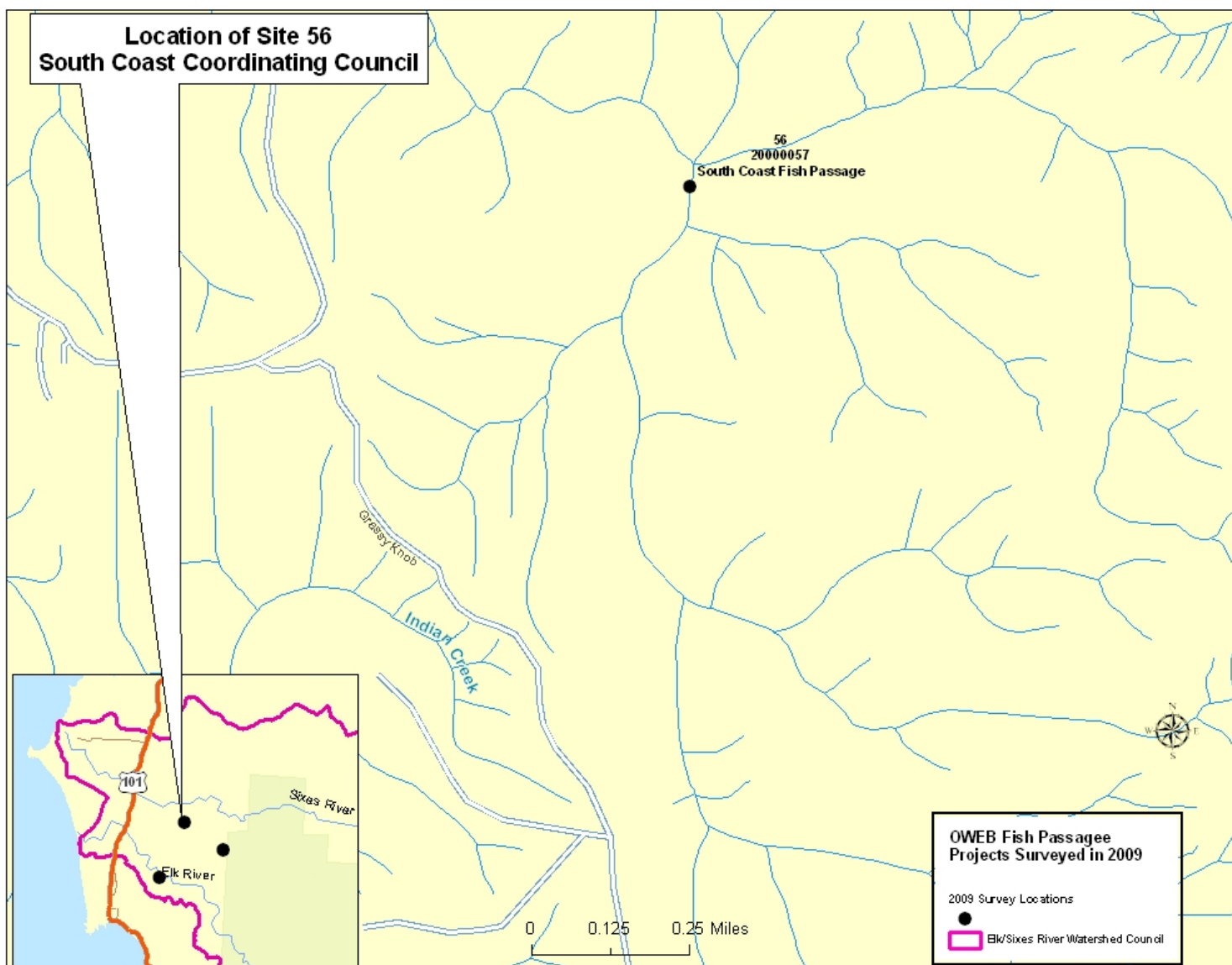
OWEB Project Name – South Coast Fish Passage

OWEB Grant Number – 097 - 096

OWRI Project Number – 220000057

Owner – Private, Roseburg Resources

OWEB Description – Fish Passage



Map 5750. Location of Site 56, Bear Creek.

Site Notes

This crossing was a rusty steel rail car bridge that was 3.5 meters wide by 12.5 meters long.

Bankfull width was 5.9 meters. In the immediate vicinity of the bridge, boulders dominated the substrate, but for the entire survey area, gravel dominated with both cobbles and boulders present. Channel gradient was 2.3%. Large amounts of boulder rip rap were noted under the bridge. This has an effect of changing the stream morphology directly under the bridge to a step pool channel. [Figure 99](#)~~Figure 88~~ illustrates the effect of the boulder rip-rap under the bridge. A relatively deep pool (0.35 meters) has been scoured there. This is somewhat out of place for the rest of the survey area which conforms to the characteristics of a plane-bed channel.

Results of the snorkeling survey (Table 87) indicate that juvenile salmonids are migrating through the project area. All pools snorkeled had juvenile fish present.

Snorkel Survey Results

Table 87. Snorkel results for Bear Creek, South Coast Coordinating Group.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number	Species	Number
1244497428109	1	Lateral Scour	5.2	2.2	0.55	Steelhead/Cutthroat	4	0	0
1244497428109	2	Straight Scour	2.5	2.2	0.32	Steelhead/Cutthroat	3	0	0
1244497428109	3	Straight Scour	7.2	2.7	0.41	Steelhead/Cutthroat	11	0	0
1244497428109	4	Straight Scour	1.19	2.5	0.62	Steelhead/Cutthroat	5	0	0
1244497428109	5	Lateral Scour	2.2	1.6	0.41	Steelhead/Cutthroat	10	0	0
1244497428109	6	Straight Scour	1.9	1.6	0.58	Steelhead/Cutthroat	6	0	0
1244497428109	7	Plunge	2.8	3.5	0.59	Steelhead/Cutthroat	22	Coho	4

Longitudinal Profile

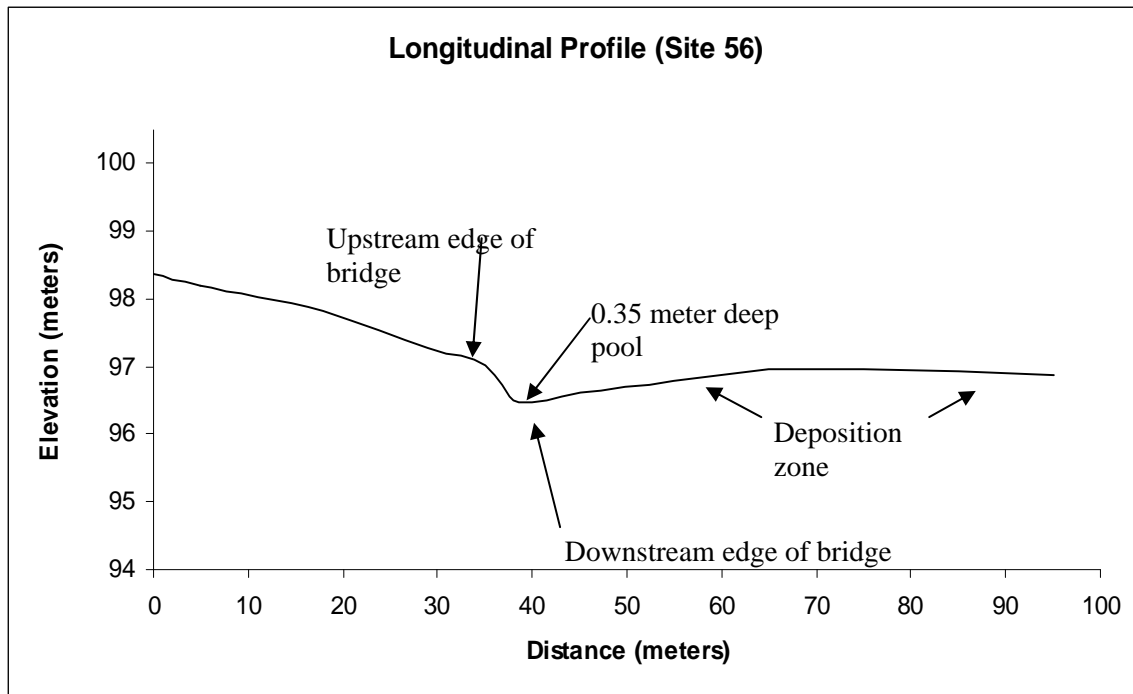


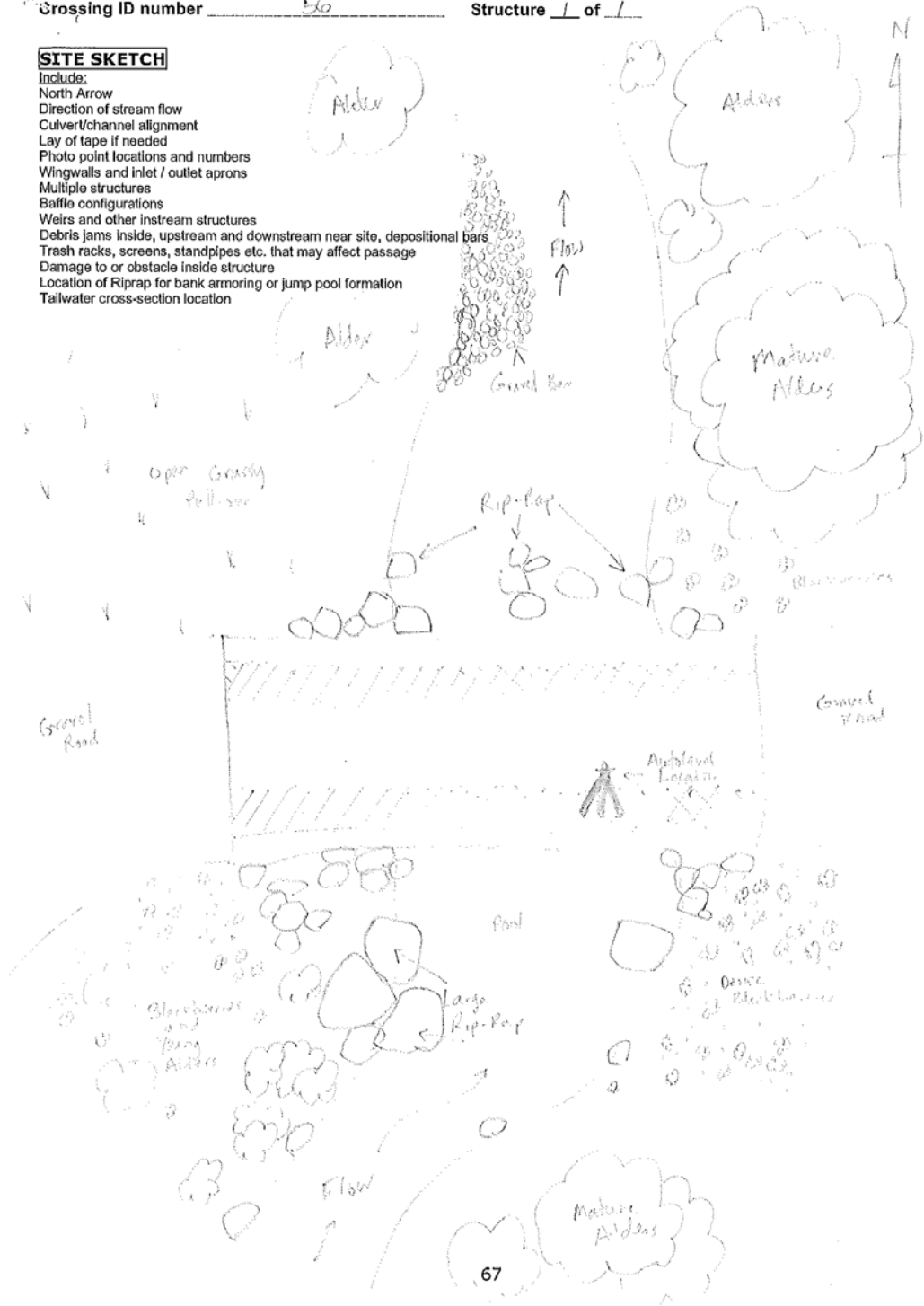
Figure 9998. Longitudinal profile for Site 56, Bear Creek.

Site Sketch

Crossing ID number 56 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 57 2009 Restoration Effectiveness Monitoring Summary

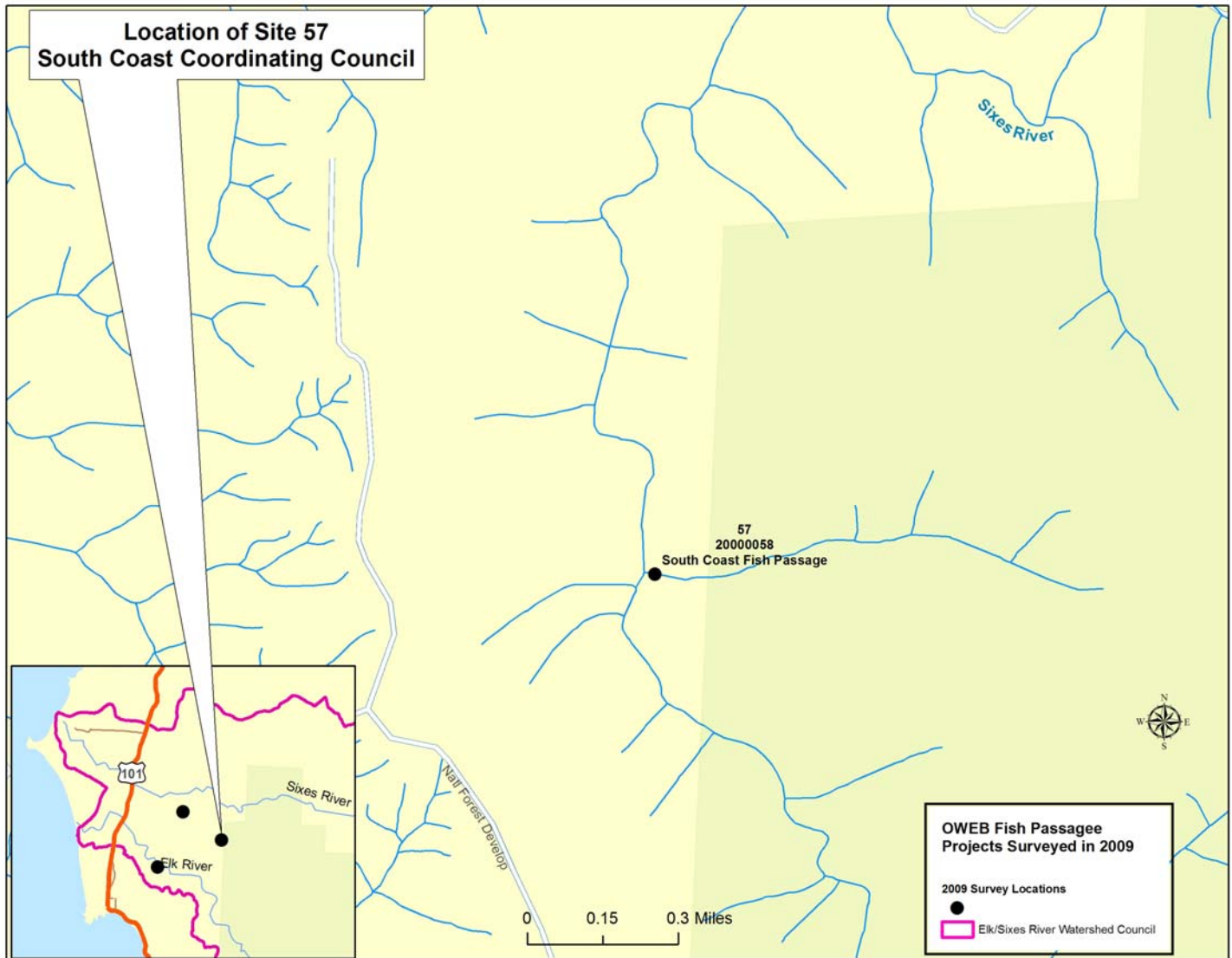
OWEB Project Name – South Coast Fish Passage

OWEB Grant Number – 097 - 096

OWRI Project Number – 20000058

Owner – Private, Ecotrust

OWEB Description – Fish Passage



Map 5851. Location of Site 57.

Site Notes

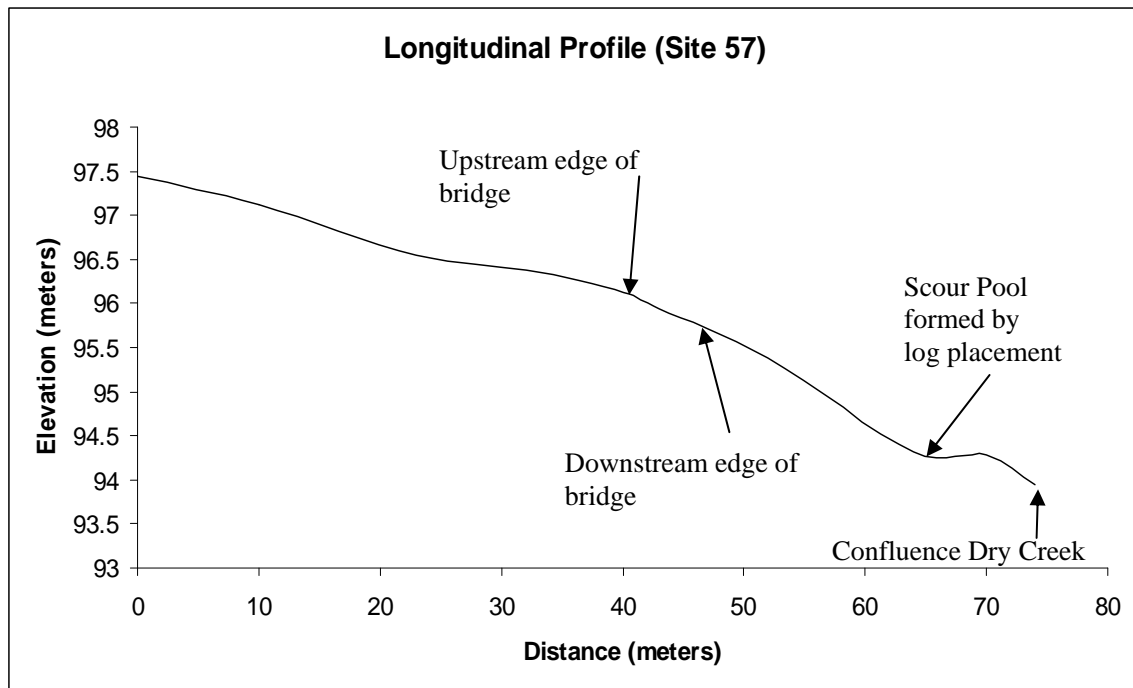
This was the site of a 4.4 meter wide by 10.5 meter long steel rail car bridge. The channel was completely dry at time of survey.

This forested mountain stream had substrate comprised of exceedingly clean gravels and cobbles indicating excellent spawning potential. Channel gradient through the survey section was 4.5%. Bankfull width averaged 5.7 meters. There was evidence of intense stream power; at two locations where log structures were placed there has been intense scouring. This has resulted in the placed wood providing 3 important functions. First the wood is forcing pools. This is seen in the longitudinal profile (

[Figure 100](#)~~Figure 99~~). Secondly the wood is accumulating sediment, and lastly the wood is providing habitat cover. The intense power of the stream is also causing some downcutting at the bridge area (~1 meter).

We hiked up the channel for over 330 meters to look for water and fish. At approximately, 360 meters above the bridge, water began to puddle and eventually flow resumed. In nearly every depression (pool less than 0.3 meters in depth) there were juvenile salmonids. The shallow nature of these pools made species identification difficult, and fish were extremely skittish. Most of these juvenile were unknown trout probably steelhead or cutthroats.

Longitudinal Profile



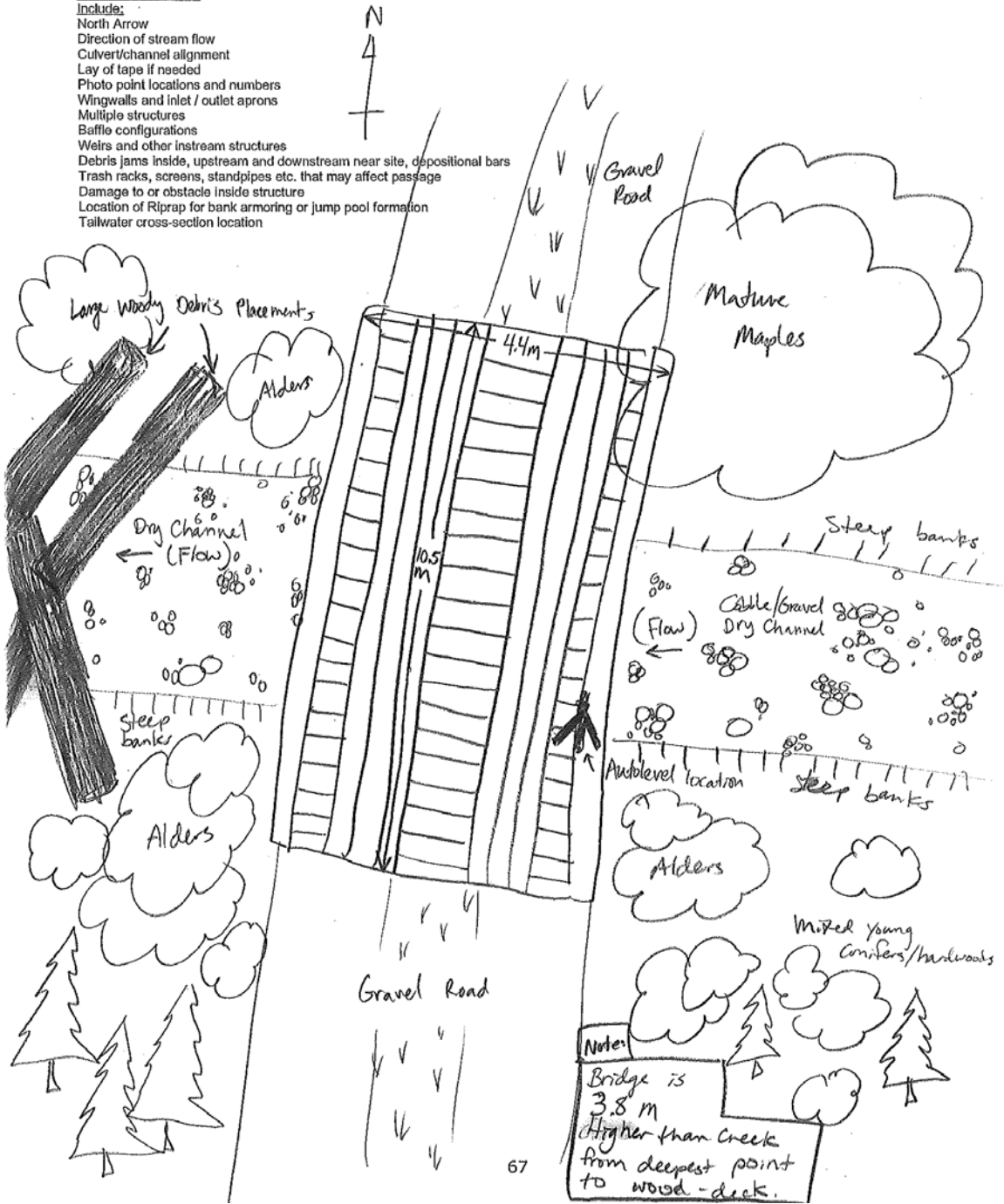
| Figure 10099. Longitudinal profile of Site 57, a tributary to Dry Creek.

Site Sketch

Crossing ID number 57 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
 - Trash racks, screens, standpipes etc. that may affect passage
 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Site # 58 2009 Restoration Effectiveness Monitoring Summary

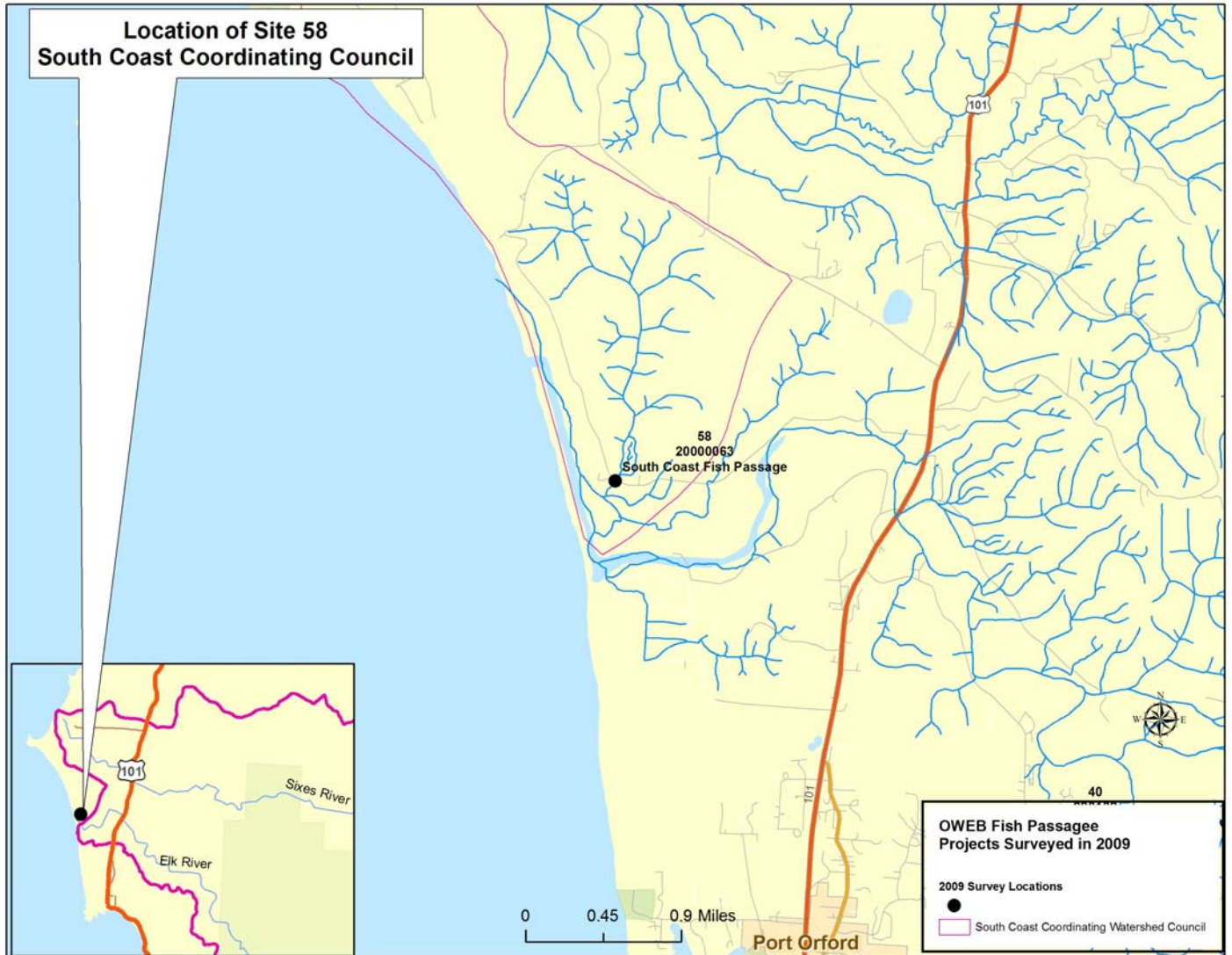
OWEB Project Name – South Coast Fish Passage

OWEB Grant Number – 097 - 096

OWRI Project Number – 20000063

Owner – Private, Beverly McKenzie

OWEB Description – Fish Passage



Map 5952. Location of Site 58, a tributary to Elk Creek.

Site Notes

This was the site of two side-by-side 1.0 meter in diameter circular culverts. These culverts were completely submerged in water and very difficult to measure and assess.

This was not the location where OWEB coordinates took us. The OWEB coordinates took us to the middle of a dry field. However, after discussing the culverts with landowner Beverly McKenzie, we decided that this was the site we were supposed to survey.

This was a deep trench channel running through a wetland (field). The culverts here were “buried” by deep water, intense silt, and dense reed canary grass. Bankfull was 6.5 meters and the ratio of inlet width to channel width was .26. Substrate was continuous through the culverts, and it was 100% silt. The channel gradient was measured at 1.2% and the culvert slope was a -1.9%.

The riparian area is dominated by reed canary grass, but there are planted willows growing within the riparian enclosure.

There were no defined pools upstream of these culverts. It was all a huge trench that blended seamlessly with a wetland. We snorkeled and found the visibility to be extremely poor. In the first 100 meters we did not see a single fish. Then between 100 meters upstream of the culverts and 175 meters we identified 1 cutthroat, 1 stickleback, 5 sculpins and a couple of red-sided shiners.

FishXings predicts that 29% of the modeled flows will be passable by juvenile salmonids. The predicted velocity block begins at 0.25 cms.

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = .1 m

Table 88. Fish Passage Summary, Site 58.

Fish Passage Summary	
Low Passage Design Flow	0.0800 cms
High Passage Design Flow	0.8500 cms
Percent of Flows Passable	29.3 %
Passable Flow Range	0.001 to 0.2501 cms
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.25 cms and Above
Pool Depth Barrier	None

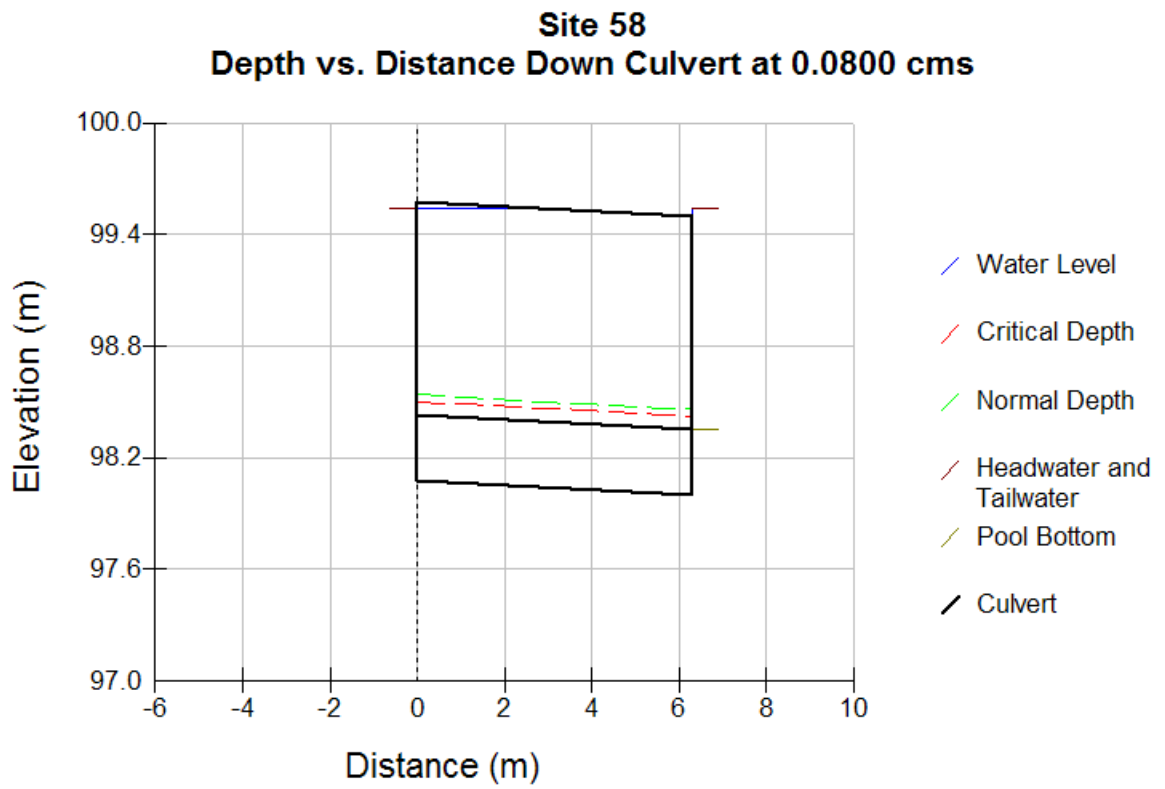


Figure 101100. Water Surface Profile at 0.08 cms, passable flows.

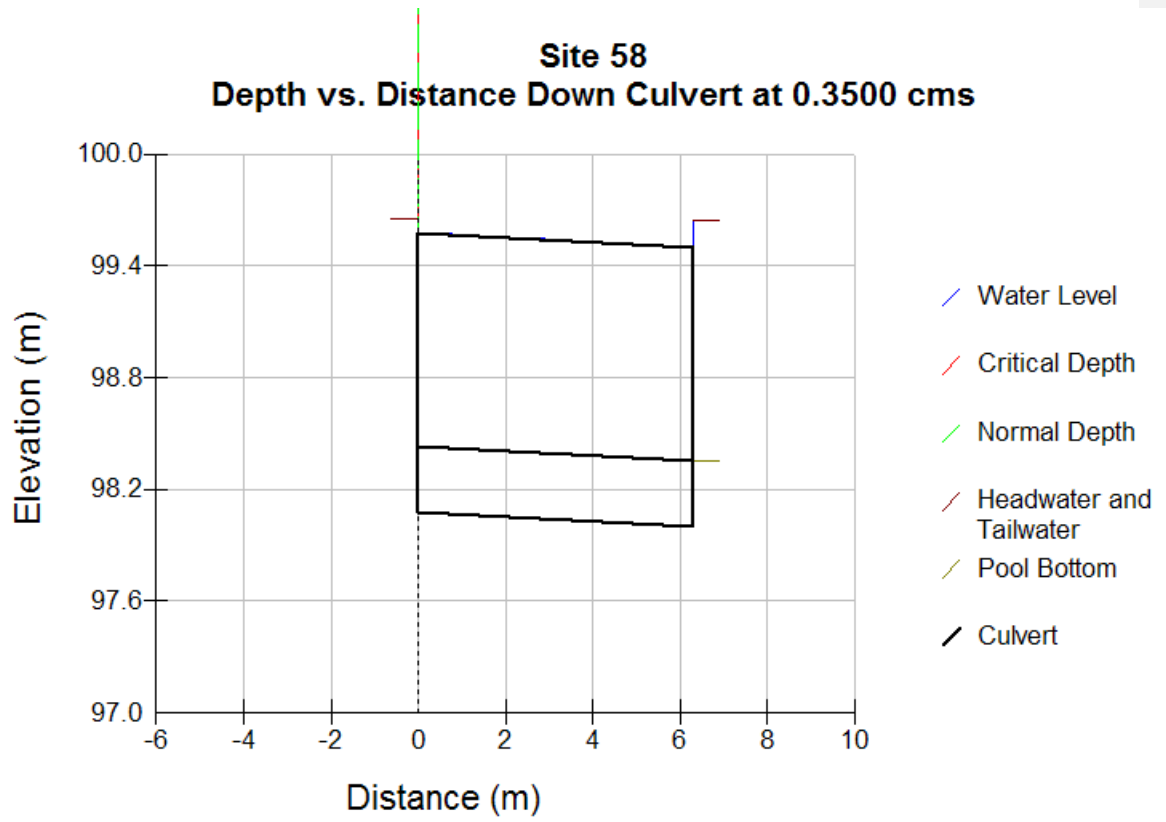


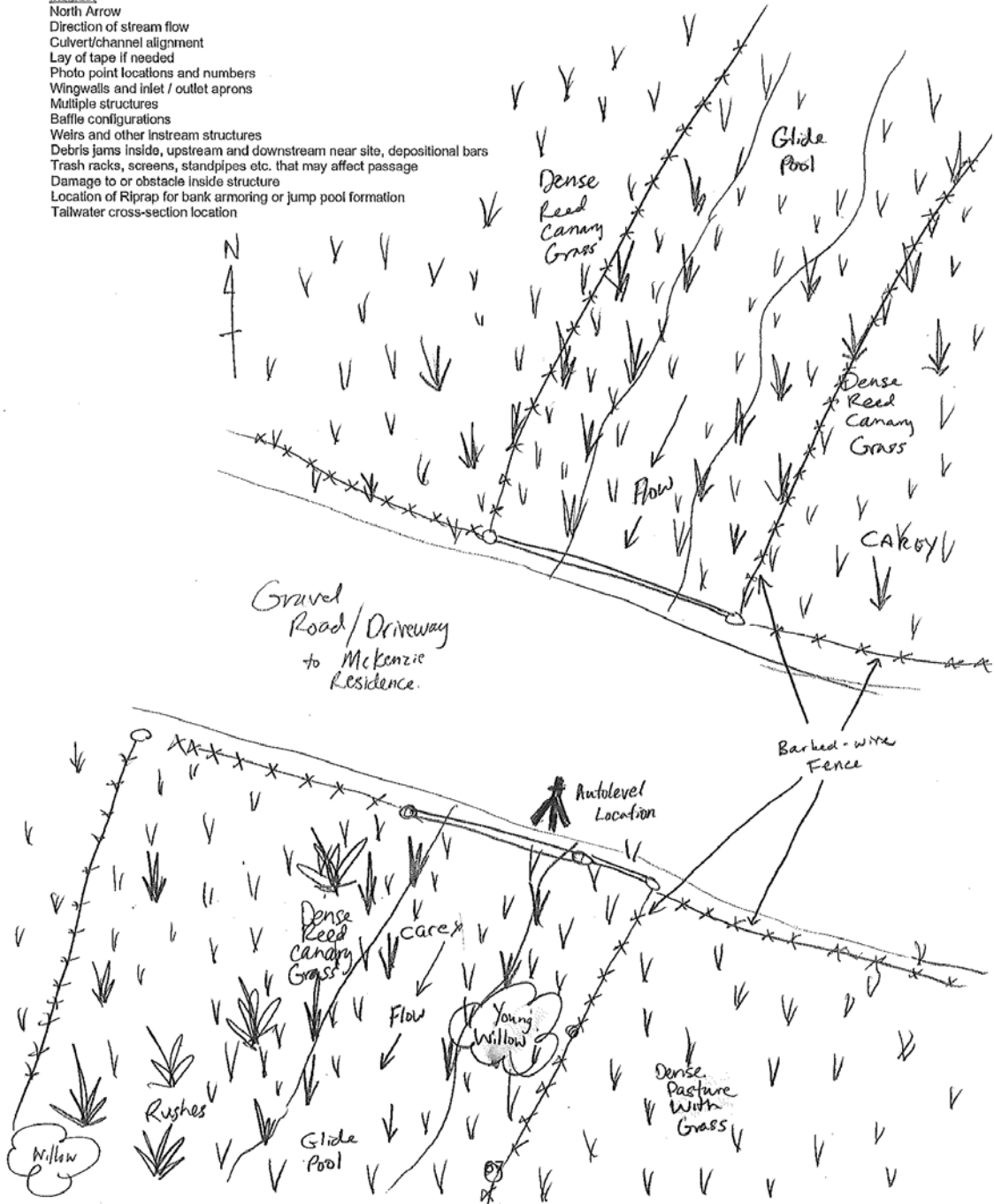
Figure 102101. Water Surface Profile at 0.35 cms, velocity block.

Site Sketch

Crossing ID number 58 Structure 1 of 1

SITE SKETCH

- Include:
- North Arrow
 - Direction of stream flow
 - Culvert/channel alignment
 - Lay of tape if needed
 - Photo point locations and numbers
 - Wingwalls and inlet / outlet aprons
 - Multiple structures
 - Baffle configurations
 - Weirs and other instream structures
 - Debris jams inside, upstream and downstream near site, depositional bars
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 - Damage to or obstacle inside structure
 - Location of Riprap for bank armoring or jump pool formation
 - Tailwater cross-section location



Illinois Sub-basin Site Report

Site # 8 2009 Restoration Effectiveness Monitoring Summary

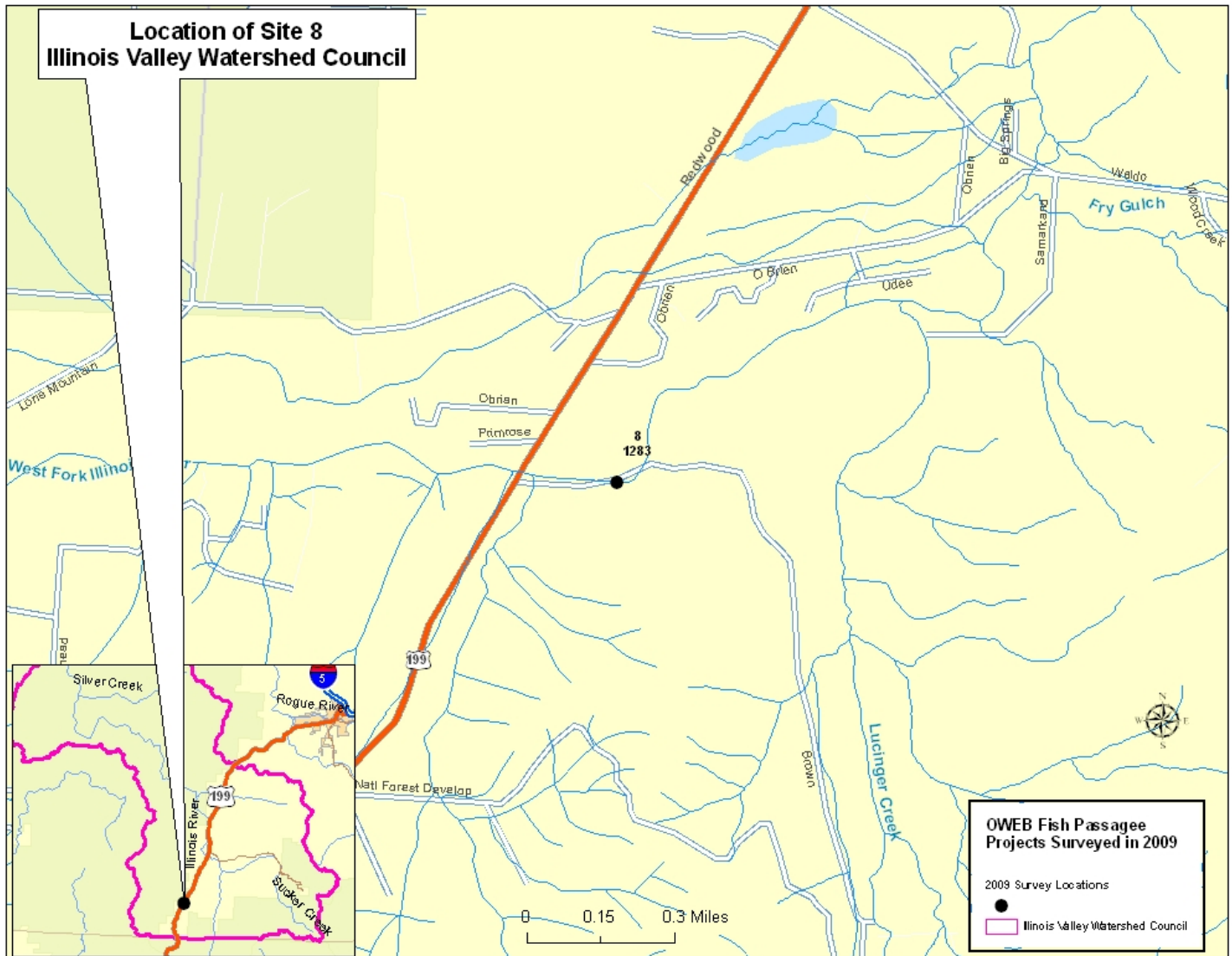
OWEB Project Name – West Fork Illinois

OWEB Grant Number – SC - 025

OWRI Project Number – 1283

Owner – Private

OWEB Description – Fish Passage



Map 60. Location of Site 8 on the West Fork of the Illinois River.

Site Notes

This was the site of a push-up dam/irrigation intake pump. The pump was recently installed. We could not evaluate the effectiveness of the intake pump fish screens because they were under deep water. The photo-series below illustrates how the pump was installed.

We conducted a longitudinal profile through the reach affected by the push up dam and intake screen (Figure 102). The channel gradient was 0.25% through the project area (~200 meters). There was a large pool just downstream of the push-up dam. The intake pump draws from this pool. The channel substrate in the vicinity of the dam and pump was dominated by large cobbles/boulders/bedrock. The push-up dam itself was constructed by piling smaller size cobbles across the creek. [Figure 103](#)~~Figure 102~~ is a longitudinal profile at a finer scale through the intake pool and push-up dam. Although there was a jump at the push-up dam spillway (~0.1 meter), it was completely submerged by water. We surveyed here in mid-September 2009. Flow was very low in the area. Even at this low of flow juvenile salmon should be able to cross this dam. However, in spring and summer when salmonids are migrating upstream there should plenty of water covering the dam and spill way to allow juvenile salmonids to easily pass.

We did not snorkel here. At the time of this survey, there were warnings in southwest Oregon about people becoming contaminated from harmful microbes associated with algal blooms in nearby streams and lakes. At the time of this survey, algal blooms were common in the West Fork of the Illinois River. We did take note of many juvenile salmonids above the dam.

Longitudinal Profiles

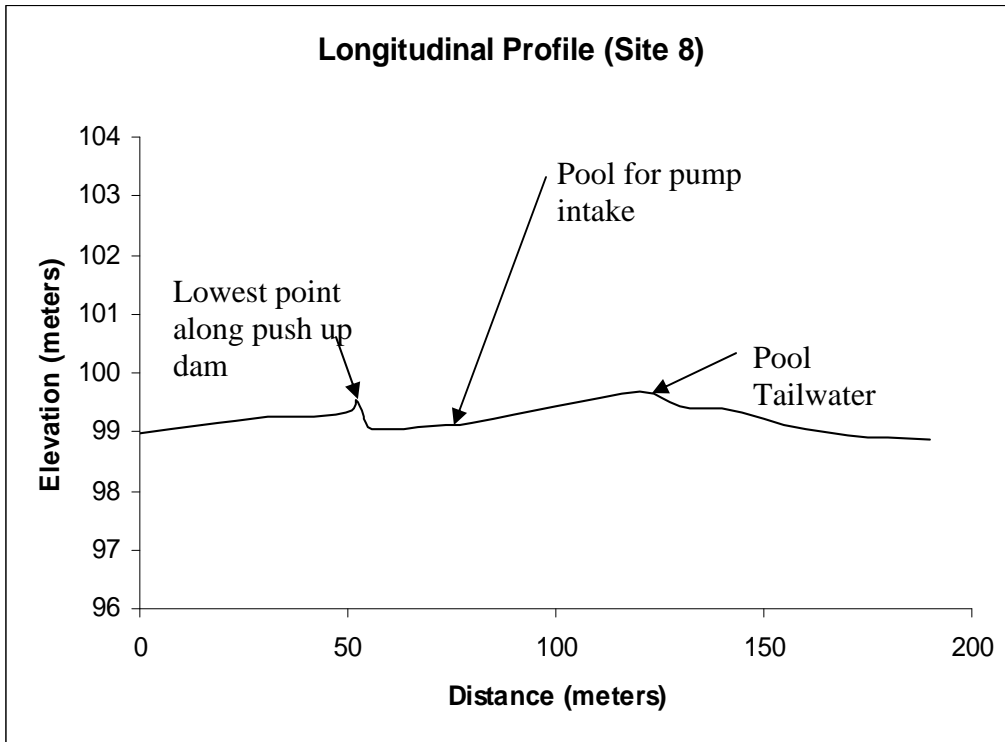


Figure 103102. Longitudinal survey of Site 8. This graph illustrates the channel profile over a 200 meter survey length.

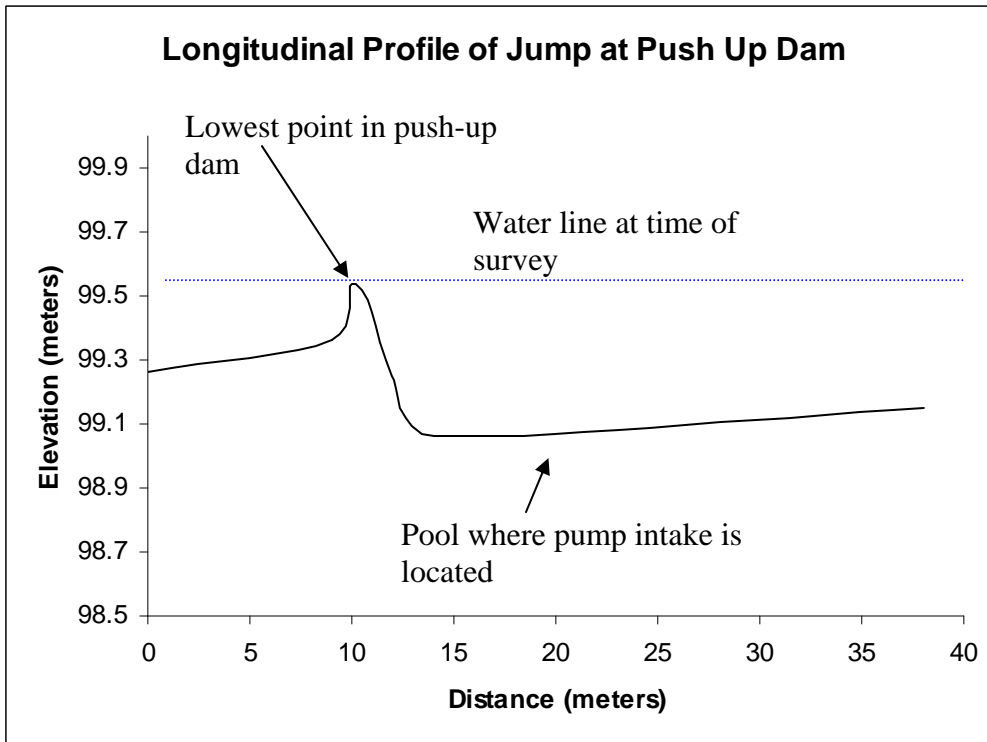


Figure 104103. Longitudinal profile of the channel at the push up dam and pump intake pool.

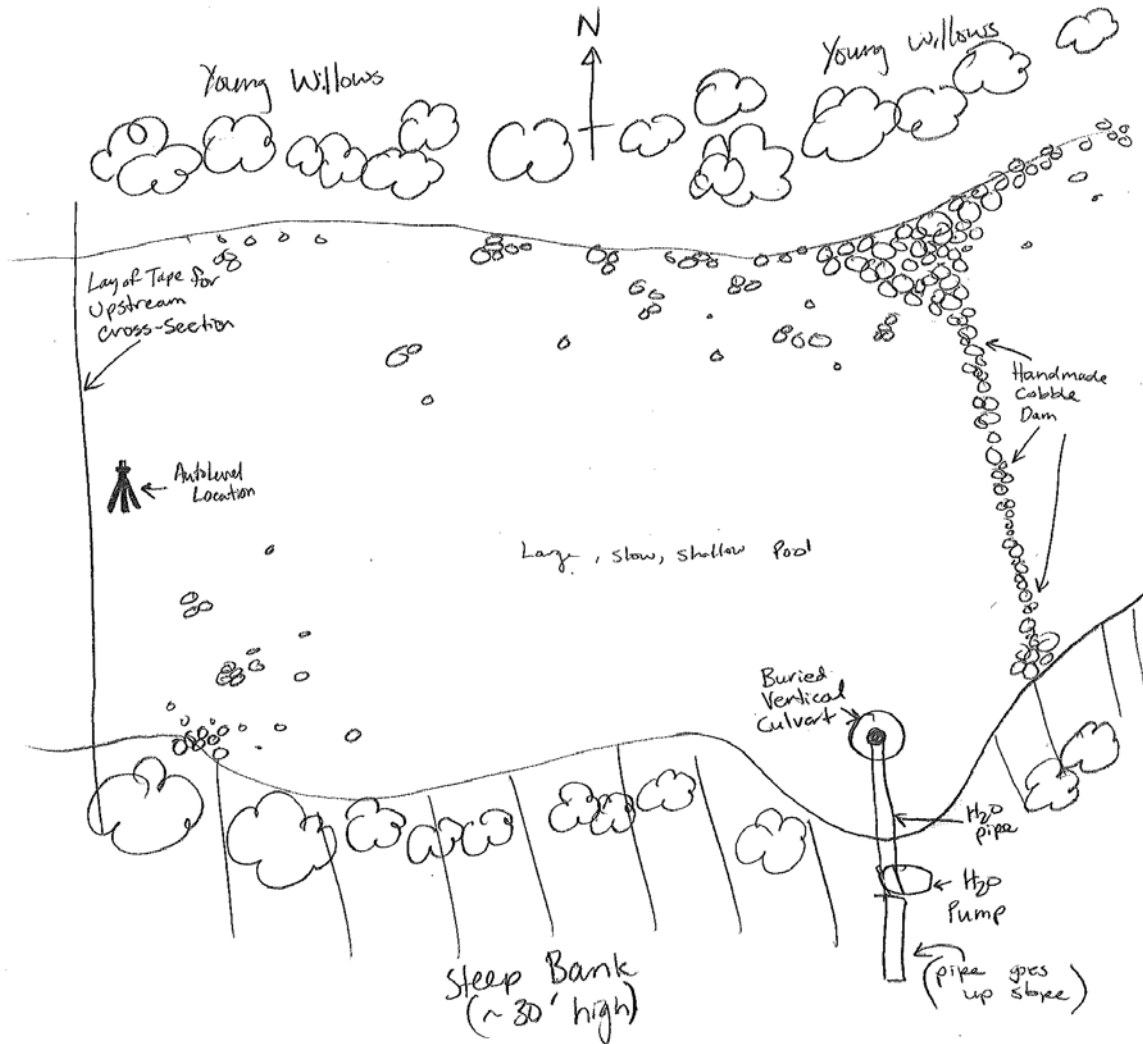
Site Sketch

Crossing ID number 8 Structure 1 of 1

SITE SKETCH

Include:

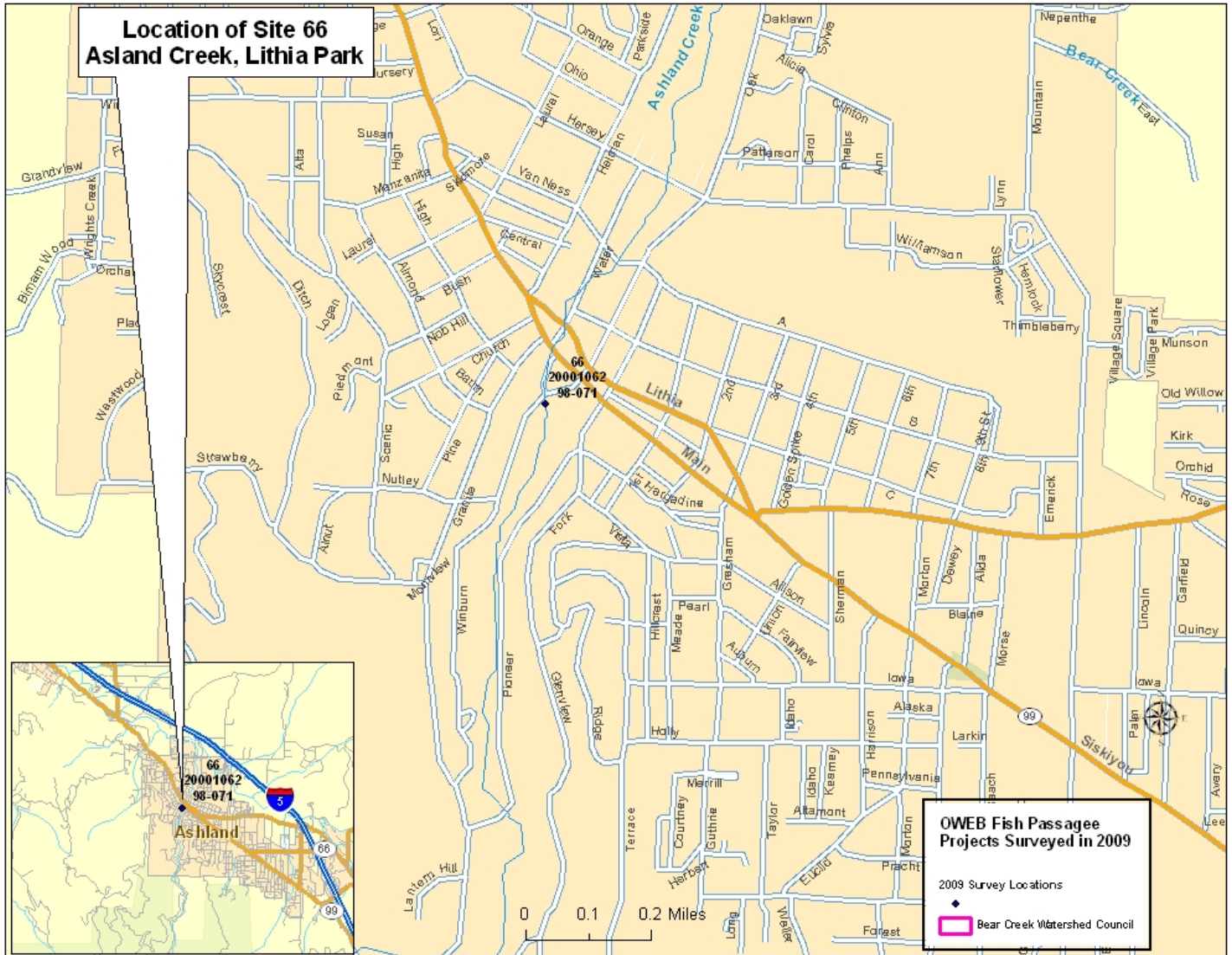
- North Arrow
- Direction of stream flow
- Culvert/channel alignment
- Lay of tape if needed
- Photo point locations and numbers
- Wingwalls and inlet / outlet aprons
- Multiple structures
- Baffle configurations
- Weirs and other instream structures
- Debris jams inside, upstream and downstream near site, depositional bars
- Trash racks, screens, standpipes etc. that may affect passage
- Damage to or obstacle inside structure
- Location of Riprap for bank armoring or jump pool formation
- Tailwater cross-section location



Rouge Basin Site Reports

Site # 66 2009 Restoration Effectiveness Monitoring Summary

OWEB Grant Number – 98-071
OWRI Project Number – 200001062
Owner – City of Ashland
OWEB Description – Fish Passage Improvement



Map 61. Location of Site 66, Ashland Creek, Lithia Park, City of Ashland

Site Notes

This site was a bridge in the City of Ashland. It was adjacent to Lithia Park and creek-side restaurants.

Above, below, and through the bridge boulders make up the dominant substrate form with cobbles, gravels, and sand following. Boulder had been placed throughout the creek creating a cascade effect. This channel is in a highly managed state as it passes through the forest park and town. [Figure 105](#)[Figure 104](#) illustrates the longitudinal profile of the channel. Large boulder steps are easy to discern as are the large pool at the bridge outlet.

Bankfull width was 6.8 meters and the channel gradient was 2.0%.

There was a warning posted all along the creek warning people to stay out of the creek to bacteria blooms and unsafe conditions. The creek was not snorkeled, but juvenile salmonids were seen at the time of survey.

Longitudinal Profile

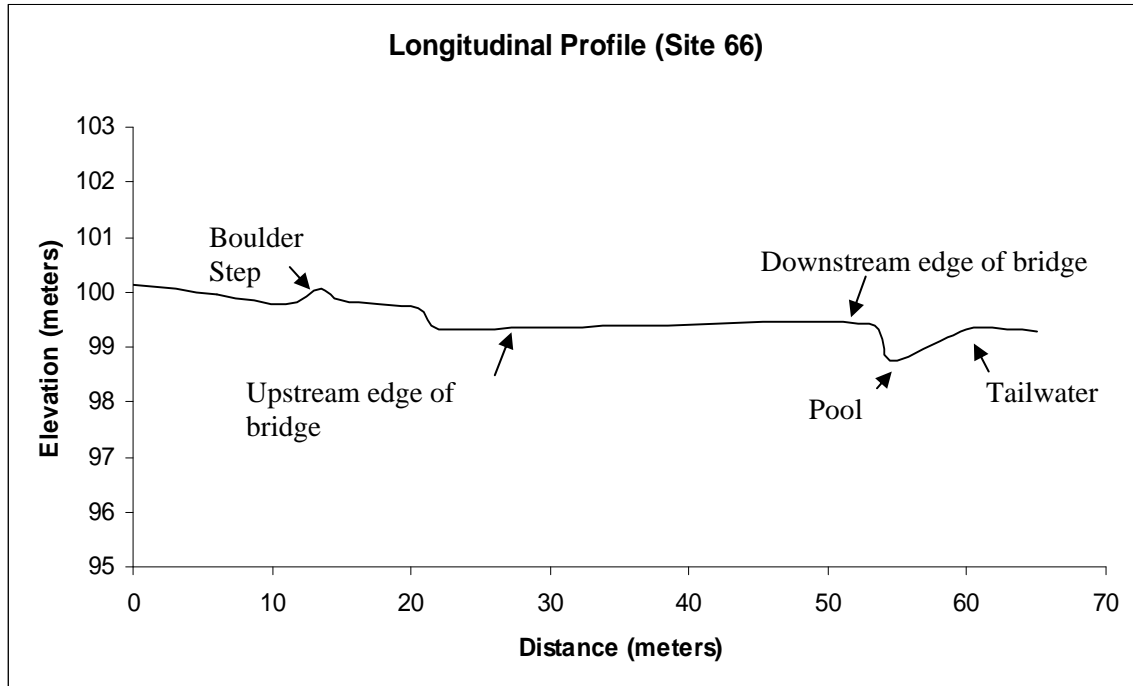


Figure [105](#)[104](#). Longitudinal profile of the surveyed section of Ashland Creek.

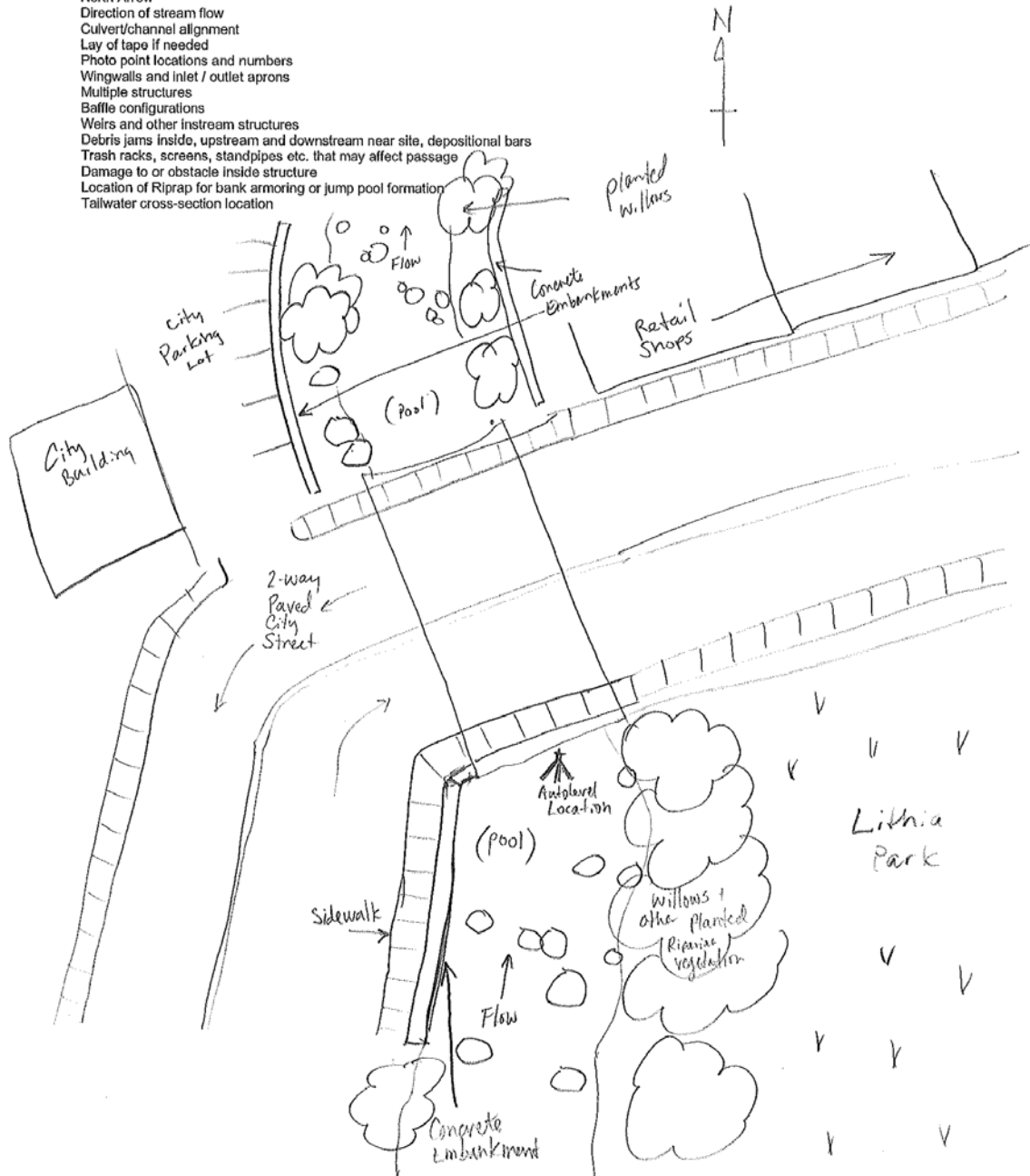
Site Sketch

Crossing ID number 66 Structure 1 of 1

SITE SKETCH

Include:

- North Arrow
- Direction of stream flow
- Culvert/channel alignment
- Lay of taps if needed
- Photo point locations and numbers
- Wingwalls and inlet / outlet aprons
- Multiple structures
- Baffle configurations
- Weirs and other instream structures
- Debris jams inside, upstream and downstream near site, depositional bars
- Trash racks, screens, standpipes etc. that may affect passage
- Damage to or obstacle inside structure
- Location of Riprap for bank armoring or jump pool formation
- Tailwater cross-section location



Site # 65 2009 Restoration Effectiveness Monitoring Summary

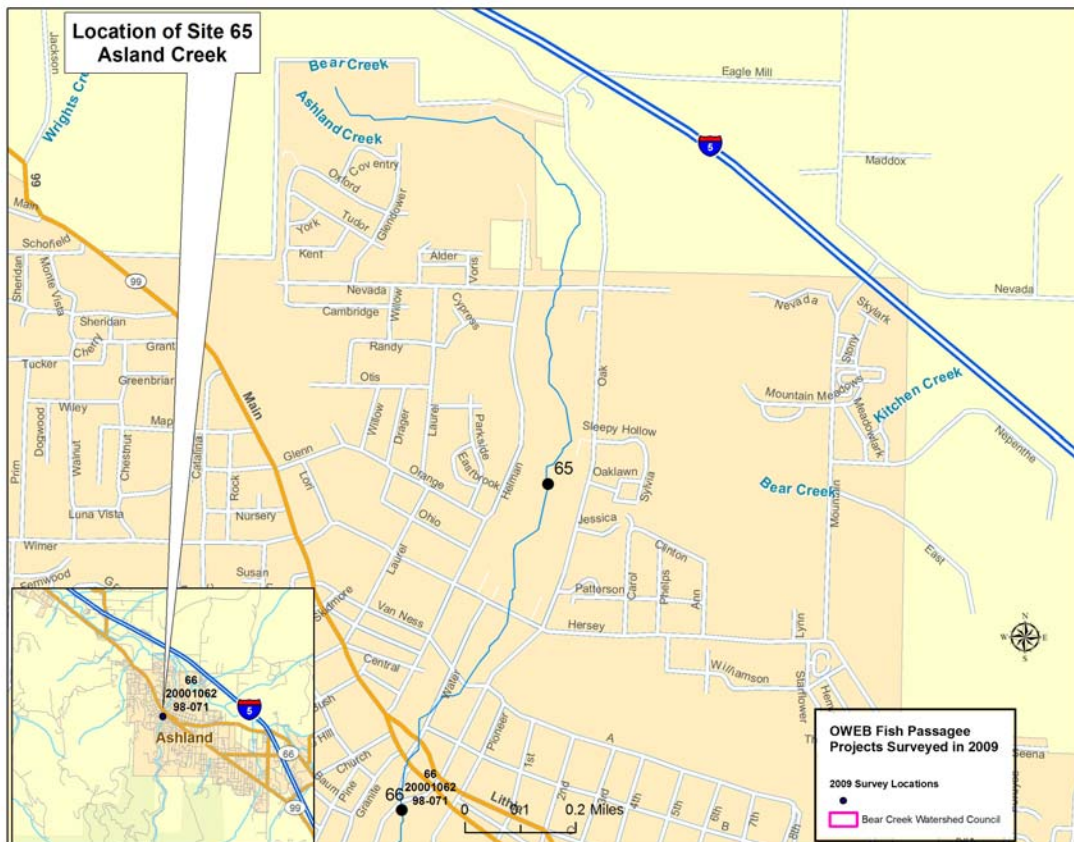
OWEB Project Name – Ashland Creek

OWEB Grant Number – 98-071

OWRI Project Number - 20001061

Owner – City of Ashland

OWEB Description – Fish Screen



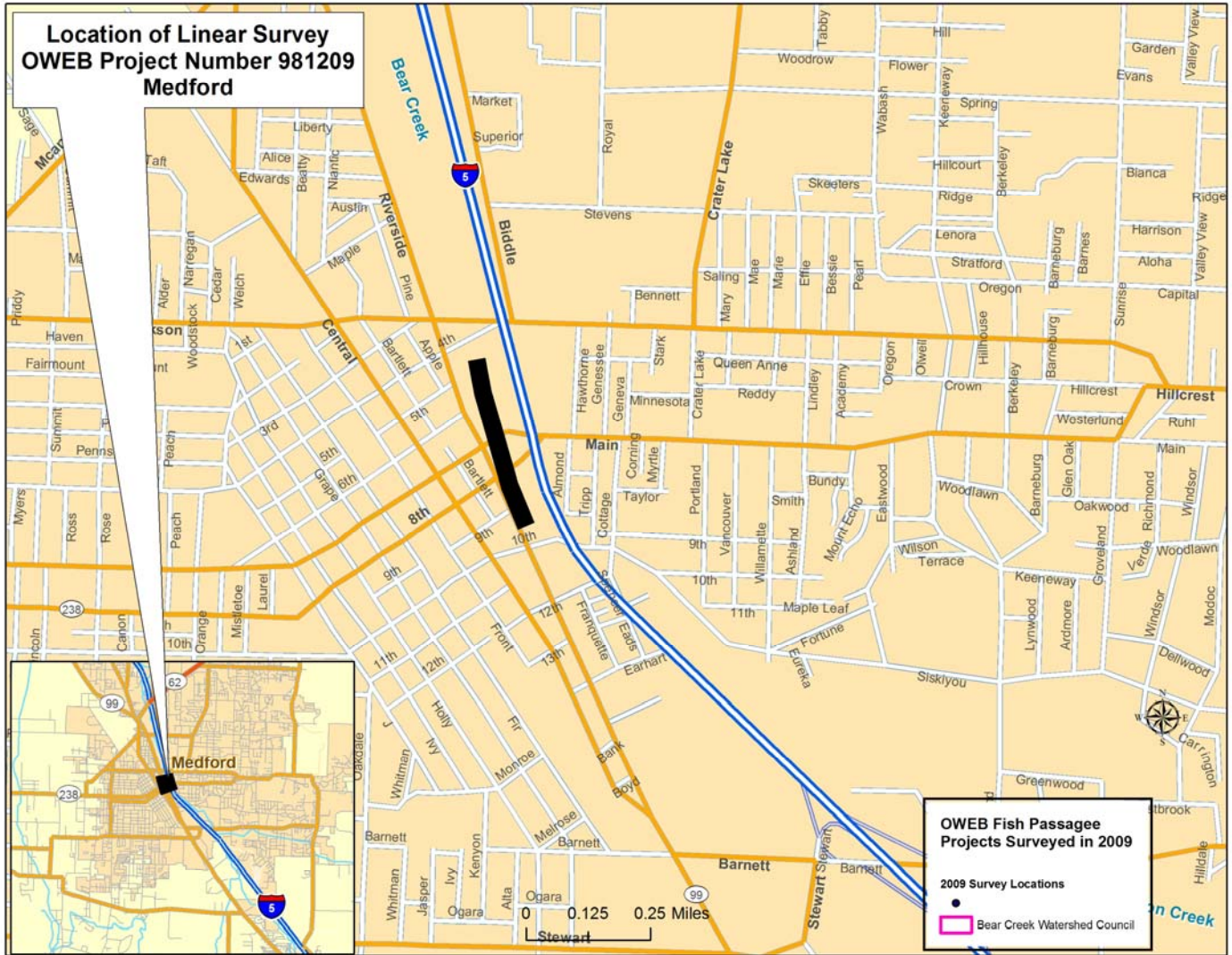
Map 62. Site 65, Ashland Creek.

Site Notes

This was the site of a recently installed fish screen on Ashland Creek. The paddle wheel had a stop (stick) in it to keep it from turning when we arrive. We freed the wheel, made certain that it turned properly and water passed through as intended and that fish would be blocked from entering. After we made this simple test, we put the stick back in to stop the wheel. This was a qualitative assessment, but the screen seemed functional.

Site 981209 2009 Restoration Effectiveness Monitoring Summary

OWEB Project Name
 OWEB Grant Number – SC-016
 OWRI Project Number – 981209
 Owner – City of Medford
 OWEB Description – Fish Ladder



Map 63. Location of the linear survey through downtown Medford.

Site Notes

This is a section of creek that runs under freeway overpasses through downtown Medford. We began walking the creek at the downstream end of the OWEB provided line. It was difficult to tell what had been done here and what we were supposed to assess. Nevertheless, we walked the entire length and took photographs along the way. At the end of the survey, we came to a dam and newly installed fish ladder that was completely surrounded by 10 foot high fencing. We had to assume this is what we were supposed to survey, yet we could not obtain access. The ladder is administered by the Rouge River Valley Irrigation District. Please see the photo-log for photos from this site.

Site # 75 2009 Restoration Effectiveness Monitoring Summary

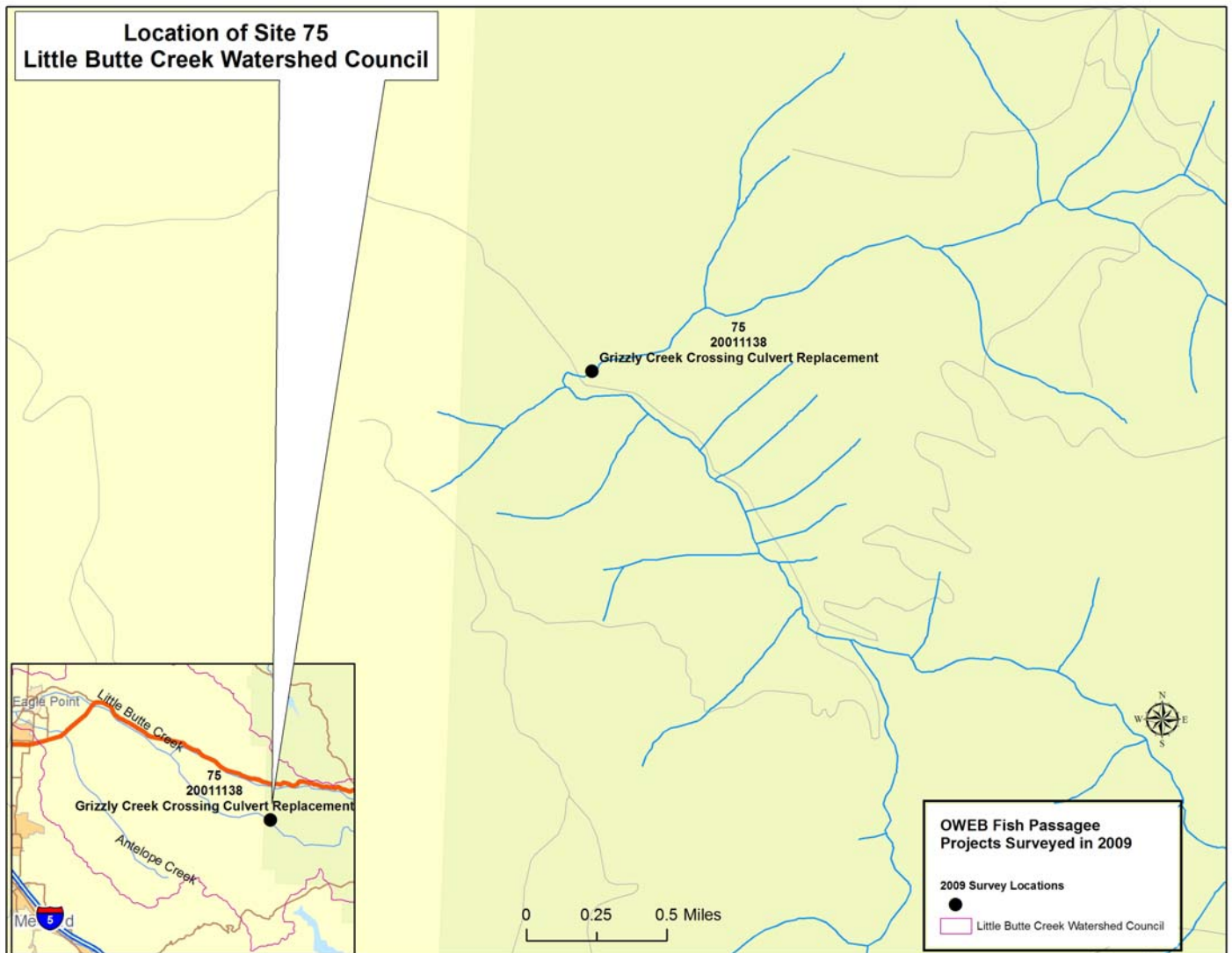
OWEB Project Name – Grizzly Creek Crossing Culvert Replacement

OWEB Grant Number – 200-056

OWRI Project Number – 20011138

Owner – Jim Eagen

OWEB Description – Fish Passage



Map 64. Location of Site 75, a tributary to Grizzly Creek.

Site Notes

This crossing was a pipe-arch culvert that was 2.3 meters wide and 1.7 meters tall. The channel slope was 7.5% and the culvert slope was 3.9%. Bankfull width was 3.4 meters and the ratio of inlet width to channel width was 0.68. This was a step pool channel with the substrate dominated by boulders/cobbles/gravels. There was no substrate in the culvert, and water seemed to be flowing somewhat under the culvert. There was a < 0.1 meter outfall onto riprap where water depth was recorded as 0.2 meters (deepest spot with 1 meter of the culvert).

Snorkel survey results (Table 89) showed that juvenile salmonids were occupying most of the habitat available to them above the culvert.

FishXings should that this culvert is a complete barrier to juvenile passage because of velocity.

Table 89. Snorkel survey results for Site 75, tributary to Grizzly Creek, Little Butte Creek Watershed Council.

Stream LLID	Pool ID	Pool Type	Pool Length	Pool Width	Pool Depth	Species	Number
1224718423508	1	Plunge	1.4	1.6	0.31	Steelhead/Cutthroat	1
1224718423508	2	Straight Scour	1.5	1.6	0.32	Steelhead/Cutthroat	2
1224718423508	3	Straight Scour	1.8	1.9	0.32	Steelhead/Cutthroat	3
1224718423508	4	Straight Scour	0.9	0.8	0.35	0	0
1224718423508	5	Straight Scour	2.6	1.2	0.32	Steelhead/Cutthroat	5

FishXings Results

Hydraulic Evaluation Criteria

Maximum Allowed Water Velocity = 0.33 m/s

Minimum Required Depth = 0.03 m

Maximum Allowed Outlet Drop = 0.1 m

Table 90. Fish Passage Summary, Site 75.

Fish Passage Summary	
Low Passage Design Flow	0.0100 cms
High Passage Design Flow	4.8000 cms
Percent of Flows Passable	0.0 %
Passable Flow Range	None
Depth Barrier	None
Outlet Drop Barriers	None
Velocity Barrier - V	0.01 cms and Above
Pool Depth Barrier	None

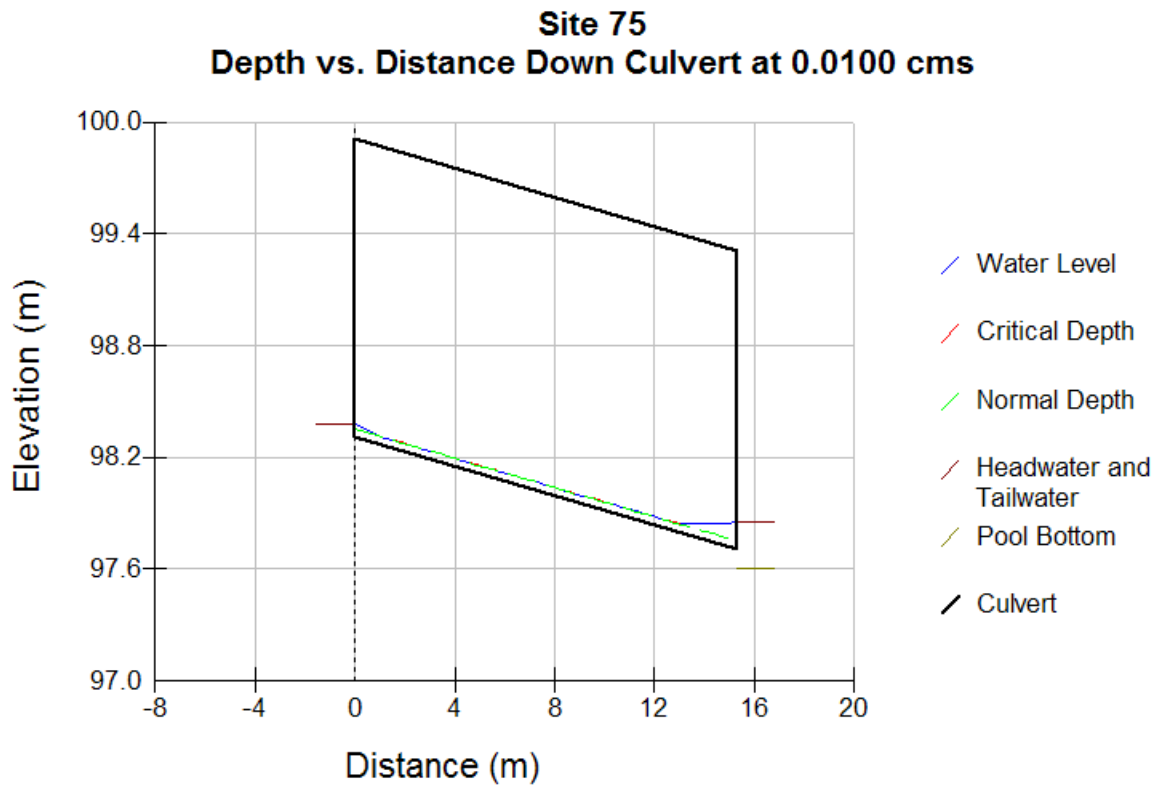


Figure 106105. Water Surface Profile at 0.01 cms, velocity block.

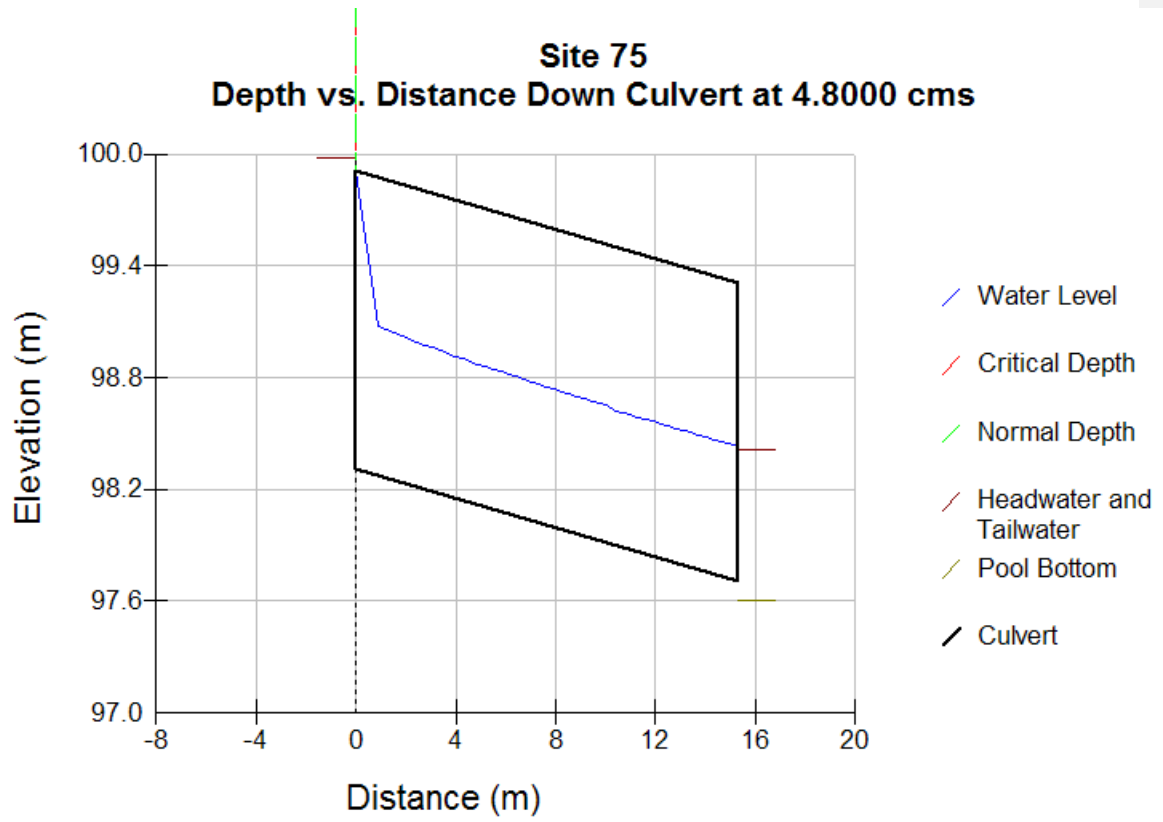


Figure 107406. Water Surface Profile at 4.8 cms, velocity block.

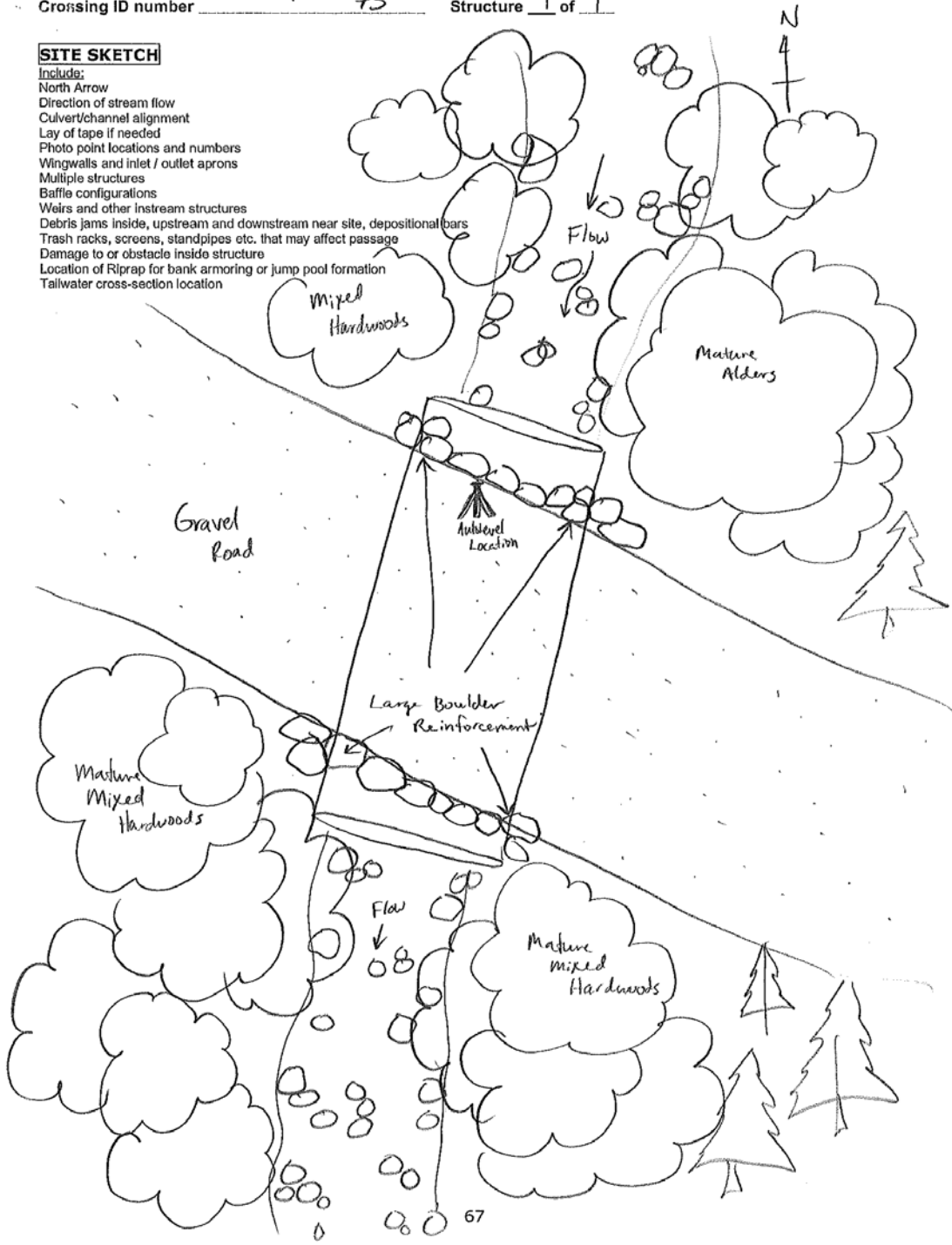
Site Sketch

Crossing ID number 75 Structure 1 of 1

SITE SKETCH

Include:

- North Arrow
- Direction of stream flow
- Culvert/channel alignment
- Lay of tape if needed
- Photo point locations and numbers
- Wingwalls and inlet / outlet aprons
- Multiple structures
- Baffle configurations
- Weirs and other instream structures
- Debris jams inside, upstream and downstream near site, depositional bars
- Trash racks, screens, standpipes etc. that may affect passage
- Damage to or obstacle inside structure
- Location of Riprap for bank armoring or jump pool formation
- Tailwater cross-section location



References

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Cooper, R.M., 2005, Estimation of peak discharges for rural, unregulated streams in Western Oregon: U.S. Geological Survey Scientific Investigations Report 2005-5116, 134 p.

FishXing software and learning systems for the analysis of fish migration through culverts

<http://www.stream.fs.fed.us/fishxing/>

NOAA-NMFS, 2001, Guidelines for Salmonid Passage at Stream Crossings.

Oregon Department of Forestry Forest Practices Technical Note Number 5, Version 1.0, 2002.

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Appendix A

Appendix B