APPLEGATE BASIN MONITORING

OWEB GRANT 204-283
FINAL REPORT

Prepared for the
Oregon Watershed Enhancement Board

By the

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1.0 Introduction

The Applegate River Watershed Council (ARWC) has collected information on the chemical, physical and biological attributes throughout the watershed since 1997. Information collected enabled the council to evaluate the health of the watershed, develop restoration projects and evaluate project effectiveness. The Applegate Basin Monitoring Project focused efforts on habitat surveys, stream temperatures, stream flow, water quality, riparian planting, and gravel/channel dynamics.

Past watershed council monitoring efforts led to the development of the *Williams Creek Watershed Assessment and Action Plan* (WCWC 2000); *Cheney Creek Watershed Assessment* (WCWC 2001); *Little Applegate Watershed Assessment and Action Plan* (ARWC 2002); *Slate Creek Watershed Assessment and Action Plan* (ARWC 2002); *Continuous Monitoring of Dissolved Oxygen, pH, and Temperature in the Applegate River Basin* (ARWC 2002); *Estimated Heat Budget for the Applegate Basin* (ARWC 2002); *Monitoring and Assessing the Applegate River Basin* (2002); *Applegate Subbsain Total Maximum Daily Load* (DEQ 2003); *Stream Habitat and Water Quality in Applegate Basin* (ARWC 2004); *Watershed Health Factors Assessment* (RBCC 2006); *Applegate River Watershed Water Quality Implementation* Plan (DRAFT 2006); and the *Middle Applegate Outreach and Assessment* (ARWC 2007).

The Applegate Basin Monitoring Project was conducted from September 2004 through December 2006. Support for this project was provided by the Oregon Watershed Enhancement Board, U.S. Forest Service, Oregon Water Trust, and Neilson Research Laboratory. Additionaly, ARWC receieved techinical support from the Oregon Department of Environmental Quality and Oregon Department of Fish and Wildlife. Other project partners included: Williams Creek Watershed Council and Newberry Watershed Consulting.

2.0 Habitat Surveys

2.1 Forest Creek

ARWC conducted a habitat survey on Forest Creek on 6/6/05-6/7/05, using the methods outlined in the *Intermediate Level Method for Stream Habitat Surveys* (ODFW, 1999). The survey began at the confluence of Forest Creek and the Applegate River (*See Figure 1*). Three reaches were surveyed. The land use within the survey is predominately agriculture and partial rural residential. Outreach for access permission was comprised of letters and phone calls. Most landowners were not only willing to grant access, but were interested in the fish presence and health of Forest Creek. The survey was terminated at the confluence of Poorman's Creek (~RM 2.6), due to limited access granted by landowners. Due to the historic mining and present land management operations it was difficult to discern to actual confluence of Forest and Poorman's Creek. See *Appendix A* for complete survey.

Figure 1. Forest Creek habitat survey map.

Reach Descriptions

Reach 1 (T38S 3W 28) begins at the confluence of Applegate River and Forest Creek and extends 1,689 meters. The channel is unconstrained within a constraining terrace in a broad valley. The valley width index is 4.5. Land use is predominately agriculture. Riparian vegetation consists of deciduous trees (5-20dbh) and shrubs (blackberries and willow). Shade within the reach averaged 36%. Riffles compose the majority of the reach: 873m/3,399m^2 (length/total area) with riffles w/pockets (571m/2,595 m^2) second. The dominant habitat type by number is lateral scour pools (32 units) with riffles (28 units) second. Gradient in the reach is 1.1%. Large woody debris is undesirable with 0.8 pieces per 100 meters stream length.

Reach 2 (T38S 3W 27) begins at the Highway 238 bridge and extends 2,227 meters, the confluence of Bishop Creek. The channel is constrained hillslope within a constraining terrace in a broad valley. The valley width index is >4. Land use is rural residential and partial agriculture. Riparian vegetation consists of shrubs and deciduous trees (5-10dbh). Shade within the reach averaged 52%. Riffles with pockets compose the majority of the reach (912m/2,891m^2) with rifles (616m/3,009 m^2) second. The dominant habitat type by number is riffles with straight scour pools (17 units) second. Gradient in the reach is 1.4%. Large woody debris is undesirable with 0.9 pieces per 100 meters stream length.

Reach 3 (T38S 3W 23) begins at the confluence of Bishop Creek and extends 2,263 meters to the approximate confluence with Poorman's Creek. The channel is constrained in hillslope within a narrow valley floor (open v-shape). The valley width index is >4. Land use is rural residential. Historical mining is very evident in this reach. Riparian vegetation consists of shrubs and deciduous and conifer trees (15-20dbh). The dominant habitat type by number is scour pools (20 units) with riffles (18 units) second. Gradient in the reach is 1.4%. The upper portion of the reach subbed out and the confluence of Poorman's Creek is difficult to discern due to extensive mine pits.

As displayed in Table 1, Forest Creek does not meet many ODFW benchmarks for desirable habitat conditions. Large wood is scarse, resulting in low a low number of complex pools. Scour pools constitute the highest percentage of pools within the surveyed reach.

Table 1. ODFW Aquatic Habitat Benchmarks.

	Pool Area	Complex Pools	Spawning Gravel	Fine Sediment	Instream Large Wood
Desirable	>35%	>2.5/km	>35%	<10%	>3/100m
Undesirable	<10%	<1/km	<15%	>20%	<1/100m

Table 2. Forest Creek habitat survey habitat benchmarks, 2005.

Reach	%Pool Area	Complex Pool	% Gravel	% Sand/Silt	Large Wood
1	34.75	1.3/km	45	18	0.8/100m
2	33.76	0.4/km	29	14	0.9/100m
3	43.21	1.1/km	35	13	2.8/100m

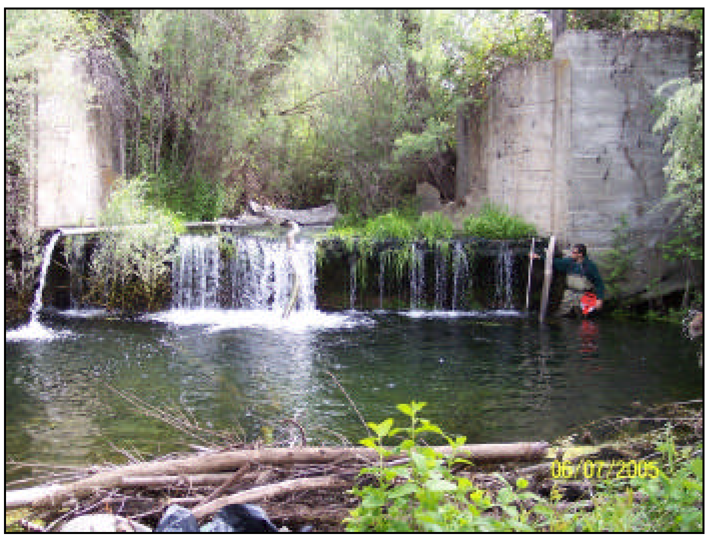
Juvenile salmonids were observed in Reaches 1 and 2. An unidentified fish was observed in Reach 3. Evidence of current dredge and historic placer mining were observed within Reaches 2 and 3 as illustrated in Figures 3 and 4.

Figure 3. Out of season dredge mining (Reach 2)

Figure 4. Historic mine tailings (Reach 3).

One partial barrier to upstream migration was identified in Reach 2 (Figure 5). The cement barrier, which measures 4'high by 20' long is the bottom portion and sides to a former bridge. Although, this barrier is not noted on the Rogue Basin Fish Access Team (RBFAT) Strategic Plan (2000), the watershed council is presently working with the landowner to remove this obstruction within Forest Creek.

Figure 5. Cement barrier below confluence of Bishop Creek.



2.2 Humbug Creek

Due to low flows and sporadic property access, ARWC did not conduct a formal survey as outlined in *Intermediate Level Method for Stream Habitat Surveys.* However, ARWC did walk the channel where possible and make notes pertaining to channel conditions, substrate, riparian and barriers. The survey began at the confluence of Humbug Creek and the Applegate River and ended just above Balls Branch. The majority of land use is rural residential and partial agriculture. Outreach for access permission was comprised of letters and phone calls.

Figure 6. Humbug Creek habitat survey, 2005.

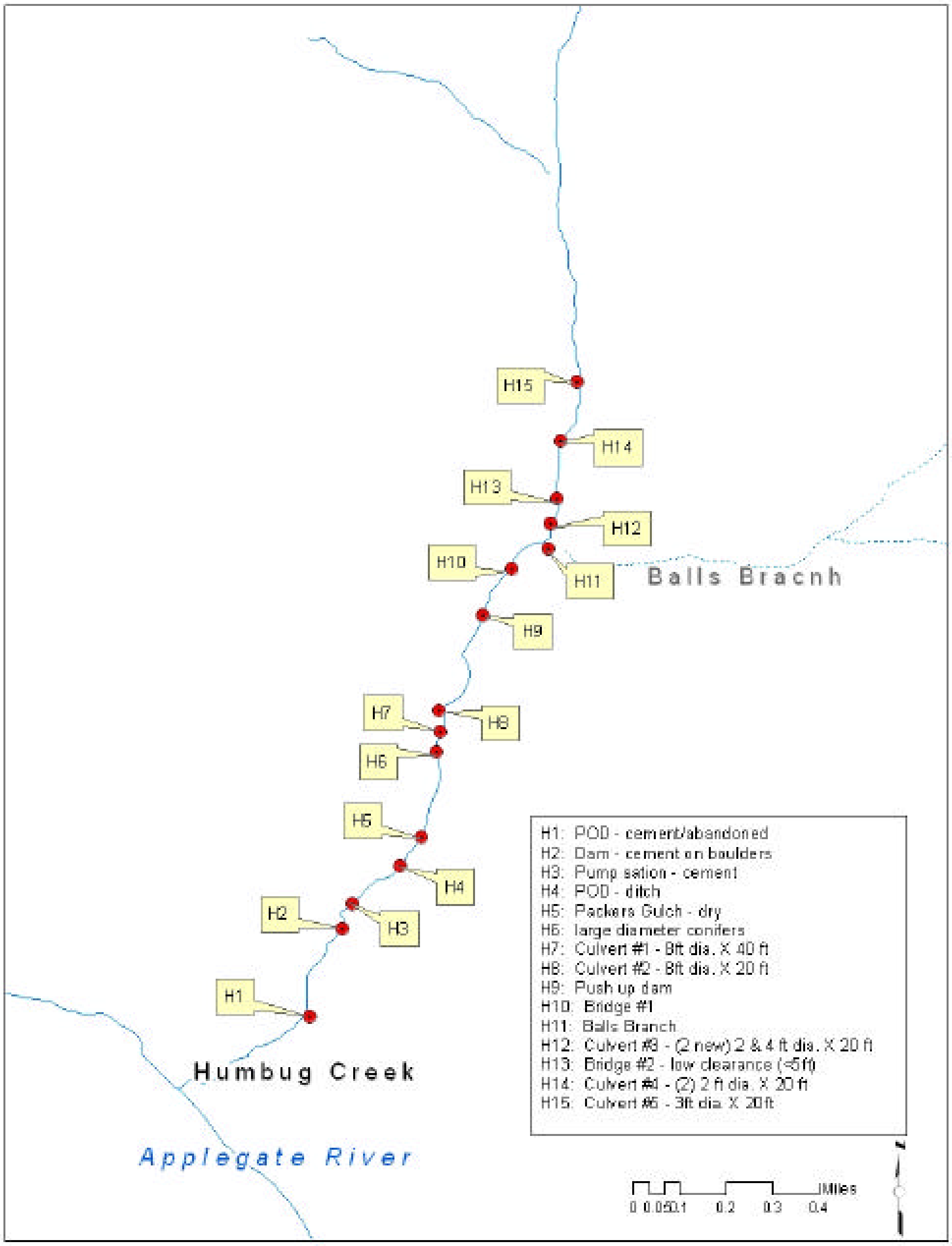


Figure 7. Cement dam (H2), Humbug Cr..

Figure 8. Private drive culvert (H15), Humbug Cr.

Salmonid juveniles were observed throughout the survey, however low in numbers. Most of Humbug Creek is incised and straightened. As with many streams in the Applegate, encroachment within the riparian area is prevalent. Due to the high density of homes along Humbug Creek many culverts (mostly under sized and improperly placed) dissect the stream into many segments. Historical mining occurred within the stream and evidence is evident. Landowners reported that stream flow routinely goes subsurface throughout summer months.

3.0 Stream Temperature

The *Applegate Subbasin Total Maximum Daily Load* (ODEQ 2003) states that approximately 126 miles of streams in the Applegate Subbasin are known to exceed the 64°F (17.8° C) summer rearing temperature criteria. The following streams are on the EPA's Clean Water Act Section 303(d) list of water-quality limited streams for temperature:

- Applegate River
- Beaver Creek
- Humbug Creek
- Little Applegate River
- Palmer Creek
- Powell Creek
- Slate Creek
- Star Gulch
- Sterling Creek
- Thompson Creek
- Waters Creek
- Williams Creek
- Yale Creek

Using *Onset Optic StowAway*™ and *HOBO Water Temp Pro Ver.1* thermo-loggers, stream temperatures were continuously recorded from June to mid-September at 30-minute intervals. Temperature Analysis Macro Ver. 1. was utilized to process and summarize data. (See *Appendix B*).

During 2005, early August exhibited the highest air temperatures for the region. Twenty-seven days of the month had temperatures equal to or higher than 90 degrees. Four of those days had high temperatures reaching or exceeding 100 degrees. The highest temperature this month was 102 degrees on the 4th and the lowest temperature was 47 degrees on the 30th (NOAA 2005).

Table 3. 2005 Top 10 Highest 7-Day Average Max Temperatures

Stream	7 – Day Average Max	303 (d) Listed
Slate Cr @ mouth	76.5	✓
Thompson Cr @ 1095	74.3	
Little Applegate @ mouth	74.0	✓
Little Applegate @ RM2.6	71.2	✓
Slate Cr @ Redwood	70.4	✓
Williams Cr @ Wms Hwy	69.9	✓
Beaver Cr @ USFS Bdy (RM 1.0)	69.9	✓
Williams Cr @ Mouth	69.7	✓
E. Fk. Williams @ Browns Rd	69.2	
Slate Cr @ Slate Cr Rd RM 1.6	68.6	✓

2006 experienced higher air temperature extremes than 2005. Two days in which record maximum temperatures occurred; on the 22nd, a high of 106 degrees and on the 23rd, 107 was recorded in Medford. There were 6 consecutive days in which the maximum temperature was equal to or exceeded 100 degrees which occurred between the 22nd and 27th. A total of four record high minimum temperatures were set for the month. The highest temperature for the month was 107 degrees on July 23rd. The lowest temperature was 48 degrees on the 7th (NOAA 2006).

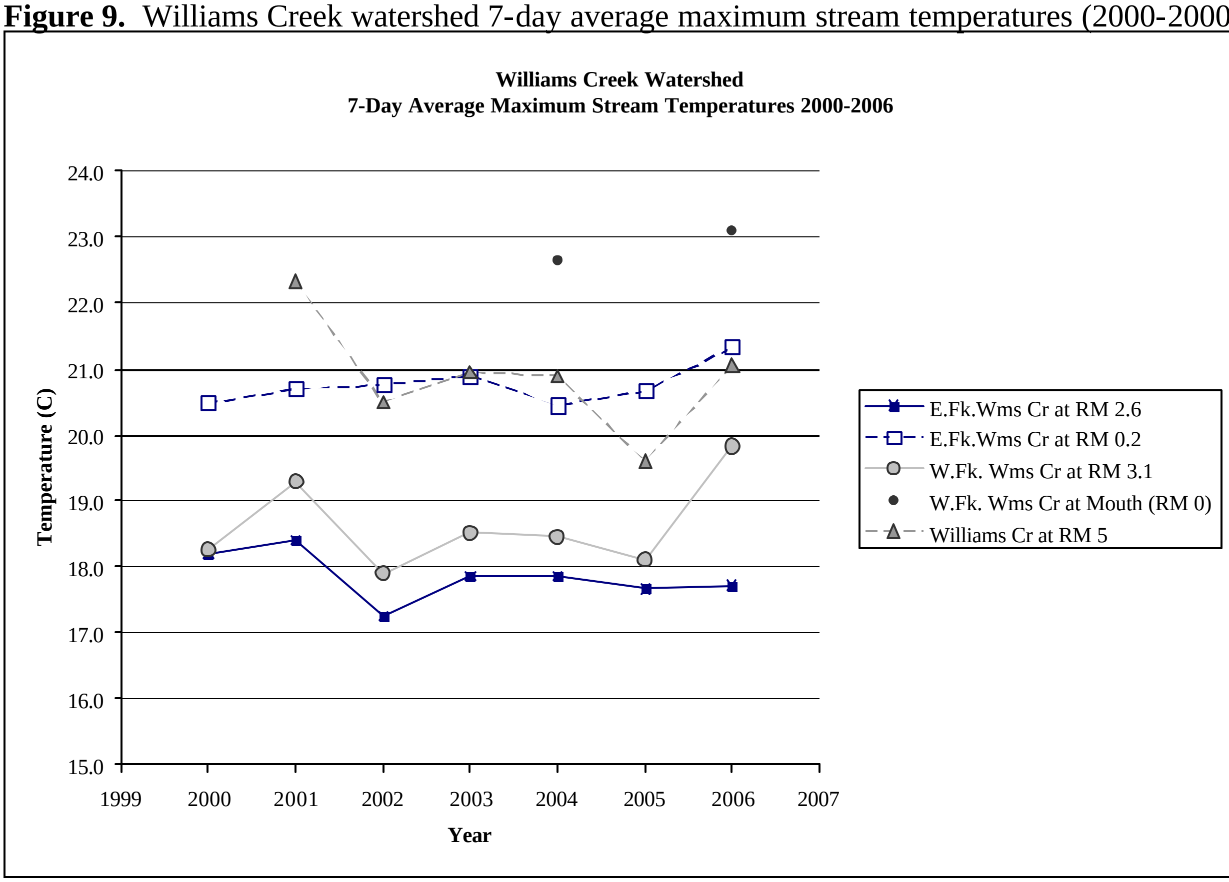
Table 4. 2006 Top 10 Highest 7-Day Average Max Temperatures

Stream	7 – Day Average Max	303 (d) Listed
Little Applegate @ mouth	74.9	✓
Slate Cr @ Redwood	73.8	✓
West Fk. Williams @ mouth	73.5	
Little Applegate @ RM 2.6	72.2	✓
Slate Cr @ Slate Cr Rd RM 1.6	71.8	
Little Applegate @ Yale Cr	70.8	
East Fk. Williams @ Browns Rd	70.4	✓
Palmer Cr @ mouth	68.6	
Murphy Cr	68.1	
Thompson Cr@ Tallowbox	67.8	✓

-

Stream temperatures fluctuate from year to year, the 7-day average stream temperatures in the Williams Creek watershed reflects this variation. (See Figure 9). Temperatures in 2005 were lower than the prior two years at all sites. In 2005 and 2006, 7-day average temperatures at West Fork Williams Creek RM 0 were higher than both East Fork Williams Creek RM 0 and Williams Creek at RM 5 (assuming higher temperatures are prevalent downstream), suggesting that West Fork Williams contributes as a heat source to the mainstem Williams Creek.

Figure 9. Williams Creek watershed 7-day average maximum stream temperatures (2000-20006).



4.0 Discharge

The Oregon Plan for Salmon and Watersheds has prioritized the restoration of stream flows to benefit critical fish runs (Oregon Watershed Enhancement Board [OWEB] 2003). Since most alternatives to restoring flows rely on voluntary actions by private landowners, ARWC has pursued water conservation strategies with users in many projects. Projects include converting water rights to instream as well as promoting and assisting users with efficient irrigation systems. ARWC has assisted the Oregon Water Resources Department (OWRD), Oregon Water Trust (OWT), Talent Irrigation District (TID), Laurel Hill Ditch Company, and the Thompson Creek Irrigation Association (TCIA) in obtaining flow information.

Low summer flows characterize most of the tributaries in the Applegate watershed. Low flows can cause elevated stream temperatures, excessive aquatic plant and bacteria growth, increased dissolved oxygen levels and fish passage problems. Many streams in the Applegate are over allocated and irrigation withdrawals exacerbate summer low flow periods.

During the 2005-2006 irrigation seasons, ARWC conducted flow measurements in the Little Applegate, Beaver, Cheney, Williams and Mungers Creeks to investigate the potential for conservation projects. ARWC worked in partnership with the Williams Creek Watershed Council (ARWC) and the Oregon Water Trust (OWT) during the 2005-2006 irrigation seasons.

4.1 Cheney Creek

Methods for monitoring stream flows in Cheney Creek vary from year to year. Instream water rights of 0.09 cfs (cubic feet per second) are protected at the Lindsey Ditch point diversion (~RM2.4).

Table 5. Cheney Creek stream flow measurements.

Date	CFS
6/22/05	1.59
6/27/06	1.39
7/10/06	0.67
7/28/06	0.75
8/14/06	0.27
8/29/06	0.38

Stream flow within Cheney Creek has a propensity to go subsurface in late summer, as flows are too low measure and/or subsurface at this site, observations are made upstream and downstream of the diversion as to water usage and flow. During the 2006 irrigation season, adequate flows ensured the instream water right was protected.

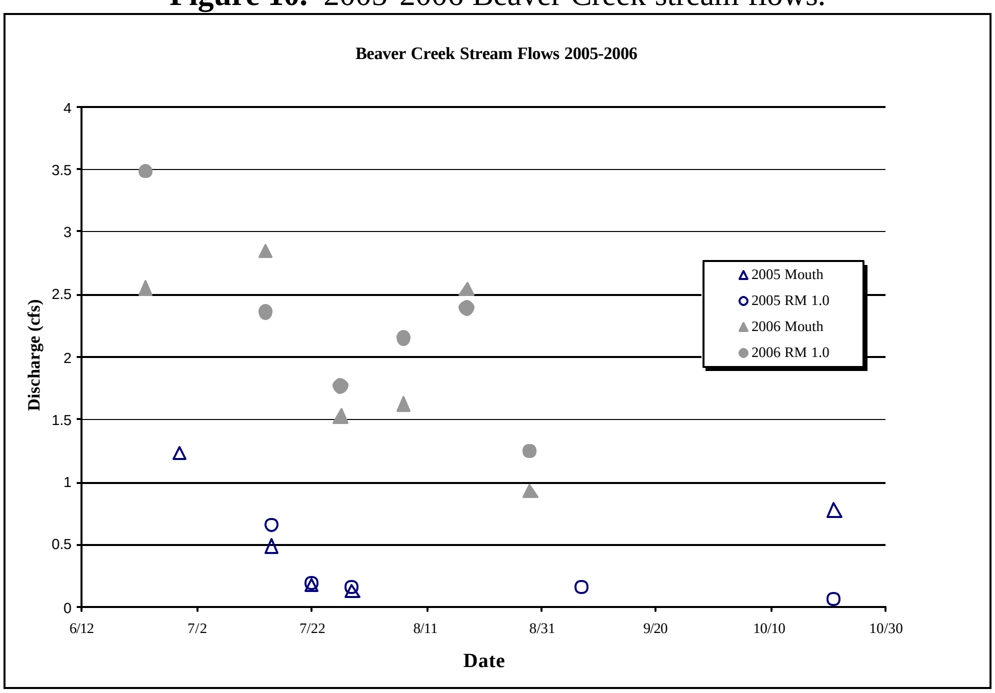
4.2 Beaver Creek

Instream water rights for Beaver Creek amount to 0.4 cfs. Measurements are taken at the mouth and one mile upstream at the boundary of private ownership and USFS. During the during 2005 irrigation season, ARWC encountered limited access to the mouth due to new bridge construction. 2006 stream flows were considerable higher than 2005 flows throughout the summer months (See Table 6 and Figure 10).

Table 6. 2005-2006 Beaver Creek stream flows.

Date	2005 Mouth	2006 Mouth	2005 RM 1.0	2006 RM 1.0
23-Jun		2.55		3.48
29-Jun	1.23			
14-Jul		2.85		2.36
15-Jul	0.49		0.66	
22-Jul	0.18		0.19	
27-Jul		1.53		1.77
29-Jul	0.13		0.16	
7-Aug		1.62		2.15
18-Aug		2.54		2.39
29-Aug		0.93		1.25
7-Sep			0.16	
21-Oct	0.78		0.06	

Figure 10. 2005-2006 Beaver Creek stream flows.



4.3 Little Applegate

ARWC established monitoring stations at the mouth of the Little Applegate and at RM 2.4, as part of the LASHEP effectiveness monitoring. In previous years, temporary continuous recorders were placed at both sites, but due to vandalism and mining activities the station at RM 2.4 was discontinued. During the 2005-2006 irrigation seasons, ARWC did operate a continuous flow station at the mouth of the Little Applegate (See Figure 11); however extensive mining occurred both years modifying flow measurements though out the summer.

Figure 11. Little Applegate hydrograph 2000-2006.

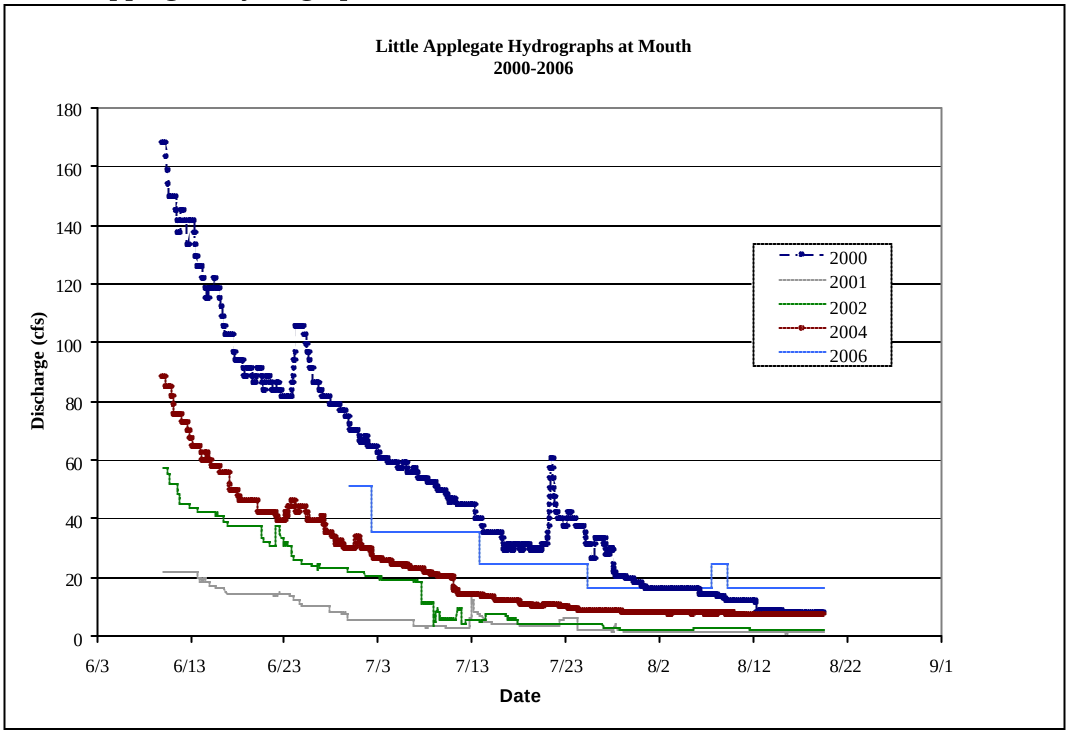


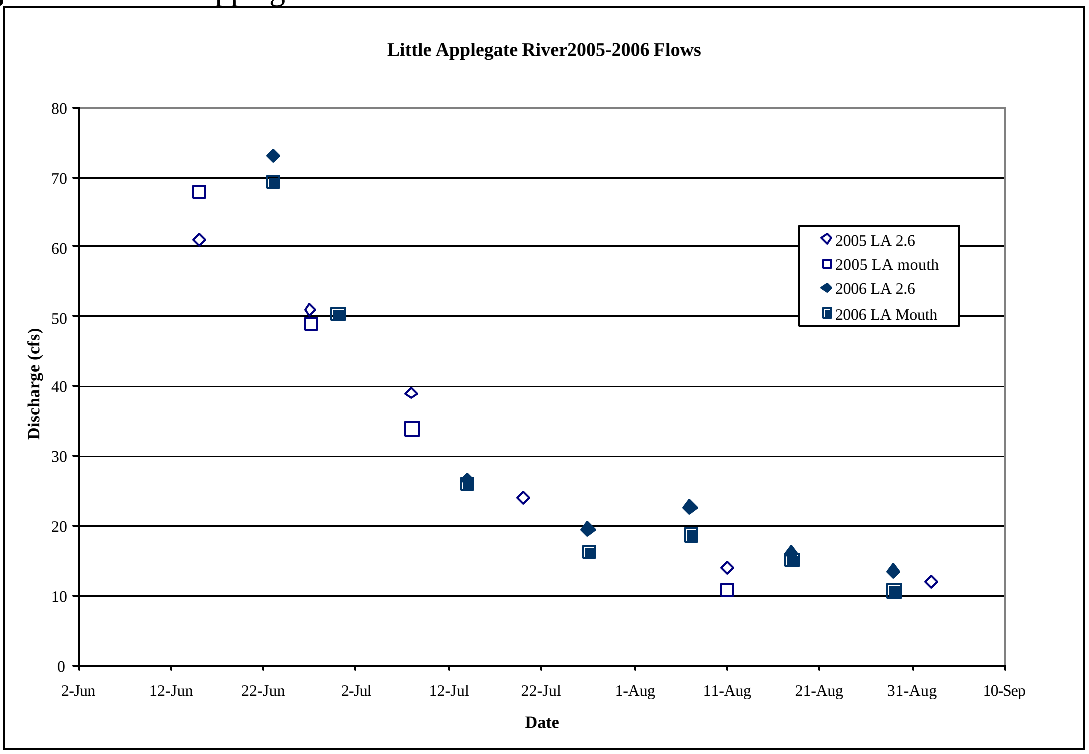
Table 7. Little Applegate stream flow measurements 2005-2006.

LA at RM 2.6		*LA at mouth*		*delta*
Date	**cfs**	**Date**	**cfs**	
6/15/05	61	6/15/05	68.00	-7.00
6/27/05	51	6/27/05	49.40	1.60
7/8/05	39	7/8/05	33.87	5.13
7/20/05	24.36			
8/11/05	14.2	8/11/05	11.29	2.91
9/2/05	11.79			
6/23/06	72.76	6/23/06	69.40	3.36
		6/30/06	50.45	
7/14/06	26.62	7/14/06	26.03	0.59
7/27/06	19.50	7/27/06	16.33	3.17
8/7/06	22.64	8/7/06	18.79	3.85
8/18/06	16.10	8/18/06	15.22	0.88
8/29/06	13.47	8/29/06	10.81	2.66

Flow measurements were similar during 2005 and 2006. Both years exhibited good winter rain fall and resulting adequate snow pack. Flows at the mouth higher than at RM 2.6 indicating that subsurface flow return from nearby agriculture fields are prevalent.

With only two days of rain on August 6th and 7th 2006, stream flows increased. The reduction in water use by irrigators during this time is clearly measured with the increase in flows.

Figure 12. Little Applegate stream flow measurements 2005-2006.



4.4 Palmer Creek

In 2005, Palmer Creek flow measurements due to instream restoration activities by the USFS to restore surface flow. This project entailed channel reconstruction and installation of subsurface structures to restore surface flow. Additionally, the Oregon Water Trust decided not to prioritize Palmer Creek for instream water rights in 2006.

4.5 Williams Creek

In 2005 ARWC working in partnership with OWT and the Williams Creek Watershed Council, focused monitoring efforts on Williams Creek and Mungers Creek. Flow measurements were obtained in Williams Creek below the Watts Topping Diversion Dam. Although water is known to flow subsurface below the dam during summer months, the timing and extent of was unclear. Flows return to the surface flow around the Bridgepoint Diversion, the cause is believed to be the result of irrigation return. WCWC is actively working with the Watts Topping water users and the OWT to improve fish passage and flow in Williams Creek.

Table 8. 2005-2006 stream flow measurements in the Williams watershed.

Site	Date	CFS
Williams Creek at mouth	6/14/05	29.5
	7/20/05	9.78
	7/12/06	17.73
	7/28/06	2.79
	8/11/06	2.35
Williams Creek below Watts Topping	7/8/05	5.46
	7/20/05	0.54
	7/29/05	0.291
Mungers Creek at Kincaid Rd	7/29/05	1.12
	8/11/05	0.65
	8/26/05	0.31
	9/16/05	0.41
	7/13/06	2.13
	7/28/06	1.55
	8/11/06	1.17
	8/29/06	1.07
Mungers Creek at mouth	8/11/05	0.26
	8/26/05	dry
	7/12/06	0.63
	7/28/06	0.81
	8/11/06	0.78
	8/29/06	0.18

Methods

Stream discharge measurements were conducted using U.S. Geological Survey (USGS) protocol. Pygmy/AA and Swoffer flow meters were used to determine velocity measurements. Discharge was calculated by multiplying cross sectional area by velocity.

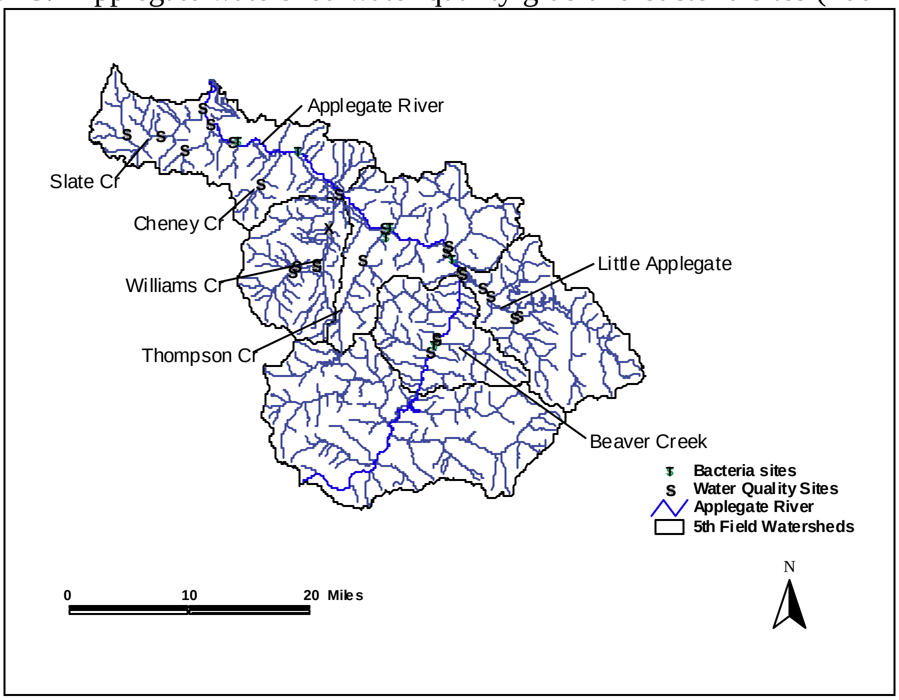
5.0 Water Quality

ARWC has monitored aspects of water quality, in the Applegate since 1997. The data collected by ARWC staff has established baseline conditions and allowed for water quality trend analysis in the 493,000-acre watershed.

The majority of the monitoring data collected by ARWC has been integrated with data collected by the Oregon Department of Environmental Quality (ODEQ) in determining Total Maximum Daily Loads (TMDLs) for the Applegate subbasin. The Environmental Protection Agency (EPA) defines TMDL as "the greatest amount of loading that a water can receive without violating water quality standards" (40 CFR 130.2(f)). In accordance with provisions of the Clean Water Act of 1986, the State of Oregon has imposed TMDLs on reaches designated "water-quality limited."

Oregon Administrative Rules (OAR 340-041-0362) adopted water quality standards to protect "beneficial uses" as defined by the EPA. Beneficial uses include domestic and agricultural water supply, recreational use, and salmonid habitat. The water quality standards are set at a level to protect the most sensitive beneficial uses. Cold-water aquatic life is the most sensitive beneficial use in the Applegate subbasin (ODEQ 1995). Monitoring by ARWC has helped to identify TMDLs applicable for the basin and areas that do not meet specified criteria.

Figure 13. Applegate watershed water quality grab and bacteria sites (2004-2006).



ARWC collected water chemistry data using grab sampling methods defined in the Oregon Plan for Salmon and Watersheds Water Quality Monitoring Technical Guide Book (1999). Temperature was measured with a DEQ-calibrated audit thermometer. A hand-held portable HACH EC10 pH meter was used to measure pH. The meter was calibrated to pH 7 and pH 10 prior to each field measurement. DO concentrations were measured by Winkler titration. Turbidity was measured using a Hach 2100P photometric turbidimeter. Conductivity was obtained using a YSI 30/10 meter. Bacteria analysis was EPA/DEQ approved Quanti-tray method for *E. coli* analysis.

5.1 Dissolved Oxygen, Turbidity, pH, Conductivity and Nitrates

Water quality data collected during 2005-2006 was consistent with previous years. Nitrates sampling was discontinued in 2006 to due the lack of a proper facility to conduct analysis. Please see Appendix C for complete data. Additional information relevant to water quality trends and driving mechanisms in the Applegate basin may be found in the following documents: *Continuous Monitoring of Dissolved Oxygen, pH, and Temperature in the Applegate River Basin* (ARWC 2002); *Estimated Heat Budget for the Applegate Basin* (ARWC 2002); *Monitoring and Assessing the Applegate River Basin* (2002); *Applegate Subbsain Total Maximum Daily Load* (DEQ 2003); *Stream Habitat and Water Quality in Applegate Basin* (ARWC 2004); *Watershed Health Factors Assessment* (RBCC 2006); *Applegate River Watershed Water Quality Implementation* Plan (DRAFT 2006).

5.2 Bacteria

During 2004 and 2005 bacteria samples were collected and analyzed to determine the timing and concentration of *Escherichia coli* (*E. coli*) in the Applegate River. *E. coli* is a type of fecal coliform bacteria commonly found in the intestines of animals and humans. The presence of *E. coli* in water is a strong indication of recent sewage or animal waste contamination. Sewage may contain many types of disease-causing organisms. Although most strains of *E. coli* are harmless, some can cause severe illness. The water quality criteria for swimming and other water contact recreation is a 30-day log mean of 126 organisms per 100ml or no single sample exceed 406 *E. coli* organism per 100ml.

DEQ currently samples the Applegate River at Highway 199 in Wilderville (DEQ Station 10428) six times per year. According to the DEQ Water Quality Assessment Database from 1/10/1996 to 11/19/2003, 0 out of 37 samples (0%) have measured greater than 406org/mls during the winter, spring and fall. During summer months from 1/10/1996 to 11/19/2003, 0 out of 20 samples (0%) measured greater than 406 organisms as well. Sampling results by the DEQ have shown varying levels of *E. coli* in the Applegate River at this site. In May 1996, sampling results were 355 colony forming units (CFU) per 100 ml of water. Two results in 1997 showed 120 and 170 CFU/100 ml. According to DEQ, the impact of this site occurs during high flow periods with high levels of fecal coliforms and biochemical oxygen demand. During the low flow summer months, high temperature and concentrated total solids and biochemical oxygen demand work to deplete dissolved oxygen concentrations.

ARWC collected samples at the following locations:

- Josephine County Fish Hatchery Park (RM 7.3)
- Hwy 238 Wayside (RM 15.5)
- Cantrall-Buckley Park (RM 27)
- USFS Jackson Campground (RM 41) as a control
- Thompson Creek at the mouth
- Forest Creek at the mouth

With the intent to provide information on transport loads (winter/spring) and safety levels (summer recreation). Samples were collected in the spring after high flows receded, throughout the low flow high temperature months, and during high flows. Water samples were analyzed by Neilson Research Corporation in Medford, Oregon. Neilson is a certified lab that uses EPA/DEQ approved Quanti-tray method for *E. coli* analysis.

Winter and spring sampling periods (peak flow) exhibited high concentrations of *E.coli* at all locations except Forest Creek at mouth, see Table XX. Forest Creek at mouth in the summer 2005 increased from 32 org/mls (7/14/05) to 308 org/mls (8/8/05). With flows remaining consistent in Forest Creek during the summer months, this increase of 276 org/mls in less than 30 days indicates there is a high loading of bacteria present in Forest Creek.

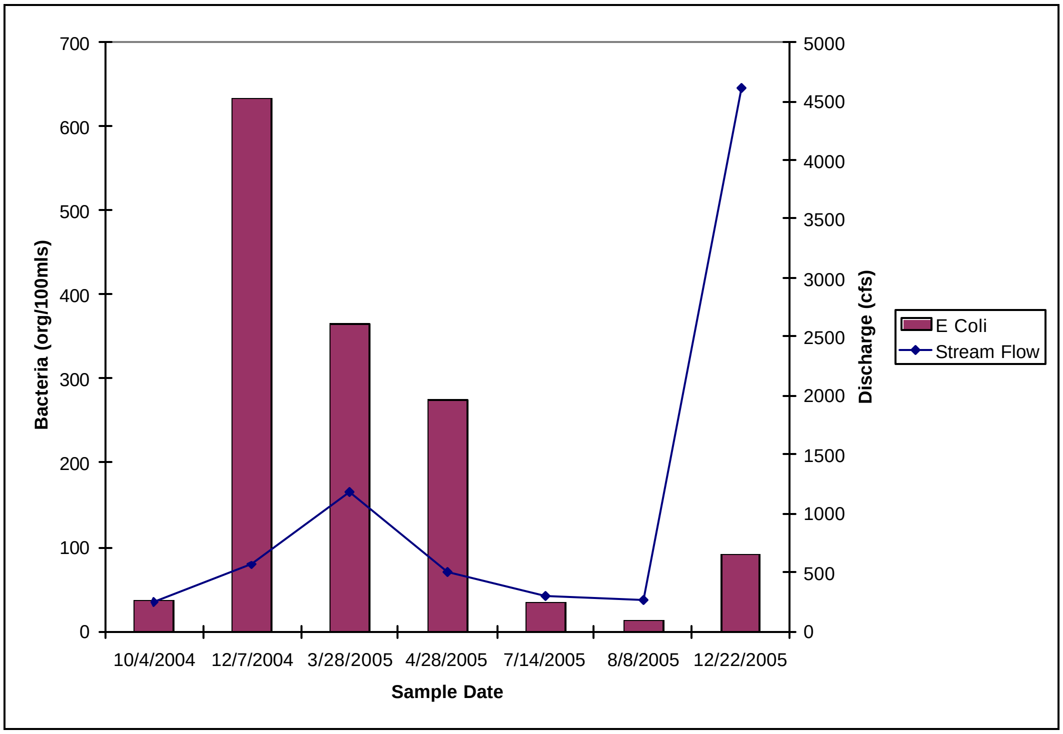
Two samples exceeded water quality criteria; Fish Hatchery Park on 12/7/04 (633 & 579 org/mls) and Hwy 238 Wayside on 3/28/05 (517 org/mls). In general, bacteria concentrations in the Applegate River are greater downstream. However, the highest concentration sample on 4/28/05 was collected at Cantrall Buckley Park (345 mls/org); indicating that bacteria is loaded and diluted within the Applegate River at various locations.

Table 9. *E.coli* samples within the Applegate watershed 2004-2005.

Sample Date	Jackson Campground RM 41	Cantrall Buckley Park Wayside RM 27	Forest Cr Mouth	Thompson Cr Mouth	Hwy 238 Wayside RM 15.5	Fish Hatchery Park RM 7.3
	org/100mls	org/100mls	org/100mls	org/100mls	org/100mls	org/100mls
10/4/2004	7	26	135	50	23	37
12/7/2004	11	62	43	197	308	633/579
3/28/2005	---	21	21	261	517	365
4/28/2005	29	345	49	275	249	275
7/14/2005	3	20	32	201	20	34
8/8/2005	9	14	308	143	21	13
12/22/2005	44	178	201	179	81	91

Figure 14. displays the discharge and bacteria at Fish Hatchery Park. The USGS Wilderville Station (14369500) is located less than 200 feet downstream of the sampling location. With limited data sets the relationship between discharge and bacteria are difficult to ascertain. In order to generate statically rigorous tests addition data samples are required.

Figure 14. E.Coli values and stream flow measurements on the Applegate River at Fish Hatchery Park (RM 7.3).


700
600
500
400
300
200
100
0
Bacteria (org/100mls)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Discharge (cfs)
E Coli
Stream Flow
10/4/2004
12/7/2004
3/28/2005
4/28/2005
7/14/2005
8/8/2005
12/22/2005
Sample Date

6.0 Riparian Planting Effectiveness Monitoring

Riparian habitat improvement projects are an integral component of ARWC's services to private landowners. Since 1996, the watershed council has attempted to ameliorate warm water temperatures throughout the basin by replanting native vegetation. Although the effects of riparian plantings will not mitigate stream temperatures until vegetation reaches maturity and adequate canopy cover is established, ARWC attempted to quantify the effectiveness of riparian plantings at sites planted in the first 5 years (1999-2000) of the watershed council's program..

Using a convex spherical densiometer, canopy cover measurements were obtained using methods outline in EMAP-Western Pilot Field Operations Manual for Wadeable Stream, Section 7 pg. 131 (2001). Additionally, information on vegetation cover (i.e. canopy, understory, and ground cover), human influences, riparian width and bank stability were noted at each site.

The following site evaluation is from a site typical in the Applegate: presence of historical mining; fluctuations of surface flow during low water months and high disturbance of channel morphology (e.g. bridge). The success of this site is the result of the landowner's willingness to care for the plants. As viewed in Figure 15, water jugs were placed at the base of each plant. This effort no doubt led the survival of many plants at the site. Please see *Appendix D* for additional site evaluations.

Landowner/Site Address: Krack, 10267 Sterling Cr Rd, Jacksonville

River/Tributary: Sterling Creek Stream Width (bankfull /wetted): 29ft/ dry

Aspect: N/NE Soil: hard, dry, cobble/sandy

Review Date: 8/24/05 Year Planted: 1998 &1999 Planted by: 2-B Forests, Inc

PLANTING MEASUREMENTS

	Distance to Stream (ft)	Length (ft)	Width (ft)	Canopy Cover**		Average Tree Height (ft)	
						Conifer	**Hardwood**
Right Bank*	3	600	25	CenUP 0	CenR 0	PIPO: 4.5, 4.4	ACMA: 5
				CenL 0	Left 0		
				CenDwn 0	Right 0		
Left Bank	3	600	75	CenUP 1	CenR 0	PIPO: 7,12,8,5 CADE: 8.5, 6.5,5,8.5 PSME: 9,8.5,6.5	POTR: 27,24.5,22.2 ALRU: 19.5
				CenL 4	Left 11		
				CenDwn 2	Right 6		

***looking downstream**
**** canopy measurement ranges: 0 (no canopy) to 17 (maximum canopy cover)**

VISUAL PLANTING ESTIMATES

Plant Vigor/Growth (circle one) Low [Med] High
Reasons for score ranking: hybrid cottonwoods and alders are healthy. Many conifers on RT bank are still very small (nutrient deprived?)

Survival Estimate (circle one) 0-25% 26-50% [51-75%] 76-100%

Maintenance Water? [Y] N Mow/Weed eat? [Y] N

Management Objectives Achieved? (circle one) [Y] N

Notes: Riparian area maintained of underbrush/blackberries. Landowner supplied water to trees and pruned lower limbs of conifer branches. Natural ash, cottonwood, and willow recruitment present. No survival of 9-bark.

VISUAL RIPARIAN ESTIMATES	0 = Absent 1 = Sparse (<1%) 2 = Moderate (10-40%) 3 = Heavy (40-75%) 4 = Very Heavy (>75%)	D = Deciduous C = Coniferous E = Broadleaf evergreen M = Mixed N = none
RIPARIAN VEGETATION COVER	**LEFT BANK**	**RIGHT BANK**
	Canopy (>5m high)	
Vegetation Type	[D] C E M N	D C E [M] N
BIG trees (trunk >0.3m DBH)	0 [1] 2 3 4	0 1 [2] 3 4
SMALL trees (trunk <0.3m DBH)	0 1 [2] 3 4	0 1 [2] 3 4
	Understory (0.5 to 5m high)	
Vegetation Type	D C E [M] N	D C E [M] N
Woody Shrubs & Saplings	0 1 [2] 3 4	0 [1] 2 3 4
Non-Woody Herbs, Grasses, & Herbs	0 1 2 3 4	0 1 [2] 3 4
	Ground Cover (<0.5m high)	
Woody Shrubs & Saplings	[0] 1 2 3 4	[0] 1 2 3 4
Non-Woody Herbs, Grasses, & Herbs	0 1 2 3 [4]	0 1 2 [3] 4
Barren, Bare Dirt or Duff	[0] 1 2 3 4	0 1 [2] 3 4

HUMAN INFLUENCE	**0 = not present P = >10m C = within 10m B= on bank**	
	LEFT BANK	RIGHT BANK
Wall/Dike/Revetment/Riprap/Dam	[0] P C B	[0] P C B
Buildings	[0] P C B	[0] P C B
Pavement/Cleared Lot	[0] P C B	[0] P C B
Road	0 P [C] B	0 [P] C B
Pasture/Range/Hay Field	0 P C [B]	0 P C [B]
Logging operations	[0] P C B	[0] P C B
Mining operations	[0] P C B	[0] P C B

RIPARIAN VEGETATIVE ZONE WIDTH SCORE		**Optimal** > 18 m	**Sub-Optimal** 12-18 m	**Marginal** 6-12 m	**Poor** <6 m
Both sides are mowed down, any native shrubs or tree sprouts would have a difficult time establishing.		human activities (i.e. roads, lawns) have not impacted the zone	marginal impact by humans	human activities have impacted zone greatly	little or no riparian vegetation due to human activities
Score 7	Left Bank:	10 9	8 [7] 6	5 4 3	2 1 0
Score 6	Right Bank:	10 9	8 7 [6]	5 4 3	2 1 0

BANK STABILITY		**Optimal** <5%	**Sub-Optimal** 5-30%	**Marginal** 30-60%	**Poor** 30-100%
LB: grass down to bank; no gradient RB: small gradient/erosion where stream width narrows		banks stable; evidence of erosion or bank failure; little potential for future problems	moderate stable; infrequent, small areas of erosion mostly healed over	moderately unstable; high erosion potential during floods	unstable; many eroded areas; obvious bank sloughing
Score 9	Left Bank:	10 [9]	8 7 6	5 4 3	2 1 0
Score 7	Right Bank:	10 9	8 [7] 6	5 4 3	2 1 0

Figure 15. Krack property, Sterling Creek 1998.

Figure 16. Krack property, Sterling Creek 2005.

Techniques

Early plantings consisted of bare root conifers, willow and cottonwood cuttings, and plug (1 year) stock. The majority of sites where historic cold mining occurred, high solar exposure, and low water table made growing conditions difficult. Shade cards, mulch mats, and browse protectors were implemented at many sites, which potentially increased survival. However, the adjustment to larger containerized planting stock most certainly improved survival rates.

Willow and cottonwood stakes had very low establishment success. With flows dropping subsurface in the summer and high winter flows, cutting establishment was poor. The use of heavy equipment to install root balls and large cuttings improved survival, however the cost associated with this method is unclear compared to using larger containerized stock.

Watering plants proved to be effective for both growth and survival; those landowners that watered trees by hand during the first 2-3 years noticed a difference in growth and survival in plants that did not receive water. Many plantings received water via sprinklers and drip as well.

Maintenance

Although ARWC did return to numerous sites for subsequent plantings, maintenance for plants was the responsibility of the landowner. In general, sites where landowners took responsibility for plant care (e.g. watering and cutting weeds) the survival of plants was higher. Blackberry sites, in particular, required additional maintenance which most landowners neglected to complete.

7.0 Spawning Gravel and Channel Dynamics

Constructed in 1980, the Applegate Dam (RM 46.3) was built to reduce flooding and provide water storage for irrigation and recreational opportunities. However, the dam is a complete barrier for anadromous fishes and the operation of flows modify natural sediment mobility in the system. Chinook, coho, and steelhead spawn immediately below the dam and the spawning gravel below the dam is important to those fish spawning at the end of the anadromous distribution in the Applegate River.

With active aggregate mining in the system, gravel recruitment above the dam cutoff, and modification of high flows, ARWC identified a need to examine spawning gravels below the dam. Limited data exists on sediment and physical channel characteristics below the Applegate Dam. Therefore ARWC hopes this information will provide more interest and baseline information for a more comprehensive sediment study. More in-depth sediment studies similar systems led to gravel supplemental projects (e.g. Trinity River, CA).

Channel cross-sections, bedload samples, pebble counts, and flow modeling constituted the study activities. ARWC continued to monitor cross-sections established in 2000. Additional cross-sections immediately below the dam, sediment analysis, and flow modeling were completed by Newberry Watershed Consulting, L.L.C.

Although high flows are regulated, sediment transport still occurs throughout the system. Fluctuations in bed elevations observed in cross-sections display this movement (See Figure 17and 18).

Figure 17. Applegate River cross-section downstream of Jackson campground (2000-2005).

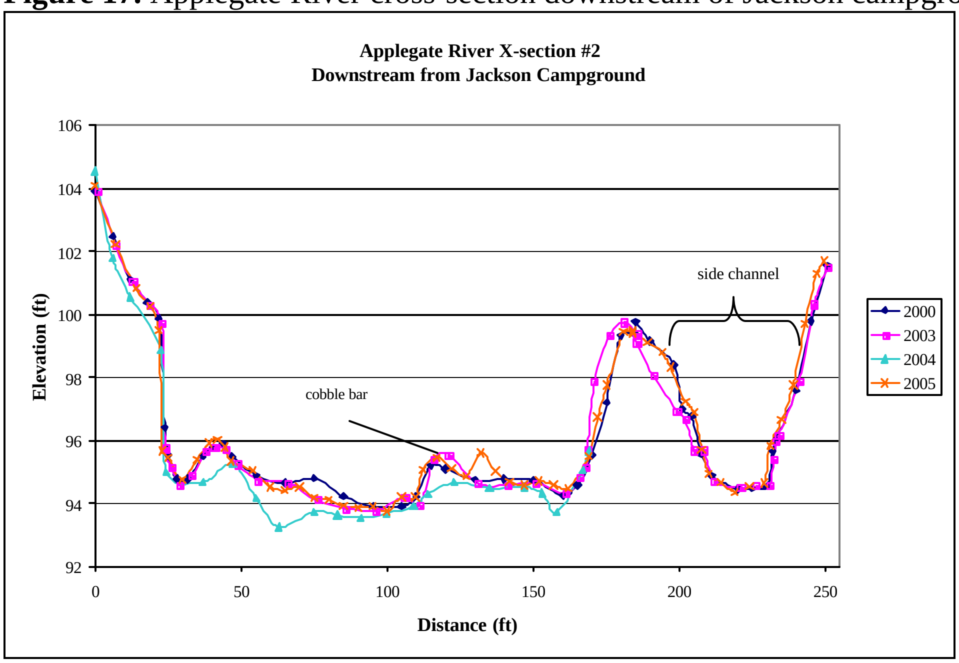
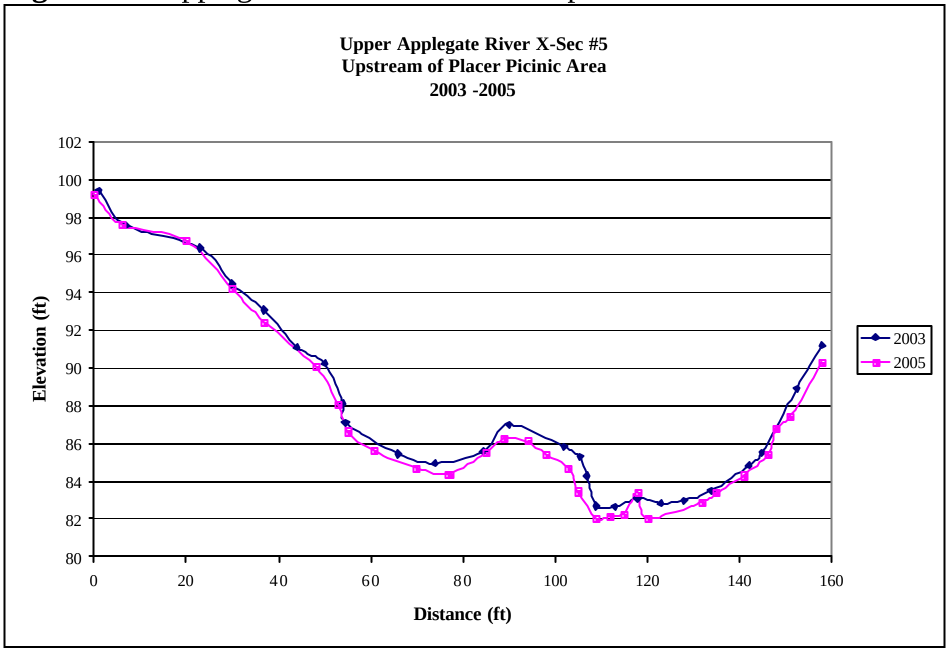


Figure 18. Applegate River cross-section upstream of Placer Picnic Area.

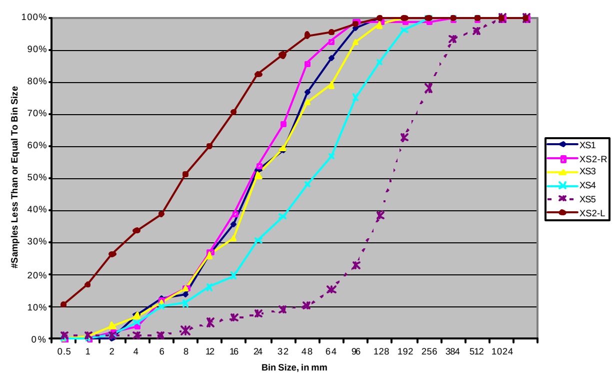


This method does not differentiate between size classes of sediment and therefore it is unclear on class mobility within the system without examining flow releases and size classes present. The following report competed by Newberry Watershed Consulting, L.C.C. examines this relationship.

Applegate Dam Sediment Investigation

December 18, 2006

FIGURE 3: Pebble Counts, Applegate Dam



Prepared for

Applegate River Watershed Council

By:

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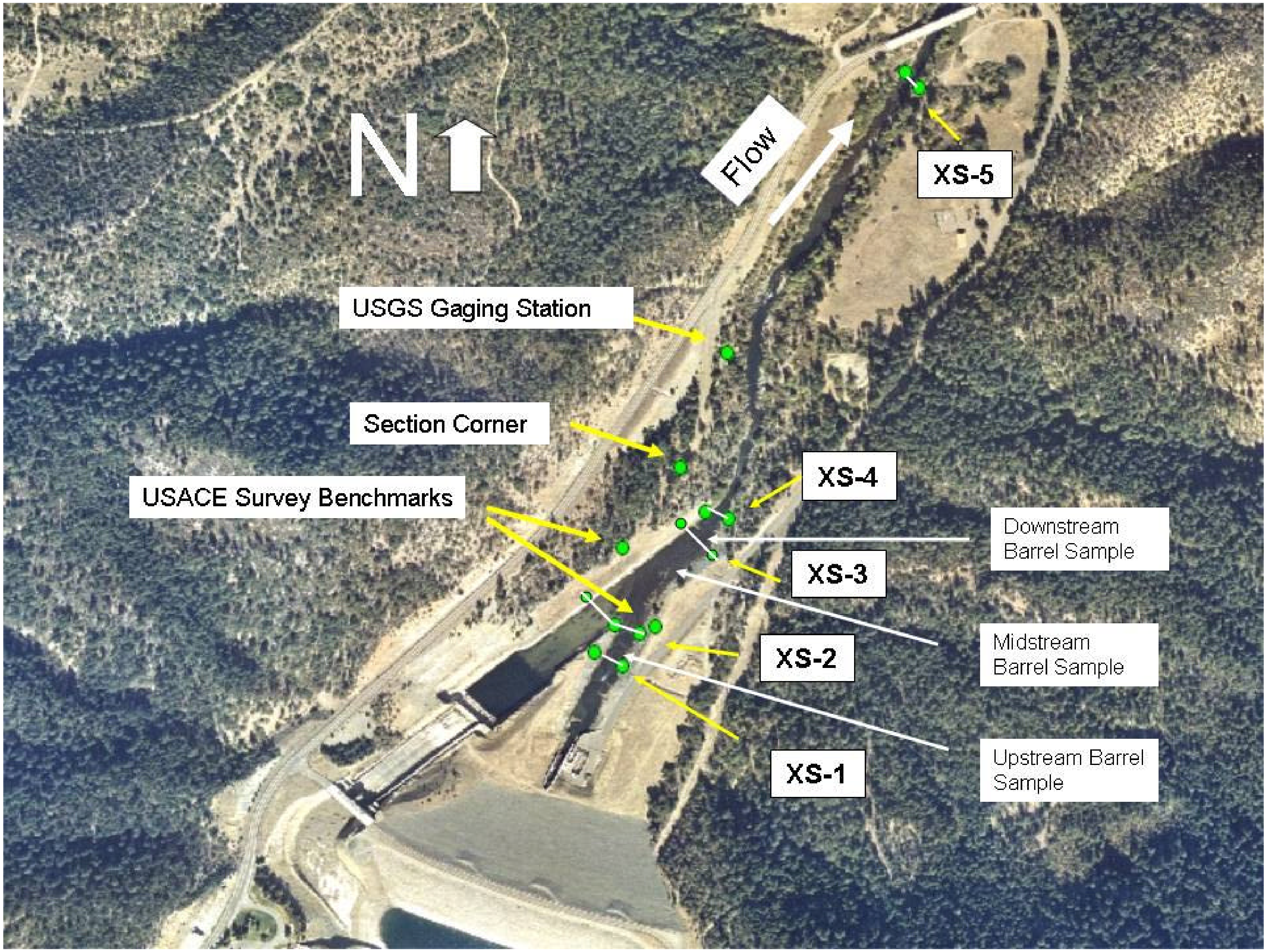
Introduction

An unintended consequence of large dam building is the interruption of natural fluvial geomorphic processes. In particular, coarse sediment flow across the dam is blocked in its entirety. Coarse sediment is necessary to sustain channel building processes, on which the biotic system has evolved. The purposed of this investigation is to gather information relating to the distribution of gravel suitable to salmonid spawning, as well as to provide baseline channel physical data to determine long-term changes in the area below Applegate Dam. In this study, suitable spawning gravel is defined as those particles with a median diameter of 8-48 millimeters, after a discussion in Reeves *et. al*, (1991, p. 528)

The Applegate Dam is located in Jackson County in Southern Oregon, immediately north of the California border on the Applegate River (T40S, R4W, Section 25, SE ¼ , W.M.). Initial construction of this dam was completed in 1980 and its operation is managed by the U.S. Army Corps of Engineers for flood control, fisheries enhancement, recreation, and irrigation. This earthen dam is 242feet tall and 1300 feet wide. Late summer flow releases from the dam range from 200-300 cubic feet per second (cfs). During the winter and spring months while the reservoir fills, releases range from 120-500 cfs, with flood control releases of 1,500 or 3,000 cfs being common.

At several locations where dams have blocked access to salmonid habitat and potential spawning gravels, a program to artificially add spawning-sized gravel to the stream has been implemented to prevent spawning gravel quantity from being a factor limiting salmonid spawning. Following the implementation of a gravel supplementation program on Clear Creek on northeastern Oregon in 1961, a five-fold increase in chniook salmon spawning was recorded (West et al., 1965, as reported by Reeves et al, op. cit.). A twelve year flow study on the Trinity River in Northern California concluded that an ongoing gravel supplementation tied to peak flow releases would supplementation program below Lewiston dam would be a necessary component to restore natural fluvial geomorphic processes (USFWS and Hoopa Tribe, 1999, p. 230).

FIGURE 1: Study Site on 2004 Aerial Photograph



Methods

Investigations for this study consisted of three techniques.

First, a topographic survey was conducted to establish baseline physical channel geometry. A Nikon DTM-420 total station was used to gather point data, which was then converted into a contour map with AutoCAD. The area surveyed is presented as Figure 1. The upper forks of this "Y-shaped" channel represent the conduit for controlled releases on the left (southwest) and uncontrolled releases on the right (southeast). This map extends from the weir immediately below the controlled release conduit, south of the dam, to the area where the channel narrows and begins to resemble the geometry of the pre-dam river.

Five channel-spanning cross section were established, maked by hex-bolts in concrete to ensure the repeatability of future measurements. Total station measurements were taken at approximately five foot intervals across each cross section. The cross section geometry presented here was created using the "Create Section" command in AutoCAD following the creation of a contour surface.

Second, pebble counts were taken on each cross section to assess the surface particle distribution, using the protocols established by Wolman (1955). The number of individual particles on many of these cross sections numbered less than the 100 count minimum because bedrock outcroppings appeared frequently.

Third, three barrel samples were taken to assess sub-surface particle distributions. The upstream sample was taken on a riffle seventeen feet downstream from cross section #1 and seventeen feet from the right edge of water. The downstream sample was taken on a riffle seventeen feet upstream from cross section #3 and seventeen feet from the right edge of water. The midstream sample was taken in a riffle, also seventeen feet from the right edge of water, midway between the other two samples. Riffle samples were taken to be representative of likely spawning areas.
A 1.5 ft (0.46 meter) diameter steel drum was placed in the river and worked into the sediment. All material within the barrel to a depth of twelve inches was removed and stored in five gallon buckets where they were transported off-site.

The usual sampling method to measure volumetric particle distribution for the assessment of spawning gravel quality is to use the McNeil sampler (McNeil and Ahnell, 1960). The coring tube of that sampling device measures 15 cm diameter by 23 cm long. Because of unusually high summer releases from the dam, the minimum height of flowing water in riffles was double that height. Sampling with such a short device would result in the loss of a significant amount of sediment in the "less than 2mm" size classes. Even with the taller barrel sampler a small amount of fine sediment was lost, and was estimated in the data analysis. Such a small diameter sampling device would also create a significant bias in the cobble-sized (>48mm) material. Finally, the greater volume of sediment in a barrel sample vis-à-vis a McNeil sampler provides a more representative sample size in potentially non-homogenous material.

Samples were wet-sieved through five 8-inch diameter brass sieves (manufactured by USA Standard to ASTM E-11 specifications) to create a particle size distribution. Sieve sizes were: 31.5mm (1 ¼"), 16mm (5/8"), 8mm (5/16"), 4mm (#5-0.157"), 2mm (#10-0.0787"). Material passing through the 2mm sieve was designated "fine." Particles not passing the coarsest sieve were each measured and reclassified in coarse bins as 48mm+, 64mm+, 96mm+, 128mm+. No particles larger than 160mm were measured.

Sieves were stacked and hand-shaken. Following shaking, each sieve was rinsed before measuring to ensure that finer sediment did not adhere to the larger particles. Material caught in the 2mm sieve was washed more extensively to insure a more accurate separation of fines. All wash water was saved and recirculated to prevent the loss of fine material. Because the river flow during sample collection was higher than in most years (249cfs during collection vs. a typical 220cfs), some fines were lost as material was dug with a shovel from inside the barrel and transferred to storage containers. An estimate of lost fines has been added to the particle size distributions. The particles in each size class were placed in a bucket of water and the volume of water displaced was measured.

Results

I. Pebble Counts

Surface particle size distributions for the six pebble counts are given below in TABLE 1, both as the number of observations in each size class, as well as cumulative frequency. The cumulative frequency is presented as a graph in FIGURE 2.

TABLE 1: Pebble Count Data

Size, mm	XS1	XS2-R	XS2-L	XS3	XS4	XS5
Fine	0	0	12	0	0	1
1	0	0	7	1	0	0
2	0	2	11	3	1	0
4	7	2	8	3	3	0
6	5	8	6	4	4	0
8	1	4	14	4	1	1
12	12	11	10	10	4	2
16	9	12	12	5	3	1
24	16	15	13	19	9	1
32	6	13	7	8	6	1
48	17	19	7	14	8	1
64	10	7	1	5	7	4
96	9	6	3	13	15	6
128	3	0	2	5	9	12
192	0	0	0	2	8	19
256	0	0	0	0	3	12
384	0	1	0	0	0	12
512	0	0	0	0	0	2
1024	0	0	0	0	0	3

Grouped

Size, mm	XS1	XS2-R	XS2-L	XS3	XS4	XS5
8	**13**	**16**	**58**	**15**	**9**	**2**
48	**60**	**70**	**49**	**56**	**30**	**6**
1024	**22**	**14**	**6**	**25**	**42**	**70**
Count:	95	100	113	96	81	78

Cumulative Frequency, in Percent

Size, mm	XS1	XS2-R	XS2-L	XS3	XS4	XS5
Fine	0%	0%	11%	0%	0%	1%
1	0%	0%	17%	1%	0%	1%
2	0%	2%	27%	4%	1%	1%
4	7%	4%	34%	7%	5%	1%
6	13%	12%	39%	11%	10%	1%
8	14%	16%	51%	16%	11%	3%
12	26%	27%	60%	26%	16%	5%
16	36%	39%	71%	31%	20%	6%
24	53%	54%	82%	51%	31%	8%
32	59%	67%	88%	59%	38%	9%
48	77%	86%	95%	74%	48%	10%
64	87%	93%	96%	79%	57%	15%
96	97%	99%	98%	93%	75%	23%
128	100%	99%	100%	98%	86%	38%
192	100%	99%	100%	100%	96%	63%
256	100%	99%	100%	100%	100%	78%
384	100%	100%	100%	100%	100%	94%
512	100%	100%	100%	100%	100%	96%
1024	100%	100%	100%	100%	100%	100%

All size bins are presented as diameters less than or equal to the amount shown: the "17" next to the 48mm bin for XS1 (cross section #1 on the map), indicates the number of particles measured in the count that were between 33mm and 48mm, inclusive. The table in the lower left groups the collected particles into fine sediment (less than 8mm), spawning gravels (8-48mm), and coarse sediment (48-1024mm).

In general, the average diameter of the particles increases in a downstream direction. One measure of this is the "D-50" parameter. D-50 is the diameter for which 50% of the particles sampled are less than or equal to that diameter. TABLE 2 displays the D-50 values. The exception to the downstream trend is XS-2L (#2, left-fork). This cross section lies in the relatively-unused spillway fork. During most of the year, water flows upstream into this area in an eddying effect, and thus the higher energy of flowing water is not available to move sediment through this channel.

TABLE 2: D-50, in mm

XS1	XS2-R	XS2-RL	XS3	XS4	XS5
24.0	21.9	6.9	24.4	73.1	195.4

FIGURE 3: Pebble Counts, Applegate Dam

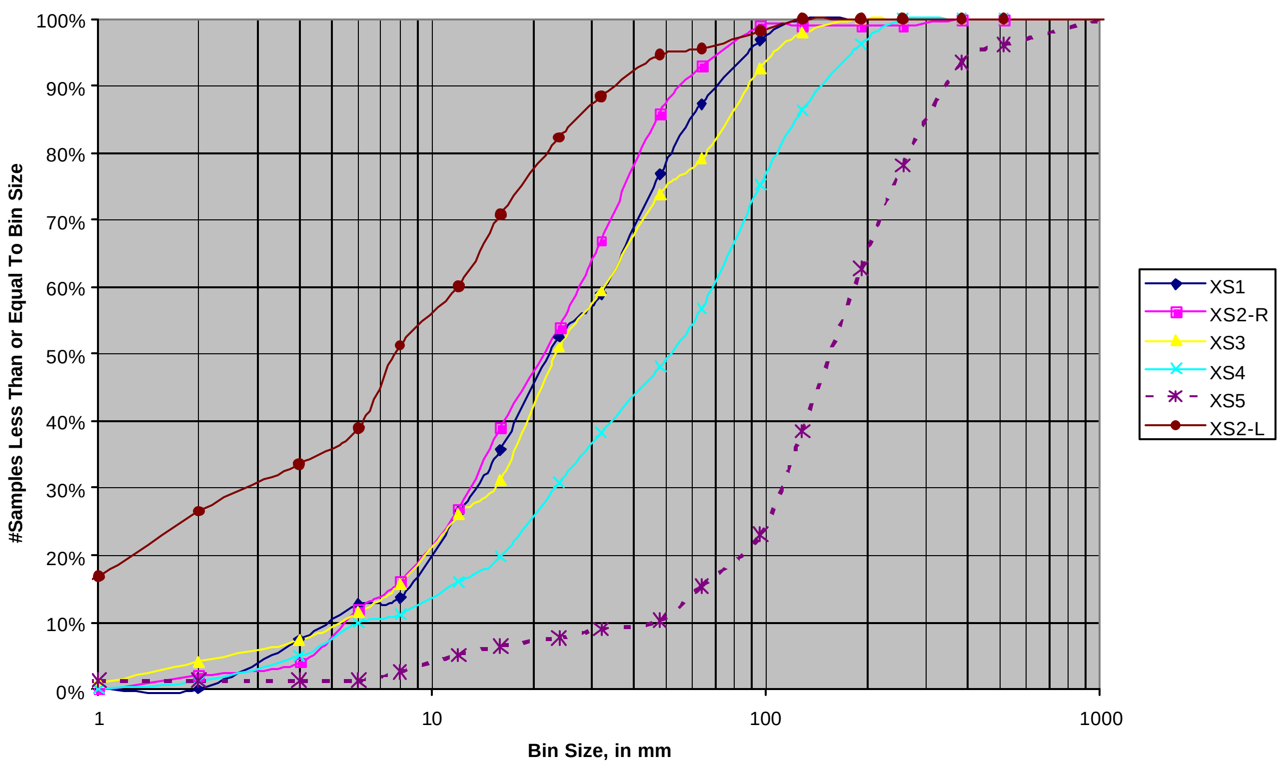
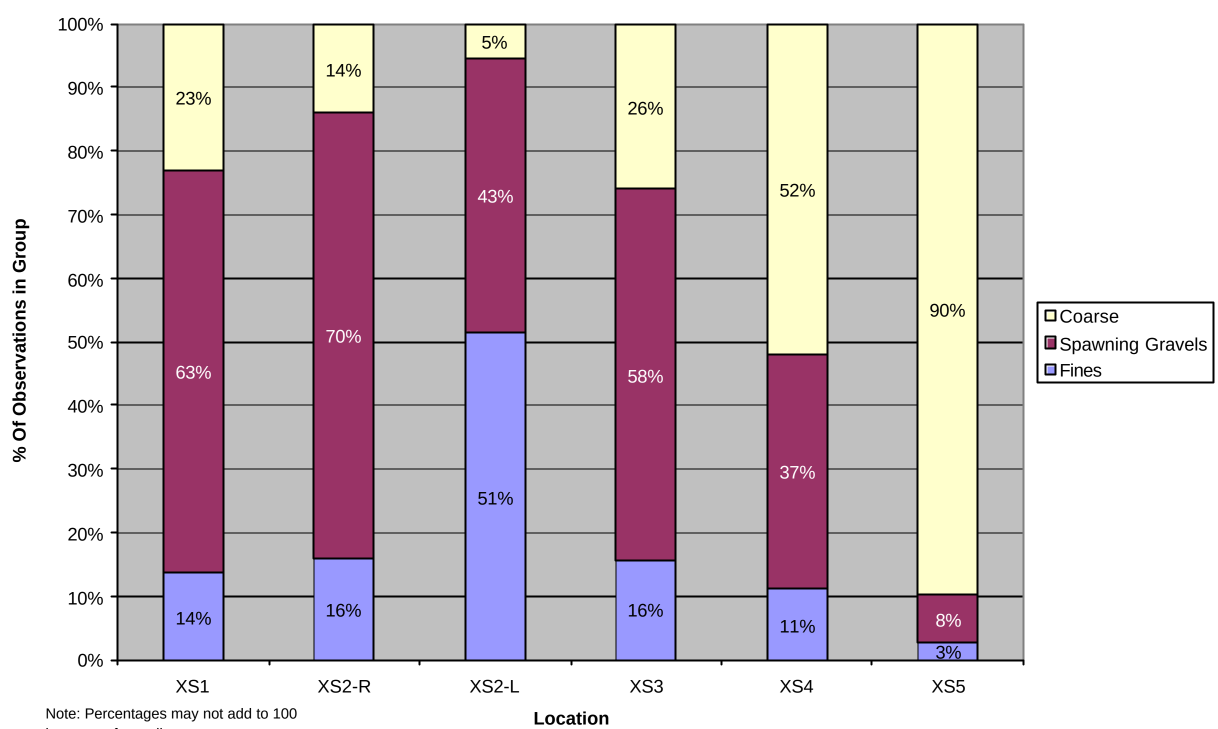


FIGURE 4: Applegate Dam Spawning Gravel Size Groupings



Note: Percentages may not add to 100 because of rounding.

II. Barrel Samples

Sediment in the upper twelve inch profile of the sediment column are presented below in TABLE 3, both as volume in milliliters of water displaced, and as the percent of the total in each size class. Volumes and percent are expressed as material caught in the corresponding sieve size: the material greater than or equal to that sieve size. All samples contain between 47% and 53% material too small for salmonid redd-building. Though the upstream sample had the highest percentage of this grouping at 53%, the downstream sample had significantly more sediment less than 2mm, by percent, than the other two. Perhaps the most noticeable difference was the difference in coarse sediment, which increased in a downstream direction. Not only did the upstream sample contain only 4% material too coarse for salmonid spawning, no particles 64mm or greater was observed in that sample. In a corresponding grouping, 11% of the midstream sample was 64mm or greater and 19% of the downstream sample was 64mm or greater. The upstream sample had a significantly higher percentage of salmonid spawning-sized material at 43% than the midstream (35%) or downstream (31%) samples.

TABLE 3: Barrel Sample Particle Size Distribution, in mL of Water Displaced and as Percent of Total

	Upstream	Mid-Profile	Downstream		Upstream	Mid-Profile	Downstream
SieveSize	Volume,ml	Volume,ml	Volume,ml	SieveSize	% of Total	% of Total	% of Total
Fines	6045	6840	8950	Fines	17%	19%	24%
2+	4632	4265	4055	2+	13%	12%	11%
4	3554	6415	4883	4	10%	18%	13%
8	2890	6590	4965	8	8%	18%	13%
16	6200	4930	4527	16	17%	14%	12%
32	2390	1150	2063	32	7%	3%	5%
48	1079	1545	1225	48	3%	4%	3%
64	0	1175	1010	64	0%	3%	3%
96	0	890	3115	96	0%	2%	8%
128+	0	2250	2910	128+	0%	6%	8%
SieveSize				SieveSize			
8	14231	17520	17888	8	53%	49%	47%
48	11480	12670	11555	48	43%	35%	31%
1024	1079	5860	8260	1024	4%	16%	22%

Observation of spawning gravel and coarse sediment yields important clues that may explain the differences. The shape of these two size categories in the upstream sample, closest to the dam, are uniformly angular and are clearly not river rock, which tends to be far rounder in those size classes. The angularity decreases somewhat in the midstream sample and very obviously in the downstream sample. Photographs of these size classes taken from the three samples are presented in FIGURE 7.

Particle size distributions between surface pebble counts and barrel samples are inherently different because barrel samples encompass the top twelve inches of sediment, and their distribution responds differently to flows that fail to entrain the entire twelve inches of streambed. In this study, pebble counts at the upstream end of the study area had a majority of particles in the gravel size category, while the barrel sample taken nearby was weighted more toward the fine sediment fraction. This is a likely result of the phenomenon just noted—flows high enough to entrain fine sediment have scoured those particles from the surface but not from the subsurface. The difference between barrel and pebble count samples is more pronounced downstream where the channel widens and surface velocity and shear stress increases.

Because salmonids dig into streambeds for spawning material, barrel samples can be more representative of the material available for spawning.

FIGURE 5: Barrell Sample Particle Size Distribution, Applegate Dam

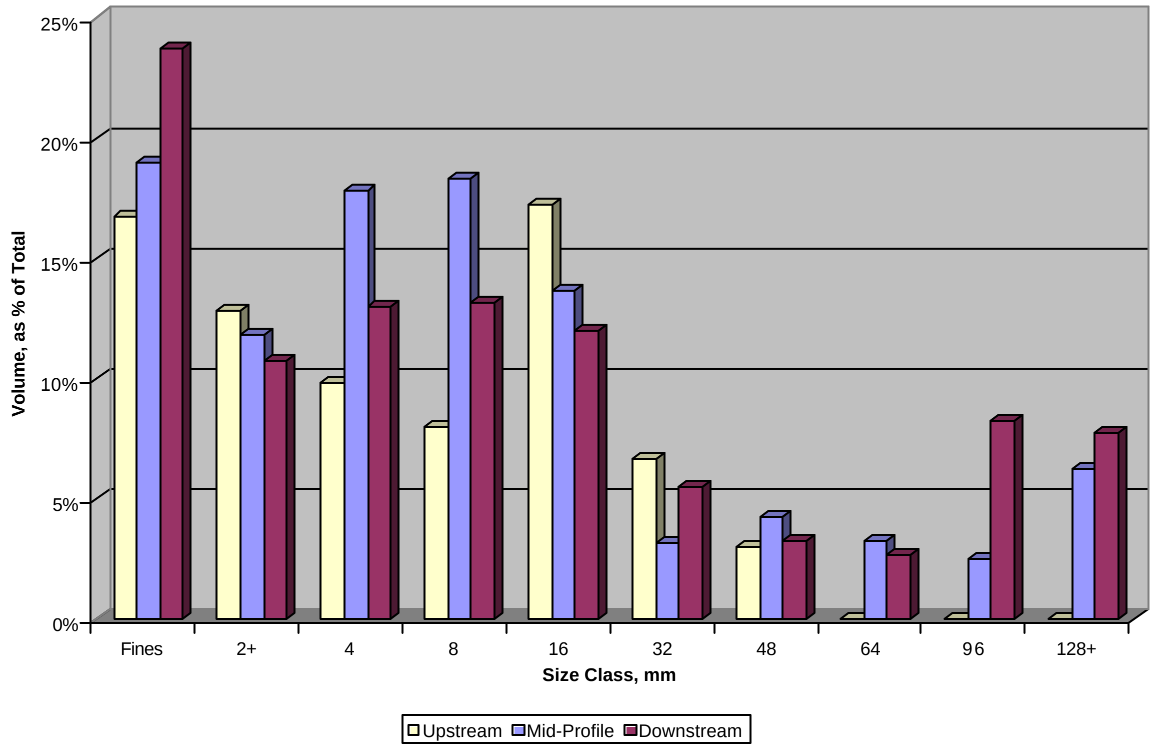


FIGURE 6: Barrell Sample Size Groupings

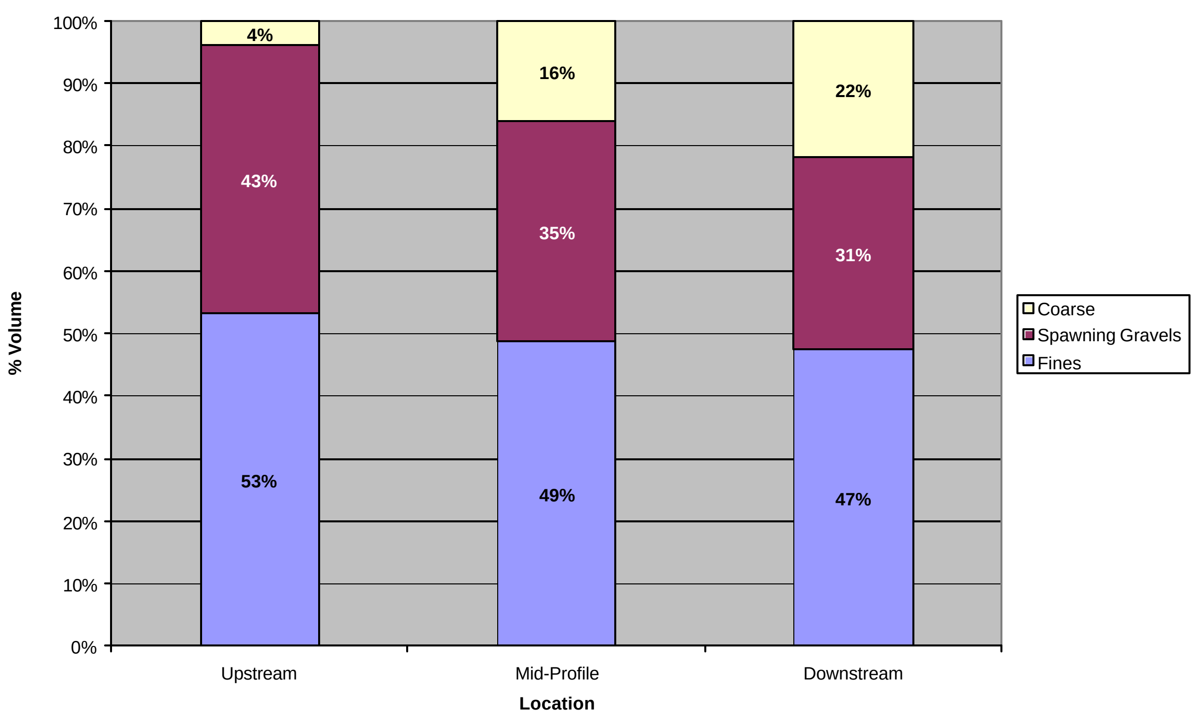


	FIGURE 7: Photographs of Gravel Shapes		
	Upstream Sample / #1	**Midstream Sample / #2**	**Downstream Sample / #3**
16 mm+			
32 mm+			
48 mm+			

III. Topographic Survey

Figure 7 shows a contour map in the vicinity of Applegate Dam. Cross-sections generated from the contour map with AutoCAD are presented below as Figure 8A through 8F.

FIGURE 8A: Applegate Dam Cross Section XS-1
10/2006

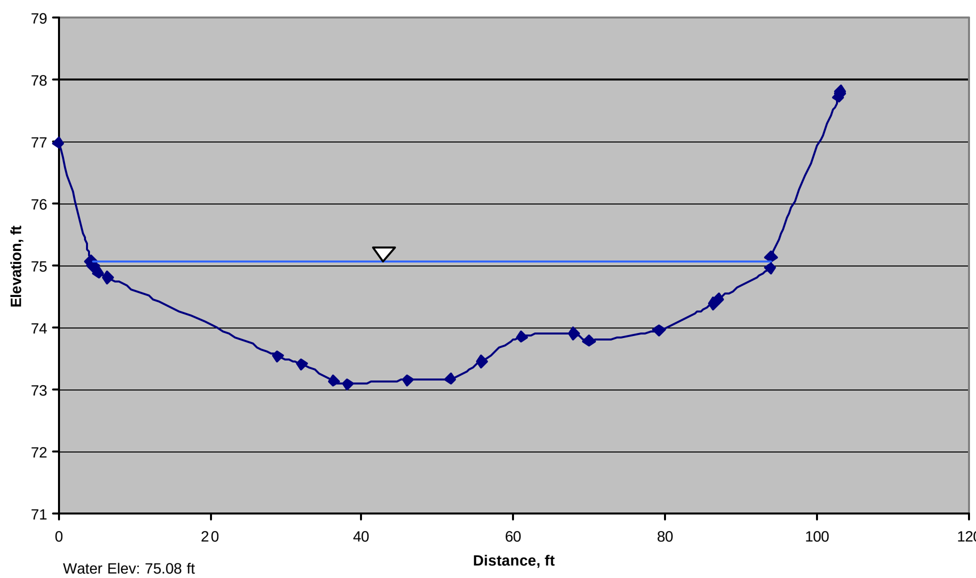


FIGURE 8B: Applegate Dam Cross Section XS2-L
10/2006

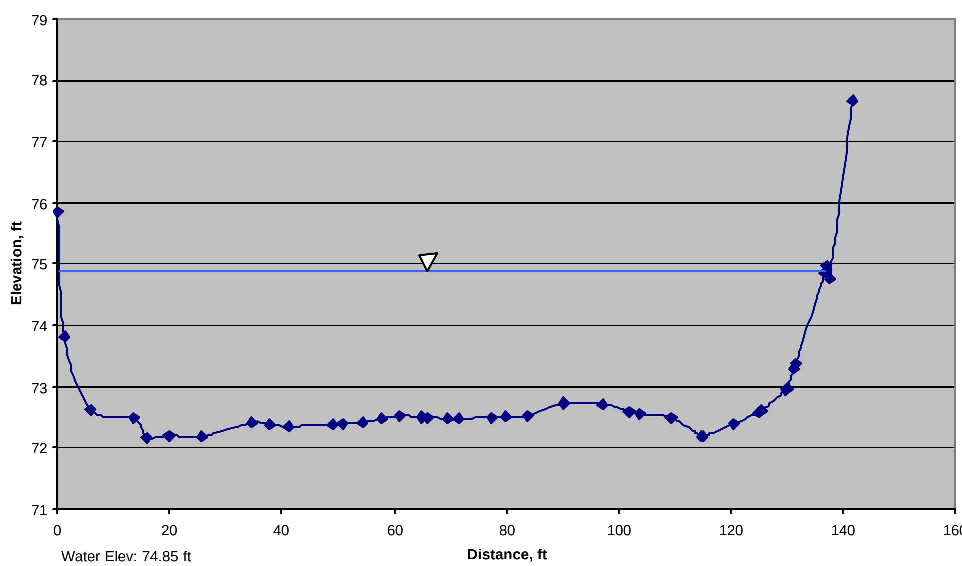


FIGURE 8C: Applegate Dam Cross Section XS-2R
10/2006

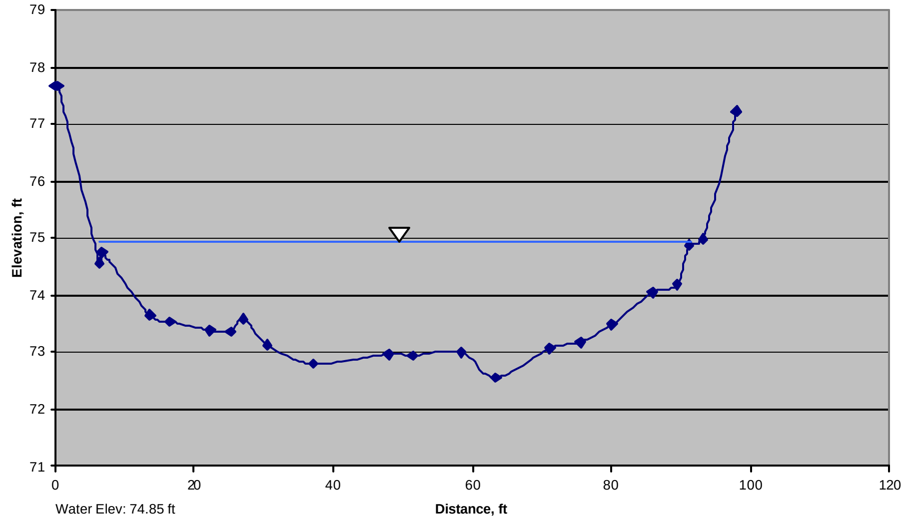


FIGURE 8D: Applegate Dam Cross Section XS-3
10/2006

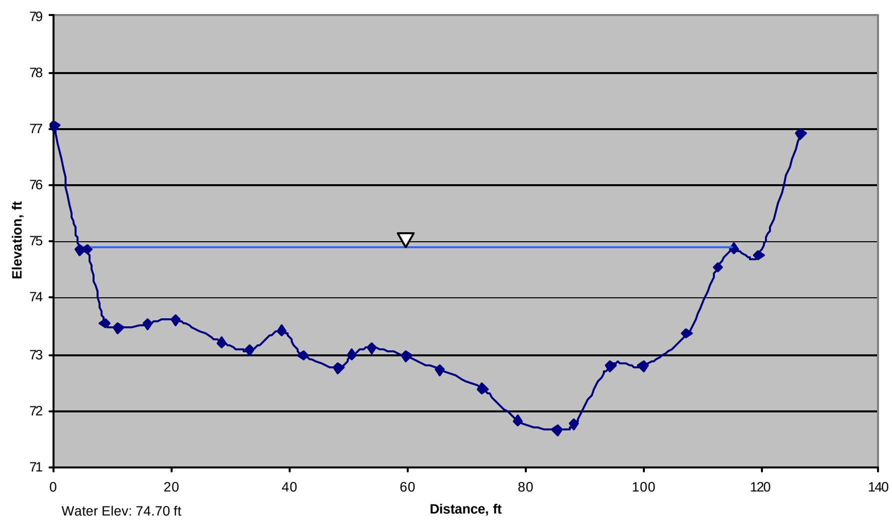


FIGURE 8E: Applegate Dam Cross Section XS-4
10/2006

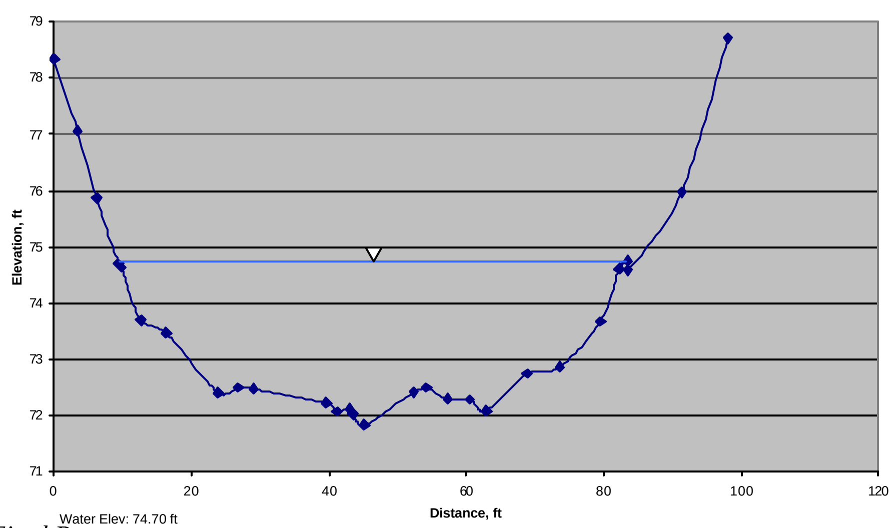
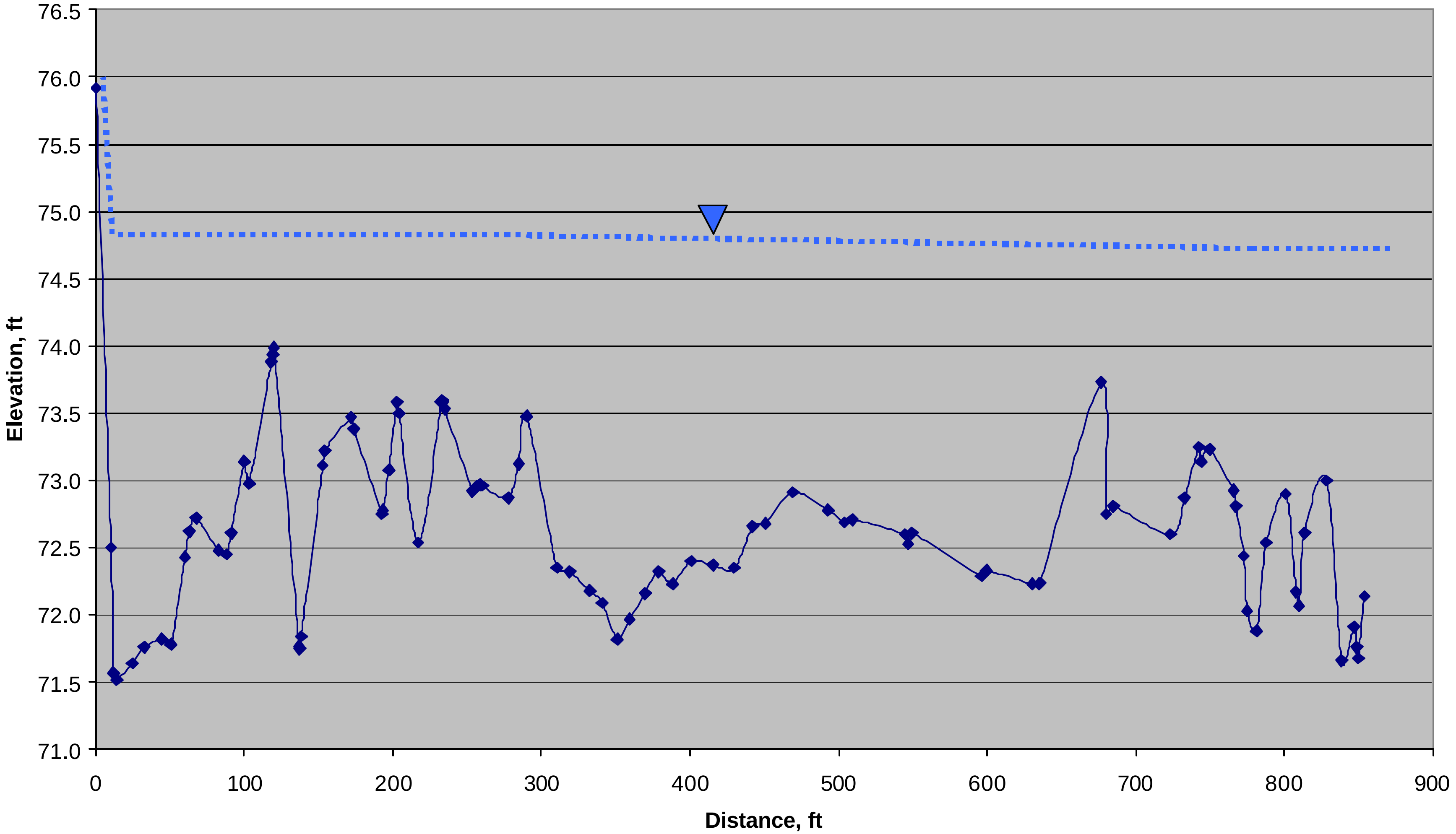


FIGURE 9: Applegate Dam Longitudinal Profile

October, 2006



The longitudinal survey, depicted in Figure 9, begins at the weir below the dam at station 0.0 and ends at cross section XS-4 at station 854.07. The deepest section in the entire profile is in the pool directly below the weir. Note the peak in the profile at station 120. This represents a "wave" of similar-sized angular sediment in a berm perpendicular to the channel flow. Resurveys in future years can monitor how quickly this wave moves downstream. The similarity of particle sizes observed in this wave may indicate a prior insertion of gravel into the system or a remnant from the original creation of this channel at the time of dam construction. Evidence of similar smaller peaks can be observed in this profile downstream.

Next Steps

The rate at which introduced sediment will become most useful to the system is partially dependent on the rate at which the sediment moves through the systems with the available flow regime. The higher the flow, the higher the shear forces on bedload sediment, and the faster and further it will move downstream. Many sediment entrainment studies have been conducted to determine the flow rate necessary to entrain a specific diameter of sediment.

A USGS study on the Roaring Fork River in Colorado is typical of these studies and outlines a straightforward method for arriving at such a flow rate, given a known particle size distribution and channel geometry (Elliot, 2002). In this study, channel geometry was used as input to the HECRAS model to determine water surface elevations that were then used to calculate mean boundary shear stress at four reference flow rates. Using cross section channel geometry and pebble count data, critical shear stress was calculated. The sediment entrainment potential at a specific cross section was then calculated as the ratio of the flood-generated boundary shear stress to the critical shear stress at a particular cross section. When the boundary shear stress just equals the critical shear stress (ration equals 1), the D_{50}-sized particles will begin to move. When the ratio is at least 2, all D_{50} particles are estimated to move.

As a simple test of this procedure, HECRAS v3.1 (USACE, 2004) was used with the channel geometry and pebble count data taken in this study, using the flow release during the original survey—of 249 cfs—as well as an actual spill release of 1710 cfs on 12/17/06. Through an iterative process, two flow releases were calculated that gave the ratio of boundary shear stress to critical shear stress of 1 (incipient motion) and 2 (most D_{50} particles move).

The two actual flow releases supplied the boundary conditions at both ends of the reach needed by HECRAS. For the higher releases, the boundary condition assumed was that the lower end of the reach was at a critical depth. This is nearly correct, as there is a topographic break in stream gradient about 100 feet downstream of the modeled reach.

Because a highly complex an accurate model of this reach was beyond the scope of this study, the model was optimized for the location at cross section XS-2. Sediment movement was modeled at that location. The table below shows the four flow rates modeled, the boundary shear stress, critical shear stress, and resulting ratio. Note that this model predicts incipient motion of D-50 particles at about 3,000 cfs and full motion at about 5,400 cfs.

To predict more accurate sediment entrainment flows, additional modeling with HECRAS is needed. This preliminary model was run only to provide a methodology with which to determine sediment flows.

TABLE 4: HECRAS Preliminary Modeling Data												
HEC-RAS Plan: SummerLowFlo River: Applegate Reach: Dam												
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Dam	6	PF 1	249	71.71	75.02		75.05	0.00049	1.2	208.12	98.42	0.14
Dam	6	PF 4	1710	71.71	77.64		77.83	0.00149	3.51	494.95	115.68	0.29
Dam	6	PF 4	3000	71.71	79.25		79.56	0.00165	4.51	686.49	122.9	0.32
Dam	6	PF 4	5400	71.71	81.55		82.06	0.00179	5.81	981.12	133.26	0.35
Dam	5	PF 1	249	72.56	74.99		75	0.0001	0.48	476.15	226.54	0.06
Dam	5	PF 4	1710	72.56	77.61		77.65	0.00035	1.62	1095.68	241.83	0.14
Dam	5	PF 4	3000	72.56	79.27		79.33	0.00038	2.12	1500.55	246.68	0.15
Dam	5	PF 4	5400	72.56	81.66		81.77	0.00042	2.79	2099.22	253.67	0.17
Dam	4	PF 1	249	72.77	74.99		75	0.00011	0.5	468.56	228.09	0.07
Dam	4	PF 4	1710	72.77	77.6		77.64	0.00035	1.63	1073.86	235.86	0.14
Dam	4	PF 4	3000	72.77	79.26		79.32	0.00039	2.14	1469.06	241.61	0.15
Dam	4	PF 4	5400	72.77	81.65		81.76	0.00043	2.82	2055.92	248.12	0.17
Dam	3	PF 1	249	72.28	74.94		74.95	0.00037	0.95	260.9	142.69	0.12
Dam	3	PF 4	1710	72.28	77.39		77.51	0.00103	2.8	618.66	149.37	0.24
Dam	3	PF 4	3000	72.28	78.98		79.18	0.0011	3.56	859.78	153.73	0.26
Dam	3	PF 4	5400	72.28	81.27		81.59	0.00117	4.57	1219.13	160.01	0.28
Dam	2	PF 1	249	71.65	74.79		74.82	0.0007	1.28	194.35	108.67	0.17
Dam	2	PF 4	1710	71.65	76.84		77.08	0.00246	3.96	446.28	131.14	0.36
Dam	2	PF 4	3000	71.65	78.39		78.74	0.0023	4.81	659.82	144.47	0.37
Dam	2	PF 4	5400	71.65	80.65		81.15	0.00214	5.86	1007.67	163.41	0.37
Dam	1	PF 1	249	71.83	74.7	73.22	74.74	0.00102	1.68	148.02	74.46	0.21
Dam	1	PF 4	1710	71.83	75.27	75.27	76.52	0.02108	8.98	192.41	80.42	0.98
Dam	1	PF 4	3000	71.83	76.45	76.45	78.18	0.01801	10.7	291.85	88.77	0.97
Dam	1	PF 4	5400	71.83	78.19	78.19	80.58	0.01532	12.7	457.9	101.46	0.95

TABLE 5: Flows for Predicted Sediment Movement				
Flow Rate, cfs	Channel Slope	Bdy Shear Stress	Crit Shear Stress	Ratio Sb / Sc
249	0.0215%	1.416245	22.24963	0.063653
1,710	0.0945%	13.55768	22.24963	0.609344
3,000	0.1245%	24.01365	22.24963	1.079283
5,400	0.1674%	44.18685	22.24963	1.985959

References

Elliot, John G. 2002. Bed-Material Entrainment Potential, Roaring Fork River at Basalt, Colorado. U.S. Geological Survey, Water Resources Investigations Report 02-4223. Denver, CO.

McNeil, J. W., and W. H. Ahnell. 1960. Measurement of gravel composition of salmon streambeds. Fish Res. Inst. Circ. 120. University of Washington, Seattle. 6 p.

Reeves, G.H., *et. al.*, Responses of Salmonids to Habitat Changes, in Meehan, W.R., editor, 1991. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society. Bethesda, MD.

U.S. Army Corps of Engineers. November, 2002. HEC-RAS River Analysis System v3.1, Software and Users Manual. USACE. Davis, CA.

U.S. Fish & Wildlife Service and Hoopa Valley Tribe, 1999. Trinity River Flow Evaluation Final Report, June 1999. USFWS, Arcata, CA.

West, D.C., *et. al.*, 1965. Habitat improvement to enhance anadromous fish production. Oregon State Game Commission, Columbia River Fisheries Development Closing Report, Clear Creek Project 11. Portland, OR.

Wolman, M.G. 1954. A Method of Sampling Coarse Riverbed Material. American Geophysical Union Transactions, v35, p. 951-956.

Applegate Dam
Topography
October 23, 2006

Newberry Watershed
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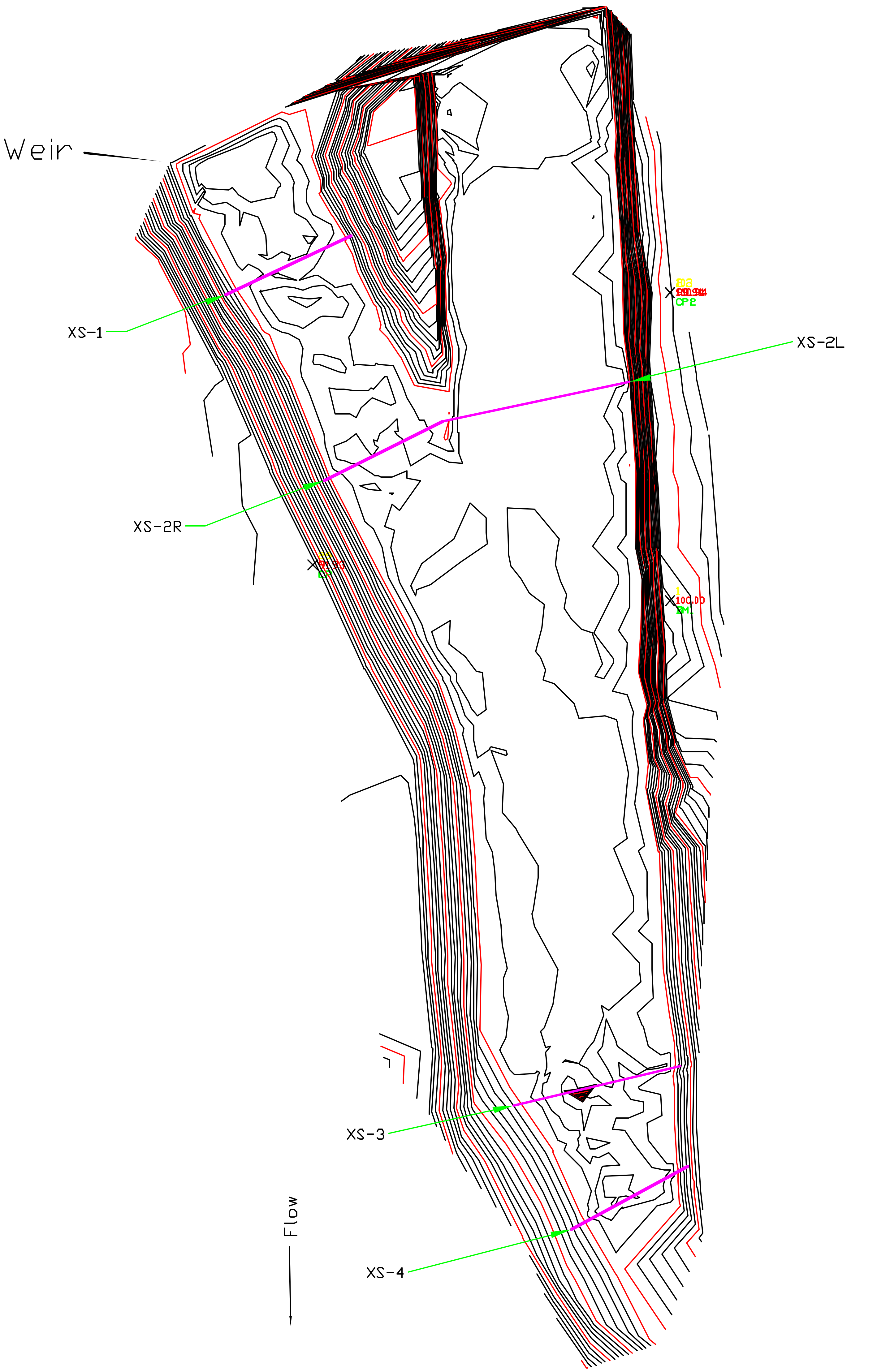


APPENDIX A

Forest Creek Habitat Survey

APPENDIX B

Stream Temperature Data

2005 Stream Temps

Site Name	Start	Stop	Seasonal Max		Seasonal Min		Seasonal Max DT		7-Day averages				Days >	Days >	Days >
			Date	Value	Date	Value	Date	Value	Date	Max	Min	D T	55 F	64 F	70 F
Applegate R at mouth of LA	6/25/05	10/23/05	6/29/05	68.4	10/23/05	46.3	6/29/05	13.1	6/28/05	66.3	55.6	10.7	105	43	0
Beaver Cr at USFS	6/24/05	10/20/05	8/5/05	70.8	10/5/05	45.8	8/11/05	8.6	8/7/05	69.9	62.4	7.5	87	49	4
E.Fk. Williams Cr at Browns Rd	6/4/05	10/18/05	8/5/05	70.3	6/8/05	47.6	7/26/05	8.1	8/3/05	69.2	63.0	6.3	112	54	2
E.Fk Williams Cr below Rock Cr	6/4/05	10/18/05	8/7/05	64.2	6/7/05	44.4	7/26/05	5.9	8/7/05	63.8	59.4	4.4	85	4	0
Forest Cr at mouth	6/24/05	10/18/05	8/9/05	59.9	7/8/05	55.4	6/30/05	3.6	8/12/05	59.6	57.7	1.9	117	0	0
Little Applegate Cr at mouth	6/15/05	10/23/05	7/31/05	75.2	10/22/05	48.0	7/27/05	13.8	7/30/05	74.0	62.7	11.3	112	72	36
Little Applegate Cr at Yale Cr	6/25/05	10/24/05	10/21/05	76.5	10/21/05	46.0	10/21/05	30.5	8/7/05	67.1	60.3	6.8	95	42	2
Little Applegate Cr at RM2.6	6/16/05	10/20/05	8/5/05	72.1	10/5/05	47.2	7/27/05	11.6	8/7/05	71.2	61.2	10.0	102	62	15
Murphy Cr	6/4/05	10/18/05	8/7/05	66.3	6/8/05	46.8	7/26/05	6.0	8/7/05	65.8	61.6	4.2	101	29	0
Thompson Cr below Ninemile Cr	6/24/05	10/18/05	8/7/05	63.2	9/25/05	48.1	8/27/05	8.7	8/7/05	62.8	56.9	6.0	95	0	0
Thompson Cr at USFS	6/24/05	10/18/05	8/7/05	63.4	9/25/05	42.7	8/28/05	10.1	8/7/05	62.5	55.5	7.0	73	0	0
Thompson Cr at Tallowbox	6/24/05	10/18/05	7/31/05	66.1	9/25/05	50.4	6/29/05	7.3	7/20/05	65.7	59.6	6.1	109	25	0
Thompson Cr at1095	6/24/05	10/18/05	8/4/05	76.4	9/25/05	44.3	9/19/05	17.8	8/1/05	74.3	63.9	10.4	115	91	50
Slate Cr at Redwood Tavern	6/4/05	10/18/05	8/7/05	71.1	9/25/05	46.7	6/30/05	7.9	8/7/05	70.4	63.5	6.9	111	55	8
Slate Cr at Slate Cr Rd RM1.6	6/4/05	10/18/05	8/7/05	69.2	10/5/05	47.1	8/27/05	7.7	8/7/05	68.6	62.3	6.3	111	44	0
Slate Cr at mouth	6/4/05	10/18/05	8/5/05	77.5	6/8/05	51.0	7/26/05	10.2	7/21/05	76.5	67.8	8.7	136	88	54
Williams Cr at Wms Hwy bridge	6/24/05	10/18/05	8/7/05	70.9	10/17/05	52.3	6/30/05	9.7	8/10/05	69.9	63.0	6.9	117	75	3
Williams Cr at mouth	6/24/05	10/18/05	8/6/05	70.4	10/14/05	54.9	6/24/05	8.0	8/7/05	69.7	63.9	5.8	117	77	3
W.Fk Williams Cr at CavesCamp	6/4/05	10/18/05	8/5/05	66.5	6/8/05	46.3	6/29/05	6.2	8/6/05	64.6	60.1	4.5	94	11	0
Yale Cr at mouth	6/15/05	10/20/05	8/7/05	65.7	10/5/05	46.0	8/13/05	7.1	8/7/05	65.0	59.2	5.8	97	13	0

2006 Stream Temps

Site Name	Start	Stop	Seasonal Max		Seasonal Min		Seasonal Max		7-Day averages				Days >	Days >	Days >
			Date	Value	Date	Value	Date	Value	Date	Max	Min	D T	55 F	64 F	70 F
Beaver Cr at mouth	6/14/06	10/15/06	6/15/06	82.1	10/11/06	46.3	6/15/06	27.2	7/25/06	70.6	63.8	6.8	112	57	9
Cheney Cr at RM2	6/8/06	10/12/06	9/12/06	70.6	6/9/06	52.6	9/12/06	12.4	9/10/06	67.5	58.2	9.4	125	27	1
East Fk Williams Cr at Browns Rd	6/8/06	10/12/06	7/24/06	72.2	10/11/06	48.5	8/27/06	7.5	7/25/06	70.4	64.5	5.9	121	56	5
East Fk Williams Cr below Rock Cr	6/8/06	10/2/06	7/24/06	65.7	9/22/06	23.5	7/25/06	41.0	7/25/06	63.9	41.2	22.6	72	4	0
Forest Cr at mouth	6/10/06	10/15/06	6/16/06	62.5	10/14/06	56.0	6/15/06	5.1	6/27/06	61.4	57.7	3.6	128	0	0
Little Applegate at mouth	6/10/06	10/16/06	7/24/06	76.2	10/11/06	45.2	8/1/06	11.7	7/25/06	74.9	64.4	10.5	117	78	16
Little Applagate at Yale Cr	6/10/06	10/15/06	7/24/06	71.9	10/11/06	44.5	7/20/06	9.0	7/25/06	70.8	63.2	7.6	106	43	7
Little Applegate at RM 2.6	6/10/06	10/15/06	7/24/06	73.4	10/11/06	45.0	9/1/06	10.1	7/25/06	72.2	63.6	8.6	113	69	7
Murphy Cr	6/8/06	10/12/06	7/24/06	69.6	10/11/06	47.0	6/24/06	6.1	7/25/06	68.1	63.9	4.2	116	16	0
Palmer Cr at mouth	6/14/06	10/15/06	7/28/06	69.1	10/14/06	49.5	9/5/06	9.8	7/26/06	68.6	63.2	5.4	116	71	0
**Slate Cr at mouth*	*6/8/06*	*10/12/06*	*9/5/06*	*117.4*	*10/11/06*	*43.9*	*8/31/06*	*65.0*	*8/25/06*	*115.2*	*56.6*	*58.6*	*127*	*124*	*109*
Slate Creek at Redwood Tavern	6/8/06	10/11/06	7/24/06	75.5	10/11/06	46.3	8/18/06	9.1	7/25/06	73.8	67.3	6.5	121	73	8
Slate Cr at Slate Cr Rd RM1.6	6/8/06	10/12/06	7/24/06	73.7	10/11/06	46.1	6/24/06	8.4	7/25/06	71.8	65.2	6.5	119	54	7
Thompson Cr at Tallowbox	6/14/06	10/15/06	7/24/06	69.0	10/11/06	48.8	6/24/06	7.7	7/25/06	67.8	62.5	5.3	121	38	0
Thompson Cr below Nine Mile Cr	6/14/06	10/15/06	7/24/06	64.5	10/10/06	46.8	9/1/06	6.7	7/25/06	63.7	59.3	4.4	101	1	0
W.Fk.Williams Cr at CavesCamp	6/8/06	10/12/06	7/23/06	69.7	10/11/06	46.9	7/20/06	7.6	7/25/06	67.7	62.2	5.5	103	14	0
W.Fk. Williams at mouth	6/8/06	10/12/06	7/24/06	74.9	10/11/06	47.9	7/20/06	10.1	7/25/06	73.5	64.3	9.1	122	75	10
**Williams Cr at Wms Hwy bridge*	*6/8/06*	*10/12/06*	*8/27/06*	*119.0*	*9/25/06*	*42.2*	*8/27/06*	*70.0*	*8/25/06*	*115.2*	*50.3*	*64.9*	*127*	*98*	*83*
Yale Cr at mouth	6/10/06	10/15/06	7/25/06	66.5	10/10/06	44.2	9/1/06	7.3	7/25/06	65.7	60.8	4.9	96	7	0

Logger errors

APPENDIX C

Water Quality –
Dissolved Oxygen, Turbidity, pH, Conductivity, Nitrates

ARWC Water Quality Grab Sample Data 2005 - 2006

Monitoring Site	Date Sampled	Temp (C)	Cond-uctivity	Ph	Turbidity (NTU)	DO (mg/L)	Nitrates (mg/L)
Applegate R. @ Beaver Cr 2005	6/29/05	17.6	101.7		0.80	9.69	0.02
Applegate R. @ Beaver Cr 2005	7/26/05	12.9	114.8	7.60	1.27	10.37	0.01
Applegate R. @ Beaver Cr 2005	8/23/05	12.2	107.7	7.80	.93 -1.34	10.69	0.00
Applegate R. @ Beaver Cr 2005	9/15/05	12.7	106.3		1.06	10.95	0.01
Applegate R. @ Beaver Cr 2006	6/15/06	14.7	114.3		0.86	9.40	
Applegate R. @ Beaver Cr 2006	7/26/06	19.0	112.1	7.56	0.98	9.73	
Applegate R. @ Beaver Cr 2006	8/20/06	14.0	114.7	7.07	0.73	11.09	
Applegate R. @ Beaver Cr 2006	9/26/06	15.3	139.0	9.2	0.82	10.71	
Applegate R. @ Cantrall Buckley 2005	6/29/05	16.8	123.4		1.15	10.09	0.02
Applegate R. @ Cantrall Buckley 2005	7/25/05	18.7	115.3	8.02	1.09	9.91	0.01
Applegate R. @ Cantrall Buckley 2005	8/22/05	17.5	108.1	6.80	1.31	9.69	0.02
Applegate R. @ Cantrall Buckley 2005	9/14/05	16.8	114.7		0.60	10.31	0.01
Applegate R. @ Cantrall Buckley 2006	6/15/06	16.0	87.4		0.86	9.73	
Applegate R. @ Cantrall Buckley 2006	7/26/06	16.8	101.1	7.48	4.17	13.61	
Applegate R. @ Cantrall Buckley 2006	8/20/06	14.9	101.4	7.53	1.26	11.47	
Applegate R. @ Cantrall Buckley 2006	9/27/06	14.6	124.0	9.44	0.54	11.05	
Applegate R. @ Fish Hatchery Park 2005	6/28/05	11:40	147.2		1.80	10.37	0.02
Applegate R. @ Fish Hatchery Park 2005	7/25/05	11:35	142.2	7.68	0.94	9.65	0.00
Applegate R. @ Fish Hatchery Park 2005	8/22/05	11:24	134.7	7.00	0.89	10.19	0.02
Applegate R. @ Fish Hatchery Park 2005	9/14/05	11:30	134.3		0.81	10.85	0.00
Applegate R. @ Fish Hatchery Park 2006	7/28/06	20.7	132.7	7.30	1.69	8.81	
Applegate R. @ Fish Hatchery Park 2006	8/21/06	21.6	134.6	7.62	1.46	7.51	
Applegate R. @ Fish Hatchery Park 2006	9/25/06	15.5	152.3	7.54	1.19	10.63	
Applegate R. @ Fish Hatchery Park 2006							
Beaver Creek at Mouth 2005	6/29/05	18.3	380.0		0.61	9.65	0.05
Beaver Creek at Mouth 2006	6/15/06	14.6	376.5		1.70	11.05	
Beaver Creek at Mouth 2006	7/26/06	21.10	365.00	7.77	1.56	9.44	
Beaver Creek at Mouth 2006	8/20/06	16.9	396.8	7.1	0.50	8.61	
Beaver Creek at Mouth 2006	9/27/06	13.6	400.0	8.6	0.41	10.99	
Cheney Creek @ 2nd bridge 2005	6/28/05	13.7	78.9		0.70	9.90	0.03
Cheney Creek @ 2nd bridge 2005	7/25/05	15.3	74.0	7.60	0.67	8.54	0.01
Cheney Creek @ 2nd bridge 2005	9/14/05	13.8	70.8		0.64	8.72	0.00
Cheney Creek @ 2nd bridge 2006	6/14/06	12.9	70.5		1.04	10.58	
Cheney Creek @ 2nd bridge 2006	7/28/06	17.5	67.7	7.16	1.36	7.86	
Cheney Creek @ 2nd bridge 2006	8/21/06	17.3	67.3	7.30	0.51	7.18	
Cheney Creek @ 2nd bridge 2006	9/25/06	12.3	68.3	8.53	0.77	8.82	
E.Fk Williams Cr. @ Browns Rd 2005	6/28/05	16.0	142.0		2.20	9.67	0.03
E.Fk Williams Cr. @ Browns Rd 2005	7/25/05	18.5	163.2	7.71	1.32	9.43	0.06

Monitoring Site	Date Sampled	Temp (C)	Cond-uctivity	Ph	Turbidity (NTU)	DO (mg/L)	Nitrates (mg/L)
E.Fk Williams Cr. @ Browns Rd 2005	8/22/05	17.1	140.7	7.40	0.40	9.85	0.00
E.Fk Williams Cr. @ Browns Rd 2005	9/14/05	15.1	145.4		4.33 - 0.69	10.19	0.00
E.Fk Williams Cr. @ Browns Rd 2006	6/14/06	12.4	116.7		1.13	10.31	
E.Fk Williams Cr. @ Browns Rd 2006	7/28/06	18.4	151.5	7.3	1.06	8.97	
E.Fk Williams Cr. @ Browns Rd 2006	8/22/06	17.0	167.3	7.2	0.56	10.70	
Forest Cr @ Hamilton Rd 2005	6/29/05	15.1	173.8		1.82	8.89	0.21
Forest Cr @ Hamilton Rd 2005	7/25/05	15.1	348.0	7.53	0.63	6.11	0.76
Forest Cr @ Hamilton Rd 2005	8/22/05	16.5	328.4	7.90	0.38	7.77	0.30
Forest Cr @ Hamilton Rd 2006	6/14/06	14.8	345.6		0.58	9.65	
Forest Cr @ Hamilton Rd 2006	8/20/06	15.0	296.2	6.7	0.27	5.45	
Forest Cr @ Hamilton Rd 2006	9/26/06	15.3	306.3	8.7	0.26	8.35	
Little Applegate R. @ Yale Cr 2005	6/29/05	13.3	165.0		1.96	10.71	0.02
Little Applegate R. @ Yale Cr 2005	7/26/05	14.8	215.3	6.62	1.29	9.73	0.00
Little Applegate R. @ Yale Cr 2005	8/23/05	15.7	247.2	8.00	1.30	10.03	0.00
Little Applegate R. @ Yale Cr 2005	9/15/05	11.2	218.6		0.80	10.65	0.00
Little Applegate R. @ Yale Cr 2006	6/15/06	11.3	137.5		2.54	12.91	
Little Applegate R. @ Yale Cr 2006	7/26/06	17.7	226.8	7.37	1.11	10.09	
Little Applegate R. @ Yale Cr 2006	8/20/06	15.7	225.0	7.14	0.81	9.09	
Little Applegate R. @ Yale Cr 2006	9/26/06	11.7	243.7	7.66	0.65	10.51	
Little Applegate R. @ Mouth 2005	6/29/05	13.5	200.0			10.33	0.02
Little Applegate R. @ Mouth 2005	7/26/05	15.7	256.2	7.02	0.90	10.05	0.02
Little Applegate R. @ Mouth 2005	8/23/05	17.0	255.0	7.50	1.21	10.15	0.01
Little Applegate R. @ Mouth 2005	9/15/05	12.7	261.3		0.71	10.67	0.00
Little Applegate R. @ Mouth 2006	6/15/06	13.8	168.0		2.90	10.73	
Little Applegate R. @ Mouth 2006	7/26/06	19.6	259.5	7.73	3.24	9.61	
Little Applegate R. @ Mouth 2006	8/20/06	17.3	266.2	7.67	0.68	8.60	
Little Applegate R. @ Mouth 2006	9/26/06	12.5	275.1	8.75	1.13	11.17	
Little Applegate R. @ RM 2.6 2005	6/29/05	13.5	200.5		0.00	10.37	0.01
Little Applegate R. @ RM 2.6 2005	7/26/05	15.3	257.8	7.08	1.27	9.85	0.02
Little Applegate R. @ RM 2.6 2005	8/23/05	16.5	260.0	7.90	1.31	8.33	0.01
Little Applegate R. @ RM 2.6 2005	9/15/05	12.0	257.2		1.28	11.01	0.02
Little Applegate R. @ RM 2.6 2006	6/15/06	13.0	164.5		2.46	10.45	
Little Applegate R. @ RM 2.6 2006	7/26/06	17.3	259.5	7.11	1.11	9.09	
Little Applegate R. @ RM 2.6 2006	8/20/06	15.7	269.0	6.82	0.59	9.35	
Little Applegate R. @ RM 2.6 2006	9/26/06	10.9	276.9	7.55	1.18	10.91	
Munger Cr @ Kincaid Rd 2005	6/28/05	13.4	102.0		0.70	10.15	0.03
Munger Cr @ Kincaid Rd 2005	7/25/05	15.0	109.8	7.98	0.57	10.25	0.05
Munger Cr @ Kincaid Rd 2005	8/22/05	17.5	113.0	7.60	0.39	9.35	0.05
Munger Cr @ Kincaid Rd 2005	9/14/05	13.2	131.0		0.36	10.57	0.00

Monitoring Site	Date Sampled	Temp (C)	Cond-uctivity	Ph	Turbidity (NTU)	DO (mg/L)	Nitrates (mg/L)
Munger Cr @ Kincaid Rd 2006	6/14/06	11.8	104.2		0.49	12.95	
Munger Cr @ Kincaid Rd 2006	7/28/06	17.8	109.2	7.20	0.54	8.93	
Munger Cr @ Kincaid Rd 2006	8/22/06	15.6	115.6	6.87	0.50	9.85	
Munger Cr @ Kincaid Rd 2006	9/26/06	12.5	118.3	9.38	0.40	10.19	
Murphy Cr @ bridge 2005	6/28/05	13.3	156.2		0.50	10.19	0.02
Murphy Cr @ bridge 2005	7/25/05	15.3	175.0	7.63	0.87	9.83	0.00
Murphy Cr @ bridge 2005	8/22/05	17.1	188.3	7.20	0.59	8.91	0.01
Murphy Cr @ bridge 2005	9/14/05	12.8	182.5		0.32	10.27	
Murphy Cr @ bridge 2006	6/14/06	12.2	148.5		0.00	10.93	
Murphy Cr @ bridge 2006	7/28/06	17.8	176.3	7.39	0.79	8.99	
Murphy Cr @ bridge 2006	8/21/06	17.1	185.6	7.63	0.75	6.65	
Murphy Cr @ bridge 2006	9/25/06	11.7	188.5	8.02	0.90	10.45	
Palmer Cr 2005	6/29/05	15.6	413.4		0.54	9.55	0.02
Palmer Cr 2006	6/15/06	14.80	385.70		0.43	9.79	
Palmer Cr 2006	7/26/06	21.1	431.2	7.86	0.25	7.57	
Palmer Cr 2006	8/20/06	19.1	423.6	7.80	0.51	7.63	
Slate Cr @ Slate Cr Rd RM 1.6 2005	6/28/05	13.6	239.3		0.60	10.73	0.00
Slate Cr @ Slate Cr Rd RM 1.6 2005	7/25/05	15.5	257.5	7.36	0.24	9.89	0.02
Slate Cr @ Slate Cr Rd RM 1.6 2005	8/22/05	16.5	279.8	6.30	0.54	9.63	0.02
Slate Cr @ Slate Cr Rd RM 1.6 2005	9/14/05	11.2	281.4		0.40	10.55	0.00
Slate Cr @ Slate Cr Rd RM 1.6 2006	6/14/06	12.8	236.8		0.00	10.49	
Slate Cr @ Slate Cr Rd RM 1.6 2006	7/28/06	20.8	274.2	8.38	0.44	9.09	
Slate Cr @ Slate Cr Rd RM 1.6 2006	8/21/06	18.8	287.7	7.80	0.55	7.13	
Slate Cr @ Slate Cr Rd RM 1.6 2006	9/25/06	10.0	288.0	5.92	0.50	11.45	
Slate Cr @ Mouth 2005	6/28/05	16.1	186.3		0.60	9.85	0.01
Slate Cr @ Mouth 2005	7/25/05	19.1	214.8	7.79	0.38	6.76	0.00
Slate Cr @ Mouth 2005	8/22/05	20.1	240.8	6.60		7.86	0.01
Slate Cr @ Mouth 2005	9/14/05	15.0	253.6		0.69	6.99	
Slate Cr @ Mouth 2006	6/14/06	15.1	169.9		0.97	10.57	
Slate Cr @ Mouth 2006	7/28/06	20.8	274.2	8.38	0.44	9.09	
Slate Cr @ Mouth 2006	8/21/06	21.7	170.1	7.15	0.83	7.09	
Slate Cr @ Mouth 2006	9/25/06	14.5	231.4	5.86	1.51	7.71	
Slate Cr @ Redwood Tavern 2005	6/28/05	14.2	216.3		0.50	10.73	0.00
Slate Cr @ Redwood Tavern 2005	7/25/05	16.2	251.3	7.63	0.53	9.22	0.01
Slate Cr @ Redwood Tavern 2005	8/22/05	17.1	275.0	6.50	0.42	9.62	0.00
Slate Cr @ Redwood Tavern 2005	9/14/05	11.8	271.8		0.64	10.48	
Slate Cr @ Redwood Tavern 2006	6/14/06	14.0	209.1		0.00	10.90	
Slate Cr @ Redwood Tavern 2006	7/28/06	20.7	262.4	7.65	0.95	8.94	
Slate Cr @ Redwood Tavern 2006	8/21/06	18.8	287.7	7.80	0.55	7.13	

Monitoring Site	Date Sampled	Temp (C)	Cond-uctivity	Ph	Turbidity (NTU)	DO (mg/L)	Nitrates (mg/L)
Slate Cr @ Redwood Tavern 2006	9/25/06	10.2	342.0	7.19	0.68	10.60	
Thompson Cr @ Mouth 2005	6/29/05	15.5	234.5		0.79	9.19	0.15
Thompson Cr @ Mouth 2005	7/26/05	15.8	255.3	7.48	0.77	8.93	0.25
Thompson Cr @ Mouth 2005	8/22/05	16.8	173.1	7.90	1.73	9.17	0.04
Thompson Cr @ Mouth 2005	9/14/05	16.4	179.2		0.68	8.83	0.11
Thompson Cr @ Mouth 2006	6/14/06	14.3	297.4		0.49	9.73	
Thompson Cr @ Mouth 2006	7/26/06	16.5	235.5	7.47	0.56	10.75	
Thompson Cr @ Mouth 2006	8/20/06	15.2	219.4	6.93	0.49	9.77	
Thompson Cr @ Tallowbox Cr 2005	6/29/05	14.0	273.0		0.48	10.55	0.07
Thompson Cr @ Tallowbox Cr 2005	7/25/05	16.8	305.7	7.64	0.90	9.39	0.02
Thompson Cr @ Tallowbox Cr 2005	8/22/05	18.6	352.7	7.00	0.96	9.05	0.25
Thompson Cr @ Tallowbox Cr 2006	6/14/06	13.0	300.6		0.72	8.88	
Thompson Cr @ Tallowbox Cr 2006	7/26/06	24.5	322.4	8.13	1.24	8.51	
Thompson Cr @ Tallowbox Cr 2006	8/20/06	15.7	339.0	7.62	0.65	5.25	
Thompson Cr @ Tallowbox Cr 2006	9/26/06	14.5	331.5	8.73	0.49	10.59	
W. Fk Williams Cr @ Caves Camp Rd 2005	6/28/05	13.3	116.2		0.90	9.93	0.00
W. Fk Williams Cr @ Caves Camp Rd 2005	7/25/05	14.4	126.4	7.93	0.67	9.37	0.06
W. Fk Williams Cr @ Caves Camp Rd 2005	8/22/05	16.5	132.4	7.60	0.85	9.09	0.02
W. Fk Williams Cr @ Caves Camp Rd 2005	9/14/05	12.4	133.3		0.81	10.23	0.00
W. Fk Williams Cr @ Caves Camp Rd 2006	6/14/06	11.4	112.6		0.93	10.25	
W. Fk Williams Cr @ Caves Camp Rd 2006	7/28/06	16.6	129.7	7.26	0.78	10.29	
W. Fk Williams Cr @ Caves Camp Rd 2006	8/22/06	14.6	137.8	6.84	0.66	6.31	
W. Fk Williams Cr @ Caves Camp Rd 2006	9/26/06	12.0	147.5	9.15	1.77	10.45	
Williams Cr @ Hwy 238 2005	6/28/05	19.2	156.2		0.90	9.26	0.01
Williams Cr @ Hwy 238 2005	7/25/05	20.5	166.5	7.80	1.16	8.86	0.02
Williams Cr @ Hwy 238 2005	8/22/05	20.2	157.9	7.70	1.05	9.84	0.02
Williams Cr @ Hwy 238 2005	9/14/05	22.0	151.6		1.12	9.68	0.04
Williams Cr @ Hwy 238 2006	6/14/06	14.6	140.2		1.29	8.10	
Williams Cr @ Hwy 238 2006	7/28/06	21.9	165.6	7.38	1.04	9.26	
Williams Cr @ Hwy 238 2006	8/21/06	21.0	167.6	7.29	0.64	7.86	
Williams Cr @ Hwy 238 2006	9/25/06	17.2	164.2	8.17	1.82	9.38	
Williams Cr @ Williams Hwy 2005	6/28/05	17.1	129.8		0.90	9.27	0.02
Williams Cr @ Williams Hwy 2005	7/25/05	20.3	141.3	7.94	0.46	8.69	0.01
Williams Cr @ Williams Hwy 2005	8/22/05	20.6	139.5	7.70	0.80	9.19	0.02
Williams Cr @ Williams Hwy 2005	9/14/05	16.9	141.1		0.69	9.53	
Williams Cr @ Williams Hwy 2006	6/14/06	13.2	120.8		0.62	9.47	
Williams Cr @ Williams Hwy 2006	7/28/06	22.9	142.9	7.45	0.65	8.47	
Williams Cr @ Williams Hwy 2006	8/21/06	14.6	137.8	6.84	0.66	6.31	
Williams Cr @ Williams Hwy 2006	9/25/06	16.1	144.6	8.62	0.57	8.85	

Monitoring Site	Date Sampled	Temp (C)	Cond-uctivity	Ph	Turbidity (NTU)	DO (mg/L)	Nitrates (mg/L)
Yale Cr @ Mouth 2005	6/29/05	12.0	230.0		1.00	10.61	0.03
Yale Cr @ Mouth 2005	7/26/05	13.1	277.3	6.00	1.96	8.93 - 10.3	0.06
Yale Cr @ Mouth 2005	8/23/05	14.5	309.7	7.40	0.99	10.17	0.08
Yale Cr @ Mouth 2005	9/15/05	10.5	316.9		2.61	10.41	0.05
Yale Cr @ Mouth 2006	6/15/06	11.2	209.2		1.74	10.45	
Yale Cr @ Mouth 2006	7/26/06	15.8	288.0	7.20	2.25	10.71	
Yale Cr @ Mouth 2006	8/20/06	14.3	333.0	7.00	0.50	8.25	
Yale Cr @ Mouth 2006	9/26/06	9.7	342.4	6.23	1.33	11.05	

APPENDIX D

Riparian Site Evaluations

Landowner/Site Address: Hanson (original-Brucker), 2440 Little Applegate Rd, Jacksonville

River/Tributary: Little Applegate Stream Width (bankfull /wetted): 25ft

Aspect: N Soil: poor, sandy-cobble

Review Date: 8/28/05 Year Planted: 1998 Planted by: 2-B Forests, Inc

PLANTING MEASUREMENTS

<table>
<tr><th rowspan="2" colspan="2">Distance to Stream (ft)</th><th rowspan="2">Length (ft)</th><th rowspan="2">Width (ft)</th><th rowspan="2" colspan="2">Canopy Cover**</th><th colspan="2">Average Tree Height (ft)</th></tr>
<tr><th>Conifer</th><th>Hardwood</th></tr>
<tr><td rowspan="3">Right Bank*</td><td rowspan="3">5</td><td rowspan="3">500</td><td rowspan="3">50</td><td>CenUP 5</td><td>CenR 9</td><td rowspan="3"></td><td rowspan="3">ALRU: 22
Salix: 24
Cottonwood: 27</td></tr>
<tr><td>CenL 15</td><td>Left 17</td></tr>
<tr><td>CenDwn 6</td><td>Right 15</td></tr>
<tr><td rowspan="3">Left Bank</td><td rowspan="3">5</td><td rowspan="3">500</td><td rowspan="3">50</td><td>CenUP</td><td>CenR</td><td rowspan="3">PIPO: 5.5,3.4,4.4,5.5</td><td rowspan="3">Hybrid cottonwood: 46, 17</td></tr>
<tr><td>CenL</td><td>Left</td></tr>
<tr><td>CenDwn</td><td>Right</td></tr>
</table>

***looking downstream**
**** canopy measurement ranges: 0 (no canopy) to 17 (maximum canopy cover)**

VISUAL PLANTING ESTIMATES

Plant Vigor/Growth (circle one) Low [Med] High
Reasons for score ranking: Alders, cottonwoods & willows –high. Conifers very small, very little nutrients in soil?

Survival Estimate (circle one) 0-25% [26-50%] 51-75% 76-100%

Maintenance Water? [Y] N Mow/Weed eat? Y [N]

Management Objectives Achieved? (circle one) [Y] N

Notes: Beaver activity, full riparian area developed; drip system used for first few years (ARWC install) –no info on how long. Blackberry constitute understory vegetation. Site was planted with the "Stinger" and backhoe.

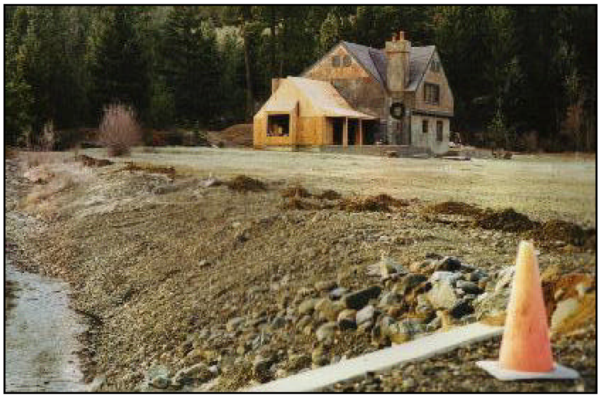
VISUAL RIPARIAN ESTIMATES	0 = Absent 1 = Sparse (<1%) 2 = Moderate (10-40%) 3 = Heavy (40-75%) 4 = Very Heavy (>75%)	D = Deciduous C = Coniferous E = Broadleaf evergreen M = Mixed N = none
RIPARIAN VEGETATION COVER	LEFT BANK	RIGHT BANK
	Canopy (>5m high)	
Vegetation Type	[D] C E M N	[D] C E M N
BIG trees (trunk >0.3m DBH)	0 [1] 2 3 4	0 [1] 2 3 4
SMALL trees (trunk <0.3m DBH)	0 1 2 [3] 4	0 1 2 [3] 4
	Understory (0.5 to 5m high)	
Vegetation Type	D [C] E M N	D [C] E M N
Woody Shrubs & Saplings	0 1 2 [3] 4	0 1 2 [3] 4
Non-Woody Herbs, Grasses, & Herbs	0 [1] 2 3 4	0 [1] 2 3 4
	Ground Cover (<0.5m high)	
Woody Shrubs & Saplings	0 1 [2] 3 4	0 1 [2] 3 4
Non-Woody Herbs, Grasses, & Herbs	0 [1] 2 3 4	0 [1] 2 3 4
Barren, Bare Dirt or Duff	[0] 1 2 3 4	[0] 1 2 3 4

HUMAN INFLUENCE	**0 = not present P = >10m C = within 10m B= on bank**	
	LEFT BANK	RIGHT BANK
Wall/Dike/Revetment/Riprap/Dam	0 P C [B]	0 P C [B]
Buildings	0 [P] C B	[0] P C B
Pavement/Cleared Lot	[0] P C B	[0] P C B
Road	0 [P] C B	0 [P] C B
Pasture/Range/Hay Field	0 P [C] B	0 P C [B]
Logging operations	[0] P C B	[0] P C B
Mining operations	[0] P C B	[0] P C B

RIPARIAN VEGETATIVE ZONE WIDTH SCORE		**Optimal** > 18 m	**Sub-Optimal** 12-18 m	**Marginal** 6-12 m	**Poor** <6 m
Plantings-willows, cottonwoods, alders very successful. Lots of natural regeneration, little to no understory species (except blackberries)		human activities (i.e. roads, lawns) have not impacted the zone	marginal impact by humans	human activities have impacted zone greatly	little or no riparian vegetation due to human activities
Score 7	Left Bank:	10 9	8 [7] 6	5 4 3	2 1 0
Score 7	Right Bank:	10 9	8 [7] 6	5 4 3	2 1 0

BANK STABILITY		**Optimal** <5%	**Sub-Optimal** 5-30%	**Marginal** 30-60%	**Poor** 30-100%
Still some areas where vegetation is absent. High banks with little to no soil composition.		banks stable; evidence of erosion or bank failure; little potential for future problems	moderate stable; infrequent, small areas of erosion mostly healed over	moderately unstable; high erosion potential during floods	unstable; many eroded areas; obvious bank sloughing
Score 6	Left Bank:	10 9	8 7 [6]	5 4 3	2 1 0
Score 6	Right Bank:	10 9	8 7 [6]	5 4 3	2 1 0

1997 post flood planted in 1999



2001

2003

2005

Landowner/Site Address: Cantrall Buckley Park, Hamilton Rd, Jacksonville

River/Tributary: Applegate River Stream Width (bankfull /wetted): 75/50ft

Aspect: N Soil: sandy/alluvium

Review Date: 9/2/05 Year Planted: 2000 Planted by: Volunteers (Earth Day)

PLANTING MEASUREMENTS

	Distance to Stream (ft)	Length (ft)	Width (ft)	Canopy Cover**		Average Tree Height (ft)	
						Conifer	**Hardwood**
Right Bank*				CenUP 0	CenR 0		
				CenL 0	Left 4		
				CenDwn 0	Right 11		
Left Bank	20	500	50	CenUP	CenR		
				CenL	Left		
				CenDwn	Right		

***looking downstream**
**** canopy measurement ranges: 0 (no canopy) to 17 (maximum canopy cover)**

VISUAL PLANTING ESTIMATES

Plant Vigor/Growth (circle one) Low Med High
Reasons for score ranking: No survival

Survival Estimate (circle one) [0-25%] 26-50% 51-75% 76-100%

Maintenance Water? Y [N] Mow/Weed eat? [Y] N

Management Objectives Achieved? (circle one) Y [N]

Notes: Willows, alders, cottonwoods absent from bank. Lawn goes directly to left bank. Plants either were mowed or trampled by park visitors.

VISUAL RIPARIAN ESTIMATES	0 = Absent 1 = Sparse (<1%) 2 = Moderate (10-40%) 3 = Heavy (40-75%) 4 = Very Heavy (>75%)	D = Deciduous C = Coniferous E = Broadleaf evergreen M = Mixed N = none

RIPARIAN VEGETATION COVER	LEFT BANK	RIGHT BANK
	Canopy (>5m high)	
Vegetation Type	D C E [M] N	D C E [M] N
BIG trees (trunk >0.3m DBH)	0 1 [2] 3 4	0 1 [2] 3 4
SMALL trees (trunk <0.3m DBH)	0 1 [2] 3 4	0 1 2 [3] 4
	Understory (0.5 to 5m high)	
Vegetation Type	[D] C E M N	[D] C E M N
Woody Shrubs & Saplings	0 1 [2] 3 4	0 1 2 3 [4]
Non-Woody Herbs, Grasses, & Herbs	0 [1] 2 3 4	0 1 [2] 3 4
	Ground Cover (<0.5m high)	
Woody Shrubs & Saplings	0 [1] 2 3 4	0 1 [2] 3 4
Non-Woody Herbs, Grasses, & Herbs	0 1 2 [3] 4	0 1 2 [3] 4
Barren, Bare Dirt or Duff	0 [1] 2 3 4	[0] 1 2 3 4

HUMAN INFLUENCE	**0 = not present P = >10m C = within 10m B= on bank**	
	LEFT BANK	RIGHT BANK
Wall/Dike/Revetment/Riprap/Dam	[0] P C B	[0] P C B
Buildings	[0] P C B	[0] P C B
Pavement/Cleared Lot	0 P [C] B	[0] P C B
Road	0 P [C] B	0 P [C] B
Pasture/Range/Hay Field	[0] P C B	0 P C B
Logging operations	[0] P C B	[0] P C B
Mining operations	[0] P C B	[0] P C B

RIPARIAN VEGETATIVE ZONE WIDTH SCORE		**Optimal** > 18 m	**Sub-Optimal** 12-18 m	**Marginal** 6-12 m	**Poor** <6 m
LB: lots of users in park, grass lawn down to water, some willow recruitment		human activities (i.e. roads, lawns) have not impacted the zone	marginal impact by humans	human activities have impacted zone greatly	little or no riparian vegetation due to human activities
Score 3	Left Bank:	10 9	8 7 6	5 4 [3]	2 1 0
Score 7	Right Bank:	10 9	8 [7] 6	5 4 3	2 1 0

BANK STABILITY		**Optimal** <5%	**Sub-Optimal** 5-30%	**Marginal** 30-60%	**Poor** 30-100%
		banks stable; evidence of erosion or bank failure; little potential for future problems	moderate stable; infrequent, small areas of erosion mostly healed over	moderately unstable; high erosion potential during floods	unstable; many eroded areas; obvious bank sloughing
Score 7	Left Bank:	10 9	8 [7] 6	5 4 3	2 1 0
Score 9	Right Bank:	10 [9]	8 7 6	5 4 3	2 1 0

2000

2005

Landowner/Site Address: Jones, 8801 Hwy 238, Jacksonville

River/Tributary: Forest Cr   Stream Width (bankfull /wetted): 45ft/dry

Aspect: SW   Soil: cobble/sandy

Review Date: 9/2/05   Year Planted: 11/98 &3/99 Planted by: 2-B Forests

PLANTING MEASUREMENTS

<table>
<tr><th colspan="2" rowspan="2">Distance to Stream (ft)</th><th rowspan="2">Length (ft)</th><th rowspan="2">Width (ft)</th><th colspan="2" rowspan="2">Canopy Cover**</th><th colspan="2">Average Tree Height (ft)</th></tr>
<tr><th>Conifer</th><th>Hardwood</th></tr>
<tr><td rowspan="3">Right Bank*</td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3">100+</td><td>CenUP
0</td><td>CenR
0</td><td rowspan="3">PIPO: 6-8
CADE: 1.5</td><td rowspan="3"></td></tr>
<tr><td>CenL
0</td><td>Left
0</td></tr>
<tr><td>CenDwn
0</td><td>Right
0</td></tr>
<tr><td rowspan="3">Left Bank</td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3">100+</td><td>CenUP
0</td><td>CenR
0</td><td rowspan="3">PIPO: 3-4.5</td><td rowspan="3"></td></tr>
<tr><td>CenL
0</td><td>Left
0</td></tr>
<tr><td>CenDwn
0</td><td>Right
0</td></tr>
</table>

***looking downstream**
**** canopy measurement ranges: 0 (no canopy) to 17 (maximum canopy cover)**

VISUAL PLANTING ESTIMATES

Plant Vigor/Growth (circle one) Low [Med] High
Reasons for score ranking: Trees are in a very exposed site. Ground very hard, better growth and survival on RT bank

Survival Estimate (circle one) 0-25% [26-50%] 51-75% 76-100%

Maintenance Water? Y [N] Mow/Weed eat? Y [N]

Management Objectives Achieved? (circle one) Y [N]

Notes: Pines along outside edge of riparian area most successful, so sign of hardwoods other than scattered willows and cottonwoods – stakes most likely did not established.

VISUAL RIPARIAN ESTIMATES	0 = Absent 1 = Sparse (<1%) 2 = Moderate (10-40%) 3 = Heavy (40-75%) 4 = Very Heavy (>75%)	D = Deciduous C = Coniferous E = Broadleaf evergreen M = Mixed N = none
RIPARIAN VEGETATION COVER	LEFT BANK	RIGHT BANK
	Canopy (>5m high)	
Vegetation Type	D C E **M** N	D C E **M** N
BIG trees (trunk >0.3m DBH)	**0** 1 2 3 4	**0** 1 2 3 4
SMALL trees (trunk <0.3m DBH)	0 1 **2** 3 4	0 1 **2** 3 4
	Understory (0.5 to 5m high)	
Vegetation Type	D C E **M** N	D C E **M** N
Woody Shrubs & Saplings	0 1 **2** 3 4	0 1 **2** 3 4
Non-Woody Herbs, Grasses, & Herbs	0 1 2 **3** 4	0 1 2 **3** 4
	Ground Cover (<0.5m high)	
Woody Shrubs & Saplings	**0** 1 2 3 4	**0** 1 2 3 4
Non-Woody Herbs, Grasses, & Herbs	0 1 2 **3** 4	0 1 2 **3** 4
Barren, Bare Dirt or Duff	0 **1** 2 3 4	0 **1** 2 3 4

HUMAN INFLUENCE	**0 = not present P = >10m C = within 10m B= on bank**	
	LEFT BANK	RIGHT BANK
Wall/Dike/Revetment/Riprap/Dam	**0** P C B	**0** P C B
Buildings	**0** P C B	**0** P C B
Pavement/Cleared Lot	**0** P C B	**0** P C B
Road	**0** P C B	**0** P C B
Pasture/Range/Hay Field	0 **P** C B	0 **P** C B
Logging operations	**0** P C B	**0** P C B
Mining operations	**0** P C B	**0** P C B

RIPARIAN VEGETATIVE ZONE WIDTH SCORE		**Optimal** > 18 m	**Sub-Optimal** 12-18 m	**Marginal** 6-12 m	**Poor** <6 m
Some historic channel modifications (stream straightening)		human activities (i.e. roads, lawns) have not impacted the zone	marginal impact by humans	human activities have impacted zone greatly	little or no riparian vegetation due to human activities
Score 8	Left Bank:	10 9	**8** 7 6	5 4 3	2 1 0
Score 8	Right Bank:	10 9	**8** 7 6	5 4 3	2 1 0

BANK STABILITY		**Optimal** <5%	**Sub-Optimal** 5-30%	**Marginal** 30-60%	**Poor** 30-100%
Little to no vegetation on banks, incised		banks stable; evidence of erosion or bank failure; little potential for future problems	moderate stable; infrequent, small areas of erosion mostly healed over	moderately unstable; high erosion potential during floods	unstable; many eroded areas; obvious bank sloughing
Score 4	Left Bank:	10 9	8 7 6	5 **4** 3	2 1 0
Score 4	Right Bank:	10 9	8 7 6	5 **4** 3	2 1 0

1998 2005

Landowner/Site Address: Hassanein (formally –Bertalomi), 2620 Little Applegate Rd, Jacksonville

River/Tributary: Little Applegate   Stream Width (bankfull /wetted): 50ft/34 ft

Aspect: NE   Soil: hard, cobbles

Review Date: 9/2/05   Year Planted: 11/98 &3/99 Planted by: 2-B Forests

PLANTING MEASUREMENTS

	Distance to Stream (ft)	Length (ft)	Width (ft)	Canopy Cover**		Average Tree Height (ft)	
						Conifer	**Hardwood**
Right Bank*			25	CenUP 8	CenR 5	PIPO: 4,3 PSME: 2.5 CADE: 1.5	ALRU: 30 Salix: 12
				CenL 16	Left 17		
				CenDwn 0	Right 13		
Left Bank			6	CenUP 0	CenR 0		Cottonwood: 4-8 ALRU: 30
				CenL 0	Left 0		
				CenDwn 0	Right 0		

***looking downstream**
**** canopy measurement ranges: 0 (no canopy) to 17 (maximum canopy cover)**

VISUAL PLANTING ESTIMATES

Plant Vigor/Growth (circle one) Low [Med] High
Reasons for score ranking: Willows and cottonwoods exhibited good growth, some beaver activity has stunted plants. Conifers very small –very harsh site.

Survival Estimate (circle one) 0-25% [26-50%] 51-75% 76-100%

Maintenance Water? [Y] N   Mow/Weed eat? [Y] N

Management Objectives Achieved? (circle one) [Y] N

Notes: Cottonwoods browsed by beaver; willows browsed by deer.

1998 2005

Landowner/Site Address: Gemmerig, 7141 Fair Haven (HWY 199)

River/Tributary: Slate Cr Stream Width (bankfull /wetted): 25ft

Aspect: W Soil: cobble/sandy

Review Date: 8/25/05 Year Planted: 1996 or 1997 Planted by: ??

PLANTING MEASUREMENTS

<table>
<tr><th colspan="2" rowspan="2">Distance to Stream (ft)</th><th rowspan="2">Length (ft)</th><th rowspan="2">Width (ft)</th><th colspan="2" rowspan="2">Canopy Cover**</th><th colspan="2">Average Tree Height (ft)</th></tr>
<tr><th>Conifer</th><th>Hardwood</th></tr>
<tr><td rowspan="3">Right Bank*</td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td>CenUP 0</td><td>CenR 0</td><td rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td>CenL 0</td><td>Left 0</td></tr>
<tr><td>CenDwn 0</td><td>Right 0</td></tr>
<tr><td rowspan="3">Left Bank</td><td rowspan="3">5</td><td rowspan="3"></td><td rowspan="3">10</td><td>CenUP 9</td><td>CenR 7</td><td rowspan="3">PIPO:
9,10,11,5,4,10,15
CADE: 6</td><td rowspan="3"></td></tr>
<tr><td>CenL 13</td><td>Left 2</td></tr>
<tr><td>CenDwn 17</td><td>Right 0</td></tr>
</table>

***looking downstream**
**** canopy measurement ranges: 0 (no canopy) to 17 (maximum canopy cover)**

VISUAL PLANTING ESTIMATES

Plant Vigor/Growth (circle one) Low [Med] High
Reasons for score ranking: Ponderosa pines are tall and full. Trees closest to pasture are smaller (exposure?)

Survival Estimate (circle one) [0-25%] 26-50% 51-75% 76-100%

Maintenance Water? Y [N] Mow/Weed eat? Y [N]

Management Objectives Achieved? (circle one) Y [N]

Notes: 10ft Riparian buffer established from pasture, lots of snowberry and maple recruitment, erosion spots on bank still present. No willows survived. Blackberries present in the southern ½ of pasture.

VISUAL RIPARIAN ESTIMATES		
	0 = Absent 1 = Sparse (<1%) 2 = Moderate (10-40%) 3 = Heavy (40-75%) 4 = Very Heavy (>75%)	D = Deciduous C = Coniferous E = Broadleaf evergreen M = Mixed N = none

RIPARIAN VEGETATION COVER	LEFT BANK	RIGHT BANK
	Canopy (>5m high)	
Vegetation Type	D C E [M] N	D C E M N
BIG trees (trunk >0.3m DBH)	0 1 [2] 3 4	0 1 2 3 4
SMALL trees (trunk <0.3m DBH)	0 1 [2] 3 4	0 1 2 3 4
	Understory (0.5 to 5m high)	
Vegetation Type	D C E [M] N	D C E M N
Woody Shrubs & Saplings	0 1 2 [3] 4	0 1 2 3 4
Non-Woody Herbs, Grasses, & Herbs	0 1 [2] 3 4	0 1 2 3 4
	Ground Cover (<0.5m high)	
Woody Shrubs & Saplings	[0] 1 2 3 4	0 1 2 3 4
Non-Woody Herbs, Grasses, & Herbs	0 1 2 [3] 4	0 1 2 3 4
Barren, Bare Dirt or Duff	0 [1] 2 3 4	0 1 2 3 4

HUMAN INFLUENCE	**0 = not present P = >10m C = within 10m B= on bank**	
	LEFT BANK	RIGHT BANK
Wall/Dike/Revetment/Riprap/Dam	[0] P C B	0 P C B
Buildings	[0] P C B	0 P C B
Pavement/Cleared Lot	[0] P C B	0 P C B
Road	[0] P C B	0 P C B
Pasture/Range/Hay Field	0 P [C] B	0 P C B
Logging operations	[0] P C B	0 P C B
Mining operations	[0] P C B	0 P C B

RIPARIAN VEGETATIVE ZONE WIDTH SCORE		**Optimal** > 18 m	**Sub-Optimal** 12-18 m	**Marginal** 6-12 m	**Poor** <6 m
Natural recruitment of maple, alder, cottonwood. Blackberries taking over ½ of pasture		human activities (i.e. roads, lawns) have not impacted the zone	marginal impact by humans	human activities have impacted zone greatly	little or no riparian vegetation due to human activities
Score 7	Left Bank	10 9	8 [7] 6	5 4 3	2 1 0
Score	Right Bank:	10 9	8 7 6	5 4 3	2 1 0

BANK STABILITY		**Optimal** <5%	**Sub-Optimal** 5-30%	**Marginal** 30-60%	**Poor** 30-100%
Stream meandering along bank, signs of bank failure & lateral scours holes		banks stable; evidence of erosion or bank failure; little potential for future problems	moderate stable; infrequent, small areas of erosion mostly healed over	moderately unstable; high erosion potential during floods	unstable; many eroded areas; obvious bank sloughing
Score 4	Left Bank	10 9	8 7 6	5 [4] 3	2 1 0
Score	Right Bank:	10 9	8 7 6	5 4 3	2 1 0

Landowner/Site Address: Piper, 7695 North Applegate, Murphy

River/Tributary: Applegate River Stream Width (bankfull /wetted): 75ft (est.)

Aspect: N Soil: Sandy

Review Date: 8/25/05 Year Planted: 1997 Planted by: ??

PLANTING MEASUREMENTS

	Distance to Stream (ft)	Length (ft)	Width (ft)	Canopy Cover**		Average Tree Height (ft) Conifer	Average Tree Height (ft) Hardwood
Right Bank*	10		25	CenUP 1	CenR 2	CADE: 20,6,15 PIPO: 20,7	Salix: 15
				CenL 0	Left 17		
				CenDwn 0	Right 17		
Left Bank	5		100+	CenUP 9	CenR 7	CADE: 3.5,6,5 PIPO: 6,4	Hybrid: 25
				CenL 13	Left 2		
				CenDwn 17	Right 0		

***looking downstream**
**** canopy measurement ranges: 0 (no canopy) to 17 (maximum canopy cover)**

VISUAL PLANTING ESTIMATES

Plant Vigor/Growth (circle one) Low Med **High**
Reasons for score ranking: Trees very well taken care of by landowner.

Survival Estimate (circle one) 0-25% 26-50% **51-75%** 76-100%

Maintenance Water? **Y** **N** Mow/Weed eat? **Y** N

Management Objectives Achieved? (circle one) **Y** N

Notes: Landower watered and set up deer browse protection. Some fertilizer too. Little bit of black berries on RT bank. Lots of blackberries on LT bank, although willows very well established.

VISUAL RIPARIAN ESTIMATES	0 = Absent 1 = Sparse (<1%) 2 = Moderate (10-40%) 3 = Heavy (40-75%) 4 = Very Heavy (>75%)	D = Deciduous C = Coniferous E = Broadleaf evergreen M = Mixed N = none

RIPARIAN VEGETATION COVER	LEFT BANK	RIGHT BANK
	Canopy (>5m high)	
Vegetation Type	[D] C E M N	D C E [M] N
BIG trees (trunk >0.3m DBH)	0 [1] 2 3 4	0 1 [2] 3 4
SMALL trees (trunk <0.3m DBH)	0 1 2 [3] 4	0 1 2 [3] 4
	Understory (0.5 to 5m high)	
Vegetation Type	[D] C E M N	D C E [M] N
Woody Shrubs & Saplings	0 1 [2] 3 4	0 1 2 [3] 4
Non-Woody Herbs, Grasses, & Herbs	0 1 [2] 3 4	0 1 [2] 3 4
	Ground Cover (<0.5m high)	
Woody Shrubs & Saplings	0 1 2 [3] 4	0 1 2 [3] 4
Non-Woody Herbs, Grasses, & Herbs	0 1 [2] 3 4	0 [1] 2 3 4
Barren, Bare Dirt or Duff	[0] 1 2 3 4	[0] 1 2 3 4

HUMAN INFLUENCE	**0 = not present P = >10m C = within 10m B= on bank**	
	LEFT BANK	RIGHT BANK
Wall/Dike/Revetment/Riprap/Dam	[0] P C B	[0] P C B
Buildings	[0] P C B	[0] P C B
Pavement/Cleared Lot	[0] P C B	[0] P C B
Road	[0] P C B	[0] P C B
Pasture/Range/Hay Field	0 P [C] B	[0] P C B
Logging operations	[0] P C B	[0] P C B
Mining operations	[0] P C B	[0] P C B

RIPARIAN VEGETATIVE ZONE WIDTH SCORE		**Optimal** > 18 m	**Sub-Optimal** 12-18 m	**Marginal** 6-12 m	**Poor** <6 m
		human activities (i.e. roads, lawns) have not impacted the zone	marginal impact by humans	human activities have impacted zone greatly	little or no riparian vegetation due to human activities
Score 9	Left Bank:	10 [9]	8 7 6	5 4 3	2 1 0
Score 7	Right Bank:	10 9	8 [7] 6	5 4 3	2 1 0

BANK STABILITY		**Optimal** <5%	**Sub-Optimal** 5-30%	**Marginal** 30-60%	**Poor** 30-100%
		banks stable; evidence of erosion or bank failure; little potential for future problems	moderate stable; infrequent, small areas of erosion mostly healed over	moderately unstable; high erosion potential during floods	unstable; many eroded areas; obvious bank sloughing
Score 9	Left Bank:	10 [9]	8 7 6	5 4 3	2 1 0
Score 6	Right Bank:	10 9	8 7 [6]	5 4 3	2 1 0

2005

Landowner/Site Address: Meinel, 604 Latigo Rd, Williams

River/Tributary: W.Fork Williams Cr Stream Width (bankfull /wetted): 50ft (6-12ft braided section)

Aspect: S Soil: rock/alluvium

Review Date: 9/1/05 Year Planted: 1999 Planted by: 2-B Forests, Inc

PLANTING MEASUREMENTS

	Distance to Stream (ft)	Length (ft)	Width (ft)	Canopy Cover**		Average Tree Height (ft)	
						Conifer	**Hardwood**
Right Bank*	?	?	?	CenUP 5	CenR 9	CADE: 4	Dogwood: 5 Salix:12
				CenL 15	Left 17		
				CenDwn 6	Right 15		
Left Bank				CenUP	CenR		
				CenL	Left		
				CenDwn	Right		

***looking downstream**
**** canopy measurement ranges: 0 (no canopy) to 17 (maximum canopy cover)**

VISUAL PLANTING ESTIMATES

Plant Vigor/Growth (circle one) Low Med High
Reasons for score ranking: Difficult to determine what was planted and is natural recruitment.

Survival Estimate (circle one) 0-25% 26-50% 51-75% 76-100%

Maintenance Water? Y N Mow/Weed eat? Y N

Management Objectives Achieved? (circle one) Y N

Notes: Deer browse fencing on some trees. Lots of blackberries in riparian area. Nice stand of alders (natural?)

VISUAL RIPARIAN ESTIMATES	0 = Absent 1 = Sparse (<1%) 2 = Moderate (10-40%) 3 = Heavy (40-75%) 4 = Very Heavy (>75%)	D = Deciduous C = Coniferous E = Broadleaf evergreen M = Mixed N = none

RIPARIAN VEGETATION COVER	LEFT BANK	RIGHT BANK
	Canopy (>5m high)	
Vegetation Type	D C E M N	**D** C E M N
BIG trees (trunk >0.3m DBH)	0 1 2 3 4	0 **1** 2 3 4
SMALL trees (trunk <0.3m DBH)	0 1 2 3 4	0 1 **2** 3 4
	Understory (0.5 to 5m high)	
Vegetation Type	D C E M N	**D** C E M N
Woody Shrubs & Saplings	0 1 2 3 4	0 **1** 2 3 4
Non-Woody Herbs, Grasses, & Herbs	0 1 2 3 4	0 **1** 2 3 4
	Ground Cover (<0.5m high)	
Woody Shrubs & Saplings	0 1 2 3 4	0 1 **2** 3 4
Non-Woody Herbs, Grasses, & Herbs	0 1 2 3 4	0 1 **2** 3 4
Barren, Bare Dirt or Duff	0 1 2 3 4	0 1 2 **3** 4

HUMAN INFLUENCE	**0 = not present P = >10m C = within 10m B= on bank**	
	LEFT BANK	RIGHT BANK
Wall/Dike/Revetment/Riprap/Dam	0 P C B	**0** P C B
Buildings	0 P C B	**0** P C B
Pavement/Cleared Lot	0 P C B	**0** P C B
Road	0 P C B	**0** P C B
Pasture/Range/Hay Field	0 P C B	**0** P C B
Logging operations	0 P C B	**0** P C B
Mining operations	0 P C B	**0** P C B

RIPARIAN VEGETATIVE ZONE WIDTH SCORE		**Optimal** > 18 m	**Sub-Optimal** 12-18 m	**Marginal** 6-12 m	**Poor** <6 m
Braided channel system. Lots of willows and alders mixed with ash and maple.		human activities (i.e. roads, lawns) have not impacted the zone	marginal impact by humans	human activities have impacted zone greatly	little or no riparian vegetation due to human activities
Score	Left Bank	10 9	8 7 6	5 4 3	2 1 0
Score 10	Right Bank:	**10** 9	8 7 6	5 4 3	2 1 0

BANK STABILITY		**Optimal** <5%	**Sub-Optimal** 5-30%	**Marginal** 30-60%	**Poor** 30-100%
Still areas where exposed bank is eroding on side channel.		banks stable; evidence of erosion or bank failure; little potential for future problems	moderate stable; infrequent, small areas of erosion mostly healed over	moderately unstable; high erosion potential during floods	unstable; many eroded areas; obvious bank sloughing
Score	Left Bank	10 9	8 7 6	5 4 3	2 1 0
Score 4	Right Bank:	10 9	8 7 6	5 **4** 3	2 1 0