TFW Effectiveness Monitoring Report

A WATERSHED-SCALE BASELINE INVENTORY OF LARGE WOODY DEBRIS IN THE UPPER COWEEMAN WAU

by:

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Abstract

A large woody debris survey was conducted in the fish-bearing streams of the Upper Coweeman WAU using TFW monitoring protocols. Stream segments identified during watershed analysis were selected for surveying using a stratified random sampling procedure that incorporated channel gradient and confinement into the stratification. Segments were further partitioned into 100-meter reach survey units. The survey resulted in a count of total wood and key-piece wood for reaches surveyed, estimates of wood density for segments, and estimates of total and key-piece wood loading at the segment, strata, and WAU scales. Precision of the estimates for total wood and key-piece wood at the segment and stratum scales averaged +/- 47% and +/- 78% for segment estimates, and +/- 39% and +/- 66% for stratum estimates, respectively at a 95% significance level. Precision of WAU-scale estimates for *total* and key-piece L WD was 15% and 27%, respectively at the same significance level. Post-study analysis showed no benefit from the stratification approach taken as higher precision was achieved for estimates made without stratification. Measures of riparian attributes were collected and tested to evaluate relationships with wood densities and their use in future stratification. These attributes were found to have a significant ($p<0.05$) but small influence on total wood loading. Additional evaluation of stratification and indexing approaches was recommended to reduce imprecision associated with parameter estimation. A repeat survey was recommended prior to the watershed analysis 5-year review to evaluate wood placement prescriptions and to begin monitoring the trend in large woody debris in a managed landscape.

Introduction

The Washington Forest Practice Board (WFPB) Watershed Analysis procedure was adopted in 1993. Since adoption, over 25 watershed analyses have been completed. Watershed analysis was designed to provide for the protection of aquatic resources through development of an adaptively managed, site-specific forest practices plan (WFPB 1995). In this context, adaptive management is defined as a system which through cooperative and collaborative research, monitoring, and evaluation will provide information on which to base future management decisions (TFW 1987). However, until recently little work has been done to develop and implement an effectiveness monitoring program to evaluate watershed analysis-based management systems. In 1998, the Northwest Indian Fisheries Commission (NWIFC) and the Timber-Fish-Wildlife (TFW) Monitoring Steering Committee requested that pilot projects be developed to evaluate the effectiveness of watershed analysis-based forest practice plans. Funding for these projects was provided by a Centennial Clean Water Fund grant from the Washington Department of Ecology. This project was one of several developed to evaluate watershed analysis effectiveness.

One of the most common legacy conditions resulting from forest management has been a severe reduction in the volume and size of large woody debris (LWD) in fish bearing stream channels (Bisson et al. 1987; McHenry et al. 1998). Much of the focus of watershed analysis has been to restore riparian functions, especially those relating to LWD recruitment and stream shading. Questions remain as to the effectiveness of prescriptions designed to increase LWD at different temporal scales as well as the effect of watershed analysis-based management on LWD levels in the Watershed Administrative Unit (WAU) as a whole. This project was designed to address these overarching questions.

The project was conducted in the Upper Coweernan WAU. The Upper Coweeman WAU was chosen for a number of reasons: (1) the watershed analysis was only recently completed allowing for collection of baseline information; (2) the riparian prescriptions developed in the watershed analysis called for active placement of wood which allowed for an evaluation of this technique for near term wood recruitment; (3) the majority of the WAU was owned by a single landowner (Weyerhaeuser) which simplified attainment of access; and (4) the landowner was willing to participate in the project.

Given this management background, the project was designed around the following monitoring questions:

1. *Resource Condition (watershed-scale) Monitoring What is the current LWD stocking level for fish-bearing channels within the Upper Coweeman WAU?*

2. *Effectiveness (site-scale) Monitoring - What is the current L WD stocking level in fish bearing channels adjacent to stands that are scheduledfor harvest in the first four years of management under the Upper Coweeman Watershed Analysis?*

3. *Both Types of Monitoring - How does the condition of riparian stands adjacent to fish bearing channel sample units effect baseline L WD levels?*

Question 1 relates to the status of LWD across the WAU and will be used to evaluate the trend in LWD stocking levels under management designed from watershed analysis given variation resulting from natural disturbance patterns. Effectiveness monitoring projects typically attempt to evaluate specific prescriptions in localized areas. Yet natural resource professionals cannot lose sight of the resource status in the WAU as a whole. The sampling design developed in this plan enabled trend monitoring of LWD in representative fish-bearing segments across the WAU.

Three causal mechanism reports pertaining to near and long-term LWD recruitment were developed during the watershed analysis. Prescriptions for all three either require or allow as an option the intentional falling or yarding of LWD into the channel during the harvest or management of adjacent stands. Monitoring question 2 was designed to collect baseline data to help determine the site-scale effectiveness of these prescriptions for providing near-term LWD.

Monitoring question 3 was developed to aid in the future design of watershed-scale LWD studies. During the stratification of stream segments, what factors need to be considered to reduce population variability? Evaluation of monitoring question 3 will determine if riparian stand condition is currently an important factor.

Project Setting

The Upper Coweeman WAU is located in the headwaters of the Coweeman River drainage in southwestern Washington (Figure 1). The Coweeman River is the first major left-bank tributary of the Cowlitz River upstream from its mouth. The Upper Coueeman Watershed Analysis was completed and reviewed in 1996. Prescriptions were developed in 1997 and final sign-off by the Washington Department of Natural Resources occurred in early 1998. The assessment describes LWD stocking levels in the WAU as low, especially in the lower portions of the mainstem and major tributaries (Weyerhaeuser 1995). The mainstem and larger tributaries are typically confined and carry substantial power making in-channel wood retention difficult. In addition, splash-damming was used extensively around the turn of the 20th century which aided in the removal of any stable LWD that may have been present in these sections of the stream network at that time.

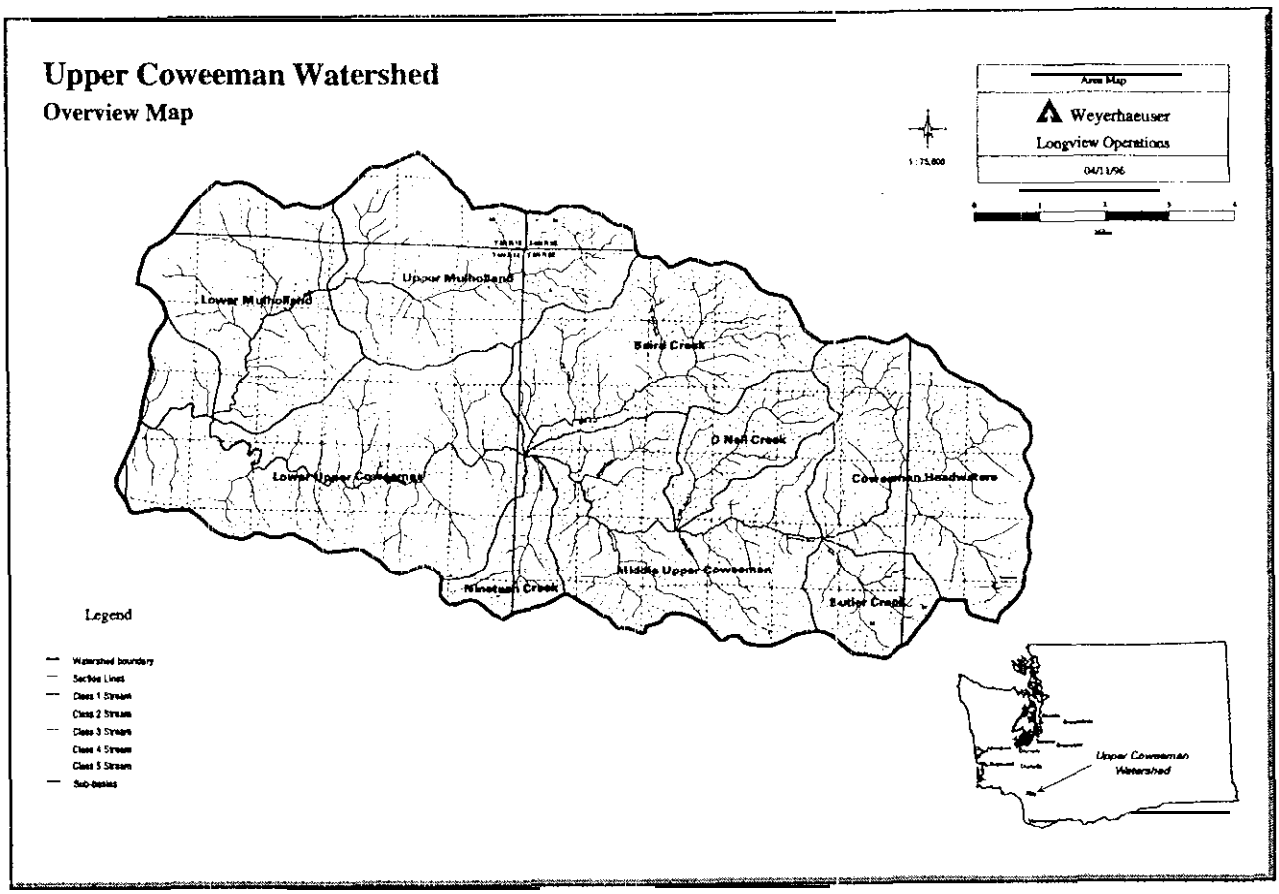

Figure 1. Site map ot the Upper Coweeman WAU.

Methods

Sample Design

Fish bearing channel segments identified during the watershed analysis were sampled using a stratified random design to select monitoring sites. Strata were defined using the gradient and confinement classes developed through the watershed analysis (Table 1). To estimate habitat components in a watershed using subsampling techniques, an assessment was needed to evaluate precision associated with sampling rates relative to expanding measured values to represent un-measured parts of the watershed. During the scoping phase prior to the start of this project, an analysis of the precision of LWD estimates associated with sampling large woody debris was conducted. Data collected from the Deschutes watershed using TFW protocols was applied to the gradient and confinement-based stratification scheme developed for this project (Appendix A).

Table 1. Strata developed following a review of the Upper Coweeman channel segment

Gradient Class	Confinement Class	Segment Number	Gradient	Length (m)
1% or less	U	107	1.0	1,740
1% or less	C	1	0.7	3,690
		4	0.9	2,040
		5	I.0	1,260
		6	0.8	4,850
		2	0.6	1,490
		3	0.8	910
			Total Length	14,240
>I % to 2%	U	250	1.5	980
		300	1.3	1,880
		302	1.5	1,010
		303	I.6	940
			Total Length	4,810
>1% to 2%	M	103	I.1	860
>1% to 2%	C	100	1.1	1,040
		101	1.1	1,160
		106	I.5	560
		203	2.0	500
		204	2.0	1,950
		301	1.7	430
		305	1.7	1,770
		304	1.5	1,310
		400	2.0	1,880
			Total Length	10,600
>2% to 4%	U	153	2.1	700
		346	2.2	540
			Total Length	1,240
>2% to 4%	M	157	3.0	550
		327	3.7	1,220
		362	3.5	1,250
		401	2.9	1,240
			Total Length	4,260
>2% to 4%	C	200	2.3	920
		104	2.2	1,410
		105	2.6	1,200
		102	2.1	590
		201	2.4	1,190
		306	2.1	2,160
			Total Length	7,470

Table I. strata developed following a review of the Upper Coweeman channel segment.

Gradient Class	Confinement Class	Segment Number	Gradient	Length (m)
>4% to 8%	U	125	5.0	1,320
>4% to 8%	M	339	6.5	670
		341	7.0	690
		353	5.3	870
		372	7.8	570
		II	6.8	1,210
		38	5.0	670
		50	5.1	1,100
		328	6.8	940
		251	6.1	2,110
		402	6.2	930
		460	6.0	570
		173	5.4	510
		202	4.7	2,040
		226	5.8	680
		413	7.1	1,370
		347	5.9	620
		360	6.2	1,070
			Total Length	16,620
4% to 8%	C	150	6.7	370
		309	7.8	310
		338	7.5	410
		476	5.9	300
		108	6.4	980
		225	6.6	430
		363	6.9	1,280
		40	6.5	1,440
		109	5.0	670
		135	5.2	410
		138	6.5	750
		152	5.0	620
		423	6.7	1,660
			Total Length	9,630
>8% to 20%	M	243	10.5	520
8.9		422		910
			Total Length	9,630
>8% to 20%	C	151	14.1	490
		308	13.2	920
		146	10.3	1,430
		149	12.8	550
		60	10.2	1,040
		69	14.4	540
		158	10.7	520
		168	12.1	1,040

Table 1. Strata developed following a review of the Upper Coweeman channel segment.

Gradient Class	Confinement Class	Segment Number	Gradient	Length (m)
		37	12.7	230
		62	12.9	210
		333	9.6	820
		337	8.7	690
		406	15.7	1,190
		361	9.4	410
		156	S.6	850
		224	9.0	270
		321	11.2	1,780
		461	8.9	830
		2:	8.8	1,050
		31	10.3	620
		322	11.6	840
		403	10.3	1,070
		405	15.4	580
		414	9.9	790
		465	10.6	790
			Total Length	19,550

The results of this analysis suggested that in the Deschutes watershed, the estimate of the number of LWD pieces per channel width for the segment, stratum, and WAU would fall within 25% of the true value 95% of the time if 40 to 50% of each selected segment and 50 to 70% of segments in each stratum were sampled. It was not known how precise this level of sampling level would prove to be in other watersheds. However, for monitoring purposes, it was recognized that funding constraints would likely limit higher sampling rates for most watershed-scale LWD monitoring programs. We felt that use of these sampling rates would provide a robust sample of segments to test the precision of LWD estimates derived from this basin. A goal was therefore established to sample 50% to 70% of segments within each stratum and 40% to 50% of the channel length within each sampled segment.

To facilitate achievement of these goals, fish-bearing segments identified in the watershed analysis were partitioned among the appropriate strata resulting in thirteen of a possible fifteen strata containing between 1 and 25 segments (Table 1). Within each stratum, a random sample of segments was taken using the sampling rates described in Table 2.

Table 2. Initial target number of segments to be sampled in each stratum.

Gradient Class	Confinement Class		
	Unconfined	Moderate	Confined
≤ 1%	1/1	n/a	5/6
> 1% to ≤ 2%	3/4	1/1	7/9
>2% to ≤ 4%	2/2	3/4	5/6
> 4% to ≤ 8%	1/1	12/17	10/13
> 8% to ≤ 20%	n/a	2/2	16/25
Totals	**7/8**	**18/24**	**43/59**

Note: The numerator in each cell represents the number of in-sample segments. The denominator represents the total number of segments in the stratum. n/a indicates unpopulated strata.

The adopted sampling strategy resulted in the selection of 68 segments out of 91 within the WAU (75%); which more than met the 50% minimum sampling criteria for segments within each stratum (Table 2). It was decided about half-way through the field season to further reduce sampling to the 50% minimum for most strata when it was determined that surveying all 68 of the sampled segments would not be completed in the allotted time. Segments actually surveyed within each stratum are presented in Table 3 and Figure 2. Twenty one of the surveyed segments were adjacent to at least one timber harvest unit slated for harvest between 1998 and 2002, 17 of which were slated to be completed by 2001 (Table 4).

Table 3. Randomly selected segments surveyed in the Upper Coweeman WAU.

Gradient Class	Confinement Class	Segment Number	Gradient	Length (m)
1% or less	U	107	1.0	1,740
1% or less	C	4	0.9	2,040
		6	0.8	4,850
		2	0.6	1,490
>1% to 2%	U	250	1.5	980
		300	1.3	1,880
		303	1.6	940
>1% to 2%	M	103	1.1	860
>1% to 2%	C	106	1.5	560
		203	2.0	500
		301	1.7	430
		305	1.7	1,770
		304	1.5	1,310
>2% to 4%	U	346	2.2	540
>2% to 4%	M	362	3.5	1,250
		401	2.9	1,240

Table 3. Randomly selected segments surveyed in the Upper Coweeman WAU.

Gradient Class	Confinement Class	Segment Number	Gradient	Length (m)
>2% to 4%	C	104	2.2	1,410
		105	2.6	1,200
		201	2.4	1,190
		306	2.1	2,160
>4% to 8%	U	125	5.0	1,320
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		372	7.8	570
		11	6.8	1,210
		38	5.0	670
		50	5.1	1,100
		328	6.8	940
		460	6.0	570
		413	7.1	1,370
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		476	5.9	300
		225	6.6	430
		40	6.5	1,440
		138	6.5	750
		423	6.7	1,660
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		60	10.2	1,040
		69	14.4	540
		37	12.7	230
		333	9.6	820
		406	15.7	1,190
		361	9.4	410
		224	9.0	270
		461	8.9	830
		23	8.8	1,050
		322	11.6	840
		403	10.3	1,070
		414	9.9	790

Upper Coweeman Watershed

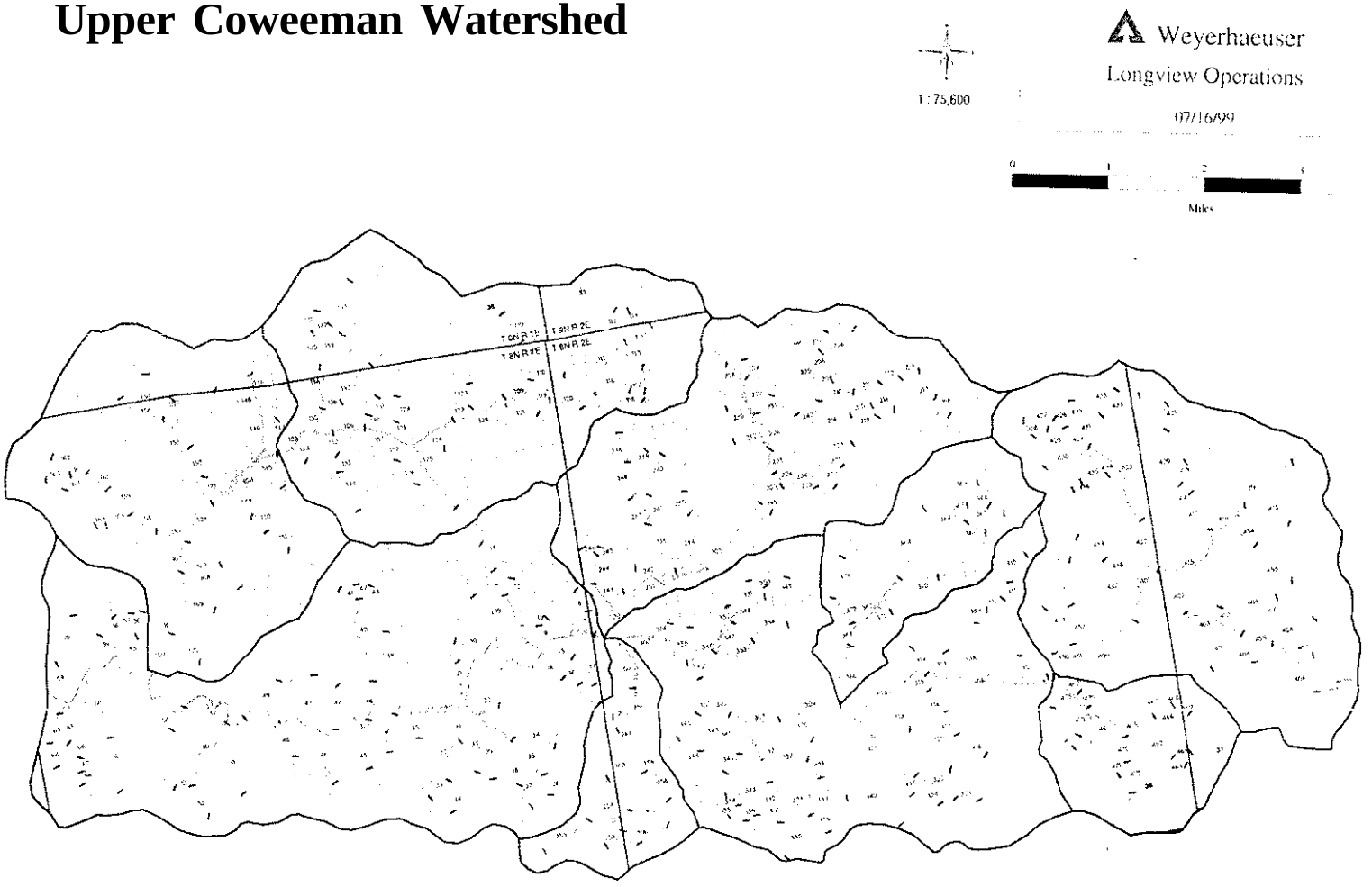

Figure 2. Fish bearing segments sampled in the Upper Coweeman WAU.

Table 4. 1998 **survey segments** adjacent to stands to be harvested between 1998 and 2002.

Gradient Class	Confinement Class	Segment Number	Anticipated Year of Harvest
1% or less	U	107	1998
	C	6	1999
		2	1998
>1% to 2%	U	300	1998
	C	106	1998
		203	2002
>2% to 4%	U	346	1998
	M	401	1999, 2000
	C	104	1998
		105	2000
		201	1998
		306	1998, 1999
>4% to 8%	M	413	1998, 2002
		347	1999
	C	138	1998
		225	2002
		423	1999, 2000, 2001
>8% to 20%	C	146	2000
		224	2002
		322	2002
		414	1998

Sampled segments were further partitioned into 100-meter reaches. Reaches in each segment were numbered from 1 to n starting at the downstream boundary of the segment and working upstream. The nth reach in the sample in most cases measured less than 100-meters in length. A greater than 40% sample of the channel within each segment was achieved by systematically sampling every other reach within a sample segment. Reaches were defined by reference points numbered from 0 to n. The starting reference point of the survey, either 0 or 1, for each sampled segment was randomly determined resulting in the survey of either all even-numbered or all odd-numbered reaches within a given segment.

Field Surveys

Field surveys were conducted from July 3 through September 22, 1998. During the survey of each segment, the starting point and ending points were monumented in the field with embossed aluminum tags nailed to trees on both sides of the stream using aluminum nails. Tags were identified with the segment number and reference point number, the year, and the surveying agency (WDFW). In addition, a number of reference points within the segment were also similarly monumented to establish in-segment measurement points for future surveys. In general, monumenting occurred for one of every four reference points within each segment. Counting starting and ending reference points, each segment had a minimum of four monumented reference points. We attempted to identify reaches that would be adjacent to

harvest units using maps provided by Weyerhaeuser. Since higher precision would he required for re-establishing these reaches, a minimum of every other reference point was monumented along reaches within harvest unit boundaries. In addition to monumenting, an attempt was made to locate all reference points using a global positioning system (GPS). A hand-held Garmin GPS 12XL was used to position reference points. The accuracy of positioning using this device is between 15m and 100m depending on effects from the U.S. Department of Defense Selective Availability Program. Reference points were also flagged in the field using vinyl flagging.

All of the LWD survey work was performed by a team of two or three technicians. Protocols for the survey of each reach followed the TFW Level 1 LWD survey protocols (Schuett-Hames et al. 1997). Prior to commencement of the field work, all crew members were certified in the Level 1 LWD protocols by the TFW Monitoring Program Quality Assurance Coordinator. Following training and a week of data collection, the Quality Assurance Coordinator verified that the protocols were being properly applied by the field crew. Subsequent quality checks were made during weekly field visits by the: project leader.

During the surveys, each piece of woody debris found within the bankfull channel that met minimum size requirements was assigned a size class. In addition to assignment of the Level 1 LWD size classes of rootwad, small log, medium log, or large log; logs were also evaluated whether they met minimum size requirements for "key" pieces using the definition by Martin Fox (WFPB 1995) (Table 5). These size requirements are channel specific. Therefore, the channel bankfull width was recorded at the beginning and end of each sample reach.

Table 5. Key piece size definitions used for the 1998 LWD survey in the Upper Coweeman WAU, from WFPB (1995).

Minimum Size or Volume to Qualify LWD as a Key Piece			
Bankfull Width (m)	**Diameter (m)**	**Length (m)**	**Volume (m^3)**
0 through 5	0.40	8	1.0
6 through 10	0.55	10	2.5
11 through 15	0.65	18	6.0
16 through 20	0.70	24	9.0

In addition to LWD counts, length and diameter was initially recorded for each log and rootwad using the TFW Level 2 LWD survey protocols to enable calculation of LWD volumes. Volumetric measurements were suspended after the first three weeks of the field season when it became apparent that the crew would not he able to sample the minimum number of segments required to meet the project goals in the allotted time. Dropping, the volumetric information was not thought to substantially reduce the value of the study. Of thr: measures of LWD stocking levels, LWD pieces/channel width is the most important since it ties back to the watershed analysis prescriptions.

When log jams were encountered, an attempt was made to count every qualifying LWD piece in the jam. In some cases, however, all pieces were not counted because the jam appeared unsafe to

walk and the jam could not be probed for uncounted logs. In these cases, a visual estimate was made of the proportion of the jam that was not counted. Two very large jams (>100m in length) formed by debris flows or dam break events were found in depositional areas. These jams were of such magnitude that counting individual logs was deemed too time consuming to attempt. The locations and lengths of these jams were noted, but no attempts were made to quantify the number of logs.

Surveys of reaches adjacent to harvest units were generally performed using the same methods as those for non-harvest adjacent reaches. However, some timber harvest units were harvested prior to the survey. Where freshly cut timber or non-merchantable material were encountered in segments adjacent to 1998 harvest units that also met the TFW Level 1 LWD Survey criteria for LWD, these pieces were identified separately from existing pieces so as not to bias baseline information.

During the surveys, riparian stand condition was visually assessed for each side of the channel in each sampled reach. At the center point of the reach, surveyors categorized riparian stand condition as it relates to size (dbh <12", dbh 12 to <20", dbh 20" or greater), species composition (70% or greater conifer, 70% or greater deciduous, all other cases), and density (<1/3rd the ground exposed, >1/3rd the ground exposed). The combination of these descriptors resulted in the riparian stand being classed in one of eighteen different categories. The riparian classification categories are the same as those used for watershed analysis assessment (WFPB 1995).

Stream discharge was measured on a weekly basis during the field season. Discharge in most sample segments was measured within a week of the survey. In. some cases, discharge measured in a nearby location (upstream/downstream segment, nearby stream with similar flow) was used as a surrogate for discharge in the sampled segment. Discharge measurements were made using a Swoffer model 2 100 flow meter using wadable discharge measurement techniques (Schuett-Hames et al. 1997 habitat unit survey).

All field data except for stream discharge data and comments or field notes were collected and stored using a data recorder manufactured by Omni Data. Comments or field notes were recorded onto field notebooks and referenced to the segment, reach, log, jam or otherwise as appropriate.

Analysis

The collected data were downloaded into an Excel spreadsheet on a weekly basis throughout the field season. Collected data was summarized by sample reach, segment, and stratum to derive mean LWD piece counts. Mean values for each segment were calculated using only data collected from 100-m reaches.

Monitoring Question 1. The census of LWD for sampled reaches was used to develop estimates of mean wood loading per 100-m reach at the segment-scale and to estimate total and

key-sized LWD pieces for the segment, stratum. and WAU. Variance estimates were also made to explore the level of precision provided by the sampling strategy employed in the study.

Two techniques were used to estimate segment statistics depending on the length of the reaches surveyed. Estimation was the most straight-forward where only 1 00-meter reaches were surveyed. In this case, the following formulas were used:

$$\bar{x} = \frac{\sum x_i}{n} \quad (1)$$

$$SE_{\bar{x}} = \sqrt{\frac{1}{n} \times \frac{\sum \left(x_i - \bar{x}\right)^2}{n - 1} \times \left(1 - \frac{n}{N_a}\right)} \quad (2)$$

$$LWD_j = \bar{x} \times N_r \quad (3)$$

$$SE_j = \sqrt{N_r^2 \times SE_{\bar{x}}^2} \quad (4)$$

where x_i = *the number of LWD pieces in reach i,*
n = *the number of full reaches sampled in segment j,*
$SE_{\bar{x}}$ = *the standard error of the mean,*
N_a = *the total number of reaches in segment j truncated to an integer value,*
N_r = *the number of 100-m reaches in segment j expressed as a real number,*
LWD_j = *the estimated LWD pieces in segment j, and*
SE_j = *the standard error for Total* LWD_j

The use of N_a and N_r needs additional clarification. In many cases, the segment length could not be evenly divided by 100-meter reaches. N_a is the total number of reaches in the segment. It is used in the standard error equations as part of a "finite population correction factor" and results in a slightly more conservative (i.e., larger) estimate of the standard error. N_r, on the other hand, is an expansion factor to estimate total wood loading for the segment. It is the total number of 100-m reaches plus the fractional component of a 100-m reach made up by a short reach. For example, Segment 0011 is 1343 meters in length. N_r for Segment 0011 is 13.43. N_a for Segment 0011 is 14.

In the second case, a reach of less than 100-m was surveyed from the segment. In this case, mean LWD for the segment was calculated using equation 1, except only censuses from 100-m reaches were used and n represented only the number of 100-m reaches sampled. The standard error of the mean was calculated from equation 2. Total LWD was estimated for the segment using the following:

$$LWD_j = N_w \times \bar{x} + x_s \quad (5)$$

where N_w = *the number of whole* (100m) *reaches in the segment, and*
x_s = *the number of LWD pieces from the short* (<100m) *reach*

The estimate is only for those 100-meter reaches not sampled since the LWD count from the short reach was a census. The standard error for the estimate of total LWD for the segment was calculated using equation 4, which is appropriate since the variability lies in the portion of equation 5 that is similar to equation 3.

Wood loading was estimated at the stratum-scale by expanding the sum of the estimates of wood loading in the sample segments by the ratio of the sum of sampled segment lengths to total length of stream in the stratum. Estimates of total wood and the standard error of the total for each stratum followed. The equations used for these estimates are:

$$L_k = L_p - L_{sp} + L_{samp} \tag{6}$$

$$LWD_k = \sum \left(LWD_j \times \frac{L_{samp}}{L_k} \right) \tag{7}$$

$$SE_k = \sqrt{\sum SE_j^2 \times \left(\frac{L_k}{L_{samp}} \right)^2} \tag{8}$$

where L_k = *length of stratum* k,
L_p = *initial projected length of stratum* k,
L_{sp} = *initial projected length of the sum of sample segments in stratum* k,
L_{samp} = *actual length of the sum of sample segments in stratum k,*
LWD_k = *total estimated LWD in stratum* k, *and*
SE_k = *the standard error of LWD,*

Wood loading for the WAU (LWD_t) was estimated by the sum of stratum-scale estimates. The standard error of this total was estimated by:

$$SE_t = \sqrt{\sum SE_k^2} \tag{9}$$

Relative precision was calculated for the 95% confidence interval for the estimates of total LWD in the segment, stratum, and WAU. The following equations were used for each:

$$RP_j = 1.96 \times \frac{SE_j}{LWD_j} \tag{10}$$

$$RP_k = 1.96 \times \frac{SE_k}{LWD_k} \tag{11}$$

$$RP_l = 1.96 \times \frac{SE_l}{LWD_l} \tag{12}$$

Equations 1 through 12 are shown for calculating total wood loading statistics. Key-piece loading was substituted for total wood loading in these equations to calculate statistics for this parameter.

Monitoring Question 2. No analysis of the monitoring data for reaches adjacent to proposed harvest units was performed. Data collected at the reach-scale was a census and assumed accurate. Segment-scale estimates of wood loading for segments containing planned harvest units were developed as part of the analysis to answer monitoring question 1.

Monitoring Question 3. Single classification analysis of variance (ANOVA) was used to evaluate the relationship between riparian condition and LWD loading. Evaluation of wood loading levels relative to riparian condition classes was treated as a Type II analysis. To simplify the analysis, riparian condition class groups were developed solely from reaches that had the same riparian condition call on both sides of the stream. For example, if the riparian condition for both the right bank and left bank of Reach A was mixed, large diameter, dense (MLD), it was assigned to the MLD group. If the riparian condition on the right bank was different than the left bank for a given reach, that reach was not assigned to a riparian condition class and was not used for this analysis. In addition, only reaches that were 100-meters in length were used in the analysis. The following hypothesis was tested:

> H_o: LWD loading (p/100-meters) was not significantly different among groups represented by different riparian condition classes ($P<0.05$).

Where single classification ANOVA resulted in a rejection of the null hypothesis, calculation of the added variance components followed (Sokal and Rohlf 1981).

Results

During the field season, a total of51 out of 91 segments were surveyed. A minimum of a 50% sample was achieved for each stratum (Table 6). Survey data was collected from 275 reaches within the 51 segments. Flow measurements were made on 40 of the 51 segments surveyed (Appendix B). Rainfall was almost non-existent: during the entire field season. Measured flows ranged from 0.08-cfs for a small, confined tributary of the Coweeman River to almost 40-cfs for the mainstem Coweeman. In one segment, flow was too low to be measured.

Table 6. Number of segments in each stratum sampled during the 1998 field season.

	Confinement Class		
Gradient Class	Unconfined	Moderate	Confined
≤ 1%	1/1	n/a	3/6
> 1% to ≤ 2%	3/4	1/1	5/9
> 2% to ≤ 4%	1/2	2/4	4/6
> 4% to ≤ 8%	1/1	9/17	7/13
> 8% to ≤ 20%	n/a	1/2	13/25
Totals	6/8	13/24	32/59

Note: The numerator in each cell represents the number of segments sampled during the 1998 field season. The denominator represents the total number of segments in the stratum. n/a indicates unpopulated strata.

One hundred thirty six jams were encountered during the survey. Data was collected from 134 of them. LWD from two jams, one on Segment 0403 and another on Segment 0362, were not measured due to their large size and distribution The jam on Segment 0403 measured 65.5-meters in length and 31-meters in width. The jam on Segment 0362 measured 57-meters in length with the upstream end of the jam forming a riparian wetland complex. Of the 134 jams in which LWD measurements were taken, all qualifying LWD was recorded for 115 of them. A percentage of the logs were not counted from 19 jams as a result of the jam being too dangerous to walk on. Estimates of logs not counted ranged from 5% to 90% and averaged 27% for these jams. Counts of total pieces and key pieces were expanded to include estimates of uncounted wood from jams where they occurred, except for the two jams in Segments 0362 and 0403 where no estimates of the amount of LWD were made. Because either none or some of the wood was not counted in 21 jams, LWD measurements for the 20 reaches where these jams occurred are estimates; whereas they are wood censuses for the remaining 255 reaches surveyed.

Monitoring Question 1. Calculations of LWD pieces were made for each reach, segment and stratum, as well as for the WAU as a whole. At the reach-scale, estimates were made for total pieces per channel width (p/cw) and key p/cw (Appendix C). These estimates were stratified by piece location (zone 1 - zone 2) and by how the wood had accumulated along the length of the channel (single logs/rootwads -jams). Total LWD density for individual reaches ranged from 0 to 148 pieces per channel width (p/cw) (Figure 3). However, densities were usually at the lower

part of the range (median = 0.96-p/cw[1]). Key pieces averaged 6% of the total wood loading for all reaches. Total LWD loading is considered "good" when piece densities exceed 2-p/cw (WFPB 1997). 'Total LWD loading exceeded 2-p/cw in 29% of reaches surveyed (Table 7).

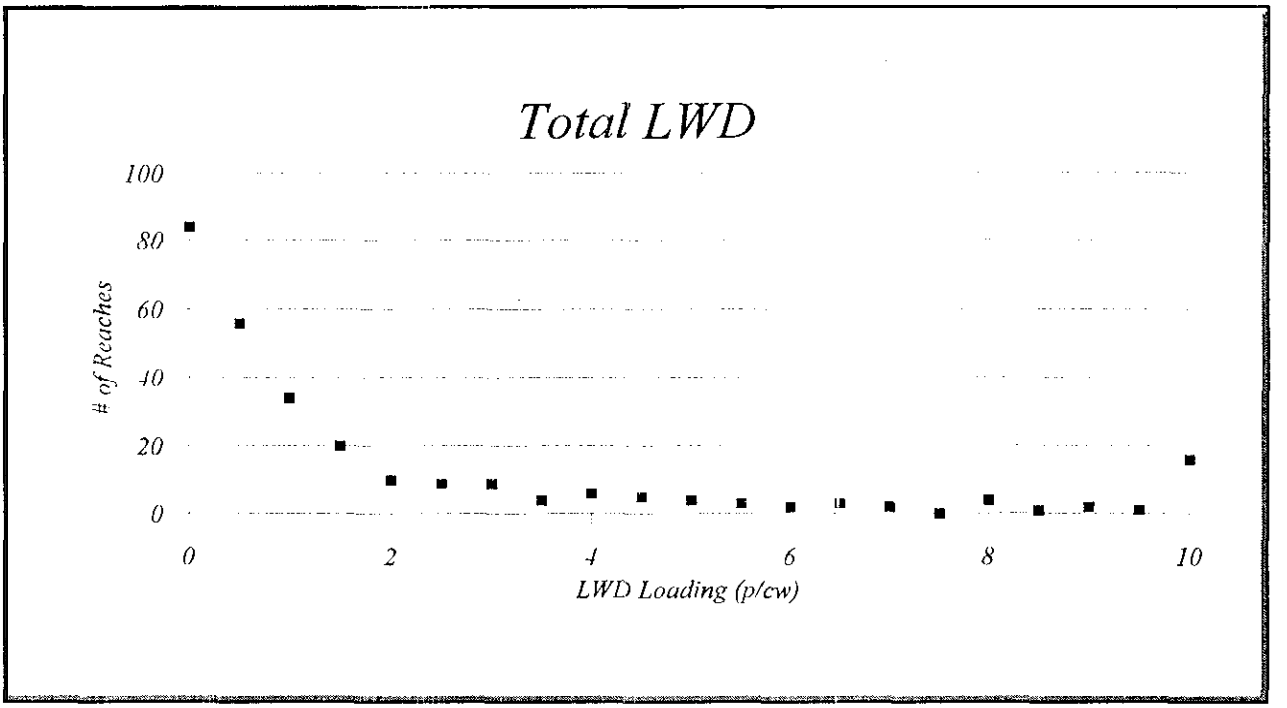

Figure 3. Frequency distribution of total LWD found in the Upper Coweeman WAU, summer 1998.

Table 7. Summarization of Reach-scale LWD loading.-

Reach-Scale Attributes	Total LWD	Key Piece LWD
Number Reaches Surveyed	*275*	275
Mean Wood Count (p/cw)	*2.91*	0.12
Standard Deviation (p/cw)	*9.51*	*0.40*
Median Wood Count (p/cw)	*0.96*	*0.00*
		0.05"
		0.00[b]
Reaches meeting criteria	81[c]	*26*
		25"
		1[b]
% meeting criteria	*29.5%*	10.3%[d]
		15.7"
		1.0[b]

[a] Applies to channels less than IO-meters bankfull width (BFW). Criteria for channels less than IO-meters wide is 0.3 key pieces per channel width.
[b] Applies to channels between IO to 20-meters BFW. Criteria for these channels is 0.5 key pieces per channel width.
[c] "Good" LWD loading criteria is greater than 2-pieces per channel width (WDPB 199?).
[d] Key piece criteria was only applied to channels less than or equal to 20-meters BFW: which included 252 of the-2'75 reaches.

'Wood loading levels were not normally distributed ($p<0.05$), therefore the median is a better estimate of the central tendency of the distribution.

Key-piece densities in sampled roaches ranged from 0 to 4-p/cw (Figure 4). The watershed analysis manual describes good key-piece wood loading conditions as at least 0.3-p/cw for channels less than lo-meters in width and 0.5-p/cw for channels between 10 and 20-meters. Of channels less than IO-meters in width, those meeting or exceeding the 0.3-p/cw criteria represented almost 16% (Table 7). Only about 1% of the 10 to 20-meter channels met or exceeded their key-piece LWD target values. Median values for key-piece wood was 0.05-p/cw for channels less than 10-m and 0-p/cw for channels between 10 and 20-meters

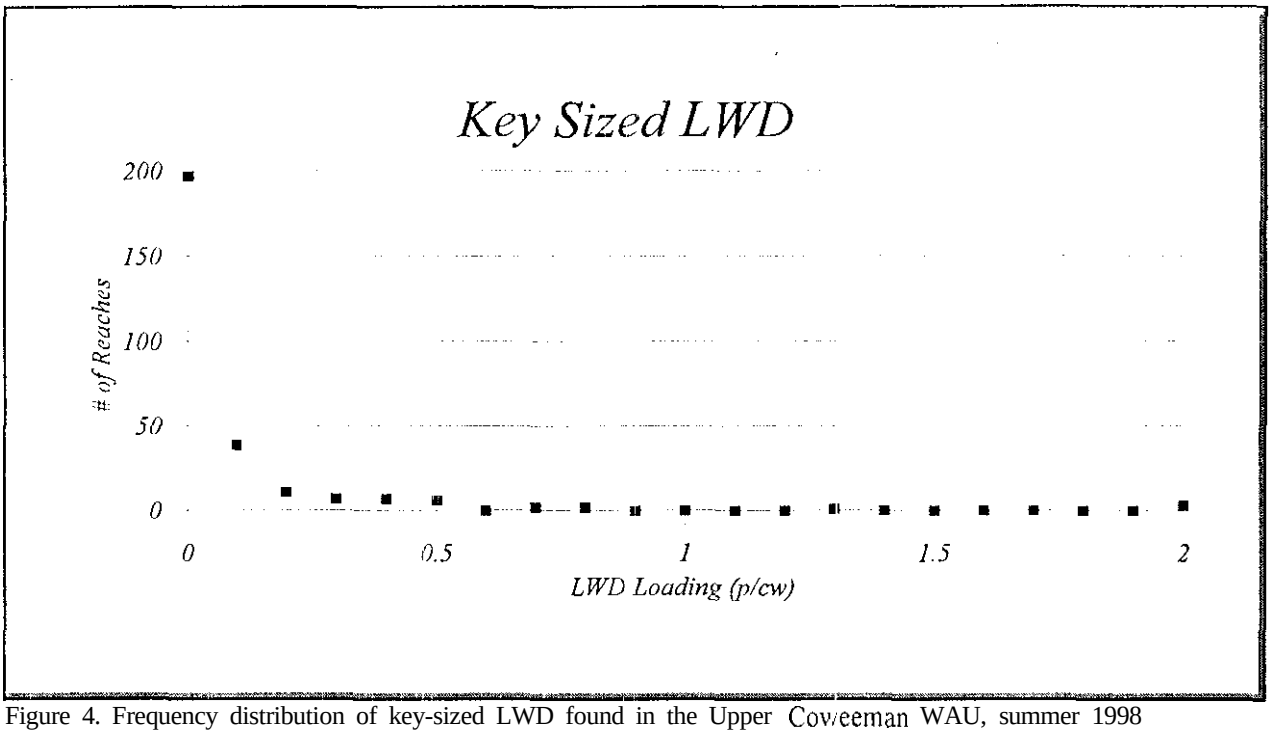

Figure 4. Frequency distribution of key-sized LWD found in the Upper Coweeman WAU, summer 1998

Wood loading was estimated for the segment and stratum scales based on reach level counts. Total LWD pieces for segments were estimated to range from 7 to 1,880 pieces (Table 8). However, the segment that had the highest LWD piece estimate,. Segment 0413 at 1,880 pieces, included a log jam of which 90% of the pieces were estimated not to have been counted. The highest estimates of total LWD loading for segments where at least 90% of the pieces from log jams were counted was 1,604 pieces. These numbers are not particularly comparable because segments were of different lengths. Mean pieces per TOO-meter reach ranged from 4 to 145 pieces; however, the higher figure again came from Segment 0413. Of those segments with jams where at least 90% of the LWD pieces were counted, the highest mean count was 89 pieces per 100-meter reach.

Key-piece wood loading at the segment-scale ranged from 0 to 243 pieces; or 0 to 27 pieces per 100-meter reach (Table 9). No key pieces were found in 11, or 22%, of the segments surveyed.

Table 8. Segment, stratum, and WAU-scale estimates of total LWD in segments sampled in the Upper Coweeman WAU.

Segment	Stratum	Length (m)	Reaches	Sampled Reaches	Mean/Reach (p/100m)	SE of Mean (p/100m)	Estimated Total (pieces)	SE of Total (pieces)	Relative Precision 95% CI
0002	1C	1,489	14.89	7.89	19.43	4.810	272.00	67.345	45.8%
0004	1C	2,100	21.00	11.00	7.00	2.103	147.00	44.171	58.9%
0006	1C	4,777	47.77	24.00	4.92	0.875	234.87	41.813	34.9%
	1C	14,226					1,111.88	154.309	27.2%
0107	1U	1,800	18.0	9.0	52.34.	12.155	942.11	218.792	45.5%
		1,800					942.11	218.792	45.5%
0106	2c	550	5.50	3.00	102.00	43.755	561 .00	240.652	84.1%
0203	2C	524	5.24	3.00	20.67	4.732	108.29	24.794	44.9%
0301	2C	371	3.71	1.71	25.00	n/a	97.54	n/a	N/a
0304	2c	958	9.58	5.00	6.20	1.903	59.40	X.227	60. 1%
0305	2c	2,142	21.42	il.00	7.91	i.444	169.4	30.917	35.8%
	2C	10,575					2,316.58	569.064	48.2%
0103	2M	883	8.83	4.00	5.00	0.680	44.15	6.008	26.7%
	2 M	883					44.15	6.008	26.1%
0250	2U	846	8.46	4.46	30.06	5.897	281.80	47.175	32.8%
0300	2U	1,894	18.94	9.94	6.89	1.175	210.32	21.154	19.7%
0303	2U	947	9.47	4.47	6.25	2.553	58.38	22.974	77.1%
	2U	4,697					720.07	79.465	21.6%
0104	3C	1,350	13.50	7.00	19.14	2.962	258.43	39.984	30.3%
0105	3c	1,300	13.00	6.00	13.00	1.551	169.00	20. 16	23.4%
020 I	3c	1,157	11.57	5.57	54.53	19.55 I	713.82	215.061	59.1%
0306	3c	2,328	23.28	12.00	16.83	3.528	391.88	82.128	41.1%
	3C	7,645					1,910.47	292.247	30.0%

Table 8. Segment, stratum, and WAU-scale estimates of total LWD in segments sampled in the Upper Coweeman WAU (continued).

Segment	Stratum	Length (m)	Reaches	Sampled Reaches	Mean/Reach (p/100m)	SE of Mean (p/100m)	Estimated Total (pieces)	SE of Total (pieces)	Relative Precision 95% CI
0362	3M	1,161	11.61	6.00	86.77	48.336	1,007.45	561.176	109.2%
0401	3M	1,200	12.00	6.00	47.00	13.142	564.00	157.698	54.8%
	3M	**1,131**					**2,749.54**	**1,019.913**	**72.7%**
0346	3U	1,005	10.05	5.05	9.20	2.349	92.00	23.495	50.1%
	3U	**2,170**					**198.65**	**50.730**	**50.1%**
0040	4C	1,144	11.44	5.44	12.20	2.573	150.11	28.306	37.0%
0138	4C	817	8.17	4.17	35.50	7.351	289.75	58.810	39.8%
0150	4C	372	3.72	2.00	31.50	7.425	117.18	27.620	46.2%
0225	4C	464	4.64	2.00	38.50	3.486	178.64	16.174	17.7%
0338	4C	430	4.30	2.00	4.00	0.775	17.20	3.331	38.0%
0423	4C	1,744	17.44	8.44	88.96	9.405	1,603.86	159.886	19.5%
0476	4C	184	1.84	0.84	n/a	n/a	n/a	n/a	n/a
	4C	**9,425**					**4,468.37**	**333.065**	**14.6%**
0011	4M	1,343	13.43	7.00	12.86	3.061	172.67	41.104	46.7%
0038	4M	800	8.00	4.00	7.25	1.510	58.00	12.083	40.8%
0050	4M	650	6.50	3.00	15.33	4.148	99.67	26.962	53.0%
0328	4M	994	9.94	5.00	27.60	4.060	274.34	40.352	28.8%
0347	4M	653	6.53	3.53	12.67	2.718	87.32	16.310	36.6%
0353	4M	539	5.39	3.00	27.00	6.976	145.33	37.601	50.6%
0372	4M	600	6.00	3.00	34.33	6.329	206.00	37.974	36.1%
0413	4M	1,359	13.49	6.49	144.50	65.016	1,880.53	845.206	88.1%
0460	4M	700	7.00	3.00	13.33	0.252	93.33	1.764	3.7%
	4M	**16,328**					**6,458.85**	**1,818.433**	**55.2%**
0125	4U	837	8.37	4.00	21.75	2.027	182.05	16.966	18.3%
	4U	**837**					**182.05**	**16.966**	**18.3%**

Table 8. Segment, stratum, and WAU-scale estimates of total LWD in segments sampled in the Upper Coweeman WAU (continued)

Segment	Stratum	Length (m)	Reaches	Sampled Reaches	Mean/Reach (p/100m)	SE of Mean (p/100m)	Estimated Total (pieces)	SE of Total (pieces)	Relative Precision 95% CI
0023	5C	1,000	10.00	5.00	84.80	2.621	848.00	26.211	6.1%
0037	5C	170	1.70	1.0	4.00	n/a	6.80	n/a	n/a
0060	5c	1,044	10.44	5.00	16.80	7.803	175.39	81.468	91.0%
0069	5c	265	2.65	1.65	14.00	n/a	28.00	n/a	n/a
0146	5c	1,470	14.70	7.00	45.57	6.886	669.90	101.219	29.6%
0224	5c	273	2.73	1.73	59.00	n/a	119.37	n/a	n/a
0322	5c	900	9.00	4.00	117.25	26.23 i	1,055.25	236.083	43.8%
0333	5C	800	8.00	4.83	36.50	5.646	292.00	45.166	30.3%
0361	5C	400	4.00	2.00	71.61	32.252	286.44	129.008	88.3%
0403	5C	1,078	10.78	5.00	39.11	14.502	421.62	156.328	72.7%
0406	5C	1,237	12.37	6.00	81.14	24.023	1,003.71	297.158	58.0%
0414	5C	842	8.42	4.42	68.25	22.955	717.29	183.643	50.2%
0461	5C	900	9.00	4.00	25.06	8.744	225.56	78.698	68.4%
	5C	**19,419**					**10,944.04**	**925.425**	**16.6%**
0243	5M	549	5.49	2.49	47.00	24.787	290.10	123.935	83.7%
	5M	**1,488**					**786.29**	**335.911**	**83.7%**
Upper Coweeman WAU Total							**32,833.05**	**2,432.537**	**14.5%**

Wood loading estimates for the strata ranged from 44 pieces to 10,944 pieces (Table 8). However, after adjusting for stratum length variability, stratum-scale loading estimates averaged from 5 to 67 pieces per 1 00-meters. Key-piece loading averaged from 0 to 13.4 pieces per 1 00-meters (Table 9). Key-piece size criteria was a function of channel size: therefore, higher densities tended to be found in strata with smaller channels (i.e.. higher gradient strata). No key-sized wood was found in the segments sampled from Stratum 1C; therefore the stratum estimate was estimated as zero key pieces. Although only 50% of the segments in the stratum were sampled, this is probably a reasonable estimate since all of the segments were from the lower upper Coweeman mainstem, which is the largest and most powerful channel in the WAU.

A total of 32,833 pieces of LWD were estimated for fish-bearing segments in the Upper Coweeman WAU. This figure was calculated by summing the stratum-scale total wood estimates. Key,-piece estimates for fish-bearing segments in the WAU are 2,401 pieces.

The sampling strategy selected for this study was designed to produce estimates of wood loading at the segment and stratum scales that were within +/- 25% of the true value for the segment or stratum 95% of the time. However, this level of precision was not achieved. For segment-scale estimates of total LWD pieces, relative precision ranged from +/- 4% to +/- 109% of the true value at a 95% significance level and averaged +/- 47% for all segments (Table 8). Less precision was achieved for key-piece estimates which averaged +/- 78% at a 95% significance level (Table 9). Stratum-scale estimates also did not achieve the designed level of precision, but came closer than the segment-scale estimates. Relative precision ranged from +/- 15% to +/- 84% for total LWD estimates with a 95% significance level, and averaged +/- 39% across all strata. Relative precision averaged +/- 66% for key-piece LWD estimates using the same level of significance.

Wood loading estimates at the watershed-scale were more precise than those made at the segment and stratum scales. Precision for the estimate of total wood loading within the Upper Coweeman WAU was within +/- 15% of the true wood loading value at a 95% significance level. The precision level for the key-piece wood loading estimate was +/- 27% of the true value using the same level of significance. The actual WAU-scale wood loading estimates, as well as those for two segments and strata, are likely higher than those estimated here since wood in the two large jams on segments 403 and 362 were not counted or estimated. In addition, the expansion of jam counts to reflect that portion of log jams not counted inserts, an unquantifiable bias into the estimate. Precision estimates do not reflect these biases.

Table 9. Segment, stratum, and WAU-scale estimates of key-size LWD in segments sampled in the Upper Coweeman WAU.

Segment	Stratum	Length (m)	Reaches	Sampled Reaches	Mean/Reach (p/100m)	SE of Mean (p/100m)	Estimated Total (pieces)	SE of Total (pieces)	Relative Precision 95% CI
0002	1C	1,489	14.89	7.89	0.00	—	0.00	—	—
0004	1C	2,100	21.00	11.00	0.00	—	0.00	—	—
0006	1C	4,777	47.77	24.00	0.00	—	0.00	—	—
	1C	**14,226**					**0.00**		
0107	1U	1,800	18.0	9.0	1.11	0.275	20.00	4.950	48.5%
		1,800					**20.00**	**4.950**	**48.5%**
0106	2C	550	5.50	3.00	2.67	1.247	14.67	6.860	91.7%
0203	2C	524	5.24	3.00	1.33	0.943	6.99	4.940	138.6%
0301	2C	371	3.71	1.71	0.00	n/a	0.00	n/a	n/a
0304	2C	958	9.58	5.00	0.80	0.412	7.66	3.950	101.0%
0305	2C	2,142	21.42	11.00	0.64	0.197	13.63	4.222	60.7%
	2C	**10,575**					**99.93**	**23.829**	**46.7%**
0103	2M	883	8.83	4.00	0.50	0.215	4.42	1.900	84.3%
	2M	**883**					**4.42**	**1.900**	**84.3%**
0250	2U	846	8.46	4.46	6.25	3.271	50.00	26.166	102.6%
0300	2U	1,894	18.94	9.94	0.00	—	0.00	—	—
0303	2U	947	9.47	4.47	0.25	0.186	2.25	1.677	146.1%
	2U	**4,697**					**72.56**	**38.542**	**104.1%**
0104	3C	1,350	13.50	7.00	0.57	0.210	7.71	2.839	72.1%
0105	3C	1,300	13.00	6.00	0.17	0.122	2.17	1.590	143.8%
0201	3C	1,157	11.57	5.57	1.94	0.724	21.31	7.963	73.2%
0306	3C	2,328	23.28	12.00	0.50	0.138	11.64	3.204	53.9%
	3C	**7,645**					**53.37**	**11.439**	**42.0%**

Table 9. Segment, stratum, and **WAU-scale estimates** of key-size LWD **in segments sampled in the** Upper Coweeman WAU (continued).

Segment	Stratum	Length (m)	Reaches	Sampled Reaches	Mean/Reach (p/100m)	SE of Mean (p/100m)	Estimated Total (pieces)	SE of Total (pieces)	Relative Precision 95% CI
0362	3M	1,161	11.61	6.00	9.87	5.462	114.62	63.414	108.4%
0401	3M	1,200	12.00	6.00	0.83	0.217	10.00	2.608	51.1%
	3 M	1,131					218.05	111.048	99.8%
0346	3u	1,005	10.05	5.05	1.60	0.574	16.00	5.745	70.4%
	3u	2,170					27.14	12.404	70.4%
0040	4c	1,144	11.44	5.44	0.80	0.362	13.35	3.980	58.5%
0138	4c	817	X.17	4.17	2.00	0.289	21.75	2.309	20.8%
0150	4c	372	3.72	2.00	0.00		0.00		
0225	4C	464	4.64	2.00	2.50	0.387	II.60	1.797	30.4%
0338	4c	430	4.30	2.00	0.00		0.00		
0423	4c	1,744	i7.44	8.44	5.78	1.062	105.17	IX.052	33.6%
0476	4c	184	LX4	0.84	n/a	n/a	n/a	n/a	n/a
	4c	9,425					287.94	35.484	24.2%
001 I	4M	1,343	13.43	7.00	0.71	0.335	9.59	4.499	91.9%
0038	4 M	800	8.00	4.00	0.50	0.204	4.00	1.633	80.0%
0050	4 M	650	6.50	3.00	2.00	0.873	13.00	5.674	85.5%
0328	4 M	994	9.94	5.00	1.20	0.141	11.93	1.406	23.1%
0347	4 M	653	6.53	3.53	1.33	0.471	8.00	2.828	69.3%
0353	4 M	539	5.39	3.00	4.67	0.471	25.15	2.541	19.8%
0372	4 M	600	6.00	3.00	4.67	0.624	28.00	3.742	26.2%
0413	4 M	1,359	13.49	6.49	0.67	0.155	8.67	2.011	45.5%
0460	4 M	700	7.00	3.00	0.67	0.504	4.67	3.528	148.2%
	4 M	16,328					241.90	21.621	17.5%
0125	4U	837	8.37	4.00	0.75	0.357	6.28	2.987	93.2%
	4u	837					6.28	2.987	93.2%

Table 9. Segment, stratum, and WAU-scale estimates of key-size LWD in segments sampled in the Upper Coweeman WAU (continued).

Segment	Stratum	Length (m)	Reaches	Sampled Reaches	Mean/Reach (p/100m)	SE of Mean (p/100m)	Estimated Total (pieces)	SE of Total (pieces)	Relative Precision 95% CI
0023	5C	1,000	10.00	5.00	7.60	0.529	76.00	5.292	13.6%
0037	5C	170	1.70	1.0	0.00	n/a	0.00	n/a	n/a
0060	5C	1,044	10.44	5.00	3.20	2.363	33.41	24.673	144.8%
0069	5C	265	2.65	1.65	0.00	n/a	0.00	n/a	n/a
0146	5C	1,470	14.70	7.00	2.29	0.760	33.60	11.165	65.1%
0224	5C	273	2.73	1.73	3.00	n/a	6.00	n/a	n/a
0322	5C	900	9.00	4.00	27.00	10.014	243.00	90.125	72.7%
0333	5C	800	8.00	4.83	1.00	0.408	8.00	3.266	80.0%
0361	5C	400	4.00	2.00	0.00	—	0.00	—	—
0403	5C	1,078	10.78	5.00	1.62	0.877	17.49	9.452	105.9%
0406	5C	1,237	12.37	6.00	13.56	9.753	167.68	120.641	141.0%
0414	5C	842	8.42	4.42	0.50	0.354	22.47	2.828	24.7%
0461	5C	900	9.00	4.00	1.50	0.887	13.50	7.984	115.9%
	5C	**19,419**					**1,162.17**	**287.487**	**48.5%**
0243	5M	549	5.49	2.49	11.50	8.133	73.83	40.666	108.0%
	5M	**1,488**					**196.20**	**110.221**	**108.0%**
Upper Coweeman WAU Total							**2,401.25**	**333.513**	**27.2%**

Monitoring Question 2. LWD density for individual reaches adjacent to stands to be harvested between 1998 and 2002 ranged from 0 to 148-p/cw (Figure 5, Appendix D). Densities, again, were usually at the lower part of the range (median = 2.07-p/cw). Key pieces averaged 4% of the total wood load for reaches adjacent to harvest areas. Total LWD loading exceeded 2-p/cw in 50% of these reaches (Table 10)

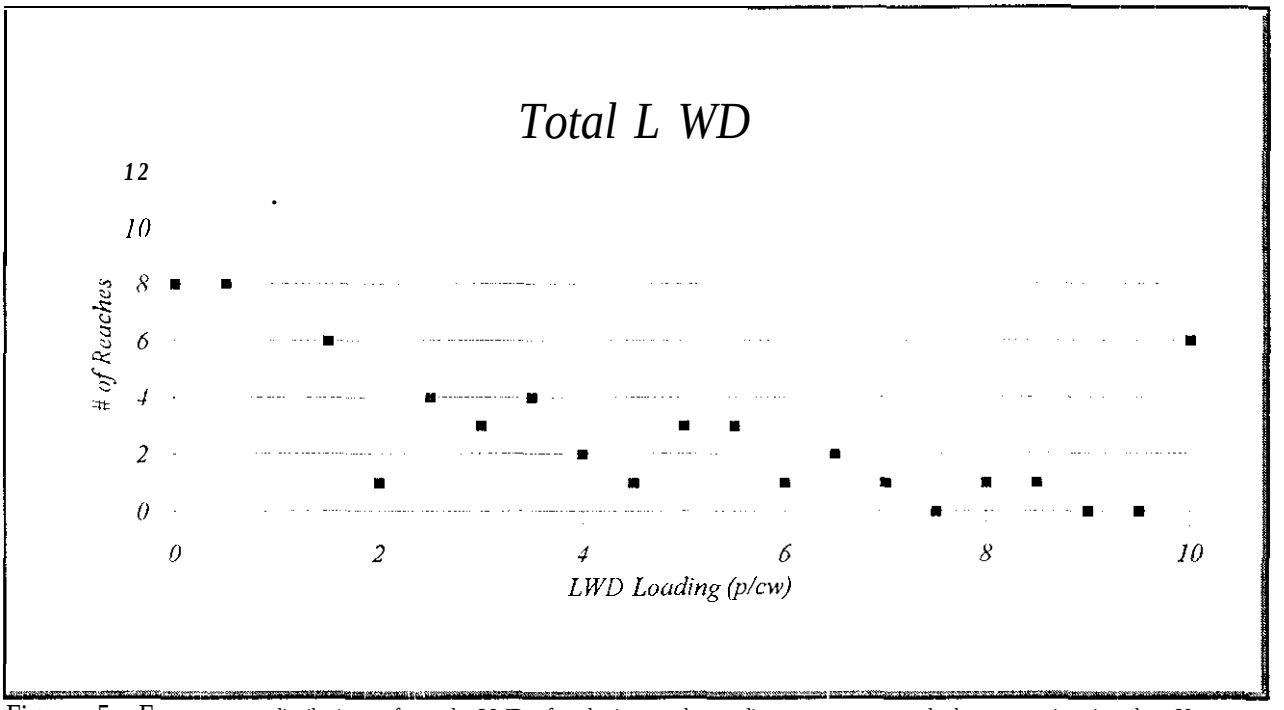

Figure 5. Frequency distribution of total LWD found in reaches adjacent to proposed harvest units in the Upper Coweeman WAU, summer 1998.

Table 10. Summarization of Reach-scale LWD loading for reaches adjacent to harvest units schedules for harvest between 1998 and 2002.

Reach-Scale Attributes	Total LWD	Key Piece LWD
Number Reaches Surveyed	62	62
Mean Wood Count (p/cw)	5.81	0.11
Standard Deviation (p/cw)	18.76	0.21
Median Wood Count (p/cw)	2.07	0.05
		0.09[a]
		0.00[b]
Reaches meeting criteria	31[c]	5
		5[a]
		0[b]
% meeting criteria	50.0%	8.6%[d]
		17.2[a]
		0.0[b]

[a] Applies to channels less than 10-meters bankfull width (BFW). Criteria for channels less than IO-meters wide is 0.3 key pieces per channel width.

[b] Applies to channels between 10 to 20-meters BFW. Criteria for these channels is 0.5 key pieces per channel width.

[c] "Good" LWD loading criteria is greater than 2-pieces per channel width (WDPB 199?).

[d] Key piece criteria was only applied to channels less than or equal to 20-meters BFW; which included 2[illegible] of the 275 reaches.

Key-piece densities in reaches adjacent to harvest units ranged from 0 to 1.4-p/cw (Figure 6). Of channels less than IO-meters in width, 17% met or exceeded the 0.3 key p/cw criteria found in the watershed analysis manual (WFPB 1995)(Table IO). None of the 10 to 20-meter channels met or exceeded their key-piece LWD target values. Median values for key-piece wood was 0.09-p/cw for channels less than 10-m and 0-p/cw for channels between 10 and 20-meters.

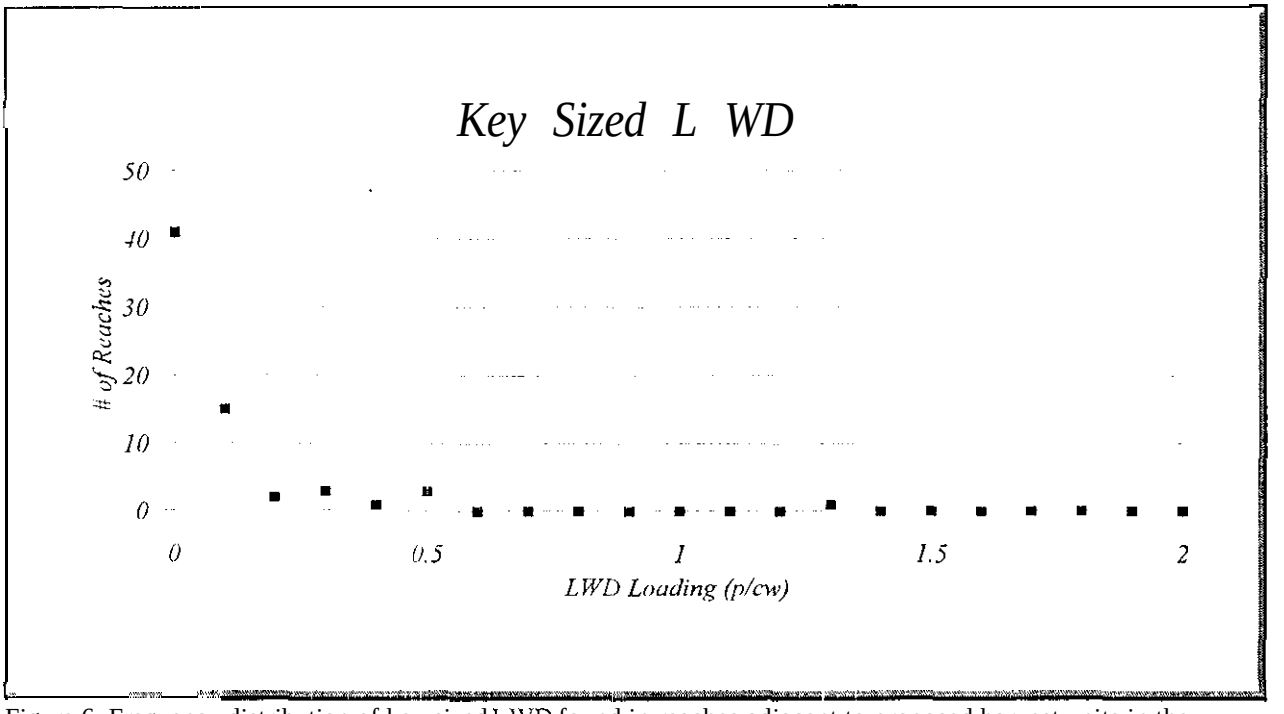

Figure 6. Frequency distribution of key-sized LWD found in reaches adjacent to proposed harvest units in the Upper Coweeman WAU, summer 1998.

Monitoring Question 3. Riparian condition calls during the field surveys identified nine out of eighteen possible riparian condition classes present in the Upper Coweeman WAU. Density calls indicated "dense" conditions in every case. Over 80% of reaches were comprised of deciduous or mixed stands (Table 11). Riparian zones with large trees were not common on the landscape. Ninety five percent of the stands contained either "small" or "medium" sized trees.

Of the 275 reaches surveyed, 180 had the same riparian condition class on both sides of the stream and were 1 OO-meters in length. ANOVA was performed on 8 of the 9 riparian condition classes encountered. The riparian class CLD (conifer-large-dense) was not included in the analysis because we were unable to calculate a variance for this class since these conditions were only found for a single reach (Figure 7).

Upon evaluation of the effects of riparian condition on wood loading, a significant difference was found for total LWD loading; but not for key-piece loading ($p < 0.05$). However, analysis of the treatment effect showed that riparian condition only accounted for 7.75% of the variation in total LWD loading.

Table 11. Number and proportion of reach-level stream banks observed in each riparian condition class during the 1998 Upper Coweeman LWD study.

Riparian Condition Class	Reach Stream Banks in Class	Proportion Stream Banks in Class
DMD	151	0.27
MMD	144	0.26
DSD	76	0.14
MSD	67	0.12
CMD	63	0.11
CSD	24	0.04
MLD	11	0.02
DLD	9	0.02
CLD	5	0.01
Total	550	
Total Small Classes	167	0.30
Total Medium Classes	358	0.65
Total Large Classes	25	0.05
Total Deciduous Classes	236	0.43
Total Mixed Classes	222	0.40
Total Coniferous Classes	92	0.17

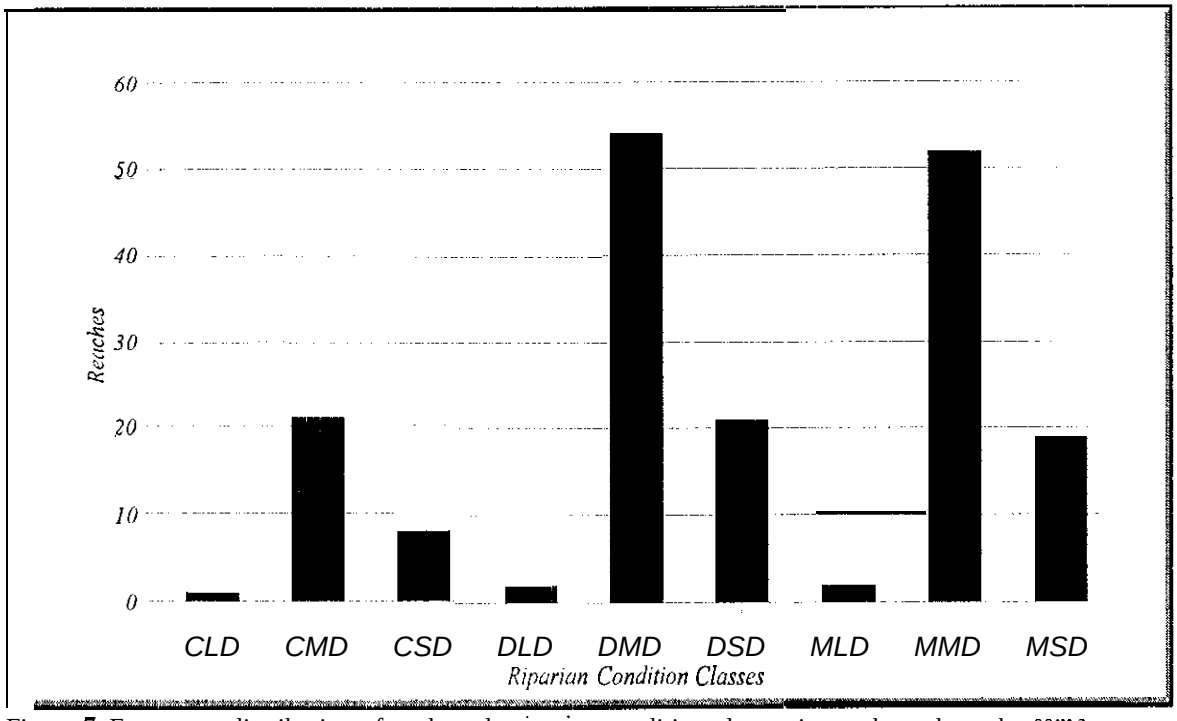

Figure 7. Frequency distribution ofreach-scale riparian condition classes in reaches where the same condition class was found on both sides of the stream

We also hypothesized that wood loading effects resulting from riparian condition may be confounded by wood stored in jams, since the distribution ofjarns may be more highly influenced by channel morphology and landform than by riparian condition. To test this hypothesis, ANOVA was again used to test riparian condition classes against total single pieces per 100-meters (i.e., total pieces/reach -jam pieces/reach). Although a significant difference was found, analysis of the treatment effect accounted for only 5.4% of the variation in single-piece LWD loading; which was not an improvement over the treatment effect found for total wood.

Discussion

Monitoring Question 1. A stratified random sampling design was used in this project to estimate LWD loading for fish-bearing streams at the segment, stratum, and, ultimately, watershed scales for use in trend monitoring of large woody debris. Analysis showed that the sampling rates employed yielded estimates of precision that, on average, were worse than those found in the Deschutes basin using similar sampling levels. Although standards for monitoring precision had not yet been developed for watershed-scale trend monitoring, it has been suggested that a confidence level of +/- 10% may be a desired precision target for evaluating habitat change (Schuett-Hames pers. comm.). Clearly, the levels of precision found for LWD estimates for the Deschutes and Upper Coweeman at the segment and stratum-scales using this level of sampling were much poorer than this target. Precision levels for total wood estimates (+/- 15%) at the WAU-scale approached, but did not quite reach this target.

Using the stratified random sampling design, wood loading is tallied at the reach-scale and estimated at the segment, stratum, and watershed scales. Imprecision associated with this sampling design lies in the estimation of wood loading at these larger spacial scales. Results from this study indicate that substantially higher sampling rates would be necessary to achieve a +/- 10% precision target in order to monitor trends in wood loading estimates at the segment, stratum, and watershed scales. Yet to sample at levels substantially higher than were used during this study would likely be cost-Iprohibitive. Furthermore, the stratification scheme used for this project did not increase the precision of the estimate of wood loading at the WAU-scale for the Upper Coweeman WAU. Using the segment estimates instead of the stratum estimates yielded a WAU-scale total wood loading estimate of 3 I ,73 1 pieces with a precision estimate of +/- 13.4% at the 95% significance level.

To achieve the target level of precision, other sampling approaches are needed. Stratification based on gradient and confinement categories did not achieve this level of precision in the Upper Coweeman WAU. The distribution of wood within the watershed may be better explained by the disturbance history within the WAU instead of by channel morphology. A number of stratification schemes could be envisioned to represent different levels of disturbance.

A simple stratification scheme (designed to reflect disturbance was tested using strata based on the nine major sub-basins identified in watershed analysis. The rationale was that sampling

within sub-basin drainages may capture the disturbance within each sub-basin and yield estimates that are more precise than sampling from the basin as a whole. This exercise yielded a total wood estimate for the WAU of 32,491 pieces with a relative precision level of +/- 13.2% at the 95% significance level. The precision of this estimate is better than that achieved using the channel morphology-based stratification scheme, but did not improve over the estimate using only segment estimates of wood loading. Other methods of stratifying the channel network to reflect the range of disturbance in the WAU may yield higher precision.

If a satisfactory stratification approach cannot be found to achieve the target precision level for wood loading estimates at the segment, stratum, and WAU scales, an index approach to watershed-scale monitoring might be an acceptable alternative. Using this approach, an initial set of monitoring reaches would be developed using a random or systematic sampling design to develop a robust sample of reaches throughout the strata/watershed. This sample would form a set of indices. The downside of using this approach is that the resulting wood loading values are indices, not estimates. There is less certainty as to how well changes in these values represent true trends within the WAU. The upside is that since the index is comprised solely of the sampled habitats, only the actual sampling bias remained. For the purposes of future monitoring in the Upper Coweeman WAU, it is recommended that the index approach be used which will result in repeat sampling of the same channel units surveyed during this study in lieu of stratified random sampling to acquire a new sample. Re-sampling using a different stratification scheme would decrease the utility of the dataset collected during this study.

Monitoring Question 2. Results from this project document baseline LWD loading in a sample ofreaches adjacent to stands proposed for harvest over the next j-years. A number of prescriptions developed in the Watershed Analysis call for wood placement where the channel lacks wood and suitable trees exist (Table 12). It is recommended that the study be repeated in 2002 to evaluate the effectiveness of these wood placement strategies for increasing wood loading in these reaches, In addition, the Watershed Analysis sets a goal of 0.25 functional pieces per channel width for fish bearing channels. Functional pieces are smaller than key pieces but are thought to have functional value in the stream for serving as roughness elements that can store or help to scour alluvium (Table 13). It is recommended that functional-sized wood is counted in future studies to evaluate prescription effectiveness in meeting the functional wood loading target.

Monitoring Question 3. Like the gradient and confinement strata, riparian condition classes were found to be a poor predictor of in-channel wood loading in fish-bearing reaches within the Upper Coweeman WAU. Removal of jam data from the analysis did not improve the relationship between riparian condition classes and wood loading. A number of confounding factors may influence or mask the relationship between wood loading and riparian stand condition. The high level of disturbance associated with splash damming practices and past riparian harvests undoubtedly removed and/or interrupted the delivery of key-sized LWD which might be expected to help retain much of the smaller LWD that is contributed from riparian stands. Debris torrents would have localized effects on LWD loading regardless of riparian stand condition, but would not explain the weak relationship between wood loading and riparian stand

condition observed across the basin as a whole. The most likely factor influencing the relationship between LWD loading and riparian stand condition is the transport of LWD downstream or out of the channel. Recent disturbance events that would transport wood include the February 1996 storm. Records indicate that this storm resulted in the highest average daily flows seen in at least 18 years in the region (USGS flow data).

Table 12. Prescriptions applicable to sampled reaches in the Upper Coweeman WAU adjacent to proposed harvest units.

Condition/Prescription	Reach #	Functional LWD Loading Goal (p/cw)
LWD1-Blue Condition: Riparisn stands largely composed of functional sized conifers that could contribute LWD to the channel. Segments are largely confined mainstem channels. Prescription: No harvest within 75-ft of the channel except when operationally necessary in which case trees must be felled toward, into, or over the channel; or concurrent with adjacent harvest individual trees from beyoun 50-ft may be felled toward, into, or over the channel. Felled trees must provide LWD of functional size.	0002-2	≥ 0.25
	0002-4	≥ 0.25
	0002-8	≥ 0.25
	0006-34	≥ 0.25
	0346-0	≥ 0.25
LWD1-Red Condition: Riparian stands largely composed of functional sized conifers that could contribute LWD to the channel. Segments are small, naturally alluvial channels. Prescription: No harvest within 50-ft of the channel except when operationally necessary in which case trees must be felled toward, into, or over the channel; or concurrent with adjacent harvest individual trees from beyond 50-ft may be felled toward, into, or over the channel. Felled trees must provide LWD or functional size; or if functional wood snot available, especially for channels greater than 20-ft in width, non-merchantable material may be used.	0138-0	≥ 0.25
	0138-2	≥ 0.25
	0146-5	≥ 0.25
	0146-7	≥ 0.25
	0322-7	≥ 0.25
LWD 1 -Green Condition: Riparian stands largely composed of functional sized conifers that could contribute LWD to the channel. Segments are small, steeper gradient, forced alluvial channels. Prescription: See LWDI-Red	0401-0	≥ 0.25
	0401-2	≥ 0.25
	0401-4	≥ 0.25
	0401-6	≥ 0.25
	0401-8	≥ 0.25
	0401-10	≥ 0.25
	0413-1	≥ 0.25
	0413-11	≥ 0.25
	0413-13	≥ 0.25

Table 12. Prescriptions applicable to sampled reaches in the Upper Coweeman WAU adjacent to proposed harvest units.

Condition/Prescription	Reach #	Functional LWD Loading Goal (p/cw)
LWD1-Yellow **Condition:** Riparian stands largely composed of functional sized conifers that could contribute LWD to the channel. Segments are channels with debris torrent potential. Prescription: **See LWDI-Red**	0414-0	≥ 0.25
	0423-1	≥ 0.25
	0423-3	≥ 0.25
	0423-5	≥ 0.25
	0423-7	≥ 0.25
	0423-9	≥ 0.25
	0423-11	≥ 0.25
	0423-13	≥ 0.25
	0423-15	≥ 0.25
	0423-17	≥ 0.25
LWD2-Blue **Condition:** Riparian stands are hardwood dominated and trees are typically too small to affect channel morphology. Segments are largely confined mainstem channels. Prescription: No harvest within 25-ft of the stream except where operationally necessary in which case trees must be felled toward, into, or over the channel; between 25 and 50-ft of the stream, hardwoods may be removed and replanted with conifer. Concurrent with adjacent harvest, individual trees from beyond 50-ft will be felled toward the channel. LWD resulting from felled trees must be of functional size; or if functional wood is not available, especially for channels greater than 20-ft in width, non-merchantable material may be used.	0104-8	≥ 0.25
	0105-3	≥ 0.25
	0106-4	≥ 0.25
	0203-0	≥ 0.25
	0203-2	≥ 0.25
	0203-4	≥ 0.25
	0300-8	≥ 0.25
	0300-10	≥ 0.25
	0300-12	≥ 0.25
	0300-14	≥ 0.25
	0300-16	≥ 0.25
	0306-4	≥ 0.25
	0306-6	≥ 0.25
	0306-8	≥ 0.25
	0306-10	≥ 0.25
	0306-12	≥ **0.25**
	0306-14	≥ **0.25**
	0306-16	≥ **0.25**

'able 12. Prescriptions applicable to sampled reaches in the Upper Coweeman WAU adjacent to proposed arvest units.

Condition/Prescription	Reach #	Functional LWD Loading Goal (p/cw)
LWD-2-Red **Condition:** Riparian stands are hardwood dominated and trees are ypically too small to affect channel morphology. Segments are small, laturally alluvial channels. 'rescription: See LWD2-Blue	0107-0	≥ 0.25
	0107-2	≥ 0.25
	0107-4	≥ 0.25
	0107-6	≥ 0.25
	0146-5	≥ 0.25
	0146-7	≥ 0.25
	0224-0	≥ 0.25
	0224-2	≥ 0.25
	0225-1	≥ 0.25
	0347-4	≥ 0.25
LWD3-Green **Condition:** Riparian stands are dominated by young hardwoods and /oung conifers that are too small to contribute large wood to stream :hannels. Segments are small, steeper gradient, forced alluvial channels. **Prescription:** For hardwood and mixed stands less than 15-years old, nanaged stands to provide for long-ten" LWD recruitment. For lardwood, and mixed stands greater than 15 years old, no harvest within 25-ft of OHWM, retain all conifer and cut deciduous and under-plant :onifer within 25-50-ft of OHWM. Concurrent with adjacent harvest, ndividual trees from beyond 50-ft will be felled toward the channel. LWD resulting from felled trees must be of functional size; or if 'unctional wood is not available, especially for channels greater than 20-i in width, non-merchantable may be used. In young conifer dominated :tands, use standard silvicultural practices.	0413-3	≥ 0.25
	0413-5	≥ 0.25
	0413-7	≥ 0.25
	0413-9	≥ 0.25

Table 13. Functional piece size definitions found in the upper Coweeman Watershed Analysis (1997).

Minimum Diameter to Qualify as a Functional LWD Piece		
Channel Size(m)	Minimum Diameter (m)	Minimum Length
1.5 to 6	0.2	Bankfull Width
6 to 10.5	0.3	Bankfull Width
10.5 to 15.25	0.4	Bankfull Width
>15.25	0.5	Bankfull Width

Future Monitoring

This study of itself was beneficial for evaluating a watershed-scale approach to large woody debris monitoring and recommendations were developed for future research to improve the precision of LWD estimates. However, in order to realize the maximum value from this work, the study needs to be repeated in 2002, prior to the five-year review for the watershed analysis. The repeat survey will enable evaluation of the effectiveness of the wood placement prescriptions for increasing functional-piece densities in and downstream of the affected channel reaches. In addition, repeating the study will begin a process of monitoring watershed-scale LWD trends in a managed landscape given the backdrop of changing management practices and natural disturbance patterns. In addition to these benefits, repeat surveys may provide for an assessment of the disposition of the placed wood. Assuming there is a record of the number, type (coniferous/deciduous), and size (functional sized/slash/other) of LWD that are placed from each harvest unit, the repeat survey may also enable evaluation of the stability of the actively recruited wood following up to four winters post-placement. The study could also be used to evaluate how the actively recruited wood are performing for providing habitat, particularly with respect to channel morphology.

Future monitoring should be repeated in the same segments and reaches monitored during this study. The same core methods should be used, although additional methods may be added to enable answering other questions such a disposition of placed wood. Segment and reach monumenting and location identification was done to enable repeating the survey in the future. If future monitoring is scheduled to enable monitoring at similar discharge levels as were found during the 1998 study, changes in wood density within the wetted perimeter could be evaluated in addition to changes within the bankfull channel. This may not be possible given the particularly dry summer experienced during the 1998 field season.

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Appendix A
Memo from Bob Conrad Dated May 13, 1998

Northwest Indian Fisheries Commission

6730 Martin Way E., Olympia, Washington 98516-5540

Phone (360) 438-1180 FAX # 753-8659

To: Greg Volkhardt (WDFW) and Dave Schuett-Hames (NWIFC)

From: Bob Conrad

Date: May 13, 1998

Subject: LWD study design for the Upper Coweeman WAU

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At our meeting on 27 April 1998 we discussed a sample design for estimating the volume and number of LWD pieces in a watershed unit. A stratified sampling design was proposed and decided to be a good approach. As originally proposed, strata were defined by gradient class, confinement class, and stream order for a total of 22 strata in the Upper Coweeman WAU. Several questions then arose:

1. How many stream segments in a stratum should be sampled? and
2. Can a segment be sub-sampled so that the entire segment does not need to be surveyed?

I have analyzed some of the segment LWD data that Dave supplied from WRIAs 13 and 14 to try to answer these questions. I will address question #2 first since if a stream segment can be sub-sampled you will be able to sample more stream segments in total during your allotted sample period. This then has a bearing on the answer to question #1.

Can stream segments be sub-sampled?

To examine this question I analyzed data from four of the longest stream segments in the data that Dave supplied that belonged to one of the 22 strata defined for the study. The stream segments analyzed were:

WRIA	Stream Segment	Survey Period	Segmentt Length (m)	Reference Points	Stratum Grade.	Stratum Confine.	Stratum Order
13.0028.000	10	7,8/92	4,300	44	2-4%	M	4
13.0028.000	19	8/92	3,528	37	1-2%	U	4
13.0028.000	19	6/95	3,383	35	<1%	C	4
13.0028.000	31	6/95	3,790	39	<1%	C	4

I first examined the variability among refer-ence points in LWD pieces and total volume of LWD for a stream segment. I did not have easy access to the length of stream surveyed for the reference points so I was not able to convert the metrics for the reference point (number of LWD pieces and total volume of LWD) into pieces per m surveyed or volume per m surveyed. Converting the metrics to per m surveyed might reduce the variability of the estimates. However, I don't think the units of number or volume per mean channel width lengths is appropriate on the reference point scale. Therefore, I used the variability of the reference point data to determine sample sizes (number of reference points to survey) necessary to estimate total number of LWD pieces or total LWD volume in the segment within specified limits of precision.

I selected a target of 25% relative precision (to the estimated mean or total) for a 95% confidence interval (i.e., α = 0.05). A relative precision of 25% for a 95% confidence interval means that if a segment has a mean number of LWD pieces per reference point of 20, then the 95% confidence interval that is calculated from the data with the given sample size will be the mean ±25% of the mean estimate, or in this case ±(25% x 20) or ±5 pieces. That is, the 95% confidence interval for the estimated mean number of LWD pieces would range from 15 to 25 pieces. Similarly, if a segment has a mean volume of 6.0 m^3 of LWD per reference point then the 95% confidence interval that is calculated from the data with the given sample size will be the mean ±25% of the mean estimate, or in this case ±(25% x 6.0 m^3) or ±1.5 m^3. That is, the 95% confidence interval for the estimated mean volume of LWD per reference point would range from 4.5 m^3 to 7.5 m^3. With α = 0.05, we would a 5% chance of the calculated confidence interval not including the true mean for the segment for both of the previous examples.

Sample sizes targets were estimated using (Cochran 1977'):

$$n_0 = \left(\frac{tS}{r\bar{Y}} \right)^2$$

where n_0 = the target sample size,
S = the estimated standard deviation of the sample,
t = the appropriate t-statistic given a,
r = the percent relative error (relative to the mean) desired for the estimate, and
$\bar{Y}$ = the estimated sample mean.

The estimated sample sizes needed to attain the target level of precision (95% confidence interval ±25% of the estimated mean) are summarized for the stream segments examined in Table 1 for LWD pieces and Table 2 for LWD volume. Because we are sampling a finite population (i.e., there are a discrete number of reference points in a stream segment), the sample size goal was corrected for finite population sampling by (Cochran 1977):

[1] Cochran, W. G. 1977. Sampling 'Techniques, Third Edition. John Wiley and Sons, New York.

$$n = \frac{n_0}{1 + (\frac{n_0}{N})}$$

where N = the total number of reference points (RP) in the stream segment.

Table 1. Summary of reference point statistics for number of LWD pieces from four stream segments in WRIA 13.0028.000. Needed sample size (SS) is for a 95% confidence interval with ±25% relative (to the mean) precision.

	Stream Segment Number (Survey Year)			
Parameter	10	19 (1992)	19 (1995)	31
Number of RP	41	34	33	37
Mean	5.29	9.71	7.06	8.03
St. Dev.	3.16	7.21	4.43	5.90
Coef. Of Variation	60%	74%	63%	74%
Needed SS	14	17	14	17
% of Number of RP	35%	50%	42%	47%

Table 2. Summary of reference point statistics for volume of LWD (m^3) from four stream segments in WRIA 13.0028.000. Needed sample size (SS) is for a 95% confidence interval with ±25% relative (to the mean) precision

	Stream Segment Number (Survey Year)			
Parameter	10	19 (1992)	19 (1995)	31
Number of RP	41	34	33	37
Mean	5.99	6.15	5.23	3.09
St. Dev.	7.77	7.63	5.93	2.82
Coef. Of Variation	130%	124%	113%	91%
Needed SS	29	25	23	21
% of Number of RP	72%	73%	71%	58%

These data indicate that we need to sample about 40% to 50% of the reference points in a stream segment to estimate the: mean number of LWD pieces with ±25% relative precision for a 95% confidence interval and about 70% of the reference points in a Stream segment to estimate the mean volume of LWD per reference point with ±25% relative precision for a 95% confidence interval.

Sampling at a 50% rate can be easily implemented in the field and will result in a significant savings in survey time. This savings in time would allow more stream segments to be sampled. Sampling at a 75% rate is more difficult to implement and the time savings will be less. I examined the results of applying a 50% sampling rate to these four stream segments using a systematic random sample design, The design was implemented by randomly selecting one of the first two reference points as a starting point and sampling between every other reference point in the stream segment. Therefore, there were two possible systematic samples that could be drawn from each stream segment.

I evaluated the effectiveness of this sample design by comparing the total number of LWD pieces and total LWD volume estimated from the sampled reference points in the segment to the actual piece counts and volumes from the original surveys (which were censuses). I also calculated the precision of these estimates. The results are summarized in Tables 3 (for LWD piece counts) and 4 (for LWD volume). Statistics for both of the systematic samples possible are provided.

As expected, with a 50% sample rate precision goals (±25% for a 95% confidence interval) were met for the estimates of the total number of LWD pieces in the segment but not for the estimates of the total volume of LWD in the segment. The relative precision of the estimates of the total number of LWD pieces ranged from 19% to 29% and averaged 23%. The relative precision of the estimates of the total volume of LWD ranged from 29% to 53% and averaged 4.0%. The errors for the estimated totals for the segments were all less than about 20%. The mean absolute percent error of the estimates of the total number of LWD pieces ranged from 8% to 21% and averaged 12%. The mean absolute percent error of the estimates of the total volume of LWD ranged from 0% to 15% and averaged 8%.

Conclusion: These data indicate that a 50% systematic sample of long stream segments will provide estimates of the number of LWD pieces with a relative precision of at least ±25% for a 95% confidence interval. This standard will not be met for estimates of LWD volume. You need to decide if sampling more segments in the WAU is a good trade-off for the lower precision of the estimates of LWD volume obtained from sub-sampling. Making the confidence level less stringent by increasing cx to 10% will improve the relative precision of the estimates. However, it improves the relative precision (decreases the ±%) by only 3% to 5% for the estimates of the total number of LWD pieces and 5% to 9% for the estimates of the total volume of LWD. This is not enough of an improvement to meet our objective of ±25% relative precision for the estimated total volume of LWD.

Table 3. Summary of precision and accuracy of estimates of the number of LWD pieces from a 50% systematic sample of reference points from four stream segments in WRIA 13.0028.000.

Parameter	Stream Segment Number (Survey Year) 10	19 (1992)	19 (1995)	31
TRUE PIECE COUNT	217	332	233	297
SAMPLE 1:			17	
Number of RP	21	17	8.47	19
Mean	5.81	10.82		7.37
St. Dev.	3.56	X.69	5.21	4.88
Coef. Of Variation	61%	80%	62%	66%
Estimated Total	23X.2	368.0	279.5	272.6
St. Error	22.2	50.7	29.0	28.9
95% Cl Rel. Pre."	19.5%	29.1%	22.0%	22.2%
Error (in pieces)	21	36	47	-24
% Error (from true)	9.8%	10.8%	20.0%	-8.2%
SAMPLE 2:				
Number of RP	20	17	16	18
Mean	4.75	8.71	5.56	8.72
St. Dev.	2.67	5.42	2.87	6.90
Coef. Of Variation	56%	62%	52%	79%
Estimated Total	194.8	296.0	183.6	322.7
St. Error	17.5	31.6	17.0	43.1
95% CI Rel. Pre.[a]	18.7%	22.5%	19.6%	28.1%
Error (in pieces)	-22	-36	-49	26
% Error (from true)	-10.3%	-10.8%	-21.2%	8.7%

[a] Relative precision (relative to mean) of 95% confidence interval.

Table 4. Summary of precision and accuracy of estimates of the total volume of LWD from a SO% systematic sample of reference points from four stream segments in WRIA 13.0028.000.

Parameter	Stream Segment Number (Survey Year) 10	19 (1992)	19 (1995)	31
TRUE LWD VOLUME (m^3)	245.1	209.2	172.6	114.4
SAMPLE 1:				
Number of RP	21	17	17	19
Mean	6.68	7.07	5.23	3.25
St. Dev.	1.26	9.92	5.68	2.75
Coef. Of Variation	35%	140%	109%	86%
Estimated Total	273.7	240.5	172.5	120.1
St. Error	45.3	57.8	31.6	16.5
95% CI Rel. Pre.[a]	34.6%	50.7%	38.9%	28.8%
Error (in m^3)	27.9	31.3	0.0	5.7
% Error (from true)	11.4%	15.0%	0.0%	4.9%
SAMPLE 2:				
Number of RP	20	17	16	18
Mean	5.28	5.23	5.23	2.93
St. Dev.	8.41	4.45	6.38	2.93
Coef. Of Variation	159%	85%	122%	100%
Estimated Total	216.4	177.9	172.6	108.5
St. Error	55.2	26.8	37.8	17.9
95% CI Rel. Pre.[a]	53.0%	31.8%	46.2%	34.6%
Error (in m')	-29.3	-31.3	0.0	-6.0
% Error (from true)	-11.9%	-15.0%	0.0%	-5.2%

[a] Relative precision (relative to mean) of 95% confidence interval.

How many stream segments in a stratum should be sampled?

The data that Dave supplied did not have sufficient numbers of segments for analysis of any of the original strata. Therefore, I stratified by gradient and confinement class only (combining over stream order). This results in 13 strata for the Upper Coweeman WAU, three of which have only a single segment and two which have only two segments in them. With this restricted stratification, the stream segments in the Upper Coweeman WAU are distributed as follows:

	Confinement Class		
Gradient Class	Unconfined	Moderate	Confined
≤ 1%	1	0	6 (A)
>1% to ≤ 2%	4 (C)	1	9 (B)
>2% to ≤ 4%	2	4 (D)	6
>4% to ≤ 8%	1	17 (E)	13
>8% to ≤ 20%	0	2	25
Totals	8	24	59

The data Dave supplied had two or more segments for five of these strata (those that are shaded above). I analyzed the among-segment variation of these data. I used the same methods used to examine the variability among reference points.

Similarly to what was found for the reference point analysis, the LWD volume data is more variable that the LWD piece count data. Therefore, a higher fraction of the total population must be sampled to estimate LWD volumes compared to that required to estimate total LWD pieces with the same relative precision for a 95% confidence interval. For the total number of LWD pieces, about 50% to 75% (mean 58%) of the segments in a stratum needed to be sampled to meet our precision objectives (Table 5). For the total volume of LWD, about 70% to 100% (mean 85%) of the segments in a stratum needed to be sampled to meet our precision objectives (Table 6).

Table 5. Summary of stream segment statistics for mean number of LWD pieces per channel width lengths from stream segments in WRIAs 13 and 14, by strata. Needed sample size (SS) is for a 9.5% confidence interval with ±25% relative (to the mean) precision. Finite population adjustment applied to sample size requirements

	Stratum (see above)				
Parameter	A	B	C	D	E
Segments Sampled	4	2	10	6	3
Mean	2.03	0.87	0.92	0.50	0.45
St. Dev.	0.84	0.21	0.35	0.20	0.21
Coef. Of Variation	41%	24%	39%	40%	46%
Needed SS	4	3	3	3	7
% of Total Segments	67%	33%	75%	75%	41%

Table 6 Summary of stream segment statistics for mean volume (m^3) of LWD per channel width lengths from stream segments in WRIAs 13 and 14, by strata. Needed sample size (SS) is for a 95% confidence interval with ±25% relative (to the mean) precision. Finite population adjustment applied to sample size requirements.

	Stratum (see above)				
Parameter	A	B	C	D	E
Segments Sampled	4	2	10	6	3
Mean	1.05	0.89	0.58	0.35	0.28
St. Dev.	0.56	0.43	0.39	0.27	0.25
Coef. Of Variation	53%	48%	67%	77%	86%
Needed SS	4	6	4	4	7
% of Total Segments	83%	61%	100%	100%	76%

My Recommendations:

Based on the previous analyses: 1 recommend the following sample design.

Reduce the design to only two stratification parameters: stream gradient and stream confinement. The other proposed stratification schemes result in too many strata, many of which have only one or two stream segments In them. Given the limited number of segments you will be able to sample, there is nothing gained by all the additional strata

Use a 50% systematic sample design based on reference points in a stream segment to collect LWD data from sampled stream segments. Hopefully, using a 50% systematic sample design will allow you to increase your segment sample size by about 75% from the 38 stream segments you originally predicted you would be able to sample if entire segments were sampled.

Sample 75% of the segments in each stratum with more than four stream segments in it. Sample all four segments in those strata with a total of four segments. Do not sample strata with less than four segments. This would result in the following sample sizes for the stratification scheme based on stream gradient and stream confinement.

Number to Sample/Number Available to Sample

	Confinement Class		
Gradient Class	Unconfined	Moderate	Confined
≤ 1%	0/1	0/0	**5**/6
>1% to ≤ 2%	**4**/4	0/1	**7**/9
>2% to ≤ 4%	0/2	**4**/4	**5**/6
>4% to ≤ 8%	0/1	**13**/17	**10**/13
>8% to ≤ 20%	0/0	0/2	**19**/25
Totals	**4**/8	**17**/24	**46**/59

This results in 67 of the 91 segments (74%) identified in the Upper Coweeman WAU being sampled. If a 50% systematic sample design of reference points in a stream segment increases the projected number of segments that can be sampled by 75% (38 x 0.75 = 28), then 67 should be an achievable sample size goal for stream segments (38 + 28 = 66).

We can discuss this at our meeting on Friday (5/15).

Appendix B
Upper Coweennan Segment and Discharge Data

Available on request from the TPW Monitoring Program (360) 438-1180.

Appendix C
Upper Coweeman Reach Data

Available on request from the TPW Monitoring Program (360) 438-1180.

Appendix D

Upper Coweeman Baseline Lwd Data for Reaches Adjacent to Timber Harvest Uniits Planned by Weyerhaeuser for 1998 - 2002

Available on request from the TPW Monitoring Program (360) 438-l 180

Appendix B
Upper Coweeman Segment and Discharge Data

Stream Name	WRIA #	Segment #	Map Length (m)	Surveyed Length (m)	stratum	survey Date	Discharge (cfs)	Discharge Date
COWEEMAN RIVER	28.0003	0002	1490	1489	1C	8127198	27.62	9/1/98
COWEEMAN	26.0003	0004	2040	2100	1C	8/31/98	39.37	9/1/98
COWEEMAN	26.0003	0006	4850	4777	1C	9/1/98	23 6	9/1/98
UNNAMED	26.0100	0011	1210	1343	4M	8/26/98	0.43	9/1/98
UNNAMED	26.0098	0023	1050	1000	5C	9/16/98	0.94	9/15/98
UNNAMED	26.0096	0037	230	170	5C	8/24/98		
UNNAMED	26.0096	0038	670	800	4M	8/24/98	0.64	8125198
UNNAMED	26.0096	0040	1440	1144	4C	8/25/98		
UNNAMED	26.0093	0050	1100	650	4M	9/3/98	0.24	9/10/98
SAM SMITH CRK	26.0083	0060	1040	1044	5C	8/20/98	0.3	8125198
BLACKMAN CRK	26.0081	0069	540	265	5C	8120198		
MULHOLLAND	26.0084	0103	860	883	2M	3/8/98	5.52	8/4/98
MULHOLLAND	26.0084	0104	1410	1350	3c	8/4/98	5.02	8/12/98
MULHOLLAND CRK	26.0084	0105	1200	1300	3C	8/7/98		
MULHOLLAND CRK	26.0084	0106	560	550	2C	8/11/98		
MULHOLLAND CRK	26.0084	0107	1740	1800	1U	8/17/98	2.53	8/25/98
MULHOLLAND CRK TRIB	26.0084T	0125	1320	837	4U	8/24/98	0.37	8125198
MULHOLLAND CRK TRIB	26.0084T	0138	750	817	4C	8/12/98		
MULHOLLAND TRIB	26.0084T	0146	1430	1470	5C	8/5/98	0.17	8/12/98
MULHOLLAND CRK TRIB	26.0084T	0150	370	372	4C	8125198		
BAIRD	26.0101	0201	1190	1157	3C	7/8/98	10.33	7/14/98
BAIRD	26.0101	0203	500	524	2C	7129198	5.41	8/4/98
LITTLE BAIRD	26.0103	0224	270	273	5C	7/28/98		
LITTLE BAIRD	26.0103	0225	430	464	4C	7/28/98	0.74	8/4/98
BAIRD CRK. TRIB.	26.0101T	0243	520	549	5M	7/14/98	0.51	7/14/98
NINETEEN	26.0105	0250	980	846	2U	7/13/98	2.61	7/14/98
COWEEMAN	26.0003	0300	1880	1894	2U	7/23/98	33.34	7/28/98
COWEEMAN	26.0003	0301	430	371	2C	7/6/98	31.34	7/14/98
COWEEMAN	26.0003	0303	940	947	2U	7/16/98	17.17	7/28/98
COWEEMAN	26.0003	0304	1310	958	2C	7/16/98	23.78	7/23/98
COWEEMAN	26.0003	0305	1770	2142	2C	7/20/98	14.28	7123198
COWEEMAN	26.0003	0306	2160	2328	3C	7/22/98	12.12	7/23/98
"NAMED	26.0112	0322	840	900	5C	9/14/98	0.92	9115198
BROWN	26.0108	0328	940	994	4M	7/30/98	1.06	8/4/98
BROWN TRIB.	26.0108T	0333	820	800	5C	7/30/98	0.36	8/4/98
BROWN CRK. TRIB.	26.0108T	0333				9122198	survey of upper reaches	
BROWN CRK TRIB	26.0108T	0338	410	430	4C	8/3/98	0.85	8/4/98
SKIPPER	26.0107	0346	540	1005	3U	7/7/98	1.66	7/14/98
SKIPPER	26.0107	0347	620	653	4M	7/7/98	1.24	7/14/98
SKIPPER TRIB.	26.0107T	0353	870	539	4M	7/13/98	0.72	7/14/98
ONEIL CRK	26.0109	0361	410	400	5C	8/18/98		
ONEIL CRK	26.0109	0362	1250	1161	3M	8/19/98	1.08	8/25/98
ONEIL CRK TRIB	26.0109T	0372	570	600	4M	9/8/98	0.57	9/10/98
COWEEMAN RIVER	26.0003	0401	1240	1200	3M	9/10/98	0.9	9/10/98
COWEEMAN	26.0003	0403	1070	1078	5C	8/13/98	0.29	8/12/98
COWEEMAN	26.0003	0406	1190	1237	5C	8/14/98	0.08	8125198
COW. RI". TRIB	26.0003T	0413	1370	1349	4M	9/9/98	0.8	9/10/98
cow. RI". TRIB	26.003T	0414	790	842	5C	9/9/98		
cow. RI". TRIB.	26.0003T	0423	1660	1744	4C	9/15/98	0.72	9/15/98
BUTLER	26.0115	0460	570	700	4M	7/27/98	3.11	7/28/98
BUTLER	26.0115	0461	830	900	5C	7/28/98	3.11	7/28/98
BUTLER	26.0115	0476	300	184	4C	7/28/98		

Appendix C
Upper Coweeman Reach Data

Reference Point #	Average Bankfull Width (m)	Reach Length (m)	Comment Reference
0002-00	18.9	100	
0002-02	20.8	100	
0002-04	18.7	100	
0002-06	21.4	100	
0002-08	22.5	100	
0002-1"	24.55	100	
0002-12	30.1	100	
0002-14	21.85	89.1	
0004-00	16.9	100	
0004-02	22.25	100	
0004-04	21.2	100	
0004-06	21.1	100	
0004-08	20.8	100	
0004-10	18.85	100	
0004-12	21.35	100	
0004-14	23.5	100	
0004-16	20.9	100	
0004-18	20.8	100	
0004-20	23.45	100	
0006-00	19.3	100	
0006-02	17.45	100	
0006-04	18.05	100	
0006-06	15.65	100	
0006-08	19.5	100	
0006-10	17.75	100	
0006-12	17.1	100	
0006-14	21.65	100	
0006-16	12.25	100	
0006-18	12	100	
0006-20	15.9	100	
0006-22	21.45	100	
0006-24	21.8	100	
0006-26	20.65	100	
0006-28	19.9	100	
0006-30	16.2	100	
0006-32	17.25	100	
0006-34	20.3	100	
0006-X	14.65	100	
0006-38	15.5	100	
0006-40	17.65	100	
0006-42	12.55	100	
0006-44	17.25	100	
0006-46	22.45	100	
0011-00	3.15	100	
0011-02	2.6	100	
0011-04	2.75	100	
0011-06	2.7	100	
0011-08	3.1	100	
0011-10	4.1	100	NO BW, BEAVER POND
0011-12	3.55	100	
0023-01	3.35	100	
0023-03	4	100	
0023-05	3.85	100	
0023-07	2.8	100	
0023-09	3.9	100	
0037-00	3.05	100	
0038-00	3.35	100	
0038-02	3.4	100	

APPENDIX C - UPPER COWEEMAN REACH DATA

	SINGLE LOGS AND ROOTWADS					
	Zone 1		Zone 2		Total	
Reference Point #	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW
0002-00	0.19	0.00	0.00	0.00	0.19	0.00
0002-02	0.00	0.00	0.00	0.00	0.00	0.00
0002-04	0.19	0.00	0.75	0.00	0.94	0.00
0002-06	0.00	0.00	0.64	0.00	0.64	0.00
0002-08	0.90	0.00	0.23	0.00	1.13	0.00
0002-10	0.00	0.00	0.49	0.00	0.49	0.00
0002-12	0.60	0.00	0.30	0.00	0.90	0.00
0002-14	0.00	0.00	0.00	0.00	0.00	0.00
0004-00	0.17	0.00	0.17	0.00	0.34	0.00
0004-02	0.00	0.00	0.67	0.00	0.67	0.00
0004-04	0.21	0.00	0.21	0.00	0.42	0.00
0004-06	0.00	0.00	0.42	0.00	0.42	0.00
0004-08	0.42	0.00	0.42	0.00	0.83	0.00
0004-10	0.19	0.00	1.13	0.00	1.32	0.00
0004-12	1.07	0.00	0.43	0.00	1.49	0.00
0004-14	0.24	0.00	0.24	0.00	0.47	0.00
0004-16	1.05	0.00	1.25	0.00	2.30	0.00
0004-18	0.00	0.00	0.00	0.00	0.00	0.00
0004-20	0.23	0.00	0.47	0.00	0.70	0.00
0006-00	1.16	0.00	0.58	0.00	1.74	0.00
0006-02	0.00	0.00	0.52	0.00	0.52	0.00
0006-04	0.00	0.00	0.00	0.00	0.00	0.00
0006-06	0.31	0.00	0.00	0.00	0.31	0.00
0006-08	0.00	0.00	0.20	0.00	0.20	0.00
0006-10	0.53	0.00	0.00	0.00	0.53	0.00
0006-12	0.34	0.00	0.34	0.00	0.68	0.00
0006-14	0.65	0.00	0.00	0.00	0.65	0.00
0006-16	0.00	0.00	0.00	0.00	0.00	0.00
0006-18	0.00	0.00	0.00	0.00	0.00	0.00
0006-20	0.32	0.00	0.48	0.00	0.80	0.00
0006-22	0.21	0.00	0.86	0.00	1.07	0.00
0006-24	0.65	0.00	1.09	0.00	1.74	0.00
0006-26	0.83	0.00	0.62	0.00	1.45	0.00
0006-28	0.80	0.00	0.40	0.00	1.19	0.00
0006-30	0.16	0.00	0.81	0.00	0.97	0.00
0006-32	0.17	0.00	0.00	0.00	0.17	0.00
0006-34	0.61	0.00	0.61	0.00	1.22	0.00
0006-36	0.00	0.00	0.00	0.00	0.00	0.00
0006-38	0.00	0.00	0.16	0.00	0.16	0.00
0006-40	0.35	0.00	0.18	0.00	0.53	0.00
0006-42	0.13	0.00	0.00	0.00	0.13	0.00
0006-44	0.17	0.00	0.00	0.00	0.17	0.00
0006-46	0.45	0.00	0.67	0.00	1.12	0.00
0011-00	0.00	0.00	0.06	0.00	0.06	0.00
0011-02	0.10	0.00	0.18	0.00	0.29	0.00
0011-04	0.17	0.00	0.08	0.00	0.25	0.00
0011-06	0.05	0.00	0.03	0.00	0.08	0.00
0011-08	0.03	0.00	0.22	0.00	0.25	0.00
0011-10	0.66	0.12	0.33	0.00	0.98	0.12
0011-12	0.96	0.07	0.21	0.00	1.17	0.07
0023-01	0.67	0.10	0.10	0.00	0.77	0.10
0023-03	0.56	0.00	0.20	0.00	0.76	0.00
0023-05	0.42	0.12	0.31	0.08	0.73	0.19
0023-07	0.31	0.00	0.06	0.00	0.36	0.00
0023-09	0.59	0.12	0.00	0.00	0.59	0.12
0037-00	0.09	0.00	0.03	0.00	0.12	0.00
0038-00	0.23	0.03	0.20	0.00	0.44	0.03
0038-02	0.03	0.00	0.10	0.00	0.14	0.00

APPENDIX C - UPPER COWEEMAN REACH DATA

Reference Point #	JAMS Zone 1 Pieces/CW	JAMS Zone 1 Key Pieces/CW	JAMS Zone 2 Pieces/CW	JAMS Zone 2 Key Pieces/CW	Total Pieces/CW	Total Key Pieces/CW
0002-00	4.16	0.00	0.00	0.00	4.16	0.00
0002-02	0.00	0.00	8.11	0.00	8.11	0.00
0002-04	2.24	0.00	0.00	0.00	2.24	0.00
0002-06	9.42	0.00	0.00	0.00	9.42	0.00
0002-08	0.00	0.00	0.00	0.00	0.00	0.00
0002-10	0.00	0.00	0.00	0.00	0.00	0.00
0002-12	0.00	0.00	0.00	0.00	0.00	0.00
0002-14	0.00	0.00	0.00	0.00	0.00	0.00
0004-00	5.75	0.00	0.00	0.00	5.75	0.00
0004-02	0.00	0.00	0.00	0.00	0.00	0.00
0004-04	0.00	0.00	0.00	0.00	0.00	0.00
0004-06	0.00	0.00	0.00	0.00	0.00	0.00
0004-08	0.00	0.00	0.00	0.00	0.00	0.00
0004-10	0.00	0.00	0.00	0.00	0.00	0.00
0004-12	0.00	0.00	0.00	0.00	0.00	0.00
0004-14	0.00	0.00	0.00	0.00	0.00	0.00
0004-16	0.00	0.00	0.00	0.00	0.00	0.00
0004-18	0.00	0.00	0.00	0.00	0.00	0.00
0004-20	0.00	0.00	0.00	0.00	0.00	0.00
0006-00	0.00	0.00	0.00	0.00	0.00	0.00
0006-02	0.00	0.00	0.00	0.00	0.00	0.00
0006-04	0.00	0.00	0.00	0.00	0.00	0.00
0006-06	0.00	0.00	0.00	0.00	0.00	0.00
0006-08	0.00	0.00	0.00	0.00	0.00	0.00
0006-10	0.00	0.00	0.00	0.00	0.00	0.00
0006-12	0.00	0.00	0.00	0.00	0.00	0.00
0006-14	0.00	0.00	0.00	0.00	0.00	0.00
0006-16	0.00	0.00	0.00	0.00	0.00	0.00
0006-18	0.00	0.00	0.00	0.00	0.00	0.00
0006-20	0.00	0.00	0.00	0.00	0.00	0.00
0006-22	0.00	0.00	0.00	0.00	0.00	0.00
0006-24	0.00	0.00	0.00	0.00	0.00	0.00
0006-26	0.00	0.00	0.00	0.00	0.00	0.00
0006-28	3.78	0.00	0.00	0.00	3.78	0.00
0006-30	0.00	0.00	0.00	0.00	0.00	0.00
0006-32	3.28	0.00	0.00	0.00	3.28	0.00
0006-34	0.00	0.00	0.00	0.00	0.00	0.00
0006-36	0.00	0.00	0.00	0.00	0.00	0.00
0006-38	0.00	0.00	0.00	0.00	0.00	0.00
0006-40	0.00	0.00	0.00	0.00	0.00	0.00
0006-42	0.00	0.00	0.00	0.00	0.00	0.00
0006-44	0.00	0.00	0.00	0.00	0.00	0.00
0006-46	0.00	0.00	0.00	0.00	0.00	0.00
0011-00	0.00	0.00	0.00	0.00	0.00	0.00
0011-02	0.00	0.00	0.00	0.00	0.00	0.00
0011-04	0.00	0.00	0.00	0.00	0.00	0.00
0011-06	0.00	0.00	0.00	0.00	0.00	0.00
0011-08	0.00	0.00	0.00	0.00	0.00	0.00
0011-10	0.00	0.00	0.00	0.00	0.00	0.00
0011-12	0.00	0.00	0.00	0.00	0.00	0.00
0023-01	2.18	0.23	0.00	0.00	2.18	0.23
0023-03	2.80	0.32	0.00	0.00	2.80	0.32
0023-05	2.66	0.04	0.00	0.00	2.66	0.04
0023-07	2.13	0.22	0.00	0.00	2.13	0.22
0023-09	2.15	0.12	0.00	0.00	2.15	0.12
0037-00	0.00	0.00	0.00	0.00	0.00	0.00
0038-00	0.00	0.00	0.00	0.00	0.00	0.00
0038-02	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX C - UPPER COWEEMAN REACH DATA

	Total LWD Pieces					
	Zone 1		Zone 2		Total	
Reference Point #	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW
0002-00	4.35	0.00	0.00	0.00	4.35	0.00
0002-02	0.00	0.00	8.11	0.00	8.11	0.00
0002-04	2.43	0.00	0.75	0.00	3.18	0.00
0002-06	9.42	0.00	0.64	0.00	10.06	0.00
0002-08	0.90	0.00	0.23	0.00	1.13	0.00
0002-10	0.00	0.00	0.49	0.00	0.49	0.00
0002-12	0.60	0.00	0.30	0.00	0.90	0.00
0002-14	0.00	0.00	0.00	0.00	0.00	0.00
0004-00	5.92	0.00	0.17	0.00	6.08	0.00
0004-02	0.00	0.00	0.67	0.00	0.67	0.00
0004-04	0.21	0.00	0.21	0.00	0.42	0.00
0004-06	0.00	0.00	0.42	0.00	0.42	0.00
0004-08	0.42	0.00	0.42	0.00	0.83	0.00
0004-10	0.19	0.00	1.13	0.00	1.32	0.00
0004-12	1.07	0.00	0.43	0.00	1.49	0.00
0004-14	0.24	0.00	0.24	0.00	0.47	0.00
0004-16	1.05	0.00	1.25	0.00	2.30	0.00
0004-18	0.00	0.00	0.00	0.00	0.00	0.00
0004-20	0.23	0.00	0.47	0.00	0.70	0.00
0006-00	1.16	0.00	0.58	0.00	1.74	0.00
0006-02	0.00	0.00	0.52	0.00	0.52	0.00
0006-04	0.00	0.00	0.00	0.00	0.00	0.00
0006-06	0.31	0.00	0.00	0.00	0.31	0.00
0006-08	0.00	0.00	0.20	0.00	0.20	0.00
0006-10	0.53	0.00	0.00	0.00	0.53	0.00
0006-12	0.34	0.00	0.34	0.00	0.68	0.00
0006-14	0.65	0.00	0.00	0.00	0.65	0.00
0006-16	0.00	0.00	0.00	0.00	0.00	0.00
0006-18	0.00	0.00	0.00	0.00	0.00	0.00
0006-20	0.32	0.00	0.48	0.00	0.80	0.00
0006-22	0.21	0.00	0.86	0.00	1.07	0.00
0006-24	0.65	0.00	1.09	0.00	1.74	0.00
0006-26	0.83	0.00	0.62	0.00	1.45	0.00
0006-28	4.58	0.00	0.40	0.00	4.98	0.00
0006-30	0.16	0.00	0.81	0.00	0.97	0.00
0006-32	3.45	0.00	0.00	0.00	3.45	0.00
0006-34	0.61	0.00	0.61	0.00	1.22	0.00
0006-36	0.00	0.00	0.00	0.00	0.00	0.00
0006-38	0.00	0.00	0.16	0.00	0.16	0.00
0006-40	0.35	0.00	0.18	0.00	0.53	0.00
0006-42	0.13	0.00	0.00	0.00	0.13	0.00
0006-44	0.17	0.00	0.00	0.00	0.17	0.00
0006-46	0.45	0.00	0.67	0.00	1.12	0.00
0011-00	0.00	0.00	0.06	0.00	0.06	0.00
0011-02	0.10	0.00	0.18	0.00	0.29	0.00
0011-04	0.17	0.00	0.08	0.00	0.25	0.00
0011-06	0.05	0.00	0.03	0.00	0.08	0.00
0011-08	0.03	0.00	0.22	0.00	0.25	0.00
0011-10	0.66	0.12	0.33	0.00	0.98	0.12
0011-12	0.96	0.07	0.21	0.00	1.17	0.07
0023-01	2.85	0.34	0.10	0.00	2.95	0.34
0023-03	3.36	0.32	0.20	0.00	3.56	0.32
0023-05	3.08	0.15	0.31	0.08	3.39	0.23
0023-07	2.44	0.22	0.06	0.00	2.49	0.22
0023-09	2.73	0.23	0.00	0.00	2.73	0.23
0037-00	0.09	0.00	0.03	0.00	0.12	0.00
0038-00	0.23	0.03	0.20	0.00	0.44	0.03
0038-02	0.03	0.00	0.10	0.00	0.14	0.00

APPENDIX C - UPPER COWEEMAN REACH DATA

	Riparian Data			
	Left Bank		Right Bank	
Reference Point #	Riparian Condition Class	Near-term Recruitment Class	Riparian Condition Class	Near-term Recruitment Class
0002-00	MMD	H	MMD	H
0002-02	MMD	H	MMD	H
0002-04	MMD	H	MMD	H
0002-06	MMD	H		H
0002-08	MMD	H	MMD	H
0002-10	MMD	H	MMD	H
0002-12	MMD	H	MMD	H
0002-14	MMD	H	MMD	H
0004-00	MMD	H	MMD	H
0004-02	MMD	H	MMD	H
0004-04	MMD	H	MMD	H
0004-06	MMD	H	MMD	H
0004-08	MMD	H	MMD	H
0004-10	MMD	H	MMD	H
0004-12	MMD	H	MMD	H
0004-14	MMD	H	MMD	H
0004-16	DMD	M	DMD	M
0004-18	DMD	M	DMD	M
0004-20	DMD	M	DMD	M
0006-00	DMD	M	DMD	M
0006-02	DMD	M	DMD	M
0006-04	DMD	M	DMD	M
0006-06	DMD	M	DMD	M
0006-08	DMD	M	DMD	M
0006-10	DMD	M	DMD	M
0006-12	DMD	M	DMD	M
0006-14	DMD	M	DMD	M
0006-16	DMD	M	DMD	M
0006-18	DMD	M	DMD	M
0006-20	DSD	L	DMD	M
0006-22	DMD	M	DMD	M
0006-24	DMD	M	DMD	M
0006-26	DMD	M	DMD	M
0006-28	DMD	M	DMD	M
0006-30	DMD	M	DMD	M
0006-32	DMD	M	DMD	M
0006-34	DMD	M	DMD	M
0006-36	MMD	H	MMD	H
0006-38	DMD	M	DMD	M
0006-40	DMD	M	DMD	M
0006-42	DMD	M	DMD	M
0006-44	DMD	M	DMD	M
0006-46	DMD	M	DMD	M
0011-00	DMD	M	DMD	M
0011-02	MMD	H	MMD	H
0011-04	MMD	H	MMD	H
0011-06	MMD	H	MMD	H
0011-08	MMD	H	MMD	H
0011-10		H	MMD	H
0011-12	MMD	H	MMD	H
0023-01	MSD	L	MSD	L
0023-03	MSD	L	MSD	L
0023-05	MSD	L	MSD	L
0023-07	MSD	L	MSD	L
0023-09	MSD	L	MSD	L
0037-00	DMD	M	DMD	M
0038-00	DSD	L	DSD	L
0038-02		L	DSD	L

Reference Point #	Average Bankfull Width (m)	Reach Length (m)	Comment Reference
0038-04	2.85	100	
0038-06	3.1	100	
0040-01	1.9	100	
0040-03	2.55	100	
0040-05	1.55	100	
0040-07	2.05	100	
0040-09	1.7	100	
0040-11	2.5	44	
0050-01	2.8	100	
0050-03	2.75	100	
0050-05	2.3	100	
0060-01	3.05	100	
0060-03	2.4	100	
0060-05	1.35	100	
0060-07	2.5	100	
0060-09	2.3	100	WETLAND,50M TO END
0069-01	1.95	100	
0069-03	1.3	65	EXTREMELY BRUSHY
0103-01	10.25	100	
0103-03	11.8	100	
0103-05	9.2	100	
0103-07	11.75	100	
0104-00	9.9	100	
0104-02	9.75	100	
0104-04	13.25	100	
0104-06	12.05	100	
0104-08	10.95	100	
0104-10	12.15	100	
0104-12	10.1	100	
0105-01	11.1	100	
0105-03	8.95	100	
0105-05	9.05	100	
0105-07	8.7	100	
0105-09	8.3	100	
0105-11	7.3	100	
0106-00	8.7	100	
0106-02	6.1	100	
0106-04	11.1	100	
0107-00	8.95	100	
0107-02	11.45	100	
0107-04	10.45	100	
0107-06	10.35	100	
0107-08	10.2	100	
0107-10	3.5	100	
0107-12	3.45	100	
0107-14	6.15	100	
0107-16	16.15	100	
0125-01	2.95	100	
0125-03	2.5	100	
0125-05	2.9	100	
0125-07	2.5	100	
0138-00	5.75	100	
0138-02	4.95	100	
0138-04	4.55	100	
0138-06	5.1	100	
0138-08	6.1	17.4	
0146-01	3.95	100	

APPENDIX C - UPPER COWEEMAN REACH DATA

	SINGLE LOGS AND ROOTWADS					
	Zone 1		Zone 2		Total	
Reference Point #	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW
0038-04	0.09	0.00	0.03	0.00	0.11	0.00
0038-06	0.12	0.00	0.12	0.03	0.25	0.03
0040-01	0.15	0.00	0.02	0.00	0.17	0.00
0040-03	0.23	0.03	0.15	0.00	0.38	0.03
0040-05	0.06	0.00	0.00	0.00	0.06	0.00
0040-07	0.21	0.00	0.04	0.00	0.25	0.00
0040-09	0.19	0.03	0.00	0.00	0.19	0.03
0040-11	0.28	0.11	0.11	0.00	0.40	0.11
0050-01	0.08	0.00	0.08	0.00	0.17	0.00
0050-03	0.30	0.03	0.11	0.03	0.41	0.06
0050-05	0.37	0.09	0.21	0.00	0.58	0.09
0060-01	0.15	0.00	0.06	0.00	0.21	0.00
0060-03	0.02	0.00	0.14	0.00	0.17	0.00
0060-05	0.07	0.00	0.00	0.00	0.07	0.00
0060-07	0.18	0.00	0.03	0.00	0.20	0.00
0060-09	0.07	0.00	0.05	0.00	0.12	0.00
0069-01	0.20	0.00	0.08	0.00	0.27	0.00
0069-03	0.00	0.00	0.00	0.00	0.00	0.00
0103-01	0.21	0.00	0.51	0.00	0.72	0.00
0103-03	0.24	0.00	0.12	0.00	0.35	0.00
0103-05	0.37	0.09	0.00	0.00	0.37	0.09
0103-07	0.24	0.00	0.47	0.12	0.71	0.12
0104-00	0.10	0.00	0.40	0.00	0.50	0.00
0104-02	0.49	0.10	0.20	0.00	0.68	0.10
0104-04	0.13	0.00	0.13	0.00	0.27	0.00
0104-06	0.60	0.12	0.60	0.00	1.21	0.12
0104-08	1.97	0.00	0.66	0.00	2.63	0.00
0104-10	0.61	0.00	0.73	0.00	1.34	0.00
0104-12	0.61	0.00	0.91	0.00	1.52	0.00
0105-01	0.00	0.00	0.67	0.00	0.67	0.00
0105-03	0.72	0.09	0.45	0.00	1.16	0.09
0105-05	0.45	0.00	0.45	0.00	0.91	0.00
0105-07	0.52	0.00	0.44	0.00	0.96	0.00
0105-09	0.08	0.00	0.42	0.00	0.50	0.00
0105-11	0.29	0.00	1.10	0.00	1.39	0.00
0106-00	0.26	0.09	0.26	0.00	0.52	0.09
0106-02	0.55	0.12	0.61	0.00	1.16	0.12
0106-04	1.11	0.00	0.67	0.00	1.78	0.00
0107-00	0.27	0.00	0.27	0.00	0.54	0.00
0107-02	2.29	0.11	1.60	0.00	3.89	0.11
0107-04	0.31	0.10	0.73	0.00	1.05	0.10
0107-06	0.93	0.10	0.10	0.00	1.04	0.10
0107-08	0.10	0.10	0.82	0.00	0.92	0.10
0107-10	0.25	0.04	0.25	0.00	0.49	0.04
0107-12	0.31	0.00	0.41	0.03	0.72	0.03
0107-14	0.37	0.00	0.18	0.06	0.55	0.06
0107-16	2.26	0.00	1.78	0.00	4.04	0.00
0125-01	0.41	0.03	0.24	0.03	0.65	0.06
0125-03	0.28	0.00	0.35	0.00	0.63	0.00
0125-05	0.32	0.00	0.09	0.00	0.41	0.00
0125-07	0.33	0.00	0.33	0.03	0.65	0.03
0138-00	0.23	0.00	0.17	0.00	0.40	0.00
0138-02	0.45	0.00	0.40	0.05	0.84	0.05
0138-04	0.50	0.00	0.59	0.05	1.09	0.05
0138-06	0.46	0.05	0.46	0.05	0.92	0.10
0138-08	0.00	0.00	0.35	0.35	0.35	0.35
0146-01	0.40	0.04	0.71	0.08	1.11	0.12

APPENDIX C - UPPER COWEEMAN REACH DATA

Reference Point #	Zone 1 Pieces/CW	Zone 1 Key Pieces/CW	JAMS Zone 2 Pieces/CW	JAMS Zone 2 Key Pieces/CW	Total Pieces/CW	Total Key Pieces/CW
0038-04	0.00	0.00	0.00	0.00	0.00	0.00
0038-06	0.00	0.00	0.00	0.00	0.00	0.00
0040-01	0.00	0.00	0.00	0.00	0.00	0.00
0040-03	0.26	0.03	0.00	0.00	0.26	0.03
0040-05	0.00	0.00	0.00	0.00	0.00	0.00
0040-07	0.00	0.00	0.00	0.00	0.00	0.00
0040-09	0.00	0.00	0.00	0.00	0.00	0.00
0040-11	0.00	0.00	0.00	0.00	0.00	0.00
0050-01	0.00	0.00	0.00	0.00	0.00	0.00
0050-03	0.00	0.00	0.00	0.00	0.00	0.00
0050-05	0.00	0.00	0.00	0.00	0.00	0.00
0060-01	0.00	0.00	0.00	0.00	0.00	0.00
0060-03	1.25	0.38	0.00	0.00	1.25	0.38
0060-05	0.00	0.00	0.00	0.00	0.00	0.00
0060-07	0.00	0.00	0.00	0.00	0.00	0.00
0060-09	0.00	0.00	0.00	0.00	0.00	0.00
0069-01	0.00	0.00	0.00	0.00	0.00	0.00
0069-03	0.00	0.00	0.00	0.00	0.00	0.00
0103-01	0.00	0.00	0.00	0.00	0.00	0.00
0103-03	0.00	0.00	0.00	0.00	0.00	0.00
0103-05	0.00	0.00	0.00	0.00	0.00	0.00
0103-07	0.00	0.00	0.00	0.00	0.00	0.00
0104-00	0.00	0.00	0.00	0.00	0.00	0.00
0104-02	0.00	0.00	0.00	0.00	0.00	0.00
0104-04	2.25	0.13	0.00	0.00	2.25	0.13
0104-06	2.29	0.12	0.00	0.00	2.29	0.12
0104-08	0.00	0.00	0.00	0.00	0.00	0.00
0104-10	2.92	0.00	0.00	0.00	2.92	0.00
0104-12	0.00	0.00	0.00	0.00	0.00	0.00
0105-01	0.00	0.00	0.00	0.00	0.00	0.00
0105-03	0.00	0.00	0.00	0.00	0.00	0.00
0105-05	0.00	0.00	0.00	0.00	0.00	0.00
0105-07	0.00	0.00	0.00	0.00	0.00	0.00
0105-09	1.08	0.00	0.00	0.00	1.08	0.00
0105-11	0.00	0.00	0.00	0.00	0.00	0.00
0106-00	18.88	0.44	0.00	0.00	18.88	0.44
0106-02	0.00	0.00	0.00	0.00	0.00	0.00
0106-04	5.33	0.00	0.00	0.00	5.33	0.00
0107-00	11.81	0.00	0.00	0.00	11.81	0.00
0107-02	0.00	0.00	0.00	0.00	0.00	0.00
0107-04	0.00	0.00	0.00	0.00	0.00	0.00
0107-06	0.00	0.00	0.00	0.00	0.00	0.00
0107-08	8.26	0.31	0.00	0.00	8.26	0.31
0107-10	0.00	0.00	0.00	0.00	0.00	0.00
0107-12	0.72	0.00	0.00	0.00	0.72	0.00
0107-14	0.00	0.00	0.00	0.00	0.00	0.00
0107-16	16.00	0.00	0.00	0.00	16.00	0.00
0125-01	0.00	0.00	0.00	0.00	0.00	0.00
0125-03	0.00	0.00	0.00	0.00	0.00	0.00
0125-05	0.00	0.00	0.00	0.00	0.00	0.00
0125-07	0.00	0.00	0.00	0.00	0.00	0.00
0138-00	2.70	0.17	0.00	0.00	2.70	0.17
0138-02	0.00	0.00	0.00	0.00	0.00	0.00
0138-04	1.32	0.05	0.00	0.00	1.32	0.05
0138-06	0.00	0.00	0.00	0.00	0.00	0.00
0138-08	0.00	0.00	0.00	0.00	0.00	0.00
0146-01	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX C - UPPER COWEEMAN REACH DATA

Reference Point #	Total LWD Pieces Zone 1 Pieces/CW	Zone 1 Key Pieces/CW	Zone 2 Pieces/CW	Zone 2 Key Pieces/CW	Total Pieces/CW	Total Key Pieces/CW
0038-04	0.09	0.00	0.03	0.00	0.11	0.00
0038-06	0.12	0.00	0.12	0.03	0.25	0.03
0040-01	0.15	0.00	0.02	0.00	0.17	0.00
0040-03	0.48	0.05	0.15	0.00	0.64	0.05
0040-05	0.06	0.00	0.00	0.00	0.06	0.00
0040-07	0.21	0.00	0.04	0.00	0.25	0.00
0040-09	0.19	0.03	0.00	0.00	0.19	0.03
0040-11	0.28	0.11	0.11	0.00	0.40	0.11
0050-01	0.08	0.00	0.08	0.00	0.17	0.00
0050-03	0.30	0.03	0.11	0.03	0.41	0.06
0050-05	0.37	0.09	0.21	0.00	0.58	0.09
0060-01	0.15	0.00	0.06	0.00	0.21	0.00
0060-03	1.27	0.38	0.14	0.00	1.42	0.38
0060-05	0.07	0.00	0.00	0.00	0.07	0.00
0060-07	0.18	0.00	0.03	0.00	0.20	0.00
0060-09	0.07	0.00	0.05	0.00	0.12	0.00
0069-01	0.20	0.00	0.08	0.00	0.27	0.00
0069-03	0.00	0.00	0.00	0.00	0.00	0.00
0103-01	0.21	0.00	0.51	0.00	0.72	0.00
0103-03	0.24	0.00	0.12	0.00	0.35	0.00
0103-05	0.37	0.09	0.00	0.00	0.37	0.09
0103-07	0.24	0.00	0.47	0.12	0.71	0.12
0104-00	0.10	0.00	0.40	0.00	0.50	0.00
0104-02	0.49	0.10	0.20	0.00	0.68	0.10
0104-04	2.39	0.13	0.13	0.00	2.52	0.13
0104-06	2.89	0.24	0.60	0.00	3.49	0.24
0104-08	1.97	0.00	0.66	0.00	2.63	0.00
0104-10	3.52	0.00	0.73	0.00	4.25	0.00
0104-12	0.61	0.00	0.91	0.00	1.52	0.00
0105-01	0.00	0.00	0.67	0.00	0.67	0.00
0105-03	0.72	0.09	0.45	0.00	1.16	0.09
0105-05	0.45	0.00	0.45	0.00	0.91	0.00
0105-07	0.52	0.00	0.44	0.00	0.96	0.00
0105-09	1.16	0.00	0.42	0.00	1.58	0.00
0105-11	0.29	0.00	1.10	0.00	1.39	0.00
0106-00	19.14	0.52	0.26	0.00	19.40	0.52
0106-02	0.55	0.12	0.61	0.00	1.16	0.12
0106-04	6.44	0.00	0.67	0.00	7.10	0.00
0107-00	12.08	0.00	0.27	0.00	12.35	0.00
0107-02	2.29	0.11	1.60	0.00	3.89	0.11
0107-04	0.31	0.10	0.73	0.00	1.05	0.10
0107-06	0.93	0.10	0.10	0.00	1.04	0.10
0107-08	8.36	0.41	0.82	0.00	9.18	0.41
0107-10	0.25	0.04	0.25	0.00	0.49	0.04
0107-12	1.04	0.00	0.41	0.03	1.45	0.03
0107-14	0.37	0.00	0.18	0.06	0.55	0.06
0107-16	18.26	0.00	1.78	0.00	20.03	0.00
0125-01	0.41	0.03	0.24	0.03	0.65	0.06
0125-03	0.28	0.00	0.35	0.00	0.63	0.00
0125-05	0.32	0.00	0.09	0.00	0.41	0.00
0125-07	0.33	0.00	0.33	0.03	0.65	0.03
0138-00	2.93	0.17	0.17	0.00	3.11	0.17
0138-02	0.45	0.00	0.40	0.05	0.84	0.05
0138-04	1.82	0.05	0.59	0.05	2.41	0.09
0138-06	0.46	0.05	0.46	0.05	0.92	0.10
0138-08	0.00	0.00	0.35	0.35	0.35	0.35
0146-01	0.40	0.04	0.71	0.08	1.11	0.12

APPENDIX C - UPPER COWEEMAN REACH DATA

	Riparian Data			
	Left Bank		Right Bank	
Reference Point #	Riparian Condition Class	Near-term Recruitment Class	Riparian Condition Class	Near-term Recruitment Class
0038-04	DSD	L	DSD	L
0038-06	DSD	L	DSD	L
0040-01	DSD	L	DSD	L
0040-03	DSD	L	DSD	L
0040-05	DMD	M		M
0040-07	DMD	M	MMD	H
0040-09	DMD	M	DMD	M
0040-11	DMD	M	DMD	M
0050-01	MSD	L	MSD	L
0050-03	DMD	M	DMD	M
0050-05	DMD	M	DMD	M
0060-01	MMD	H	DMD	M
0060-03	DSD	L	DMD	M
0060-05	MMD	H	MMD	H
0060-07	MMD	H	MSD	L
0060-09	MSD	L	MSD	L
0069-01	DMD	M	DMD	M
0069-03	DSD	L	DSD	L
0103-01	DMD	M	DMD	M
0103-03	DMD	M	DMD	M
0103-05	MSD	L	DSD	L
0103-07	DMD	M	DSD	L
0104-00	DLD	M	DLD	M
0104-02	DMD	M	DSD	L
0104-04	DSD	L	MSD	L
0104-06	DMD	M	DSD	L
0104-08	DMD	M	DMD	M
0104-10	DMD	M	MMD	H
0104-12	MMD	H	DMD	M
0105-01	DLD	M	DMD	M
0105-03	DMD	M	DMD	M
0105-05	DMD	M	DLD	M
0105-07	DLD	M	DMD	M
0105 09	MLD	H	DMD	M
0105-11	MMD	H	DMD	M
0106-00	DMD	M	MLD	H
0106-02	DMD	M	DMD	M
0106-04	DMD	M	DMD	M
0107-00	DMD	M	DMD	M
0107-02	DMD	M	DMD	M
0107-04	DSD	L	DSD	L
0107-06	DSD	L	DLD	M
0107-08	DMD	M	DMD	M
0107-10	DMD	M	DMD	M
0107-12	DMD	M	DSD	L
0107-14	DMD	M	DSD	L
0107-16		M	DMD	M
0125-01	DMD	M	DMD	M
0125-03	DMD	M	DMD	M
0125-05	DMD	M		M
0125-07	DMD	M	DMD	M
0138-00		H	MMD	H
0138-02	DMD	M	MMD	H
0138-04	CMD	H	MMD	H
0138-06	DMD	M	DMD	M
0138-08	MMD	H	MMD	H
0146-01		H		H

Reference Point #	Average Bankfull Width (m)	Reach Length (m)	Comment Reference
0146-03	3.8	100	
0146-05	3.25	100	
0146-07	2.5	100	
0146-09	5.75	100	
0146-11	2.95	100	
0146-13	8	100	
0150-00	2.2	100	
0150-02	1.45	100	
0201-01	8.75	100	
0201-03	10.35	100	
0201-05	8.85	100	
0201-07	9.75	100	
0201-09	9	100	
0201-11	10.85	57	
0203-00	8.8	100	
0203-02	6.75	100	
0203-04	9.75	100	
0224-00	3.35	100	
0224-02	3.9	73	
0225-01	2.6	100	
0225-03	4.15	100	
0243-01	2.6	100	
0243-03	3.3	100	
0243-05	3.55	49	
0250-01	4.15	100	
0250-03	4.9	100	
0250-05	3.75	100	
0250-07	4.55	100	
0250-09	5.9	46	
0300-00	17.75	100	
0300-02	15.45	100	
0300-04	14.45	100	
0300-06	19.4	100	
0300-08	22.2	100	
0300-10	17.1	100	
0300-12	16.1	100	
0300-14	18.85	100	
0300-16	15.85	100	
0300-18	15.45	95	
0301-01	18.4	100	C.C.LT. BANK.
0301-03	18.25	71	
0303-01	14.9	100	
0303-03	13.65	100	
0303-05	13.55	100	
0303-07	13.9	100	
0303-09	12.2	47	
0304-01	12.6	100	
0304-03	14.15	100	
0304-05	13.95	100	
0304-07	12.8	100	
0304-09	13.3	100	
0305-00	11	100	
0305-02	12.25	100	
0305-04	11.3	100	
0305-06	14.8	100	
0305-08	11.45	100	
0305-10	9.8	100	
0305-12	17.4	100	

APPENDIX C - UPPER COWEEMAN REACH DATA

	SINGLE LOGS AND ROOTWADS					
	Zone 1		Zone 2		Total	
Reference Point #	eces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW
0146-03	1.22	0.00	0.57	0.00	1.79	0.00
0146-05	0.26	0.00	0.55	0.00	0.81	0.00
0146-07	0.35	0.03	0.40	0.03	0.75	0.05
0146-09	0.40	0.00	0.46	0.00	0.86	0.00
0146-11	0.38	0.03	0.38	0.00	0.77	0.03
0146-13	0.96	0.00	1.36	0.16	2.32	0.16
0150-00	0.42	0.00	0.51	0.00	0.92	0.00
0150-02	0.12	0.00	0.19	0.00	0.30	0.00
0201-01	0.00	0.00	0.09	0.00	0.09	0.00
0201-03	0.21	0.00	0.10	0.00	0.31	0.00
0201-05	0.35	0.00	0.27	0.00	0.62	0.00
0201-07	0.39	0.00	1.46	0.00	1.85	0.00
0201-09	0.54	0.09	0.63	0.09	1.17	0.18
0201-11	0.57	0.00	0.00	0.00	0.57	0.00
0203-00	0.00	0.00	0.18	0.00	0.18	0.00
0203-02	0.34	0.00	0.68	0.00	1.01	0.00
0203-04	0.29	0.00	0.98	0.00	1.27	0.00
0224-00	0.13	0.00	0.23	0.00	0.37	0.00
0224-02	0.05	0.00	0.00	0.00	0.05	0.00
0225-01	0.10	0.00	0.16	0.00	0.26	0.00
0225-03	0.62	0.04	0.21	0.04	0.83	0.08
0243-01	0.26	0.03	0.13	0.00	0.39	0.03
0243-03	1.09	0.33	0.83	0.33	1.91	0.66
0243-05	1.30	0.43	0.65	0.14	1.96	0.58
0250-01	0.58	0.00	0.33	0.00	0.91	0.00
0250-03	0.39	0.10	0.15	0.05	0.54	0.15
0250-05	0.98	0.53	0.19	0.08	1.16	0.60
0250-07	0.46	0.05	0.36	0.05	0.82	0.09
0250-09	0.38	0.00	0.00	0.00	0.38	0.00
0300-00	0.53	0.00	1.24	0.00	1.78	0.00
0300-02	0.15	0.00	0.15	0.00	0.31	0.00
0300-04	0.29	0.00	0.58	0.00	0.87	0.00
0300-06	0.19	0.00	0.19	0.00	0.39	0.00
0300-08	1.78	0.00	0.89	0.00	2.66	0.00
0300-10	0.34	0.00	2.22	0.00	2.57	0.00
0300-12	0.16	0.00	0.32	0.00	0.48	0.00
0300-14	0.19	0.00	0.19	0.00	0.38	0.00
0300-16	0.79	0.00	0.79	0.00	1.59	0.00
0300-18	0.16	0.00	0.98	0.00	1.14	0.00
0301-01	1.66	0.00	2.94	0.00	4.60	0.00
0301-03	1.29	0.00	2.83	0.00	4.11	0.00
0303-01	0.00	0.00	0.15	0.00	0.15	0.00
0303-03	0.41	0.00	0.41	0.00	0.82	0.00
0303-05	1.08	0.00	1.08	0.14	2.17	0.14
0303-07	0.14	0.00	0.14	0.00	0.28	0.00
0303-09	0.00	0.00	0.26	0.00	0.26	0.00
0304-01	0.13	0.00	0.50	0.13	0.63	0.13
0304-03	0.28	0.00	0.00	0.00	0.28	0.00
0304-05	1.26	0.42	0.14	0.00	1.40	0.42
0304-07	0.00	0.00	0.26	0.00	0.26	0.00
0304-09	0.13	0.00	0.13	0.00	0.27	0.00
0305-00	0.22	0.00	0.44	0.11	0.66	0.11
0305-02	0.61	0.12	1.35	0.00	1.96	0.12
0305-04	0.23	0.00	0.34	0.00	0.57	0.00
0305-06	0.00	0.00	0.74	0.00	0.74	0.00
0305-08	0.00	0.00	0.69	0.00	0.69	0.00
0305-10	0.20	0.00	0.10	0.00	0.29	0.00
0305-12	0.35	0.00	1.57	0.00	1.91	0.00

Reference Point #	Zone 1		Zone 2		Total	
	ieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW
0146-03	0.84	0.00	0.00	0.00	0.84	0.00
0146-05	0.72	0.00	0.00	0.00	0.72	0.00
0146-07	0.00	0.00	0.00	0.00	0.00	0.00
0146-09	4.31	0.46	0.00	0.00	4.31	0.46
0146-11	0.00	0.00	0.00	0.00	0.00	0.00
0146-13	0.00	0.00	0.00	0.00	0.00	0.00
0150-00	0.00	0.00	0.00	0.00	0.00	0.00
0150-02	0.00	0.00	0.00	0.00	0.00	0.00
0201-01	8.17	0.47	0.00	0.00	8.17	0.47
0201-03	14.11	0.24	0.00	0.00	14.11	0.24
0201-05	0.00	0.00	0.00	0.00	0.00	0.00
0201-07	0.00	0.00	0.00	0.00	0.00	0.00
0201-09	0.00	0.00	0.00	0.00	0.00	0.00
0201-11	11.80	0.00	0.00	0.00	11.80	0.00
0203-00	2.82	0.35	0.00	0.00	2.82	0.35
0203-02	0.00	0.00	0.00	0.00	0.00	0.00
0203-04	0.00	0.00	0.00	0.00	0.00	0.00
0224-00	1.61	0.10	0.00	0.00	1.61	0.10
0224-02	0.00	0.00	0.00	0.00	0.00	0.00
0225-01	0.86	0.08	0.00	0.00	0.86	0.03
0225-03	0.00	0.00	0.58	0.00	0.58	0.00
0243-01	0.00	0.00	0.00	0.00	0.00	0.00
0243-03	0.69	0.07	0.00	0.00	0.69	0.07
0243-05	0.00	0.00	0.00	0.00	0.00	0.00
0250-01	0.00	0.00	0.00	0.00	0.00	0.00
0250-03	0.00	0.00	0.00	0.00	0.00	0.00
0250-05	0.64	0.15	0.00	0.00	0.64	0.15
0250-07	0.97	0.00	0.00	0.00	0.97	0.00
0250-09	2.05	0.00	0.00	0.00	2.05	0.00
0300-00	0.00	0.00	0.00	0.00	0.00	0.00
0300-02	0.00	0.00	0.00	0.00	0.00	0.00
0300-04	0.00	0.00	0.00	0.00	0.00	0.00
0300-06	0.00	0.00	0.00	0.00	0.00	0.00
0300-08	0.00	0.00	0.00	0.00	0.00	0.00
0300-10	0.00	0.00	0.00	0.00	0.00	0.00
0300-12	0.00	0.00	0.00	0.00	0.00	0.00
0300-14	0.00	0.00	0.00	0.00	0.00	0.00
0300-16	0.00	0.00	0.00	0.00	0.00	0.00
0300-18	12.20	0.00	0.00	0.00	12.20	0.00
0301-01	0.00	0.00	0.00	0.00	0.00	0.00
0301-03	0.00	0.00	0.00	0.00	0.00	0.00
0303-01	0.00	0.00	0.00	0.00	0.00	0.00
0303-03	0.00	0.00	0.00	0.00	0.00	0.00
0303-05	0.00	0.00	0.00	0.00	0.00	0.00
0303-07	0.00	0.00	0.00	0.00	0.00	0.00
0303-09	0.00	0.00	0.00	0.00	0.00	0.00
0304-01	0.00	0.00	1.26	0.00	1.26	0.00
0304-03	0.00	0.00	0.00	0.00	0.00	0.00
0304-05	0.00	0.00	0.00	0.00	0.00	0.00
0304-07	0.00	0.00	0.00	0.00	0.00	0.00
0304-09	0.00	0.00	0.00	0.00	0.00	0.00
0305-00	0.00	0.00	0.00	0.00	0.00	0.00
0305-02	0.00	0.00	0.00	0.00	0.00	0.00
0305-04	0.00	0.00	0.00	0.00	0.00	0.00
0305-06	0.00	0.00	0.00	0.00	0.00	0.00
0305-08	0.00	0.00	0.00	0.00	0.00	0.00
0305-10	0.00	0.00	0.00	0.00	0.00	0.00
0305-12	2.44	0.17	0.00	0.00	2.44	0.17

APPENDIX C - UPPER COWEEMAN REACH DATA

Reference Point #	Total LWD Pieces Zone 1 Pieces/CW	Zone 1 Key Pieces/CW	Zone 2 Pieces/CW	Zone 2 Key Pieces/CW	Total Pieces/CW	Total Key Pieces/CW
0146-03	2.05	0.00	0.57	0.00	2.62	0.00
0146-05	0.98	0.00	0.55	0.00	1.53	0.00
0146-07	0.36	0.03	0.40	0.03	0.75	0.05
0146-09	4.7%	0.46	0.46	0.00	5.18	0.46
0146-11	0.38	0.03	0.38	0.00	0.77	0.03
0146-13	0.96	0.00	1.36	0.16	2.32	0.16
0150-00	0.4%	0.00	0.51	0.00	0.92	0.30
0150-02	0.12	0.00	0.19	0.00	0.30	0.30
0201-01	8.17	0.47	0.00	0.00	8.25	0.47
0201-03	14.31	0.24	0.10	0.00	14.42	0.24
0201-05	0.35	0.00	0.27	0.00	0.62	0.30
0201-07	0.39	0.00	1.46	0.00	1.85	0.30
0201-09	0.54	0.09	0.63	0.09	1.17	0.18
0201-11	12.31	0.00	0.00	0.00	12.37	0.30
0203-00	2.82	0.35	0.18	0.00	2.99	0.35
0203-02	0.34	0.00	0.68	0.00	1.01	0.00
0203-04	0.29	0.00	0.08	0.00	1.27	0.00
0224-00	1.74	0.10	0.23	0.00	1.98	0.10
0224-02	0.05	0.00	0.00	0.00	0.05	0.00
0225-01	0.96	0.08	0.16	0.00	1.12	0.08
0225-03	0.62	0.04	0.70	0.04	1.41	0.08
0243-01	0.26	0.03	0.13	0.00	0.30	0.03
0243-03	1.78	0.40	0.83	0.33	2.61	0.73
0243-05	1.30	0.43	0.65	0.14	1.96	0.58
0250-N	0.58	0.00	0.33	0.00	0.9,	0.00
0250-03	0.39	0.10	0.15	0.05	0.54	0.15
0250-05	1.61	0.68	0.19	0.08	1.80	0.75
0250-07	1.42	0.05	0.36	0.05	1.79	0.09
0250-09	2.44	0.00	0.00	0.00	2.44	0.00
0300-00	0.53	0.00	1.24	0.00	1.78	0.00
0300-02	0.15	0.00	0.15	0.00	0.31	0.00
0300-04	0.29	0.00	0.58	0.0"	0.87	0.00
0300-06	0.19	0.00	0.19	0.00	0.39	0.00
0300-08	1.78	0.00	0.89	0.00	2.66	0.00
0300-10	0.34	0.00	2.22	0.00	2.57	0.00
0300-12	0.16	0.00	0.32	0.00	0.48	0.00
0300-14	0.19	0.00	0.19	0.00	0.38	0.00
0300-16	0.79	0.00	0.79	0.00	1.59	0.00
0300-18	12.36	0.00	0.98	0.00	13.34	0.00
0301-01	1.66	0.00	2.94	0.00	4.60	0.00
0301-03	1.29	0.00	2.83	0.00	4.11	0.00
0303-01	0.00	0.00	0.15	0.00	0.15	0.00
0303-m	0.41	0.00	0.41	0.00	0.82	0.00
0303-05	1.08	0.00	1.08	0.14	2.17	0.14
0303-07	0.14	0.00	0.14	0.00	0.28	0.00
o-303-09	0.00	0.00	0.26	0.0"	0.26	0.00
0304-01	0.13	0.00	1.76	0.13	1.89	0.13
0304-03	0.28	0.00	0.00	0.00	0.28	0.00
0304-05	1.26	0.42	0.14	0.00	1.40	0.42
0304-07	0.00	0.00	0.26	0.00	0.26	0.00
0304-09	0.13	0.00	0.13	0.00	0.27	0.00
0305-00	0.22	0.00	0.44	0.11	0.66	0.11
0305-02	0.61	0.12	1.35	0.00	1.96	0.12
0305-04	0.23	0.00	0.34	0.00	0.57	0.00
0305-06	0.00	0.00	0.74	0.00	0.74	0.00
0305-08	0.00	0.00	0.69	0.00	0.69	0.00
0305-10	0.20	0.00	0.10	0.00	0.29	0.00
0305-12	2.78	0.17	1.57	0.00	4.35	0.17

APPENDIX C - UPPER COWEEMAN REACH DATA

Reference Point #	Riparian Data			
	Left Bank		Right Bank	
	Riparian Condition Class	Near-term Recruitment Class	Riparian Condition Class	Near-term Recruitment Class
0146-03	MMD	H	MMD	H
0146-05	CLD	H	MLD	H
0146-07	DMD	M	MMD	H
0146-09	CMD	H	MMD	H
0146-11	CLD	H	CLD	H
0146-13				
0150-00	MSD	L	MSD	L
0150-02	MSD	L	MSD	L
0201-01	MMD	H	MMD	H
0201-03	MSD	L	MLD	H
0201-05	CSD	L	MLD	H
0201-07	MMD	H		H
0201-09	MMD	H	CMD	H
0201-11	DMD	M	DMD	M
0203-00	MMD	H	MMD	H
0203-02	CMD	H	CMD	H
0203-04	MMD	H	CMD	H
0224-00	MMD	H	MMD	H
0224-02	CMD	H	CMD	H
0225-01	MLD	H	MMD	H
0225-03	DMD	M	MMD	H
0243-01	DMD	M	DMD	M
0243-03	MLD	H	MLD	H
0243-05	DMD	M	MMD	H
0250-01	DSD	L	CMD	H
0250-03	DSD	L	CMD	H
0250-05	CSD	L	CMD	H
0250-07	DLD	M	DLD	M
0250-09	DMD	M		M
0300-00	DSD	L	DSD	L
0300-02	DMD	M		H
0300-04	DSD	L	DSD	L
0300-06	MSD	L	DSD	L
0300-08	DSD	L	DSD	L
0300-10	MMD	H	DSD	L
0300-12	MMD	H	CLD	H
0300-14	DMD	M	MSD	L
0300-16	MMD	H		H
0300-18	DMD	M	MMD	H
0301-01	MSD	L	MMD	H
0301-03	MMD	H	DMD	M
0303-01	MMD	H	MMD	H
0303-03	CLD	H	DMD	M
0303-05	DSD	L	DSD	L
0303-07	DSD	L	MSD	L
0303-09	DSD	L	DSD	L
0304-01	DSD	L	DSD	L
0304-03	DSD	L	MMD	H
0304-05	MMD	H	MMD	H
0304-07	MSD	L	CMD	H
0304-09	MMD	H	MSD	L
0305-00	DSD	L	MSD	L
0305-02	DSD	L	DSD	L
0305-04	CSD	L	MSD	L
0305-06	DSD	L	DSD	L
0305-08	DSD	L	MSD	L
0305-10		L		L
0305-12	MSD	L	DSD	L

Reference Point #	Average Bankfull Width (m)	Reach Length (m)	Comment Reference
0305-14	12.65	100	
0305-16	9.25	100	
0305-18	13.9	100	
0305-20	9.55	100	
0306-00	12.7	100	
0306-02	15.3	100	
0306-04	11.55	100	
0306-06	13.85	100	
0306-08	12	100	
0306-10	14.4	100	
0306-12	10.15	100	
0306-14	14.1	100	
0306-16	13.5	100	
0306-18	10.9	100	
0306-20	15.85	100	
0306-22	11.7	100	
0322-01	5.85	100	
0322-03	4.05	100	
0322-05	4.85	100	
0322-07	4.5	100	
0328-00	2.2	100	
0328-02	3	100	
0328-04	3.05	100	
0328-06	3.75	100	
0328-08	2.95	100	
0333-00	4	100	1st surveyed on 7/30/98
0333-02	4.4	83.4	1st surveyed on 7/30/98
0333-03	3.85	100	CONTINUATION SEG 333 surveyed 9/22/98
0333-05	2.85	100	CONTINUATION SEG 333 surveyed 9/22/98
0333-07	*1.75*	*100*	*CONTINUATION SEG 333 surveyed 9/22/98*
0338-01	3.35	100	
0338-03	3.75	100	
0346-00	5.6	100	SPLIT CRK. AT -00.
0346-02	5.4	100	
0346-04	4.9	100	CROSSES 1660 RD.
0346-06	5.6	100	2 CHANNELS AT END.
0346-08	*3.75*	*100*	*NO G.P.S. AT END.*
0346-10	3.25	5	NO L.W.D.
0347-00	4.6	100	R.M.Z.DATA AT 75M.
0347-02	4.25	100	
0347-04	2.4	100	
0347-06	2.7	53	
0353-00	2.2	100	
0353-02	4.15	100	
0353-04	2.9	100	
0361-00	12.75	100	
0361-02	9	100	
0362-00	4.9	100	NO GIS, NO STRM CHNL
0362-02	2.7	100	NO GIS, NO BNK WDTH
0362-04	5.85	100	
0362-06	5.65	100	
0362-08	4.45	100	
0362-10	5.65	100	
0372-00	2.4	100	
0372-02	2.8	100	
0372-04	2.8	100	
0401-00	9.5	100	
0401-02	9.4	100	

APPENDIX C - UPPER COWEEMAN REACH DATA

	SINGLE LOGS AND ROOTWADS					
	Zone 1		Zone 2		Total	
Reference Point #	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW
0305-14	0.00	0.00	0.63	0.00	0.63	0.00
0305-16	0.28	0.09	0.19	0.19	0.46	0.28
0305-18	0.56	0.14	0.70	0.00	1.25	0.14
0305-20	0.10	0.00	0.10	0.00	0.19	0.00
0306-00	0.13	0.00	1.52	0.00	1.65	0.00
0306-02	0.00	0.00	1.38	0.00	1.38	0.00
0306-04	0.35	0.00	0.35	0.00	0.69	0.00
0306-06	0.14	0.00	0.55	0.00	0.69	0.00
0306-08	0.12	0.00	0.24	0.00	0.36	0.00
0306-10	0.29	0.00	1.87	0.00	2.16	0.00
0306-12	0.30	0.10	1.02	0.10	1.32	0.20
0306-14	0.56	0.00	0.85	0.14	1.41	0.14
0306-16	0.14	0.00	0.54	0.00	0.68	0.00
0306-18	0.22	0.00	0.44	0.00	0.65	0.00
0306-20	0.16	0.00	0.95	0.16	1.11	0.16
0306-22	0.23	0.00	0.82	0.00	1.05	0.00
0322-01	0.53	0.00	0.18	0.06	0.70	0.06
0322-03	1.13	0.28	0.24	0.12	1.38	0.41
0322-05	0.15	0.05	0.19	0.10	0.34	0.15
0322-07	0.59	0.18	0.09	0.09	0.68	0.27
0328-00	0.53	0.02	0.15	0.00	0.68	0.02
0328-02	0.48	0.03	0.12	0.00	0.60	0.03
0328-04	0.58	0.00	0.24	0.03	0.82	0.03
0328-06	1.01	0.04	0.75	0.00	1.76	0.04
0328-08	0.27	0.03	0.12	0.03	0.38	0.06
0333-00	0.80	0.04	0.24	0.04	1.04	0.08
0333-02	1.48	0.05	0.37	0.00	1.85	0.05
0333-03	1.27	0.04	0.46	0.04	1.73	0.08
0333-05	0.40	0.00	0.37	0.00	0.77	0.00
0333-07	0.40	0.00	0.18	0.00	0.58	0.00
0338-01	0.03	0.00	0.13	0.00	0.17	0.00
0338-03	0.08	0.00	0.04	0.00	0.11	0.00
0346-00	0.34	0.11	0.62	0.06	0.95	0.17
0346-02	0.11	0.00	0.11	0.00	0.22	0.00
0346-04	0.00	0.00	0.05	0.00	0.05	0.00
0346-06	0.73	0.22	0.22	0.00	0.95	0.22
0346-08	0.19	0.04	0.08	0.00	0.26	0.04
0346-10	0.00	0.00	0.00	0.00	0.00	0.00
0347-00	0.14	0.00	0.18	0.00	0.32	0.00
0347-02	0.43	0.04	0.43	0.04	0.85	0.09
0347-04	0.10	0.02	0.17	0.02	0.26	0.05
0347-06	0.05	0.00	0.25	0.00	0.31	0.00
0353-00	0.15	0.02	0.11	0.02	0.26	0.04
0353-02	0.46	0.08	0.71	0.08	1.16	0.17
0353-04	0.15	0.09	0.12	0.09	0.26	0.17
0361-00	1.28	0.00	2.04	0.00	3.32	0.00
0361-02	1.26	0.00	0.99	0.00	2.25	0.00
0362-00	0.74	0.25	0.39	0.05	1.13	0.29
0362-02	0.05	0.00	0.11	0.03	0.16	0.03
0362-04	0.76	0.00	0.53	0.00	1.29	0.00
0362-06	0.11	0.00	0.11	0.00	0.23	0.00
0362-08	0.00	0.00	0.13	0.04	0.13	0.04
0362-10	0.11	0.06	0.17	0.00	0.28	0.06
0372-00	0.36	0.07	0.10	0.05	0.46	0.12
0372-02	0.64	0.08	0.31	0.00	0.95	0.08
0372-04	1.12	0.14	0.28	0.03	1.40	0.17
0401-00	0.19	0.00	0.48	0.10	0.67	0.10
0401-02	0.00	0.00	0.66	0.09	0.66	0.09

APPENDIX C - UPPER COWEEMAN REACH DATA

Reference Point #	JAMS Zone 1 Pieces/CW	JAMS Zone 1 Key Pieces/CW	JAMS Zone 2 Pieces/CW	JAMS Zone 2 Key Pieces/CW	Total Pieces/CW	Total Key Pieces/CW
0305-14	0.00	0.00	0.00	0.00	0.00	0.00
0305-16	0.00	0.00	0.00	0.00	0.00	0.03
0305-18	0.00	0.00	0 00	0.00	0.00	0.03
0305-20	0.00	0.00	0.00	0.00	0.00	0.03
0306-00	4.06	0.13	2.41	0.00	6.46	0.13
0306-02	0.00	0.00	0.00	0.00	0.00	0.00
0306-04	0.00	0.00	1.27	0.12	1.27	0.12
0306-06	0.00	0.00	0.00	0.00	0.00	0.00
0306-08	0.00	0.00	0.00	0.00	0.00	0.00
0306-10	0.00	0.00	0.00	0.00	0.00	0.00
0306-12	0.00	0.00	0.00	0.00	0.00	0.00
0306-14	0.00	0.00	2.68	0.00	2.68	0.00
0306-16	0.00	0.00	0.00	0.00	0.00	0.00
0306-18	0.00	0.00	0.00	0.00	0.00	0.00
0306-20	0.00	0.00	0.00	0.00	0.00	0.00
0306-22	0.00	0.00	2.34	0.00	2.34	0.00
0322-01	11.35	3.66	0.00	0.00	11.35	3.86
0322-03	0.00	0.00	0.00	0.00	0.00	0.00
0322-05	4.95	0.73	0.49	0.00	5.43	0.73
0322-07	4.28	0.32	0.00	0.00	4.28	0.32
0328-00	0.00	0.00	0.00	0.00	0.00	0.00
0328-02	0.00	0.00	0.00	0.00	0.00	0.00
0328-04	0.00	0.00	0.00	0.00	0.00	0.00
0328-06	0.00	0.00	0.00	0.00	0.00	0.00
0328-08	0.00	0.00	0.00	0.00	0.00	0.00
03X-00	0.00	0.00	0.00	0.00	0.00	0.00
0333-02	0.00	0.00	0.00	0.00	0.00	0.00
0333-03	0.58	0.00	0.00	0.00	0.58	0.00
0333-05	0.00	0.00	0.00	0.00	0.00	0.00
0333-07	0.00	0.00	0.00	0.00	0.00	0.00
0338-01	0.00	0.00	0.00	0.00	0.00	0.00
0338-03	0.00	0.00	0.00	0.00	0.00	0.00
0346-00	0.00	0.00	0.00	0.00	0.00	0.00
0346-02	0.00	0.00	0.00	0.00	0.00	0.00
0346-04	0.00	0.00	0.00	0.00	0.00	0.00
0346-06	0.00	0.00	0.00	0.00	0.00	0.00
0346-08	0.00	0.00	0.00	0.00	0.00	0.00
0346-10	0.00	0.00	0.00	0.00	0.00	0.00
0347-00	0.00	0.00	0.00	0.00	0.00	0.00
0347-02	0.00	0.00	0.00	0.00	0.00	0.00
0347-04	0.00	0.00	0.00	0.00	0.00	0.00
0347-06	0.00	0.00	0.00	0.00	0.00	0.00
OX-00	0.37	0.04	0.00	0.00	0.37	0.04
0353-02	0.62	0.00	0.00	0.00	0.62	0.00
0353-04	0.00	0.00	0.00	0.00	0.00	0.00
0361-00	0.00	0.00	0.00	0.00	0.00	0.00
0361-02	8.30	0.00	0.00	0.00	8.30	0.00
0362-00	19.60	2.06	0.00	0.00	19.60	2.06
0362-02	0.00	0.00	0.00	0.00	0.00	0.00
0362-04	3.37	0.48	0.00	0.00	3.37	0.48
0362-06	0.00	0.00	0.00	0.00	0.00	0.00
0362-08	0.00	0.00	0.00	0.00	0.00	0.00
0362-10	0.00	0.00	11.00	0.00	0.00	0.00
0372-00	0.00	0.00	0.00	0.00	0.00	0.00
0-372-02	0.00	0.00	0.00	0.00	0.00	0.00
0372-04	0.00	0.00	0.00	0.00	0.00	0.00
0401-00	4.37	0.00	0.00	0.00	4.37	0.00
0401-02	0.00	0.00	2.91	0.00	2.91	0.00

APPENDIX C - UPPER COWEEMAN REACH DATA

Reference Point #	Total LWD Pieces Zone 1 Pieces/CW	Zone 1 Key Pieces/CW	Zone 2 Pieces/CW	Zone 2 Key Pieces/CW	Total Pieces/CW	Total Key Pieces/CW
0305-14	0.00	0.00	0.63	0.00	0.63	0.00
0305-16	0.28	0.09	0.19	0.19	0.46	0.28
0305-18	0.56	0.14	0.70	0.00	1.25	0.14
0305-20	0.10	0.00	0.10	0.00	0.19	0.00
0306-00	4.19	0.13	3.94	0.00	8.13	0.13
0306-02	0.00	0.00	1.38	0.00	1.38	0.00
0306-04	0.35	0.00	1.62	0.12	1.96	0.12
0306-06	0.14	0.00	0.55	0.00	0.69	0.00
0306-08	0.12	0.00	0.24	0.00	0.36	0.00
0306-10	0.29	0.00	1.87	0.00	2.16	0.00
0306-12	0.30	0.10	1.02	0.10	1.32	0.20
0306-14	0.56	0.00	3.53	0.14	4.09	0.14
0306-16	0.14	0.00	0.54	0.00	0.68	0.00
0306-18	0.22	0.00	0.44	0.00	0.65	0.00
0306-20	0.16	0.00	0.95	0.16	1.11	0.16
0306-22	0.23	0.00	3.16	0.00	3.39	0.00
0322-01	11.88	3.86	0.18	0.06	12.05	3.92
0322-03	1.13	0.28	0.24	0.12	1.38	0.41
0322-05	5.09	0.78	0.68	0.10	5.77	0.87
0322-07	4.86	0.50	0.09	0.09	4.95	0.59
0328-00	0.53	0.02	0.15	0.00	0.68	0.02
0328-02	0.48	0.03	0.12	0.00	0.60	0.03
0328-04	0.58	0.00	0.24	0.03	0.82	0.03
0328-06	1.01	0.04	0.75	0.00	1.76	0.04
0328-08	0.27	0.03	0.12	0.03	0.38	0.06
0333-00	0.80	0.04	0.24	0.04	1.04	0.08
0333-02	1.48	0.05	0.37	0.00	1.85	0.05
0333-03	1.85	0.04	0.46	0.04	2.31	0.08
0333-05	0.40	0.00	0.37	0.00	0.77	0.00
0333-07	0.40	0.00	0.18	0.00	0.58	0.00
0338-01	0.03	0.00	0.13	0.00	0.17	0.00
0338-03	0.08	0.00	0.04	0.00	0.11	0.00
0346-00	0.34	0.11	0.62	0.06	0.95	0.17
0346-02	0.11	0.00	0.11	0.00	0.22	0.00
0346-04	0.00	0.00	0.05	0.00	0.05	0.00
0346-06	0.73	0.22	0.22	0.00	0.95	0.22
0346-08	0.19	0.04	0.08	0.00	0.26	0.04
0346-10	0.00	0.00	0.00	0.00	0.00	0.00
0347-00	0.14	0.00	0.18	0.00	0.32	0.00
0347-02	0.43	0.04	0.43	0.04	0.85	0.09
0347-04	0.10	0.02	0.17	0.02	0.26	0.05
0347-06	0.05	0.00	0.25	0.00	0.31	0.00
0353-00	0.53	0.07	0.11	0.02	0.64	0.09
0353-02	1.08	0.08	0.71	0.08	1.78	0.17
0353-04	0.15	0.09	0.12	0.09	0.26	0.17
0361-00	1.28	0.00	2.04	0.00	3.32	0.00
0361-02	9.56	0.00	0.99	0.00	10.55	0.00
0362-00	20.34	2.30	0.39	0.05	20.73	2.35
0362-02	0.05	0.00	0.11	0.03	0.16	0.03
0362-04	4.13	0.48	0.53	0.00	4.66	0.48
0362-06	0.11	0.00	0.11	0.00	0.23	0.00
0362-08	0.00	0.00	0.13	0.04	0.13	0.04
0362-10	0.11	0.06	0.17	0.00	0.28	0.06
0372-00	0.36	0.07	0.10	0.05	0.46	0.12
0372-02	0.64	0.08	0.31	0.00	0.95	0.08
0372-04	1.12	0.14	0.28	0.03	1.40	0.17
0401-00	4.56	0.00	0.48	0.10	5.04	0.10
0401-02	0.00	0.00	3.57	0.09	3.57	0.09

APPENDIX C - UPPER COWEEMAN REACH DATA

	Riparian Data			
	Left Bank		Right Bank	
Reference Point #	Riparian Condition Class	Near-term Recruitment Class	Riparian Condition Class	Near-term Recruitment Class
0305-14	DSD	L	MSD	L
0305-16	MSD	L	MSD	L
0305-18	MSD	L	MSD	L
0305-20	MSD	L	MSD	L
0306-00	DSD	L	MSD	L
0306-02	MSD	L	MSD	L
0306-04	DSD	L	MSD	L
0306-06	DSD	L	DSD	L
0306-08	DSD	L	MMD	H
0306-10	MMD	H	MSD	L
0306-12	DMD	M	CMD	H
0306-14	DSD	L	DMD	M
0306-16	DSD	L	DMD	M
0306-18	DMD	M	DMD	M
0306-20	MMD	H	DMD	M
0306-22	DSD	L	DSD	L
0322-01	DMD	M	DMD	M
0322-03	MMD	H	MMD	H
0322-05	MMD	H	MMD	H
0322-07	MMD	H	MMD	H
0328-00	MSD	L	CSD	L
0328-02	MSD	L	MSD	L
0328-04	MMD	H	MSD	L
0328-06	DMD	M	DMD	M
0328-08	DLD	M	MLD	H
0333-00	MSD	L	MSD	L
0333-02	MSD	L	MSD	L
0333-03	MMD	H	MMD	H
0333-05	MMD	H	MMD	H
0333-07	CMD	H	CMD	H
0338-01	MSD	L	CSD	L
0338-03	CSD	L	MSD	L
0346-00	MMD	H	MMD	H
0346-02	CMD	H	CMD	H
0346-04	CMD	H	CMD	H
0346-06	DMD	M	DMD	M
0346-08	DMD	M	DMD	M
0346-10	DMD	M	MSD	L
0347-00	DSD	L	CSD	L
0347-02	MSD	L	MSD	L
0347-04	CMD	H	CSD	L
0347-06	DSD	L	DSD	L
0353-00	MSD	L	DMD	M
0353-02	DSD	L	DSD	L
0353-04	MLD	H	MLD	H
0361-00	CMD	H	DMD	M
0361-02	DMD	M	MMD	H
0362-00	MMD	H	MMD	H
0362-02	MMD	H	MMD	H
0362-04	DSD	L	DSD	L
0362-06	DSD	L	DSD	L
0362-08	DSD	L	DSD	L
0362-10	DSD	L	DSD	L
0372-00	MMD	H	MMD	H
0372-02	MMD	H	MMD	H
0372-04	MMD	H	MMD	H
0401-00	MMD	H	MMD	H
0401-02	MMD	H	MMD	H

Reference Point #	Average Bankfull Width (m)	Reach Length (m)	Comment Reference
0401-04	8.2	100	
0401-06	7.9	100	
0401-08	6.2	100	
0401-10	10.25	100	
0413-01	9.45	100	
0413-03	10.15	100	
0413-05	15	100	
0413-07	26	100	
0413-09	10.3	100	
0413-11	10.55	100	
0413-13	10.6	49.2	
0414-00	11	100	
0414-02	5.95	100	
0414-04	12.8	100	
0414-06	11.15	100	
0414-08	4.7	42.1	
0423-01	7	100	
0423-03	7.75	100	
0423-05	10.55	100	
0423-07	7.6	100	
0423-09	5.9	100	
0423-11	5.6	100	
0423-13	6.7	100	
0423-15	5.65	100	
0423-17	5.75	43.7	
0460-01	10.05	100	
0460-03	8.85	100	
0460-05	5.35	100	
0461-01	6.6	100	
0461-03	5.75	100	
0461-05	5.85	100	
0461-07	6.4	100	
0476-01	7.1	84	
0403-01	8.65	100	
0403-03	11.25	100	
0403-05	8.3	100	
0403-07	7.75	100	
0403-09	6.7	100	
0406-01	9.9	100	
0406-03	8.3	100	
0406-05	9.2	100	
0406-07	5.15	100	
0406-09	6.25	100	
0406-11	5	100	

APPENDIX C - UPPER COWEEMAN REACH DATA

	SINGLE LOGS AND ROOTWADS					
	Zone 1		Zone 2		Total	
Reference Point #	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW
0401-04	0.08	0.00	0.00	0.00	0.08	0.00
0401-06	0.00	0.00	0.00	0.00	0.00	0.00
0401-08	0.12	0.00	0.06	0.00	0.19	0.00
0401-10	0.00	0.00	0.41	0.10	0.41	0.10
0413-01	0.19	0.00	0.38	0.00	0.57	0.00
0413-03	0.00	0.00	0.81	0.10	0.81	0.10
0413-05	0.60	0.00	3.00	0.00	3.60	0.00
0413-07	1.04	0.26	1.56	0.00	2.60	0.26
0413-09	0.00	0.00	0.10	0.00	0.10	0.00
0413-11	0.00	0.00	0.32	0.00	0.32	0.00
0413-13	0.00	0.00	0.22	0.00	0.22	0.00
0414-00	0.22	0.00	0.55	0.00	0.77	0.00
0414-02	0.12	0.00	0.24	0.00	0.36	0.00
0414-04	0.00	0.00	1.15	0.00	1.15	0.00
0414-06	0.45	0.00	1.67	0.22	2.12	0.22
0414-08	0.00	0.00	0.11	0.00	0.11	0.00
0423-01	0.07	0.00	0.98	0.14	1.05	0.14
0423-03	0.93	0.08	0.62	0.00	1.55	0.08
0423-05	0.63	0.00	0.74	0.00	1.37	0.00
0423-07	0.23	0.00	0.15	0.00	0.38	0.00
0423-09	0.47	0.06	0.65	0.00	1.12	0.06
0423-11	0.17	0.00	0.56	0.11	0.73	0.11
0423-13	0.74	0.13	1.21	0.00	1.94	0.13
0423-15	0.57	0.06	0.23	0.06	0.79	0.11
0423-17	0.13	0.00	0.26	0.00	0.39	0.00
0460-01	0.40	0.00	0.90	0.00	1.31	0.00
0460-03	0.35	0.00	0.89	0.00	1.24	0.00
0460-05	0.32	0.00	0.37	0.11	0.70	0.11
0461-01	0.07	0.07	0.40	0.00	0.46	0.07
0461-03	0.23	0.00	0.40	0.00	0.63	0.00
0461-05	0.00	0.00	0.06	0.00	0.06	0.00
0461-07	0.00	0.00	0.26	0.00	0.26	0.00
0476-01	0.00	0.00	0.25	0.00	0.25	0.00
0403-01	0.00	0.00	0.87	0.00	0.87	0.00
0403-03	0.34	0.00	0.90	0.00	1.24	0.00
0403-05	0.00	0.00	0.08	0.00	0.08	0.00
0403-07	0.00	0.00	0.47	0.00	0.47	0.00
0403-09	0.07	0.00	0.80	0.00	0.87	0.00
0406-01	0.40	0.00	1.29	0.00	1.68	0.00
0406-03	0.42	0.00	1.00	0.00	1.41	0.00
0406-05	0.74	0.00	1.75	0.00	2.48	0.00
0406-07	0.46	0.00	1.13	0.00	1.60	0.00
0406-09	1.00	0.00	0.81	0.00	1.81	0.00
0406-11	0.10	0.00	0.25	0.00	0.35	0.00

APPENDIX C - UPPER COWEEMAN REACH DATA

Reference Point #	JAMS Zone 1 Pieces/CW	JAMS Zone 1 Key Pieces/CW	JAMS Zone 2 Pieces/CW	JAMS Zone 2 Key Pieces/CW	Total Pieces/CW	Total Key Pieces/CW
0401-04	9.02	0.08	0.98	0.08	10.00	0.16
0401-06	0.00	0.00	0.00	0.00	0.00	0.00
0401-08	0.00	0.00	0.00	0.00	0.00	0.00
0401-10	2.46	0.00	3.79	0.00	6.25	0.00
0413-01	0.00	0.00	2.46	0.09	2.46	0.09
0413-03	0.00	0.00	0.00	0.00	0.00	0.00
0413-05	0.00	0.00	0.00	0.00	0.00	0.00
0413-07	145.60	0.00	0.00	0.00	145.60	0.00
0413-09	15.55	0.10	2.47	0.00	18.03	0.10
0413-11	0.00	0.00	5.70	0.00	5.70	0.00
0413-13	0.00	0.00	0.00	0.00	0.00	0.00
0414-00	0.00	0.00	0.00	0.00	0.00	0.00
0414-02	5.24	0.00	0.95	0.00	6.19	0.00
0414-04	8.45	0.00	7.94	0.00	16.38	0.00
0414-06	0.00	0.00	0.00	0.00	0.00	0.00
0414-08	7.94	0.87	0.00	0.00	7.94	0.87
0423-01	4.62	0.35	0.00	0.00	4.62	0.35
0423-03	2.95	0.31	0.00	0.00	2.95	0.31
0423-05	13.40	1.37	0.00	0.00	13.40	1.37
0423-07	8.28	0.53	0.00	0.00	8.28	0.53
0423-09	5.61	0.00	0.00	0.00	5.61	0.00
0423-11	0.67	0.00	0.00	0.00	0.67	0.00
0423-13	3.15	0.00	0.00	0.00	3.15	0.00
0423-15	5.07	0.41	0.00	0.00	5.07	0.41
0423-17	4.87	0.39	0.00	0.00	4.87	0.39
0460-01	0.00	0.00	0.00	0.00	0.00	0.00
0460-03	0.00	0.00	0.00	0.00	0.00	0.00
0460-05	0.00	0.00	0.00	0.00	0.00	0.00
0461-01	0.00	0.00	0.00	0.00	0.00	0.00
0461-03	*1.50*	*0.00*	*0.00*	*0.00*	*1.50*	*0.00*
0461-05	1.29	0.00	1.71	0.29	3.00	0.29
0461-07	0.00	0.00	0.00	0.00	0.00	0.00
0476-01	0.00	0.00	0.00	0.00	0.00	0.00
0403-01	5.02	0.35	3.51	0.18	8.53	0.53
0403-03	0.00	0.00	0.00	0.00	0.00	0.00
0403-05	4.65	0.17	0.00	0.00	4.65	0.17
0403-07	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
0403-09	0.00	0.00	0.00	0.00	0.00	0.00
0406-01	8.18	0.13	0.00	0.00	8.18	0.13
0406-03	0.00	0.00	0.00	0.00	0.00	0.00
0406-05	4.80	0.00	0.00	0.00	4.80	0.00
0406-07	0.00	0.00	0.00	0.00	0.00	0.00
0406-09	0.00	0.00	0.00	0.00	0.00	0.00
0406-11	11.20	4.00	0.00	0.00	11.20	4.00

APPENDIX C - UPPER COWEEMAN REACH DATA

	Total LWD Pieces					
	Zone 1		Zone 2		Total	
Reference Point #	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW
0401-04	9.10	0.08	0.98	0.08	10.09	0.16
0401-06	0.00	0.00	0.00	0.00	0.00	0.00
0401-08	0.12	0.00	0.06	0.00	0.19	0.00
0401-10	2.46	0.00	4.20	0.10	6.66	0.10
0413-01	0.19	0.00	2.84	0.09	3.02	0.09
0413-03	0.00	0.00	0.81	0.10	0.81	0.10
0413-05	0.60	0.00	3.00	0.00	3.60	0.00
0413-07	146.64	0.26	1.56	0.00	148.20	0.26
0413-09	15.55	0.10	2.58	0.00	18.13	0.10
0413-11	0.00	0.00	6.01	0.00	6.01	0.00
0413-13	0.00	0.00	0.22	0.00	0.22	0.00
0414-00	0.22	0.00	0.55	0.00	0.77	0.00
0414-02	5.36	0.00	1.19	0.00	6.55	0.00
0414-04	8.45	0.00	9.09	0.00	17.54	0.00
0414-06	0.45	0.00	1.67	0.22	2.12	0.22
0414-08	7.94	0.87	0.11	0.00	8.05	0.87
0423-01	4.69	0.35	0.98	0.14	5.67	0.49
0423-03	3.88	0.39	0.62	0.00	4.50	0.39
0423-05	14.03	1.37	0.74	0.00	14.77	1.37
0423-07	8.51	0.53	0.15	0.00	8.66	0.53
0423-09	6.08	0.06	0.65	0.00	6.73	0.06
0423-11	0.84	0.00	0.56	0.11	1.40	0.11
0423-13	3.89	0.13	1.21	0.00	5.09	0.13
0423-15	5.63	0.47	0.23	0.06	5.86	0.52
0423-17	5.00	0.39	0.26	0.00	5.26	0.39
0460-01	0.40	0.00	0.90	0.00	1.31	0.00
0460-03	0.35	0.00	0.89	0.00	1.24	0.00
0460-05	0.32	0.00	0.37	0.11	0.70	0.11
0461-01	0.07	0.07	0.40	0.00	0.46	0.07
0461-03	1.73	0.00	0.40	0.00	2.13	0.00
0461-05	1.29	0.00	1.77	0.29	3.06	0.29
0461-07	0.00	0.00	0.26	0.00	0.26	0.00
0476-01	0.00	0.00	0.25	0.00	0.25	0.00
0403-01	5.02	0.35	4.37	0.18	9.39	0.53
0403-03	0.34	0.00	0.90	0.00	1.24	0.00
0403-05	4.65	0.17	0.08	0.00	4.73	0.17
0403-07	0.00	0.00	0.47	0.00	0.47	0.00
0403-09	0.07	0.00	0.80	0.00	0.87	0.00
0406-01	8.58	0.13	1.29	0.00	9.87	0.13
0406-03	0.42	0.00	1.00	0.00	1.41	0.00
0406-05	5.54	0.00	1.75	0.00	7.28	0.00
0406-07	0.46	0.00	1.13	0.00	1.60	0.00
0406-09	1.00	0.00	0.81	0.00	1.81	0.00
0406-11	11.30	4.00	0.25	0.00	11.55	4.00

APPENDIX C - UPPER COWEEMAN REACH DATA

	Riparian Data			
	Left Bank		Right Bank	
Reference Point #	Riparian Condition Class	Near-term Recruitment Class	Riparian Condition Class	Near-term Recruitment Class
0401-04	MMD	H	MMD	H
0401-06	MMD	H	MMD	H
0401-08	MMD	H	MMD	H
0401-10	MMD	H	MMD	H
0413-01	MMD	H	DMD	M
0413-03	MMD	H	MMD	H
0413-05	MMD	H	DMD	M
0413-07	MMD	H	DMD	M
0413-09	MMD	H	MMD	H
0413-11	CMD	H	CMD	H
0413-13	CMD	H	CMD	H
0414-00	CMD	H	CMD	H
0414-02	CMD	H	CMD	H
0414-04	CMD	H	CMD	H
0414-06	CMD	H	CMD	H
0414-08	CMD	H	CMD	H
0423-01	CMD	H	CMD	H
0423-03	CMD	H	CMD	H
0423-05	CMD	H	CMD	H
0423-07	CMD	H	CMD	H
0423-09	CMD	H	CMD	H
0423-11	CMD	H	CMD	H
0423-13	CMD	H	CMD	H
0423-15	CMD	H	CMD	H
0423-17	CMD	H	CMD	H
0460-01	MMD	H	MSD	L
0460-03	DSD	L	MSD	L
0460-05	MSD	L	MSD	L
0461-01	MSD	L	MSD	L
0461-03	CSD	L	CSD	L
0461-05	CMD	H	CMD	H
0461-07	CMD	H	CMD	H
0476-01	DSD	L	MSM	L
0403-01	CSD	L	CSD	L
0403-03	CMD	H	CMD	H
0403-05	MMD	H	CMD	H
0403-07	CMD	H	MMD	H
0403-09	CMD	H	CMD	H
0406-01	CSD	L	CSD	L
0406-03	CSD	L	CSD	L
0406-05	CSD	L	CSD	L
0406-07	CSD	L	CSD	L
0406-09	CSD	L	CSD	L
0406-11	CSD	L	CSD	L

Appendix D
Upper Coweeman Baseline Lwd Data for Reaches Adjacent to Timber Harvest Units Planned by Weyerhaeuser for 1998 - 2002

APPENDIX D - UPPER COWEEMAN BASELINE LWD DATA FOR REACHES ADJACENT TO TIMBER HARVEST UNITS PLANNED FOR 1998 - 2002

Stream Name	LWD Survey Segments	Harvest Prescription	Affected Reach Numbers	Affected # Banks	Mean Bankfull Width (m)
Coweeman River	2	LWD1-Blue	2	1 BANK	20.8
	2	LWD1-Blue	4	1 BANK	18.7
	2	LWD1-Blue	8	1 BANK	22.5
Coweeman River	6	LWD1-Blue	34	1 BANK	20.3
Mullholland Creek	104	LWD2-Blue	8	1 BANK	10.95
Mullholland Creek	105	LWD2-Blue	3	2 BANKS	9
Mullholland Creek	106	LWD2-Blue	4	1 BANK	11
Mullholland Creek	107	LWD2-Red	0	1 BANK	8.95
	107	LWD2-Red	2	1 BANK	11.45
	107	LWD2-Red	4	1 BANK	10.45
	107	LWD2-Red	6	1 BANK	10.35
Mullholland Creek Trib	138	LWD1-Red	0	2 BANKS	5.75
	138	LWD1-Red	2	2 BANKS	4.95
Mullholland Creek Trib	146	LWD1-Red	5	1 BANK	3.25
	146	LWD2-Red	5	1 BANK	
	146	LWD1-Red	7	1 BANK	2.5
	146	LWD2-Red	7	1 BANK	
Baird Creek	201	LWD2-Blue	7	1 BANK	9.75
	201	LWD2-Blue	9	1 BANK	9
	201	LWD2-Blue	11	1 BANK	10.85
Baird Creek	203	LWD2-Blue	0	1 BANK	8.8
	203	LWD2-Blue	2	1 BANK	6.75
	203	LWD2-Blue	4	1 BANK	9.75
Little Baird Creek	224	LWD2-Red	0	2 BANKS	3.35
	224	LWD2-Red	2	2 BANKS	3.9
Little Baird Creek	225	LWD2-Red	1	2 BANKS	2.6
Coweeman River	300	LWD2-Blue	8	1 BANK	22.2
	300	LWD2-Blue	10	1 BANK	17.1
	300	LWD2-Blue	12	1 BANK	16.1
	300	LWD2-Blue	14	1 BANK	18.85
	300	LWD2-Blue	16	1 BANK	15.85
Coweeman River	306	LWD2-Blue	4	1 BANK	11.55
	306	LWD2-Blue	6	1 BANK	13.85
	306	LWD2-Blue	8	1 BANK	12
	306	LWD2-Blue	10	1 BANK	14.4
	306	LWD2-Blue	12	1 BANK	10.15
	306	LWD2-Blue	14	1 BANK	14.1
	306	LWD2-Blue	16	1 BANK	13.5
Unnamed	322	LWD1-Red	7	2 BANKS	4.5
Skipper Creek	346	LWD1-Blue	0	1 BANK	5.6
Skipper Creek	347	LWD2-Red	4	1 BANK	2.4
Coweeman River	401	LWD1-Green	0	1 BANK	9.5
	401	LWD1-Green	2	1 BANK	9.4
	401	LWD1-Green	4	1 BANK	8.2
	401	LWD1-Green	6	1 BANK	7.9
	401	LWD1-Green	8	1 BANK	6.2
	401	LWD1-Green	10	1 BANK	10.25
Coweeman River Trib	413	LWD1-Green	1	1 BANK	9.45
	413	LWD3-Green	3	1 BANK	10.15
	413	LWD3-Green	5	1 BANK	15
	413	LWD3-Green	7	2 BANKS	26
	413	LWD3-Green	9	1 BANK	10.3
	413	LWD1-Green	11	1 BANK	10.55
	413	LWD1-Green	13	1 BANK	10.6
Coweeman River Trib	414	LWD1-Yellow	0	1 BANK	11
Coweeman River Trib	423	LWD1-Yellow	1	2 BANKS	7
	423	LWD1-Yellow	3	1 BANK	7.75
	423	LWD1-Yellow	5	1 BANK	10.55

APPENDIX D - UPPER COWEEMAN BASELINE LWD DATA FOR REACHES ADJACENT TO TIMBER HARVEST UNITS PLANNED FOR 1998 - 2002

				SINGLE LOGS AND ROOTWADS					
				Zone 1		Zone 2		Total	
Stream Name	LWD Survey Segments	Affected Reach Numbers	Mean Bankfull Width (m)	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW
Coweeman River	2	2	20.8	0.00	0.00	0.00	0.00	0.00	0.00
	2	4	18.7	0.19	0.00	0.75	0.00	0.94	0.00
	2	8	22.5	0.90	0.00	0.23	0.00	1.13	0.00
Coweeman River	6	34	20.3	0.61	0.00	0.61	0.00	1.22	0.00
Mullholland Creek	104	8	10.95	1.97	0.00	0.66	0.00	2.63	0.00
Mullholland Creek	105	3	9	0.72	0.09	0.45	0.00	1.16	0.09
Mullholland Creek	106	4	11	1.11	0.00	0.67	0.00	1.78	0.00
Mullholland Creek	107	0	8.95	0.27	0.00	0.27	0.00	0.54	0.00
	107	2	11.45	2.29	0.11	1.60	0.00	3.89	0.11
	107	4	10.45	0.31	0.10	0.73	0.00	1.05	0.10
	107	6	10.35	0.93	0.10	0.10	0.00	1.04	0.10
Mullholland Creek Trib	138	0	5.75	0.23	0.00	0.17	0.00	0.40	0.00
	138	2	4.95	0.45	0.00	0.40	0.05	0.84	0.05
Mullholland Creek Trib	146	5	3.25	0.26	0.00	0.55	0.00	0.81	0.00
	146	5		0.26	0.00	0.55	0.00	0.81	0.00
	146	7	2.5	0.35	0.03	0.40	0.03	0.75	0.05
	146	7		0.35	0.03	0.40	0.03	0.75	0.05
Baird Creek	201	7	9.75	0.39	0.00	1.46	0.00	1.85	0.00
	201	9	9	0.54	0.09	0.63	0.09	1.17	0.18
	201	11	10.85	0.57	0.00	0.00	0.00	0.57	0.00
Baird Creek	203	0	8.8	0.00	0.00	0.18	0.00	0.18	0.00
	203	2	6.75	0.34	0.00	0.68	0.00	1.01	0.00
	203	4	9.75	0.29	0.00	0.98	0.00	1.27	0.00
Little Baird Creek	224	0	3.35	0.13	0.00	0.23	0.00	0.37	0.00
	224	2	3.9	0.05	0.00	0.00	0.00	0.05	0.00
Little Baird Creek	225	1	2.6	0.10	0.00	0.16	0.00	0.26	0.00
Coweeman River	300	8	22.2	1.78	0.00	0.89	0.00	2.66	0.00
	300	10	17.1	0.34	0.00	2.22	0.00	2.57	0.00
	300	12	16.1	0.16	0.00	0.32	0.00	0.48	0.00
	300	14	18.85	0.19	0.00	0.19	0.00	0.38	0.00
	300	16	15.85	0.79	0.00	0.79	0.00	1.59	0.00
Coweeman River	306	4	11.55	0.35	0.00	0.35	0.00	0.69	0.00
	306	6	13.85	0.14	0.00	0.55	0.00	0.69	0.00
	306	8	12	0.12	0.00	0.24	0.00	0.36	0.00
	306	10	14.4	0.29	0.00	1.87	0.00	2.16	0.00
	306	12	10.15	0.30	0.10	1.02	0.10	1.32	0.20
	306	14	14.1	0.56	0.00	0.85	0.14	1.41	0.14
	306	16	13.5	0.14	0.00	0.54	0.00	0.68	0.00
Unnamed	322	7	4.5	0.59	0.18	0.09	0.09	0.68	0.27
Skipper Creek	346	0	5.6	0.34	0.11	0.62	0.06	0.95	0.17
Skipper Creek	347	4	2.4	0.10	0.02	0.17	0.02	0.26	0.05
Coweeman River	401	0	9.5	0.19	0.00	0.48	0.10	0.67	0.10
	401	2	9.4	0.00	0.00	0.66	0.09	0.66	0.09
	401	4	8.2	0.08	0.00	0.00	0.00	0.08	0.00
	401	6	7.9	0.00	0.00	0.00	0.00	0.00	0.00
	401	8	6.2	0.12	0.00	0.06	0.00	0.19	0.00
	401	10	10.25	0.00	0.00	0.41	0.10	0.41	0.10
Coweeman River Trib	413	1	9.45	0.19	0.00	0.38	0.00	0.57	0.00
	413	3	10.15	0.00	0.00	0.81	0.10	0.81	0.10
	413	5	15	0.60	0.00	3.00	0.00	3.60	0.00
	413	7	26	1.04	0.26	1.56	0.00	2.60	0.26
	413	9	10.3	0.00	0.00	0.10	0.00	0.10	0.00
	413	11	10.55	0.00	0.00	0.32	0.00	0.32	0.00
	413	13	10.6	0.00	0.00	0.22	0.00	0.22	0.00
Coweeman River Trib	414	0	11	0.22	0.00	0.55	0.00	0.77	0.00
Coweeman River Trib	423	1	7	0.07	0.00	0.98	0.14	1.05	0.14
	423	3	7.75	0.93	0.08	0.62	0.00	1.55	0.08
	423	5	10.55	0.63	0.00	0.74	0.00	1.37	0.00

APPENDIX D - UPPER COWEEMAN BASELINE LWD DATA FOR REACHES ADJACENT TO TIMBER HARVEST UNITS PLANNED FOR 1998 - 2002

Stream Name	LWD Survey Segments	Affected Reach Numbers	Mean Bankfull Width (m)	JAMS Zone 1 Pieces/CW	JAMS Zone 1 Key Pieces/CW	JAMS Zone 2 Pieces/CW	JAMS Zone 2 Key Pieces/CW	JAMS Total Pieces/CW	JAMS Total Key Pieces/CW
Coweeman River	2	2	20.8	0.00	0.00	8.11	0.00	8.11	0.00
	2	4	18.7	2.24	0.00	0.00	0.00	2.24	0.00
	2	8	22.5	0.00	0.00	0.00	0.00	0.00	0.00
Coweeman River	6	34	20.3	0.00	0.00	0.00	0.00	0.00	0.00
Mullholland Creek	104	8	10.95	0.00	0.00	0.00	0.00	0.00	0.00
Mullholland Creek	105	3	9	0.00	0.00	0.00	0.00	0.00	0.00
Mullholland Creek	106	4	11	5.33	0.00	0.00	0.00	5.33	0.00
Mullholland Creek	107	0	8.95	11.81	0.00	0.00	0.00	11.81	0.00
	107	2	11.45	0.00	0.00	0.00	0.00	0.00	0.00
	107	4	10.45	0.00	0.00	0.00	0.00	0.00	0.00
	107	6	10.35	0.00	0.00	0.00	0.00	0.00	0.00
Mullholland Creek Trib	138	0	5.75	2.70	0.17	0.00	0.00	2.70	0.17
	138	2	4.95	0.00	0.00	0.00	0.00	0.00	0.00
Mullholland Creek Trib	146	5	3.25	0.72	0.00	0.00	0.00	0.72	0.00
	146	5		0.72	0.00	0.00	0.00	0.72	0.00
	146	7	2.5	0.00	0.00	0.00	0.00	0.00	0.00
	146	7		0.00	0.00	0.00	0.00	0.00	0.00
Baird Creek	201	7	9.75	0.00	0.00	0.00	0.00	0.00	0.00
	201	9	9	0.00	0.00	0.00	0.00	0.00	0.00
	201	11	10.85	11.80	0.00	0.00	0.00	11.80	0.00
Baird Creek	203	0	8.8	2.82	0.35	0.00	0.00	2.82	0.35
	203	2	6.75	0.00	0.00	0.00	0.00	0.00	0.00
	203	4	9.75	0.00	0.00	0.00	0.00	0.00	0.00
Little Baird Creek	224	0	3.35	1.61	0.10	0.00	0.00	1.61	0.10
	224	2	3.9	0.00	0.00	0.00	0.00	0.00	0.00
Little Baird Creek	225	1	2.6	0.86	0.08	0.00	0.00	0.86	0.08
Coweeman River	300	8	22.2	0.00	0.00	0.00	0.00	0.00	0.00
	300	10	17.1	0.00	0.00	0.00	0.00	0.00	0.00
	300	12	16.1	0.00	0.00	0.00	0.00	0.00	0.00
	300	14	18.85	0.00	0.00	0.00	0.00	0.00	0.00
	300	16	15.85	0.00	0.00	0.00	0.00	0.00	0.00
Coweeman River	306	4	11.55	0.00	0.00	1.27	0.12	1.27	0.12
	306	6	13.85	0.00	0.00	0.00	0.00	0.00	0.00
	306	8	12	0.00	0.00	0.00	0.00	0.00	0.00
	306	10	14.4	0.00	0.00	0.00	0.00	0.00	0.00
	306	12	10.15	0.00	0.00	0.00	0.00	0.00	0.00
	306	14	14.1	0.00	0.00	2.68	0.00	2.68	0.00
	306	16	13.5	0.00	0.00	0.00	0.00	0.00	0.00
Unnamed	322	7	4.5	4.28	0.32	0.00	0.00	4.28	0.32
Skipper Creek	346	0	5.6	0.00	0.00	0.00	0.00	0.00	0.00
Skipper Creek	347	4	2.4	0.00	0.00	0.00	0.00	0.00	0.00
Coweeman River	401	0	9.5	4.37	0.00	0.00	0.00	4.37	0.00
	401	2	9.4	0.00	0.00	2.91	0.00	2.91	0.00
	401	4	8.2	9.02	0.08	0.98	0.08	10.00	0.16
	401	6	7.9	0.00	0.00	0.00	0.00	0.00	0.00
	401	8	6.2	0.00	0.00	0.00	0.00	0.00	0.00
	401	10	10.25	2.46	0.00	3.79	0.00	6.25	0.00
Coweeman River Trib	413	1	9.45	0.00	0.00	2.46	0.09	2.46	0.09
	413	3	10.15	0.00	0.00	0.00	0.00	0.00	0.00
	413	5	15	0.00	0.00	0.00	0.00	0.00	0.00
	413	7	26	145.60	0.00	0.00	0.00	145.60	0.00
	413	9	10.3	15.55	0.10	2.47	0.00	18.03	0.10
	413	11	10.55	0.00	0.00	5.70	0.00	5.70	0.00
	413	13	10.6	0.00	0.00	0.00	0.00	0.00	0.00
Coweeman River Trib	414	0	11	0.00	0.00	0.00	0.00	0.00	0.00
Coweeman River Trib	423	1	7	4.62	0.35	0.00	0.00	4.62	0.35
	423	3	7.75	2.95	0.31	0.00	0.00	2.95	0.31
	423	5	10.55	13.40	1.37	0.00	0.00	13.40	1.37

APPENDIX D - UPPER COWEEMAN BASELINE LWD DATA FOR REACHES ADJACENT TO TIMBER HARVEST UNITS PLANNED FOR 1998 - 2002

Stream Name	LWD Survey Segments	Affected Reach Numbers	Mean Bankfull Width (m)	Total LWD Pieces Zone 1 Pieces/CW	Zone 1 Key Pieces/CW	Zone 2 Pieces/CW	Zone 2 Key Pieces/CW	Total Pieces/CW	Total Key Pieces/CW
Coweeman River	2	2	20.8	0.00	0.00	8.11	0.00	8.11	0.00
	2	4	18.7	2.43	0.00	0.75	0.00	3.18	0.00
	2	8	22.5	0.90	0.00	0.23	0.00	1.13	0.00
Coweeman River	6	34	20.3	0.61	0.00	0.61	0.00	1.22	0.00
Mullholland Creek	104	8	10.95	1.97	0.00	0.66	0.00	2.63	0.00
Mullholland Creek	105	3	9	0.72	0.09	0.45	0.00	1.16	0.09
Mullholland Creek	106	4	11	6.44	0.00	0.67	0.00	7.10	0.00
Mullholland Creek	107	0	8.95	12.08	0.00	0.27	0.00	12.35	0.00
	107	2	11.45	2.29	0.11	1.60	0.00	3.89	0.11
	107	4	10.45	0.31	0.10	0.73	0.00	1.05	0.10
	107	6	10.35	0.93	0.10	0.10	0.00	1.04	0.10
Mullholland Creek Trib	138	0	5.75	2.93	0.17	0.17	0.00	3.11	0.17
	138	2	4.95	0.45	0.00	0.40	0.05	0.84	0.05
Mullholland Creek Trib	146	5	3.25	0.98	0.00	0.55	0.00	1.53	0.00
	146	5		0.98	0.00	0.55	0.00	1.53	0.00
	146	7	2.5	0.35	0.03	0.40	0.03	0.75	0.05
	146	7		0.35	0.03	0.40	0.03	0.75	0.05
Baird Creek	201	7	9.75	0.39	0.00	1.46	0.00	1.85	0.00
	201	9	9	0.54	0.09	0.63	0.09	1.17	0.18
	201	11	10.85	12.37	0.00	0.00	0.00	12.37	0.00
Baird Creek	203	0	8.8	2.82	0.35	0.18	0.00	2.99	0.35
	203	2	6.75	0.34	0.00	0.68	0.00	1.01	0.00
	203	4	9.75	0.29	0.00	0.98	0.00	1.27	0.00
Little Baird Creek	224	0	3.35	1.74	0.10	0.23	0.00	1.98	0.10
	224	2	3.9	0.05	0.00	0.00	0.00	0.05	0.00
Little Baird Creek	225	1	2.6	0.96	0.08	0.16	0.00	1.12	0.08
Coweeman River	300	8	22.2	1.78	0.00	0.89	0.00	2.66	0.00
	300	10	17.1	0.34	0.00	2.22	0.00	2.57	0.00
	300	12	16.1	0.16	0.00	0.32	0.00	0.48	0.00
	300	14	18.85	0.19	0.00	0.19	0.00	0.38	0.00
	300	16	15.85	0.79	0.00	0.79	0.00	1.59	0.00
Coweeman River	306	4	11.55	0.35	0.00	1.62	0.12	1.96	0.12
	306	6	13.85	0.14	0.00	0.55	0.00	0.69	0.00
	306	8	12	0.12	0.00	0.24	0.00	0.36	0.00
	306	10	14.4	0.29	0.00	1.87	0.00	2.16	0.00
	306	12	10.15	0.30	0.10	1.02	0.10	1.32	0.20
	306	14	14.1	0.56	0.00	3.53	0.14	4.09	0.14
	306	16	13.5	0.14	0.00	0.54	0.00	0.68	0.00
Unnamed	322	7	4.5	4.86	0.50	0.09	0.09	4.95	0.59
Skipper Creek	346	0	5.6	0.34	0.11	0.62	0.06	0.95	0.17
Skipper Creek	347	4	2.4	0.10	0.02	0.17	0.02	0.26	0.05
Coweeman River	401	0	9.5	4.56	0.00	0.48	0.10	5.04	0.10
	401	2	9.4	0.00	0.00	3.57	0.09	3.57	0.09
	401	4	8.2	9.10	0.08	0.98	0.08	10.09	0.16
	401	6	7.9	0.00	0.00	0.00	0.00	0.00	0.00
	401	8	6.2	0.12	0.00	0.06	0.00	0.19	0.00
	401	10	10.25	2.46	0.00	4.20	0.10	6.66	0.10
Coweeman River Trib	413	1	9.45	0.19	0.00	2.84	0.09	3.02	0.09
	413	3	10.15	0.00	0.00	0.81	0.10	0.81	0.10
	413	5	15	0.60	0.00	3.00	0.00	3.60	0.00
	413	7	26	146.64	0.26	1.56	0.00	148.20	0.26
	413	9	10.3	15.55	0.10	2.58	0.00	18.13	0.10
	413	11	10.55	0.00	0.00	6.01	0.00	6.01	0.00
	413	13	10.6	0.00	0.00	0.22	0.00	0.22	0.00
Coweeman River Trib	414	0	11	0.22	0.00	0.55	0.00	0.77	0.00
Coweeman River Trib	423	1	7	4.69	0.35	0.98	0.14	5.67	0.49
	423	3	7.75	3.88	0.39	0.62	0.00	4.50	0.39
	423	5	10.55	14.03	1.37	0.74	0.00	14.77	1.37

APPENDIX D - UPPER COWEEMAN BASELINE LWD DATA FOR REACHES ADJACENT TO TIMBER HARVEST UNITS PLANNED FOR 1998 - 2002

Stream Name	LWD Survey Segments	Harvest Prescription	Affected Reach Numbers	Affected # Banks	Mean Bankfull Width (m)
	423	LWD1-Yellow	7	2 BANKS	7.6
	423	LWD1-Yellow	9	1 BANK	5.9
	423	LWD1-Yellow	11	1 BANK	5.6
	423	LWD1-Yellow	13	1 BANK	5.7
	423	LWD1-Yellow	15	1 BANK	5.65
	423	LWD1-Yellow	17	1 BANK	5.75

Note: Harvest prescriptions are described fully in the watershed analysis. The first part of each entry is the prescription number (e.g., LWD 1). The second part of the entry is the color associated with channel type:

Blue - confined mainstem channels
Red - alluvial channels
Green - steeper gradient, forced alluvial channels
Yellow - channels with debris torrent potential

APPENDIX D - UPPER COWEEMAN BASELINE LWD DATA FOR REACHES ADJACENT TO TIMBER HARVEST UNITS PLANNED FOR 1998 - 2002

				SINGLE LOGS AND ROOTWADS					
				Zone 1		Zone 2		Total	
Stream Name	LWD Survey Segments	Affected Reach Numbers	Mean Bankfull Width (m)	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW	Pieces/CW	Key Pieces/CW
	423	7	7.6	0.23	0.00	0.15	0.00	0.38	0.00
	423	9	5.9	0.47	0.06	0.65	0.00	1.12	0.06
	423	11	5.6	0.17	0.00	0.56	0.11	0.73	0.11
	423	13	6.7	0.74	0.13	1.21	0.00	1.94	0.13
	423	15	5.65	0.57	0.06	0.23	0.06	0.79	0.11
	423	17	5.75	0.13	0.00	0.26	0.00	0.39	0.00

APPENDIX D - UPPER COWEEMAN BASELINE LWD DATA FOR REACHES ADJACENT TO TIMBER HARVEST UNITS PLANNED FOR 1998 - 2002

Stream Name	LWD Survey Segments	Affected Reach Numbers	Mean Bankfull Width (m)	JAMS Zone 1 Pieces/CW	JAMS Zone 1 Key Pieces/CW	JAMS Zone 2 Pieces/CW	JAMS Zone 2 Key Pieces/CW	Total Pieces/CW	Total Key Pieces/CW
	423	7	7.6	8.28	0.53	0.00	0.00	8.28	0.53
	423	9	5.9	5.61	0.00	0.00	0.00	5.61	0.00
	423	11	5.6	0.67	0.00	0.00	0.00	0.67	0.00
	423	13	6.7	3.15	0.00	0.00	0.00	3.15	0.00
	423	15	5.65	5.07	0.41	0.00	0.00	5.07	0.41
	423	17	5.75	4.87	0.39	0.00	0.00	4.87	0.39

APPENDIX D - UPPER COWEEMAN BASELINE LWD DATA FOR REACHES ADJACENT TO TIMBER HARVEST UNITS PLANNED FOR 1998 - 2002

Stream Name	LWD Survey Segments	Affected Reach Numbers	Mean Bankfull Width (m)	Total LWD Pieces Zone 1 Pieces/CW	Zone 1 Key Pieces/CW	Zone 2 Pieces/CW	Zone 2 Key Pieces/CW	Total Pieces/CW	Total Key Pieces/CW
	423	7	7.6	8.51	0.53	0.15	0.00	8.66	0.53
	423	9	5.9	6.08	0.06	0.65	0.00	6.73	0.06
	423	11	5.6	0.84	0.00	0.56	0.11	1.40	0.11
	423	13	6.7	3.89	0.13	1.21	0.00	5.09	0.13
	423	15	5.65	5.63	0.47	0.23	0.06	5.86	0.52
	423	17	5.75	5.00	0.39	0.26	0.00	5.26	0.39