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Overview Hydrologic Assessment

for the

ASP CREEK WATERSHED (ID # 164)

(Merritt Forest District)

Prepared for
Weyerhaeuser Canada LTD.

by
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March 1999

Overview Hydrologic Assessment

of the

Asp Creek Sub-basin (# 164)

EXECUTIVE SUMMARY

This report presents the results of an overview hydrologic assessment of the Asp Creek sub-basin located immediately north of Princeton. Weyerhaeuser Canada Ltd. (Merritt Division) initiated the study, partly in response to the results of the 1997 Merritt Forest District IWAP, and partly to address concerns from the Ministry of Forests. Concerns included peak flows, surface erosion, riparian buffers, and the impact of the five-year forest development plan. Field work was carried out in October 1998.

The IWAP hazard index for peak flow is reduced from medium in the 1997 IWAP report to low. The current ECA of 14.3% is a low concern for increased peak flows over natural levels. The proposed maximum ECA associated with proposed forest development is 19.7% in 2002 which represents a low to moderate hazard for increased peak flows.

The IWAP surface erosion is reduced to a low hazard index from high in the 1997 IWAP report. This reduction is based on the low number of sediment-generating crossings, moderate road density (1.68 km/km^2), and low amount of surface erosion observed.

Erosion noted at stream crossings from cattle movement is a minor but potentially chronic sediment source in this sub-basin.
Adherence to FPC harvesting and road building techniques should minimize surface erosion and sediment delivery related to proposed forest development. There is a low surface erosion concern associated with proposed harvesting.

The IWAP riparian buffers hazard index is decreased from high to low. A low percentage of mainstem or permanent tributary channels have been logged to streambank (< ½ %) in this sub-basin. Proposed development presents a low-moderate risk to riparian buffers. About 750 m of permanent channels and 2 km of small intermittent streams are identified at the edge of or within proposed cutblock boundaries. Recommendations are provided to mitigate risk to riparian buffers associated with proposed harvesting.

Natural mass wasting was identified in the lower gorge area, associated with steeply sloping banks located next to an irrigated hayfield. There was no mass wasting evident anywhere else in the Asp Creek sub-basin and the hazard index remains unchanged from the 1997 IWAP report (low).

Channels in the Asp Creek sub-basin were found to be stable in the headwaters and in the lower reach near Princeton. Some partial to moderate disturbance was noted at CSS2 located in the middle reach of Asp Creek. Overall, the channel was found to be stable with a low amount of disturbance indicators. The channels are unlikely to be affected by the low potential for peak flow increases associated with the proposed development.

Based on the field survey, there is a current overall low hydrologic concern in the Asp Creek sub-basin for peak flows, surface erosion, riparian buffers and mass wasting. There is a low-moderate channel stability concern in this sub-basin.

Adherence to Forest Practices Code standards for forest harvesting and road construction, and implementation of the recommendations provided in the following section are considered adequate protection to the water resources associated with proposed harvesting.

The following measures are recommended to protect the water quality in the Asp Creek sub-basin:

The following measures are recommended to protect the water quality in the Asp Creek sub-basin:

- Distribute proposed development over two or more years to mitigate any hydrologic concern associated with the current schedule of proposed harvest;
- Construct a sump at Sediment Source 3 (SS3) to reduce sediment delivery into the channel,
- Install a cross-drain culvert at SS2,
- Determine risk to riparian buffers and channel along permanent streams identified adjacent to proposed CP 534-3 and 672-9; relocate CP 534-3 boundary to top of outer gorge (about 20 m from stream edge),
- Protect the small intermittent streams located adjacent to or within proposed cutblocks (CP 534-1 and 5; CP 672-1, 2, 3, 10 and 11) by utilizing FPC regulations and /or implementing a 5m no-machine buffer prior to harvesting and site preparation,
- Construct sumps or employ other sediment control measures at stream crossings on proposed roads to minimize sediment delivery into channels.

Weyerhaeuser Canada Ltd.

Overview Hydrologic Assessment
for the

ASP CREEK WATERSHED (ID # 164)

(Merritt Forest District)

1.0 INTRODUCTION

The Asp Creek watershed is located directly north of Princeton, with the lower reach of the channel within the city limits. The watershed has an area of 64.5 km^2, is linear in shape and approximately 20 km long by 3.5 km wide. Elevations range from 650 m at the confluence with the Tulameen River, to 1650 m at the north end of the watershed. The average channel gradient is equal to 5%.

Relatively little forest development has occurred in the watershed to date. Cultivation (hay fields), grazing and recreational uses were identified in the watershed. Snowpatch, a downhill ski area, and the China Ridge cross-country ski area are located within the watershed, at approximately 6.5 km on West China Creek Road. Private property totals about 12% (780 ha) of the total watershed area and is situated in the southeast part of the basin. Field work was carried out in October, 1998.

2.0 RESULTS OF THE 1997 MERRITT DISTRICT IWAP

The 1997 IWAP results for Asp Creek (Table 1) indicated a medium peak flow hazard, a high hazard for surface erosion and riparian buffers, and a low mass wasting hazard. An ECA of 11.1% was reported, which represents a low concern for peak flow increases over natural levels. The reported road density of 1.75 km/km^2 was responsible for bringing the peak flow index up into the medium category. The length of streams logged was 29.9 km or about 29% of the total stream length. Forty-three percent of the stream channels were identified as fish bearing streams.

TABLE 1
1997 IWAP Results In The Asp Creek Sub-Basin

IWAP Impact Category	Hazard Index	Hazard Category
Peak Flow	0.51	Medium
Surface Erosion	1.00	High
Riparian Buffers	0.95	High
Mass Wasting	0.03	Low

Note: The 1997 IWAP is an office-based procedure incorporating logging up to part of 1994, and results therefore represent *potential* concerns up to that year. Confirmation of the office IWAP results based on actual 1998 field conditions is one of the objectives of this report.

Identified Potential Hydrologic Concerns

Other potential hydrologic concerns in this sub-basin include:

- The current and proposed equivalent clearcut area (ECA) (MoF review of the five-year Forest Development Plan).

3.0 RESULTS

The results of the field survey of the Asp Creek sub-basin are presented in this section. Refer to the attached map for details on traverse routes and field site locations.

3.1 Peak Flows

The current ECA for the Asp Creek sub-basin is 14.3%, which is a low concern for increased peak flows over natural levels (Table 2).

The proposed ECA (Table 2, Figure 1) ranges from 14.3% in 1998 to a maximum of 19.7% in 2002. ECAs near 20% are considered a low to moderate concern for increased peak flows.

The ECA difference is 6.1% if no harvesting were to occur over the same time period up to the year 2002 (Figure 1). Almost all of this difference occurs in the year 2002 when forest harvesting in 16 cutblocks will increase the ECA by 5.4%. Although the proposed ECA of 19.7% represents a low-moderate concern, the amount of cut in one year is aggressive from a hydrologic viewpoint. To mitigate any potential hydrologic impacts, it would be preferable to distribute the cut over two or more years.

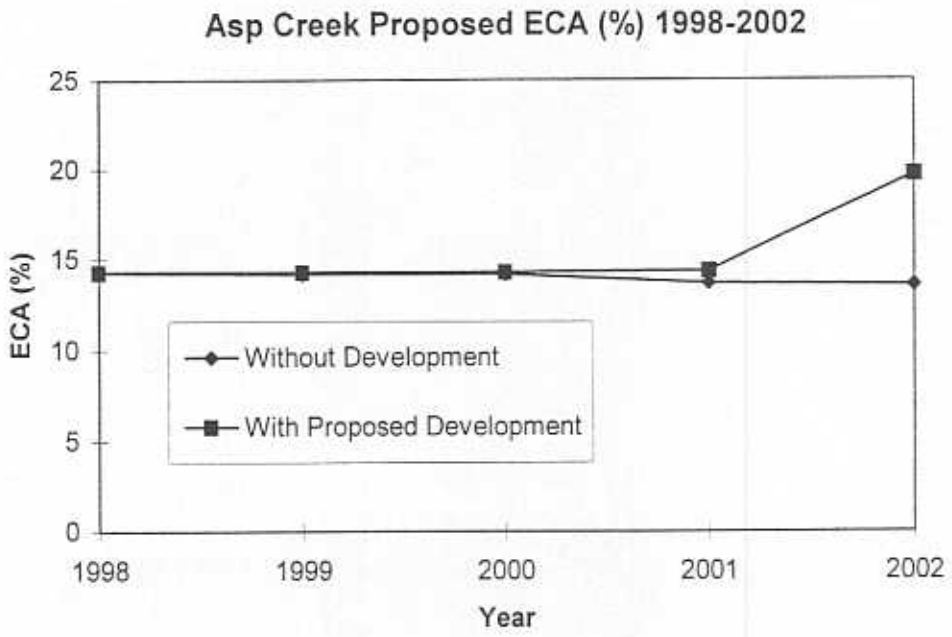
TABLE 2

Current (1998) And Proposed ECA (1999-2002) In The Asp Creek Sub-Basin

Units	Current ECA	Proposed ECA			
	1998	1999	2000	2001	2002
ha	918.5	920.5	920.5	929.5	1269.2
% > H_{60}	7.0	7.0	7.0	7.0	11.8
% Total Basin	14.3	14.3	14.3	14.4	19.7

FIGURE 1

1998-2006 ECA For The Asp Creek Sub-Basin - With And Without Proposed Development



3.2 Surface Erosion

Road density in the Asp Creek watershed is 1.63 km/km^2, which is a moderate amount of roads.

In general, only minor sediment sources were identified within the basin (Table 3). Three sediment sources were located in the headwaters at 16.1 km, 18.75 km and 19.3 km China Creek Road (SS1, SS2 and SS3).

A sump is recommended at SS3 (moderate hazard) to prevent ditch and road erosion from entering the tributary channel (W_b = 2 m).

SS1 and SS2 are considered a low hazard. SS1 consists of erosion at culvert inlet due to cattle trampling. SS2 is an area where ditch flow travels across the road surface and is creating fill slope erosion. The installation of a cross-drain culvert is recommended.

There is minor erosion and sediment input at the ford at Burn-1 Road due to vehicular traffic and cattle trampling (SS4).

TABLE 3

Sediment Source Survey Results For The Asp Creek Watershed

Sediment Source	Description	Risk/Hazard rating	Recommendations
SS1	Eroding culvert inlet (cattle trampling) - 16.1 China Creek Road.	Low	No action required.
SS2	Eroding fill slope due to ditch flow across the road - 18.75 km China Creek Road.	Low	Install cross-drain culvert.
SS3	Road surface and ditch erosion into channel - 19.3 km China Creek Road.	Moderate	Construct a sump to reduce sediment delivery.
SS4	Ford on tributary stream - 0.6 km Burn-1 Road.	Low	No action required.

3.3 Riparian Buffers

Logging–related disturbances to the riparian area were not observed during the field survey.

According to the 1997 IWAP report, 29% of the total stream length has been logged, and 22% of fish-bearing streams have been logged. This represents a high concern for riparian buffers and potential impacts on fish and channel stability.

However, counting only the mainstem channel, about 175 m or less than 0.5 % of the channel has been logged to streambank. The remainder of the stream length identified as logged is located along small intermittent streams which do not present a serious concern. There is therefore an overall low concern for riparian buffers in the Asp Creek watershed.

3.4 Mass Wasting

An unstable slope is located in the Asp Creek gorge (about 2.5 km upstream of stream mouth) below a private property hay field (Lot 969/958, 1.75 km China Creek Road). The steeply sloping banks have slumped (MW1 and MW2) at the site of two springs located approximately 200 m apart and 20 m from the edge of the field. The Asp Creek channel is located about 100 m from these springs. The landslide surfaces are actively eroding, however, the fairly heavy vegetation cover located below the springs traps much of the sediment before it reaches the stream.

It appears that the mass wasting events are the result of subsurface flow which emerges at this site. The mass wasting is considered to be natural. Bank erosion and/or slumping will likely continue on an on-going basis in the area surrounding the springs. The slumps are currently presenting a low risk to stream sedimentation and no remedial work is recommended at this time.

No mass wasting events were identified in the remainder of the watershed.

3.5 Channels

A helicopter reconnaissance of Asp Creek was conducted in September 1998. In general, the channel was determined to be stable with good riparian vegetation cover. Slumping and raveling banks located in the lower gorge area (see Mass Wasting section), and raveling stream banks located about halfway up the Asp Creek channel were noted during the flight.

Results of the detailed channel assessment are found in Table 4. The channel surveys indicated that Asp Creek has a CP_c-w morphology (CSS1, CSS2 and CSS3).

At CSS1 (approximately 6 km up the mainstem channel from its confluence with the Tulameen River) the channel was found to be partially to moderately disturbed (30% D1, 35% A2 and 35% S to A1). Disturbance was due to a large, steeply eroding bank which occurred over a 25 m section, and a recently formed LWD jam. There was evidence of a large peak flow event which occurred in the recent past (possibly November 1995).

The channel was stable in the headwaters (CSS2) and near the town of Princeton (CSS3).

Based on the field results, stream channels are considered stable to moderately disturbed and represent a low-moderate hydrologic concern.

TABLE 4
Channel Survey Results For The Asp Creek Watershed

Channel Survey Site/Location	Description	Survey Distance (m)	Morphology and Disturbance Level	Risk/Hazard Rating	Remarks
CSS1 Middle reach of Asp Creek - about 6 km upstream of confluence with Tulameen River.	**1.** W_b=6.8m d=50cm s=4% D=45cm **2.** W_b=13m d=40cm s=3.5% D=45cm **3.** W_b=6.5m d=50cm s=4% D=40cm	200	CP_c-w: 35% A2 35% S-A1 30% D1	Moderate	Disturbance indicators were LWD jams, eroding banks and extensive bars.
CSS2 Headwaters - 18 km China Creek Road.	W_b=2.5m d=30cm s=3% D=20cm	100	CP_c-w: S	Low	No concerns
CSS3 Adjacent to Ingerbell Road in Princeton.	W_b=4.4m d=45cm s=5% D=30cm	100	CP_c-w: S	Low	No concerns

4.0 PROPOSED DEVELOPMENT

Proposed development up to the year 2002 consists of 16 cutblocks totaling 346 ha, the construction of 20 km of roads outside the blocks and 8 additional stream crossings. Five of the stream crossings are on intermittent streams and 3 are located on permanent channels. The cutblocks are scheduled for harvest in 2002, and are located mainly on the plateau-like terrain situated away from the main channel (CP 534 and 672). Tolko Forest Industries Ltd. has a proposed block (1999) that straddles the Asp/Connaly watershed divide (7.4 ha within Asp Creek sub-basin).

Table 2 and Figure 1 presented earlier summarize the overall change in ECA associated with proposed development. It is suggested to distribute proposed development over two or more years, rather than the current one year period.

The 1:30,000 FDP maps indicate that several proposed cutblocks have boundaries to the edge of tributary channels. CP 534-3 and 672-9 have boundaries along stream channels that are identified as definite streams. Proposed block 534-3 was inspected on the ground: we recommend that the northeast block boundary be established above the outer gorge, which is located about 20 m from the stream edge. Establish riparian protection measures for the northeast boundary of 672-9 based on field inspections and FPC regulations.

CP 534-1 and 5, and CP 672-1, 2, 3, 10 and 11 are located on intermittent tributary channels, and are considered a lower concern with regard to potential riparian buffers and channel impacts.

Adherence to Forest Practice Code (FPC) standards for forest harvesting, road construction and sediment control measures are considered adequate protection for surface erosion in this sub-basin. Mass wasting is also considered a low concern with proposed development.

5.0 CONCLUSIONS

Based on the field survey the following conclusions are presented for peak flow, surface erosion, riparian buffers, mass wasting and channel stability in the Asp Creek sub-basin.

The IWAP hazard index for peak flow is reduced from medium in the 1997 IWAP report to low. The current ECA of 14.3% is a low concern for increased peak flows over natural levels. The proposed maximum ECA associated with proposed forest development is 19.7% in 2002 which represents a low to moderate hazard for increased peak flows.

The IWAP surface erosion is reduced to a low hazard index from high in the 1997 IWAP report. This reduction is based on the low number of sediment-generating crossings, moderate road density (1.68 km/km^2), and low amount of surface erosion observed.

Erosion noted at stream crossings from cattle movement is a minor but potentially chronic sediment source in this sub-basin.

Adherence to FPC harvesting and road building techniques should minimize surface erosion and sediment delivery related to proposed forest development. There is a low surface erosion concern associated with proposed harvesting.

The IWAP riparian buffers hazard index is decreased from high to low. A low percentage of mainstem or permanent tributary channels have been logged to streambank (< 0.5 %) in this sub-basin. Proposed development presents a low-moderate risk to riparian buffers. About 750 m of permanent channels and 2 km of small intermittent streams are identified at the edge of or within proposed cutblock boundaries. Recommendations are provided to mitigate risk to riparian buffers associated with proposed harvesting.

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Channels in the Asp Creek sub-basin were found to be stable in the headwaters and in the lower reach near Princeton. Some partial to moderate disturbance was noted at CSS2 located in the middle reach of Asp Creek. Overall, the channel was found to be stable with a low amount of disturbance indicators. The channels are unlikely to be affected by the low potential for peak flow increases associated with the proposed development.

Based on the field survey, there is a current overall low hydrologic concern in the Asp Creek sub-basin for peak flows, surface erosion, riparian buffers and mass wasting. There is a low-moderate channel stability concern in this sub-basin.

Adherence to Forest Practices Code standards for forest harvesting and road construction, and implementation of the recommendations provided in the following section are considered adequate protection to the water resources associated with proposed harvesting.

6.0 RECOMMENDATIONS

The following measures are recommended to protect the water quality in the Asp Creek sub-basin:

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Watershed Assessment: ECA Determination

Asp Creek *Watershed*

Regen. Growth/year (m): 0.2 *H60 Elevation (m)* 1280 *Threshold ECA (%)* 20

Watershed area (ha) 6444.0 *1st year of study* 1998

Road width(m) *Main:* 30.0 *2ndary* 20.0 *Other:* 10.0

Note: Data entry fields are shaded.

1. ECA without development

For NSR areas enter NSR in height column and no reference year in year column.

*Regeneration values: Leader= increment; Height= average height of regen.; year= reference year.

CP-block	Opening/ Polygon	Year Logged	Area (ha) <H60	Area (ha) >H60	Regeneration* Measured (m) Leader	Year	Height	1998 ECA Adjusted <H60	1998 ECA (ha.) >H60	1999 ECA Adjusted <H60	1999 ECA (ha.) >H60	2000 ECA Adjusted <H60	2000 ECA (ha.) >H60	2001 ECA Adjusted <H60	2001 ECA (ha.) >H60	2002 ECA Adjusted <H60	2002 ECA (ha.) >H60
	116	U	6.00				NSR	6.00	0.00	6.00	0.00	6.00	0.00	6.00	0.00	6.00	0.00
	114	U	11.1				NSR	11.10	0.00	11.10	0.00	11.10	0.00	11.10	0.00	11.10	0.00
	128	Logged	8.8			1991	12.00	0.88	0.00	0.88	0.00	0.88	0.00	0.88	0.00	0.88	0.00
	129	Logged	30.1			1991	13.00	3.01	0.00	3.01	0.00	3.01	0.00	3.01	0.00	3.01	0.00
	131	Logged	37			1991	18.00	3.70	0.00	3.70	0.00	3.70	0.00	3.70	0.00	3.70	0.00
	132	Logged	69				NSR	69.00	0.00	69.00	0.00	69.00	0.00	69.00	0.00	69.00	0.00
	125	Logged	42.6			1991	30.00	4.26	0.00	4.26	0.00	4.26	0.00	4.26	0.00	4.26	0.00
	134	1965	32.9			1991	16.00	3.29	0.00	3.29	0.00	3.29	0.00	3.29	0.00	3.29	0.00
	154	1965	18.1			1991	14.00	1.81	0.00	1.81	0.00	1.81	0.00	1.81	0.00	1.81	0.00
	151	1965	1.5			1991	16.00	0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00
	150	1965	43.7			1991	17.00	4.37	0.00	4.37	0.00	4.37	0.00	4.37	0.00	4.37	0.00
	580	1965	1.5			1992	16.00	0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00
	149	U	20.6				NSR	20.60	0.00	20.60	0.00	20.60	0.00	20.60	0.00	20.60	0.00
	581	1965	24.2			1992	24.00	2.42	0.00	2.42	0.00	2.42	0.00	2.42	0.00	2.42	0.00
	136	1965	9			1991	22.00	0.90	0.00	0.90	0.00	0.90	0.00	0.90	0.00	0.90	0.00
	22	1966	13.9			1991	17.00	1.39	0.00	1.39	0.00	1.39	0.00	1.39	0.00	1.39	0.00
	27	Logged	23.6			1991	20.00	2.36	0.00	2.36	0.00	2.36	0.00	2.36	0.00	2.36	0.00
	586	C	28.1				NSR	28.10	0.00	28.10	0.00	28.10	0.00	28.10	0.00	28.10	0.00
	29	Logged	7.8				NSR	7.80	0.00	7.80	0.00	7.80	0.00	7.80	0.00	7.80	0.00
	28	Logged	1.9			1991	15.00	0.19	0.00	0.19	0.00	0.19	0.00	0.19	0.00	0.19	0.00
	135	U	6.1				NSR	6.10	0.00	6.10	0.00	6.10	0.00	6.10	0.00	6.10	0.00
20	9		5.1			1993	0.10	5.10	0.00	5.10	0.00	5.10	0.00	5.10	0.00	5.10	0.00
	7	Logged	11.6			1991	20.00	1.16	0.00	1.16	0.00	1.16	0.00	1.16	0.00	1.16	0.00
	11/672	1965	22.4			1991	22.00	2.24	0.00	2.24	0.00	2.24	0.00	2.24	0.00	2.24	0.00
21	3	1989		28.70		1993	0.60	0.00	28.70	0.00	28.70	0.00	28.70	0.00	28.70	0.00	28.70
3	155	1977	4.6	23.20		1991	13.40	0.46	2.32	0.46	2.32	0.46	2.32	0.46	2.32	0.46	2.32
	661	Logged	13.1			1991	15.00	1.31	0.00	1.31	0.00	1.31	0.00	1.31	0.00	1.31	0.00
	659	Logged	32.2			1991	20.00	3.22	0.00	3.22	0.00	3.22	0.00	3.22	0.00	3.22	0.00
	616	Logged	9.7			1989	19.00	0.97	0.00	0.97	0.00	0.97	0.00	0.97	0.00	0.97	0.00
	656	1965	15.6			1991	10.00	1.56	0.00	1.56	0.00	1.56	0.00	1.56	0.00	1.56	0.00
	657	1966	19.6			1991	18.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00
	618	1965	30.1			1991	10.00	3.01	0.00	3.01	0.00	3.01	0.00	3.01	0.00	3.01	0.00

	609	1966	24.9				NSR	24.90	0.00	24.90	0.00	24.90	0.00	24.90	0.00	24.90	0.00
	608	Logged	59.2			1991	18.00	5.92	0.00	5.92	0.00	5.92	0.00	5.92	0.00	5.92	0.00
	610	1966	7.1			1991	28.00	0.71	0.00	0.71	0.00	0.71	0.00	0.71	0.00	0.71	0.00
	607	1991	9.6				NSR	9.60	0.00	9.60	0.00	9.60	0.00	9.60	0.00	9.60	0.00
25	622	1985	4.9			1994	20.00	0.49	0.00	0.49	0.00	0.49	0.00	0.49	0.00	0.49	0.00
	651	1965	20.1			1991	14.00	2.01	0.00	2.01	0.00	2.01	0.00	2.01	0.00	2.01	0.00
	730	1965	12.8				NSR	12.80	0.00	12.80	0.00	12.80	0.00	12.80	0.00	12.80	0.00
35	732		3.6			1991	0.40	3.60	0.00	3.60	0.00	3.60	0.00	3.60	0.00	3.60	0.00
34	733	1987	1.2			1997	1.60	1.20	0.00	1.20	0.00	1.20	0.00	1.20	0.00	1.20	0.00
	731	Logged	37.2			1991	5.00	18.60	0.00	18.60	0.00	18.60	0.00	9.30	0.00	9.30	0.00
36	379	1987	5.8			1991	0.40	5.80	0.00	5.80	0.00	5.80	0.00	5.80	0.00	5.80	0.00
	649	1965	35.6			1969	24.00	3.56	0.00	3.56	0.00	3.56	0.00	3.56	0.00	3.56	0.00
37	679	1991	9.7			1997	0.40	9.70	0.00	9.70	0.00	9.70	0.00	9.70	0.00	9.70	0.00
	641	1965	51.3			1980	20.00	5.13	0.00	5.13	0.00	5.13	0.00	5.13	0.00	5.13	0.00
18	624	1971	38.4	36.60		1981	20.00	3.84	3.66	3.84	3.66	3.84	3.66	3.84	3.66	3.84	3.66
	494	1971	23				NSR	23.00	0.00	23.00	0.00	23.00	0.00	23.00	0.00	23.00	0.00
15	489	1978		18.90		1988	19.00	0.00	1.89	0.00	1.89	0.00	1.89	0.00	1.89	0.00	1.89
16	625	1978				1992	17.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	628	1978		10.60		1993	5.00	0.00	5.30	0.00	5.30	0.00	5.30	0.00	5.30	0.00	5.30
22	492	1989	15	8.30		1997	0.40	15.00	8.30	15.00	8.30	15.00	8.30	15.00	8.30	15.00	8.30
19	648	1973	2.9	23.00		1989	15.00	0.29	2.30	0.29	2.30	0.29	2.30	0.29	2.30	0.29	2.30
19	647		19.8			1992	2.50	14.85	0.00	14.85	0.00	14.85	0.00	14.85	0.00	14.85	0.00
58	784			0.90		1996	0.30	0.00	0.90	0.00	0.90	0.00	0.90	0.00	0.90	0.00	0.90
	736	W		16.40		1991	24.00	0.00	1.64	0.00	1.64	0.00	1.64	0.00	1.64	0.00	1.64
	735	W				1969	17.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	732	1967		45.70		1980	20.00	0.00	4.57	0.00	4.57	0.00	4.57	0.00	4.57	0.00	4.57
33	539	1971		34.20		1993	9.20	0.00	3.42	0.00	3.42	0.00	3.42	0.00	3.42	0.00	3.42
	533	W		20.20		1992	24.00	0.00	2.02	0.00	2.02	0.00	2.02	0.00	2.02	0.00	2.02
50	507			7.10		1996	0.20	0.00	7.10	0.00	7.10	0.00	7.10	0.00	7.10	0.00	7.10
31	207	1980		21.50		1994	2.00	0.00	21.50	0.00	16.13	0.00	16.13	0.00	16.13	0.00	16.13
30	202	1980		25.30		1995	1.80	0.00	25.30	0.00	25.30	0.00	25.30	0.00	18.98	0.00	18.98
28	75			23.00			NSR	0.00	23.00	0.00	23.00	0.00	23.00	0.00	23.00	0.00	23.00
29	100	1981		12.80		1993	1.50	0.00	12.80	0.00	12.80	0.00	12.80	0.00	9.60	0.00	9.60
29	788			1.10			NSR	0.00	1.10	0.00	1.10	0.00	1.10	0.00	1.10	0.00	1.10
18	185	1982		11.90		1992	0.70	0.00	11.90	0.00	11.90	0.00	11.90	0.00	11.90	0.00	11.90
66	63			0.30			NSR	0.00	0.30	0.00	0.30	0.00	0.30	0.00	0.30	0.00	0.30
24	106	1981		49.60		1992	1.20	0.00	49.60	0.00	49.60	0.00	49.60	0.00	37.20	0.00	37.20
	59	W		4.00		1997	0.10	0.00	4.00	0.00	4.00	0.00	4.00	0.00	4.00	0.00	4.00
25	53	1981		24.50		1992	1.00	0.00	24.50	0.00	24.50	0.00	24.50	0.00	24.50	0.00	18.38
90	699	1991		15.70			NSR	0.00	15.70	0.00	15.70	0.00	15.70	0.00	15.70	0.00	15.70
89	738	1993		33.00		1995	0.10	0.00	33.00	0.00	33.00	0.00	33.00	0.00	33.00	0.00	33.00
29	787			5.60		1993	1.50	0.00	5.60	0.00	5.60	0.00	5.60	0.00	4.20	0.00	4.20
29	786			8.80		1993	0.70	0.00	8.80	0.00	8.80	0.00	8.80	0.00	8.80	0.00	8.80
29	789	1981		2.40		1993	0.70	0.00	2.40	0.00	2.40	0.00	2.40	0.00	2.40	0.00	2.40
25	776	Logged		13.80		1992	0.80	0.00	13.80	0.00	13.80	0.00	13.80	0.00	13.80	0.00	13.80

	658	1966	10.6				NSR	10.60	0.00	10.60	0.00	10.60	0.00	10.60	0.00	10.60	0.00
533-3				19.90			NSR	0.00	19.90	0.00	19.90	0.00	19.90	0.00	19.90	0.00	19.90
533-4				27.60			NSR	0.00	27.60	0.00	27.60	0.00	27.60	0.00	27.60	0.00	27.60
								0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROADS	*length (km)*		Area (ha)														
	<H60	*>H60*	<H60	>H60													
Main			0.00	0.00			road	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Secondary	50	37.7	100.00	75.40			road	100.00	75.40	100.00	75.40	100.00	75.40	100.00	75.40	100.00	75.40
Other			0.00	0.00			road	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Included above in ECA calculations as clearings																	
Road																	
Rail																	

Without Proposed Blocks

	Area (ha)		
	Total	<H60	>H60
with roads	1744.2	1094.2	650.0
w/o roads	1568.8	994.2	574.6

	1998 ECA		1999 ECA		2000 ECA		2001 ECA		2002 ECA	
	Adjusted	(ha.)	Adjusted	(ha.)	Adjusted	(ha.)	Adjusted	(ha.)	Adjusted	(ha.)
	<H60	>H60	<H60	>H60	<H60	>H60	<H60	>H60	<H60	>H60
ECAs(ha)	470.2	448.3	470.2	442.9	470.2	442.9	460.9	419.6	460.9	413.5
Total ECA(ha)	918.5		913.1		913.1		880.5		874.4	
Total ECA (%):	14.3		14.2		14.2		13.7		13.6	
ECA (%) >H60:		7.0		6.9		6.9		6.5		6.4
Total available ECA (ha)	370.3		375.7		375.7		408.3		414.4	
Roads										
ECAs(ha)	100.0	75.4	100.0	75.4	100.0	75.4	100.0	75.4	100.0	75.4
length (km)	50.0	37.7	50.0	37.7	50.0	37.7	50.0	37.7	50.0	37.7
density(km/km2	0.78	0.59	0.78	0.59	0.78	0.59	0.78	0.59	0.78	0.59
Total road density (km/km2)	1.36		1.36		1.36		1.36		1.36	

Roads

Total area (ha)	175.40
Total length (km)	87.7
Tot.density (km/km2)	1.36

Asp Creek Watershed
2. ECA with Proposed Blocks

CP	BLOCK	Year Logged	Area (ha) <H60	Area (ha) >H60				1998 ECA Adjusted (ha.) <H60	1998 ECA Adjusted (ha.) >H60	1999 ECA Adjusted (ha.) <H60	1999 ECA Adjusted (ha.) >H60	2000 ECA Adjusted (ha.) <H60	2000 ECA Adjusted (ha.) >H60	2001 ECA Adjusted (ha.) <H60	2001 ECA Adjusted (ha.) >H60	2002 ECA Adjusted (ha.) <H60	2002 ECA Adjusted (ha.) >H60
534	1	2002		38.80				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.80
534	2	2002		37.20				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.20
534	3	2002		27.50				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.50
534	4	2002		34.20				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.20
534	5	2002		27.50				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.50
672	1	2002		18.40				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.40
672	2	2002		9.70				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.70
672	3	2002		23.70				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.70
672	4	2002		4.70				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.70
672	5	2002		28.30				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.30
672	6	2002	17.90	2.60				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.90	2.60
672	7	2002		9.10				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.10
672	8	2002		15.00				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00
672	9	2002	2.80	9.30				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.80	9.30
672	10	2002	6.30	10.30				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.30	10.30
672	11	2002		22.50				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.50
68	8	1999		7.40				0.00	0.00	0.00	7.40	0.00	7.40	0.00	7.40	0.00	7.40
								0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Roads			Area (ha)		Length (km)												
Secondary			<H60	>H60	Total	<H60	>H60										
		2001	19.00	22.60	20.80	9.50	11.30	0.00	0.00	0.00	0.00	0.00	0.00	19.00	22.60	19.00	22.60
			0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

With Proposed Blocks
Current plus up to the to the year 2002

	Area (ha) Total	<H60	>H60
with roads	2139.0	1140.2	998.8
w/o roads	1922.0	1021.2	900.8

	1998 ECA Adjusted (ha.) <H60	1998 ECA Adjusted (ha.) >H60	1999 ECA Adjusted (ha.) <H60	1999 ECA Adjusted (ha.) >H60	2000 ECA Adjusted (ha.) <H60	2000 ECA Adjusted (ha.) >H60	2001 ECA Adjusted (ha.) <H60	2001 ECA Adjusted (ha.) >H60	2002 ECA Adjusted (ha.) <H60	2002 ECA Adjusted (ha.) >H60
ECAs (ha)	470.2	448.3	470.2	450.3	470.2	450.3	479.9	449.6	506.9	762.3
Total ECA (ha):	918.5		920.5		920.5		929.5		1269.2	
Total ECA (%):	14.3		14.3		14.3		14.4		19.7	
ECA (%) >H60:		7.0		7.0		7.0		7.0		11.8
Total available ECA (ha)	370.3		368.3		368.3		359.3		19.6	
Roads										
ECAs (ha)	100.0	75.4	100.0	75.4	100.0	75.4	119.0	98.0	119.0	98.0
length (km)	50	37.7	50	37.7	50	37.7	59.5	49	59.5	49
density(km/km2	0.78	0.59	0.78	0.59	0.78	0.59	0.92	0.76	0.92	0.76
Total road density (km/km2)	1.36		1.36		1.36		1.68		1.68	

Roads (Current plus up to the year 2002)

Total area (ha)	217.00
Total length (km)	108.50
Tot.density (km/km2)	1.68

Plate 1: Channel Survey Site 1 showing steep eroding bank and moderate aggradation.

Plate 2: Eroding landslide surface (MW1) located in gorge (1.75 km China Creek Road) - note green vegetation at site of spring, and Asp Creek channel in background.

Plate 3: Sediment Source 1 - 16. km China Creek Road.

Plate 4: Sediment Source 2 - 18.75 km China Creek Road.

Plate 5: Sediment Source 3 - 19.3 km China Creek Road.

Plate 6: Sediment Source 4 - ford on tributary stream at Burn-1 Road.