

Interior Watershed Assessment Update

Upper Horsefly Watershed (Horsefly above MacKay)

1.0 WATERSHED DESCRIPTIVE INFORMATION

Table 1.1 Summary information – Biophysical

Size (km ²)	BEC Zones	Elevation Range (m)	H ₆₀ Elevation (m)	Stream Density km/km ²	Distribution of slope gradients within the watershed (% of watershed)			
					<10% slope	10 to 30% slope	30 to 60% slope	>60% slope
142.44	ATp ESSFwk1	1081 - 2556	1688	2.29	8.48	29.95	48.12	13.45

Table 1.2. Characteristics of main stream reaches – (assessment is based on a combination of air-photo interpretations, TRIM maps, helicopter over-flight and various reports).

Reach ID	Minimum Elevation (m)	Maximum Elevation (m)	Reach Length (m)	Reach Gradient (%)	Stream Disturbance Assessment
Main-R1	1020	1040.64	5295	0.4	Sinuuous and stable with old growth riparian zone
Main-R2	1040.64	1059.98	1736	1.1	Sinuuous and stable with old growth riparian zone
Main-R3	1059.98	1139.63	2803	2.8	Sinuuous and stable with old growth riparian zone
Main-R4	1139.63	1179.49	2288	1.7	Stable with intact riparian zone
Main-R5	1179.49	1180	4088	0.0	Stable with intact riparian zone
Main-R6	1180	1206.57	5584	0.5	Alluvial and sensitive to increased flows
Main-R7	1206.57	1259.97	2899	1.8	Alluvial and sensitive to increased flows
Main-R8	1259.97	1285.26	3364	0.7	Alluvial and sensitive to increased flows
Main-R9	1285.26	1439.08	3642	4.2	
Main-R10	1439.08	2004.56	4588	12.3	

RPg = Riffle-Pool gravel morphology

2.0 WATERSHED HARVESTING, ROADS AND LAND-USE HISTORY

Table 2.1. Upper Horsefly Watershed

Private	Total harvest 2002 (%)	Current ECA (%)	Planned Harvest (%)	Current ECA below H60 (%)	Current ECA Above H60 (%)	Peak Flow Index		Road Density Active (km/km ²)		Stream Crossing density active (#/km ²)		Road Density De-active (km/km ²)	
						Current (2002) (%)	End of FDP (2007)(%)	Current (2002)	End of FDP (2007)	Current (2002)	End of FDP (2007)	Current (2002)	End of FDP (2007)
0	7.84	7.13	1.76	6.9	0.2	7.22	8.97	0.33	0.37	0.39	0.41	0.22	0.22

3.0 SUMMARY OF EXTENT OF RIPARIAN REMOVAL (agriculture and forestry)

Table 3.1. Upper Horsefly Watershed

Watershed name	Length (km) of riparian removal on small tributaries (<5m in width)	Length (km) of riparian removal on large tributaries (>5m)	% Riparian removal of all tributaries	Length (km) of riparian removal on mainstem	% Riparian removal of mainstem	Total length of all tributaries (from Trim) (km)	Total length of mainstem (km)
Upper Horsefly	12.94	0.00	3.97	0.00	0.00	326.06	21.89

4.0 SUMMARY OF LARGE SEDIMENT SOURCES

Table 4.1. Upper Horsefly Watershed

Watershed Name	Large natural sediment sources		Large natural sediment sources directly connected to a stream		Large land-use related sediment sources		Large land-use related sediment sources directly connected to a stream		Large sediment sources	
	number	density (#/km ²)	number	density (#/km ²)	number	density (#/km ²)	number	density (#/km ²)	number	density (#/km ²)
Upper Horsefly	26	0.183	2	0.014	0	0.000	0	0.000	26	0.183

5.0 SUMMARY OF LAND-USE ACTIVITIES ON UNSTABLE TERRAIN

Table 5.1. Upper Horsefly Watershed

Watershed	Length of road on unstable terrain (km)		Area of cut blocks on unstable terrain (km ²)		Road density on unstable terrain (km/km ²)	Source of information for stability assessment
	Active	Proposed	Harvested	Proposed		
Upper Horsefly	0.13	0.58	3.16	0.63	0.0050	Class IV and V

6.0 SUMMARY OF ROAD RELATED SOURCES OF SURFACE EROSION

Table 6.1 Upper Horsefly Watershed - summary of stream crossing sediment source survey –			
Number of crossings surveyed	Estimated total # of crossings (TRIM maps)	Percentage surveyed	Watershed Size (km ²)
46	50	92	142

Table 6.2 Summary of Water Quality Concern Ratings (WQCR) – Upper Horsefly Watershed							
No Concern		Low		Medium		High	
Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
3	6.5	13	28.3	9	19.6	21	45.6

Stream Width Class	Table 6.3 Summary of Water Quality Concern Ratings by Stream Size - Upper Horsefly Watershed								# of streams surveyed per class
	None		Low		Medium		High		
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	
1	0	0.0	0	0.0	0	0.0	0	0.0	0
2	0	0.0	3	60.0	0	0.0	2	40.0	5
3	1	14.3	4	57.1	1	14.3	1	14.3	7
4	1	4.3	4	17.4	8	34.8	10	43.5	23
5	1	9.1	2	18.2	0	0.0	8	72.7	11

Table 6.4 ESC Summary - Upper Horsefly	
WQCR	“Equivalent” number of stream crossings
No Concern	0.0
Low	4.2
Moderate	6.8
High	22.8
Total	33.9

Table 6.5 Surface erosion hazard – Upper Horsefly Watershed	
Equivalent stream crossing density (xings/km ²)	Surface Erosion Hazard
0.24	Moderate

7.0 SUMMARY OF MAINSTEM CHANNEL CONDITIONS

Table 7.1. Extent of channel disturbance

Reach ID	Reach Length (m)	Reach Gradient (%)	Length disturbed (m)	% of channel disturbed	Level of channel disturbance	Probable cause of disturbance
Main-R1	5295	0.4	1257	23.7	Moderate	Natural
Main-R2	1736	1.1	0	0	None	N/a
Main-R3	2803	2.8	0	0	None	N/a
Main-R4	2288	1.7	329.5	14.4	Moderate	Natural
Main-R5	4088	0.0	0	0	None	N/a
Main-R6	5584	0.5	0	0	Moderate	N/a
Main-R7	2899	1.8	0	0	None	N/a
Main-R8	3364	0.7	0	0	None	N/a
Main-R9	3642	4.2	0	0	None	N/a
Main-R10	4588	12.3	0	0	None	N/a

8.0 SUMMARY OF FISHERIES RESOURCES IN THE WATERSHED

Table 8.1. Documented fish species presence

Category	Common Name	Latin Name	Species Code	Reference
Freshwater game species	Rainbow Trout	<i>Oncorhynchus mykiss</i>	RB	Fish Wizard ¹
N/A	Unidentified Species	N/A	N/A	Fish Wizard ¹

¹Fish Wizard available at <http://pisces.env.gov.bc.ca>

9.0 SUMMARY OF HAZARDS FOR THE UPPER HORSEFLY WATERSHED

Table 9.1. Watershed assessment hazards

Watershed	Sub-basin	Hazard Ratings ²						Generalized Channel Disturbance ¹
		Increases in peak-flows (Current/Proposed)	Reduction in riparian functions	Large logging related sediment sources	Road related sediment sources (field work)	Accelerated surface erosion from GIS (Current/proposed)	Accelerated mass wasting	
Upper Horsefly		VL/VL	VL	VL	M	M/H	L	2

¹Note: Generalized channel disturbance codes: 1 = no disturbance identified, 2 = localized channel disturbance, 3 = minor localized land-use related disturbance, 4 = moderate land-use related channel disturbance, 5 = extensive land-use related channel disturbance.

²Note: Hazard ratings: VL=very low, L=low, M=moderate, H=high, VH=very high

10.0 INTERPRETATIONS

10.1 Peakflow Hazards

The peak flow index (PFI) for this watershed is currently 7% (**Very Low hazard**) and will climb to 9% (**Very Low hazard**) by the end of the forest development plan (FDP) (Table 2.1). Considering these very low values, I believe that there are no peak flow concerns for the Horsefly above MacKay.

10.2 Hazards Associated with a loss in Riparian Functions

The riparian hazard for this watershed has been assessed as **Very Low**. There is no riparian logging anywhere along the mainstem of this river. There is some older localized riparian harvest along smaller tributary streams.

10.3 Hazards Associated with Large Sediment Sources

There are no large land-use related sediment sources directly connected to a stream in this watershed (Table 4.1). Consequently, the hazard is **Very Low**.

10.4 Hazards Associated with Roads Related Surface Erosion

We surveyed 46 stream crossings in this watershed, which represents 50% of TRIM stream crossings (Table 6.1). Of these, 16 crossings (34.8%) had no or low water quality concerns and 30 crossings (65%) had medium or high concerns. This has resulted in an equivalent stream crossing density of 0.24 crossings/km² and a **Moderate** hazard. As with all other watershed that were surveyed in the Horsefly, we found fewer streams in the field than were identified on TRIM 2 maps. We believe that our sampling intensity was closer to 80 to 90% of all stream crossings in this watershed, rather than the 50% indicated by TRIM mapping.

10.5 Hazards Associated with Accelerated Mass Wasting (from logging on steep slopes).

There are 3.1 km² of harvesting and 0.1 km of roads on unstable terrain in this watershed (Class IV and V terrain stability classes) (Table 5.1). The terrain in this watershed is very steep in many locations and the harvesting has, for the most part, been confined to stable terrain. The hazard for this indicator is **Low** which means that it is unlikely that forest harvesting will cause any significant amount of accelerated mass wasting.

10.6 Watershed Cumulative Effects and Channel Stability

The assessment of the Horsefly watershed above MacKay Creek has not identified any potential for negative cumulative watershed effects or problems causing channel instability. Numerous localized problems with accelerated surface erosion at stream crossings were identified. These may have a localized impact on water quality.

11.0 RECOMMENDATIONS

11.1) Recommendations for the Forest Development Plan (landscape level)

There are no significant landscape or watershed level cumulative impacts for this watershed, consequently no recommendations are provided.

11.2) Recommendations for Site Specific Activities (site level)

The site specific recommendations for this watershed focus on managing sources of surface erosion at stream crossings. A relatively large proportion of stream crossings that were surveyed in this watershed (65%) had a moderate or high water quality concern rating (WQCR). This area is very steep, the soils are erodible and the climate is wet, consequently it is very difficult to totally control erosion and sediment transport. However, it is my opinion that erosion and sediment control (ESC) practices could be improved in this area in an effort to minimize impacts to water quality. Stream crossings with a high score should be visited and it should be determined at that time if more effective erosion and sediment control measures can be implemented.

The forest licensees should maintain effective Erosion and Sediment Control plans for the Upper Horsefly watershed. This would include: a) Development of a plan with precise objectives and standards and clear operating procedures, b) clearly define the types of erosion and sediment control practices that need to be implemented, c) regular maintenance of any ESC structure that has been installed, d) regular field monitoring to evaluate the effectiveness of the plan.

APPENDIX 1 – Database of disturbed riparian areas

ID	Channel Width	Stream Type	One or 2 sided	Length of RL (km)	Landuse
UppHsRL-001	4	2	2	0.4476	1
UppHsRL-002	4	2	2	0.2683	1
UppHsRL-003	4	2	2	0.1812	1
UppHsRL-004	3	2	2	0.4788	1
UppHsRL-005	4	2	2	0.6401	1
UppHsRL-022	4	2	2	0.3713	1
UppHsRL-021	4	2	2	0.1327	1
UppHsRL-017	4	2	2	0.4048	1
UppHsRL-016	4	2	2	1.1489	1
UppHsRL-015	4	3	2	1.4464	1
UppHsRL-014	4	2	2	1.9698	1
UppHsRL-013	4	2	2	1.3616	1
UppHsRL-011	4	2	2	0.6324	1
UppHsRL-012	4	2	2	0.2961	1
UppHsRL-007	4	2	2	0.3564	1
UppHsRL-006	4	2	2	0.3673	1
UppHsRL-010	4	2	2	0.6279	1
UppHsRL-009	4	2	2	0.2748	1
UppHsRL-008	4	2	2	0.2506	1

APPENDIX 2 – Database of large sediment sources

ID	Type	Cause	Deliverability	Degree of Revegetation	Activity Level
UppHsLS-002	4	5	2	1	2
UppHsLS-003	4	3	1	1	2
UppHsLS-004	5	5	2	3	1
UppHsLS-001	5	5	2	2	2
UppHsLS-005	4	8	2	1	2
UppHsLS-008	4	8	2	1	2
UppHsLS-006	4	8	2	1	2
UppHsLS-007	4	5	2	1	2
UppHsLS-009	4	5	2	1	2
UppHsLS-010	4	5	2	1	2
UppHsLS-011	4	8	2	1	2
UppHsLS-012	4	5	2	2	1
UppHsLS-013	4	5	2	2	2
UppHsLS-014	5	3	1	1	2
UppHsLS-015	4	8	2	1	2
UppHsLS-016	4	8	2	1	2
UppHsLS-017	4	8	2	1	2
UppHsLS-018	4	5	2	1	2
UppHsLS-019	4	5	2	1	2
UppHsLS-020	5	3	1	2	1
UppHsLS-021	4	8	2	1	2
UppHsLS-022	4	3	2	1	2
UppHsLS-023	4	3	2	2	2
UppHsLS-024	4	8	2	1	2
UppHsLS-025	8	3	3	2	2
UppHsLS-026	9	3	3	2	2

APPENDIX 3 – Database of stream crossing survey (surface erosion)

Sub Basin	Crossing ID	UTM Easting	UTM Northing	Structure type	Size of Culvert	Crossing Erosion Score	WQCR	Stream width Class	Stream gradient Class
U-Horsefly	N01	654674	5806476	1	NA	0.0	s.pt	2	3
U-Horsefly	M01	668823	5810805	1	NA	0.9	High	3	2
U-Horsefly	M02	668664	5810807	5	600	1.0	High	5	6
U-Horsefly	M03	667620	5811955	5	600	1.0	High	5	6
U-Horsefly	M04	667607	5811996	5	600	1.0	High	5	6
U-Horsefly	M05	666619	5813147	1	NA	0.4	Med	3	4
U-Horsefly	M06	663291	5813677	1	NA	0.1	Low	3	5
U-Horsefly	M50	668715	5810817	5	600	1.0	High	5	5
U-Horsefly	M51	668172	5810872	5	600	1.0	High	5	5
U-Horsefly	M52	668107	5810855	2	N/A	1.0	High	2	3
U-Horsefly	M53	667692	5811605	5	600	1.0	High	5	5
U-Horsefly	M54	667432	5812234	2	N/A	0.4	Med	4	5
U-Horsefly	M55	667338	5812346	5	600	0.8	High	4	4
U-Horsefly	M56	667283	5812387	5	1800	1.0	High	4	5
U-Horsefly	M57	667223	5812484	5	600	0.9	High	4	3
U-Horsefly	M58	666796	5812831	5	600	0.9	High	5	6
U-Horsefly	M59	666735	5812924	5	600	0.9	High	5	6
U-Horsefly	M60	666464	5813263	5	600	1.0	High	4	4
U-Horsefly	M61	666463	5813261	5	600	0.5	Med	4	3
U-Horsefly	M62	665423	5813563	5x2	1200/1000	0.5	Med	4	4
U-Horsefly	M63	664529	5813732	2	N/A	0.3	Low	2	5
U-Horsefly	M64	663849	5813666	5	600	0.0	None	4	5
U-Horsefly	M65	663406	5813741	5	600	0.5	Med	4	4
U-Horsefly	M66	660407	5812492	2	N/A	0.2	Low	2	3
U-Horsefly	M67	659555	5810738	2	N/A	0.2	Low	2	2
U-Horsefly	M68	659043	5808783	2	N/A/	0.9	High	2	5
U-Horsefly	M69	658710	5808295	5x2	1000/600	0.3	Low	3	6
U-Horsefly	M70	658308	5808033	5	800	1.0	High	4	4
U-Horsefly	M71	658106	5807907	5	600	0.9	High	4	6
U-Horsefly	M72	658074	5807889	5	600	0.8	High	4	6
U-Horsefly	M73	657904	5807810	5	500	0.6	Med	4	4
U-Horsefly	M74	657766	5807765	5	600	0.8	High	4	4
U-Horsefly	M75	657737	5807731	5	900	0.8	High	4	5
U-Horsefly	M76	657620	5807639	5x2	500	0.8	High	4	4

Sub Basin	Crossing ID	UTM Easting	UTM Northing	Structure type	Size of Culvert	Crossing Erosion Score	WQCR	Stream width Class	Stream gradient Class
U-Horsefly	M77	657381	5807473	5	500	0.5	Med	4	5
U-Horsefly	M78	659008	5807971	6	N/A	0.4	Low	3	6
U-Horsefly	M79	658383	5807609	6	N/A	0.4	Med	4	5
U-Horsefly	M80	658170	5807487	6	N/A	0.2	Low	4	4
U-Horsefly	M81	657966	5807377	6	N/A	0.4	Med	4	5
U-Horsefly	M82	657562	5807249	6	N/A	0.3	Low	4	6
U-Horsefly	L02	658612	5809251	8	N/A	0.3	Low	4	2
U-Horsefly	L03	658158	5808887	5	600	0.1	Low	4	3
U-Horsefly	L04	658155	5808907	8	N/A	0.3	Low	3	3
U-Horsefly	L05	658024	5808856	5	600	0.2	Low	5	2
U-Horsefly	L06	657935	5808815	5	700	0.4	Low	5	2
U-Horsefly	L07	657902	5808802	5	600	0.0	None	5	2
U-Horsefly	L08	657785	5808737	8	N/A	0.0	None	3	5

APPENDIX 4- Inventory of disturbed channel reaches

ID	Length (m)	Instability level	Source	Reach
Up-Horse-01	196.72	M	5	MR4
Up-Horse-02	132.83	M	5	MR4
Up-Horse-03	419.92	L	5	MR1
Up-Horse-04	517.94	M	5	MR1
Up-Horse-05	319.12	M	5	MR1

APPENDIX 5 – Selected photographs



Photograph #1272. Horsefly River above MacKay.



Photograph #1273. Natural sediment sources from eroding banks



Photograph # 1279. Large snow avalanche track into river



Photograph #1284. Recent bridge installation on tributary stream

APPENDIX 5 – Selected photographs



Photograph #1649. De-activated - Site L04, score = 0.3 (Low)



Photograph #1652. De-activated – Site L-08, score 0.0 (none)



Photograph # 212-14, Site #M51, score = 1.0 (High)



Photograph # 212-17, Site #M56, score = 1.0 (High)