WATERSHED REVIEW
OWEN CREEK WATERSHED

BIOPHYSICAL CHARACTERISTICS OF WATERSHED

Table 1. Summary Information – Watershed Characteristics – (see Figure 1)

Size (km^2)	Dominant BEC Zones	Dominant NDT	Elevation Range (m)	Dominant Surficial Geology	Stream Density (km/km^2)	Biggest % of watershed in same elevation band[1]	Distribution of slope gradients within the watershed (% of watershed)			
							<10% slope	10 to 30% slope	30 to 60% slope	>60% slope
211.14	SBS	NDT3	668 - 2060	Coarse textured till on rolling terrain	1.39	54	50.7	40.2	7.7	1.4

[1] The entire watershed is divided into 300 m elevation bands of harvestable forest land-base. The less elevation bands there are and the more area is represented by any given single elevation band, then the greater will likely be the effect of forest harvesting on increased peak flows due to the theoretical concept of "synchronization" (i.e. the melt from the cutblocks is synchronized as much of it comes from the same elevation), and the greater sensitivity it will have.

Table 2. Dominant soil textures in the watershed

Surficial Geology	**Total area of surficial material in watershed (km^2)**	**Percent in watershed**	**Sensitivity to disturbance (mostly roads, trails and crossings)**
Very Fine Textured Lacustrine	0	0.0	Very High Sensitivity
Fine textured fluvial	0	0.0	Very High Sensitivity
Fine textured till	0	0.0	High Sensitivity
Medium textured till	80.81	38.3	Moderate Sensitivity
Coarse textured till on rolling terrain	130.62	61.9	Low Sensitivity
Coarse textured fluvial	0	0.0	Moderate Sensitivity
Colluvial	0	0.0	Low Sensitivity
Organic	0	0.0	Very High Sensitivity
Bedrock	0	0.0	Very Low Sensitivity
Eolian	0	0.0	Very High Sensitivity
Marine (including glaciomarine)	0	0.0	Very High Sensitivity

Table 3. Rating of "Sensitivity" of Watershed to Increased Peak Flow at the lower reaches

Rosgen Stream Channel Score	Rosgen Stream Channel Sensitivity Score	Sensitivity score relative to topography	Sensitivity score relative to lateral connectivity	Sensitivity score relative to vertical conductivity	Sensitivity score relative to climate	Sensitivity score relative to flow synchroniza-tion potential	Sensitivity score relative to NDT type	Sensi-tivity Score	Sensi-tivity Rating
C4- Lightly unstable/dis-turbed	4	0.75	1.05	0.95	1.1	1	1	3.29	Mod

Table 4. Rating of "Sensitivity" of Watershed to Increased Production of Fine Sediment at lower reaches

Most sensitive fish species in watershed[1]	Species Sensitivity Score	Sensitivity score relative to topography	Sensitivity score relative to lateral connectivity	Sensitivity score relative to climate	Sensitivity Score	Sensitivity Rating
Dolly Varden	5	0.75	1.1	1.1	4.5375	Very High

[1]Note: See Figure 2 for distribution of fish species in this watershed.

Table 5. Rating of "Sensitivity" of Watershed to a Loss in Riparian Function.

Most sensitive fish species in watershed	Species Sensitivity Score	Sensitivity score relative to loss of LWD	Sensitivity score relative to Aspect	Sensitivity score relative to climate	Overall watershed sensitivity to loss of riparian	Loss of Riparian Sensitivity Rating
Dolly Varden	5	1.25	0.95	1.1	6.53	Extreme

Table 6. Peak Flow Hazard Rating, as indexed by HEDA

Watershed area (km^2)	Total area Pine Leading (km^2)	Total area Pine Mixed (km^2)	Total area harvest (km^2)	Total HEDA from Pine Beetle alone (%)	Total HEDA from logging alone (%)	Total HEDA from logging and Pine Beetle mortality (%)
211.14	23.6	32.62	44.21	10.22	12.85	23.07

Table 6 (continued)

Total area in Agriculture (km^2)	Total area in Agriculture (% of watershed)	Total area in Other Openings[1] (km^2)	Total HEDA with Logging, O and G & Agriculture (%)	HEDA Hazard rating Score (includes Logging, O and G and Agriculture)	HEDA Hazard Rating
2.22	1.05	15.43	31.43	3.00	Mod

[1]Note: This includes Oil and Gas and mining openings

Table 7. Fine Sediment Hazard Rating, as indexed by the Stream Crossing Density

Watershed area (km^2)	# of x-ings	# of fish bearing X-ings[1]	# of non-fish bearing X-ings	Density of x-ings (#/km^2)	Density of fish bearing X-ings (#/km^2)	Density of non-fish bearing X-ings (#/km^2)	Hazard Rating Score	Hazard Rating
211.1	92	91	1	0.4	0.4	0.0	1.98	Low

[1]Note: The information on stream crossings was provided by MoE and was generated with a GIS model, not fieldwork.

Table 8. Loss of Riparian Function Hazard Rating (See Figures 3 to 7)

Reach Number	Rosgen Stream Type	Reach Length (m)	% riparian logged (as interpreted from air photos)	Apparent stability and other comments (as viewed from air photos)
1	C4 - Unstable/disturbed	362	0.0	Moderately De-stabilized
2	C5 - Unstable/disturbed	502	0.0	Moderately De-stabilized
3	C5- Lightly unstable/disturbed	1306	0.0	Lightly De-stabilized
4	C5- Stable	1196	0.0	Lightly De-stabilized
5	C5- Lightly unstable/disturbed	1218	0.0	Lightly De-stabilized
Hazard Scores:			Hazard Rating Score	Hazard Rating
			0.5	Very Low

Table 9. Risk Rankings for the Different Hazards in the watershed

Watershed Hazard Types	Sensitivity Score	Sensitivity Rating	Hazard Score	Hazard Rating	Risk Score	Risk Rating
Increased Peak Flow	3.29	Mod	3.00	Mod	9.9	Mod
Increase in Production of Fine Sediment	4.54	Very High	1.98	Low	9.0	Mod
Reduction in Riparian Function	6.53	Extreme	0.5	Very Low	3.3	Low

RECOMMENDATIONS FOR LAND-BASED INVESTMENT ACTIVITIES IN PRIORITY WATERSHEDS

1. Prior to the allocation of permits for treatment activities, the Owen Creek watershed management plan should be reviewed and carefully considered in order to determine how any LBI planned activities may affect peak flow risk in the Owen Creek watershed.
2. The allocation of permits for treatment activities in the Owen Creek watershed should be planned in collaboration with all major licences that operate in the watershed so that the total disturbance does not exceed the peak flow risk threshold set by government for this priority watershed.
3. Maintain long term recruitment of large woody debris (LWD), shade and bank stability by retaining at least 90% of the riparian area. This riparian area refers to the management area measured from the closest streambank to a distance 15m upslope from the streambank on:
    i. S4 streams that are 0.5m or greater in stream channel width, or
    ii. S6 streams that are 0.5m or greater in stream channel width that flow directly into a fish stream.
4. Develop and implement effective erosion and sediment control plans for all stream crossings that are your responsibility, whether you are building them, using them or just maintaining them. The effectiveness of the erosion and sediment control at the stream crossing should be measured using the Water Quality Effectiveness Evaluation methodology developed by the Government of BC[1]
5. Prior to the initiation of any treatment activities, identify the presence of any 'flat-over steep" topography and manage appropriately where needed (Figures 3 and 8). These topographic features can be prone to slope instability when forest cover is removed and localized drainage is not well planned.
6. Consider under-planting as a reforestation treatment as this minimizes the detrimental effects on peak flow risk, compared to completely knocking down the stand.
7. In order to optimize hydrological recovery, planting of all treated sites should be done with the best growing stock that is appropriate for the site. The selection of appropriate species and planting densities should be done by a qualified professional based on a site specific assessment.
8. Not all of the dead pine stands in the watershed should be targeted for knock down treatments. Some should be left for natural regeneration and biodiversity thus creating a more diverse forest in the future with more age classes, i.e. the presence of dead pine stands in the watershed is not an ecological disaster.

[1] http://www.for.gov.bc.ca/ftp/hfp/external/!publish/frep/indicators/Indicators-WaterQuality-Protocol-2009.pdf

Table 10. Table of comments and observations

Comment #1	There may be an ECA effect in this watershed as there is no significant riparian logging and no landslides, yet significant lower reach destabilization. ECA control is a major recommendation for this watershed.
Comment #2	It looks like the lower reaches have gone from E5 type to unstable C4 type. There has also been an avulsion in Reach #1 just above the bridge. These indicate a very sensitive stream channel.
Comment #3	There is a big lake in the headwaters followed by low gradient E5 type streams and then followed by some unstable C5 streams.
Comment #4	There is a lot of open range and agriculture in this watershed, which significantly affects the HEDA
Comment #5	There are no significant problems with management of steep lands in this watershed.
Comment #6	There are significant fisheries values in the upper watershed and in the small streams (Figure 8). These need to be better protected. Thus one of the main strategies will be better protection around small streams.
Comment #7	Stream crossing and sediment control is not really a big issue in this watershed, given the mature age of the road network and the coarse soils. Should not be a significant area of management recommendations, however effective erosion and sediment practices at stream crossings is always important.
Comment #8	Much of the logging in this watershed is associated with salvage operations of an old fire (Swiss Fire ???).

INTERPRETATIONS AND RECOMMENDATIONS FOR MANAGEMENT STRATEGIES FOR PROTECTION OF FISH RESOURCES WITHIN THIS CANDIDATE FISHERIES SENSITIVE WATERSHED

This watershed has a moderate sensitivity to increased peak flows and very high sensitivities to increases in fine sediment and extreme sensitivity to loss of riparian functions. The risk ratings are Moderate, Moderate and Low for peak flows, fine sediments and riparian hazards respectively (Table 9).

The main FSW objectives for Owen Creek should focus on providing effective riparian protection to the small streams in the upper watershed to maintain channel integrity and riparian function (Figure 8). The fish inventory indicates that there are Dolly Varden well up into the headwater streams of this watershed, which appear to be small streams. The objective of providing effective riparian protection could be achieved by implementing the following practice along all S4 and S6 streams in this watershed:

1) Maintain long term recruitment of large woody debris (LWD), shade and bank stability to the stream channel by retaining at least 90% of the riparian area in a state undisturbed by primary forest activities.

Riparian Area – For the purposes of the Owen Creek Fisheries Sensitive Watershed, riparian area refers to the management area measured from the closest streambank to a distance 15 m upslope from the streambank on:

iii. S4 streams that are 0.5m or greater in stream channel width, or
iv. S6 streams that are 0.5m or greater in stream channel width that flow directly into a fish stream.

The lower reaches of this watershed are very sensitive to disturbances and appear to be somewhat unstable (Figures 3 to 7). The current risk associated with increased peak flows is currently at a moderate level (Table 9). As a fisheries sensitive watershed, one of the main land management objectives for this watershed is the protection of fish and their habitat. With this objective in mind, it is important to maintain the peak flow risk below a “Moderate” level. This means that further stand treatments and forest harvesting activities in this watershed will have to minimized and possibly curtailed until hydrological recovery has occurred on the newer cut-blocks, if a low peak flow risk is desired.

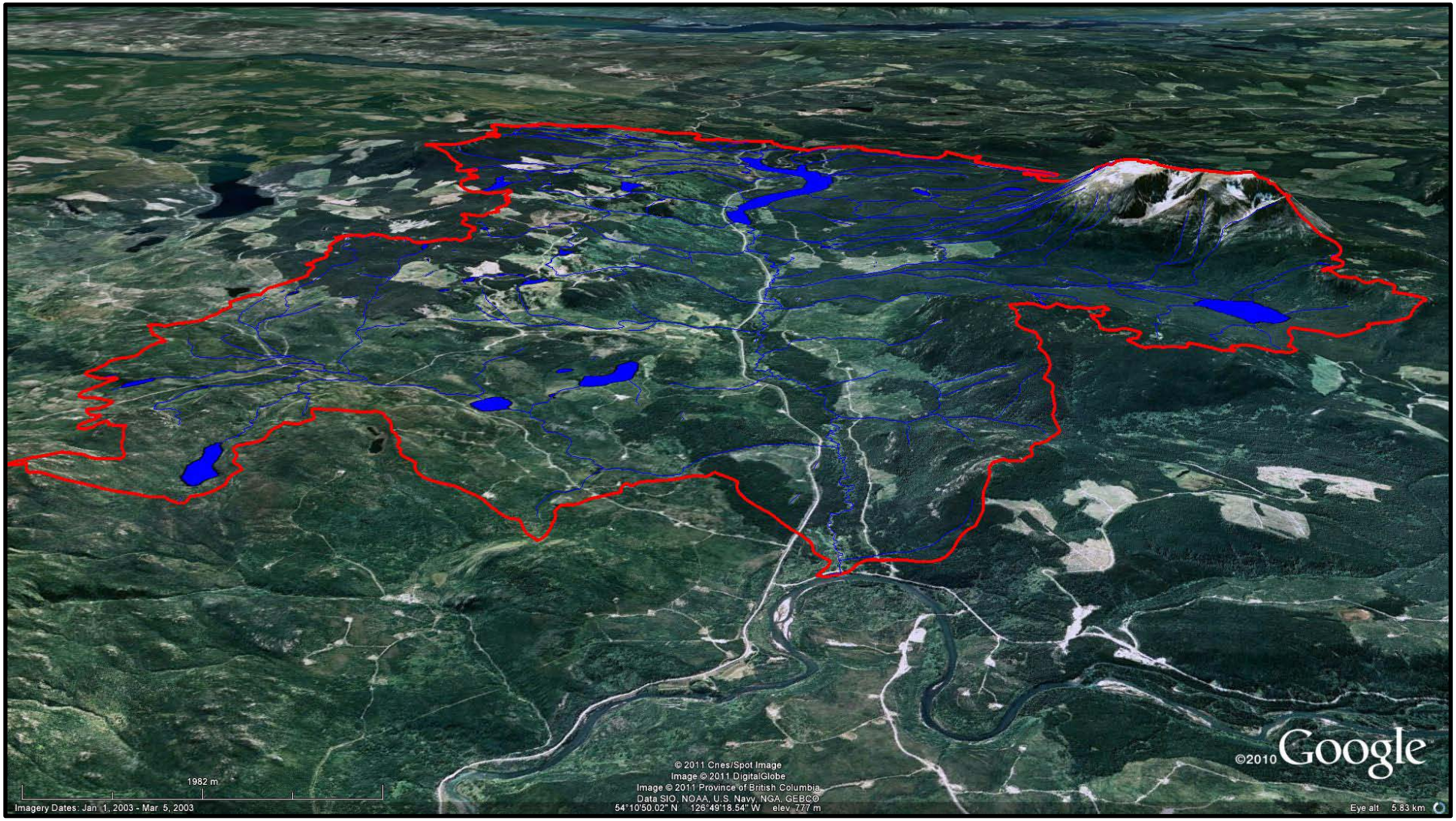

Figure 1. Overview image of Owen Creek watershed, looking upstream into the watershed.

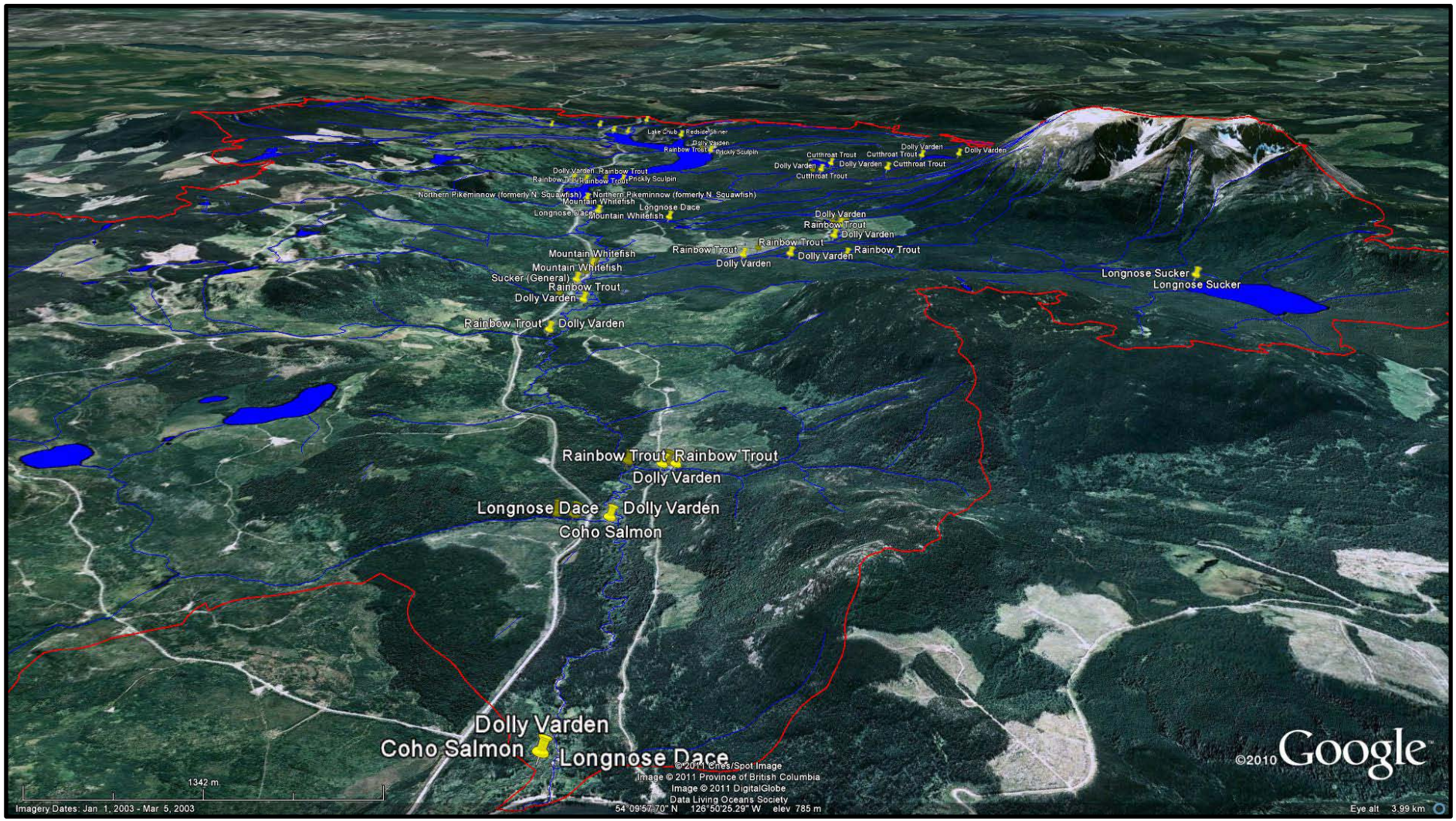

Figure 2. General distribution of fish species in the Owen Creek watershed.

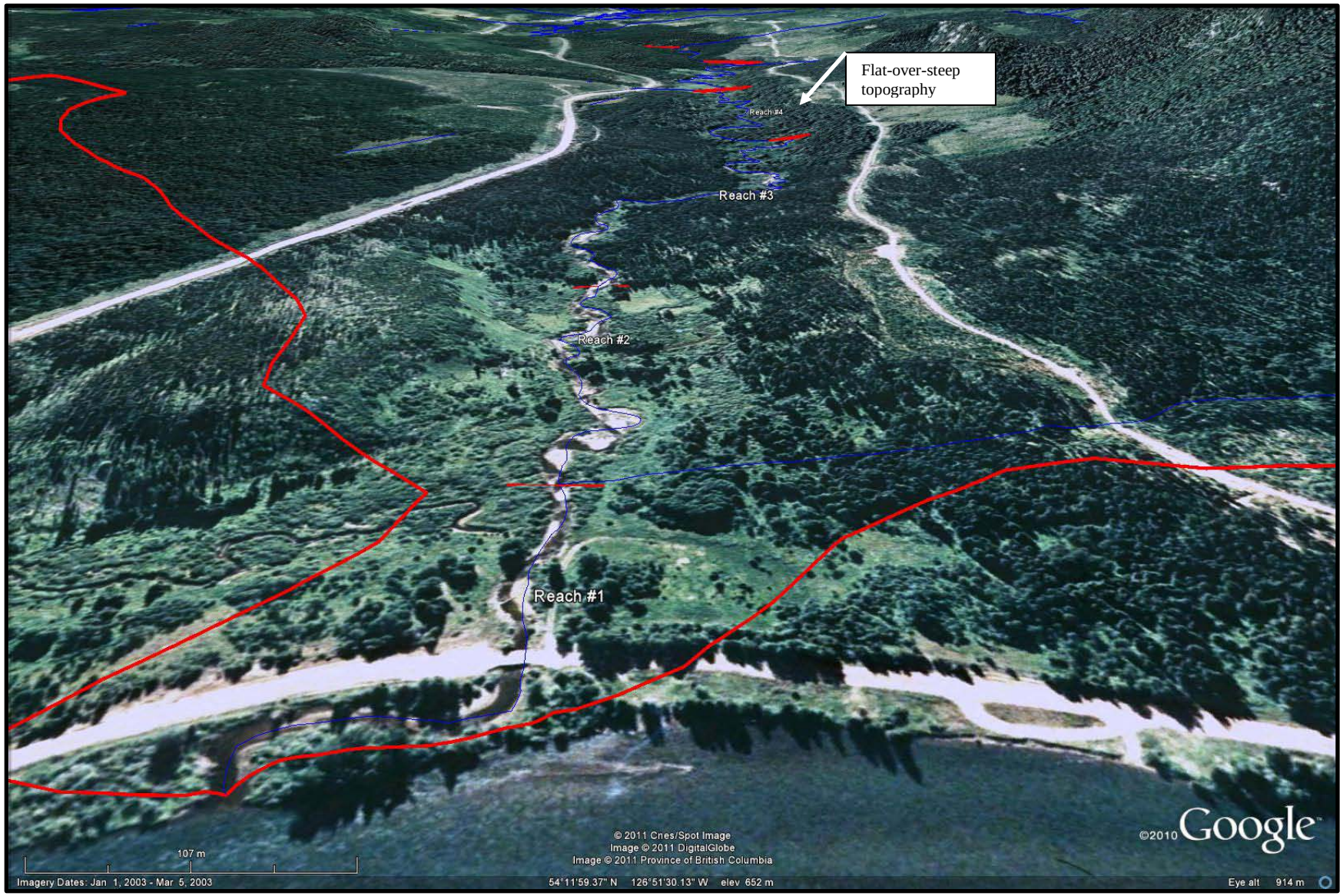

Figure 3. Google Earth image of reaches 1 to 3 in the Owen Creek watershed.

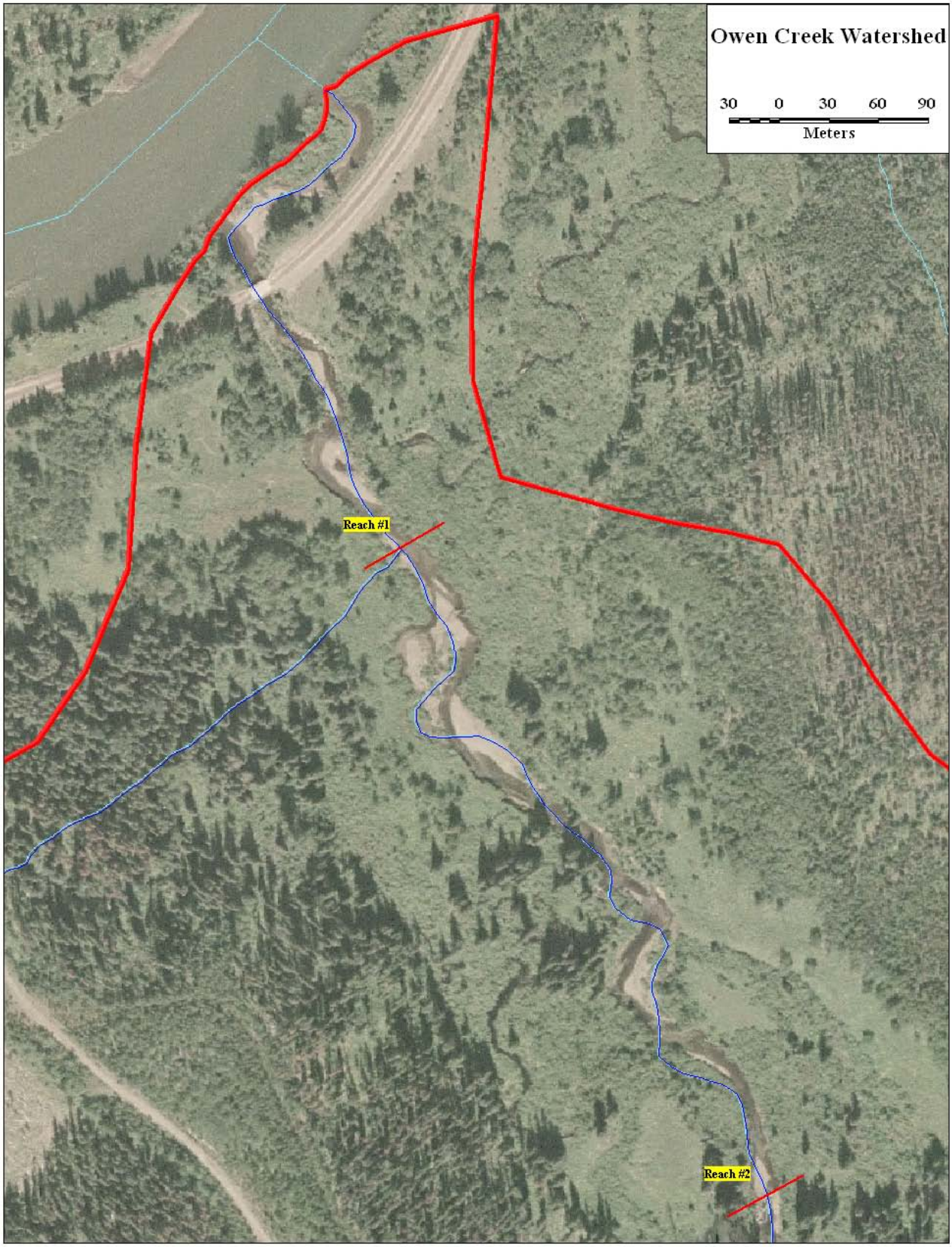

Figure 4.Vertical orthophoto of reaches 1 and 2 – Owen Creek watershed.

Figure 5.Vertical orthophoto of reach 3 – Owen Creek watershed.

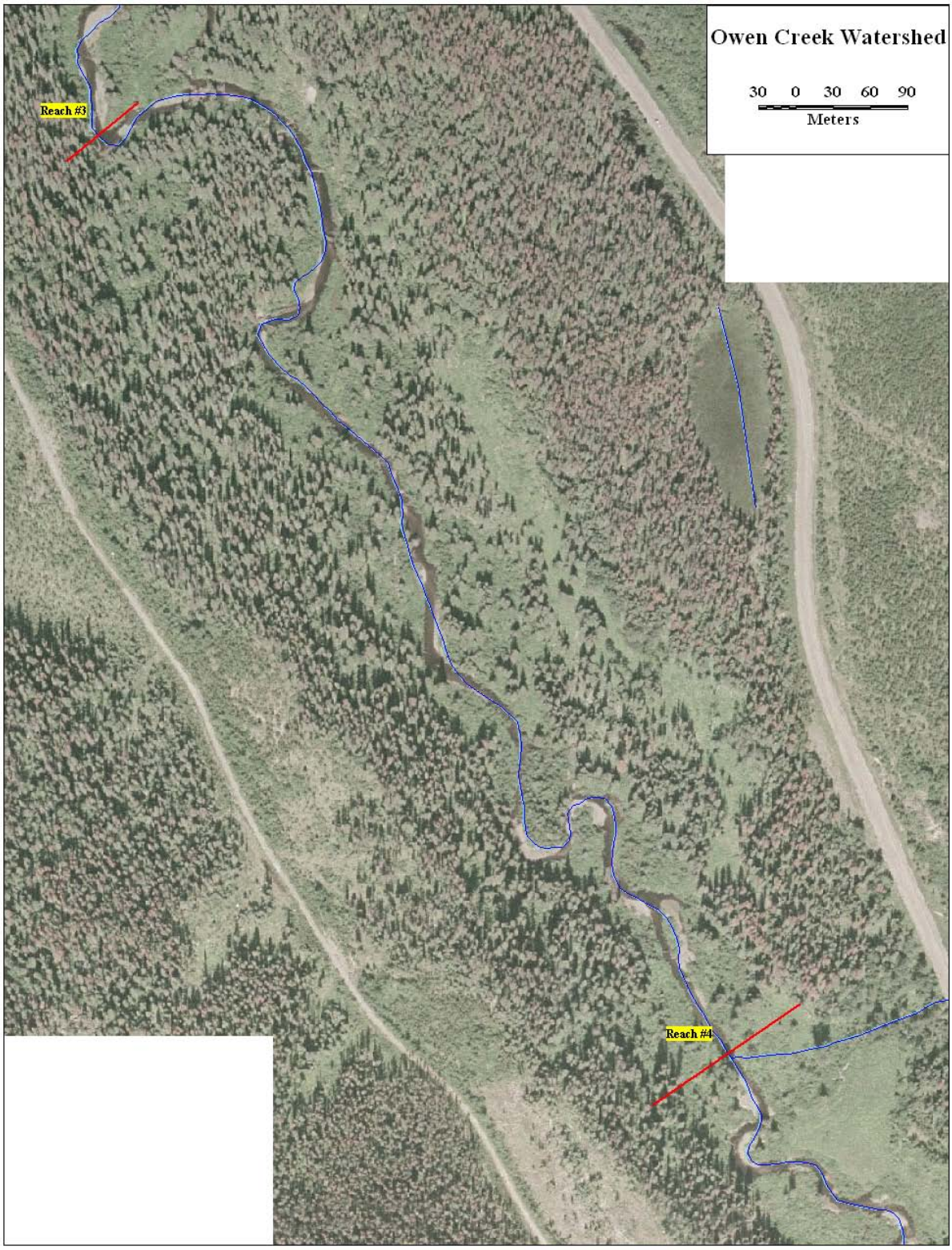

Figure 6.Vertical orthophoto of reach 4 – Owen Creek watershed.

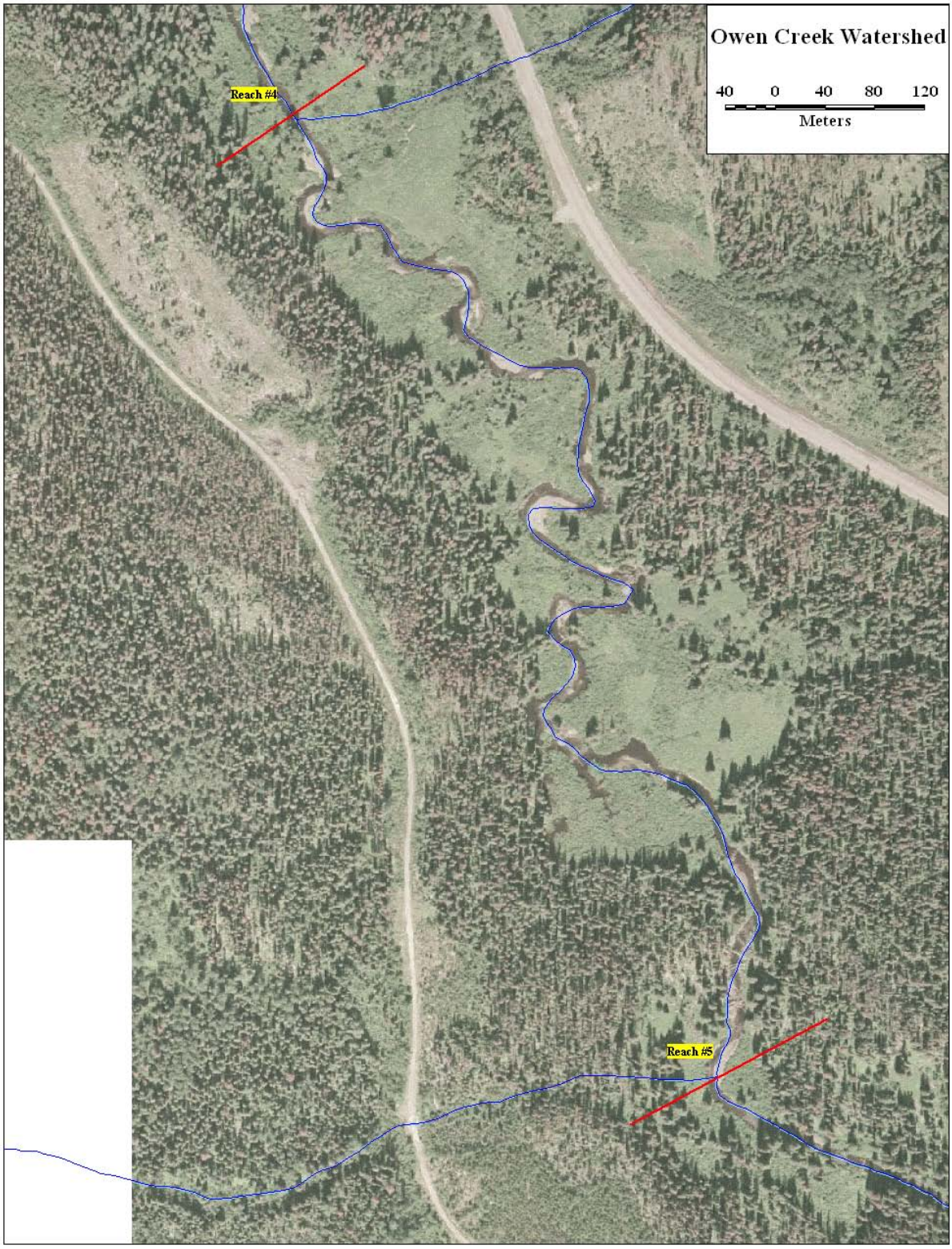

Figure 7.Vertical orthophoto of reach 5 – Owen Creek watershed.

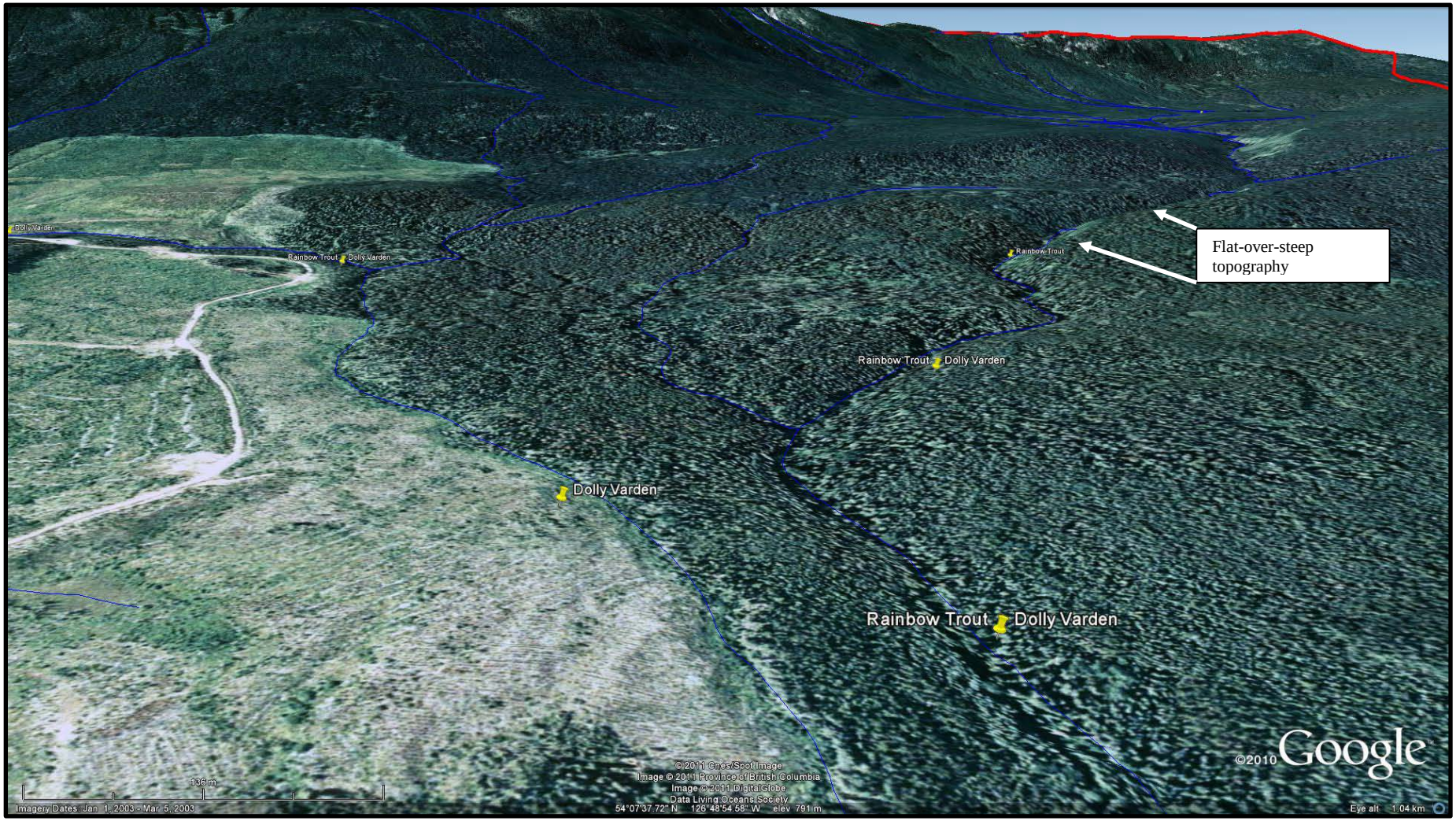

Figure 8. Example of fish distribution on upper watershed. Note the presence of Dolly Varden high up into the watershed. The protection of the riparian areas along these small streams is very important for fish habitat.