Salmon River Enhancement Society

Response
to
Information Request
by
Pro Information Pro Environment United People Network (PIPE UP Network)

Information Request to Salmon River Enhancement Society
Trans Mountain Pipeline ULC (Trans Mountain)
Trans Mountain Expansion Project (Project)
Application under sections 52 and 58 of the National Energy Board Act
File Number OF-Fac-Oil-T260-2013-03 02
June 22, 2015

Authored by

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July 14, 2015

1. Freshwater

Habitat

Reference:

C301 - Salmon River Enhancement Society

https://docs.neb-one.gc.ca/ll-eng/llisapi.dll?func=ll&objId=2450952&objAction=browse&sort=name&viewType=1

Request Responses by the Salmon River Enhancement Society

1. **Explain the role of riparian habitat, and the expected effects as a result of TMEP on streams, particularly to streams in the area of SRES interest.**

Role of Riparian Habitat in Streams

Why is the Riparian Area Important?

Riparian areas and the vegetation and structure associated with this component of aquatic environments in streams and lakes comprise critical habitats for many species, including commercial, recreational and aboriginal (CRA) fishery fishes.

A riparian zone, or riparian area, is the water/land interface between the terrestrial upland area and a river or stream (Figure 1). Plant communities along the edge of streams or lakes are usually referred to as the riparian vegetation (Figure 2). The plant community within a riparian area often is dominated by hydrophilic species, but not always (Figure 2). In British Columbia watercourses that support CRA fisheries rely profoundly on intact and functional riparian areas (viz., Forest and Range Practices Act https://www.for.gov.bc.ca/code/ Table 1; Riparian Areas Regulation http://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/fish/riparian-areas-regulation Table 2).

To reiterate, the scientific literature is very clear that riparian areas comprise critical habitats for both fishes and other species (Wenger 1999, Broadmeadow and Nisbet 2004).

The role of riparian habitats is elegantly described by excerpts in the following quotes:

> *Riparian buffers are important for good water quality* [in streams]. *Riparian zones help to prevent* [deleterious] *sediment*[s]*, nitrogen, phosphorus, pesticides and other pollutants from*

reaching a stream. Riparian buffers are most effective at improving water quality when they include a native grass or herbaceous filter strip along with deep rooted trees and shrubs along the stream. Riparian vegetation is a major source of energy and nutrients for stream communities. They are especially important in small, headwater streams where up to 99% of the energy input may be from woody debris and leaf litter. [Invertebrates associated with this and instream vegetation contribute as fish food.] *Overhanging riparian vegetation keeps streams cool,* [and] *this is especially important for…mountain trout* [i.e., salmonid] *populations. Riparian buffers provide valuable habitat for wildlife. In addition to providing food and cover they are an important corridor or travel* [path]*way*[s] *for a variety of wildlife. Forested streamsides benefit game species* [e.g., deer and bear]*…and nongame species like migratory songbirds. Riparian vegetation slows floodwaters, thereby helping to maintain stable streambanks and protect downstream property. By slowing down floodwaters and rainwater runoff, the riparian vegetation allows water to soak into the ground and recharge groundwater. Slowing floodwaters allows the riparian zone to function as a site of sediment deposition, trapping sediments that build stream banks and would otherwise degrade our streams and rivers.*

[http://www.bae.ncsu.edu/programs/extension/wqg/sri/riparian5.pdf Accessed 6 July 2015.]

The critical nature of riparian areas to a properly functioning stream cannot be overstated. As Tschaplinski and Pike (2009), in their analysis of the function of riparian areas to British Columbia streams, point out *"No other landscape features within forests provide linkages that are as extensive and complex as those provided by riparian ecotones."* Tschaplinski and Pike (2009) go further to indicate that riparian areas contain and support many of the highest-value resources in natural forests and quote Hartman and Scrivener (1990) as evidence. In another citation, Gregory et al. (1991) indicate that the plant and animal communities in riparian areas frequently have the highest species richness found in forests.

The issues relating to riparian areas are particularly relevant to the Trans Mountain Expansion Project (TMEP) as many of the streams crossed by the pipeline construction are typical of the watercourses that Tschaplinski and Pike (2009) and others refer to in respect to the importance of the role of riparian vegetation and the zone as fish habitat. And riparian areas are key habitats that TMEP will destroy as a function of crossing the streams where trenching will take place.

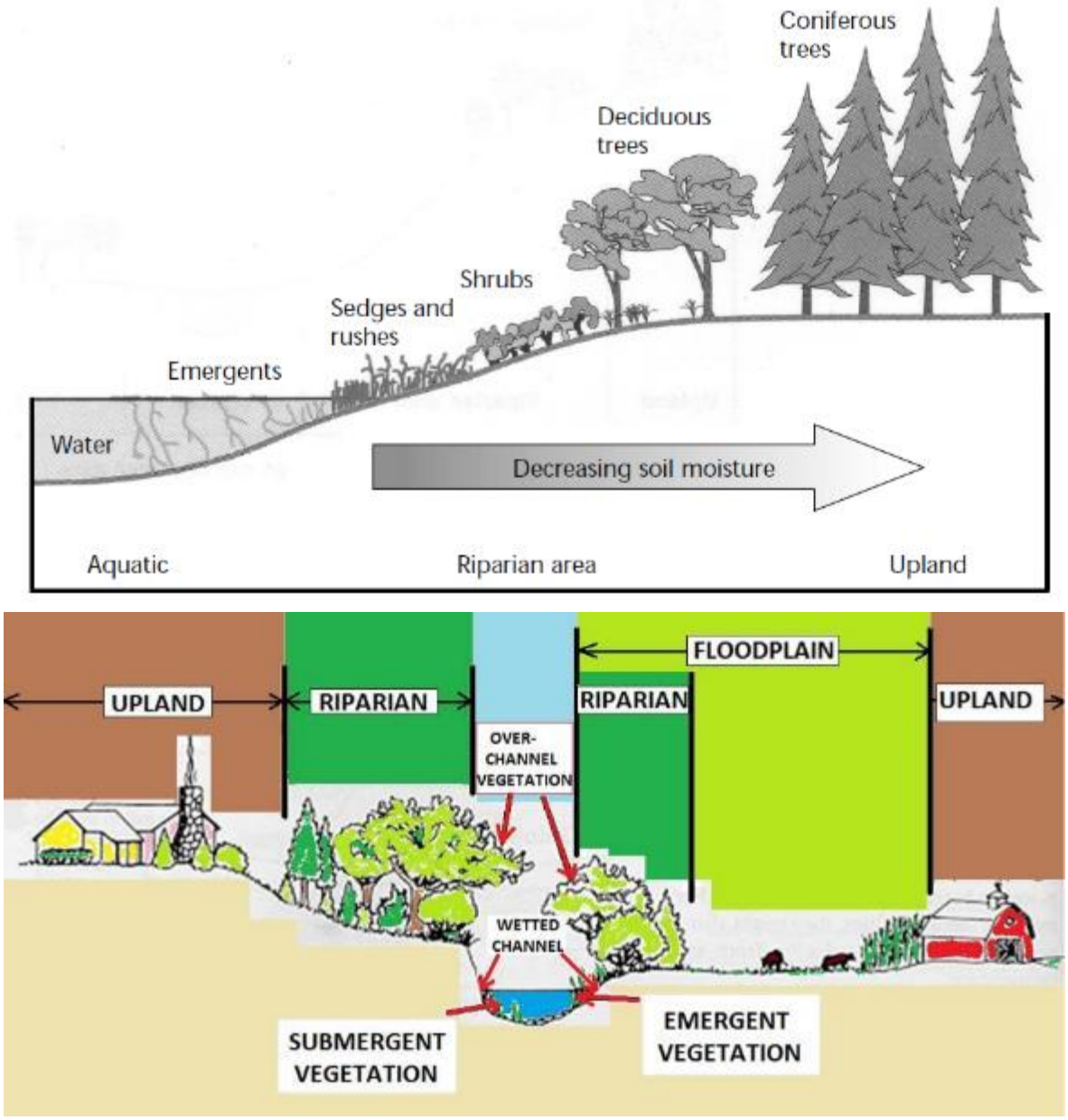


Figure 1 Line drawings describing the physical aspects of a riparian area. Top figure from Stevens et al. 1995.

Figure 2 Streams with intact riparian areas. Left photo from Tschaplinski and Pike (2009); right photo from http://deq.mt.gov/wqinfo/wetlands/RiparianWetlands.mcpx accessed July 7, 2015.

Conversely, when riparian areas become harmfully altered:

> *Degraded riparian buffers reduce water quality values, reduce wildlife and fish populations, cause serious property damage (bank erosion) and loss of valuable agricultural lands.* [Biodiversity losses are extensive when stream riparian areas are destroyed or altered.] *Removal of riparian vegetation results in increased water temperatures and decreased dissolved oxygen. The loss of shade exposes soils to drying out by wind and sunlight and reduces the water storage capacity of the riparian area. Loss of riparian vegetation causes streambank erosion. Eroding banks contribute to sedimentation and lead to a wide shallow stream with little habitat value. These factors result in significant reductions in aquatic stream life.*

[http://www.bae.ncsu.edu/programs/extension/wqg/sri/riparian5.pdf Accessed 6 July 2015.]

For most jurisdictions in North America where CRA species can be found, riparian areas have some level of legislated protection (e.g., Figure 3). Within the framework of the various pieces of legislation, policies and regulations, for the protection of fish-bearing streams in western North America, the general-rule-of-thumb is around 30 m but can dip to below 10 m in some jurisdictions and be greater than this distance in others (Tschaplinski and Pike 2009).

For British Columbia, the two primary activities that have clearly-defined rules around working near streams include land development (Table 1) and forest harvesting (Table 2). The protected riparian areas for these streams with fishes in undeveloped locations in British Columbia, for these activities, is usually at least 30 m but can be 15 m, or less, for developments in highly urbanized communities.

Nevertheless, in the context of working-in-and-about watercourses, regardless of the subtleties, the requirement for a protected area in the riparian zone is considered to be “a given” in both British Columbia and throughout the Pacific Northwest and Alaska.

For some reason, at no point do TMP or its consultants propose addressing this impact in any meaningful way for the TMEP. For all of the TMEP-proposal documents, neither TMP or its consultants provide any measureable assessment of the effects of the project or restoration/compensation (see *Serious Harm* self assessment) for riparian areas and its vegetation as a result of stream crossings in British Columbia.

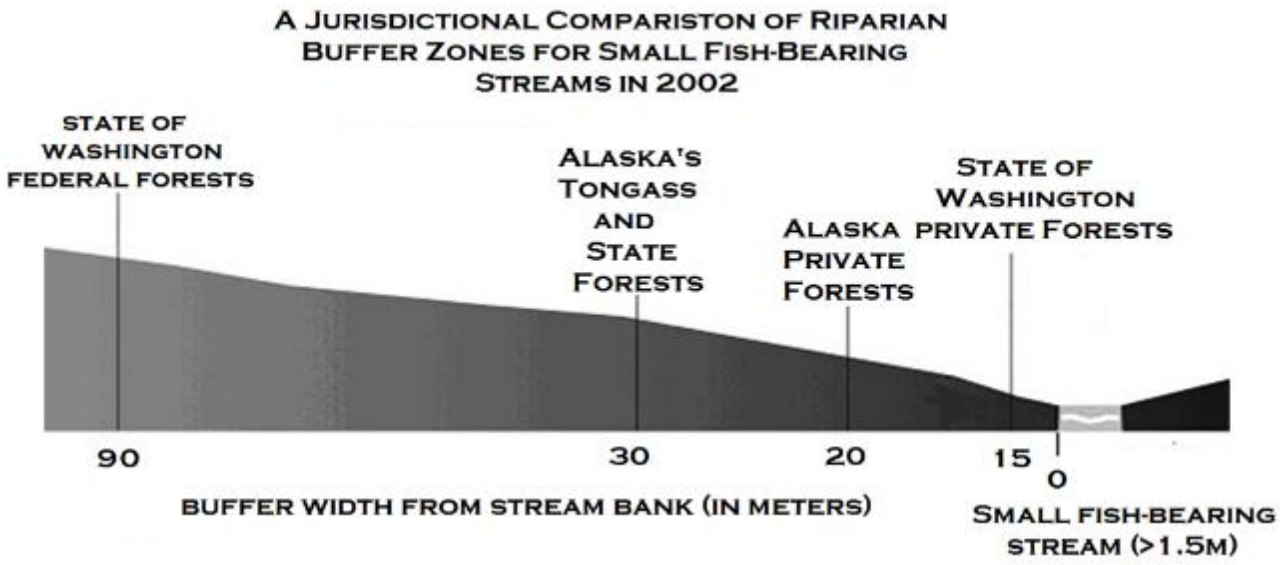


Figure 3 Stream riparian buffer-zone dimensions for various jurisdictions in western North America for watercourses that support commercial, recreational or aboriginal fisheries.

Table 1 British Columbia Riparian Areas Regulation protected-area dimensions.

SPEA widths - in simple terms (adapted from SPR, section 6)

Existing or *potential streamside vegetation* conditions *Sec.6(1)**	Streamside Protection and Enhancement Area width *Section 6(2)*		
	Fish bearing	*Non Fish bearing*	
		Permanent	*Non Permanent*
≥50 m or ≥30 - 50 m *(a),(b)**	At least 30 m* *2.(a)*		At least 15 m *2.(b)*
≥15 & <30 m *(c)**	Greater of: - existing width or - potential width or - 15 m *2.(d)*	15 m *2.(c)*	
< 15 m *(d)**		At least 5 & up to 15 m *2.(e)*	

All widths measured from *top of the bank*. See *"Definitions and Concepts"* for a more detailed explanation of SPEA factors and widths.

Table 2 Forest Practices Code and *Forest and Range Management Ac*t riparian areas dimensions. Table from Taschaplinski and Pike (2009).

TABLE 15.1 *Riparian management area standards for streams under the FPC and FRPA. Widths of reserve and management zones are slope distances measured from the streambank perpendicular to the channel. This classification framework developed for the FPC has been retained under the FRPA.*

Riparian class	Average channel width (m)	Reserve zone width (m)	Management zone width (m)	Total width of RMA (m)	Retention in RMZ (%)[a]
S1-large (FPC) = S1-A (FRPA)	> 100 (for > 1 km of stream length)	0	100	100	≤70[b]
S1 (FPC) = S1-B (FRPA)	> 20	50	20	70	50
S2	> 5 to ≤ 20	30	20	50	50
S3	1.5 to ≤ 5	20	20	40	50
S4	< 1.5	0	30	30	25
S5[c]	> 3	0	30	30	25
S6[c]	≤ 3	0	20	20	5

a Recommended in the *Riparian Management Area Guidebook* for FPC only as maximum and averaged over large operating areas, not specific to each cutblock (B.C. Ministry of Forests and B.C. Ministry of Environment 1995a).
b Softwood retention = 50% within 20 m of island perimeters and channel banks (see Table 6, B.C. Ministry of Forests and B.C. Ministry of Environment 1995a). Hardwood retention as per active floodplains = 70% (see Table 6, B.C. Ministry of Forests and B.C. Ministry of Environment 1995a).
c Non-fish-bearing streams.

Riparian Area Information Sources

Broadmeadow, S., and T.R. Nisbet. 2004. The effects of riparian forest management on the freshwater environment: a literature review of best management practice. Hydrology and Earth System Sciences 8: 286-305.

Gregory, S.V., F.J. Swanson, W.A. McKee, and K.W. Cummins. 1991. An ecosystem perspective of riparian zones. BioScience 4:540–551.

Hartman, G.F. and J.C. Scrivener. 1990. Impacts of forestry practices on a coastal stream ecosystem, Carnation Creek, British Columbia. Dep. Fish. Oceans, Ottawa, Ont. Can. Bull. Fish. Aquat. Sci. No. 223.

Stevens, V., F. Backhouse, and A. Eriksson. 1995. Riparian management in British Columbia: an important step towards maintaining biodiversity. B.C. Min. For. And B.C. Min. Environ., Lands and Parks, Victoria, B.C. Work. Pap. 13/1995.

Tschaplinskli, P.T. and R.G. Pike. 2009. Chapter 17 Riparian Management and Effects on Function. In Compendium of Forest Hydrology and Geomorphology in British Columbia R.G. Pike et al. (editors). B.C. Ministry of Forests and Range, Research Branch, Victoria, B.C. and FORREX Forest Research Extension Partnership, Kamloops, B.C. Land Management Handbook (TBD). https://www.for.gov.bc.ca/hfd/pubs/docs/lmh/Lmh66/Lmh66_ch15.pdf

Wenger, S. 1999. A review of the scientific literature of riparian buffer width, extent and vegetation: http://outreach.ecology.uga.edu/tools/buffers/lit_review.pdf

Trans Mountain Pipeline Anchor Loop as a Paradigm of Impacts for TMEP

Trans Mountain Pipeline's Position of the Environmental Considerations of the Anchor Loop and its Relation to TMEP

TMP has touted the 2004-2008 Anchor Loop (Jasper National Park; Mount Robson Provincial Park) construction of the pipeline in these parks as an example of how the terrestrial and aquatic ecosystem impacts were mitigated by the Project (http://www.transmountain.com/anchor-loop ; public information meetings, Coquitlam/Langley May 19/20, 2015). The empirical evidence, however, shows that large-scale and unmitigated damage occurred as a result of this part of the project and much of the impacts still persist as a result of this Anchor Loop.

In order to assess some of the post-construction Anchor Loop effects to these protected park ecosystems, SRES provides, below, an assessment of some of the available information from conversations and material made available by TMP and its vegetation and fisheries specialists (terrestrial and aquatic habitats) at the April 16, 2015 SRES/TMEP and May 19/20, 2015 Coquitlam/ Langley public meetings in addition Kinder Morgan material taken from the internet.

As well, site-visits to some of the terrestrial-corridor and stream-crossings, of the Anchor Loop section of the TMEP, were undertaken during June 19-21, 2015 in order to further-assess the impacts and possible mitigation.

Damage to the Terrestrial Ecosystem in the Corridor

The stated positions of TMP and its vegetation consultants were that impacts to the terrestrial (non-aquatic) component of the Anchor Loop were mitigated during the project. This was reiterated numerous times by the TMP consultants during the May 19/20, 2015 Coquitlam/Langley meetings. Of particular interest was the term "functional" which was repeatedly and extensively used by the TMP consultants during the April 16, 2015 SRES/TMEP and May 19/20, 2015 Coquitlam/Langley meetings (but undefined by the TMEP consultants)). That is, their positions were that the landscape had been "returned to its functional' capacity". However, at no time was the term "functional", or its synonyms ever defined by a legal, regulatory or scientific meaning. SRES has come to the conclusion that the word "functional" is as a term of restoration is being used by TMP and its consultants as a deliberate

obfuscator.

An examination of various locations of the pipeline corridor of the Anchor Loop shows a wide (often ~40 m) swath through the native vegetation with little structural (either the soil or rock, or vegetation) diversity (Figures 4, 5, 6). The 2003 air photo near Snaring River (Figure 4, upper photo) in the Anchor Loop ROW shows that there had been a measure of historic ecological "recovery" from the 1953 impact with the growth of low shrubs, etc,. However, by 2008 this vegetation had been destroyed by the Anchor Loop project (Figure 4, lower photo). Furthermore, the corridor width of the damage to the terrestrial vegetation had been expanded extensively, by ~20 m, into the previously-untouched forested areas (~15 m to ~35 m). By 2012 (Figure 4, bottom) and 2015 (Figures 5, 6) no meaningful vegetation recovery had taken place and any vegetation planting that did occur appears to have both not matched the local plant community or had largely failed (Figure 7). Specifically, there does not seem to have been a mitigation plan for the loss of large trees where the Anchor Loop encroached into "virgin" timber (c.f., Figure 4 with Figures 5, 6, 7).

At another location, at Clairvaux Creek, the homogeneity of the landscape and vegetation is apparent (Figure 8). The lack of biodiversity is stark in contrast to the adjacent, untouched, forested area. In large part, the ROW was dominated by a smoothed-over soil and a mono-culture of grasses as ground cover. Significant patches of invasive species (dandelions) could be seen mixed in with the grasses. Similarly, at Meadow Creek the damage to the landscape in both the riparian and terrestrial areas was extensive with little or no attempt at mitigating the biodiversity losses.

It should be noted that there may have been a very small attempt to provide some physical diversity to the Anchor Loop ROW. For example, at the location 2.6 km south of Snaring River, at a few spots someone had dumped, in a windrow, some small woody debris (Figure 10). This may have been an attempt to offset lost habitat for small vertebrates. At another nearby location, a large log "fence" was constructed across the ROW (Figure 11). There were more than one of these structures built on the ROW.

Loss of Large Live Vegetation

A key concern of the TMEP has been the potential for loss of large, older old-growth and second-growth trees in both the construction zone as well as regrowth within the ROW of the 1953 project. For the

Anchor Loop project it is very clear that there was large-scale clearing of older, mature vegetation (trees and shrubs) as well as younger plants that had recolonized the disturbed zone from 1953 and onwards (c.f., Figures 4, 5, 6, 7). There is no evidence in the ROW or putative construction zone that any significant recovery has occurred since 2004-2008. Furthermore, there is no evidence that TMP or its restoration consultants put in any effort to replace the biodiversity that was extant prior to construction (Figures 5, 6, 7).

That TMP was not obligated to mitigate the damage to this larger-older trees and other plants, caused to the physical and biological landscapes in both national and provincial parks as a result of the Anchor Loop project, is incomprehensible.

Anchor Loop Terrestrial ROW Summary

In summary, it is not clear what the TMP vegetation consultants mean by "functional" in regards to the biodiversity of the vegetation structure that was planted post-construction for the ROW and construction corridor of the Anchor Loop pipeline construction. The landscape is so uniform and devoid of vegetation and landscape diversity that one could land a Boeing 737 on the resulting ROW. Perhaps if one were looking to create a golf fairway or a WalMart parking lot, the resulting ROW could be considered "functional". Ecologically, however, what was left in the pipeline corridor was a "scorched earth zone".

Environmentally what happened to these national and provincial park landscapes, as a result of the TMP Anchor Loop, could only be described as both horrific and ecologically genocidal. It is not clear how such travesties could be allowed in some of our most important protected areas in western Canada.

Clearly, considering the egregious extent of the impacts by TMP to the Anchor Loop project in these parks warrant a retroactive investigation as to why such destruction was permitted.

Figure 4a A comparison of the Trans Mountain Pipeline Anchor Loop pipeline project pre-construction versus post-construction vegetation communities showing large-scale habitat damage caused to the terrestrial landscape as a result of vegetation clearing in the construction and ROW corridor approximately 2.6 km south of Snaring River. This Google Earth location was chosen for illustrative purposes to show the TMP unmitigated damage to the terrestrial landscape in Jasper National Park because of the ground level photos that were available for comparison. Top photo was taken June 16, 2003, prior to construction (2004-2008) while bottom photo shows extent of the unmitigated vegetation damage as of June 26, 20212. Compare these photos with Figures 5, 6, 7 to see ground level extent of natural vegetation losses. See also, Figure 11.

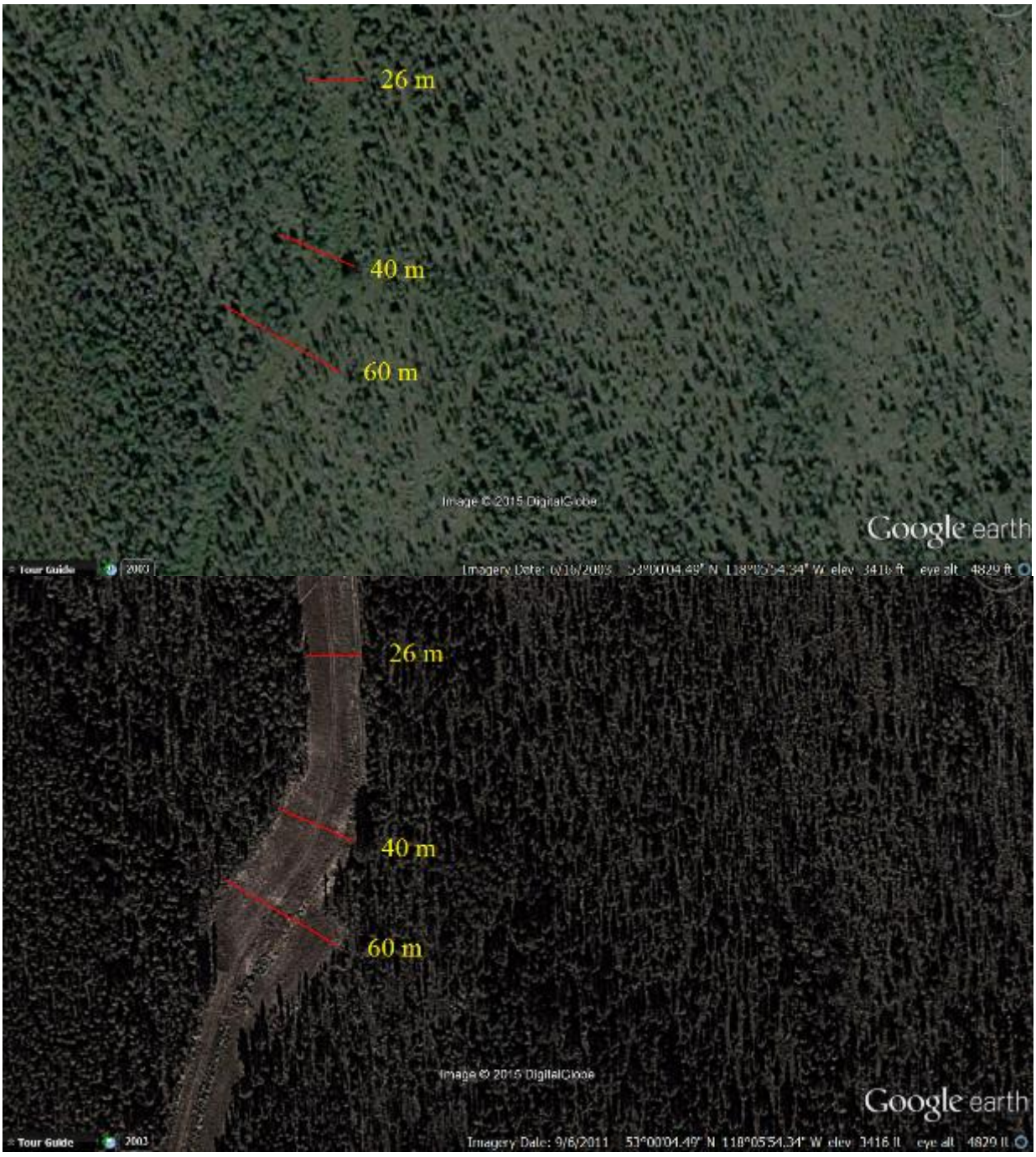


Figure 4b Random example of extensive losses of old-growth montane-community trees, in addition to lower-level vegetation that colonized the ROW since 1953, in the terrestrial portion of Jasper National Park as a result of clearing in the corridor as part of the TMP Anchor Loop. Location is approximately 1 km south of Snaring River. Top photo: 2003; Bottom photo 2011. There is no indication that TMP ever adequately mitigated or compensated for these extensive terrestrial losses of old-growth large vegetation in this national park.

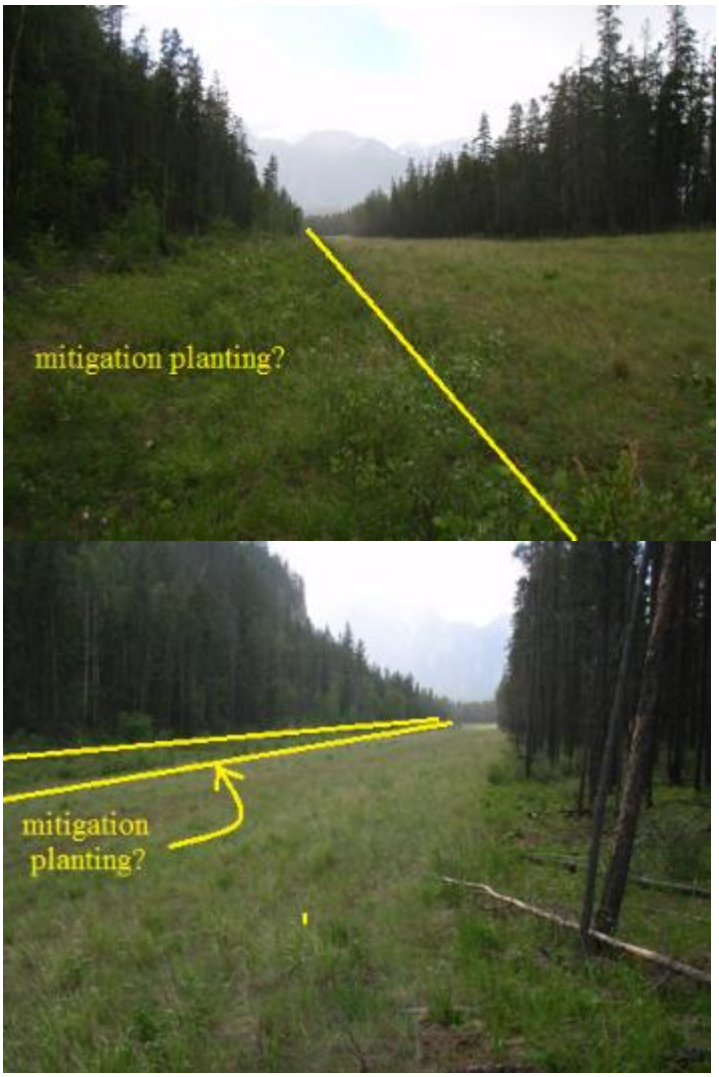


Figure 5 Ground-level view of extreme habitat damage caused to the terrestrial landscape as a result of vegetation clearing in the construction and ROW corridor approximately 2.6 km south of Snaring River due to the Trans Mountain Pipeline Anchor Loop pipeline project, looking north, and located on Figure 4a. Photo was taken June 19, 2015 approximately seven years after the end of the stated construction period (2004-2008). Strip of slightly higher (~knee height) vegetation along the left side of these photos is, presumably, the mitigation for impacts occurring to pre-construction vegetation community seen in Figure 4, lower photo. Note that the ROW vegetation is almost a monoculture compared to the much greater pre-construction plant diversity.

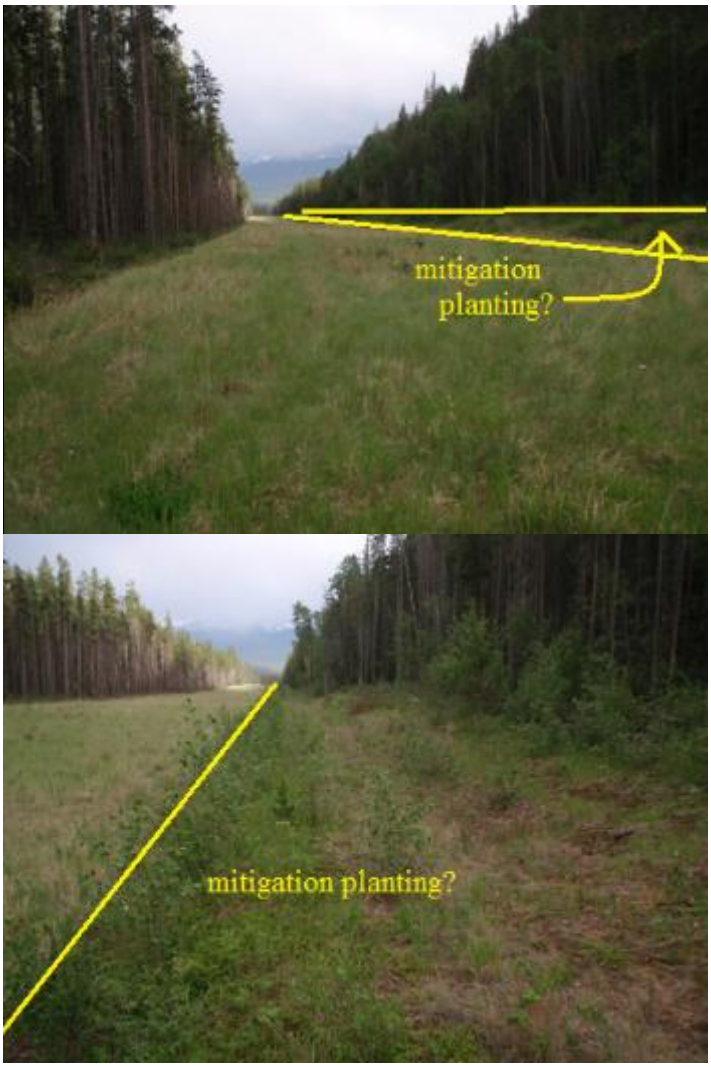


Figure 6 Ground-level view of extreme habitat damage caused to the terrestrial landscape as a result of vegetation clearing in the construction and ROW corridor approximately 2.6 km south of Snaring River due to the Trans Mountain Pipeline Anchor Loop pipeline project, looking south, and located on Figure 4a. Photo was taken June 19, 2015 approximately seven years after the end of the stated construction period (2004-2008). Strip of slightly higher (~knee height) vegetation along the left side of these photos is, presumably, the mitigation for impacts occurring to pre-construction vegetation community seen in Figure 4, lower photo. Note that the ROW vegetation is almost a monoculture compared to the much greater pre-construction plant diversity.

Figure 7 Putative-vegetation mitigation planting by TMP, along the perimeter of the forested area, within the presumed construction-zone portion of the Anchor Loop. This is a current ground-level view of extreme habitat damage due to the Trans Mountain Pipeline Anchor Loop pipeline project caused to the terrestrial landscape as a result of vegetation clearing in the construction and ROW corridor approximately 2.6 km south of Snaring River, looking south. Photo was taken June 19, 2015 approximately seven years after the end of the stated construction period (2004-2008). The strip of slightly higher (~knee height) vegetation is, presumably, the mitigation for impacts seen to pre-construction vegetation community seen in Figure 4a (compare the upper, pre-construction, photo to the lower, post-construction, photo which shows the extent of natural vegetation pre-densities and post-losses). Note that if this meant to be "mitigation" for ecological losses the vegetation does not mimic the perimeter plants. Presumably there is no longer any assessment as the density of plants appears to be minimal, compared to a thriving vegetative community, given how poorly these plants are growing in the 10 m strip along the forested zone.

Figure 8 Trans Mountain Pipeline Anchor Loop corridor near Clairvaux Creek looking east (top left photo) including close-up of the dominant vegetation community (top right and bottom left photos) including dense patches of invasive species (bottom right). Note the extreme homogeneity of the landscape, both physically and in regards to vegetation community. Photo taken June 21, 2015.

Figure 9 Heavily-impacted riparian and terrestrial habitats at Meadow Creek, Jasper National Park, on the true-left bank This section of the ROW was part of the Anchor Loop project. Note the lack of any apparent attempt by TMP at mitigating the destroyed vegetation community or at providing organic or landscape structure. It is not clear why such devastation was allowed in a national park. Photo taken June 19, 2015.

Figure 10 Very small diameter coarse woody debris left along the margin of the Anchor Loop pipeline corridor south of Snaring River approximately 2.6 km. It is not clear if this material was simply discarded from the ROW and construction zone or intended "mitigation" to provide physical and biological diversity to the Anchor Loop. In any event, this material was simply piled in a windrow with not apparent thought to providing habitat for small vertebrates or other species. Photo taken June 19,

2015.

Figure 11 Large wooden structure located across the Anchor Loop corridor 2.6 km south of Snaring River. A number of these were constructed in the TMP ROW in Jasper National Park. Photo taken June 19, 2015.

Damage to Streams and Riparian Areas in the Anchor Loop in Jasper National Park

Trans Mountain Pipeline has touted the Anchor Loop (Jasper National Park; Mount Robson Provincial Park) as having protected the streams at locations where the pipeline crossings took place. The empirical evidence, however, is extensively to the contrary. In particular is the large-scale damage to the riparian areas at the crossings although the bank hardening with its disruption to fluvial processes also falls within the spectrum of the damage done by TMP to the streams of Jasper National Park and Mount Robson Provincial Park.

There are many visual illustrations of the extensive, unmitigated, damage caused to streams with CRA fishes, by TMP, in the Anchor Loop. Perhaps the most interesting are two examples provided directly by TMP and its consultants for the Mount Robson Provincial Park portion of the project (Figures 12, 13) (they may be the same location). It can be seen that TMP extensively damaged the riparian area in these two figures. It is not known what date the photos were taken on, or if the damage was mitigated.

A site that was not mitigated and comprised an example of large-scale damage in the Anchor Loop project was the crossing at Snaring River in the Jasper National Park (Figure 14). At this site, the crossing entailed the passage of the pipe through the main channel, a secondary channel (and across an island) and a number of ephemeral tertiary streams. Major losses of riparian vegetation occurred as a result of the pipeline construction.

Major unmitigated losses to stream habitats, as a result of the Anchor Loop, have also been observed at Meadow Creek (Figures 15, 16). This site was complicated, of course, by the proximity to the highway crossing which was immediately downstream of the pipeline crossing.

There appeared to be an attempt, by the Anchor Loop project, to provide a modicum of riparian planting on the Fiddle River (Figures 17, 18, 19). The planting of vegetation can be seen to be very sparse and appears to have failed in patches.

Another attempt at mitigation was observed at Clairvaux Creek in the Anchor Loop within Jasper National Park (Figures 20, 21). Some vegetation appears to have been planted, but this may have been feral in nature. The banks had been bermed in order to entrain the flows in a laminar direction across

the ROW (Figure 20) disrupting any possibilities of retaining normal bank, floodplain or riparian physical fluvial processes.

Figure 12 Extensive damage to the stream bank and riparian areas at a Trans Mountain pipeline crossing putatively in the Anchor Loop TMP project. For all intents-and-purposes, and from a fish-habitat perspective, this stream crossing can be viewed as a "biological scorched-earth zone". Figure adapted (notations on photo, SRES additions) from May 19/20, 2015 TMP information meetings (presentation powerpoint by Calum Bonnigton).

Figure 13 Extreme riparian habitat damage to a stream in Mount Robson Provincial Park in the 2004-2008 Anchor Loop project. It is not clear how or why the regulatory agencies would allow such an egregious impact in such a sensitive area. Taken from: http://www.transmountain.com/anchor-loop-construction and accessed July 10, 2015.

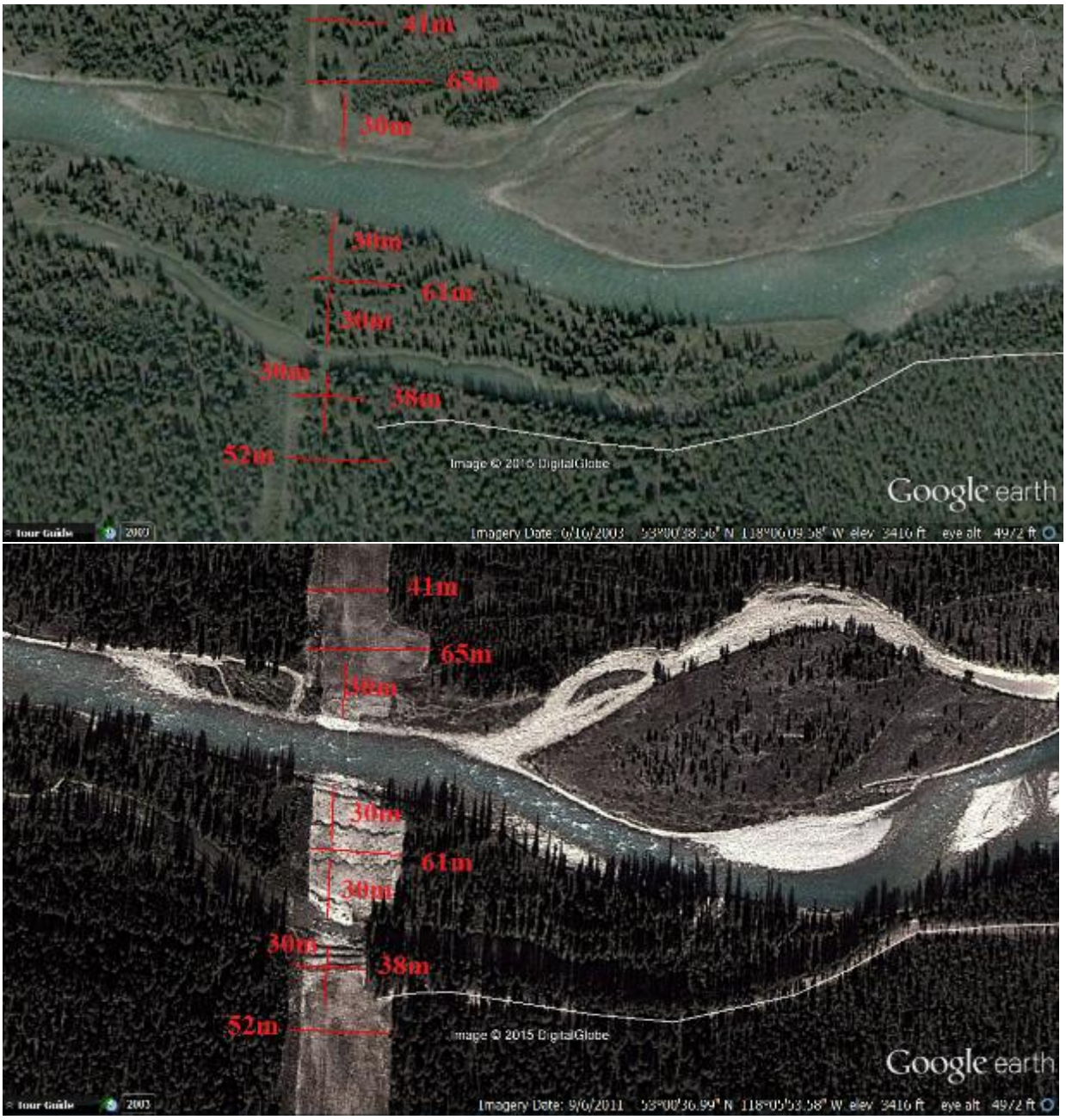


Figure 14 Extreme and extraordinarily unmitigated fish-habitat damage in the riparian areas of Snaring River and side channels caused by the Anchor Loop construction. Top photo shows Google Earth air photo taken June 16, 2003, prior to the Anchor Loop construction; bottom photo shows Google Earth air photo taken September 6, 2011 three years after the end of construction. Note the extensive amount of live large-woody vegetation within the 30 m riparian zone, in 2003, that was destroyed between 2004-2008. Note, as well, the profoundly impacted impacts to ephemeral channels within the island. Finally, note, that in many instances the vegetation removal far-and-away exceeds the 45 m corridor widths indicated by TMP at the public meetings and in the TMEP documents. Distances determined from Google Earth app.

Figure 15 Extreme damage to the left-bank riparian area of Meadow Creek as a result of the Anchor Loop project. Middle photo: taken from highway bridge looking upstream; Bottom photo: looking from left bank across the stream to the right bank upstream of the highway. There was no observable structural mitigation by TMP to either the instream channel or the bank integrity. No observable riparian vegetation was planted at this location (outside of grasses). The coarse sediments are simply being windrowed along the banks of the stream as a form of armoring without any due consideration to instream or bank-habitat complexing. Photo taken June 19, 2015.

Figure 16 Extreme and unmitigated damage to the instream, bank and riparian areas for both stream-sides on Meadow Creek in Jasper National Park as a result of the TMP Anchor Loop project. Photo taken June 19, 2015.

Figure 17 Right- (left photo) and left-bank (right photo) Fiddle River TMP crossing in the Jasper National Park section of the Anchor Loop project. Large-scale destruction of the shoreline integrity (rip rapping) occurred here without any attempt at creating any instream or bank physical diversity. Unlike Meadow Creek, however, it appears that ~10 m of vegetation was planted along the riparian areas of this stream on both banks; nevertheless, it is clear that some of these shrubs/trees failed to properly survive and since 2008 most are only about knee-to-waist height (Figure 18).

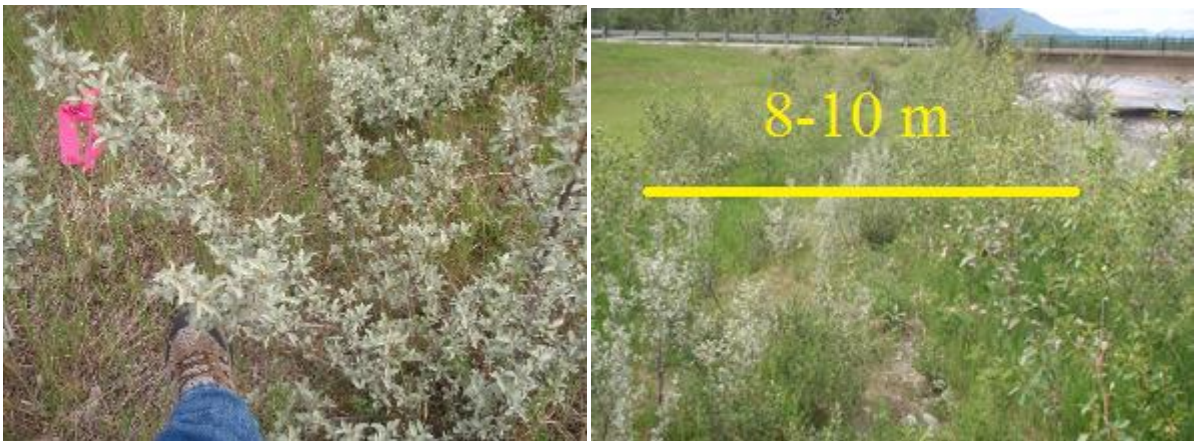


Figure 18 Most of the apparently-planted vegetation at Fiddle River is about knee-to-waist height. It is not clear when these plants were placed here, but the project ended in 2008. Presumably the flagging is part of a post-construction assessment.

Figure 19 Right bank vegetation (looking upstream from the highway) at the TMP crossing at Fiddle River on the Anchor Loop in Jasper National Park. Note that there are large sparse patches that may have indicated that some of it has failed. Note, as well, that the species composition is very different than the natural vegetation community just upstream of the crossing.

Figure 20 Left bank of Clairvaux Creek looking downstream in the Anchor Loop section of the TMP ROW. Vegetation along the bank and in the riparian area varies from moderate, to sparse to non-existent. Species of trees may have been planted but are mostly breast height or less. The plant diversity did not match the downstream, un-impacted stream. Even though the TMP ROW on this stream crossing is downstream of both the rail tracks and the highway, both banks have been bermed and this disrupts the natural fluvial processes.

Figure 21 Coco-mat debris remaining at Clairvaux Creek from the TMP Anchor Loop construction.

Damage to Streams and Riparian Areas within the TMP ROW in the Anchor Loop Outside of Jasper National Park and/or Adjacent Locations

The 2004-2008 Anchor Loop project by TMP doubled the pipelines from Hinton, Alberta, to Hargreaves, British Columbia. As seen above, the Jasper National Park section of the pipeline twinning had considerable negative impacts to the aquatic and terrestrial ecosystems in this protected area that continue to be unmitigated. Damage to streams outside of Jasper National Park also occurred as a result of TMP's activities. For example, both the riparian areas and bank structure of Rockingham Creek, British Columbia, were largely destroyed with little habitat mitigation put into place (Figure 22).

Another example of a destroyed stream within the ROW of TMP, and in British Columbia, can be found west of Rockham Creek (Figure 23). While this may or may not be a CRA fisheries stream, its discharge eventually flows into such a watercourse.

Figure 22 Rockingham Creek, British Columbia, upstream of the highway bride looking across (top photo) and upriver (bottom photo) at the TMP ROW. Note the destroyed stream banks and almost-complete loss of riparian-habitat vegetation. It is not clear why TMP has been allowed to maintain this habitat in such an extremely degraded state.

Figure 23 Extreme damage to a stream crossing the TMP ROW. Virtually all habitat capacity has been destroyed in this small stream located west of the Alberta-British Columbia border adjacent to the highway and crossing the TMP ROW. Under any-other circumstances it is incomprehensible that such destruction would be allowed to take place in a CRA-fisheries stream, or a stream that flows into CRA-fisheries waters.

Summary of Impacts to Streams as a Result of the TMP Project in the Anchor Loop

Large-scale impacts and egregious unmitigated damage occurred to the streams at the ROW crossings of TMP's Anchor Loop occurred during the construction of this project. Many of the impacts associated with the Anchor Loop are still evident within this leg of the TMP ROW and have never been properly addressed. Because the damage to the terrestrial environments and the watercourses are still highly evident, and extensively unmitigated, seven years after the construction had apparently been completed, questions need to be raised as to what levels of oversight were in place to protect aquatic ecosystems in two of Canada's/British Columbia's more important protected areas (Jasper National Park; Mount Robson Provincial Park). The habitat conditions that TMP have left at many of these streams can only be described as "genocidal".

These circumstances indicate a need for a post-construction investigation of the Anchor Loop environmental considerations and requirements.

And, the experience of the Anchor Loop bodes very poorly in regards to what TMP and its consultants plan to do to CRA habitat and aquatic resources for streams within the TMEP.

Effects at Trans Mountain Pipeline Stream Crossings Due to the TMEP

In large part, the combined TMEP construction and right-of-way (ROW) corridors will entail destroying a vegetated width of approximately 45 m. This comprises both the permanent ROW (18.3 m) and the "temporary" construction zone (26.7 m) (Figures 24, 25). We use the term "temporary" in this context in quotes as, from our experience in the Anchor (Jasper National Park; Mount Robson Provincial Park) Loop in Alberta, these impacts to the construction zone last far longer than a decade and, for-all-intents-and-purposes, are going to be largely permanent within the lifetime of the project.

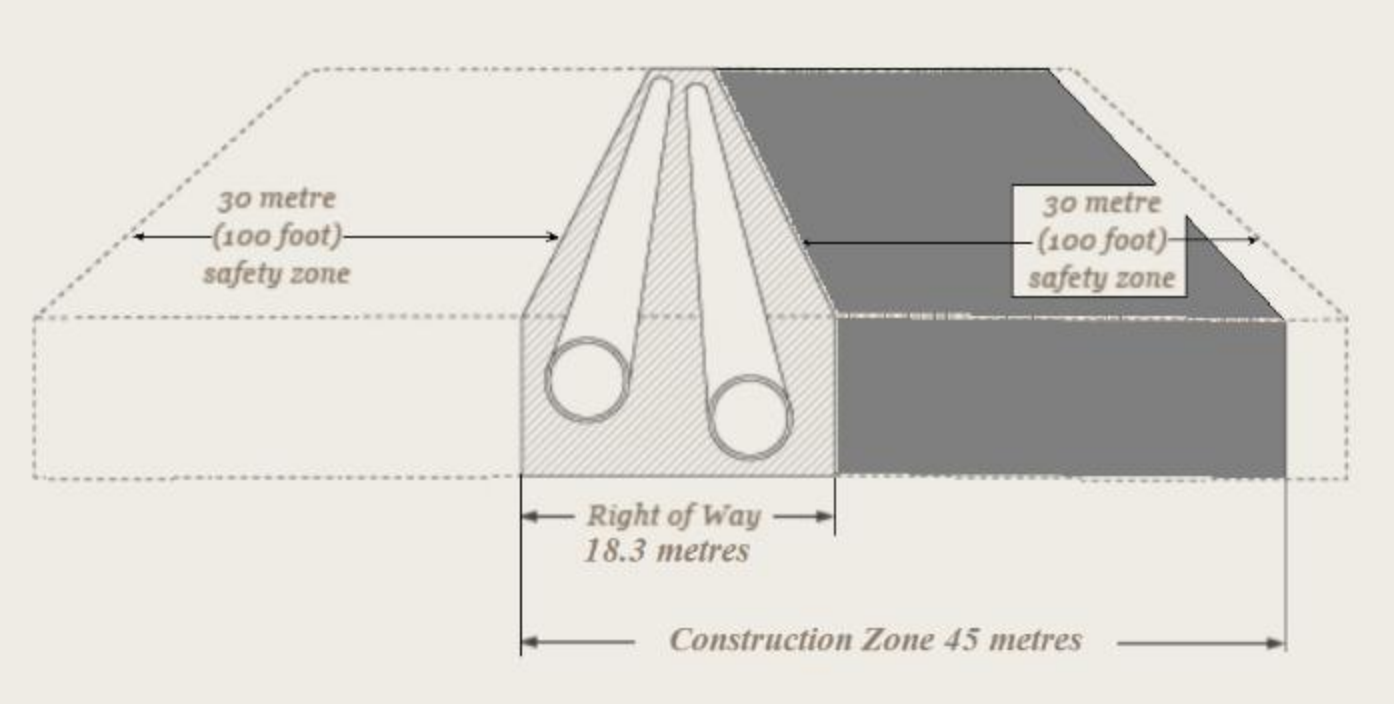


Figure 24 The approximate dimensions of the Trans Mountain Pipeline's construction zone, including the permanent right-of-way (18.3 m) and the "temporary" construction widths (26.7 m). Figure modified from TMP web site.

Figure 25 Large-scale ecological devastation of the landscape for both the existing ROW and construction zone when laying pipelines. When constructing petroleum pipelines, the vegetation is typically stripped in both the ROW and the construction zone, the landscape is compacted by machinery and all natural ecological function is destroyed. Left photo: http://www.vancouversun.com/business/things+know+about+Kinder+Morgan+pipeline+protest+Burnaby/10400385/story.html Right photo: https://financialpostcom.files.wordpress.com/2013/12/transmountain.jpg?w=620

Trans Mountain Pipeline (TMP) indicates that there will be approximately 249 stream crossings in British Columbia that are habitats for fishes of commercial, recreational and aboriginal (CRA) interests. For stream crossings, Trans Mountain Pipeline (TMP) has largely proposed trenched crossings (Figure 26), as opposed to trenchless (Figure 27). Confirmation of this information can be reviewed in the TMEP/Triton Environmental Consultant's self-evaluations of *Serious Harm* for British Columbia CRA streams. Note that the TMEP/Triton Environmental Consultant's refusal to engage in the use of trenchless crossings is contrary to the Oil & Gas Commission's recommendations for stream crossings with fish (Figure 8). It is not clear why TMP is deliberately ignoring the Oil and Gas Commission's expectation for stream crossings through watercourses containing fish. Trenchless crossing have the potential for protecting riparian habitats. For its habitat-impact self-assessments, TMP has publically stated that it does not consider the destruction of riparian habitats in its TMEP to constitute *Serious Harm.*

Similar to the generic vegetation removal for the terrestrial portion of the TMEP, for these streams the expected disruption of the riparian area is approximately 45 m wide, including 18.3 m for the existing ROW and 26.7 m for the construction zone (c.f., Figures 24, 25). For stream crossings, of course, there will be an impact to riparian areas on both the stream banks.

Recognizing that an, apparently, small number of the streams have been proposed by the TMEP to be crossed using non-trenching methods (and we will expect the riparian area to be largely protected when

non-trenching methods are used), an approximate-area estimate of riparian losses will be 250 streams (less those that are being crossed via trenchless methods) X 45 m wide X 2 stream-banks X 30 m depth, or 675,000 square meters.

For the ROW, for the watercourses being crossed (less those that are being crossed via trenchless methods), the area of vegetation destroyed will be 250 streams X 18.3 m widths X 2 stream-banks X 30 m depths, or 274,500 square meters of vegetation that will be impacted in the existing ROW project clearing.

For the ROW, all of the riparian habitat had already largely been destroyed by the 1953 pipeline project. TMP has refused to consider mitigating this original damage. Nevertheless, it should be noted that, based on the experience with the Anchor Loop, at many locations some level of riparian recovery had occurred in the ROW and this vegetation will be destroyed by TMEP. Again, based on the information provided, and the conversations at public meetings (April 16, 2015; May 19/20, 2015), TMP has refused to consider the historical impacts to riparian fish habitat for the 1953 project, or the effects to the current ROW riparian habitats (sometimes limited, but often still extant) by the TMEP in any explicit way.

Finally, for approximately 250 streams (less those that will be crossed via trenchless methods) X 2 stream-banks X 30 m depth X 26.7 m width there will be 400,500 square meters of construction-zone riparian habitat lost. As was discussed f when considering the empirical observations at the Anchor Loop (Jasper National Park; Mount Robson Provincial Park), these construction-zone losses are more-or-less permanent.

Just as a note, considering that the twinning of the pipeline from Edmonton to Burnaby is about 1,100 km, including the Anchor Loop about 50,000,000 m^2 of landscape (both aquatic and terrestrial—1,100 km X 1,000 m/km X 45 m) will be impacted. There is no indication that Trans Mountain Pipeline is prepared to compensate for any of this massive landscape damage.

And, again, as pointed out in earlier documents by SRES, these are massive losses (Figure 29) to critical riparian fish habitat as a result of the TMEP and for which TMP and its consultants have refused to consider in any meaningful ways.

Figure 26 Pipeline construction across a stream using trenching methodology as proposed by Trans Mountain Expansion Project for most of its stream crossings.
Vegetation in both the ROW and construction zone, including the riparian areas, are completely destroyed using this method (c.f., Figure 5). The environmental proposal documents for the Trans Mountain Expansion Project indicate that TMP plans to use trenching technology for most stream crossings with no meaningful restoration or compensation for this critical aquatic habitat feature.
Figure adapted from:
http://www.enbridge.com/~/media/www/Site%20Documents/Delivering%20Energy/Projects/Construction/ENB2012PipelineConstructionFINAL09%2010%2012web.pdf. Accessed May 22, 2015.

Figure 27 Generic example of a trenchless method of stream crossing.
Note that the riparian areas, in this diagram, are largely protected as a result of this method. Figure adapted from:
http://www.spectraenergy.com/content/documents/Media_Resources_PDFs/HowWeCrossRiversStreams.pdf . Accessed April 7, 2015.

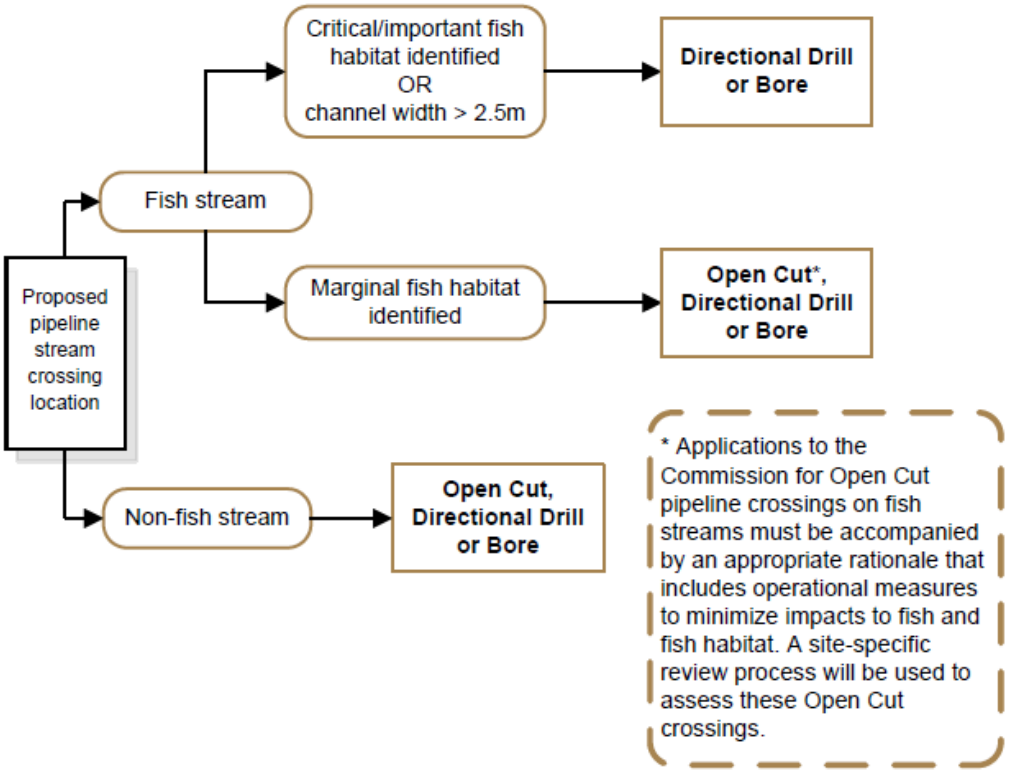


Figure 7: Pipeline stream crossing type flow chart. Refer to the corresponding BMPs (below) for expectations regarding each crossing type.

Figure 28 Decision-pathway for trenchless versus trenched pipeline stream crossings as recommended by the BC Oil and Gas Commission.
Figure from: https://www.bcogc.ca/node/5899/download. Accessed 7 April 2015.

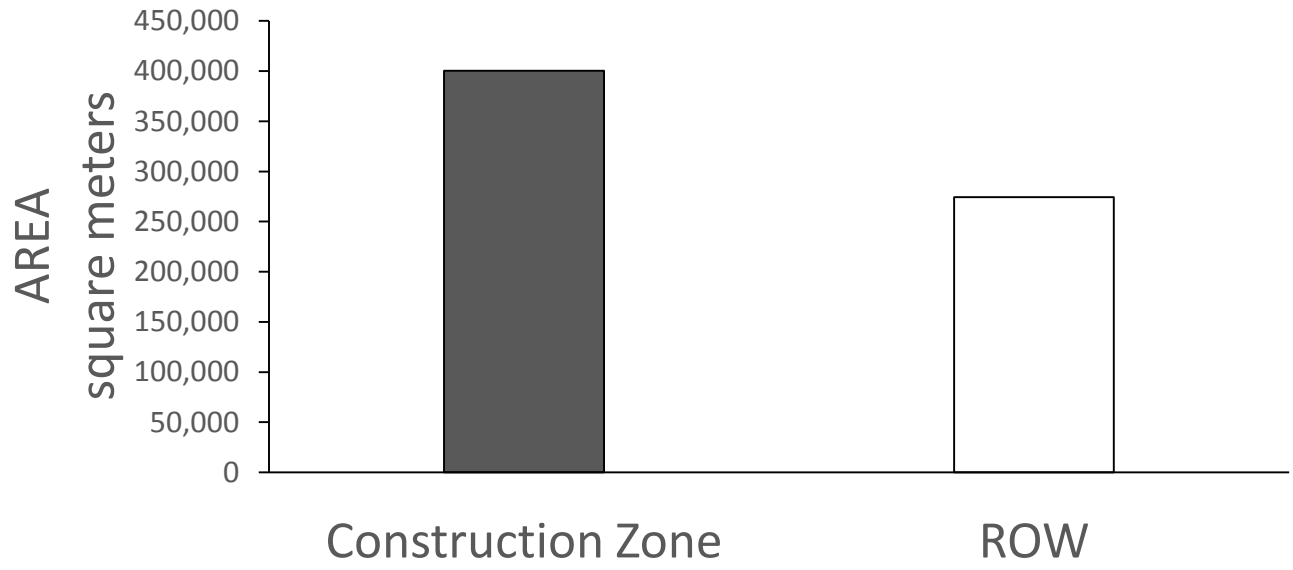


Figure 29 Area destruction of riparian habitat for CRA fisheries streams in British Columbia for the proposed TMEP calculated using the length, width and number of crossings provided by TMP. In its April 16, 2015 meeting with SRES, Trans Mountain Pipeline's fisheries representatives made it clear that TMP has no intention of mitigating or compensating for this aspect of destroyed fisheries habitat as a result of the Project. To quote the casual and cavalier attitude by TMP and its fisheries consultants: "*Trees and vegetation in riparian areas eventually grow back*." thus the removal of such vegetation does not constitute *Serious Harm.*

2. Articulate the issues of *Serious Harm* and the permanency of vegetation removal (esp. large, old trees).

Corridor Losses of Large Vegetation via Removal

Significant amounts of vegetation will be removed as a result of the corridor clearing for TMEP for both the ROW and construction zones (Figure 25). This will include both riparian and terrestrial landscapes and, in addition, to other, lesser-footprint-area, removals (e.g., pumping stations). For the most part, the clearing will comprise a corridor width of ~45 m of which 18.3 m will be the ROW and 26.7 m will include the construction zone (Figure 24).

Some of this vegetation removal in the construction and ROW corridors will entail the clearing of larger old-growth and second-growth forest trees. Significant amounts of such large and older vegetation were destroyed in the laying of the pipeline in the Anchor Loop component of the route from Edmonton-to-Burnaby, and which largely took place in Jasper National Park and Mount Robson Provincial Park. This extensive damage to the vegetation ecosystem of these protected areas included both terrestrial (Figures 4 a,b) and riparian (Figure 14) trees. There is no indication that TMP had, or was prepared to, mitigate or compensate for these large-scale losses.

In the absence of a detailed assessment and analysis of the likely destruction of large trees in the terrestrial or riparian areas of the TMEP (which TMP or its consultants have not appeared to have provided to the public), there are a number ways of providing a sense of the level of impact to British Columbia and, in particular, the areas of SRES interest for this parameter.

Firstly, while much of the landscape from Hope to Burnaby, British Columbia, has been largely cleared and urbanized, the nature of the pipeline is to follow the existing 1953 ROW and/or use routes that are less settled. As an important note, because of the sensitive nature of the existing pipeline, for many locations of the 1953 ROW there has been colonization of the landscape by trees and other ecosystem-beneficial vegetation (Figures 4, 14, 30). Using the dimensions and descriptions of landscape clearing of the construction and ROW corridors provided by TMP and their consultants (Figures 14, 15), at locations that have not been developed, there is the potential for extensive vegetative losses on the existing corridor (e.g., Figures 30, 31, 32).

In addition to the losses of the terrestrial vegetation, there will be destruction of trees in the riparian

areas of the stream crossings where trenched crossings will take place on the TMEP. Examples in the Township of Langley, in the areas of direct SRES interest, include West and Nathan creeks (Figures 33, 34) and the Salmon River (should the decision be made to not use trenchless technology). Given the number of stream crossings that will be crossed via trenching technology (Figure 24), and the examples of extreme destruction of such habitat attributes by TMP in the Anchor Loop (Figure 14), there are many more streams where large, older trees will be destroyed in the riparian areas for this project.

Summary: There is no indication that the TMEP is prepared to meaningfully mitigate or compensate for these large, older tree vegetation losses (see http://www.transmountain.com/uploads/pages/1409251834-PIPELINE_EPP.pdf ; April 16, 2015 TMP meeting with SRES in Langley; May 19/20, 2015 information meetings in Coquitlam/Langley). As an added point, the TMEP vegetation specialist in the May 19/20, 2015 indicated that he "*would be surprised*" that there was any older-tree vegetation, of note, in the TMEP corridor. It appears that this individual has not visited any of the sites where stream crossings are to take place in British Columbia.

Figure 30 Groomed ROW of the Trans Mountain Pipeline just west of the Vedder Canal, looking west, with the loss of almost all natural ecosystem attributes including large trees. Note that no large vegetation is permitted to grow on the ROW. This includes riparian areas at stream crossings. During the TMEP many of these trees will likely be lost at this location as a result of the clearing for the construction zone of the corridor (depending on the alignment). Based on the experience of the Anchor Loop, and conversations with the vegetation specialist in the May 19/20, 2015, there is no indication that TMP is prepared to mitigate or compensate for this aspect of ecosystem loses. (see also http://www.transmountain.com/uploads/pages/1409251834-PIPELINE_EPP.pdf).

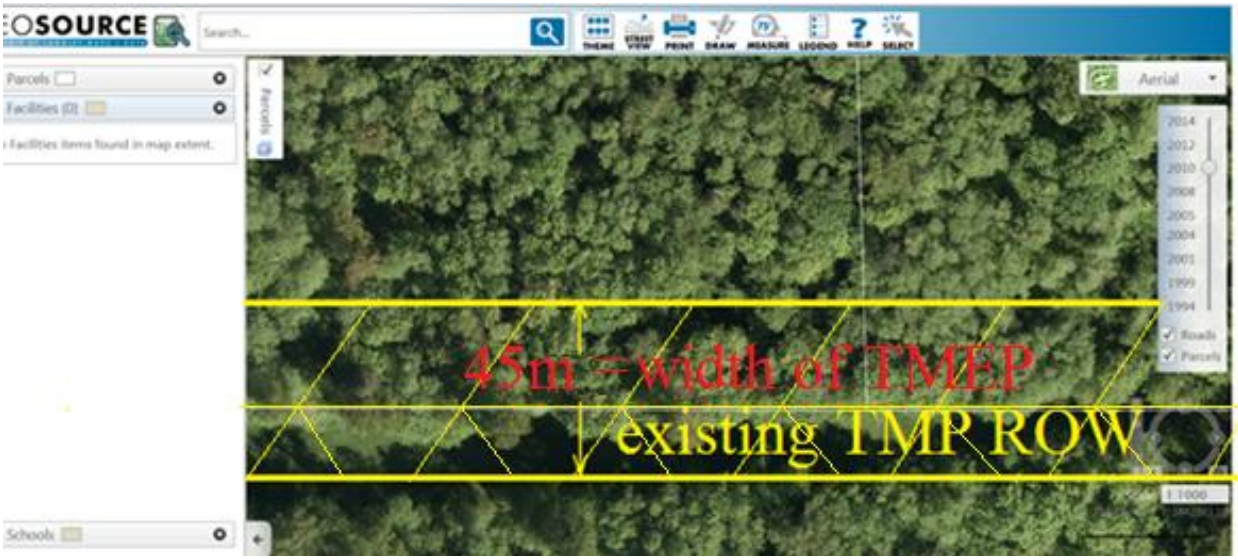


Figure 31 Air photo of the TMP ROW in the Township of Langley areas. Extensive losses of large second-growth vegetation in the Township of Langley area that will occur as a result of TMEP. This location is a short distance from the intersection of Nathan Creek and the existing TMP ROW, which was constructed in 1953. Note that the TMEP will clear these trees as part of both the ROW and construction zone (Figure 4). Adapted from: http://geosource.tol.ca/external/ and accessed April 4, 2015.

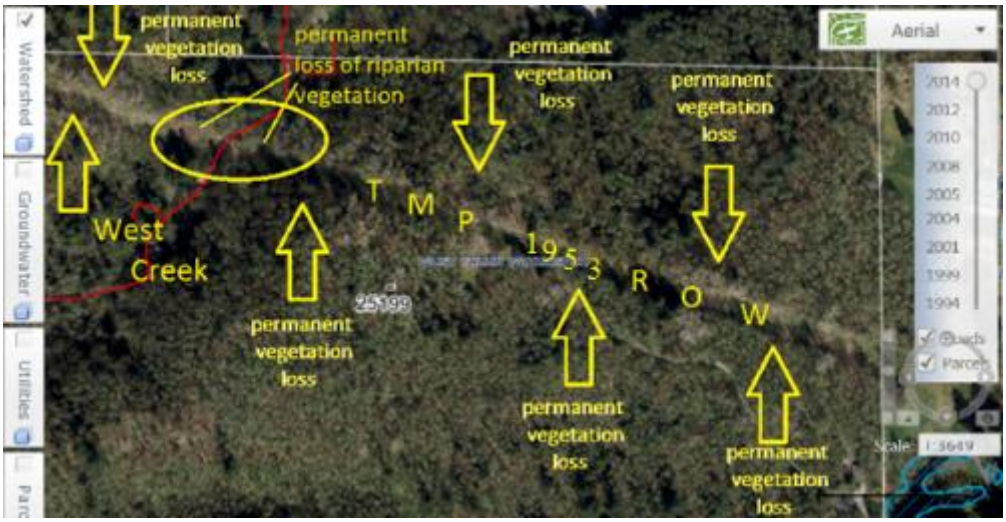


Figure 32 Permanent loss of second-growth forested vegetation at West Creek in the SRES area of interest, including damage to stream-side riparian areas, that will occur in the TMP corridor for the TMEP should it be approved as proposed. Note that the TMEP will clear these trees as part of both the ROW and construction zone (Figure 4). Figure adapted from: http://geosource.tol.ca/external/ and accessed April 4, 2015.

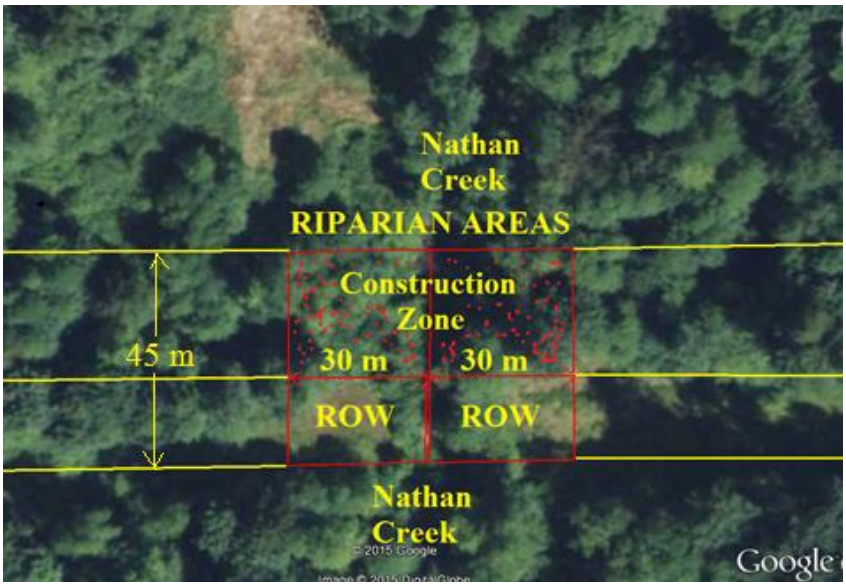


Figure 33 Clearing of the large trees in the riparian areas of Nathan Creek that will occur as a result of TMEP. Note that the impact will not only occur in the construction zone but the ROW, as well, due to the encroachment growth since 1953. TMP and its consultants do not consider such habitat destruction, of trees that are decades or hundreds of years old, to be *Serious Harm* as it is their stated view that *"it will eventually grow back."* (April 16, 2015 meeting with SRES in Langley.) It is not clear how or why TMP and its consultants do not consider such riparian habitats to be important given the extensive evidence, in the scientific literature, that they are critical to stream health.

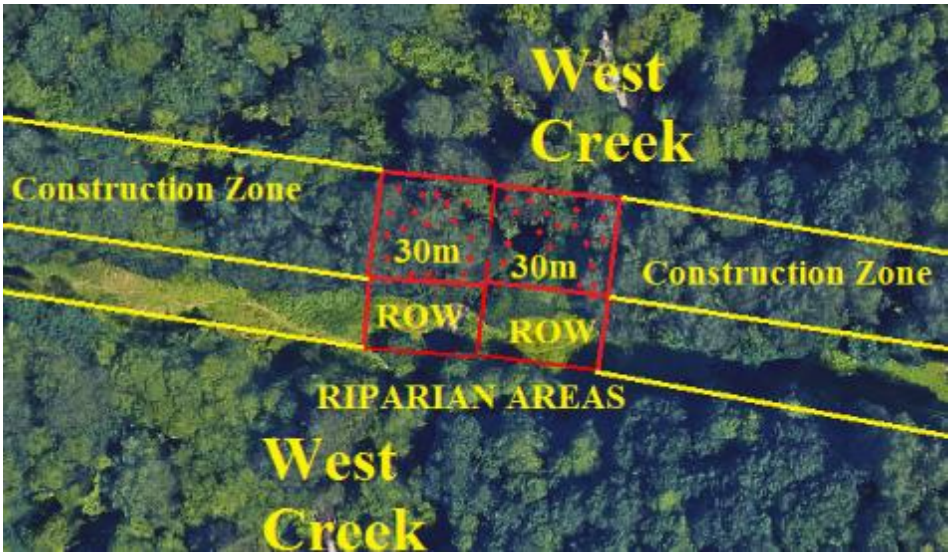


Figure 34 Clearing of the large trees in the riparian areas of West Creek that will occur as a result of TMEP. Note that the impact will not only occur in the construction zone but the ROW, as well, due to the encroachment growth since 1953. TMP and its consultants do not consider such habitat destruction, of trees that are decades or hundreds of years old, to be *Serious Harm* as it is their stated view that *"it will eventually grow back."* (April 16, 2015 meeting with SRES in Langley.) It is not clear how or why TMP and its consultants do not consider such riparian habitats to be important given the extensive evidence, in the scientific literature, that they are critical to stream health.

Trans Mountain Pipeline Quantification of the Expected Losses of Riparian Habitat for the TMEP

Trans Mountain Pipeline has taken the position that there will not be any *Serious Harm* impact to fisheries habitat in streams over the extent of the TMEP. This is an incomprehensible position to any trained stream-habitat biologist, examining the complexities of TMEP, and given the scope (~1,000 km, ~250 streams) of the project through some of the most valuable and complex CRA fish ecosystems in western Canada.

No-where in the TMEP preparatory-proposal documents for fish habitat, including the self-assessments of *Serious Harm,* does TMP or its consultant's address the issue of the losses of riparian habitat in its stream crossings in a meaningful way. The casual and cavalier disregard for such critical habitat is professionally astonishing. Indeed, for the self-assessment of *Serious Harm*, there is no inventory or assessment of the vegetation communities for any of the stream crossings much less a quantification of the habitat capacity, or loss there-of due to the construction of the riparian habitat. Indeed, despite stating that the zone of influence (ZOI) for the assessments of *Serious Harm* comprise 100 meters upstream, and 300 m downstream, of the pipeline corridor, there is nothing more that superficial quantification of the stream habitat nor any significant mention of riparian habitat (Figure 35).

SRES believes that these are serious error and omission on the part of the TMEP and its consultants.

The primary proposed exceptions by TMP, where they may use trenching technology for crossing streams in the more-westerly portions of TMEP, is at some of the locations where there are at-risk listed non-game species (i.e., Nooksack Dace). For listed non-game species there is the suggestion by TMP that Riparian Areas Regulation may apply. However, the information provided by the proponent's fisheries documents, and the *Serious Harm* assessments, is limited and it is not clear which streams TMP is actually prepared to use trenchless crossings.

For its *Serious Harm* evaluations, it is not clear why TMP and its consultants outright ignored the destruction of riparian areas for the streams that it proposes to cross. The Oil and Gas Commission is very clear on this issue, and recommends, that trenchless drilling has the potential of minimizing these riparian habitat losses for high-value CRA streams (Figure 28). It is also not clear why TMP and its consultants are ignoring very clear direction from the Oil and Gas Commission to protect CRA streams of high value by using trenchless technology.

Finally, as a telling note, in the May 19, 2015 Coquitlam TMP public meeting the TMEP fisheries

consultant vociferously argued that it was impossible to provide any substantive number of stream crossings for the Project.

In other words, TMP and its consultants are, largely, refusing to use trenchless technology to protect riparian areas as part of the TMEP regardless of the position by the regulatory agencies and/or the concerns by the stakeholders who will be affected by this project.

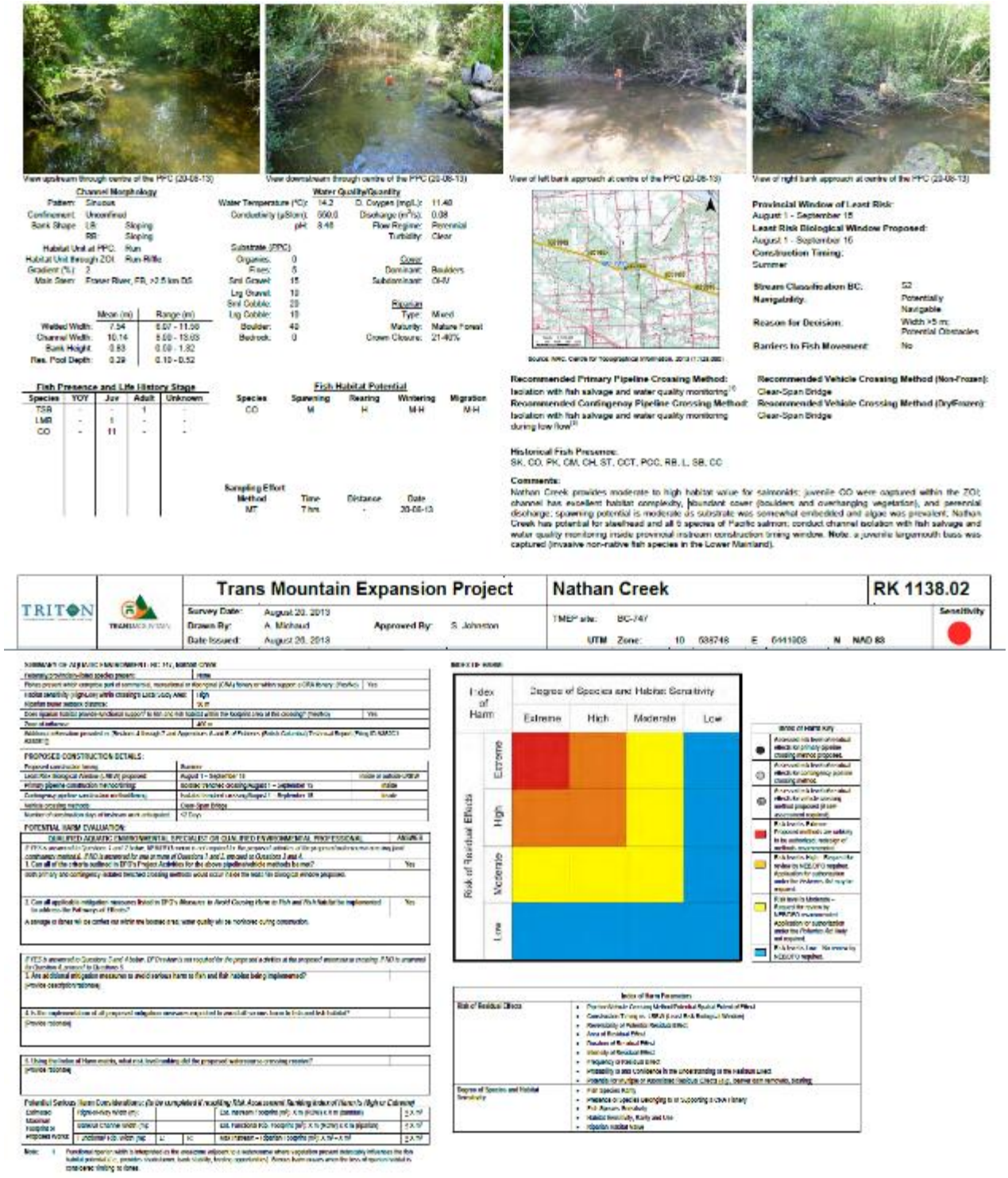


Figure 35 TMP assessment of TMEP stream crossing at Nathan Creek, Page 1.
Note the lack of any meaningful habitat information contained within this assessment/evaluation with respect to the assessment of riparian areas and the potential for loss due to a trenched crossing. This assessment and its lack of information is typical of all stream-crossing assessments by TMP. B323-9_-_Self_Assessment_Potential_for_Serious_Harm_to_Fish_and_Fish_Habitat_Part_7_of_7_-_A4I6C7.pdf B323-9_-_Self_Assessment_Potential_for_Serious_Harm_to_Fish_and_Fish_Habitat_Part_7_of_7_-_A4I6C7.pdf Accessed April 6, 2015.

3. Explain the SRES position on mitigation and compensation relating to TMEP

Trans Mountain Pipeline and its consultants (e.g., Triton Environmental) have taken the position that there will be no instances of *Serious Harm* to CRA fisheries habitat in the British Columbia leg of the TMEP (e.g., April 16, 2015 meeting with SRES, Langley; May 19/20, 2015 public consultation meetings in Coquitlam/Langley). Note that this project, including the Anchor Loop, is approximately 1,100 km long and will cross about 250 CRA fisheries streams. Within the National Energy Board process, it has been pointed out by numerous interveners that, given the biological and physical complexity of the aquatic ecosystems being impacted, this position by TMP and its consultants is a probabilistic impossibility. In short, no-one that understands fish habitat and impacts associated with working in and around instream and riparian environments for projects such as TMEP believes that it will not cause serious harm to the CRA fisheries affected by this project (Figures 29). Furthermore, the track record of impacts as per the experience with the Anchor Loop is that the effects will be substantial and not mitigated (Figures 12-16, 23, 23) and/or the damage will only be superficially addressed (Figures 17-21)

There is a large body of scientific literature that deals with watercourse restoration and mitigation relating to impacts to streams that have been affected by development, forestry and industrial activities (e.g., http://water.epa.gov/type/watersheds/archives/appa.cfm http://www.ecrr.org/RiverRestoration/Whatisriverrestoration/tabid/2614/Default.aspx http://wdfw.wa.gov/publications/00043/wdfw00043.pdf http://www.therrc.co.uk/manual-river-restoration-techniques). It is not the intention of SRES to review this information nor tell TMP or its consultants how to, exactly, do their stream mitigation, compensation or restoration work on TMEP. However, in the context of the expected TMEP impacts that are largely not mitigatable (e.g, loss of trees that are decades or hundreds of years old due to clearing in the riparian area; disruption of lateral fluvial processes due to bank armoring; vertical degradation of the stream bed due to channel narrowing and armoring in order to protect the pipes from scour), the proponent should be required to adequately compensate for these losses to CRA ecosystems.

SRES is of the position that these non-mitigatable impacts should be addressed through a compensation agreement with appropriate funding attached. For the Anchor Loop, such a compensation agreement has been developed in the form of a legacy fund (http://www.transmountain.com/legacy-fund).

This fund, for stream impacts, should deal not only with TMEP but with historical 1953 impacts to watercourse ecosystems as well. As shown above, at many locations the 1953 crossings of streams

have had partial recovery of habitat attributes but have been (Figure 14) or will be (Figures 33, 34) destroyed by the Anchor Loop/TMEP. It is clear that it is impossible to separate out the damage for the 1953 project from TMEP and TMP has both social and legal obligations to redress the outstanding and future impacts.

A legacy compensation fund would help in addressing outstanding impacts that have not, and/or cannot, been/be mitigated.

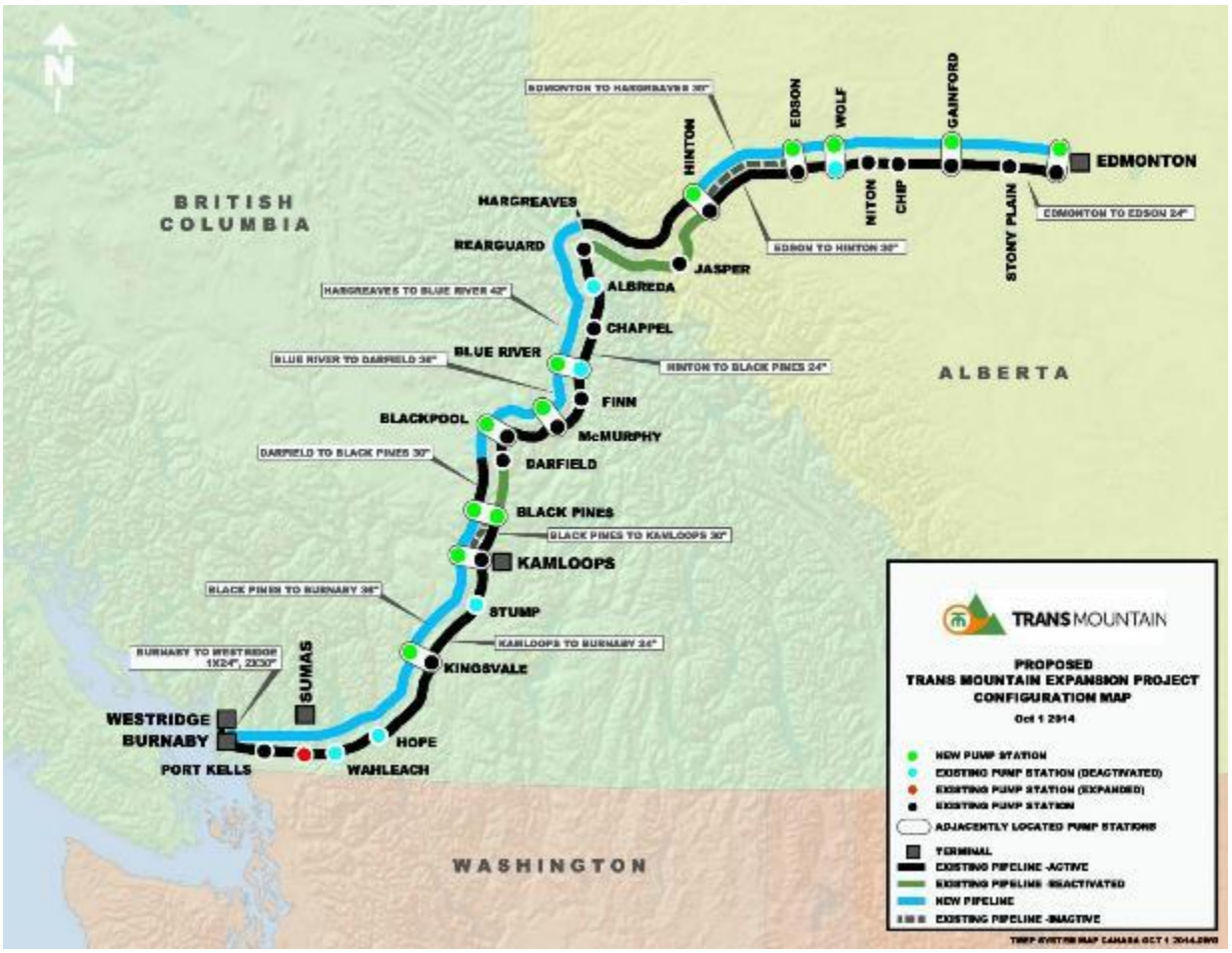


Figure 36 Trans Mountain Pipeline's TMEP route including the Anchor Loop leg.
Figure from: http://www.transmountain.com/uploads/pages/1417802986-TMEP%20SYSTEM%20MAP%20CANADA%20OCT%2001%202014.jpg.

4. Clarify the SRES assessment of the 1953 TMP impacts and linkages to the TMEP.

For the existing ROW corridor, there is no indication that TMP has ever provided any meaningful mitigation or compensation for its 1953-built pipeline and the impacts to fish habitat that resulted from its construction and/or operation. The existing ROW at many, if not all, stream crossings has had, and continues to have, negative effects on the aquatic ecosystem of CRA watercourses. In particular, for watercourses crossed by the existing 1953 ROW, the riparian habitat has been profoundly diminished in its quality and abundance. For the area of SRES interest in the Langley/north Surrey this includes Nathan and West creeks (Figures 37, 38) as well as the Salmon River (Figure 39). Another form of damage to the stream has been to use the ROW as a travelling corridor for off-road vehicles. This is particularly prevalent in some of the lower mainland small streams. Interruptions of natural fluvial processes due to extensive rip-rapping to protect the integrity of the pipeline have also occurred as a matter of due course in many of the 1953-built watercourse crossings. However, these extensive-historic impacts have occurred not only in the lower mainland CRA streams but to high-fisheries-value watercourses in the interior of the province. Such streams include the Coquihalla, Coldwater and Nicola rivers as well as in the North Thompson River watershed (Figure 40).

The damage to the streams by TMP over the years did not stop in 1953. As upgrades to the pipeline crossings occurred over the passing years, increasingly more bank protection/hardening has been used. Again, there is no indication that any meaningful mitigation or compensation has ever been forthcoming from TMP as a result of the continuing and increasing damage to CRA streams in British Columbia.

For TMEP the second line will largely parallel the 1953 project, with exceptions at some locations (e.g., Ft. Langley to Port Mann). In this context, the 1953 bank integrity and riparian habitats will be interrupted for those TMEP locations where trenching is used to cross the watercourse. This means that at some locations, over the last 60 years where there has been a semblance of habitat recovery, the habitat will, again, be destroyed (e.g., Figures 14, 33, 34). It will be difficult to separate out the historic damage from the TMEP given that the two projects are so intertwined and that TMP is largely using the same ROW for both lines.

Some would say that TMP has been given an environmental “free-ride” over the last 60 years of its operation of the 1953 project, particularly in respect to the fisheries impacts. And that it has never

addressed the negative externalities associated with the original pipeline. What is also clear is that it is impossible, in many instances, to segregate the historic from the TMEP.

Given the economies of scale associated with the new project, the costs associated with the restoration of historical damage should be included in the addressing of TMEP impacts. This will provide TMP, in part, the social license to undertake TMEP should this project be approved.

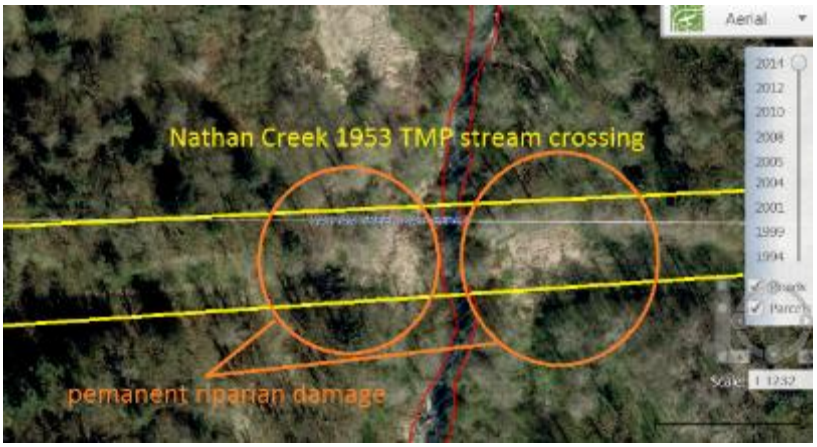


Figure 37 Significant permanent serious harm caused by the 1953 Trans Mountain Pipeline crossing at Nathan Creek. Adapted from: http://geosource.tol.ca/external/ and accessed April 4, 2015.

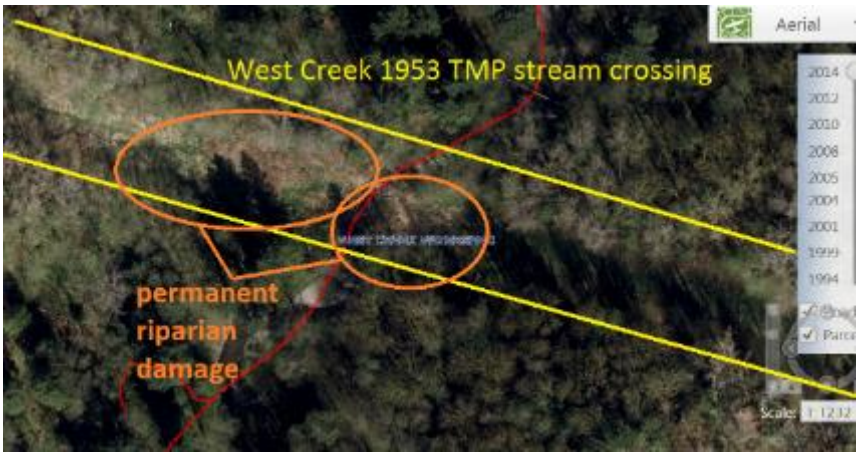


Figure 38 Significant permanent serious harm caused by the 1953 Trans Mountain Pipeline crossing at West Creek. Adapted from: http://geosource.tol.ca/external/ and accessed April 4, 2015.

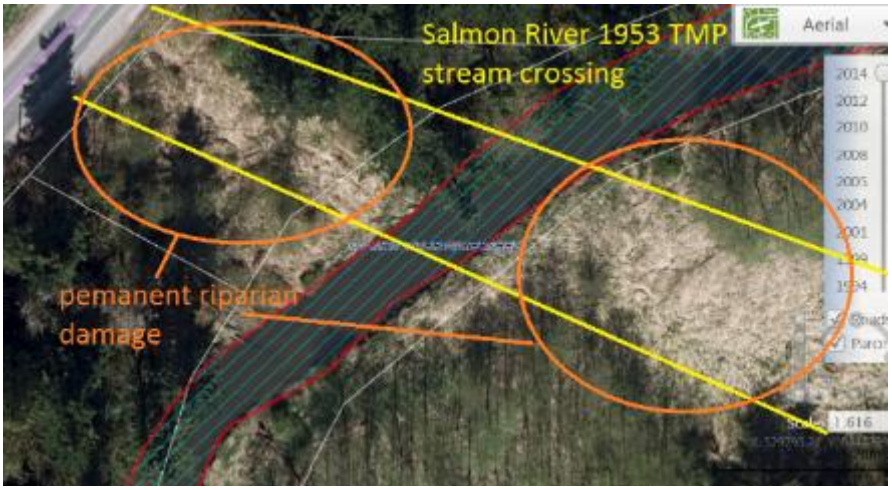


Figure 39 Significant permanent serious harm caused by the 1953 Trans Mountain Pipeline crossing at Salmon River. Adapted from: http://geosource.tol.ca/external/ and accessed April 4, 2015.

Figure 40 Extensive and extreme damage to the shoreline habitat of Juliet Creek on the Coldwater River drainage due to rip rapping, channelization and vegetation removal at the TMP crossing. Top photo: on left bank, looking downstream; Bottom photo: on left bank looking cross stream. Photos taken May 2015.

5 Provide the background and information (including any notes taken by SRES) in regards to the meetings with TMP and its consultants, with SRES, as articulated in its *IR*'s and *Written Evidence*.

On April 16, 2015 SRES met with representatives of the TMEP project. Included at the meeting were:

Christie Libby—TMP Stakeholders and Communications
Calum Bonnington—TMP Fisheries
[Routing engineer}—TMP
Annabel Young—SRES
Marvin Rosenau—SRES
Mark Haddock—at the request of SRES

Key aspects that were discussed included:

1. The routing direction the project will take through the Township of Langley will be somewhere through the Redwood golf course.
2. TMP stated that they want to work with SRES; this has not happened, to date.
3. TMP is of the position that the removal of riparian vegetation does not constitute *Serious Harm* under the Canada *Fisheries Act.*
4. Calum Bonnington's (TMP's) position was that since (100 year old) trees will eventually grow back, their destruction in the riparian area is only temporary and not permanent harm.

Table 3 SRES notes from TMP meeting in Langley with SRES on TMEP fisheries issues, April 16, 2015.

Notes from Meeting with TM April 16, 2015

Christie Libby , Marvin Rosenau, Annabel Young, Mark Haddock, Callum Bonnington, Jonathon Lingman.

TM made the commitment that they do want to meet with SRES again and work with ideas that we bring forward.

It is unlikely that we could get the timeline changed and TM is not prepared to ask the NEB to do this.

TM is satisfied they are within compliance across the board from rare plants to animals to fish.

TM self assessment to harm is complete, but with the exception of the detailed self assessment.

Marvin said the sheets were empty of relevant info in respect to crossings. For example the index of harm for Nathan Creek.

Callum and John :- the routing of the pipeline will follow the original line until 120 metres before 217A then turn north. Then run through Redwoods Golf course but could be anywhere in the coloured section on the map.

Callum said he had no response to the impacts from the 1950s pipeline.

Discussion on the New Fish Act. What is serious harm?

Callum: killing fish, impacts that have a negative effect on a population of fish.

Said he had spoken to many DFO people about this, namely;

DFO in Nanaimo; Darren Chow

Rene Talbot and Al Magnum

Discussion on permanent alteration. What is that?

Callum: says permanent alteration is loss of habitat, a year-seasonal alteration.

Callum; TM has a Conceptual Offset Plan, but do not know what it will be until DFO and NEB review their potential for serious harm and then they will have their Conceptual Offset Plan.

Said TM wants our feedback and not clear how we input ideas(?)

Discussion on 'temporary' loss of riparian land.

Callum: a 100 year old tree and the loss of it is temporary. Cost of the loss of the 100 year old tree?

Callum: it will grow back.

As far as wetlands; done through self assessment. And using background from DFO and NEB

Mark asked did Callum think there was serious harm anywhere on the whole pipeline?

Callum: No does not believe there is any permanent loss anywhere along the whole length of the pipeline.

The next meeting will be in May and is when the Environmental Assessment group meet.

6 **Comment on the issue of the errors and omissions that may be present in the TMEP consultants' reports and the Self Assessments of *Serious Harm* under the Canada *Fisheries Act.***

Key issues not addressed (and were generic, across the board throughout the British Columbia-length of the project), for the CRA fish habitat *Serious Harm* self-assessments at TMEP stream crossings include:

1. No quantification of extant pre-project habitat capacity.
2. No estimation of loss of habitat capacity due to the stream crossings.
3. No estimation of loss of habitat capacity due to bank hardening.
4. No characterization of the riparian habitats or estimation of loss of capacity for this habitat.
5. No estimation of instream spawning habitat and the likely potential for damage.
6. No estimation of instream rearing habitat and the likely potential for damage.
7. No vegetation plots for the riparian habitats.
8. No Fish Habitat Assessment Procedure (FHAP, or similar inventory) estimates of habitat character.
9. No RISC assessments.
10. No fluvial geomorphology assessments.
11. No assessments or modeling of disruption of fluvial processes (e.g., meandering processes; wood-debris recruitment; erosion/deposition; channel stability; side-channel creation, etc.).
12. No site hydrology or hydraulics.
13. Fish sampling was largely an office procedure (as confirmed by Calum Bonnington in the April 16, 2015 meeting with SRES)
14. There was no seasonally stratified sampling the above parameters, including fish use.
15. There are no clear analyses showing how the potential for *Serious Harm* was determined.

7 SRES appeared to note deficiencies in the "professional qualifications" of the consultants undertaking the fish habitat self-assessments of *Serious Harm* to Fish and Fish Habitat filed on Feb.27, 2015 and other ancillary fish work. Please explain.

As per the Christie Libby email below (Figure 41) for British Columbia there are three primary individuals that are involved in the TMEP CRA fish habitat self-assessment of *Serious Harm* including Calum Bonnington (lead fisheries biologist for the project), as well as Shawn Johnston and Ian Emerson (Triton Environmental) (Figure 41). The Resumes of these individuals were provided by TMP (Christie Libby) and are attached in Appendix A of this SRES response to PIPEUP.

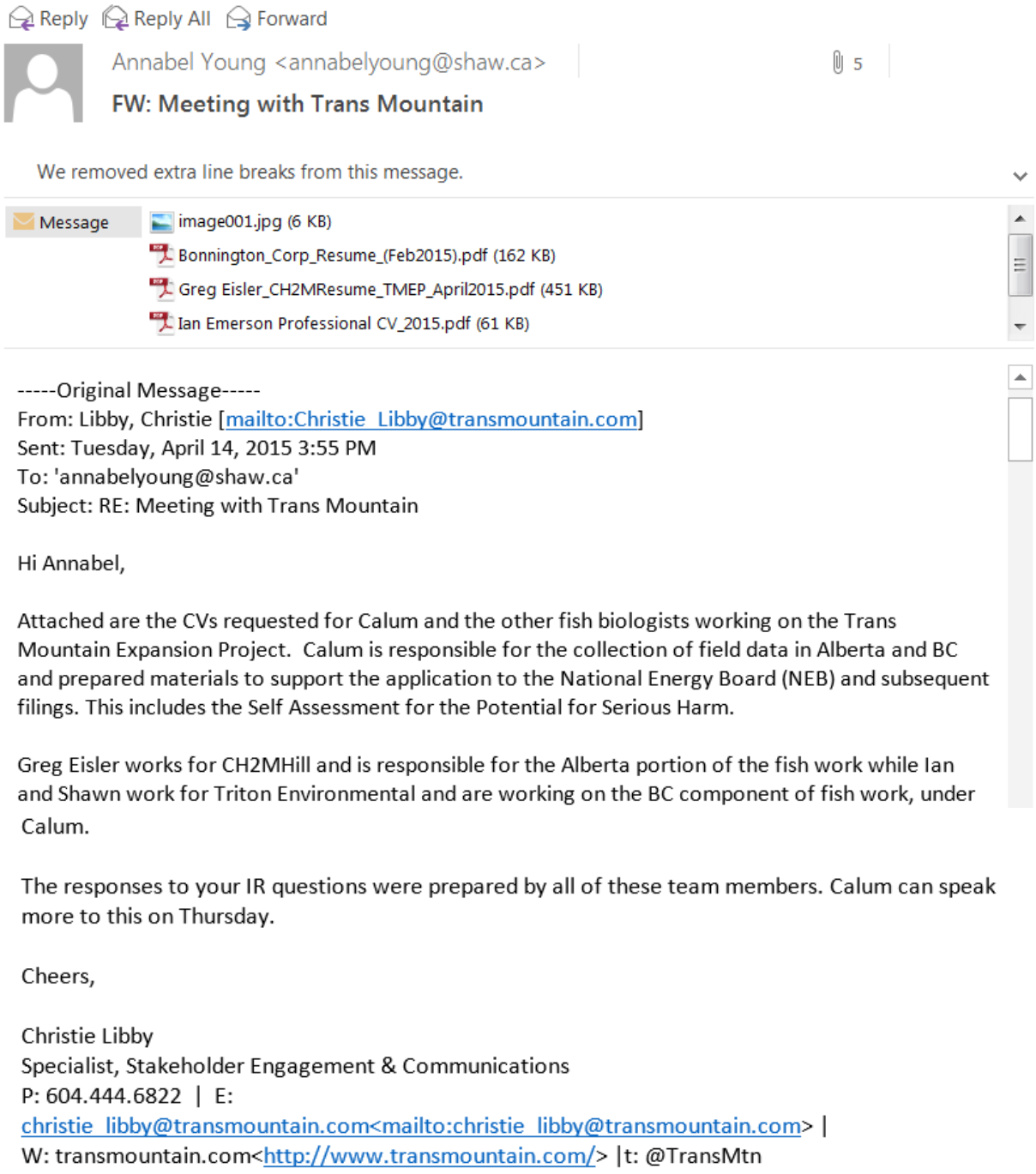
These individuals, along with other technical staff, are named as the individuals responsible for conducting the *Serious Harm* self-assessments for British Columbia (e.g., Figure 35). While some of these individuals appear to have worked for some time in the oil and gas pipeline consulting industry (see Appendix A), there is no evidence from the Resumes provided that there is has been any significant training in respect to habitat inventory and assessment, particularly in regards to project impacts. Further, none of the resumes in Appendix A show any training in the field of habitat restoration. This is particularly important in respect to the wording under the newly revised habitat provisions of the Canada *Fisheries Act*.

SRES points out that while the issue may seem subtle, doing pipeline aquatic consulting and being properly and professionally trained and doing pipeline aquatic-habitat consulting are vastly different. SRES suggests that the significant errors and omissions for the TMEP, articulated above in point #6, may be derived from a lack of proper professional training.

If it is correct that the individuals that TMP has hired to do the fisheries assessments and mitigation/compensation for TMEP are not qualified to do such work, for a $5.3 Billion project with such a large potential for profound impacts, these apparent deficiencies need to be addressed.

Due to this lack of clarity in these regards, SRES suggests that the British Columbia College of Applied Biology needs to be brought into this issue and involved in assessing the circumstances surrounding the *Serious Harm* self-assessments for TMEP.

Figure 41 Christie Libby email to SRES providing professional background of fisheries staff involved in *Serious Harm* assessments and



Reply Reply All Forward

Annabel Young <annabelyoung@shaw.ca> 5

FW: Meeting with Trans Mountain

We removed extra line breaks from this message.

Message image001.jpg (6 KB)
Bonnington_Corp_Resume_(Feb2015).pdf (162 KB)
Greg Eisler_CH2MResume_TMEP_April2015.pdf (451 KB)
Ian Emerson Professional CV_2015.pdf (61 KB)

-----Original Message-----
From: Libby, Christie [mailto:Christie_Libby@transmountain.com]
Sent: Tuesday, April 14, 2015 3:55 PM
To: 'annabelyoung@shaw.ca'
Subject: RE: Meeting with Trans Mountain

Hi Annabel,

Attached are the CVs requested for Calum and the other fish biologists working on the Trans Mountain Expansion Project. Calum is responsible for the collection of field data in Alberta and BC and prepared materials to support the application to the National Energy Board (NEB) and subsequent filings. This includes the Self Assessment for the Potential for Serious Harm.

Greg Eisler works for CH2MHill and is responsible for the Alberta portion of the fish work while Ian and Shawn work for Triton Environmental and are working on the BC component of fish work, under Calum.

The responses to your IR questions were prepared by all of these team members. Calum can speak more to this on Thursday.

Cheers,

Christie Libby
Specialist, Stakeholder Engagement & Communications
P: 604.444.6822 | E:
christie_libby@transmountain.com<mailto:christie_libby@transmountain.com> |
W: transmountain.com<http://www.transmountain.com/> |t: @TransMtn

8 Explain the SRES position on mitigation, compensation and offsets.

SRES is of the opinion that the TMEP will cause large-scale impacts to the CRA stream ecosystems of British Columbia (Figure 29). Furthermore, it has become abundantly clear that TMP and its habitat consultants have not adequately assessed and addressed the impacts that will be caused by stream crossings and, in particular, riparian habitat (Figure 29). Because of this it is imperative that the public and the regulatory agencies negotiate adequate protection for the environment should TMEP be approved.

Since it will be impossible to mitigate all of the impacts to CRA aquatic resources, compensation and offsets will be needed to achieve a fair and equitable redress from TMP. Firstly, because it is not possible to separate the impacts to aquatic ecosystems of the TMEP construction, and subsequent expanded operations, versus the 1953 historic impacts, there needs to be TMP compensation for the effects associated with the development of the both first pipeline and linked to the current project. While TMP has refused to incorporate the 1953 historic impacts, the Canadian public needs to insist that those effects must be addressed in order to achieve social license to proceed with TMEP. Foremost, compensation is required for the footprint ecological impacts associated of both the historic project and the proposed project. This compensation must address both the pipeline ROW, which will be altered in perpetuity, and the construction zone which will not recover for many years. This compensation needs to address both terrestrial and riparian effects.

In particular, and notwithstanding the fact that many of the landscapes that will be affected may be on properties that are privately held, there will be a substantial amount of disturbance over the life of the project within the construction zone for areas where the pipes will be twinned. This has now become abundantly clear for the Anchor Loop; little recovery of the ecosystem has occurred in the seven years since its completion (e.g., Figures 4-10, 14-22). In fact, the construction impacts can be considered permanent because in many locations the recovery period will exceed the project lifetime. There will also be permanent damage to vegetation and other communities in those areas where the pipeline will take a new route.

Of a critical nature will be the impacts to riparian areas, in both the construction zones and ROW.

Short shift has been given by TMP and its aquatic consultants for this critical habitat.

SRES is of the opinion that there are a number of options to provide compensation for non-mitigated impacts. This can take place as both legacy funding and landscape offsets. For the offsets, TMP should provide equivalent-ecosystem landscapes in the form of purchased properties and set-asides as permanently-protected-areas. The area of the offsets should be determined using appropriate multipliers where applicable (http://www.dfo-mpo.gc.ca/pnw-ppe/offsetting-guide-compensation/index-eng.html). The protected-areas offsets should be reasonable and fair for both the proponent, British Columbia and Canada. Furthermore, the offsets should be sufficient in nature that they provide TMP the social license to operate in British Columbia.

There are recent precedents for this concept of offsets to provide social license to impact the environment including the Teck Resources Limited's Elk Valley purchase of a protected-property of high ecological value which is currently being managed by The Nature Trust. BC Hydro also developed retroactive reparation programs such as the Bridge-Coastal, Columbia Basin and Peace River compensation programs to address historical footprint-impacts to aquatic and terrestrial ecosystems. BC Hydro's environmental compensation program involves both land purchases and monies for restoration projects.

Precedents for restoration of historical environmental impacts include other projects such as the Britannia Beach mine remediation initiative in British Columbia and the Superfund (Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)) initiatives in the United States.

Any arguments by TMP or NEB that the 1953 impacts are not "*on the table*" are invalid because it is not possible to accurately and completely separate the impacts to aquatic ecosystems of the TMEP construction and expanded operations versus the 1953 historic impacts. Thus the compensation between the "old" and the "new" needs to be linked. SRES maintains that linking 1953 with TMEP and subsequent operational impacts, for compensation purposes, is non-negotiable. The property purchases should involve setting up a fund with public, agency and First Nations inputs.

The TMEP project should it go ahead, will eventually involve operations activities that affect aquatic resources. Some of these include vegetation-grooming of ROW's in order to maintain safety objectives. Major industries, in British Columbia and throughout North America, are now being required to address operational impacts as a legal or social license to continue or expand on their activities. A primary example in the British Columbia energy sector was the Water Use Planning process that BC Hydro embarked upon in the late 1990s, which followed from the Electric Systems Operating Review (ESOR) and water-licenses audits.

SRES is of the opinion that such a fund should be put in place in order to deal with the historical impacts to aquatic (and other ecosystem) values that have not been/will not be dealt with through environmental offsets, as well as ongoing system operations effects on ecosystems. SRES maintains that linking 1953 with TMEP and subsequent operational impacts, for compensation purposes, is non-negotiable. This "Legacy Fund" should involve setting aside money and involving public, agency and First Nations inputs. It could be administered by a neutral third party such as the Habitat Conservation Trust Foundation or the Pacific Salmon Foundation.

9 Provide the Trans Mountain Expansion Project EPP workshop materials / documents that were sent to by email previous to May 20 and distributed to participants in binders at the May 20, 2015 stakeholder workshop re Surrey Bend Park and the Township of Langley Salmon River proposed routes.

See attached in Appendix B.

10 Advise as to whether any notes were filed with the National Energy Board Trans Mountain Expansion Project document repository by Trans Mountain ULC to your knowledge.

SRES is not aware of any meeting notes, filed by TMP with the National Energy Board, for any of the meetings that the Society met with Trans Mountain Pipeline. This includes the April 16, 2015 consultation with SRES as well as the May 19/20, 2015 public information meetings in Coquitlam and Langley.