Petro-Canada Sullivan Field Development Project
EIA Review

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General Comments-

The proposal by Petro-Canada to create an industrial footprint that will persist for 50 years and arguably for much longer requires a high level of scrutiny to address potential impacts and question the suitability of the project. Petro-Canada wishes to undertake the initiative for corporate economic interests- the question that needs to be addressed is whether the project, as planned, is in the public interest. Public interest in this case has to include short and long term effects on fish and wildlife resources, water and visual/aesthetic resources. My analysis is primarily on fisheries and wildlife resources which include westslope cutthroat trout, bull trout and grizzly bears, all species of public concern in Alberta because of shrinking, fragmented and unsuitable habitat created by a combination of landuses, including the growing industrial footprint.

To help with the determination of impacts and the suitability of the project, in the public interest, it is useful to consider these questions:

1. **What are the qualifications and experience of the individuals who collected, analyzed and derived conclusions found in the impact assessment? I was unable to address this question although discrepancies in study design point to a lack of competence and experience in several areas.**
2. **Was the study design appropriate, in terms of framing key questions, determining adequate sample sizes robust enough to be defensible, selecting suitable techniques and spending enough time on data collection? My comments follow in the text.**
3. **Was the data interpreted objectively and are the conclusions consistent with the data and other relevant sources? My comments follow in the text.**

Fisheries and Aquatic Resources-

The watersheds affected by Petro-Canada's proposal contain native and naturalized fish species. Two species, bull trout and westslope cutthroat trout are found in many of the streams and exist downstream of the pipeline crossing sites. These two species have had significant reductions in distribution and population size, as a function of overfishing and habitat loss. Bull trout populations have declined to an estimated 31% of their former range in southwestern Alberta and in several streams are considered extirpated (Fitch 1997). Westslope cutthroat trout have had significant decreases in range and population size (Costello 2006), especially in the Bow River basin where the species occupies only five percent of its former range (Mayhood 2000). Both bull trout and westslope cutthroat trout exist in watersheds subject to high levels of natural instability and are vulnerable to additive, human-induced

perturbations. Recovery efforts, to ensure populations are viable, can maintain themselves within the natural range of variability and expand to occupy previous ranges are predicated on the maintenance of existing populations and their habitat. Portions of the Highwood River watershed, Pekisko Creek watershed, Willow Creek watershed and Livingstone River headwaters form key refuges for these species (Western Native Trout Campaign 2001).

Except for the recognition that bull trout and cutthroat trout are provincially designated "sensitive" and "may be at risk" respectively, there is no attempt to determine the status of these populations, regionally or locally or to acknowledge the status of these species as significantly diminished (westslope cutthroat are considered "threatened" as of 2007). At low population levels even small losses can incrementally imperil those populations. The comparatively low level of sampling effort, more synoptic than comprehensive, provides little indication of the status in each of the watersheds. A useful impact assessment would help answer the questions: "what were fish population sizes and the distribution of those populations?"; what are the current population levels and the distribution?"; and what is the likely trajectory given the effects of the project?".

The narrow scope of fisheries investigations (temporally and spatially) and limited sampling of fish failed to provide information on fish populations upstream and downstream of the project area (and indeed even at the proposed pipeline crossings), on fish movement/migration, spawning, population size, natural fluctuations in population dynamics, age class structure or on current angling use. This is insufficient to gauge effects, to realistically plan effective mitigation and to establish a biological benchmark, key to monitoring and evaluation.

The narrow scope of fish habitat evaluations, in terms of a minimal amount of channel assessed as well as a largely ocular evaluation of instream and bank features fails to acknowledge that fish habitat occurs at various scales. Effects of the project will occur at a site level and at a watershed scale. The former is inadequately mapped, the later ignored. Hydrologic changes, sediment additions and riparian disturbances will be manifested at the site, as well as upstream and downstream of the site. By way of example, Pekisko Creek contains bull trout downstream of the channel reach assessed, within or downstream of the "local study area" (LSA) as well as supporting a provincially significant spawning run of Bow River rainbow trout (Rhodes 2005). The Livingstone River, downstream of the pipeline project end, supports populations of bull trout and westslope cutthroat trout. Willow Creek has had bull trout reintroduced, again downstream of the LSA. No commentary is provided on the value of largely unroaded watersheds as refuges for fish survival, especially species deemed to be sensitive, at risk or threatened.

Small streams, as represented by the headwater tributaries of the Highwood and Livingstone rivers and Willow and Pekisko creeks are more important to fish and aquatic resources than are given credit for in Petro-Canada's impact assessment. Small streams are the destination for some species to spawn and to rear in, even if

they are intermittent in flow at times of the year or in some years (Boag and Hvenegaard 1997). The lack of rigorous sampling (or of any sampling), especially in spawning periods means that the assessment of many of these streams, intermittent or not, is deficient.

Even when the streams are inaccessible because of barriers or lack of flow, they still carry water, sediment, nutrients and woody debris from the upper portions of the watershed to the lower portions. Those that lack a well defined channel also perform these essential ecological services. A high proportion of trout production at a watershed level is accounted for by small streams. They influence the quality of habitat in downstream reaches in positive ways or can be negative influences when land use activities alter channels, riparian vegetation or add anthropogenic levels of bare ground (Chamberlin, et al 1991).

Without any supporting evidence most of the cutthroat populations found in several streams in all of the watersheds were deemed to be hybridized with rainbow trout and the sensitivity of those populations downgraded as a consequence. Since no DNA material was collected from a representative sample of the fish and analyzed, such conjecture on the basis of physical features is untenable. Pure strain cutthroat trout can exist in watersheds with hybridized populations (Janowicz 2005). Therefore any cutthroat trout collected must be assumed to be of the westslope strain until otherwise determined. The new status of westslope cutthroat trout as "threatened" means much more attention needs to be addressed at protecting and sustaining existing populations. There is a failure to understand that native fish species populations are typically highly subdivided into small, locally adapted, ecologically differentiated and often genetically distinct subpopulations. Low level sampling and the study design of Petro-Canada's impact assessment would fail to determine these relatively well known phenomena in native salmonid populations.

The impact assessment notes the LSA has a high degree of soil erosion potential from water. This can translate into high sediment loads to the receiving streams yet the baseline information on water quality is seriously deficient. There is no comprehensive water quality data from the pipeline crossing locations, upstream or downstream of each site that provides a baseline useful for monitoring. The data is insufficient to gauge the range of natural variability in water chemistry, especially current sediment loadings. Without this type of data no mitigation measure can be assessed as to its efficacy. No aquatic invertebrate sampling was undertaken at any crossing site. Aquatic invertebrates are sensitive to water quality changes, especially sediment loadings and could be an effective monitoring surrogate.

The potential for surface erosion is directly related to the amount of bare ground exposed to rainfall and runoff. All of the proposed activities in support of Petro-Canada's project can contribute fine sediments to stream channels both during construction and afterward. The disruption of soil and soil profiles by trenching and by road construction can alter the pathways water takes to stream channels. This can increase or decrease the volume of peak streamflows (Chamberlin et al 1991).

This can also result in mass wasting of slopes, through the interception of shallow ground water by pipeline trenches, with serious implications for aquatic life.

Sediment loadings to the streams affected by the Petro-Canada proposal can influence aquatic invertebrates (fish food) and fish in a variety of ways. Intrusions of fine sediment can persist, especially in lower gradients areas and be quite resistant to flushing by higher flows (Swanston 1991). Persistent sediment sources from roads, trails, pipeline right of ways and eroding banks allow fine sediment to intrude deeper into larger substrate materials inhibiting spawning, egg incubation, rearing and aquatic insect production (Waters 1995). Sediment from construction, and cumulatively afterward, is a major issue for aquatic life, yet is not treated seriously.

Chamberlin, et al (1991) suggests reviewing five main categories of cumulative effects related to industrial changes to a watershed:
-changes in timing or magnitude of small or large runoff events;
-changes in the stability of streambanks;
-changes in the supply of sediment to channels;
-changes in sediment storage and structure in channels, especially those involving large woody debris; and
-changes in the energy relationships involving water temperature, snowmelt and freezing.

Nowhere in the Petro-Canada impact assessment is there enough baseline information to accomplish such a cumulative effects analysis despite the fact these parameters will determine, in large part, the ability of fish populations to persist, especially threatened populations of westslope cutthroat trout. Hydrological information to determine streamflows is not available from the individual streams crossed; at best it is roughly extrapolated from distant gauging stations. No analysis is done to predict the effects of climate change on stream flows and any need to modify design criteria for pipeline construction or maintenance actions. Some site specific information was collected from the crossing sites but no more extensive information exists on streambanks/channels such as a Rosgen stream channel classification (Rosgen 1996) or a riparian health inventory (Alberta Riparian Habitat Management Society 2008) as an aid to construction difficulty or reclamation issues. Sediment supply has not been estimated despite the acknowledgement of high soil erosion potential. The effects of sediment release during construction and chronically, after construction, from an eroding right of way, on fish are underrepresented. No comprehensive data has been collected on stream temperatures. It would be virtually impossible to monitor the effects of the project with this fragmentary, scattered and unsystematic baseline condition measurement.

There is reluctance to address these issues and instead a blind reliance is placed on "mitigation" to compensate or ameliorate the effects of the project. The efficacy of many of the mitigative strategies is impossible to gauge since they are to be

determined at some future point in the project beyond the scope and view of the hearing process and of public scrutiny. As an example, the use of directional drilling to avoid an open cut trench crossing of a stream course seems to be a reasonable response to concerns of sediment addition, loss of structural attributes of fish habitat and disruption of riparian vegetation. However, every crossing apparently will have to have a geotechnical evaluation prior to use of the technique. While reasonable to do so there is no evidence provided as to how many pipeline crossings, in similar terrain, have been accommodated with the technique, how many sites are unsuitable, how many had issues of "frac-out" and whether the technique has been evaluated as to its effectiveness at protecting instream and riparian habitat and fish populations. Apparently each time the technique fails and a pressure loss occurs (a "frac-out") a report is provided to Alberta Environment. Is a provincial rollup of this information available and is the information stratified by terrain type to understand its utility in the LSA? If the technique in unsuitable for some, or many of the stream crossings, the default is an open cut with issues of timing constraints for construction and habitat remediation. Again the reliance is on one technique with no margin for error.

Any open cut, on a perennial or intermittent stream will require some level of streambank stabilization and possible habitat amelioration. An evaluation of the efficacy of these mitigative techniques is required to determine the chance of success. Generally there are no evaluations completed of these "fixes" but they continue to be used, because they were used before. Pattenden, et al (1998) evaluated the short and long term persistence and effectiveness of several hundred stream habitat structures in southwestern Alberta, many of which were the type of structure employed in pipeline mitigation. In the short term, under normal flood flows, 37% failed; under greater flood flows 81% failed. One conclusion from the multi-year study was that structural approaches to fish habitat mitigation are short term, ineffective over the longer term and fail to restore habitat structure and function.

The federal Department of Fisheries and Oceans has a national mitigation policy to ensure there is "no net loss" of fish habitat. It requires proponents of development to compensate for losses to ensure fish habitat doesn't diminish as a result of the activity. Departmental biologists have determined that only 10 percent of development projects reviewed met the goal of "no net loss"; in 86 percent the results are unknown (Harper and Quigley 2005). The inescapable conclusion from this analysis is that it is difficult to determine mitigation effectiveness when there is a dearth of evaluations to gauge whether mitigation techniques are useful. The Petro-Canada impact assessment fails to provide the background to convincingly establish the mitigation strategies suggested have worked elsewhere, under similar situations of topography and stream type to protect and maintain fish populations and restore habitat structure and function over time.

My conclusions on the fisheries and aquatic resources portion of the impact assessment are:

1. **The assessment fails to establish the diminished nature of two fish species of concern (bull trout and westslope cutthroat trout) provincially, regionally and locally. The impact of incremental or catastrophic losses of these populations as a result of the project is not addressed at any scale.**
2. **There is an attempt to downplay the sensitivity of westslope cutthroat populations by assuming many are hybridized.**
3. **No attempts were made to put fish populations sampled on the project route into a watershed context.**
4. **No biological baselines suitable for monitoring have been conducted and the information that was collected was not designed with statistical analysis in mind for detecting change.**
5. **No serious attempt has been made to grapple with the very real issues of loss of productive fish habitat and effect on other aquatic resources at a site and a watershed level. Most mitigation strategies are largely to be designed in the future, based on some other unspecified level of information collection and collaboration with regulators. Any mitigation strategy that is suggested in the impact assessment is unproven, with no supporting evidence of efficacy in the short or long term.**
6. **As it can be interpreted from the impact assessment the project will have a High magnitude of effects, at both local and regional levels; the duration is Far Future, stretching past the abandonment stage; the likelihood of the effects occurring is High; and the environmental consequence is High.**

Wildlife Resources-

The area that Petro-Canada proposes to cross with a pipeline, especially the headwaters portion of Pekisko and Willow creeks is a unique foothills/montane landscape largely because it is one of only a few relatively large, contiguous, unfragmented and unroaded areas left along the Eastern Slopes. Between the US border and the Bow River, this landscape and the Bob Creek/Whaleback area stand apart because of their unfragmented and large scale nature. It isn't surprising to see the high level of biodiversity expressed in this landscape (225 species), given those features. The text of the impact assessment indicates there are 45 wildlife species of management concern, the table referenced (Table 13-3) lists 50 species and from my own analysis 8 additional species have been missed (Alberta Sustainable Resource Development 2005; Semenchuk 1992).

This "complex faunal association" of 225 species, 58 of which are of management concern are represented, for the purposes of this impact assessment, by 7 species. Habitat models for 3 bird species represent 155 bird species, 4 mammals represent 58 mammal species and no representative species model covers amphibians and reptiles. There is little support or explanation for the use of 7 species models to effectively determine effects on the broader wildlife assemblage. The use of "valued

ecosystem components" tends to be species based, and not particularly broad, given the biodiversity metrics for the area. For the headwaters areas of Pekisko and Willow creeks a more useful "valued ecosystem component" for analysis of impact would be space- unfragmented space at a sufficient scale that biodiversity metrics (species) are high.

The general use of habitat suitability models as predictors of effects is somewhat flawed when the models are not verified for the geographic area. Additionally, as is stated in the impact assessment, "models are not designed to provide accurate predictions of suitability or use at a stand level". Despite the caveats issued no verification is provided for this geographic area and models are used to predict effects at a stand level. This seems more a matter of economy than one of biology. For grizzly bears the resource selection function model is the newer tool, yet the older habitat suitability index is used, without explanation.

There is a high level of effort, complete with mapping, modeling and rationalizing to mask the effect of constructing a pipeline right of way through what is now essentially an unroaded area. This is predicated on the definitions of "open access", part of the Alberta Grizzly Bear Recovery Plan (Alberta Sustainable Resource Development 2008) and an assignment of higher mortality for grizzlies on routes with motorized access. The general conclusion from the impact assessment is motorized access will not increase, the classification of linear disturbance as "open access" is unchanged from the base case (and below the guidelines for the Recovery Plan) and the due diligence for reduced risk to grizzlies is met.

The issue is not the "access designation" of the pipeline administratively, but rather does the pipeline have the potential to increase human access into the area (Nielsen, et al 2004). I believe the answer is unequivocally, yes. No trails are currently designated or shown on Kananaskis Country maps, access routes are not immediately evident to the uninitiated recreational user and existing foot and equestrian routes are unsigned, unmaintained and generally difficult. The level of use now is low, as judged by local residents. A pipeline would create new access opportunities and the level of use would increase substantially. Road density is a surrogate measurement for human-caused grizzly mortality. It is the increased ability for humans to access an area, irrespective of access mode, that should define risks to a species like grizzly bears. Given that mortality risk is the key, not access designation, some attempt should have been made to assess what the effect of even a few grizzly mortalities would mean to population viability.

The mitigative strategies for the creation of new motorized access opportunity seems to be to rely on motorized vehicle restrictions in Kananaskis Country, to provide locked gates and create a "roll-back" on the right of way. No evidence is provided in the impact assessment that motorized access restrictions in K Country, or elsewhere, works to provide an effective mechanism to block unauthorized use. As to "locked gates", these may be a deterrent to a few, but experience shows it is extremely difficult to physically block access. Roll-back may be a partial mitigative

strategy to deal with slope stability issues and erosion, but experience shows the technique does not thwart motorized access. The pipeline will be an attractant to unauthorized motorized access, adding to the risk factor for grizzlies and other wildlife species.

My conclusions on the wildlife resources portion of the impact assessment are:

1. **The roadless, unfragmented nature of most of the project area (Pekisko and Willow creeks headwaters) creates a wildlife refuge for many sensitive species, especially grizzly bears.**
2. **Wildlife inventories as part of the impact assessment are limited in scope, timing, lack statistical design and the overall wildlife impact assessment relies heavily on modeled approaches, with little verification.**
3. **Cumulative effects analysis is weak, and inadequately references existing and potential landuses that could add to the footprint and impact of the project.**
4. **Most impacts of the project are trivialized as being "too localized" to result in changes in wildlife diversity, distribution or population viability. The reliability of such assertions based largely on the modeled results of 7 species is suspect.**
5. **No serious attempt has been made to grapple with the very real issues of habitat loss, increased rates of predation, wildlife displacement and increased mortality. The mitigative strategies are untested and unproven.**
6. **The project should be interpreted as having a High magnitude of effects, at both local and regional levels; the duration is Far Future, stretching past the abandonment stage; the likelihood of the effects occurring is High; and the environmental consequence is High.**

General Conclusions-

No substantive discussion is found in the Petro-Canada impact assessment that details the line of reasoning for selection of the Highwood to Livingstone route, through the headwaters of Pekisko and Willow creeks, over other possible routes. That inclusion would have been helpful to weigh the possible implications of one route over another and arrive at a project submission that truly evidences the "precautionary principle" as well as the concept of "avoidance" as the first and best option for mitigation of impacts. An initial review of this route would have likely shown substantially negative implications especially for fisheries and wildlife resources and lead to other route selections which might have been more appropriate. Then Petro-Canada could legitimately state their use and adherence to the precautionary principle and avoidance of impacts. The route selected by Petro-Canada has a number of serious implications to fish and wildlife resources, which no amount of planning, design and mitigation will cure. Losses of habitat integrity with fragmentation, increased human access, sediment addition and cumulative effects will persist over the length of the project, to the detriment of fish and wildlife resources. That condition, as a consequence of Petro-Canada's proposal, would not be in the public interest.

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