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COTTONWOOD RIVER PIPELINE REPLACEMENT PROJECT

SPECTRA ENERGY TRANSMISSION 4BL1 KM 40 PROPONENT ACTION PLAN

Prepared for:

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Prepared for:

Westcoast Energy Inc.
doing business as
Spectra Energy Transmission
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1.0 Introduction

Westcoast Energy Inc., doing business as Spectra Energy Transmission (Spectra) is proposing to replace a section of their 30-inch natural gas pipeline under and adjacent to the Cottonwood River, north of Quesnel, B.C. Lateral migration of the river channel and redistribution of bedload materials has exposed sections of the pipeline. The exposed pipeline is at risk of having its integrity compromised by continued scour, downcutting and channel migration.

1.1 Location and Access

The Spectra right-of-way (ROW) crossing of the Cottonwood River is located approximately 9 river-kilometres upstream from the confluence with the Fraser River, and 24 river-kilometres downstream from the Highway 97 bridge on the Cottonwood River. The nearest major community is Quesnel, located approximately 20 km south, although there are several nearby hamlets including Cinema, Dunkley, and Moose Heights. A project location map is included in Figure 1.

To access the site by road from Quesnel, turn west onto the Quesnel-Hixon Road from Highway 97 approximately 800 m south of the junction with Highway 26. Proceed north on the Quesnel-Hixon Road for approximately 16.5 km to Morris Road. Turn left (west) onto Morris Road, and follow to near its terminus at a farm. The south bank of the Cottonwood River at the project site is to the east, across private property. To access the north bank, continue on the Quesnel-Hixon Road past Morris Road for an additional 7.8 km (across the Cottonwood River and Ahbau Creek bridges) to Tertiary Road. Turn left (west) onto Tertiary Road and proceed for 2.1 km to the Spectra ROW. The site is located approximately 500 m to the south, across private property.

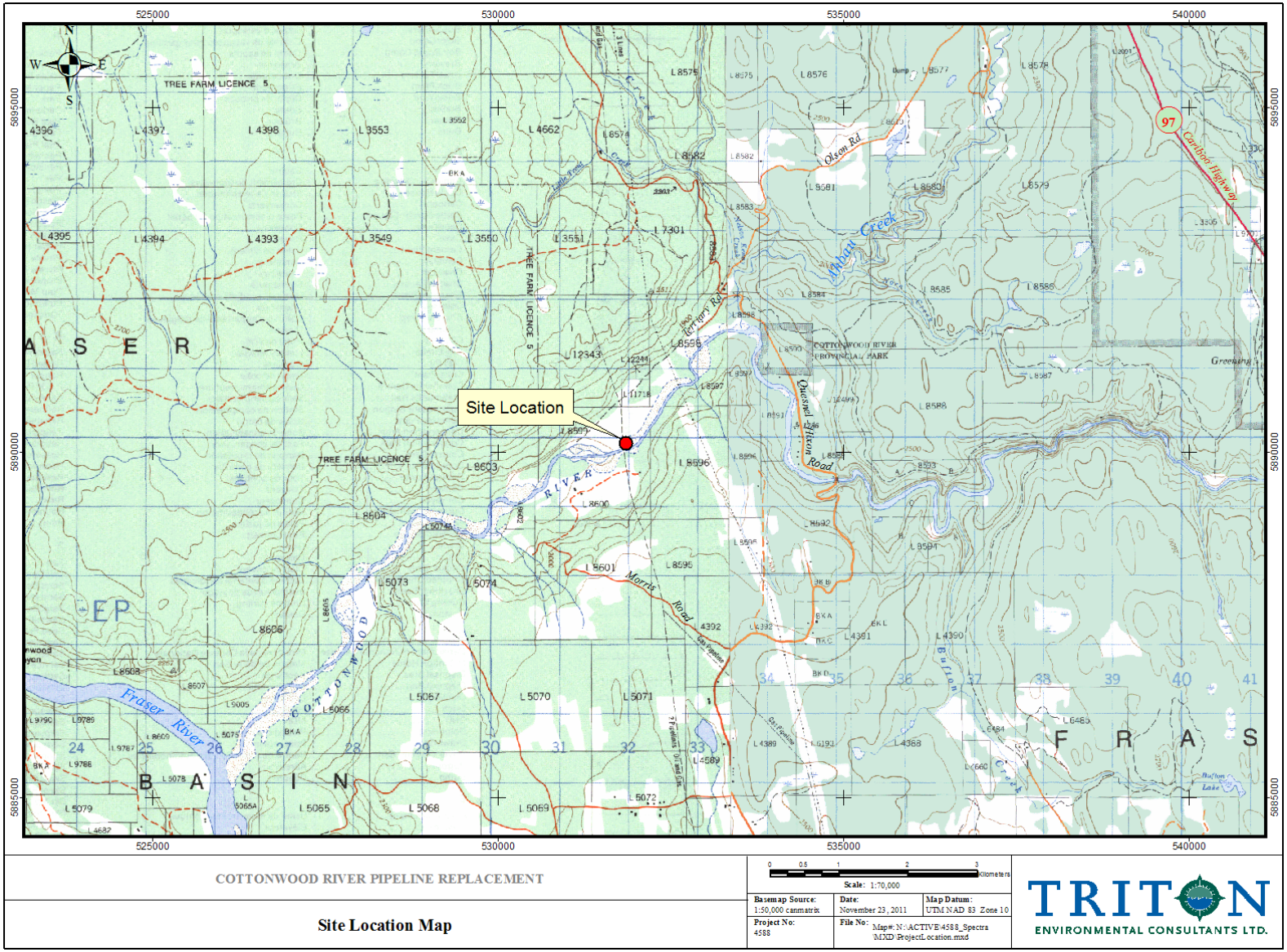

Figure 1. Project location map.

1.2 Site History

The pipeline ROW was installed at this location in approximately 1957, to accommodate a 30-inch natural gas pipeline. A 12-inch oil pipeline (now operated by Pembina Pipeline Corp.) was added to the same ROW in the early 1960's. Training dykes were constructed on both sides of the river in 1971, and the 36-inch natural gas pipeline loop installation was completed in 1972. The 12-inch oil pipeline was lowered across the active Cottonwood River channel at that time. In 1975, additional training works and maintenance to the original dykes was completed. Repairs to the riprap dyking were undertaken again several times in the 1980's. In 2006, routine maintenance checks by Spectra revealed that riprap armouring along the south bank had been lost. Since that time, the river has continued to erode the right bank, and has reduced the depth-of-cover (DoC) over a 30 m section of pipe to 150 mm or less. In March of 2011, Spectra installed 15 Armourflex mats over the pipe to protect it from damage during the 2011 spring freshet, until a more permanent solution could be engineered and implemented. The installation of these mats is documented in a post-construction report (Triton 2011).

Higher than average flows in the Cottonwood River in the Spring of 2011, which caused extensive property damage at other locations, resulted in the failure of the Armourflex matting, additional northward migration of the river, and downcutting over the 30-inch pipeline. As of the last assessment on Nov. 2nd, sections of the pipe under the thalweg of the river near the right bank are now completely exposed.

2.0 Project Description

2.1 Need for the Project

The 30-inch natural gas pipeline does not have sufficient DoC to meet CSA standards, and continued exposure could compromise the integrity of the pipeline by increasing the risk of damage from bedload and debris movement in the river, accelerating corrosion, or structurally compromising the pipe if loss of cover were to occur over a large section of the pipe. Any hazard of pipe failure not only represents an extreme safety hazard in the vicinity, but would also result in negative environmental effects.

The Spectra 30-inch natural gas pipeline at the Cottonwood River (as well as the 36-inch natural gas pipeline and 12-inch oil pipeline) represent critical provincial infrastructure and supply southern BC and the northwest United States (via interconnected 3rd party pipeline operators). Service disruptions on this pipeline would have significant economic consequences in several industries that rely on natural gas for various operations, and would affect the delivery of natural gas to the general public.

2.2 Summary of Proposed Project

To restore DoC over the pipeline and reduce the potential for continued lateral migration and bedload redistribution in the Cottonwood River from further exposing the pipe, a replacement section of 30-inch pipeline will be installed under the entire width of the Cottonwood River crossing, the north bank floodplain area, and past the existing berm on the south bank. The proposed section of pipe to be replaced is 380 m long. Installation of a new pipe will allow the existing pipe to remain in service during the construction period, and will allow the new section of pipe to be installed at a greater depth than the existing pipe, which will help it avoid becoming exposed again in the future.

To reduce impacts to fish and fish habitat at the crossing site and downstream, Spectra proposes to divert the flow within the river to the south bank (but within the existing river channel), allowing a plastic casing to be installed in the north portion of the channel while isolated from the main flow of the river. The river will then be returned to its north channel, and a trench will be constructed in the south portion of the river to facilitate the installation of the pipe. The pipe will be pulled through the plastic casing, under the active north channel without any additional disruption of flows.

The proposed technique will maintain upstream/downstream connectivity for fish at all times, and reduce the potential for significant sediment mobilization to downstream habitats. Diversion of flows and operation of heavy machinery within the Cottonwood River channel will result in a localized disruption of fish habitat. Additionally, riparian vegetation will be cleared to accommodate the new 30-inch alignment on either side of the crossing. The failed Armourflex mats that were installed in 2011will be removed from the channel during the diversion to prevent excessive disturbance.

2.3 Alternatives Assessment

Several alterative solutions were considered, but rejected for a variety of reasons. Alternative approaches to the project included:

- **Do Nothing.** Although the pipe is functional in its current state, the dynamic nature of the channel bed at this location creates significant risk that the pipe could become further exposed. Exposure of the pipe leaves it at risk of accelerated corrosion, damage from impacts with rafted debris and ice, and stress from pipe movement if the loss of cover became severe. Additionally, the depth-of-cover (DoC) at this location does not currently meet CSA standards.
- **Install ArmourFlex Matting Permanently.** ArmourFlex mats were installed in March of 2011 as a temporary measure to protect the pipe through the freshet of 2011. The installation of the mats was not envisioned to be permanent at the time of installation. Furthermore, high flows in 2011 caused the mat installation to fail, and re-installation of the mats is not being contemplated until the cause of the failure is determined.
- **Lower Existing Pipe by Cutting Slack.** This technique is logistically complicated and involves exposing the entire pipe across the width of the river; therefore, a relatively large introduction of sediment would be expected, over a significant period of time. The environmental impacts of proceeding with this option were considered too great.
- **Install new pipe using Horizontal Directional Drill (HDD).** Analysis of drill logs and cross sections from geotechnical investigations at the site indicated a low probability of success due to the presence of a thick non-cemented granular deposit. Boreholes within the deposit would likely collapse before a new pipe could be pulled through.
- **Install new pipe on an Aerial Crossing.** Geotechnical investigations indicated that pier foundation conditions were favourable, but at least one pier would be required within the active river channel. The footprint of the pier would result in a permanent loss of fish habitat at the site, and may act as a debris trap that could further destabilize the river or create a navigation hazard. Aerial crossings are less preferable from a security and maintenance stance compared to underground options. Although feasible, the proposed in-channel pipe replacement option was considered to be superior, given the lower long-term environmental impact, maintenance cost, safety risk, and ease of construction.

3.0 Description of Aquatic Habitats

The cottonwood river is known to contain a variety of fish species, including: bull trout (*Salvelinus confluentus*), Dolly Varden (*Salvelinus malma*)[1], chinook salmon *(Oncorhynchus tshawytscha),* coho salmon *(Oncorhynchus kisutch),* pink salmon (*Oncorhynchus gorbuscha*), mountain whitefish (*Prosopium williamsoni*), rainbow trout (*Oncorhynchus mykiss*) and suckers (MOE 2011). In addition to these species, burbot (*Lota lota*), slimy sculpin (*Cottus cognatus*), longnose sucker (*Catostomus catostomus*), largescale sucker (*Catostomus macrocheilus*), white sucker (*Catostomus commersoni*), longnose dace (*Rhinichthys cataractae*), northern pikeminnow (*Ptychocheilus oregonensis*), redside shiner (*Richardsonius balteatus*), lake chub (*Couesius plumbeus*), and peamouth (*Mylocheilus caurinus*) are known from the watershed and likely occur within the Cottonwood River mainstem (MOE 2011). Eastern brook trout (*Salvelinus fontinalis*) and goldfish (*Carrasius auratus*) have been introduced within the watershed. Records of finescale dace (*Phoxinus neogaeus*) are more likely to be misidentified lake chub based on the known distribution of that species within the province (McPhail 2007). Given the relatively close proximity to the Fraser River and lack of obstructions to fish passage, all fish species known to occur in the middle Fraser River watershed may occur at the project site, although no critical habitat for any species has been identified.

In 2008, Triton conducted a fish and fish habitat assessment at the proposed project site in order to support environmental permitting for proposed streambank armour repairs (Triton 2009). Sampling was targeted in areas more likely to be affected by that project, but in general the results of that assessment are relevant to the currently proposed project. The average channel width within the main channel at the crossing was 35 m with a stream gradient of 1% (Triton 2009). In November of 2011, the channel width across the exposed pipe section was 70.7 m, likely a reflection of the widening channel, and loss of vegetation from mid-channel bars. Substrates are predominantly composed of gravel and cobble, though sand comprises a relatively large proportion of the substrates just beneath the washed surface. The habitat types vary across the width of the channel at the crossing, including mainly riffle habitat, though some pool habitat exists just upstream and downstream of the crossing. On the south bank, off-channel refuge habitat for smaller fish exists at lower flow levels when the south channel does not have surface flows. Cover is limited in the vicinity of the crossing, although some large woody debris on elevated bars may provide cover at higher flows. Salmonid fry and smaller coarse fish may utilize the interstitial spaces between cobbles and the occasional boulder, especially on the south bank where riprap armour is present. In general, higher-value fish habitat is concentrated in large woody debris accumulations that occur sporadically within the reach, but not specifically at the crossing location. Although some pools are present, the area is characterized primarily by riffles and maximum water depths deeper than 1 m are uncommon during low water conditions in the vicinity. As such, there is potential for overwintering fish to be present but overwintering habitat potential is considered low overall.

Spawning habitat potential for most fish is considered low due to the lack of cover, relatively high velocities, and coarse substrates. It is possible that larger fish, especially Pacific salmon,

[1] Records of Dolly Varden in the middle Fraser River watershed are more likely to represent bull trout based on genetic and morphometric data presented in Haas and McPhail (1991).

could utilize the substrates in the vicinity for spawning. The area was surveyed for salmon carcasses and redds on Nov. 2nd, 2011, but no redds, carcasses, or sign of scavengers were observed. Chinook salmon are known to utilize the Cottonwood River although spawning has not been recorded from the project area specifically. Pink and coho salmon use of the watershed is sporadic, and spawning sites are not well-documented. It is possible that these species may use the habitats in the vicinity of the crossing for spawning, but the lack of historical records and the widespread availability of similar habitat throughout the lower reaches of the Cottonwood River suggest that no important salmon spawning habitat is located at the crossing location.

4.0 Description of Riparian Habitats

Riparian vegetation on both sides of the river at the crossing location is dominated by immature deciduous trees (black cottonwood and paper birch), scattered white spruce, and shrubs. Woody vegetation on the existing ROW on the north bank is sparse, consisting primarily of black cottonwood saplings that are less than 1.5 m tall. Some of these stems were damaged or pruned while accessing the river for the Armourflex mat installation in March of 2011, but those stems appear to have recovered. The sparse area on the north bank where an access road was constructed to install the mats is approximately 30 m wide, and extends from the edge of the active river channel back 10 m to a historic gravel berm.

Adjacent to this area, tree cover is dominated by immature black cottonwood saplings up to 8 m tall, and < 15 cm dbh. The existing stem density varies from approx. 1.5 to 6 stems per m^2. White spruce and Douglas-fir seedlings are sporadic throughout the area. Areas adjacent to relict side channels feature prickly rose, red-osier dogwood, willow, and spirea shrubs. Soopolallie is scattered on level, more rapidly drained gravel flats. The herb layer throughout the area consists primarily of grasses.

On the south bank, the gravel berm is sparsely vegetated with occasional black cottonwood saplings. The sparse herb layer of crust lichens and yellow mountain-avens suggests rapid drainage and xeric soil moisture conditions. As the berm moves south away from the existing river channel on the downstream edge of the ROW, the native streambank features immature black cottonwoods up to 20 cm dbh, and scattered mature paper birch to approx. 30 cm dbh. Scattered Douglas-fir seedlings, red-osier dogwood, prickly rose, and soopolallie comprise the shrub layer. Beyond the gravel berm the ROW is maintained as cattle pasture.

5.0 Impacts to Fish and Fish Habitat

5.1 Riparian Areas

Clearing for the new pipeline alignment will require excavation and the complete removal of existing riparian vegetation on both banks of the Cottonwood River. A 30 m wide statutory ROW will be required to accommodate the new section of pipe. The buried pipeline will require excavation of the streambanks and trenching through the riparian area. In addition to the 30 m wide ROW addition, a 30 m wide temporary additional workspace is proposed. This workspace will be used to accommodate equipment such as excavators and side booms, as well as construction materials and excavation stockpiles. Clearing will be reduced to the minimum possible during construction, if the workspace is required at all. However, the possibility of clearing riparian vegetation within the temporary workspace is retained as a contingency, given that construction plans for this project have not yet been finalized.

The ROW addition will have a footprint area of 1,800 m^2 within 30 m of the Cottonwood River; however the total footprint would be as high as 3,600 m^2 if the full width of the temporary workspace was cleared. It is not anticipated that clearing within the temporary workspace within 30 m of the Cottonwood River will be required, except perhaps danger trees (assessed by a qualified danger tree assessor). If clearing is required, it will be kept to the minimum possible to safely accommodate the works. Vegetation clearing outside of the area necessary to excavate for the pipe installation would consist of pruning only – grubbing and stripping will not be conducted and the root networks of existing vegetation will be left intact.

5.2 Instream Works

Given that the channel at the crossing location is relatively homogenous gravel/cobble/sand substrates and riffle/glide habitat, it is expected that the existing instream conditions can be restored to their pre-construction state following the pipe installation with little or no habitat modification. The actual amount of excavation within the channel will be approximately 450 m^2. During construction, sections of the wetted channel will be diverted temporarily within the existing channel, which will displace any fish present within those areas, and may result in slightly elevated turbidity downstream immediately following the restoration of flows into dewatered areas. Although similar amounts of wetted habitat will be available at all times (i.e., diversion channels are likely to provide a similar wetted habitat area to the natural channels that are being dewatered), the habitat quality of diversion channels would be reduced as dry gravel bars converted to wetted area would contribute very little to invertebrate and other food source production, while the invertebrates within the diversion reach would be lost as they were dewatered.

The wetted habitat area from the upstream diversion dam to the confluence of the north channel and south diversion channel is approximately 300 linear metres. With an anticipated average wetted width of 20 m during the construction window, this represents 6,000 m^2 of potential habitat disruption. However, Spectra is proposing to reduce this impact by using a pump to keep the north channel at least partially wetted behind the downstream backwater dam, which could

keep up to 2,500 m^2 of habitat wetted. A schematic of the proposed diversion structures is included in Appendix 1.

6.0 Proposed Mitigation

6.1 Riparian Vegetation

In order to restore riparian vegetation as quickly as possible, stripping and grubbing will be reduced to the minimum possible width to safely excavate a trench and install the pipeline. Prior to construction, the limits of disturbance should be flagged and appropriate areas for staging should be delineated. Where equipment access is required but no excavation is necessary, deciduous trees and shrubs will be pruned, rather than grubbed, to preserve the root network. By constructing during the winter, potential impacts to the riparian vegetation community are reduced. The frozen ground will prevent heavy machinery from creating large ruts and damaging near-surface root networks. If heavy traffic is expected, geotextile cloth and a shallow layer of fill will be laid over the pruned shrubs temporarily.

Where stripping and grubbing is required, shrubs can be salvaged by excavating the frozen root masses and stockpiling them to be replanted at the end of the project. Root masses will be trimmed of excess aerial biomass and damaged stems to prevent desiccation during the growing season. In general, large root masses are able to generate biomass much more quickly than live stakes or bare-root planted stock, and will assist the native vegetation community to recover more quickly. Pruned tops and excess biomass will be buried or laid on the surface of the soil to aid in erosion control, as well as promote suckering and the establishment of additional stems. Wherever cleared and/or disturbed soils are not revegetated with salvaged shrubs, replanting will occur in the spring of 2012. Disturbed areas larger than 4 m^2 will be planted with willow live stakes and/or nursery-grown rooted stock. Such areas will be planted at a density of 4 shrubs per m^2 to initiate the riparian recovery in these areas. All planted areas will be monitored for at least 3 years post-construction. Riparian regeneration will be considered successful if an average of at least 1 shrub per m^2 or 1 tree per 4 m^2 is present in each distinct planted area, and the shrubs appear healthy with demonstrated yearly growth. Shrubs may be from planted stock, live stakes, brush mats, or natural regeneration. No distinction amongst these sources will be made during follow-up efforts, and no assessment of the survivorship of planted stock will be made; the goal of the riparian restoration effort will be to produce functional riparian vegetation regardless of method or planting density.

Where stripping is required, topsoil will be salvaged and stored separately from the underlying mineral soil to preserve the native seed bank and promote natural recolonization of the site. Disturbed soils will be mulched with hay (preferably sourced from local pastures) or straw and an erosion control grass seed mixture will be applied. Application of the seed mixture should be light in areas where live-stakes or rooted stock needs to be planted, to avoid out-competing the shrub species. Seed mixtures used should be approved by adjacent landowners, whom have pastures next to the site.

It is anticipated that by ensuring all disturbed areas within 15 m of the Cottonwood River are initially replanted with a mix of native shrub and tree species, a net gain of functional riparian vegetation can be achieved by increasing the vegetation density in areas that were previously sparse, including a 15 m wide by 10 m deep area (150 m^2) previously used to access the Cottonwood River which is currently void of shrubby vegetation

6.2 Water Quality

6.2.1 Spill Control

Equipment will be working in and adjacent to the Cottonwood River. All equipment must be in good working order and free from fluid leaks or excessive grease. Each piece of machinery should be equipped with a spill kit containing both hydrocarbon and hydrophilic (antifreeze) sorbents. A large spill kit containing a hydrocarbon-sorbent boom long enough to span the wetted width of the river should be onsite and located downstream of the work are in an accessible location. Re-fuelling of machinery will not occur within 30 m of the Cottonwood River, except for non-mobile equipment. If fuelling of non-mobile equipment is required within 30 m of the river, fuelling will occur using truck-mounted tidy tanks with automatic shut-off nozzles, or portable jerry cans. When using tidy tanks one person will stand-by at the shut off nozzle, while the other fuels the machinery. Spill pads will be used to catch drips. Smaller equipment (e.g. trash pumps, welders) should be placed within plastic-lined containment berms capable of containing at least 150% of the fluid volume of the fuel tanks. Mobile equipment will not be permitted to park within the Cottonwood River channel overnight unless operationally required to do so. All equipment parked within 30 m of the River will be required to have drip trays placed under the oil pan/transmission, and/or other fluid reservoirs.

6.2.2 Sediment Control

The main objective of an erosion and sediment control (ESC) plan is to minimize the introduction of sediment into drainages surrounding the site and to the surrounding vegetation, and to avoid soil loss from disturbed sites. Preventing erosion from the source is the primary goal of erosion control and reduces the need for down slope sediment control measures. Temporary sediment control measures such as perimeter silt fence barriers, spoil berms, sumps, ditches, flow check dams, and sediment traps will be implemented as required to address site specific issues that may be encountered during the course of construction.

Where vegetation must be cleared from riparian areas, hand clearing would be preferred to mechanical methods that may result in excessive ground disturbance. Disturbed soils will be seeded and/or mulched as soon as is practical after construction.

The introduction of flows onto disturbed in-channel areas will likely result in a short-duration increase in sediment. However, due to the coarse nature of the substrates, it is anticipated that flows would quickly return to background levels once flows are re-introduced. If large amounts of fine sediments are encountered during construction, the channel can be washed using a trash pump and fire nozzle prior to re-instating flows. A sump would be constructed at the downstream end of the channel and turbid water pumped to nearby vegetated areas for natural filtration if channel washing is used.

6.3 Instream Impacts

6.3.1 Fish Salvage

All wetted areas will have fish salvages completed before any dewatering occurs, and will be observed during the dewatering phase for stranding fish. It is anticipated that pole seines could be used in ice-free areas to remove larger fish. Minnow traps are not recommended as they may attract additional fish to the work area. Although the effectiveness of electrofishing is reduced in cold water, several electrofishing passes will be conducted through the dewatered area to attempt to remove small fish that would be rearing in the interstitial spaces. All captured fish will be transported downstream of the site, and released. A scientific fish collection permit with a variance to allow electrofishing after Sept. 15th in bull trout waters, and to allow electrofishing to occur in water below 5°C will be applied for before any fish salvage takes place. An assessment of the current conditions would be completed 1 week ahead of the proposed fish salvage schedule to assess river conditions for the feasibility and effectiveness of salvaging. Extensive ice cover may necessitate machine-clearing of sections of ice in order to effectively complete a fish salvage.

Pumps used to withdraw water from the Cottonwood River for any purpose will be screened to prevent entrainment/impingement of fish on the intake as per recommendations in the Freshwater End-of-Pipe Fish Screen Guidelines (DFO 1995).

6.3.2 Timing of Instream Works

The project is proposed to be completed as soon as possible, anticipated to be mid to late winter 2012 (late January through March), ahead of the 2012 freshet. Works are anticipated to be completed prior to March 15th, 2012. There is no reduced-risk work window for the Cottonwood River mainstem (MOE, nd), as both spring and fall spawners are present. The timing of the works coincides with the period of lowest flows, which will likely make water diversions easier and reduce the overall footprint of dewatered areas. No major fish migrations are expected to occur during construction, although it is possible that outmigrating pink salmon could be encountered towards the end of the project if pink salmon have spawned upstream of the site in 2011. Once initiated, work will be pursued to completion as quickly as possible with no work stoppages. It is anticipated that the channel diversion would be installed for approximately 1 week.

6.3.3 Fish Habitat

Given that it is not possible to accurately predict exactly how much wetted habitat area will become dewatered at the time of construction (due to varying water levels, seepage remaining in channels, difficulty in measuring during winter conditions, etc.), Spectra proposes to quantify the disruption to fish habitat using fish-days. The approach has been successfully applied to other project where impacts to fish are difficult to quantify spatially. For example, temporary displacement of fish associated with a temporary berm and coffer dam in the Nechako River during the construction of the John Hart Bridge (Highway 97) was offset by installing large woody debris and boulder clusters in a nearby side channel (Triton 2001). The effectiveness of the compensation habitat was measured using the fish-days approach, rather than compensating

for the areal extent of the instream disturbance. The project received *Fisheries Act* authorizations (#'s HEB-UFR-00-001 and HEB-UFR-99-001) using this approach.

Fish-days are calculated by determining the actual number of fish displaced from the work area through fish salvage. Since fish salvages are not 100% effective at removing all fish from a work area, a multiplier of 1.5 will be added to the fish salvage total to determine the number of fish displaced. This figure is multiplied by the number of days fish are displaced from the habitat to arrive at fish-days. For example, if 10 fish were salvaged from the work area, and the diversion was in place for 5 days, a total of 75 fish-days would result (10 fish ×1.5 multiplier×5 days).

In order to offset the loss of 75 fish-days, a habitat area would be selected for enhancement. Baseline sampling would be conducted to determine the pre-enhancement number of fish using the area. Following the improvements, follow-up sampling would be conducted to determine the average number of additional fish using the improved habitat. Habitat improvements would continue to be monitored until an equivalent number of fish-days have been achieved.

As an example, baseline fish sampling in nearby Ahbau Creek indicates a fish density of 0.1 fish per m^2 within the overwidened, floodplain lower reach. A woody debris complex is constructed that improves 10 m^2 of habitat. Follow-up sampling on several occasions reveals that an average of 15 fish is utilizing the enhanced habitat. Since 5 additional fish are now using the habitat, 75 fish-days would be achieved as long as the structure remained functional for 15 days.

The use of fish-days favours compensation habitat that provides measurable increases in fish usage, rather than habitats that provide the requisite areal extent of improvements and demonstrate "expected fish use and density".

A detailed fish compensation plan will be developed upon the completion of the project, once the duration and approximate areal extent of the dewatered sections of channel are known, and the number of fish-days required are calculated. It is anticipated that a woody debris complex/point bar feature in the lower reach of Ahbau Creek will be selected, pending a feasibility review and site selection process. The lower reach of Ahbau Creek has similar habitat values to the Cottonwood River, in that it has a wide floodplain and an aggrading, dynamic channel. Ahbau Creek discharges into the Cottonwood River 2.5 river-kilometres upstream from the project area. Ahbau Creek is preferred over the Cottonwood River for a habitat enhancement project due to its smaller discharge volume and energy of flows, which present a higher likelihood of having the feature persist for a longer period of time.

As a potential mitigation measure to reduce the amount of dewatered channel that results from the project, Spectra is currently investigating the feasibility of keeping a portion of the north channel above the confluence with the diversion channel wetted. This option would reduce the overall length of the north diversion channel from by 130 m to 170 m. At an average wetted width of 20 m, the reduction would account for 2,600 m^2 of wetted habitat area.

The reduction in diversion channel length will be achieved by erecting a backwater dam downstream of the new pipeline crossing location. A pump or flume would then be used to

convey water from upstream of the new pipeline crossing to below this dam. It is anticipated that sufficient seepage water and leakage from the primary diversion would be present to convey downstream. Alternatively, a flume could be installed on the diversion dam to provide enough water to the downstream portion of the north channel. The feasibility of this option can be more fully assessed once the construction methods and timelines have been completed.

6.4 Contingency Plans

Winter flow volumes in the Cottonwood River typically range from 5 to 10 m^3/sec, indicative of the 50^{th} to 75^{th} percentile of flow (i.e., exceeded 25 to 50% of the time, B. Costerton, BC Rivers Consulting, pers. comm.). Historic maximum flows range from 20 to 40 m^3/sec during the proposed construction window. The diversion channels and dams will be designed to handle up to 40 m^3/sec, to reduce the likelihood that anomalous high-flow events would overwhelm the diversion channel. A flume(s) were considered as an alternative to channel diversion, but the average winter flow volume in the Cottonwood River is near the maximum possible flume flow rate, and therefore even moderate high flow events could cause work stoppages, put workers at risk, and increase the risk of sediment transport downstream.

Spectra will retain the services of a qualified environmental monitor (EM) for the duration of the project. The EM (working in conjunction with the on-site project manager) will have work-stopping authority. It will be the EM's responsibility to direct the fish salvage operations, direct erosion and sediment control measures, document pre-work conditions, and keep an accurate account of all disturbed areas such that a habitat balance table can be completed at the completion of the project that demonstrates that no net loss of fish habitat has resulted. The EM will also be responsible for completing a post-construction report, which contains recommendations for any follow-up actions required.

A river engineer/hydrologist would be retained to direct the installation of temporary diversions, provide surveying where required, and complete post-construction as-built drawings.

7.0 Environmental Permitting and Approval Process

Given that a disruption of fish habitat is expected to occur as a result of this project (the dewatering of a fish bearing channel), it is expected that the DFO will conclude that a Harmful Alteration, Disruption, or Destruction (HADD) of fish habitat will occur, and therefore the DFO will opt to issue a formal *Fisheries Act* authorization. A copy of this document will be submitted along with a Project Review Application Form (PRAF) to the subdistrict office in Prince George for their review. DFO's use of their decision-making authority under the federal *Fisheries Act* would trigger a screening-level review under the *Canadian Environmental Assessment Act* (CEAA). It is expected that the DFO would act as the lead agency on the review process.

The Cottonwood River is a navigable waterway and the proposed project would result in an interruption to the normal navigability of the stream. As such, the project will be referred to the Navigable Waters Protection Division of Transport Canada for review under the *Navigable Waters Protection Act*.

The project constitutes w*orks in and about a stream* under the definition in the provincial *Water Act*, and will require a Section 9(1) *Water Act* approval from the provincial Ministry of Environment.

The additional 30 m statutory ROW and temporary workspace will require *Land Act* approval, and the removal of any merchantable timber will require a license to cut under the *Forest Act.*

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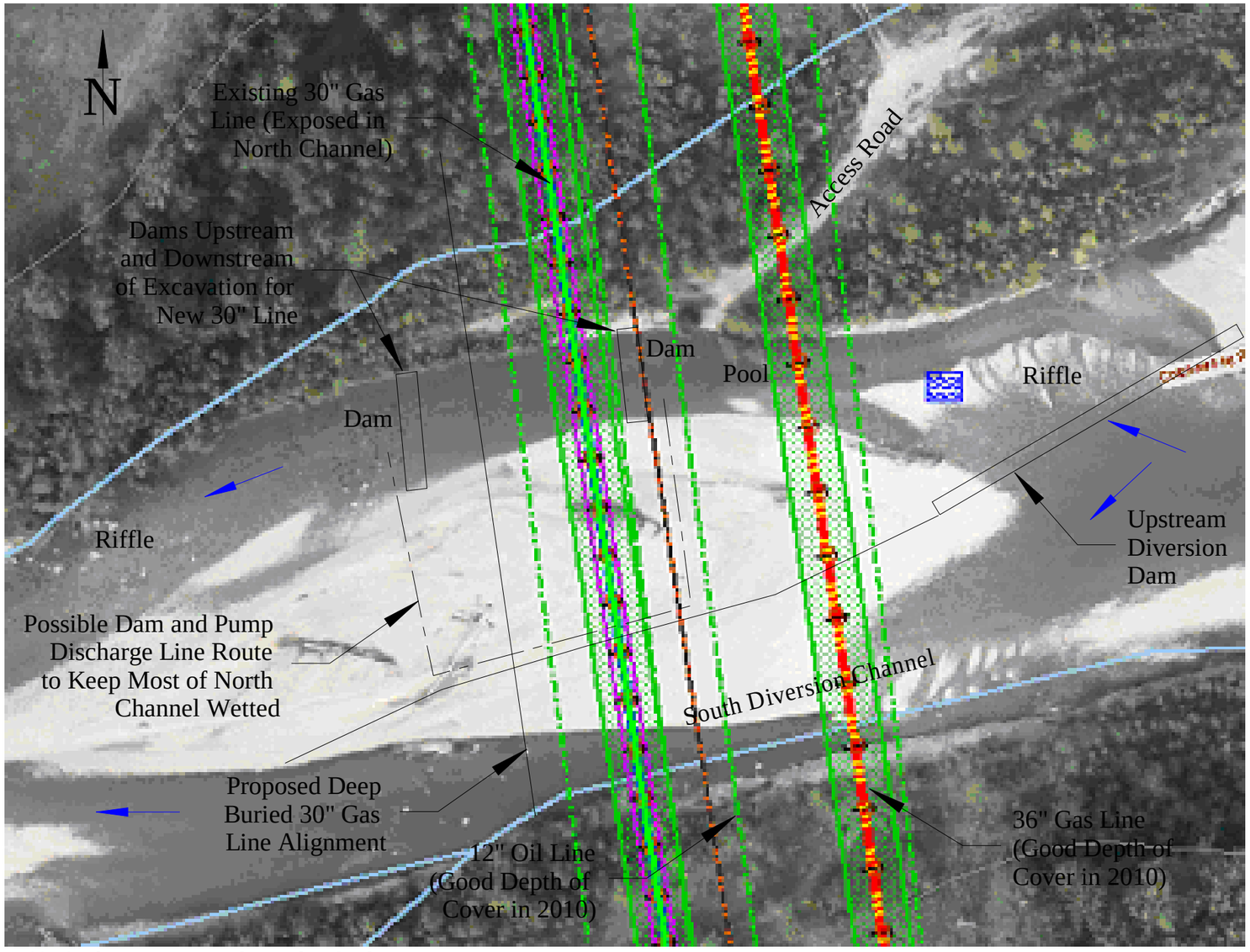
APPENDIX 1

WATER DIVERSION LAYOUT (PROVIDED BY BC RIVERS CONSULTING)

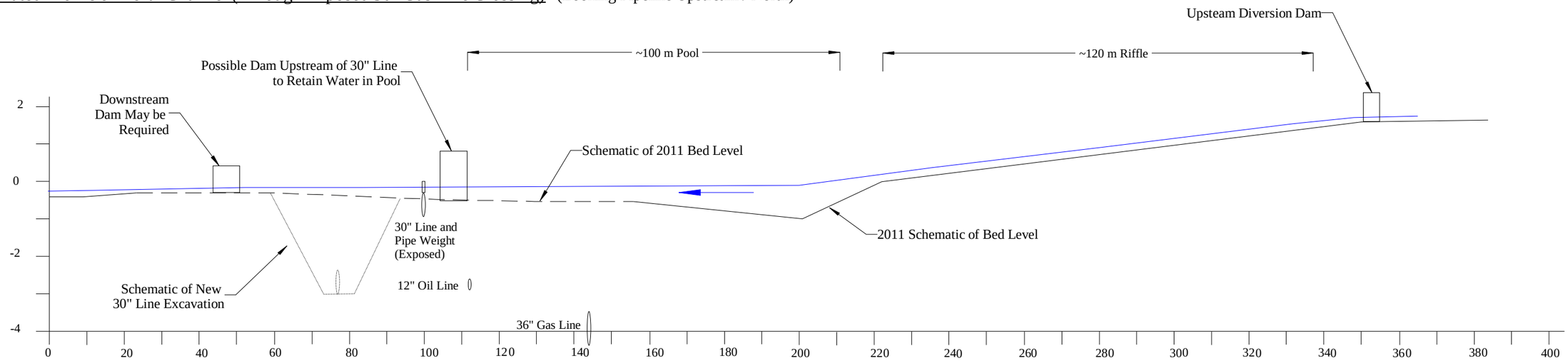
Possible Layout of Water Diversion Around Deep Burial of New 30" Line in North Channel



~2007 Airphoto Base - Typical Low Flow Conditions

Spectra Energy Transmission Cottonwood River	**Figure 1** **Possible Layout of Water Diversion**	BC River Consulting Drawn By: Bob Costerton, P.Eng. Date: 8 November 2011

Estimated Profile of North Channel (Through Exposed 30" Gas Line Crossing) (Looking Pipeline Upstream / North)



Note: Vertical Exaggeration is 10 times on Profile

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Cottonwood River

Figure 2

Schematic River Profile of North Channel Diversion Works

BC Rivers Consulting

Drawn By: Bob Costerton, P.Eng.

Date: 8 November 2011