locations. If these preferred work windows cannot be used for logistical reasons, 2) pre-construction surveys will be used to determine the locations of breeding sites and 3) "no work" buffers will be instituted at breeding sites during the breeding season. Clearing will then occur outside the breeding period, using methods which reduce ground disturbance near raptor and toad breeding sites within a defined management buffer. More background on the adverse effects of direct mortality is presented in Section 7.9.5.2 of the EAC Application and details of the mitigation measures are presented in the Environmental Management Plan (Chapter 11 of the EAC Application). With implementation of suggested mitigation, no residual effects of direct mortality on birds or toads are likely.

The EAC Application identified the potential for residual adverse effects to bears, marten, and fisher due to direct mortality from vehicle-wildlife collisions due to the potential increase in vehicle traffic during construction and because these species are frequently found as road kill in this region. These residual effects are also likely for the Bell-Irving route, each with a low magnitude effect.

6.7.5.3 Phase 1 Potential Effects: Sensory Disturbance

The potential adverse effects of sensory disturbance on wildlife are discussed, in detail in Section 7.9.5.2 of the EAC Application. Many wildlife species, such as moose, bears and birds will move away from the construction area for the periods that clearing and construction will be occurring. Potential adverse effects on these species are considered minimal because the short period of disturbance and for these species there is an abundance of alternate habitat available in the study area.

Other species, which are sedentary or linked with a fixed breeding location, such as mountain goats, active bear dens and raptor nests, may be disturbed by construction activities, which could result in higher magnitude effects for these species. Mitigation measures are therefore focused on these species.

Mountain goats can be disturbed by over-flights by helicopters. Although no highly-suitable goat habitat was identified in the study area, some suitable habitat may occur and goats may occupy Mount Bell-Irving. Therefore, as a precautionary measure, all helicopters used for the Project will follow BC MOE guidelines, remaining at least 1.5 km from any goats observed during the kidding and winter seasons, and at least 1 km from goats observed during the summer and fall periods. If no goats are observed, then this mitigation will not apply.

Preconstruction surveys will identify active bear dens and raptor nests. Appropriate no-work buffers will be maintained around these sites during the hibernation and breeding periods and site clearing will follow protocols to reduce ground and vegetation disturbance when clearing within a buffer distance around raptor nests outside of the breeding season.

With mitigation, residual effects of low magnitude are likely for moose, bears, raptors, waterbirds, and forest birds. Other species, such as marten and fisher, do not appear to be affected by construction noise, and mountain goats have not been confirmed in the area. These results parallel those presented in the EAC Application.

6.7.5.4 Phase 2 Potential Effects: Indirect Habitat Alteration

Indirect habitat alteration can occur through the construction of linear developments, resulting in increased edge effects and fragmentation of habitats. Habitats will also be periodically altered through vegetation maintenance within the ROW.

The Bell-Irving route will traverse an area already heavily fragmented by forestry operations. The route was designed to traverse existing cutblocks as much as possible. Approximately 35% of the route will

travel through mature forest. The remainder of the route is either early seral state vegetation in cut blocks, naturally occurring shrub communities, or other landforms such as wetlands or open water.

Vegetation maintenance within the ROW will be conducted in a manner that will return the vegetation community to an early seral state community which will not interfere with the transmission line. Vegetation maintenance can have beneficial and adverse effects on various species, by producing more available forage for animals like moose and bears. Adverse effects include disturbance to animals and production of open areas where predators may be able to hunt more effectively. Mitigation will include buffer zones around raptor nests and toad breeding areas to minimize disturbance to these species during the breeding period. With mitigation, the effects of increased fragmentation and vegetation management are not likely to result in a residual effect on any wildlife VECs.

During operations, indirect habitat alteration is expected to produce a residual beneficial effect for raptors that often prefer edge habitat with early seral hunting areas adjacent to old forest nesting habitat. Low magnitude negative residual effects are predicted for cavity-nesting waterfowl and for forest birds, since areas of forest cover will be altered through edge effects and these animals could be adversely affected through ongoing vegetation maintenance in the ROW. No residual effects are likely for moose, bears, marten or fisher because these species can benefit from edge habitat. Mountain goats and toads were not assessed because they were not confirmed to occupy the study area, and do not use forested habitats for breeding, respectively. These effect ratings parallel those in the EAC Application.

6.7.5.5 Phase 2 Potential Effects: Indirect Mortality

Considerable research over the past 30 years has shown that the primary adverse effect of new linear corridors on wildlife is increased access for hunters and recreation users. These effects are largest when a new line provides access to an otherwise pristine and inaccessible area. Effects are minimized when the linear corridor traverses areas which are already accessible and disturbed through forestry and other development.

In order to minimize the need to build new access roads and mitigate for potential adverse effects to fish and wildlife, where practical the Project alignment, including the Bell-Irving route, will be designed to utilize existing forest service roads (FSRs), public roads, and private roads for access and maintenance of the transmission line ROW. BC Hydro has developed a preliminary Access Plan for the Project, which identifies which existing roads will be used for construction access and where new roads will be constructed. The plan also identifies which roads will be temporary and which ones would be retained for access during operation and maintenance of the Project.

Design mitigation measures, described in Chapter 11 of the EAC Application, will minimize the creation of new access for hunters and anglers. An analysis was conducted to evaluate the amount of new areas that may be accessible to hunters due to the construction and operations of the Bell-Irving route. This analysis assumes that all areas within 500 m of existing roads and cutblocks, and the cutblocks themselves are already available to hunters. The newly-accessible areas within 500 m of the ROW and access roads are then evaluated. A detailed description of the assumptions underlying this analysis, including the types of hunters in this area and the distances they will travel is available in Section 7.9.5.3 of the EAC Application and in Section 5.3.3.2 of the Hanna-Tintina Alternatives Report.

The access analysis indicated that a total of 433 ha of new access will be produced. New access will be produced for 22 ha of moose UWR and 66 ha of grizzly bear WHA. No new access is expected to effect mountain goat habitat, because the ROW will not intersect any modelled goat habitat, nor intersect any alpine tundra areas, thereby giving hunters access to alpine areas.

Mitigation for these adverse effects is described in the Access Plan and will include:

- basing roads used for inspection and maintenance on existing roads wherever practical;
- avoiding circle routes from and to the highway or main road;
- deactivating and allowing roads used only for construction to regenerate naturally.

BC Hydro will also work with the BC MOE, the BC MOFR, and interested and affected Aboriginal groups to develop and implement feasible and site-specific access control and management strategies in accordance with applicable legislation, permits, approvals, and ROW agreements. Practical access and management strategies could include measures such as:

- limiting the total number of access points to high value habitat;
- developing and implementing effective and practical methods of controlling access for vehicle traffic, to balance a variety of access interests and requirements;[1]
- retaining vegetation where practical between the ROW and the road where concerns over windfall can be mitigated to minimize a direct line of sight to wildlife moving along the ROW;
- keeping brush away from road crossings that attracts wildlife.

Avian mortality caused by transmission lines is also assessed. Birds may be electrocuted on towers, but the risk of electrocution is largely based on the transmission line type and configuration of electrical hardware and support structures. In the United States, nearly all electrocutions occur on comparatively low-voltage distribution lines (<69 kV) as opposed to transmission lines which transmit electricity at higher loads, such as the 287 kV NTL line. As a result, there is a low likelihood of avian electrocutions from birds contacting an NTL conductor. In some cases, birds, particularly waterfowl, may strike transmission lines, resulting in some level of mortality near waterfowl habitats such as wetlands. Approximately 286 ha of wetland shrub/herb and water communities were mapped in the Bell-Irving route study area. However, only three wetlands were mapped in close proximity (i.e. < 100 m) to the proposed Bell-Irving ROW (Figure 6.2.3). The ROW will skirt one of these wetlands. For this wetland some trees may need to be removed along the wetland's eastern border. The actual requirement for the removal of the trees will be determined during the final design stage of the Project. Due to the low numbers of wetlands crossed by the transmission line ROW, the likelihood of adverse effects on bird populations due to strikes with the NTL conductors is considered low.

Indirect mortality will likely result in a low magnitude residual adverse effect as a result of increased hunting for moose, bears, marten, and fisher. Goats were not confirmed to occur in the study area and are not assessed. Raptors and waterfowl are evaluated with a low magnitude residual effect due to the electrocutions and line-strikes. Forest birds and toads are not assessed for these effects. These effects parallel those in the EAC Application, except for effects on mountain goats, which were evaluated as a low magnitude residual adverse effect in the EAC Application because the ROW will intersect alpine tundra near goat UWRs and may provide new access to these areas.

[1] BC Hydro does not have the authority to control access on Crown land. The BC MOFR can direct BC Hydro to control access under Section 58 of the *Forest and Range Practices Act*.

6.7.6 Potential Residual Effects and Significance

6.7.6.1 Ungulates

Residual adverse effects for moose are expected of low magnitude in response to direct habitat alteration and noise during construction and due to increased access and hunting during operations. Residual adverse effects from direct mortality due to vehicle strikes and indirect habitat alteration are considered not likely.

Phase 1: Construction and Restoration

The majority of high-quality moose habitat along the ROW is composed of shrub ecosystems. A relatively small amount of other forms of moose habitat (riparian vegetation and forested habitats) will be removed during construction. This conversion of forested habitat to shrub habitat along the ROW will likely result in an increase in moose habitat, which is a potential beneficial effect for moose. However, construction will decrease the value of high quality moose habitat along some areas of the ROW resulting in a potential negative adverse residual effect. Sensory disturbance to moose will likely cause moose to avoid areas undergoing clearing and construction activities. Moose are anticipated to re-occupy the habitat once the disturbance is removed. Direct mortality is not likely to result in a residual effect because of the low number of vehicles used in the construction process and as a result of implemented mitigation measures. Together, these potential effects are not expected to affect the viability of the local moose population, and thus the likelihood of a significant effect during construction is low.

These assessments are based on a regional geographic extent and medium-term duration. Vegetation conversion will have a one-time frequency and be partially irreversible because the 38m ROW will be permanently managed in a shrub state, while area beyond will be allowed to grow to forest. Noise disturbance will have a one-time frequency and be reversible, because disturbances will stop when construction is finished. The areas over which these potential adverse effects will alter moose habitat and behaviour are relatively small compared to their home ranges, yielding a neutral resilience to these effects. The probability of these effects occurring at the forecasted magnitude is medium, with intermediate confidence, because predicting wildlife behaviours to disturbances cannot be done with high confidence.

The study area does not overlap any modelled mountain goat habitat. Despite this, helicopter may use areas extending outside the study area and will be managed to reduce effects on goats. Mitigation will include following BC MOE guidelines for helicopter use (BC MOE 2002), with buffer distances of 1.0 to 1.5 km from observed (if any) mountain goats depending on the season. With mitigation, no potential residual effects for mountain goats are likely.

Phase 2: Operations and Maintenance

During operations, indirect habitat alteration is not expected to result in a potential for residual adverse effects on moose because edge effects and vegetation management are not expected to adversely affect moose. Disturbance and indirect mortality caused by an increase in access for recreation and hunting purposes is predicted to result in a negative residual effect of low magnitude. This potential effect is rated with a regional extent, extending outside the study area, and a far future duration because greater access and hunting pressure will likely occur over the life of the Project. Frequency will be regular and irreversible because some roads will not be deactivated. The potential effect of access and increased hunting on moose is not expected to affect the viability of local moose populations and is therefore not likely to result in a significant residual adverse effect because the amount of new access is relatively small. The probability of increased hunting is medium and the likelihood of the predicted result is medium, as it is likely but may not occur. The assessment is of

intermediate confidence because the number and location of new, re-activated, and permanent access roads, the actual number of hunters who will use these areas and the associated effect on the local moose population is uncertain.

For mountain goat, indirect habitat alteration is not likely to result in a potential for residual adverse effects, because mountain goat habitat does not occur in the ROW. An increase in hunting is also not expected because mountain goat habitat is not adjacent to the study area and the ROW does not intersect areas of alpine tundra, which could provide access to alpine areas for hunters.

Overall Effect on Ungulates

The primary concern for moose is increased access for hunters, possibly leading to an increase in unregulated hunting. The route has been purposefully located in areas with existing access, and mitigation measures will both reduce access where warranted and increase forage quality for moose. Hence, the overall potential residual effect on the local moose population is predicted to not affect the viability of the VEC and as a result the likelihood of significant adverse effects on moose is low.

Both mule deer and white-tailed deer were excluded from this assessment because any potential effects on these species were addressed in the moose assessment in this report. Hence, the potential Project effect on these ungulates is not expected to affect the viability of the local populations and is not likely significant.

6.7.6.2 Bears

Residual adverse effects are predicted for bears due to direct mortality and noise during construction and due to increased access and hunting during operations.

Phase 1: Construction and Restoration

The proposed ROW will be maintained in a permanent shrub state, providing increased forage for bears during the growing season, particularly during the fall berry season. This is considered a potential beneficial effect. However, removal of existing bear habitat and Kermode bear denning habitats will result in a potential adverse effect. Together, these potential effects are considered to balance one another, yielding a low likelihood of a net residual effect.

Direct mortality caused by increased traffic is expected to result in a potential residual adverse effect of low magnitude. Direct mortality from felling trees with bear dens will not result in a residual adverse effect because mitigation includes pre-clearing surveys during any winter work within high quality denning habitat to identify active bear dens. Noise disturbance on bears during construction is also predicted to result in a potential residual adverse effect of low magnitude. Indirect mortality, whereby potential Project construction camps produce problem bears, is not likely to be a residual effect because construction camps will not be positioned in the Bell-Irving study area. Together, these potential residual adverse effects are not likely to negatively affect the viability of the local grizzly bear and Kermode bear populations, and thus no significant residual effects are likely during construction.

These potential residual adverse effects are evaluated with a regional geographic extent and medium-term duration. The frequency of these potential effects is rated as sporadic for vehicle-related mortality and regular for noise disturbance frequency. Potential effects will be reversible in the long term once construction activities have subsided and sensory disturbances diminish. The resilience of the bear population to increased traffic-related mortality and disturbances from noise is considered neutral, because the bear populations are considered healthy in this region. Bears may temporarily avoid habitats where construction activities are occurring, but are expected to re-occupy the habitat

once the disturbance is removed. The probability of these residual adverse effects occurring at this magnitude is rated as medium with intermediate confidence, because bear behaviour is relatively difficult to predict with a high degree of certainty.

Phase 2: Operations and Maintenance

During operations, the primary potential adverse residual effect will likely result from increased access due to the ROW and access roads, and associated increases in human activity and hunting pressure. This potential effect is rated as a residual adverse effect of low magnitude, with regional extent, extending outside the proposed ROW, and regular frequency. Increased access will occur for the life of the proposed Project and will therefore be far-future in duration and irreversible. Black bear populations are extremely healthy while grizzly bear populations in all area of WMUs can support a spring and fall harvest, though the number of LEH authorisations in WMU 16-b are low (4 and 3 fro fall and spring) likely reflecting the access from Hwy 37 this area provides. Thus, bear populations in the area would have a medium resilience to increased hunting, but many grizzly bear populations would have a relatively low resilience to increased hunting. Because bears have large home range sizes and are broad habitat generalists, access to and along the proposed ROW may increase opportunities for hunting. However, this effect is not anticipated to affect the viability of bear populations. Thus, the potential residual adverse effect is not likely to be significant. This confidence in this assessment is intermediate, because predicting the behaviour of hunters and their potential effect on the local bear populations is uncertain.

Overall Effect on Bears

The primary concern is increased access and resulting increases in hunting. Sensory disturbance and some habitat alteration (primarily of Kermode bear denning areas) are predicted to occur during construction, with ongoing loss of denning areas. The overall potential residual adverse effect on local bear populations is likely to cause a small shift from baseline conditions but not to affect the viability of the local bear populations. Thus, the adverse effects of the Project on bears is assessed as not likely to be significant.

6.7.6.3 Furbearers

Phase 1: Construction and Restoration

During construction, clearing the proposed ROW and one-time clearing area is not expected to result in residual adverse effects on furbearer habitat. Noise disturbance is also not expected to result in a residual adverse effect on furbearers. However, direct mortality from vegetation clearing and the possibility of removing arboreal dens combined with possible vehicle strikes is likely to result in a potential residual effect with low magnitude. This potential residual effect is not predicted to affect the viability of the local fisher or American marten populations, and thus will not likely result in a significant effect during construction. This is evaluated with a regional geographic extent, medium-term duration, and sporadic frequency; potential effects will be reversible in the short-term once construction activities have been completed. The population of marten is considered relatively healthy in this region and so the resilience of this population is considered neutral to these effects, while fisher are much more rare, resulting in a low resilience to further population decline. These potential effects are rated with medium probability and intermediate confidence because the actual number of dens is unknown in the proposed ROW and one-time clearing area and the population dynamics of these furbearers is not known with high confidence.

Phase 2: Operations and Maintenance

Indirect mortality from increased trapping pressure was identified as a likely potential residual adverse effect related to access during the operations and maintenance phase and may result in a potential adverse effect on both American marten and fisher mortality at a local scale. The potential effect is considered far future in duration for both furbearer species.

For American marten, the magnitude of the potential adverse effect was classified as low because trapping interest is currently relatively low, and management of each affected tenure is by a single trapline holder with maintaining viable marten populations in the best interest of the trapper. The resource is not available to harvest by other individuals not authorised by the trapper. The extent will be local with far future duration. The frequency of the potential effect will be regular and reversible in the long term with high resilience. Thus, the potential effect of access and increased trapping pressure on American marten is not expected to affect the viability of the local American marten population and is not likely to result in a significant residual effect. The confidence in this assessment is intermediate, because predicting the behaviour of trappers and their potential effect on the local furbearer populations is uncertain.

For fisher, the magnitude of the potential adverse effect was classified as low because an increase in trapping pressure for American marten will only result in the incidental capture of the much less common fisher. The extent will be local, far-future duration, and sporadic frequency. The reversibility and resilience of decreased fisher abundance will be long term and low because of the low density of animals on the landscape. Together, the potential effect of access and increased incidental trapping pressure on fisher is not expected to affect the sustainability of the local fisher population and significant residual effects are unlikely. The confidence in this assessment is low considering the associated uncertainties.

Overall Effect on Furbearers

Overall, the primary concern is increased access and resulting increases in trapping pressure and direct mortality from clearing large cottonwoods and/or spruce trees during birthing periods. The overall residual adverse effect on the local American marten and fisher populations is predicted to cause a minor change from baseline conditions for a short time but will not affect the viability of the local furbearer populations. Thus, it is not likely to be significant.

Lynx, fox, coyote, and weasels were excluded from this assessment because any potential adverse effects on these species were addressed in the furbearer assessment of this report. Hence, potential residual effects on these species from construction and operation are also not likely to be significant.

6.7.6.4 Birds (Raptors, Waterfowl, Forest Birds)

Phase 1: Construction and Restoration

Vegetation clearing during construction will result in some direct habitat alteration for bird species. This potential adverse effect is not likely a residual effect for waterfowl, because the majority of cleared areas will be forests with low waterfowl numbers, or for raptors with implementation of appropriate pre-construction nest surveys and mitigation to avoid nests. However, for forest birds some habitat will be removed, resulting in a high probability, low magnitude potential residual adverse effect. Forest birds are assumed to have a high resilience to adapt to forested habitat changes. This potential residual effect is not predicted to affect the viability of the local bird populations, and thus no significant adverse effects are likely during construction. The confidence in this assessment is intermediate.

Noise disturbance is rated as a potential residual adverse effect for each of the three groups of birds because many birds will avoid construction activities because of human presence and noise. However, direct mortalities were not rated as potential residual effects because of the low potential for population-level effects, based on the proposed mitigation. The magnitude of potential residual effects for all avian VECs are expected to be low across a landscape extent, short term duration, one-time frequency, short term reversible with high resiliency. This potential residual effect is not predicted to affect the viability of the local bird populations, and thus the residual effect is not likely significant during construction. This assessment is made with with high probability and intermediate confidence.

Phase 2: Operations and Maintenance

The proposed Project is expected to result in a potential beneficial effect for raptors through indirect habitat alteration, whereby potential hunting, perching, and nesting opportunities could be created. However, the landscape surrounding the study area has been determined to be able to provide sufficient amounts of hunting and nesting habitat for raptors, and thus the potential residual beneficial effect is predicted to be of low magnitude and local geographic extent. The potential effect will extend into the far future, have sporadic frequency, and will be irreversible. Raptors will have a neutral adaptability to this potential effect, as not all raptors are expected to use the proposed transmission line, structures, or the ROW (i.e. northern goshawk tend to hunt and nest in mature forest). Overall, the potential residual effect is not likely significant. The confidence in this assessment is intermediate.

Waterfowl and interior forest birds are expected to be adversely affected by indirect habitat alteration. The structure of the landscape will be permanently altered and some forest birds respond negatively to fragmentation and habitat loss, particularly interior specialist and understory birds. Other types of forest birds that prefer shrubby and mixed habitat, generally created by forests edges, may be positively affected by indirect habitat alteration. Potential residual adverse effects are predicted to be of low magnitude and have a landscape geographic extent, with far future extent, continuous frequency, and will be irreversible. Waterfowl and forest birds are expected to have a neutral resiliency to potential effects and the potential residual effects on waterfowl and forest birds will not likely be significant. The confidence in this assessment is intermediate.

Direct mortality from electrocutions and line-strikes was rated as a potential residual adverse effect of low magnitude for raptors and waterfowl. Potential residual effects are expected to be of local geographic extent, extending into the far future, and will occur at a sporadic frequency for most species. Potential effects will be irreversible, as the Project will be permanent. Raptors and waterfowl are expected to have a high resiliency to adapt to these effects. The potential residual adverse effect is likely not significant. The confidence in this assessment is intermediate.

Overall Effect on Birds

The primary concerns are direct mortality, disturbance, and nest removal from vegetation and tree clearing. This potential adverse residual effect will be mitigated through avoiding breeding periods, conducting pre-clearing surveys, and buffering any identified active nests. Other potential effects on birds include indirect habitat alteration and direct mortality from bird strikes with transmission lines. Considering all the aforementioned potential effects on birds, the amount of suitable habitat in the study area, existing human disturbance and activity (i.e., forestry, roads) in the area, the overall potential residual effect on the local raptor, waterfowl, and forest bird populations is not likely significant.

6.7.6.5 Amphibians

Phase 1: Construction and Restoration

Two amphibian species were documented in the Bell-Irving study area: western toad (*Anaxyrus boreus*) and Columbia spotted frog (*Rana luteiventris*). Western toads are listed as Special Concern by COSEWIC and they are listed under Schedule 1 of SARA (2002b) while Columbia spotted frogs are not considered to be at risk either provincially or federally.

The assessment focused on western toad. The other common amphibians in the area – Columbia spotted frog and long-toed salamanders (*Ambystoma macrodactylum*) were excluded from the assessment because they are not federally or provincially listed. Both of these species use a variety of types of ponds and pools in wetlands for breeding.

Toads are found in a variety of habitats, but aquatic breeding sites are their only predictable habitat feature. Maintaining aquatic breeding sites is essential to maintaining amphibian populations as amphibian population dynamics are driven in a large part by the success of recruitment of new terrestrial juveniles into the local population. This requires maintaining wetland extent and function as breeding habitat. Clearing activities could disturb breeding sites if construction occurs during the breeding period. Mitigation includes 1) preconstruction surveys, 2) no-work buffers about active breeding ponds and 3) mitigation buffers where clearing practices with lower potential for altering soils, shrubby vegetation and wetland hydrology are used outside the breeding period.

With mitigation, no residual effects for western toad or Columbia spotted frog habitat loss or alteration are anticipated.

Direct mortality of adults and newly emerged terrestrial juveniles close to wetlands during the spring and the late summer could occur because of the presence of heavy machinery involved in Project-related construction activities or vehicles moving through the area. This potential effect will also be mitigated as described above. With implementation of suggested mitigation, no residual effects are likely.

Phase 2: Operations and Maintenance

No potential effects were identified or evaluated for western toad or Columbia spotted frog for the operations phase of the Project.

Overall Effect on Amphibians

Residual effects of the Project are unlikely for western toad or Columbia spotted frog.

6.8 WETLANDS

The following section provides information regarding wetland ecosystems for the Bell-Irving route study of the proposed NTL Project. No wetland-specific field studies were conducted in this area to identify wetland extent and wetland function. However, data collected during the ecosystem mapping study identified a number of wet community types that are analogous to wetland communities; these data were used to support this section. The methods for the ecosystem mapping are summarized in Section 6.6 and are presented in detail in Section 7.8.1.2 of the EAC Application.

The only type of wetlands that were identified from the ecosystem mapping study are shrub/herb. Only those polygons identified as wetland shrub/herb or water in the primary decile were described in the ecosystem mapping study. However, area calculations for wet communities included all deciles.

6.8.1 Environmental Setting

6.8.1.1 General Description of Bell-Irving Route

Approximately 286 ha of wetland shrub/herb and water communities were mapped in the Bell-Irving route study area. Of this, approximately 221 ha were identified as the primary decile (dominant community type within an ecosystem polygon). The area of all identified wetland communities is presented in Table 6.8-1; a map of wetland communities is presented Figure 6.6-1.

Table 6.8-1. Area of Wetlands (Wetland shrub/herb and Water) within BEC Zones of the Study Area

	BEC Zone/Subzone			
Ecosystem	**ESSFwv**	**ICHmc1**	**ICHvc**	**Total**
Water	2.06	120.94	16.63	139.62
Wetland Shrub/herb	4.35	131.37	11.34	147.05
Total	**6.40**	**252.31**	**27.96**	**286.67**

All units are hectares (ha)

The wetland shrub/herb community was identified within two BEC zones/subzones, the ICHvc and ICHmc1. The majority of wetland shrub/herb communities were identified in the ICHmc1, which is defined as low- to mid-elevation forest found within the coast-interior transition dominated by cedar and hemlock. The mc1 subzone is a Nass variant and denotes ecosystems that are moist and cold.

The water community was identified in three BEC zones/subzones, the ESSFwv, ICHvc, and ICHmc1. The majority of the water communities were identified in the ICHmc1. The ICHmc1 accounted for approximately 67% of the area within the study area.

Wetlands likely to be present within the BEC zones were identified by comparing the BEC zones of the study area against tables of the distribution of wetland associations within biogeoclimatic zone (MacKenzie and Moran 2004). The wetland associations and likelihood of occurrence are presented in Table 6.8-2.

Table 6.8-2. Wetland Associations and Likelihood within BEC Zones in the Study Area

Wetland	**Wetland**		**BEC Zone**	
Class	**Association**	**Wetland Name**	**ESSF**	**ICH**
Bog	Wb02	Lodgepole pine - Bog rosemary - Peat-moss		x
Bog	Wb04	Western Hemlock - Cloudberry - Peat-moss		x^n
Bog	Wb05	Black spruce - Water sedge - Peat-moss		x
Bog	Wb07	Lodgepole pine - Water sedge - Peat-moss	x	x
Bog	Wb08	Black spruce - Soft-leaved sedge - Peat-moss		x
Bog	Wb10	Lodgepole pine - Few-flowered sedge - Peat-moss	x	x
Bog	Wb11	Black spruce - Buckbean - Peat-moss		x
Bog	Wb12	Scheuchzeria - Peat-moss		x
Bog	Wb13	Shored sedge - Buckbean - Peat-moss	x	x
Fen	Wf01	Water sedge - Beaked sedge	x	xx
Fen	Wf02	Scrub birch - Water sedge	x	xx

(continued)

Table 6.8-2. Wetland Associations and Likelihood within BEC Zones in the Study Area (completed)

Wetland Class	Wetland Association	Wetland Name	BEC Zone	
			ESSF	ICH
Fen	Wf03	Water sedge - Peat-moss	xx	
Fen	Wf04	Barclay's willow - Water sedge - Glow moss	xxx	
Fen	Wf05	Slender sedge - Common hook-moss		xx
Fen	Wf06	Slender sedge - Buckbean		x
Fen	Wf07	Scrub birch - Buckbean - Shore sedge		x
Fen	Wf08	Shored sedge - Buckbean - Hook-moss	x	
Fen	Wf09	Few-flowered spike-rush - Hook-moss	x	
Fen	Wf11	Tufted clubrush - Star moss	x	x
Fen	Wf12	Narrow-leaved cotton-grass - Marsh-marigold	xxx	
Fen	Wf13	Narrow-leaved cotton-grass - Shore sedge	xx	
Fen	Wf51	Sitka sedge - Peat-moss		x
Marsh	Wm01	Beaked sedge - Water sedge	x	xxx
Marsh	Wm02	Swamp horsetail - Beaked sedge		x
Marsh	Wm04	Common spike-rush		xx
Marsh	Wm05	Cattail		xx
Marsh	Wm06	Great Bulrush		x
Marsh	Wm51	Three-way sedge		x
Swamp	Ws01	Mountain alder - Skunk cabbage - Lady Fern		xx
Swamp	Ws02	Mountain alder - Pink spirea - Sitka sedge	x	xx
Swamp	Ws04	Drummond's willos - Beaked sedge		x
Swamp	Ws06	Sitka willow - Sitka sedge		xx
Swamp	Ws07	Spruce - Common horsetail - Leafy moss	x	xx
Swamp	Ws08	Subalpine fir - Sitka valerian - Common horsetail	xx	
Swamp	Ws09	Black spruce - Skunk cabbage - Peat-moss		xx
Swamp	Ws10	Western redcedar - Spruce - Skunk cabbage		xx
Swamp	Ws50	Pink spirea - Sitka sedge		x
Swamp	Ws51	Sitka willow - Pacific willow - Skunk cabbage		x

x=incidental <5% of wetlands, xx=minor 5-25% of wetlands, xxx=major >25% of wetlands, and x^n=northern subzones only (Summarized from MacKenzie and Moran 2004)

6.8.2 Spatial and Temporal Boundaries

The spatial boundary for the ecosystem mapping and the wetlands effects assessment includes a 2 km zone extending 1 km from either side of the centreline of the proposed Bell-Irving route.

This assessment considers two distinct temporal phases of development:

1. Construction and restoration (3 years).
2. Operations and maintenance (>50 years).

Although the construction and restoration period will be three years in total, each construction activity at any one location (i.e., 300 m of road clearing, 300 m of road construction, and 300 m of ROW clearing)

will last a week or less on average; foundation installation and structure erection activities will take even less time.

6.8.3 Issues Scoping

The BC government recognizes wetlands as some of the most important ecosystems on earth (BC MOE 2007). They currently comprise approximately 5.6% of the provincial land base. Wetlands provide a number of specific functions and provide critical habitat for fish, birds, and other wildlife. Most wildlife in the province use wetland habitat at some point in their life cycle, including many red- and blue-listed species (Mitsch and Gosselink 2000; BC MOE 2007). Wetlands were also identified as important by Nisga'a, Gitanyow and Skii km Lax Ha.

The principal issue regarding developments and wetlands is a loss of wetlands associated with changes to the landscape. Other types of project/wetland interactions include alterations of community type and changes to wetland function as a result of vegetation clearing, introduction of invasive species, and alterations to the hydrological regime.

6.8.4 Valued Environmental Components

Wetland extent and wetland function were selected as valued environmental components (VECs) because they represent aspects of wetlands that are measurable and include tasks that are valued by society. These components involve the spatial distribution, types, total area, and size of individual wetlands. Wetland extent is valued because loss of wetland area is one of the greatest threats to wetlands globally (Mitsch and Gosselink 2000). Wetland function is valued because it is often the processes carried out by wetlands that have the greatest potential interaction with other VECs and value to society. A detailed description of the VECs is provided in Section 7.7.4 of the EAC Application.

6.8.5 Identification of Potential Effects and Mitigation

Approximately 286 ha of wetland shrub/herb and water communities were mapped in the Bell-Irving route study area. However, only three wetlands were mapped in close proximity (i.e. < 80 m) to the proposed Bell-Irving ROW. The locations of these wetlands are presented in Figure 6.2.3 of this report. The ROW will skirt one of these wetlands. For this wetland some trees may need to be removed along the wetland's eastern border. The actual requirement for the removal of the trees will be determined during the final design stage of the Project. Mitigation measures to reduce the potential effect include following EMPs for vegetation and riparian management (BC Hydro et al. 2003; BCTC 2008), monitoring and recording any wetland loss/alteration during the construction phase to identify any potentially rare or unique wetland communities, and facilitate developing a wetland compensation plan, if required. Despite the mitigation, in order to take a conservative approach with this assessment, a potential residual adverse effect due to alteration of this wetland, is considered likely.

Other activities that may have an adverse effect on wetland extent/function during construction of the proposed Bell-Irving route include access road construction/improvements/deactivation and watercourse crossings. Watercourse crossings could affect wetlands, particularly if, in the unlikely need, wetlands are covered or drained to facilitate the crossing. Potential effects from access road construction will be limited as 67% of the access roads required to construct the route, are already existing.

Potential adverse effects can be mitigated by following the guidelines set out in the riparian management area guidebook (BC MOE 1995). It is recommended that the reserve and management buffer distances in this guidebook be extended to all wetlands; large wetlands, wetland complexes, and regionally important wetlands should be buffered by 50 m (all other wetlands should be buffered

by 30 m). Wetland features of small areal extent may have narrower buffers or non-machine approaches to vegetation removal practices.

Additional mitigation measures could also include avoiding wetlands or limiting construction activities to the margins of wetlands when placing roads and infrastructure and following standard operating procedures (SOPs) relating to water course crossings. Road sites should also be selected such that water sources, including seepage ponds, groundwater springs, and other surface water features, are not affected. Despite mitigation, potential adverse residual effects are likely due to watercourse crossings and access road construction.

6.8.6 Potential Residual Effects and Significance

Residual effects due to loss/alteration of wetland extent and function are likely along the Bell-Irving route as a result of the proposed Project activities. Implementing pre-construction surveys and recording the area of wetlands and the types of wetland communities lost/altered will aid in identifying wetland associations that may require compensation. Because the ROW avoids two of the three wetlands along the route and skirts a third wetland, it is likely that the magnitude of potential effects will be low as the areas that may be affected are likely small. Consequently the extent is also assumed to be local. Although the exact extent of wetland loss is not known, the effect of the Project on wetlands along the Bell-Irving route is not likely to be significant provided mitigation measures, pre-construction surveys, and wetland compensation procedures, if required, are developed and implemented.

6.9 ATMOSPHERIC ENVIRONMENT

This section provides an assessment of the potential effects of the proposed Bell-Irving route realignment on the atmospheric environment in terms of climate and meteorology.

Meteorology focuses on weather processes and forecasting (short-term; i.e., a few weeks maximum) whereas climatological studies involve weather conditions averaged over a longer period of time. For example, Environment Canada publishes 30-year climate normals for various jurisdictions that are used for a variety of purposes including water resource studies and Project design. In general, this section focuses on the potential effects that the proposed Bell-Irving route may have on:

1. Climatic conditions (Section 6.9.1).
2. Ambient air quality (Section 6.9.2).

Potential climatic effects are discussed in terms of greenhouse gas (GHG) emissions resulting from the burning of fuels and deforestation because these are the major Project components that could contribute to climate change. Conversely, ambient air quality is discussed in terms of criteria air contaminants (CACs), which include carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and particulate matter (PM). These contaminants will be emitted by various fuel, residue burning (i.e., burning of non-merchantable timber and slash), and dust-generating sources.

Detailed methodologies, baseline conditions, and effects assessments provided in the climate and meteorology baseline report remain valid for the Bell-Irving route and can be found in Section 7.2 and Appendix 7.2-1 of the EAC Application .

6.9.1 Climate and Meteorology

6.9.1.1 Environmental Setting

The climate and meteorological setting for the proposed Bell-Irving route is summarized below in terms of wind, temperature, and precipitation. These are the most useful meteorology parameters for the Project designers for structure composition and placement.

In the EAC Application, three stations were selected as representative climate regions for the northern, middle, and southern portions of the proposed Project corridor. The Bell-Irving route alignment exists in the middle portion of the proposed Project corridor. Since it exists at a similar elevation to the originally proposed Hanna-Tintina route, it can be deduced that it lies within the same representative climate region. Therefore, the same middle weather station identified in the EAC Application, namely Stewart Airport (Station #16), is an appropriate selection for providing long-term meteorological data relevant for the Bell-Irving route. Section 7.2.1.3 in the EAC Application summarizes the wind, temperature, and precipitation data relating to Stewart.

6.9.1.2 Spatial and Temporal Boundaries

Spatial Boundaries

The proposed Project's potential effects on climate and meteorology may occur through the release of GHGs, which may contribute to global climate change. Therefore, the climate effects assessment is limited to the effect the proposed Project will have on atmospheric GHG levels.

As highlighted in the EAC Application, it is not appropriate to discuss the implications of emissions within a defined spatial boundary because it is the total global atmospheric GHGs that contribute to climate change. Thus, potential climate effects assessed for any components of the Project, including the Bell-Irving route segment, are considered to have a trans-boundary geographic extent.

Temporal Boundaries

In the EAC Application, an approximate 3-year construction and restoration phase of the Project was identified as having the highest energy demand and level of activity, while the operation and maintenance phase of 50+ years was determined to have a very small level of activity. Subsequently, potential climate and meteorology effects of the Project were assessed only for the construction and restoration phase. Following the same principle, this assessment only examines the potential climate and meteorology effects of the proposed Bell-Irving realignment during the construction and restoration phase.

The total length of the originally proposed transmission line, following the Hanna-Tintina route, was 335 km. This total length will be increased by approximately 17 km following the newly proposed Bell-Irving route. This equates to a 5% overall increase in the total length of the transmission line. Accordingly, while this will increase the construction and restoration effort by 5%, it is assumed that the construction phase would be scheduled over the same period as presented in the EAC Application, namely 3 years.

6.9.1.3 Issues Scoping

Overview

The effect on climate and meteorology from the incremental increase in atmospheric GHGs from any single source cannot be quantified (CEA Agency 2003). Therefore, the significance of the proposed

Project's potential effects on climate and meteorology is assessed by comparing projected Project emissions to national and provincial standards. Because the route will cause an increase of 17 km in overall length of the ROW, the Bell-Irving route is likely to add approximately 5% to the total Project emissions that were quantified in the EAC Application report.

Section 7.2.1.5 of the EAC Application includes a complete overview of the issues scoping.

Principal Issues

The issues of concern related to the atmospheric environment were identified in the EAC Application through consultation. Most concerns expressed by Project stakeholders, First Nations, and the Nisga'a Nation related to climate change, GHGs, and carbon sink removal.

6.9.1.4 Valued Environmental Components

Climate was selected as a VEC in the EAC Application because it is a fundamental aspect of the natural environment. Climate describes the predominant weather patterns in an area and changes to it may affect many other ecosystem components. For the same reasons, climate remains the VEC for the Bell-Irving route option.

Section 7.2.1.6 in the original EAC Application contains more details on the climate VEC.

6.9.1.5 Identification of Potential Effects and Mitigation

Potential Effects

The primary anthropogenic GHGs (CO_2, CH_4, and N_2O) emitted by the proposed Project will be associated with fuel consumption, slash burning, and deforestation, as the existing baseline conditions along the proposed Project corridor is generally forested. Diesel, aviation gasoline, and propane fuel energy consumption will result in direct GHG emissions by equipment in each Project phase, with the majority consumed during the construction phase. This information is consistent for the Project following the proposed Bell-Irving route, although there may be slightly less deforestation because the route does not pass through a proposed protected area and the route has many existing cutblocks.

The EAC Application lists estimates of diesel, aviation gasoline, and propane consumption, based on the Project Equipment List and Operating Hours and manufacturer's fuel consumption ratings. These estimations were based on a three-year construction period.

The Climate Registry General Reporting Protocol Version 1.1 (Climate Registry 2008) was used to estimate the GHG emissions in units of CO_2-eq from the estimated fuel and power usage associated with the original Project (i.e., Hanna-Tintina Route) during a year of construction. It was assumed that construction will take place over a three-year period and that activity levels will remain similar throughout the construction phase. Total (direct and indirect) annual GHG emissions from the originally proposed Project during the construction phase were estimated to be 107 kt of CO_2-eq per year. Section 7.2.1.7 of the original EAC Application contains more details on the method followed to calculate the GHG emissions.

Simply increasing the total annual emissions calculated in the original EAC Application by 5% (to account for the 5% increase in construction effort caused by the 5% increase in length of the transmission line), yields a value of 112 kilotonnes (kt) of CO_2-eq per year for the Project following the Bell-Irving route.

The incremental increase in global GHG emissions from a single facility cannot be used to estimate a resulting change in the global or local climate (CEA Agency 2003). Therefore, the nature and extent of potential adverse effects from GHG emissions from the proposed Project are gauged by comparing the estimated Project emissions to current legislation and national and provincial norms in terms of total emissions.

Based on the current facility reporting thresholds and comparison to national and provincial emissions, the nature and extent of the potential adverse effects of the Project's GHG emissions on the environment during the construction phase of the Project can be assessed. Although GHG emissions will be emitted during the operations phase of the Project, because of their small magnitude, their nature and extent are expected to be negligible. There are no sulphur hexafluoride (SF_6) emissions expected during the operations phase because the equipment will be designed to the appropriate engineering standards and have negligible leak rates. In addition, the vegetation management cycle will be far less intensive than the tree clearing program required to clear the ROW during construction. Consequently, the GHG emissions for the operations phase have not been assessed quantitatively.

Table 6.9-1 presents the estimated annual total GHG emissions during construction of the proposed Project, if the Bell-Irving Route was selected, to total emissions from national and provincial sources for 2007. Data for 2007 are used for comparison as it is the most recent year for which national and provincial emission data are available. Total emissions from the proposed Project following the Bell-Irving route are minor in comparison to total national and provincial emissions. The proposed Project's GHG emissions are anticipated to decrease considerably during the operations phase after construction is completed.

Table 6.9-1. Summary of Estimated Project Emissions and 2007 Canadian GHG Emissions

Source	GHG Emissions (kt CO_2-eq)	Project Emission as Percent of Source Emissions
Project – projected for annual construction	112.04	100
Canada [1]	721,000	0.016
British Columbia [1]	62,300	0.18

[1] *Environment Canada (2008)*

In summary, the proposed Project following the Bell-Irving route is projected to result in:

- annual GHG emissions that will not exceed 150 kt CO_2-eq;
- annual GHG emissions that will require reporting to the BC MOE under the Mandatory Reporting of Greenhouse Gas Emissions Regulation (greater than 10 kt CO_2-eq/a) ((BC MOE 2008);
- annual GHG emissions that constitute a minor portion of national and provincial inventories; and
- a minor reduction in the carbon sink.

Mitigation

The specific mitigation measures identified in the EAC Application to minimize GHGs during construction of the Project are also applicable to the Bell-Irving route. These include:

- Regular maintenance programs for diesel-powered equipment.

- Use of low sulphur fuels, where practical (depends on the available fuel grades in the region).
- Restrict speed limits for mobile diesel equipment.
- Use modern diesel engines with pollution control technology.
- Implement practices to reduce engine idling.
- Equip driver cabins with air filtration systems, where practical.
- Develop and implement Project-specific slash management and disposal measures in the environmental management program. These measures will include procedures for appropriate management of cleared vegetation and will identify a specific methodology for handling and burning slash along the Project corridor based on local weather conditions and complying with local BC MOFR burning restrictions.
- Include procedures within the slash management and disposal measures to ensure compliance with the Open Burning Smoke Control Regulation (2003), which states that "open burning of debris must not be initiated if the local air flow will cause the smoke to negatively impact on a nearby population or cause pollution." This includes obtaining a custom ventilation index from the BC MOE.
- Implement practices to plan and reduce the length and duration of helicopter flights where practical.

6.9.1.6 Potential Residual Effects and Significance

Significance of Residual Effects

With projected annual emissions of 112 kt CO_2-eq, relative to 62,300 kt CO_2-eq for British Columbia, and 721,000 kt CO_2-eq for all of Canada, the magnitude of the estimated potential adverse residual effects from the project are likely to be low. However, the predicted emissions during the construction of the proposed Project (as a whole) will be considered as contributing in a minor way to the global GHG inventory, and therefore the potential climate effects will have a trans-boundary spatial extent.

GHGs will be emitted throughout the three-year construction phase of the proposed Project, and will decrease considerably during the operations and maintenance phase. Thus, the potential adverse climate effects will likely have a continuous frequency for a short duration.

CO_2, which is the dominant GHG that will be emitted during construction of the proposed Project, will be consumed by carbon sinks, such as forests and large waterbodies. Hence, a portion of the GHG emissions will naturally be consumed, resulting in a short-term reversibility of the climate effects.

For GHG emissions, it is only appropriate to consider the total emissions from all components of the proposed Project. Therefore, the assessment of significance of the residual GHG emissions has been conducted for a typical high-intensity construction year but has not been subdivided for individual components within each phase.

Because of the natural ability of the environment to consume GHG emissions and the global nature of the inventory to which the Project emissions will contribute, the resilience of the climate to the potential effects is high.

In addition, the Project will provide a supply of clean, renewable electricity generated by hydroelectric power, and therefore will potentially reduce future emissions from fossil fuel-based power generation. The transmission line could conservatively generate 1,700 GWh of electrical power per year. This

'clean' energy could be used to replace approximately 158 million litres of diesel fuel annually, which could lead to a reduction of 403 kt of CO_2 equivalent emissions on an annual basis. Proposed mining projects such as Galore Creek and Red Chris are intending to use hydroelectric power for mineral processing and heating. If the Project is not built they will likely have to use fossil fuels, which will generate significantly more GHG emissions and require additional trucking. Similarly, other mining projects that are currently in the planning process, such as Kerr-Sulphurets-Mitchell, will benefit from an available hydroelectric power source. Because of the low magnitude, the incremental contribution of GHGs to total atmospheric levels, and the resiliency of the climate to GHG emissions, the potential residual adverse climate effects of the Project are likely to be not significant.

Likelihood

Because of a recent focus on energy use and climate change, it is likely (i.e. probable) that energy use and the resulting GHG emissions will deviate from the current projections because of improved technology and more stringent regulations. Thus, there is an intermediate degree of uncertainty in the conclusions made during this assessment.

The release of CO_2, CH_4, and N_2O during fossil fuel consumption is scientifically certain. However, uncertainty exists in the projection of annual energy consumption and the resulting amount of GHG emissions. The loss and replanting of vegetation is certain, but the amount of GHG emissions caused by the development and the amount sequestered with re-vegetation are uncertain. Therefore, the confidence level in this potential effect is intermediate.

6.9.2 Air Quality

6.9.2.1 Environmental Setting

The EAC Application provides an environmental setting for the entire Project, which includes a summary of the baseline dustfall data collected in the Project area and background concentrations from nearby air quality monitoring stations. Section 7.2.2.1 of the EAC Application contains a summary of the baseline and background ambient air quality. Station NTL6 is relevant to the Bell-Irving route.

6.9.2.2 Spatial and Temporal Boundaries

Spatial Boundaries

It is expected that the proposed Project's construction and restoration phase will result in air emissions from fuel combustion, emissions of fugitive dust caused by wind erosion, and on-site movements of construction vehicles and large equipment, blasting, and burning non-merchantable timber and slash. Compounds that may be emitted during construction activities include sulphur dioxide (SO_2), oxides of nitrogen (NO_x), carbon monoxide (CO), particulate matter (PM), and GHGs including CO_2.

As with the EAC Application, the spatial boundary for the air quality assessment is defined as the proposed route plus a buffer of 5 km on either side of the route. While the majority of potential Project emission effects will likely occur within a 0.5 km distance on either side of the eventual ROW, the larger 5-km buffer zone considers that there may be multiple construction crews working simultaneously along the Project corridor. Concentrations of air quality compounds reported below are based on a distance of 5 km from the route. This spatial boundary was selected because emissions will be transient in nature as construction vehicles and equipment use access roads to transport equipment and supplies, and as construction activities advance along the Project corridor.

Temporal Boundaries

The majority of air quality emissions associated with the proposed Project will occur during the estimated three years of construction activities, which will be localized and transient in nature. During operations and maintenance, there will be no emissions from the transmission lines. Emissions associated with periodic vegetation management and line maintenance during the operations phase of the proposed Project will be sporadic and negligible. Because of the long-term nature of the operation phase, which will be 50 years or greater, a detailed evaluation of the potential effects of decommissioning has not been undertaken.

6.9.2.3 Issues Scoping

Air emissions during the proposed Project's lifetime may lead to an increase in ambient concentrations of CACs, and hence a degradation of local or regional air quality, which may cause potential health effects.

Section 7.2.2.3 of the EAC Application report contains a detailed rational for the selection of the principal issues.

6.9.2.4 Valued Environmental Components

Air quality was previously selected as a VEC in the EAC Application because of its importance to the health of workers and surrounding residents, wildlife, vegetation, and water quality. Air quality also has aesthetic qualities in terms of visibility and odour. In addition, air quality issues can extend to regional and global scales to include climate effects (global warming). For the same reasons, air quality remains the VEC for the Bell-Irving route.

Section 7.2.2.4 of the original EAC Application report contains more details on the air quality VEC.

6.9.2.5 Identification of Potential Effects and Mitigation

Air emissions resulting from Project activities were predicted for the EAC Application using an air quality model combined with the background concentrations. The air quality model was not location specific, and therefore air emissions are anticipated to be similar for the Bell-Irving route.

Section 7.2.2.5 of the EAC Application contains the air dispersion modeling methodology and results.

The mitigation measures identified in the original EAC Application for managing air emissions during the Project construction phase remain valid for the Bell-Irving route. As with any pollution management activity, the most effective control mechanism is prevention. Particularly with dust emissions, once dust is generated and airborne, it is more difficult to mitigate. Emissions management will involve the adoption of best management practices (BMPs), including:

- Maintain construction vehicles and equipment according to manufacturers' specifications.
- Avoid engine idling, where practical.
- Implement practices to plan and reduce the length and duration of helicopter flights, where practical.
- Apply water to access roads and materials handled in dry conditions and strong wind, where practical.
- Consider using blasting mats to reduce dust generation, where practical.

- Project-specific slash management and disposal measures will be included in the Project Environmental Management Program. These measures will include procedures for the appropriate management of cleared vegetation and will identify specific prescriptions for handling and disposing of non-merchantable timber and slash along the Project corridor.
- Slash management and disposal measures will include procedures to maintain compliance with the Open Burning Smoke Control Regulation (2003) and/or bylaws administered by regional governments to minimize air emissions, including controlled burning during appropriate weather conditions and limiting the volume and number of active slash burn piles.

The nature and extent of the control measures employed will determine the magnitude of emissions reduction. Adopting BMPs for mitigating fugitive dust from vehicle activity and heavy equipment movement will further act to reduce total particulate matter (TPM) emissions. Despite mitigation, residual effects from Project emissions are likely during the construction phase of the

Project Emissions from the operations and maintenance phase will be expected to be negligible, as a result, a residual effect is not likely.

6.9.2.6 Potential Residual Effects and Significance

Significance of Effects

The BC and Canada ambient air quality objectives define concentrations that are acceptable for protecting receptors outside the Project area. This assessment focused on potential emissions during Project construction. Construction emissions are likely to be short term (approximately three years) and will frequently advance along the Project corridor (i.e., non-stationary).

For the construction phase, ambient air concentrations for all CACs were predicted using the worst case scenario and the most conservative air dispersion model (Section 7.2.2.5 of the EAC Application describes the model). Results show that emissions from the originally proposed Project are expected to meet the Canada-wide Standards and BC ambient air quality objectives for ambient SO_2, NO_2, CO, and $PM_{2.5}$ and PM_{10} emissions during the construction phase for the worst case emissions scenario. The Bell-Irving route will not alter these results as the model was not location specific. Further, implementing BMPs will considerably reduce emissions.

Classification of potential residual effects was based upon the expected effectiveness of the mitigation measures described above. During the short-term construction phase, an increase in ambient CACs concentrations will occur but the concentrations will not exceed the Canada-wide Standards and BC ambient air quality objectives at or beyond the 5-km study boundary. The duration and frequency of the potential effect is short term. Implementing mitigative measures and sound environmental management programs will minimize potential air quality effects. Therefore, the significance of the potential residual adverse effect of the Project on air quality is not likely significant.

Likelihood

The original EAC Application determined that the probability of air contaminants being emitted during the construction phase for the Project was high, while the confidence level was considered intermediate. This remains true using the Bell-Irving route because the air quality dispersion model developed for estimating ambient air contaminant concentrations was not location specific.

To generate the ambient air quality model, several assumptions were made regarding the input parameters such as specific diesel-powered mobile equipment that will be used, and other sources of

air emissions included in the air emissions inventory. Although the assumptions were based on industry practice, these uncertainties are consistent with the confidence level associated with a screening level air dispersion modeling assessment.

6.10 SURFACE WATER AND GROUNDWATER RESOURCES

6.10.1 Environmental Setting

6.10.1.1 Surface Water

The Bell-Irving route is along the Nass and Bell-Irving rivers, and comprises three route areas for the purposes of evaluation and discussion regarding surface water and groundwater resources. Route Area 1 extends in the south from the Orenda forest service road (FSR) to the Nass River; Route Area 2 extends from the Nass River to the Bell-Irving River, and Route Area 3 extends from the Bell-Irving River to Highway 37. The proposed transmission line will cross 82 streams along the three route areas (Table 6.10-1, Figure 6.10-1). Although the transmission line will cross the Bell-Irving River and the Nass River, the majority of the crossings are of low order (1st order) streams. Generally the stream crossing watersheds are well forested (see Section 6.6) and range in area from less than 1 ha to more than 1,000,000 ha.

Stream crossings were identified within a Geographic Information System (GIS) based on the proposed transmission centre line and a stream layer provided by the Gitanyow First Nations in April 2010. Stream crossings identified during fisheries field surveys (see Section 6.2 of this report) as non-classified drainages were not included as stream crossings in this assessment.

Table 6.10-1. Transmission Line Stream Crossings along the Bell-Irving Route

	Route Area		
Characteristic	**1**	**2**	**3**
Number of Stream Crossings [a]	34	24	24
Stream Order			
1 or 2	27	22	21
3 or 4	6	1	2
5 or 6	0	0	1
7 or 8	0	1	0
>8	1	0	0
Median Watershed Area (ha)	24.7	6.7	24.0
Range of Watershed Areas (ha)	0.2–1,187,082	0.8–513,648	3.3–7,717

[a] *- Non-classified streams identified during fisheries assessment are not included in the stream crossing inventory.*

The hydrologic response of watersheds along the route is dominated by snowmelt during the spring freshet, which typically commences in April with peak flows occurring in May or June. Following freshet peak flows, runoff decreases to a summer low flow period in August and early September. From mid-September through mid-October, high flow events are common because of fall storms. The winter low flow period generally starts in October or November as air temperatures drop towards freezing and precipitation begins to occur as snow rather than rain and is stored as snowpack. Additional discussion on the hydrologic regime along the proposed ROW is provided in Section 7.3 and Appendix 7.3-1 of the EAC Application.

480000 490000 500000 510000

6240000 6230000 6220000 6210000 6200000

N

Bell - Irving River

37

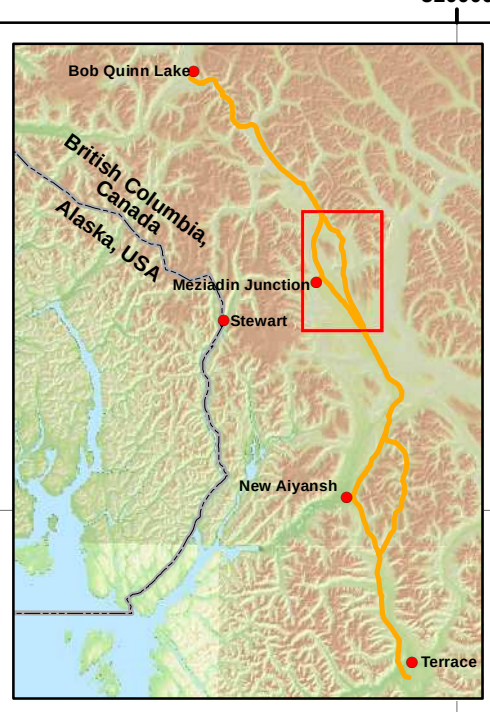
37A

Meziadin Lake Provincial Park

Meziadin Lake

Moore Creek

Nass River



- Stream Crossing
- Stream Crossing Watershed
- Identified Sections of Highway 37
- Bell-Irving Route
- Hanna Tintina Route
- Paved Road
- Rough / Gravel Road
- 100 m Contour
- Wetlands
- Permanent Ice/Snow

1:150,000

0 2.5 5

Kilometres

Projection: UTM9, NAD83

BC hydro

Proposed Bell-Irving Route Surface Hydrology Effects Assessment

FIGURE 6.10-1

Rescan™

There are no licensed surface water points of diversion along the Bell-Irving route ROW and the route does not cross any watershed listed in the provincial community watersheds database.

Comparison of the identified transmission line stream crossings to Highway 37 within GIS at a 1:150,000 scale indicated that approximately 15 km of the ROW within Route Area 1 and 5 km of the ROW within Route Area 3 will be upstream of existing drainage structures along Highway 37.

6.10.1.2 Groundwater

The majority (70%) of the Bell-Irving Route is on morainal materials, which are typically medium to coarse textured, and include sands with a varying content of silt and fine sand. They generally occur on the moderately sloping topography in the area. Other surficial deposits along the route include colluvial, fluvial, and glaciofluvial material as well as bedrock, organics, and veneers. The surficial materials along the route are presented in more detail in Section 6.5.

The inferred direction of groundwater flow in the area is towards the Nass and Bell-Irving Rivers, following local topography.

There are no provincially registered groundwater wells or aquifers along the proposed Bell-Irving route.

6.10.2 Spatial and Temporal Boundaries

6.10.2.1 Surface Water Hydrology

Spatial Boundaries

The baseline and effects assessment boundaries include all streams and rivers crossed by the proposed Bell-Irving route. The primary assessment of effects to surface water hydrology is conducted at locations of maximum potential effect, which will be immediately downstream of stream crossings along the proposed Bell-Irving route. The assessment also considers additional points of interest near the proposed route but outside the immediate Project corridor, including existing Highway 37 drainage structures (bridges, culverts, and ditches) on streams crossed upstream by the proposed route.

The transmission line stream crossing assessment points are considered to be at a local scale. The existing Highway 37 drainage structures are considered to be landscape scale assessment locations because they are outside the immediate ROW footprint.

Temporal Boundaries

Consistent with temporal boundaries applied in the EAC Application, potential effects on surface water quantity are assessed for the construction and restoration as well as the operations and maintenance phases of Project implementation.

6.10.2.2 Groundwater

Spatial Boundaries

Spatial boundaries for the assessment of effects to groundwater along the Bell-Irving route are consistent with those used in the EAC Application. The EAC Application focused on effects on the areas surrounding proposed new substation sites, the existing Skeena Substation, as well as seven potential construction camp locations. The focus was on these locations as the effects to groundwater from construction and operations, as well as maintenance of the transmission line are considered to be inconsequential, with the potential exception of the highlighted infrastructure and activities.

Registered groundwater wells within 1,000 m of the proposed Bell-Irving route were investigated for consideration within the assessment. However, none were found to exist within the provincial database.

Temporal Boundaries

Consistent with temporal boundaries applied in the EAC Application, potential effects on surface water quantity are assessed for the construction and restoration as well as the operations and maintenance phases of Project implementation.

6.10.3 Issues Scoping

6.10.3.1 Surface Hydrology

Potential adverse effects to surface hydrology could include changes to the amount, timing, and distribution of overland runoff conveyed in surface watercourses (i.e., streams, creeks, and rivers). In general, development projects can have direct effects on surface hydrology via water intakes and discharge; placement of in-stream and near-stream structures, and watercourse diversion. Surface hydrology can also be indirectly affected by changes to watershed characteristics such as land use and vegetative cover.

There are no proposed permanent water intakes or discharges related to the Project, nor are there any proposed permanent watercourse diversions. Short-term and localized stream diversions are not anticipated, but could possibly be necessary for access road improvements or construction. Constructing roads and removing forests could affect surface hydrology along the proposed route and create pathways for effects on other aspects of the biophysical environment such as fisheries and aquatics resources and baseline sedimentation/erosion patterns. In addition, potential alteration of surface hydrology could lead to direct effects on watercourse infrastructure along the Bell-Irving Route. Therefore, the principal issue to be addressed in responding to concerns in relation to surface water hydrology is alteration of land cover.

Forest cover along the proposed transmission corridor will be converted to lower lying shrub and/or grass cover. Soils may be compacted during access road and transmission line construction, thereby changing the hydrologic properties of the affected sites. Vegetation has a considerable role in watershed hydrology by affecting surface water runoff rates, infiltration, evapo-transpiration, temperature, snow accumulation, and snowmelt. Changes to the amount and type of vegetative cover within a watershed can lead to changes in annual runoff, peak flow rates, and discharge during low flow periods. Therefore, the principal issue to be addressed in responding to concerns in relation to surface water hydrology is alteration of land cover.

6.10.3.2 Groundwater

It is anticipated that the groundwater flow regime along the Bell-Irving route will not be affected by the construction, maintenance, and operation of the Project and its components. The proposed transmission facilities will not require groundwater supply wells, temporary or permanent dewatering wells, or waste disposal in the subsurface.

Groundwater quantity near the Project's sustained and temporary components could be affected by changes in groundwater recharge. Potential effects to recharge may be caused by removing surface vegetation and/or diverting surface water runoff, streams, and creeks. Additionally, changes to stream and creek flow rates may also affect groundwater recharge and discharge rates. However, these changes are expected to be of negligible magnitude and generally undetectable.

It is unlikely that there will be any principal issues to be addressed with respect to groundwater quantity.

6.10.4 Valued Environmental Components

6.10.4.1 Surface Water Hydrology

Surface water hydrology is a critical component of the biophysical environment because of its role in supporting aquatic and terrestrial life and providing transport for nutrients, energy, and sediment. In addition, the British Columbia Ministry of Transportation and Infrastructure (BC MOTI) has expressed concerns about the design capacity of highway drainage structures downstream of the proposed route and the potential for increased flood magnitudes and frequency as a result of Project development. Therefore, surface water hydrology in these areas is an important aspect of the human environment and requires consideration as a VEC in this effects assessment.

6.10.4.2 Groundwater

Groundwater discharge into streams can be a considerable source of total stream flow. Therefore, changes in groundwater discharge rate can adversely affect overall stream flow rate.

6.10.5 Identification of Potential Effects and Mitigation

6.10.5.1 Surface Water Hydrology

Construction and Restoration

Constructing the proposed transmission line will require vegetation clearing along the proposed ROW for constructing transmission structures, substations, temporary and permanent access roads, laydown areas and construction camps. Because of soil compaction, vegetation removal, and reduction of surface depressions that naturally act to increase infiltration and retard surface water runoff, grading and site-clearing activities could affect local runoff conditions.

The potential effects of land cover alterations associated with the proposed ROW and new retained access roads will persist beyond the construction and restoration phase. The effects may continue over longer time periods and are therefore discussed in the following section that relate to the Project's operations and maintenance phase.

Potential effects resulting from land disturbance during the active construction and restoration phase will be mitigated by minimizing disturbed areas and implementing standard best management practices. Residual adverse effects on surface hydrology are not likely.

Operations and Maintenance

During the operations and maintenance phase, the sustained change in land cover along the proposed ROW and new access roads could lead to a change in watershed runoff conditions. Vegetation plays a considerable role in watershed hydrology by affecting surface runoff rates, infiltration, evapo-transpiration, temperature, snow accumulation, and snowmelt. Changes to the amount and type of vegetative cover within a watershed can lead to changes in annual runoff, peak flow rates, and discharge during low flow periods. Additional detail on the relationship between altered vegetation cover and hydrologic response is provided in Sections 7.3.5.1 of the EAC Application.

Currently, land cover along the proposed Bell-Irving Route consists primarily of forested areas (Section 6.6) although some of the forests are younger areas of re-growth (approximately 35%) from previous

forestry activities. Following construction, the forested areas along the maintained ROW will be replaced mostly by a mixture of grass species and smaller shrub species. ROW vegetation height will be maintained to ensure appropriate clearances from the ground to the transmission line for safety and reliability during operations.

The degree of land alteration will be reduced as much as practical by establishing and maintaining low-growing stable plant communities in the ROW in accordance with BC Hydro's Vegetation Management Standard: Site Objectives (Chapter 11) and by managing the number of new access roads constructed. However, some residual effects to surface hydrology are likely. The primary Project component that is likely to result in residual adverse effect on surface hydrology through altered land cover is the proposed transmission line ROW. A screening level assessment for specific sites along the Bell-Irving Route that could have residual effects to surface hydrology was completed following the same rationale used for the original NTL route as outlined in Section 7.3.5.1 of the EAC Application.

Although altered land cover will occur at new permanent roads outside the proposed ROW, the limited footprint of these components, it is not likely to result in a residual effect on surface hydrology. Also BC Hydro intends to use existing roads as much as possible for access, thereby limiting the number areas that have to be completely cleared for new access roads.

Stream Crossing Watersheds

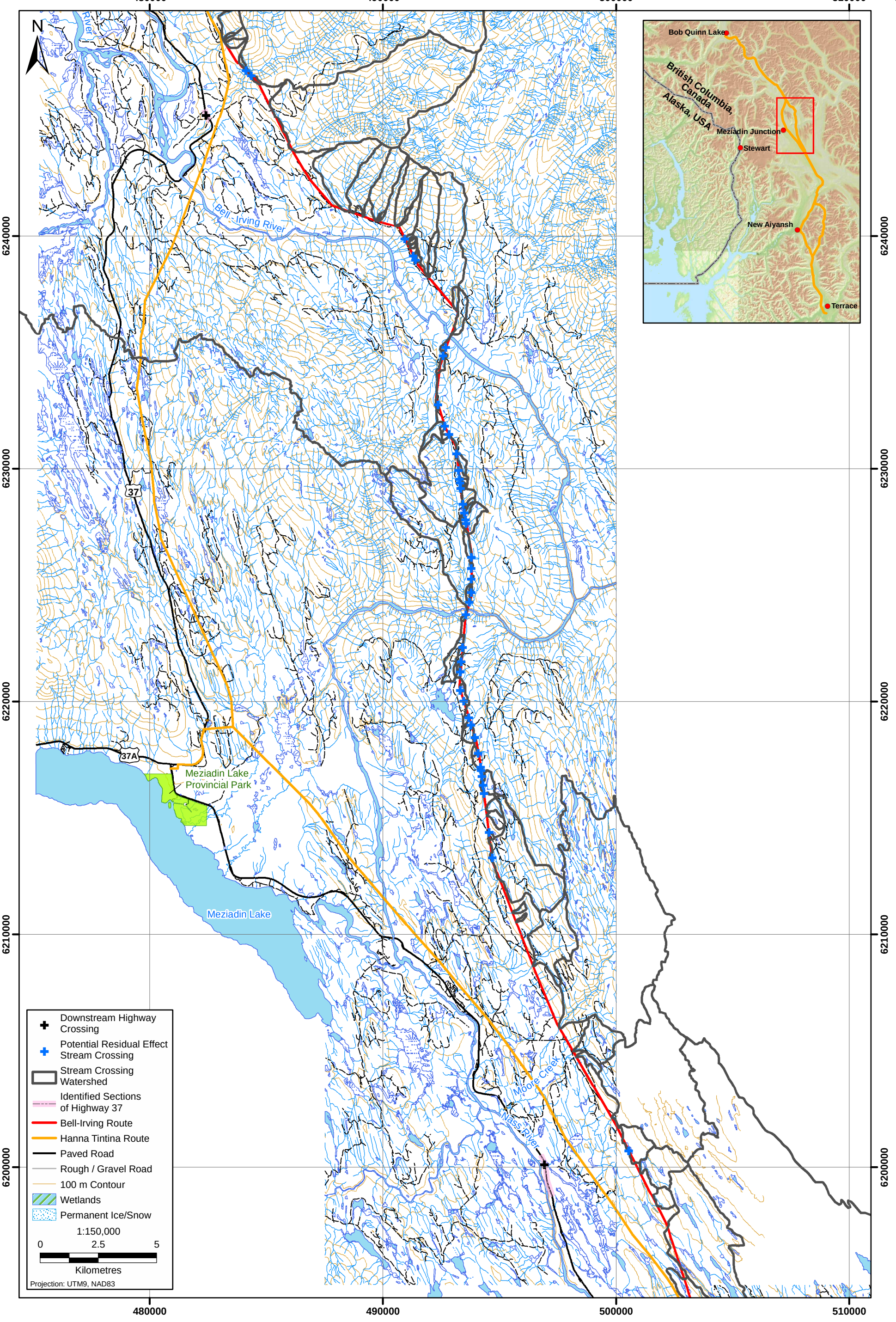
A conservative screening threshold of 4% change in vegetation cover within a stream crossing watershed was used to identify where residual effects to surface hydrology may be likely (Table 6.10-2). Watersheds that will be affected by less than 4% are unlikely to result in residual adverse effects and were not assessed in the final effects assessment. Watersheds that will be affected by more than 4% could have marginal residual effects and were assessed in the final effects assessment.

Table 6.10-2. Summary of Potentially Affected Areas of Bell-Irving Route Stream Crossing Watersheds

Assessment Variable	Route Area		
	1	2	3
Number of Stream Crossings	34	24	24
Average Affected Area of Watershed (%)	4.5	8.2	1.8
Range of Affected Area of Watershed (%)	<0.1–83.3	0.2–74.5	0.1–52.0
Number of Watersheds with Affected Areas >4%	18	19	5

A conservative width of initial ROW clearing (80 m) was used to calculate the potential affected areas for each transmission line stream crossing watershed. This was considered a conservatively high value of cleared area because there will be sections of the proposed routes that will not require the full 80-m clearing (i.e., portions of the ROW that will parallel existing transmission ROWs, areas with no hazard trees). In addition, following construction of the transmission line, the width of the new ROW maintained with low growing vegetation will be approximately 38 m.

Of the 82 streams crossed along the proposed route, 42 will experience land clearing over 4% of the total watershed area (Figure 6.10-2). Residual adverse effects to surface hydrology from Project development are likely in these 42 watersheds.



BC hydro

Proposed Bell-Irving Route Stream Crossing Watersheds with Potential Residual Effects on Surface Hydrology

FIGURE 6.10-2

Rescan™

Existing Highway Drainage Structures

The screening for residual effects at existing highway drainage structures was based on whether residual adverse effects were expected at upstream proposed transmission stream crossings. If residual effects at transmission stream crossings upstream of Highway 37 were unlikely, it was assumed that residual effects will also be unlikely at downstream existing highway drainage structures.

Of the 42 stream crossing watersheds where marginal residual adverse effects are likely on surface hydrology as a result of the proposed Project, three are upstream of Highway 37 stream crossings and drainage structures (Figure 6.10-2). Two of the transmission line stream crossings confluence before crossing Highway 37. Therefore, two highway stream crossings were examined for potential residual effects.

Watershed areas were delineated for the two highway stream crossings and the percent area affected by the transmission corridor was calculated (Table 6.10-3). Neither of the two highway stream crossings have watershed areas that will be affected by greater than 4%; thus, residual adverse effects are unlikely at all existing Highway 37 stream crossings downstream of the proposed Bell-Irving route.

Table 6.10-3. Summary of Potentially Affected Areas of Highway 37 Stream Crossing Watersheds

Route Area	Transmission Corridor Stream Crossing ID	Watershed Area of Downstream Highway Stream Crossing (ha)	Affected Area (ha)	Affected Area (% of Watershed Area)
1	8011	3,786	43.5	<0.1
3	NGT-5, NGT-7	8,056	15.5	<0.1

6.10.5.2 Groundwater

Construction and Restoration

Potential adverse effects on groundwater quantity during the Project's construction and restoration phase will be very limited in spatial extent. These limited potential effects could result from changes made to the local topography during road building, structure site preparation and grading of sites for camps, and temporary work areas or laydown sites that will affect surface runoff and hence recharge rates to groundwater in a localized area. Natural soils will be disturbed, replaced, reworked, or compacted, which could also have a minor effect on the local groundwater recharge rate. Few mitigation methods can be applied to these practices. However, such effects are expected to be localized and not large enough to be detectible.

The majority of excavations for foundations will use a common engineering design, and be less than 2 m in depth and less than 2 m^2 in area. As these excavations are shallow, no residual adverse effects on groundwater are likely. The exceptions to the generic structure sites involve a small number of locations that may require potential installation of specialized structures (e.g., Skeena River crossing; larger structures at major river crossings such as the Nass River and Bell-Irving River along the Bell-Irving route). Any resulting residual adverse effects are anticipated to be negligible.

High groundwater levels may be encountered in association with several soil and terrain types, and in areas indicated by specific vegetation types. Section 6.5 of this report identifies soil drainage class descriptions for poorly drained and very poorly drained soils, which are saturated for much or all of the year. Sites along the route identified to have these drainage characteristics are listed in Appendix 6.5-1. Organic-rich and saturated soil presence is evaluated at the site-level as an input to final engineering of roads and structure placement.

Potential adverse effects of high groundwater levels encountered during road or foundation excavation will be controlled by construction of temporary sumps and pumping or by installation of ditches or

drains. Roads will be designed with suitable ditches, drains or granular filters to intercept and control both shallow groundwater seepage and surface runoff. These practices will ensure that water quality will be maintained where site conditions result in water re-entering surface streams. Foundation designs will be developed, which will be suitable for the likely materials, or groundwater levels to be encountered. No residual adverse effects are likely.

Operations and Maintenance

The operations and maintenance phase is not expected to result in soil compaction, modification of landforms, or other activities that will affect recharge rate of water into the groundwater aquifer. These activities will also not require measurable demand on groundwater resources supplied by wells. Therefore, adverse effects caused by the operations and maintenance of the Project on groundwater quantity are not likely.

6.10.6 Potential Residual Effects and Significance

6.10.6.1 Surface Water Hydrology

Construction and Restoration Phase

Residual adverse effects to surface hydrology are likely from the sustained alteration to land cover that will occur initially during the construction and restoration phase. However, these effects will occur over a long period; therefore, they are fully assessed under the operations and maintenance phase. No other residual effects are likely to surface water hydrology during the construction and restoration phase.

Operations and Maintenance Phase

Residual adverse effects are likely on surface water hydrology for 42 streams crossed along the proposed Bell-Irving route because of the percentage of the area of the stream crossing watersheds that will be cleared for the transmission line ROW or for new sustained access roads. The significance of these residual effects is assessed following the methodology applied in the EAC Application and summarized in Chapter 5 of this report. Definitions of descriptors used in the assessment of surface hydrology are generally consistent with those applied to the surface water hydrology effects assessment in Chapter 7.3 of the EAC Application.

Magnitude of Residual Effects

The magnitude of appreciable residual surface water hydrology effects were classified as low, moderate, and high. A category for negligible magnitude was not included, as all assessment locations that were not expected to have detectable adverse effects were not considered to have likely residual adverse effects and therefore were not carried forward to the final assessment stage. The low, moderate, and high categories were set based on the percent of area assumed to be cleared for the transmission line ROW and related to maximum equivalent clear-cut areas (ECA) specified in resource management plans (BC ILMB 2006 and 2009) established for the region. It is a common index used to set thresholds for a maximum clear-cut allowed to maintain hydrological integrity. From the regional land use plans, the lowest ECA allowed for any of the watersheds of interest listed in the respective plans was 20% of either fourth order watersheds (assumed to be based on 1:50,000 scale mapping) and higher, or watersheds of more than 250 ha in size. Thus, ECA value and watershed size were used as the criteria to establish the three magnitude categories (Table 6.10-4). Additional information on the relationship between change in vegetation cover and expected change in hydrological parameters (i.e., annual runoff, peak flows, and low flow) is provided in Section 7.3.6.1 of the EAC Application.

Table 6.10-4. Magnitude Definitions Used for Surface Hydrology Residual Effects Assessment

Magnitude	Definition
Low	Affected area of watershed greater than 4% of watershed area, but less than 20%
Moderate	Affected area of watershed greater than 20% of watershed area for 1st to 3rd order watersheds smaller than 250 ha in size
High	Affected area of watershed greater than 20% of watershed area for 4th order watersheds or higher, or greater than 250 ha in area

Using the definitions for magnitude outlined in Table 6.10-4, of the watersheds that were identified for the residual adverse effects assessment 26 are expected to experience low magnitude residual effects, 16 are expected to experience moderate magnitude residual effects, and none are expected to experience high magnitude residual effects (Table 6.10-5). Of the 16 watersheds expected to experience moderate magnitude residual adverse effects, none are larger than 15 ha in size.

Table 6.10-5. Magnitude of Residual Surface Hydrology Effects along the Bell-Irving Route

Route Area	Stream Crossing ID	Watershed Area (ha)	Watershed Order [a]	Affected Area (% of Watershed Area)	Magnitude of Residual Effect
Transmission Corridor Stream Crossings					
1	60	3.5	1	22.8	Moderate
	62	19.6	1	14.9	Low
	63	4.0	1	12.8	Low
	64	4.0	1	24.5	Moderate
	65	5.4	1	17.4	Low
	66	4.0	1	15.2	Low
	67	6.6	1	4.6	Low
	68	29.9	2	7.7	Low
	69	1.9	1	38.8	Moderate
	70	8.1	1	4.4	Low
	71	4.3	1	42.7	Moderate
	72	2.9	1	28.1	Moderate
	73	3.6	1	50.9	Moderate
	74	0.2	1	83.3	Moderate
	75	44.9	2	8.1	Low
	78	6.1	1	40.8	Moderate
	79	0.8	1	47.4	Moderate
	8011	138.5	2	6.1	Low
2	37	3.4	1	21.2	Moderate
	38	14.7	1	38.0	Moderate
	39	1.2	1	50.5	Moderate
	41	3.8	1	5.2	Low
	43	693.7	4	4.8	Low
	44	19.9	1	6.8	Low
	45	7.9	1	16.0	Low
	46	5.0	1	4.3	Low
	47	3.1	1	5.8	Low
	48	1.8	1	11.5	Low
	49	27.8	2	7.2	Low

(continued)

Table 6.10-5. Magnitude of Residual Surface Hydrology Effects along the Bell-Irving Route (completed)

Route Area	Stream Crossing ID	Watershed Area (ha)	Watershed Order [a]	Affected Area (% of Watershed Area)	Magnitude of Residual Effect
	52	73.6	2	9.3	Low
	53	2.8	1	11.8	Low
	54	3.6	1	6.8	Low
	55	24.1	1	17.6	Low
	56	2.3	1	74.5	Moderate
	57	0.8	1	56.0	Moderate
	58	2.8	1	65.9	Moderate
	59	10.9	1	13.2	Low
3	5	8.8	1	10.2	Low
	7	7.0	1	52.0	Moderate
	23	4.5	1	4.4	Low
	26	3.3	1	6.2	Low
	27	5.8	1	5.7	Low

[a] *- Watershed order based on stream order data in the BC Freshwater Atlas (GeoBC 2009).*

Extent of Residual Effect

The only assessment locations that could experience residual adverse effects are streams that cross the proposed corridor. The scale of potential residual effect for these locations is assessed as local. For the Highway 37 stream crossings that could experience residual effects, the assessment of the effects was considered to be at landscape scale because they exist outside the immediate Project footprint.

Any changes to surface water hydrology will diminish with increasing distance downstream from the corridor as stream flow confluences with other unaffected water courses.

Duration of Residual Effect

Residual adverse effects on surface water hydrology will occur as a result of sustained alteration to land cover along the maintained ROW. Any changes in water runoff characteristics in the affected watersheds will be similar temporally. Therefore, the effects will persist throughout the operations and maintenance phase, which is assumed to extend into the future (i.e., more than 50 years).

Frequency of Residual Effect

The residual adverse effects on surface water hydrology will be continuous.

Reversibility of Residual Effect

Residual adverse effects on surface water hydrology will be reversed if the vegetation along the proposed transmission corridor were allowed to return to pre-Project conditions. Within the life of the Project, such a reversal is expected for areas of one-time hazard tree removal outside the ROW, which is roughly 30% of the total area. This will gradually occur over a period of 10 or more years; therefore, the effects are considered to be reversible over the long term.

Resilience of Residual Effect

Surface water hydrology is considered to have a relatively high resilience to the potential adverse effects from the proposed Project. This is reflected in the literature (see Section 7.3.6.1 for discussion on magnitude of potential effects) where a relatively large change in watershed land cover is necessary to result in detectable changes in the stream flows. Because of the coastal region's humid

environment, watersheds in this region are more resilient to change than drier interior areas. The Bell-Irving route is within a transition zone between the two areas.

Significance of Residual Effect

Considering primarily the magnitude and extent of the residual adverse effects on surface water hydrology, the potential residual effects are considered to be not significant. The Bell-Irving route will be approximately 60 km long; its effect on surface hydrology will be divided into 82 separate local watersheds, such that the effect at any specific stream crossing is not likely to be significant. In addition, because potential residual effects will be primarily at a local scale and will diminish with distance downstream from the route, the collective effect on the watersheds is also anticipated to be not significant.

Likelihood of Residual Effects

The probability of residual adverse effects on surface water hydrology for any given assessment point depends on the magnitude of land cover alteration within any specific watershed area. For the assessment locations that are considered to have a low magnitude, the probability of residual effects is medium; that is, a detectable change to surface hydrology may occur. There is greater probability for detectable effects to occur for assessment locations that were considered to have a moderate magnitude. For these locations, the probability of residual effects is high.

There is a substantial body of research about land alteration effects on surface water hydrology primarily related to the forestry industry; this was incorporated and considered in this effects assessment. However, the total spatial extent of the Project is over such a large and varied geographical area that there may be a dramatic difference in the hydrological response between individual affected watersheds. Therefore, the confidence of this assessment is considered to be intermediate.

6.10.6.2 Groundwater

Construction and Restoration

It is anticipated that any changes to the groundwater flow regime caused by the Project along the Bell-Irving route will be temporary, localized, and minor. As a result, the anticipated magnitude of any residual effects on groundwater quantity is expected to be low and highly localized to the vicinity of the construction sites. These residual effects not likely be significant.

Operations and Maintenance

It is not anticipated that there will be residual adverse effects caused by the operations and maintenance programs with respect to groundwater quantity.

Effects on groundwater quality from operations and maintenance will be limited to accidents and spills. Response plans will be put in place by BC Hydro to ensure that spills are addressed immediately. With proper spill management, the effects will be spatially limited and not significant. Effects from the use of herbicide, or other similar products, are not considered likely. More detail on accidents and malfunctions can be found in Chapter 13 of the EAC Application.

6.11 LAND AND RESOURCE USE

Potential Land and Resource effects are assessed in detail in Section 7.11 of the EAC Application. In the EAC Application, the land and resource effects are generally assessed for the entire Project rather than specific routes or segments and it is anticipated that most potential effects identified previously, will

also be applicable to the Bell-Irving route. The intent of the Bell-Irving route alternative is to reduce potential environmental, socio-economic, Land and Resource Management and Traditional Use effects identified with the more sensitive Hanna-Tintina area. Where any differences specific to the Bell-Irving route are noted, they are addressed in detail in this section.

6.11.1 Environmental Setting

Potential land and resource effects are assessed in this section and Section 7.11 of the EAC Application. The land and resource effects are generally assessed for the entire Project but also specific routes or segments as needed. Thus, the potential effects identified previously, will also be applicable to the Bell-Irving route, but on a proportionate basis. As a measure of the proportionate difference, if one considers the relative difference of the NTL assessed in the EAC Application with the proposed Bell-Irving route versus prior assessed route; the difference is < 2%.

The proposed Bell-Irving route crosses through a remote, but relatively accessible region east of the Highway 37 corridor and Meziadin Lake. It is an area of upland terrain drained by two large river systems; the Nass and the Bell-Irving (a tributary of the Nass River). The area experiences low levels of backcountry recreation, commercial guide outfitter, trapping, hunting and traditional use; there are no private land tenures, although the entire region is part of the Nass Area and the southern portion a part of the Nass Wildlife Area, areas which are defined in the Nisga'a Final Agreement.

In general the area south of the Nass River contains poor quality, old, hemlock and amabilis balsam forest. North of the Nass River the forests can be described as very poor quality, over mature hemlock and interior balsam stands.

The proposed Bell-Irving route right of way (ROW) overlaps a large amount of harvested cutblocks, therefore the impact to old forests and undisturbed ecosystems is limited to the unharvested areas between cutblocks known as leave strips. There are currently two forest companies operating along the proposed Bell-Irving route; Canada Resurgence Developments (FL A16884) and BC Timber Sales. Both of these organizations have overlapping proposed and permitted cutblocks with the proposed Bell-Irving route

6.11.2 Spatial and Temporal Boundaries

6.11.2.1 Spatial Boundaries

The land and resource use effects assessment focuses on a study area defined as 1 km on either side of the proposed Bell-Irving route. The spatial scope of the database varies; for example the landusers referred to exhibit patterns of use throughout the region for many km surrounding the proposed Bell-Irving route between the Ellswoth Camp and Bell 1 crossing areas; the spatial scope of the forestry assessment for detailed analysis is the proposed ROW clearing, but extends to the TSA for broader effects assessment. The 2 km wide land and resource study area for the effects assessment is consistent with boundary assessed in the EAC Application (Section 7.11.1). Figure 6.11-1 presents the Bell-Irving route study area.

6.11.2.2 Temporal Boundaries

This assessment considers two distinct temporal phases of development:

1. Construction and restoration (3 years).
2. Operations and maintenance (>50 years).

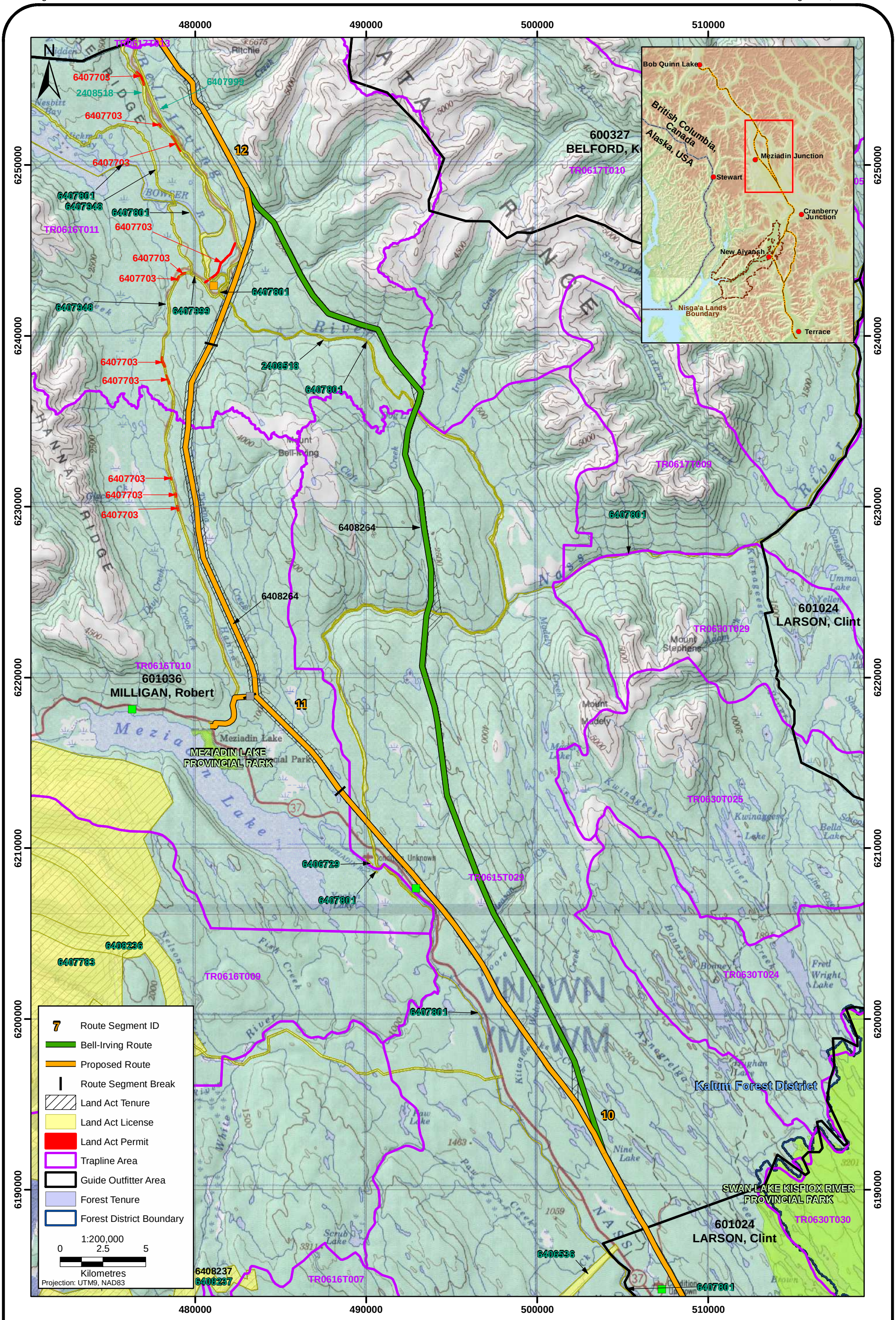


FIGURE 6.11-1

Land and Resource Study Area of Bell-Irving Route

Additional details regarding Project activities for these two phases are presented in Chapter 4 of the EAC Application.

6.11.3 Issues Scoping

Issues scoping specific to land and resource use has considered the outcomes of public, government, Nisga'a Nation, and First Nations consultation; traditional use and knowledge studies; input from the working group; and comments received from the public review of the EAC Application as well as the content of the *Proposed Northwest Transmission Line Project Hanna-Tintina Route Alternatives Evaluation Report* (Gitanyow Hereditary Chiefs Office, BC Hydro, and Rescan 2010) and comment on this report by the EAO Technical Working Group.

Some of the common concerns raised during the issue identification process were:

- **Forestry**: a major economic driver in the region. Potential adverse and beneficial effects on the forestry sector are a concern for many local residents and businesses.
- **Access**: various concerns were expressed by all groups (public, government, Aboriginal) that new and improved roads and ROW for the proposed Project will create increased access to, and use of, remote areas. Concerns were primarily related to indirect effects of access, including potential adverse effects on wildlife from increased hunting.
- **Aboriginal land use and values**: Aboriginal groups have stated the importance of lands and resources for both economic and cultural purposes, including hunting, fishing, and plant harvests. These resources and activities are often tied to a sense of cultural identity, and are actively pursued by many Aboriginal residents. The Gitanyow Hereditary Chiefs, and Nisga'a Nation have also requested that their land use planning efforts be considered on par with other regional and sustainable resource land and resource management plans.

The principal issues related to land and resource use include: access, altering land cover, site contamination, sensory disturbance, economic development, and Aboriginal interests. The relationships between identified concerns, principal issues, and the selection of VECs, necessary for the analysis of potential effects are detailed in Table 6.11-1 (sourced from Table 7.11-8 of the EAC Application).

6.11.4 Valued Environmental Components

The Land Use VECs for this assessment are presented in Table 6.11-2 and are consistent with those assessed in the EAC Application. For detailed rationale on the VEC selection see Section 7.11.4 of the EAC Application.

6.11.5 Identification of Potential Effects and Mitigation

6.11.5.1 Construction and Restoration

VEC: Access

During the construction and restoration phase, Project activities could temporarily inhibit access to certain known land use areas, such as parks and protected areas, recreation areas, and areas currently undergoing mineral and/or coal exploration. Access to roads addressed in Section 6.15 and access to forestry tenures and operations is addressed under the Forestry VEC.

Table 6.11-1. Land and Resource Use Issues of Concern Identified through Consultation

Concern Identified	From	Principal Issue	VEC (or EA section)
Need to ensure continued use of traditional territories, for economic, cultural, and sustenance purposes.	Aboriginal Groups	Aboriginal Interests	Chapter 9 (Nisga'a Nation Considerations) and Chapter 10 (First Nations Considerations)
Need to consider the value of the land as an economic provider for First Nations Aboriginal Groups, including food, medicines, forestry, etc.	Aboriginal Groups	Aboriginal Interests	Chapter 9 (Nisga'a Nation Considerations) and Chapter 10 (First Nations Considerations)
Concern that the availability of wildlife, fish, and other harvests will be affected.	Aboriginal Groups	Aboriginal Interests	Chapter 9 (Nisga'a Nation Considerations) and Chapter 10 (First Nations Considerations); Environmental Quality
Need to consider how the Project will infringe on asserted Aboriginal rights and title.	Aboriginal Groups	Aboriginal Interests	See commentary below and Chapter 2 and Chapter 10.
Concern that herbicides will be used to manage the right-of-way.	Aboriginal Groups	Site Contamination	Quality of Land Use Activities Section 7.8: Terrestrial Ecosystems and Vegetation; Section 7.14: Human Health
Concern that quality and quantity of country foods will decrease.	Aboriginal Groups	Aboriginal Interests	Quality of Land Use Activities Section 7.14: Human Health
Concern about potential effects on trapping.	Aboriginal Groups	Aboriginal Interests	Access; Quality of Land Use Activities
Need to consider cultural values of lands and resources.	Aboriginal Groups	Aboriginal Interests	Chapter 9 (Nisga'a Nation Considerations) and Chapter 10 (First Nations Considerations)
Concern about compensation for loss of land, fish, wildlife, etc. in short-term and long-term.	Aboriginal Groups	Aboriginal Interests	Chapter 9 (Nisga'a Nation Considerations) and Chapter 10 (First Nations Considerations)
Concern that cultural and heritage features, including trails and camps, may be affected.	Aboriginal Groups	Aboriginal Interests	Chapter 9 (Nisga'a Nation Considerations) and Chapter 10 (First Nations Considerations)
Concern that opportunities for recreation may be affected.	Public, government	Access, Sensory Disturbance	Access, Quality of Land Use Activities
Concern that land use activities based under the proposed transmission line will result in health effects related to EMF exposure.	Aboriginal Groups	Sensory Disturbance	Quality of Land Use Activities; Section 7.14: Human Health

Table 6.11-2. Land and Resource Use VECs

VEC	Description
Access	Ease of access to land use activities is valued for existing activities, but a strong desire to limit new access to undisturbed areas is also recognized.
Quality of Land Use Activities	The quality of land use activities considers the ability of land users to appreciate or benefit from land use activities. This includes both qualitative (e.g., personal appreciation of viewscapes and soundscapes) and, where possible, quantitative (e.g., predicted decline in harvest volumes) considerations. Quantity of resources, wilderness areas, and pine mushroom harvesting are considered under this VEC.
Forestry	The forestry sector is highly valued in northwestern BC, and has faced considerable hardship in recent years. This VEC includes consideration of both support for this industry, and potential limitations of forest sector activities. Timber supply is considered under this VEC.
Nisga'a Nation and First Nations Land and Resource Use	The special importance of lands and resources to Aboriginal groups (for both economic and cultural purposes, including hunting, fishing, and plant harvests) is recognized, including the provisions of the Nisga'a Final Agreement with regard to land and resource use. Aboriginal land and resource values often overlap with those discussed for the broader region (including the other VECs).

Access to Parks, Protected Areas, and Recreation Sites

No parks or protected areas have been identified for the proposed Bell-Irving route. The route was specifically chosen to avoid the proposed Hanna-Tintina protected area, and is over 10 km east of the existing Meziadin Lake Provincial Park.

Access to Other Recreation Areas

The network of public and FSRs in the proposed Bell-Irving route area include the Windfall mainline commencing in the vicinity of Ellsworth Camp to the Nass River, and the Kotcho Mainline adjacent to the Bell Irving River east and southeast of the Bell 1 Highway 37 bridge. These main forestry access road systems are used by local and regional residents for recreation, including snowmobiling ATV-riding, hiking, hunting, fishing, and plant gathering. These roads will also be used during construction to facilitate the movement of equipment, supplies, and personnel between Terrace, construction camps, and work sites. Construction traffic and activities on and around these roads may cause temporary delays or minor inconvenience for forestry workers and recreational users of the area. Mitigation for these potential adverse effects is presented in Section 6.15 of this report and in Chapter 11 of the EAC Application. In order to minimize the need to build new access roads associated with construction of the proposed Bell-Irving ROW and mitigate for potential adverse effects to fish and wildlife, where practical the Project alignment will be designed to utilize existing forest service roads (FSRs), public roads and private roads for access and maintenance of the transmission line BC Hydro would cooperate with the BC MOE, the BC MOFR, and interested First Nations in the development and implementation of feasible and site-specific access control and management strategies in accordance with applicable legislation, permits, approvals, and ROW agreements, where necessary. Through the use of practical access and management strategies, increased access is not likely to result in a significant adverse indirect effect on other users at any stage of the Project. No potential residual effect is likely.

Access to Other Tenures

Few tenures overlap the proposed Bell-Irving route study area. Apart from forestry concerns discussed below under the section on the forestry VEC, specific effects/concerns were not identified, and/or information was not available, despite efforts to engage the tenure holders. This includes forestry, guide outfitting, trapping, and commercial recreation tenures. If concerns or issues are raised before and/or during construction, BC Hydro will work with tenure holders to reach an agreeable solution, which may

comprise elements of the communication and road-sharing considerations described in Section 6.15 and Chapter 11 of the EAC Application. No residual effect is likely.

VEC: Quality of Land Use Activities

Two quality-related aspects of the study area could be affected by Project activities during the construction and restoration phase of the proposed Bell-Irving route. First, the aesthetic quality of the environment may be affected by increased noise, dust, and other industrial by-products associated with construction. Second, harvesting activities could be indirectly affected by potential effects on fish (Section 6.2); vegetation (Section 6.6); and wildlife (Section 6.7), whereby either the abundance of these resources may be altered, or their health may be compromised.

Aesthetic Disturbance of Land Use Activities

Activities associated with the construction and restoration phase (including logging, earthworks, and use of heavy equipment) may decrease the aesthetic environmental quality for nearby land users and is addressed in Section 6.12. This may include an increase in noise and dust, and a general industrial presence that may conflict temporarily with the natural land use qualities often sought and valued by other land users, including recreationists, guide outfitters, and trapline holders along the proposed Bell-Irving route, thereby diminishing their appreciation of the natural environment.

The potential effects of noise and dust (including mitigation) on human health are assessed in Section 6.14. The potential adverse effects of noise and dust on land users in the area are related to the potential to temporarily diminish their appreciation of the natural environment. As such, a potential residual aesthetic effect is likely. Mitigation for noise and dust generated during the Project's construction phase is presented in Chapter 11 of the EAC Application. Although the construction and restoration activities will be transient in nature and noise and dust are expected to be short-lived, a potential aesthetic residual effect is likely.

Biophysical Disturbance of Subsistence Harvests

Subsistence harvests (e.g., wildlife, fish, berries, mushrooms, other plants) are common amongst Aboriginal residents of northwestern BC, as well as many non-Aboriginal residents, and often supplement household resources in times of economic hardship. The proposed Project's construction and restoration phase could affect subsistence harvests in two ways. The quality of harvests could be affected (e.g., through contamination, or decreased health of wildlife, etc.), as well as the quantity of resources available for harvest (e.g., through population change, or decreased biological productivity). Non-subsistence harvests (including guide outfitting, trapping, hunting, and commercial mushroom gathering) could experience similar effects to those described for subsistence harvests.

Potential Project-related effects on subsistence resources along the proposed Bell-Irving route are assessed in Section 6.2, 6.6, 6.7 and 6.14. Mitigation of these potential effects is also discussed in these sections and in Chapter 11 of the EAC Application. During construction and restoration, any potential adverse residual effects with respect to the quality or quantity of fish, wildlife, and berry harvests are likely to be not significant. Therefore, no residual effects are likely for fish, wildlife, and berry harvests, and the land user groups harvesting these resources.

Pine mushroom harvesting has been highlighted as a particular concern amongst both Aboriginal and non-Aboriginal communities, in large part because of the economic profits that can arise from the harvest and sale of pine mushrooms. Approximately1392 ha along the Bell-Irving route have been identified as probable pine mushroom habitat (Table 6.6-3). The potential effects of the Project on pine mushrooms are assessed in Section 6.6.6-2, where potential residual effects are reported to likely to be not significant. However, due to the geographic restrictions and economic importance of this

harvest, a potential residual effect on subsistence harvesting is likely. This may affect the following land user groups: Aboriginal groups, and commercial operators, and other residents who presently pick pine mushrooms in areas where the ROW will be constructed.

Physical Disturbance of the Agricultural Land Reserve

The proposed Bell-Irving route does not cross any Agricultural Land Reserve land, or land known to be used for agricultural purposes.

VEC: Forestry

The identified potential effects of the NTL Project on forestry activities in northwestern BC include:

- alterations to the existing timber harvesting land base and future timber harvest volumes
- impacts to constrained land base
- overlap and interactions with harvesting operations and permits
- impacts to the commitments of forest licensees made to the Crown or third parties
- competition for labour and equipment

Both beneficial and adverse effects on forest industry economics could result from Project activities.

The forest resource values associated with the proposed Bell-Irving route of the NTL were assessed by ForTech Consulting (2010).

Scope of Forestry Resource Assessment for the proposed Bell-Irving Route

The forestry resource assessment study area is defined as all lands within the approximate maximum clearing width (80m wide) of the proposed NTL alignment along the proposed Bell-Irving route. The route is generally described as; following the Windfall Mainline commencing in the vicinity of Ellsworth Camp to the Nass River, then north of the Nass River, proceeding along the Kotcho Mainline adjacent and west of the Bell Irving River and then crossing the Bell-Irving River east of Bell 1 Bridge, progressing along the Irving Mainline northeast of the Bell-Irving River to the NTL route north of the Bell 1 Highway 37 bridge as shown in Figure 6.11-1.

The scope of the forestry resource assessment undertaken for the proposed Bell-Irving route entailed:

- Estimation of the total area (ha) of the proposed Bell-Irving route alignment overlapping the Kalum District's Timber Harvesting Land Base (THLB) as per provided Bell-Irving route shape file.
- Classification of the overlapping land as per Figure 6.11-2.
- Estimation of the area (ha) associated with each category of classified land.
- Estimation of the total volumes and percentage of sawlog content (m^3) of forested, merchantable, and operable land.
- Estimation of the overlap area between the proposed Bell-Irving alignment right of way and proposed and permitted cutblocks

The information pertaining to volumes, species composition, and silviculture status of the openings is based on the BC MoFR official VRI forest cover data for the study area.

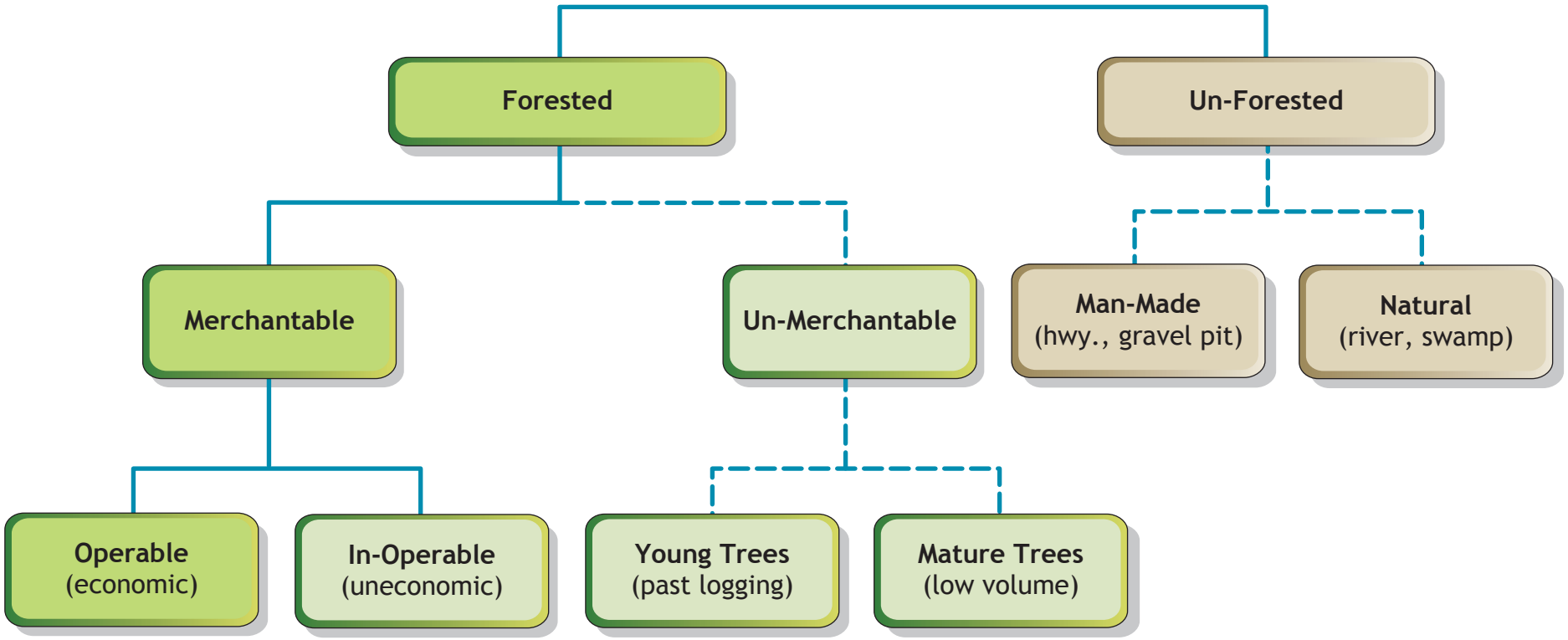


Figure 6.11-2

BC hydro

Forestry Assessment - Land Classification Framework for the NTL Route

Figure 6.11-2

Rescan™ Engineers & Scientists

The estimated sawlog and pulp log content is based on local knowledge of the timber profile, and the summary of log grades for harvested blocks in the NTL area. This approach for estimating sawlog content is used because the proposed Bell-Irving route overlaps only three recently harvested blocks, and log grade data from these blocks may not be representative of the entire proposed Bell-Irving route in regards to the quality of timber.

Methodology for Forestry Resource Assessment for the proposed Bell-Irving Route

The methodology used to prepare this analysis is presented as a series of steps listed in the order that the work was conducted:

The analysis was based on current VRI (Vegetation Resource Inventory) data. Local knowledge of the area was integrated into the analysis.

1. Gathered all necessary digital map data (Trim II, VRI forest inventory, THLB, etc.) required for the assessment from three main sources:
   - BC Hydro shapefiles for proposed Bell-Irving alignment and Timber Supply Area maps provided by Rescan.
   - Trim II and the VRI from the Land and Resource Data Warehouse (LRDW).
   - Information regarding past logging areas and current proposed harvest units and cutting permits was made available for this Project courtesy of the Ministry of Forests Harvest Billing System, forest licensees and BC Timber Sales.
2. Reviewed and organized maps with transmission line location, then draped all data into 3D format for use in a softcopy environment.
3. Organized all stereo models for the study area.
4. Designed a classification scheme (Figure 6.11-2), and conducted photo interpretation of all the land within the transmission line right of way using 3D stereo models.

For the purpose of consistency, the classification scheme used for the proposed Bell-Irving route is the same as the classification scheme described in the NTL EAC Application forest resources analysis.

The primary goal of the classification framework was to identify forested, merchantable and operable lands. Operable Merchantable Forest (OMF) was defined as economically viable timber recoverable during the course of clearing the right-of-way.

The forested class areas were separated into two broad groups as being either merchantable or un-merchantable. All areas which were identified as being previously logged, where trees are young and too small to be converted to marketable logs (Y), contributed to the un-merchantable category. Such trees are un-merchantable given prevailing markets.

Areas identified as containing open forest types with limited tree cover, i.e. a crown closure of less than ten percent (L), also contributed to the un-merchantable category. This type is normally associated with very poor growing sites having regeneration and growth problems such as soils being either too wet or too dry, high water table, old avalanche tracks etc. Although the timber in these areas is mature their volume is low and quality is very poor.

The merchantable classification contains both operable merchantable forest (OMF) and one category of areas which does not contribute to operable timber volume. The inoperable (I) or uneconomic category

is most often inoperable because the terrain is too difficult to set up an economically viable logging operation. Examples of this are ravines and gullies, broken terrain and steep river banks.

The un-forested class areas included all land which has already been permanently modified by man (M), for example existing transmission line right of ways, gravel pits, roads and other activities. The other category under this classification includes all naturally non-forested areas (N) such as rivers, wetlands, brush patches, avalanche tracks, ravines, rocky outcrops and other non-forest areas.

Estimation of sawlog content for each operable merchantable forest area (OMF).

During the classification phase, an estimation of sawlog content for all OMF polygons was completed. This estimation was made by examining the following characteristics of forest stands:

- tree characteristics: age, height, volume,
- stand characteristics: density, species composition, crown closure,
- development stage: stand vertical and horizontal structure, occurrence of small openings (due to windthrow or disease),
- stand location: general geographic area, elevation, aspect, and stand position (crest, valley bottom, site slope, etc.)

For the purpose of the forest resources assessment, the proposed Bell-Irving route was divided into two segments. One segment is located south of the Nass River proposed Bell-Irving route crossing (former Orenda Logging Forest License A16883), and one segment is located north of the Nass River crossing (FL A16884). Based on local operational experience, timber quality and sawlog content vary significantly between these two areas (ForTech Consulting, 2010). Since the desk-top forestry analysis is only an estimate and details of timber quality will be made following on-the ground measurements during the NTL forest engineering assessment; the local experience of ForTech was a valuable consideration in undertaking this preliminary estimate.

Timber Harvesting Land Base and Timber Volumes

Area Associated with Classified Land Types

Table 6.11-3 below illustrates the amount of land associated with the classification type delineated along the proposed Bell-Irving alignment. Note that only the highlighted area (operable merchantable forest - OMF and low volume – L) can be considered as contributing to timber volume. Remaining areas, inoperable – I, young trees – Y, as well as un-forested types natural – N and man made – M although possibly having some volume associated, due to the inaccuracy of VRI files were not considered as timber volume contributing types.

Table 6.11-3. Areas of Forest and Non-forest Classified Lands along the Proposed Bell-Irving Route

Classification Type	Ha
I	19.9
M	7.4
N	7.6
Y	231.4
OMF	140.3
L	74.7
Total:	**481.3**

Along the proposed route nearly half of the land has been previously harvested. These areas are labelled as young trees – Y, and account for 231.4 ha. Young forest can be divided into Free Growing (FG), Satisfactorily Restocked (SR) and Non-Satisfactorily Restocked (NSR). A total of 216.5 ha of FG stand overlap the proposed Bell-Irving ROW, while 13.9 ha of SR are overlapping (RESULTS, MoFR, 2010). The amount of recent NSR is currently unknown as this information has not been updated in the RESULTS database.

Total Volumes

The majority of timber volume is within two classification types; operable merchantable forest (OMF) and unmerchantable low volume (L). Table 6.11-4 illustrates the volume distribution between these two classification types.

Table 6.11-4. Total Volume of OMF and L Classification Types

Classification Type	Total Volume (m^3)
OMF	44,570
L	16,907
Total:	**61,477**

Volume by Species Composition

Figure 6.11-3 illustrates the total timber volume distribution by species. The majority of the timber volume is represented by Western Hemlock (Hw) 47698 m^3 (77%), then Balsam (Bl) 8873 m^3 (14%), while the remaining 4906 m^3 (8%) is distributed between other species. Distribution of volume and species is generally consistent with this portion of the Kalum Timber Supply Area (TSA) and with scaling history from harvesting operations.

Sawlog Content

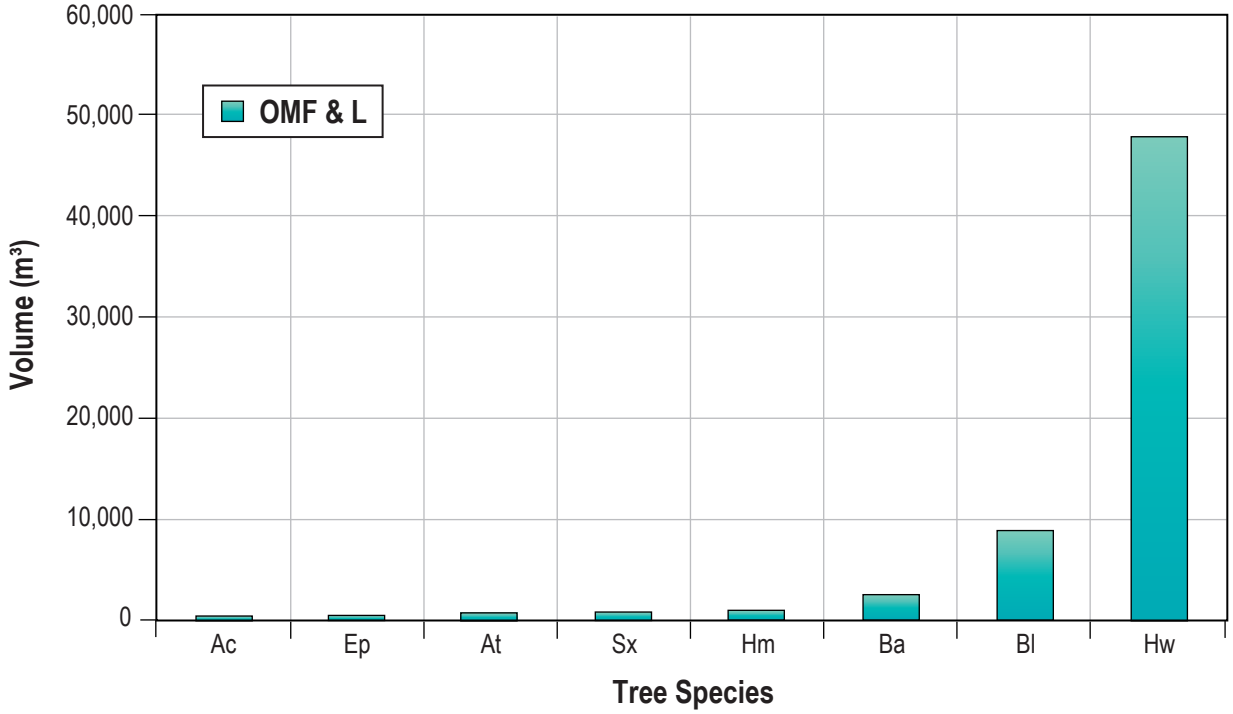
The estimation of sawlog content was based on local knowledge by ForTech Consulting, and a summary of log grades for blocks harvested within the vicinity of the NTL as outlined above.

The proposed Bell-Irving route has been separated into two areas for the estimation of sawlog content. Area one starts at the commencement of the proposed Bell-Irving route at approximately 14 km south of Ellsworth Camp and proceeds north to the Nass River. Area two extends from the Nass River north to cover off the northern part to where the route rejoins the NTL described in the EAC Application north of the Bell Irving River crossing (Bell 1) of Hwy 37.

As part of the sawlog content estimation, a photo interpretation of 140.3 ha of operable merchantable forest (Type OMF), and 74.7 ha of low volume forest type (Type L) was conducted. The results are summarized in Table 6.11-5.

Table 6.11-5. Summary of Estimated Sawlog Content of OMF and L Classified Land Types

NTL Bell-Irving Route	OMF (% Sawlog)	L (% Sawlog)
South of Nass River (Area 1)	39	23
North of Nass River (Area 2)	33	21



BC hydro

Timber Volume by Species along the Proposed Bell-Irving ROW Alignment

Figure 6.11-3

Rescan™ Engineers & Scientists

The review and compilation of historic log grade data from harvesting in the vicinity of the proposed Bell-Irving Route, was completed. Forest Licence A16883, Orenda Logging data, from year 1995-1999 (equivalent Area 1), and Forest Licence A16884, Buffalo Head Forest Product, data from year 1995-1999 (equivalent Area 2) is presented in Table 6.11-6.

Table 6.11-6. Average OMF Sawlog Type by Licensee

Forest Licence #	Cutting Permits #	Area Equivalent #	Average Sawlog Type (OMF) %
A16883	25	1	41
A16884	10	2	51

Scaling information from, Harvest Billing System, MoFR 2010

Because cutblock locations are usually established to achieve the best possible economic opportunity for harvesting, the factors to achieve this include the best possible timber quality (highest value), and lowest possible harvesting and road building costs. In other words the objective of locating the cutblock is to harvest the best most cost effective timber. The location of the proposed Bell-Irving route is not biased by timber quality and overlaps the areas that have been left from previous logging. Therefore, the timber quality within those areas is of lower value overall, than past logging. This is the primary reason why the scaled sawlog content is higher in comparison to the authors' estimates. For the purpose of this report an average sawlog content was adopted for two timber types OMF and L at the level of 36% overall for the entire length of the Bell-Irving route. Table 6.11-7 and 6.11-8 illustrate the distribution of timber volumes within OMF and L types. These estimated volumes would be verified during the pre-ROW clearing timber cruise field investigations.

Table 6.11-7. Total and Sawlog Content of OMF and L Classified Lands

Classification Type	Total Volume (m^3)	Sawlog Content 36%
OMF	44,570	16,045
L	16,907	6,086
Total:	**61,477**	**22,131**

Table 6.11-8. Total and Sawlog Content of OMF and L by Tree Species

Tree Species	Total Volume Type OMF and L	Sawlog Content Type OMF and L
Hw	47,698	17,171
Bl	8,873	3,194
Ba	2,316	834
Hm	866	312
Sx	713	257
At	651	234
Ep	191	69
Ac	168	60
Total (m^3):	**61,477**	**22,131**

Timber Harvesting Land Base Overlapped by the Proposed Bell-Irving Route

The Timber Harvesting Land Base (THLB) is defined as:

> *"the current timber harvesting land base for a tree farm licence area or a timber supply area, whichever is applicable, as set out in the most recent allowable annual cut determination for the area" (AAC Administration Regulation, MoFR 2009)*

THLB excludes areas that are inoperable or uneconomic for timber harvesting, or are otherwise off-limits to timber harvesting. Table 6.11-9 summarizes the THLB area and total estimated timber volumes along the proposed Bell-Irving ROW.

Table 6.11-9. Total Timber Volumes and THLB Area for All Land Categories

Category	Volume (m^3)	Area (ha)
THLB	31,187.1	196.1
NTL Category Y	2,485	231.0
NTL Category OMF and L	61,477	215.0
NTL Category M and N	3,258	15.0
NTL Category I	2,615	19.9
BCTS* Planned Category OMF and L	7,689	25.0
CRD** Planned Category OMF and L	8,947	29.1
CRD CP Issued Category OMF and L	3,182	8.9
CRD Logged Category OMF and L	2,439	8.9
BCTS Planned and CRD Planned Overlap, Category OMF	1,393	4.4
BCTS CP Issued and CRD Planned Overlap, Category OMF	117	0.4

**BCTS – British Columbia Timber Sales*
***CRD – Canada Resurgence Development Ltd.*
CP – Cutting Permit

Of the 481.3 ha of land the proposed Bell-Irving route ROW will cover, 40.7 %, for a total of 196.1 ha is THLB. The proposed Bell-Irving ROW crosses a total of 63.0 ha of cutblocks proposed or under permit by Canada Resurgence Developments and BC Timber Sales. Cutblocks can be proposed and harvested outside the THLB if the licensees feel there is an economic opportunity. This may explain the apparent large amount (63.0 ha or 32%) of proposed cutblock overlap in a 196.1 ha THLB overlap with the proposed Bell-Irving ROW. The proposed or permitted cutblocks have had capital invested in field work and planning and is a consideration in the assessment of the effects and proposed mitigation of effects to the forest tenure holders.

The entire land base of the proposed Bell-Irving ROW 481.3 ha over its 60.1 km length contributes to the crown forested land base and is considered in land and resource use plans and forest management plans when managing landscape level objectives for biodiversity and non-timber values. These values are discussed in Sections 6.1 to 6.10 and 6.12 to 6.15.

Under Section 8 of the *BC Forest Act*, the area of the THLB covered by the proposed Bell-irving ROW could potentially be removed from the THLB in the next timber supply review for the Nass TSA. The removal of the ROW area from the THLB will also remove the area associated with the ROW for future timber production. Although there will be no short term effect for the licensees, the net medium to long term result will be a likely loss in AAC for the region once a new Timber Supply Review is completed.

There are no mitigation measures proposed to address the potential effect of the loss of the THLB, as it is not possible to create more land for timber harvesting. However, the potential impact and residual effect is considered unlikely when comparing the 196.1 ha of overlapping THLB to total Nass TSA THLB area 175,932 ha[2] . The estimated total impact for the TSA that would be contributed by the proposed Bell-Irving route is 0.11 % of THLB.

Potential Loss of Merchantable Timber Volume

Loss of AAC is directly related to the loss of THLB. As the THLB decreases, all things being equal, the AAC associated with the original area also decreases. Approximately 44,570m^3 of operable merchantable timber volume and 61,477m^3 of total volume is estimated to be harvested from the proposed ROW (including the one-time clearing width) (Fortech 2010). These volumes are associated with both THLB and operable merchantable forests outside of the THLB.

The long term timber volume loss differs from the existing timber volume within the Project ROW in that volume within the THLB is calculated as potential long term loss and the existing timber volume includes THLB and area outside of the THLB. The long term timber volume loss is estimated to be 45,366 m^3. This volume is based on the average Mean Annual Increment for the Nass TSA, a 100 year rotation age and the THLB overlap area.

As outlined in Section 60 of the *Forest Act* (1996a), there will be no compensation for forest licensees by the Crown as a result of this reduction, as the reduction will not exceed 5% of the current AAC.

The potential effects have two timelines; (a) medium- to long-term and (b) short-term.

- Medium- to long-term: The main medium to long-term effect from the clearing of the proposed Bell-Irving ROW will be a likely loss to the AAC. Major licensees and BC Timber Sales have a combined AAC of 865,000 m3 for the Nass TSA (MoFR 2002). This AAC is 1.25% of the total provincial AAC. This includes an apportionment of 200,000 m3 for the upper Nass TSA in which the proposed Bell-Irving route does not cross through. The next AAC review will be undertaken prior to July, 2012. In recent years a substantial undercut has occurred. Based on a 100 year rotation, the estimated AAC effect is less than 0.06% of the total Nass TSA AAC. This converts to a harvesting activity of approximately 10 - 12 logging truck loads (assuming 50m^3 load) annually. In the context of the larger industry the effect is considered unlikely therefore no mitigation measures are proposed for medium to long-term effects.
- Short-term: The short-term effect consists of overlaps between the Project ROW and forest licensee proposed cut blocks. One method to mitigate short-term effects will be to have affected licensees harvest the ROW instead of planned cut blocks within their respective chart areas. It is anticipated that since BC Hydro will construct any new or temporary roads and replanting of the ROW will not be necessary, savings could be realized by the licensees. If the timber to be harvested is not of sufficient value or quantity to cover harvesting costs, the companies will be compensated for the difference based on a formula agreeable to both parties. This will fully mitigate expected losses, and potential residuals effects are unlikely.

[2] Tree Farm License 1 Management Plan, Coast Tsimshian Resource Limited Partnership, 2009
Kalum Timber Supply Area Analysis Report, Ministry of Forests, March 1999
Nass Timber Supply Area Analysis Report, Ministry of Forests, June 2001
Cranberry Timber Supply Area Analysis Report, Ministry of Forests, November 1997
Cassiar Timber Supply Report Analysis Report, Ministry of Forests, March 2001

When alignment of the proposed Bell-Irving route is finalized, consultation with the licensees will be required to determine which areas are of interest to the licensees at that time for clearing. This consultation will also provide the opportunity for licensees to supply an updated list of overlapping proposed blocks.

Accuracy of THLB and Timber Volume Assessment

The calculations, estimations and values presented in this section are based on publicly available data obtained through the Land and Resource Data Warehouse (LRDW), and through the authors' experience in the area with other industries. The assessment was not supported by detailed field assessments and this factor is considered when ascertaining conclusions and the level of confidence in the assessment.

Impacts to Constrained Land Base

Consistent with current legislation, constrained areas in the form of Old Growth Management Areas (OGMAs) have been identified for the South Nass SRMP and agreed upon by groups consisting of representatives from First Nations, BC MOFR, BC ILMB, BC MOE, Forest Licensees, and members of the public. It is estimated that the proposed Bell-Irving ROW will overlap 21.9 ha of OGMA (Table 6.6.7). These estimates are based on an assumed 80-m clearing width.

BC Hydro will work with the BC Ministry of Forests and Range (BC MOFR) District Manager and the relevant licensees, depending on the status of the OGMAs affected by construction, to work out suitable replacements, if required. Assuming that directives from the BC MOFR District Manager are followed, no potential residual effects for OGMAs are likely.

Potential Effects on First Nations/Nisga'a Forest Tenures

There are two types of First Nations Tenure holders in the NTL study area, those tenures held by First Nations as a result of a Forest and Range Agreement, and tenures that were purchased by First Nations/Nisga'a as part of a business plan or opportunity.

Forest and Range Agreement tenures for each First Nation are spatially limited to that First Nation's traditional territory. They are meant to provide feasible accommodation of Aboriginal interests that may be affected by forestry decisions during the term of the agreement until a treaty is reached. This includes sharing forest revenues and in some cases direct award of timber tenure, where necessary. In return, the First Nation will acknowledge being accommodated with respect to the economic component of administrative and operational decisions made during the term of the Agreement within their traditional territory. Most Forest and Range Agreements have a 5-year term and therefore the associated tenures are non-replaceable and subject to renewal of the Forest and Range Agreement[3]. To date, most of the tenures associated with the Forest and Range Agreements are volume-based. The funding-through-revenue-sharing is intended to address possible infringements of Aboriginal rights. There is one First Nations Forest and Range Agreement tenure that may be impacted. The Gitanyow Hereditary Chiefs have been offered a forest tenure but to date, have not activated the licence.

There is also one licence operating in the Project area held by the Nisga'a but it is not part of a Forest and Range Agreement and instead represents business opportunities. The holder of this tenure is Sim Gan Forest Corporation.

The operating area of the Sim Gan Forest Corporation license is outside the proposed Bell-Irving ROW and one-time clearing width of the Bell-Irving route and therefore no overlap occurs. However, as this

[3] www.for.gov.bc.ca/haa/Docs/Public_Q&A_Oct27_2004.htm#general1

area is a timber supply area (TSA) any reduction in AAC may impact all licensees in the TSA proportionately despite overlaps. As the Gitanyow Forest License has not yet been activated, there is no impact to this group. In terms of Forest and Range Agreements, if a loss of revenue-sharing and/or economic opportunity exists, it is unclear whether the Project conflict with these tenures will affect the Forest and Range Agreements between the province and each First Nation group.

Similar to the loss of merchantable timber volume, First Nation tenures have the same two potential effects. Two timelines should be considered: (a) long-term timber yield and potential effects on AAC, and (b) short-term merchantable timber and economic opportunity loss.

- Long-term timber yield and effect on AAC: First Nation tenures associated with Forest and Range Agreements are volume based and regulated by the *Forest Act* (1996). Since these tenures are generally non-replaceable and derived from a combination of unallocated cut and licensee undercut, they are not affected to any great extent by reductions in the AAC. In addition, as outlined in the section labelled, Potential Loss of merchantable timber volume, the overall average *AAC* impact in the Nass TSA is on the order of 0.06%. This impact is likely to be negligible.
- Short-term merchantable timber and economic opportunity loss: The short-term effect consists of overlaps between the Project ROW and forest licensee proposed cut blocks. One method to mitigate short-term effects could be to give Forest and Range Agreement First Nations tenure holders the option to harvest the proposed ROW that overlaps the First Nation tenure area. It is anticipated that since BC Hydro will construct the roads and replanting of the ROW will not be necessary, considerable savings could be realized by the First Nations tenure holders. If the timber to be harvested is not of sufficient value or quantity to cover harvesting costs, the First Nations Tenure holders will be compensated the difference based on a formula agreeable to both parties. This strategy will fully mitigate expected losses, and no potential residual effect is likely.

The AACs for tenures under Forest and Range Agreements are adjusted differently as a function of the administrative unit they are contained within. Within the TSAs, the AACs on these licences will be adjusted with the overall AAC of the TSA. Within the TFL the AAC remains fixed, while the AAC of the TFL may change (Lind, 2009, pers. comm.).

When the location and alignment of the proposed Bell-Irving route is finalized, consultation with the First Nation licensees will be required to determine which area are of interest to the licensees at that time. This consultation will also provide the opportunity for licensees to supply an updated list of overlapping proposed blocks.

Disruption of Forestry Operations

Project-related construction and restoration activities could affect the use of forest resource roads and increase the cost of maintaining those roads from increased usage. The most frequent disruption to forest operations will likely be from trucking or transporting construction materials, supplies, and equipment, and forestry log hauling, equipment transport, crew transport, and services.

The areas of greatest concern, due to increased road usage, are around the Windfall Mainline where BC Timber Sales and Canada Resurgence Developments share an operating area. The Kotcho Mainline is the remaining haul road that overlaps the proposed Bell-Irving route and is used by the Forest Sector. This road has not seen harvesting activity for approximately 10 years and has limited blocks under Cutting Permit. Increased traffic on resource roads could have three outcomes:

- Transport vehicles may have increased delays because of the need to let oncoming vehicles pass. The increased delays will result in increased cycle times.
- The cost of transporting logs for the forest industry and the cost of transporting equipment, labour, and materials for constructing both the proposed Bell-Irving route and forest industry activities will increase because of increased cycle times.
- Increased road usage may degrade the road surface resulting in increased road maintenance costs for the forest licensee.

At the current low levels of harvesting in the areas overlapping the proposed Bell-Irving route, the likelihood of a negative effect on hauling cycle times is low. If harvest levels increase, the probability of a conflict increases considerably because of the poor alignment of these road systems. There will be some degree of overlapping road use by both the construction of the proposed Bell-Irving route and the forest industry, the amount of overlap will vary depending on harvest levels and the roads used by both parties. There is potential for increased hauling costs incurred by the forest industry as a result.

Mitigation strategies to reduce or eliminate the increased hauling cost to the forest industry include consultation with forest licensees to address the timing of activities to lessen or avoid road use conflicts. Adherence to the Traffic Management Plan in EAC Application, Chapter 11, will greatly reduce the probability of road user conflicts. The plan could include road calling procedures, schedule of operations to avoid conflicts, and protocols for communication between parties for updating road use information. In situations where operational coordination is not achievable, road safety could be improved through constructing additional truck pullouts, widening roads, and improving visibility by removing brush on corners.

The likelihood for a residual effect related to overlapping road use will depend on the levels of harvest by the forest licensees during construction, which is not known at this time. At low to moderate levels of harvest (i.e., current levels), it is likely that no potential residual effect will be encountered. It is anticipated that low harvest levels will persist for the immediate future and, as a result no residual effect is likely. However, it is noted that if high harvest levels are experienced (i.e., 75 to 100% of the AAC, not seen in northwestern BC for 15 years) there would likely be a residual effect in the form of increased trucking costs for forest licensees, as well as potential safety considerations related to road sharing. High harvest levels are highly unlikely; therefore, for the foreseeable future a thorough operational coordination and communication plan will mitigate any residual effect to the forest industry.

Part 8, Section 117 of the *Forest Act* (1996b) requires an industrial user of a Forest Service Road (FSR) to obtain a Road Use Permit from the BC MOFR. Under Part 8, Section 119 of the *Forest Act* (1996b), the BC MOFR District Manager may apply terms and conditions that are consistent with the appropriate act, regulations, and standards to ensure suitable stewardship of the forest resources. As part of these conditions the District Manager may require industrial users to enter into a Road Use Agreement with the Road Permit holder (licensee). A large portion of the potentially affected road infrastructure along the proposed Bell-Irving route is under a road permit held by Canada Resurgence Developments. Increased use of the road systems may result in an increased need for road maintenance such as resurfacing, grading, ditching, and culvert replacement. There is an added benefit for the forest licensees, in that there will be roads currently not used by licensees that will be upgraded for the Bell-Irving route construction. This will reduce licensee road maintenance and inspection costs on those roads.

In order to address the increase in road maintenance costs BC Hydro will pursue a road use agreement to share costs with the forest licensees, where necessary. If such an agreement is in place, no potential

residual effect would be likely. If an agreement cannot be reached, a residual effect is likely, however, in terms of viability of the VEC, this residual effect would not likely be significant as forestry operations would still be able to continue.

Conflicts with Forest Licensee Commitments and Operational Plans

Where the proposed Bell-Irving route overlaps cut blocks having outstanding silviculture obligations associated with one or more licensees, those licensees will be required to amend Pre-harvest Silviculture Prescriptions, Silviculture Prescriptions, or Site Plans to remove the overlapping area from the net area to be reforested for those cut blocks not presently declared free to grow. An estimated 231 ha of previously harvested cut blocks will be overlapped by the Bell-Irving route (land classified as Y). The new stands growing in these cut blocks vary in age, some of which will be free to grow. The number of hectares and/or operational plans requiring amendment is unknown at this time because:

- at the time of this assessment completion, the final route and alignment of the Bell-Irving route was not confirmed,
- future harvest levels and locations within the study area that will create new cut blocks are unknown at this time, and,
- the temporal nature of growing forests.

As the cut blocks grow, they will eventually meet free-growing standards. At that time, they will no longer be a forest licensee obligation and therefore will not require amendments. The responsibility and cost to complete the amendments is held by the licensee. The data retrieved by the LRDW indicates that almost all cutblocks overlapping the Belling-Irving route are Free Growing status with the exception of very recently harvested blocks that will be NSR and older blocks of SR. Removing the cut block area with outstanding silviculture liabilities overlapping the proposed Bell-Irving ROW will also benefit licensees. Cut blocks recently harvested are the most costly to reach free-growing status, due to planting, brushing, and survey costs. Removing the area will reduce liabilities the licensees have and in some situations reduce silviculture costs. It is anticipated that reduced silviculture costs associated with removing silviculture areas will be greater than the cost of amendments (Rutledge, 2009, pers. comm.; Engelbertink, 2009, pers. comm.). Therefore, it is likely that conflicts with the operational plans listed in this section will have no adverse residual effect on the forest industry as a result of construction of the proposed Bell-Irving route.

When the proposed Bell-Irving alignment is finalized, BC Hydro will communicate with the forest licensees and BC MOFR to determine the affected hectares of silviculture liabilities. This will assist the licensees in amending the appropriate documents.

Potential Effects of Visual Alteration on Established Visual Quality Objectives

It is unclear at this time if visual alteration associated with the proposed Bell-Irving route must be considered by forest licensees when addressing visual management required by forest operations activities. The BC MOFR has indicated that forest licensees are required to address other industrial alterations to the visual landscape. However, the BC MOFR also recommends that this topic be referred to a professional advisory board for more input (Marc, 2009, pers. comm.).

Maximum allowable visual alteration has been established for each Visual Quality Objective (VQO) through differing mechanisms such as the SRMP processes and Forest Stewardship Plan approvals. If the visual alteration within a polygon has exceeded the maximum allowable amount, visible alterations from harvesting operations must cease in that polygon until visual green-up is achieved, or, operations must adapt through increased visual design to eliminate the visible impact.

The proposed Bell-Irving route will overlap an unknown area of scenic area polygons with established VQOs of modification. If the route increases the visible alteration in polygons that are presently close to exceeding the maximum alteration levels, and visual design cannot be adjusted to compensate, harvesting operations could be negatively affected.

Section 6.13 (Visual Resources and Aesthetics) provides an analysis of the visual impact of the ROW from more accessible vantage areas. There are likely to be low residual effects to harvesting operations from the clearing of the proposed ROW due to the narrow nature of the ROW and the abundance of surrounding tall mature forests, and distance from the Highway 37 corridor. Mitigation strategies are limited because of the ROW engineering and vegetation clearing requirements.

If Regulatory authorities determine that the proposed Bell-Irving route will constitute a visual alteration required to be addressed by the forest licensees, it is likely that the potential effect to forestry operations would be minimal and could be managed through vegetation management and forest licensees adjusting visual design of cutblock proposals. It is likely that a small potential residual effect will remain for the forest industry.

Reduction of Labour and Equipment Force for Forest Licensees

Potential effects regarding the reduction of labour and equipment force for forest licensees were assessed in Section 7.12.5.1 of the EAC Application. Overall, based on that analysis, no residual effects are likely. No residual effects are also likely for the Bell-Irving route, based on the current and forecast log market conditions.

Potential Log Market Effects

The proposed Bell-Irving route is estimated to generate 61,477 m^3 of timber from the clearing of the ROW. This volume of timber on its own, and not as part of the larger Project, is not likely to have a large impact on local log values. Due to terrain constraints that restrict equipment access to the total volume, the operationally feasible timber to harvest is estimated at 22,131 m^3 saw log and 39,346 m^3 pulp log, totalling 61,477 m^3. If economically feasible, the majority of the log volume will be sold to or handled by local log brokers in Stewart. A small portion of the log volume, such as some hemlock and balsam may be sold to Kitwanga Lumber if the mill is operating. The marketability of logs will depend on the cost of harvesting, processing, and hauling compared to the value of those logs at the time of harvest. At current log market values it is anticipated that a large amount of the ROW timber volume will not be commercially economical for log sale.

From 2005 to 2009 an estimated average volume of 114,521 m^3 per year was harvested from major tenures and BC Timber Sales tenures (approximately 13% of the AAC) within the Nass TSA (BC MOFR 2009). This period is considered a time of low economic activity within the forestry sector with in the Nass TSA and represents a reasonable average for the current industry in northwestern BC. The forestry sector in Nass TSA is unlike other forest sectors in the province in that there are presently no large operating sawmills. Local sawmills and conversion facilities consist of 1 to 3 person operations, with the exception of one tie manufacturing facility that employs approximately 10 personnel and has operated intermittently in the past 5 years. As a result, most logs are sold to an out-of-region, free market environment.

It is anticipated that clearing the ROW within the proposed Bell-Irving route may not generate enough volume to negatively alter the log values for forest licensees. Due to the particularly poor quality timber associated with the ROW a large amount of pulp log volume, 39,000 m^3 will be generated. This large amount of pulp log volume is a concern because of the inability of the volatile pulp log market to absorb additional log volume without causing a depressed log value. Approximately 70 to 80% of the

pulp logs from northwestern BC are sold to pulp mills in the Lower Mainland and on Vancouver Island (Wilson, 2009, pers. comm.). These facilities have operated at intermittent levels and schedules over the past several years. The potential negative effect of reduced log values is likely to result in consequences for northwestern forest licensees. It is anticipated that forest licensees may not be able to absorb this reduction in log value and could face economic hardship as a result.

Canadian and international log markets are a free market environment in which log prices are set by global and domestic demands for wood products. This makes it difficult to mitigate the adverse aspects of this potential effect. However, one possible solution is that licensees could be given the opportunity to harvest the proposed Project ROW that overlaps the licensee tenure area. Having no road building and silviculture costs will be an incentive for the licensee to harvest less expensive timber from the proposed Project ROW. If harvesting costs are not recovered fully in log sales, the licensees could be compensated for the difference based on an agreed upon formula. Based on this mitigation strategy, no potential residual effect is likely.

When the proposed Bell-Irving route and alignment is finalized, additional consultation with the licensees will be required to determine which areas are of interest to the licensees at that time.

Increased Economic Activity Related To Forestry

Clearing the ROW is expected to benefit economic activity in the northwestern forestry sector. Although this increase in economic activity may not benefit the forest licensees it will, in the short term, benefit logging, hauling, road building, and maintenance contractors, log brokers, consultants, and service industries working with those phases. In the long term, the economic benefit will extend to vegetation and road maintenance contractors.

A typical mid-size harvesting contractor in the northwestern region harvests approximately 70,000 m^3 per year, employing 8 to 12 personnel including trucking, depending on equipment configuration (Keswick, 2009, pers. comm.). Additional personnel will be required for camp operations and transporting equipment in remote areas. Clearing the ROW is estimated to generate 10 jobs per year, (based on a two-year timeframe)[4]. An additional estimated 3 person-years of employment will be generated in forestry consulting services (based on a 12-month timeframe).

A total of 13 jobs per year may be associated with clearing the proposed Bell-Irving ROW. The current harvesting contractor complement for the region is estimated at 15 to 18 contractors (Keswick, 2009, pers. comm.). Regional contractors and workforce are expected to have sufficient capacity to complete the clearing. A full assessment of potential business contracting opportunities (including mitigation and residual benefits) is provided in EAC Application Section 7.12.

6.11.5.2 Operations and Maintenance

VEC: Access

The potential for the proposed Bell-Irving route to increase access to previously less-accessible areas is one of the issues that were raised during consultation, despite the high levels of former access development along this route. Access was a major issue raised by First Nations, Nisga'a Nation and agencies during their review of the EAC Application. Specific concerns are related to potential biophysical effects of increased access, including potential adverse effects on wildlife, fish, and

[4] Estimates are based on the expected amount of work required for ROW clearing (including one-time clearance), as provided by Fortech forestry consultants, Terrace, BC.

ecosystems in areas that are relatively remote and undisturbed at present. This concern was stated more prominently by Ministry of Environmental and Skii km Lax ha.

In order to minimize the need to build new access and mitigate for potential effects to fish and wildlife, the proposed Bell-Irving route was routed to maximize the use of existing FSRs and private roads for access and maintenance of the ROW. It is estimated that about 67 % of the access roads to be used by BC Hydro will be existing roads, thereby substantially reducing the requirement to build new roads. BC Hydro has committed to not constructing bridges over the Nass River and Bell-Irving River which effectively prevents the creation of any new "circle routes", to reduce the attractiveness of these access points to hunters. The preliminary Access Plan has taken this into account. During operation and maintenance, these roads will generally only be accessible using high-clearance four-wheel drive vehicles or all-terrain vehicles (ATVs) and will be used infrequently for inspections and vegetation maintenance access.

In order to measure the amount of new area that will be accessible to human activity (including fishing and hunting), an analysis was conducted which compared the access that will be provided by the Project to the level of existing access.

Access to Remote Areas

An analysis was conducted to determine the areas of land (near the proposed Project) that are currently accessible by road, as well as new areas to which access will be created by the proposed ROW and supporting roads. The analysis and conclusions for the proposed Bell-Irving route are described in Section 6.7.

Increased access may be viewed as a beneficial or adverse change, depending on the land user group. Improved access may benefit individuals and businesses seeking to access more remote areas for resource extraction, recreation, or other activities; however, it is also seen to be undesirable by many parties (including First Nations and regulators), over concern that relatively undisturbed landscapes may be compromised by an increased number of land users and activities. While many forms of backcountry recreation have little effect on the natural environment, others (notably ATVs and similar motorized vehicles) can physically scar landscapes. Increased use and access can introduce pollution from littering, increased forest fire hazards and increased incidents of vandalism. These potential adverse effects were the predominant concerns expressed during consultation with government agencies, Aboriginal groups, and the public, and were more commonly referred to in discussions than the anticipated benefit associated with increased access. Thus, for the purposes of this assessment, only potential adverse residual effects of increased access associated with increased distance from existing access are considered.

As described in Section 6.7, increased access to the region along the proposed Bell-Irving route could result in a variety of indirect adverse effects, including the potential for increased hunting and fishing (and related pressures on fish and wildlife), and increased recreation (including motorized recreation such as trucks and ATVs). First Nations have also expressed concern that increased access via the proposed ROW will result in an increased number of people using an expanded area of their traditional territories.

There are two mitigation measures proposed to address the potential effects of individuals using new access roads to more remote areas. These mitigation measures are also discussed in the wildlife assessment EAC Application Section 7.9 and Section 6.7 of this report and include:

- Roads used only for construction will either be deactivated and/or allowed to regenerate naturally. Roads required for inspection and maintenance will be kept open for the lifetime of

the Project. However, roads used for inspection and maintenance will be based on existing roads wherever practical.

- Prior to construction, BC Hydro will develop an access plan for the Project, and will work with MOE, MOFR and interested and affected Aboriginal groups to develop and implement feasible and site specific access strategies in accordance with applicable legislation, permits, approvals and ROW agreements, where necessary.

The indirect effects of increased access could also affect tenure holders along the proposed Project, such as guide outfitters and trappers, through changes to the quantity of wildlife available (discussed further under the VEC for the Quality of Land Use Activities), as well as the general nuisance factor of having an increased number of people using a particular area. For traplines, increased access will likely have the greatest potential effect on tenure TR0615T029 as this is the primary trapline that encompasses over three quarters of the length of the proposed Bell-Irving route; for guide outfitters, the tenure held by Coast Mountain Outfitters is the only territory affected.

BC Hydro has previously contacted tenure holders to inform them of the proposed NTL Project and the ongoing environmental assessment and consultation process. BC Hydro will continue to keep tenure holders informed throughout Project development, and invite stakeholders to bring forward issues of concern. If access-related (or other) issues arise, BC Hydro will engage tenure holders to develop solutions to these problems, where practical. In addition, BC Hydro may also engage in discussions with government agencies, including the BC MOFR, regarding potential mitigation and/or offsetting measures that may be implemented to manage access.

In consideration of mitigation, the proposed Bell-Irving route will still result in new access to some areas along the ROW, which could influence future use of these areas for recreational and other activities such as hunting and motorized recreation. Mitigation measures of deactivating construction roads or allowing them to naturally regenerate, as well as developing an access plan by working with various government agencies and affected Aboriginal groups would be employed. As such, residual effects are likely for most land user groups. The probability of access-related cumulative effects are likely to be high due the certainty of constructing new access, and confidence in the effect is determined to be intermediate in view of the likely effect of people being attracted to using new road access. As much of the Bell-Irving route will access existing FSRs and new accesses will be kept to a minimum where practical, the magnitude and extent are likely to be low and the overall effect is likely not significant.

VEC: Quality of Land Use Activities

Aesthetic Disturbance of Land Use Activities

Following the completion of construction activities, the production of noise, dust, and other industrial by-products will largely cease. Once the Project's infrastructure and ROW is established, visual quality is expected to be the primary aesthetic disturbance. Concerns have also been expressed regarding potential health effects (related to exposure to electric and magnetic fields (EMF)) that may be caused or exacerbated by the pursuit of land use activities near the proposed Bell-Irving route.

Potential health effects from EMF on people using the ROW for activities such as hunting, fishing, and berry picking is assessed in Section 6.14, which also addresses mitigation; this assessment concludes that residual health effects are not likely. However, it is noted that the public perception of potential health effects (although not supported by global scientific research panels) may be cause for some to avoid or limit land use in these areas.

Potential health effects from the use of herbicides during vegetation maintenance on people consuming foods harvested from the ROW or near the ROW is assessed in Section 6.14; this assessment concludes that residual health effects are not likely. However, the public perception of potential health effects from exposure to herbicides may influence some people to avoid or limit land use in these areas. No mitigation is proposed to reduce this public perception, thus residual effects on the quality of land use activities is likely, as some people will avoid or limit land use in these areas.

Visual quality changes are expected to be the primary aesthetic effect during the operations and maintenance phase. Visual quality depends on many factors such as the current shape (relief and terrain) and nature of the landscape, observation points, and existing natural and non-natural disturbances. Natural processes cause the landscape to undergo gradual modifications over extended periods. Activities associated with constructing a transmission line can change landscape appearance and accelerate and alter the natural processes, such as vegetation composition and maturity.

The visibility of the transmission line, structures, and ROW could diminish the aesthetic appreciation sought by many recreationists and other land users who value undisturbed natural landscapes. Changes to visual quality and aesthetics for the proposed Bell-Irving route are discussed in section 6.12.5 and for the entire NTL Project in EAC Application Section 7.13. Visual quality residual effects along the ROW are likely not significant (6.12.6.2 of this report).

Biophysical Disturbance of Subsistence Harvests

Subsistence harvests (e.g., wildlife, fish, berries, mushrooms, other plants) are common amongst Aboriginal and non-Aboriginal residents of northwestern BC and often supplement household resources in times of economic hardship. Non-subsistence harvests (including guide outfitting, fishing and hunting, and commercial mushroom gathering) may experience similar potential effects to those described for subsistence harvests.

During the operations and maintenance phase, no potential adverse effects are likely on fish (Section 6.2) or berries (Section 6.6). Potential health effects associated with herbicide use and ROW maintenance are discussed in Section 6.14. No residual effects are likely with respect to herbicide use. Of note, berry-producing plants are predicted to benefit from the proposed Bell-Irving ROW through the establishment of a permanent, early seral shrub state environment. The potential decrease in pine mushroom habitat (Section 6.6 of this report and Section 7.8 of the EAC) is likely not significant due to the relatively small area (30 ha or 2%) involved with the proposed Bell-Irving ROW compared to the total potential pine mushroom area.

The results of the wildlife assessment predict that effects on moose and grizzly bear populations may be complex, depending on the relative scale of cause and effect relationships involving hunter effort, animal populations and environmental conditions (adverse seasonal conditions). The numbers of harvestable animals could decline in localized populations during the operations and maintenance phase should there be increased vehicular and human (walking) access to previously less-hunted areas, or more remote areas (via the proposed ROW and supporting access roads). This may lead to increased regulated and un-regulated hunting pressure in some of these areas. For areas frequented by regulated hunters, no residual effect is likely. Non-regulated hunters often hunt opportunistically, preferentially harvest reproductive age females, which for moose, could have a noticeable effect, more so than for grizzly bear with lower reproductive rates. A likely residual effect in the proposed Bell-Irving route area has therefore been predicted by the wildlife assessment (Section 6.7 of this report and EAC Section 7.9). Guide outfitting operations and subsistence hunting in these areas thus may be affected if these wildlife populations decline. As such, there is a likely residual effect on harvest levels among tenure holders and land users (for all segments).

Although trapping activity is generally low (because of a decline in fur prices, increased costs of traps, among other factors), TR0615T029 is the trapping territory that encompasses approximately 75% of the proposed Bell-Irving route. No information is available regarding the specific locations of traps or trapper cabins within this territory. However, the effects assessment for wildlife found in Section 6.7 in this report, and EAC Application Section 7.9, does not predict a noticeable decrease from baseline populations. As such, residuals effect on trapping levels among tenure holders are not likely.

BC Hydro has contacted tenure holders, including guide outfitters and trappers, to inform them of the proposed NTL Project and the ongoing environmental assessment and consultation process. They will continue to keep tenure holders informed throughout the proposed Project development and operations, and invite stakeholders to bring forward issues of concern. If wildlife-related (or other) issues arise, BC Hydro will engage tenure holders to develop solutions to these problems, where practical.

Physical Disturbance of the Agricultural Land Reserve

No ALR has been identified for the Bell-Irving route.

VEC: Forestry[5]

Long-Term Harvest Constraints

Transmission lines and structure locations can result in negative effects for forest licensees planning and constructing new roads adjacent to and/or under transmission lines. These potential effects were assessed in the EAC Application (Section 7.11). With mitigation, no residual effects are likely. The results of the effects assessment presented in the EAC Application are also applicable to the proposed Bell-Irving route as supported by the forestry resources assessment above.

6.11.6 Potential Residual Effects and Mitigation

There are some potential residual effects identified with respect to Aboriginal Group land use, during the construction and restoration phase and as well during the operations and maintenance phase of the proposed Bell-Irving route. These potential residual effects (and associated Aboriginal groups) are as follows:

- Pine mushroom harvests may be affected by right-of-way clearing during construction (Nisga'a Nation)
- Interruptions and delays during construction to access land use areas and undertake traditional use activities (Gitanyow Hereditary Chiefs (Wilp Gamlaxyeltxw and Wilp Wii'litsxw, and Wilp Malii))
- Potential partial or full removal of cultural features during both construction and operations/maintenance (Gitanyow Hereditary Chiefs (Wilp Gamlaxyeltxw and Wilp Wii'litsxw, and Wilp Malii))
- Harvesting of moose and grizzly bear may be adversely affected by decreased wildlife populations during both construction and operations/maintenance (Nisga'a Nation, Gitanyow Hereditary Chiefs (Wilp Gamlaxyeltxw and Wilp Wii'litsxw, and Wilp Malii), Skii km Lax Ha)

However, there may be other residual effects that have not been identified because of a lack of site-specific information (in whole or in part) from the Nisga'a Nation, and First Nations. As such, it is recognized that additional residual effects may be identified upon receipt of the TU/TK reports

[5] Forestry information and analysis was provided by Fortech forestry consultants, Terrace, BC.

anticipated from the Gitanyow and Skii km Lax ha in September 2010. Ongoing consultation with these groups may also identify additional residual effects.

6.11.6.1 Construction and Restoration

Nisga'a Nation

A likely effect is identified with respect to Nisga'a pine mushroom harvesting during the construction/restoration period (and will extend through the life of the proposed Project). However, given that the area of the ROW is relatively small compared to other areas of suitable pine mushroom habitat, it is anticipated that this effect will be not significant. The probability of the effect occurring is medium (likely but may not occur) with a high degree of confidence.

There is no likely residual effect identified with respect to Nisga'a interests in the Nass Wildlife Area respecting fish as the proposed Bell-Irving route is not likely to result in residual effects on fisheries.

Gitanyow Hereditary Chiefs (Wilp Gamlaxyeltxw, Wilp Malii, and Wilp Wii'litsxw)

A likely residual effect on Wilp Gamlaxyeltxw, Wilp Malii, and Wilp Wii'litsxw land use is identified, with respect to potential temporary interruptions/delays when accessing land use areas and/or undertaking traditional use activities, as well as possible partial or full removal of culturally valued features. Identified areas of interest for Wilp Gamlaxyeltxw include Sideslip Lake, Ellsworth Camp, Wolverine Creek, and through the limited preliminary TKTU information provided by the Gitanyow Chiefs Office, a fishing camp has been identified as being located in the approximate area of the northern boundary of Wilp Gamlaxyeltxw territory close to the ROW. For Wilp Wii'litsxw, the primary area of interest was the proposed Hanna Tintina protected area. No specific areas of interest have been identified for Wilp Malii.

With communication between BC Hydro and the Gitanyow during proposed Bell-Irving route construction and the final determination of the route alignment, it is expected that many of these issues will be suitably addressed/avoided. Thus, the magnitude of this likely residual effect is considered low, and its extent is on a landscape level. The potential effect is assessed to be short-term and sporadic, as construction of the Project will occur over approximately 3 years (although less time will be spent in one location). Effects are expected to be reversible in the short term, and the resilience of the Gitanyow is assessed to be neutral, depending on the individual and the features overlapping the proposed Bell-Irving route. The residual effect is likely to be not significant, with medium probability (likely but may not occur) and intermediate confidence rating.

Skii km Lax Ha

A likely residual effect on Skii km Lax Ha land use is identified, with respect to potential temporary interruptions/delays when accessing land use areas and/or undertaking traditional use activities, as well as possible partial or full removal of culturally valued features. No specific areas of interest have been identified.

With communication between BC Hydro and the Skii km Lax Ha during proposed Bell-Irving route construction and the final determination of the route alignment, it is expected that many of these issues will be suitably addressed/avoided. Thus, the magnitude of this likely residual effect is considered low, and its extent is on a landscape level. The potential effect is assessed to be short-term and sporadic, as construction of the Project will occur over approximately 3 years (although less time will be spent in one location). Effects are expected to be reversible in the short term, and the resilience of the Skii km Lax Ha is assessed to be neutral, depending on the individual and the features overlapping the proposed Bell-Irving route. The residual effect is likely to be not significant, with medium probability (likely but may not occur) and intermediate confidence rating.

6.11.6.2 Operations and Maintenance

Nisga'a Nation

No likely adverse residual effects are identified with respect to Nisga'a Nation wildlife harvests and harvesting allocations (Section 6.7).

Gitanyow Hereditary Chiefs (Wilp Gamlaxyeltxw and Wilp Wii'litsxw, and Wilp Malii)

The three potentially affected Gitanyow Wilp may experience a residual effect related to their ability to harvest resources of cultural importance (Section 6.6), including wildlife (Section 6.7). In particular, the Gitanyow may be adversely affected in their ability to harvest moose and grizzly bears, if declines in localized populations occur due to increased hunting pressure related to access to remote areas (as described in 6.7 of this report and EAC Application Sections 7.11.5.2 and 7.9). This effect is likely to have a medium magnitude, and extend across the landscape level over the long term. The residual effect is reversible in the long term (if restoration is implemented). The resilience of Gitanyow Wilp members is not known and may vary depending on the individual; as such, it assessed to be neutral. Given the planning and communication-related mitigation measures proposed to mitigate increased access (as described in EAC Section 7.11.5.2 for the Access VEC, as well as Section 7.9 of the EAC) it is likely that potential effects on wildlife harvests will not be significant. The probability of this residual effect occurring is medium, related to the wildlife assessment in Section 6.7 of this report and EAC section 7.9 with an intermediate confidence level.

Skii km Lax Ha

A likely adverse residual effect is identified (Section 6.7) for the Skii km Lax Ha in terms of moose harvests within their asserted traditional territory. The magnitude of this residual effect is anticipated to be medium, while the extent is on a landscape level. The potential effect will likely be long term and continuous, and reversible in the long term (if restoration measures are initiated after the operations and maintenance phase). However, most of these traditional use areas are large in comparison with the expected area of overlap with proposed Project. Therefore, it is assumed that members of the Skii km Lax Ha could use other areas east and west of the Project. Therefore, the resilience of the Skii km Lax Ha to adapt to this effect is considered neutral: while they have stated their dependence on moose for subsistence, especially during times of economic hardship, they may also be able to transfer their harvests to alternative areas in case of population declines.

Given the planning and communication-related mitigation measures proposed to mitigate increased access (as described in EAC Section 7.11.5.2 for the Access VEC, as well as EAC Section 7.9), it is anticipated that potential effects on wildlife harvests will likely be not significant The probability of this residual effect occurring is medium, related to the wildlife assessment in Section 6.7 of this report and EAC Section 7.9) with an intermediate confidence level.

6.11.7 Conclusions

Three broad categories of potential effects were considered in this assessment: (a) how access to land use activities may be limited or improved, (b) how the quality of land use activities may be affected (aesthetically and/or biophysically), and (c) how forestry activity (as a valued economic driver for the region) may be supported or limited. Potential effects were also evaluated in the context of land use values and interests of the Nisga'a Nation and First Nations.

Construction and Restoration

The majority of potential effects during construction are likely to be short term, and geographically limited. Likely residual effects during construction include aesthetic disturbances (e.g., noise, dust)

that may diminish the appreciation of the natural environment for some land users (e.g., recreationists). Some relatively small areas of pine mushroom habitat will be removed during construction, contributing to a negligible potential loss of pine mushroom harvesting capacity for the area that will persist for the life of the proposed Bell-Irving route.

Likely residual effects on forestry during construction include a general loss of THLB and a potential disruption of forestry operations (through a need for shared road use). Another effect relates to the forestry-based VQOs, and the potential for landscape-level visual alteration created by the proposed transmission line and ROW could inhibit forest licensees from harvesting in some VQO areas of retention; whether or not the proposed Bell-Irving route will be included under VQOs must be further clarified with regulatory authorities.

During the construction and restoration phase, all identified residual effects are likely to be not significant, based on the proposed mitigation measures.

Operations and Maintenance

The most notable potential effects during the operations phase are primarily tied to maintained access to remote areas that will be created by the proposed Bell-Irving ROW, as well as continued visual quality effects related to the establishment of transmission line infrastructure and the ROW. Increased access to remote areas is considered to be an adverse effect, and a number of Aboriginal groups and government agencies have expressed a desire to limit land-based access to areas that at present are relatively unroaded and/or inaccessible. Increased access may also contribute to increased hunting pressure in these areas, and potential adverse pressures on moose and grizzly bear populations is likely to be a potential adverse effect.

Decreased visual quality may contribute to decreased aesthetic quality for recreationists and others who value natural visual landscapes. For forestry, long-term harvest constraints are identified as a likely effect, as the presence of the transmission line may bisect the landscape so as to make it economically infeasible to pursue harvests in some areas. During the operations and maintenance phase, all identified potential residual effects are likely to have not significant ratings, based on the proposed mitigation measures.

Nisga'a Nation and First Nations

It is not possible to fully assess the residual effects to the Gitanyow Hereditary Chiefs (Wilp Gamlaxyeltxw and Wilp Wii'litsxw, and Wilp Malii) or the Nisga'a Nation at this time because of a lack of site-specific and detailed information about timing, location, nature, and extent of land uses and sites. These effects are described in detail in Section 6.11 and 6.12 in the EAC Application and Section 6.13 in this report. A TK/TU report is expected in September 2010 from the Gitanyow, the Skii km Lax Ha have a TK/TU in a draft form that does not indicate any site specific concerns for the Bell-Irving route, and no report is forthcoming from the Nisga'a Nation. BC Hydro will consider any land use information First Nations or Nisga'a Nation may provide within reasonable timelines, prior to clearing and construction. Refer to Chapters 7 (Nisga'a Nation Interests) and 8 (First Nations Interests) for details on how aboriginal interests are addressed in this report.

During construction, the effects experienced by Aboriginal groups are generally related to access and quality of land use experience similar in nature to those discussed in the previous section, but also potential effects on physical cultural features. Because of the availability of alternative sites for practising traditional activities and mitigation measures addressing access, and based on the proposed mitigation measures, the identified potential residual effects during construction and restoration are likely not significant.

During operations, potential residual effects are primarily related to resource availability for harvesting. The potential residual effect is likely not significant based on the proposed mitigation measures. EAC Tables 7.11-15 to 7.11-18 summarize the assessment of potential effects on land and resource use.

6.12 VISUAL RESOURCE USE AND AESTHETICS

A visual assessment was conducted for the Bell-Irving route to identify areas in the landscape that could be seen from one or more observation points (e.g., recreation site) or lines (e.g., highway corridor). Potential visually sensitive areas that were within 10 km either side of the centreline of the proposed Bell-Irving route were chosen for the visual quality assessment.

6.12.1 Environmental Setting

Field studies were conducted in August 2010 to gather baseline information on the current visual quality conditions within the study area. Field sites that deemed to have potential for heightened adverse visual effects were chosen through a map analysis, road-site survey, and a helicopter survey of the Bell-Irving route. The proposed Bell-Irving route is primarily forested with extensive past timber harvesting and some existing access roads. Very few potential visual sensitive areas occur along this route.

The proposed Project route is approximately 1.5 km to 12 km east of Highway 37, a major north-south travel corridor that runs parallel to the Bell-Irving route. Much of Highway 37 is bordered by a visual barrier of trees that effectively block the view of the proposed route. There are a small number of sites along the highway with fewer trees, but these are not in an area where travellers may stop to rest. Continuing north along Highway 37 from Gitanweliks Creek, the Bell-Irving route traverses farther east, reducing the opportunity for visual sightings. Although Ellsworth camp has a more open landscape, the Bell-Irving route will be approximately 3 km east of the camp and at this point the transmission line will be a very minor visual disturbance or not visible at all. Although parts of Meziadin Lake Provincial Park are within the 10 km visual boundary, the campsite falls outside the boundary. Typically, the majority of users in the area will be focusing their attention on the lake and western portion of this Provincial Park. Between Meziadin Junction and Bell-Irving 1 Highway 37 crossing, the view eastwards to the Bell-Irving route is outside of the 10km visual boundary, or is effectively obscured by the Mount Bell-Irving topographic relief, or roadside vegetation. There is a rest stop just north of the Bell-Irving River crossing enclosed with large coniferous trees blocking any view of the route as it traverses the lower slopes to the northeast of the Bell-Irving River.

The Nass and Bell-Irving Rivers may be used for recreational activities such as river rafting and fishing. These field sites were chosen because of the transmission line crossing the rivers. Lake 00208NASR is just south of the Nass River and was chosen as a site because of its recreational potential.

Four potential sites were identified: the area where the transmission line will cross the Bell-Irving River, the Nass River, the west side of 00208NASR Lake, and at a rest stop just north of the Bell-Irving River. Photographs and descriptions of these identified areas are provided in Appendix 6.12-1. At each site, photographs were taken in one or more directions looking toward the proposed Project route. The global positioning system (GPS) coordinates for the photograph(s) locations were recorded and, where possible, the compass bearing for the direction of each photograph was also recorded.

First Nations have indicated their use of the forest road and cutblock landscape in the area south of the Nass River and west of the Bell-Irving River for hunting and berry picking activities. While the Bell-Irving route most certainly will be visible from some vantage points in these areas, there are no defined user locations identified for these activities.

6.12.2 Spatial and Temporal Boundaries

The spatial boundary for data collection and the effects assessment is a 10 km zone extending from the centreline of the proposed Bell-Irving route.

Temporal boundaries for the effects assessment include the Project's proposed lifetime, which involves a 3-year construction and restoration phase and a 50+ year operations and maintenance phase.

6.12.3 Issues Scoping

This effects assessment addresses visual quality issues and concerns regarding the development of the Bell-Irving route. The principal issue during construction and operation of the proposed Project is sensory disturbance associated with the presence of the cleared ROW, access roads, and Project infrastructure; the potential effect will be an increase in the visual disturbance of the landscape.

6.12.4 Valued Environmental Components

Visual quality was identified as a VEC for this effects assessment. Visual quality depends on many factors such as the current shape (relief and terrain) and nature of the landscape, observation points, and existing natural and non-natural disturbances. Natural processes cause the landscape to undergo gradual modifications over extended periods. Activities associated with constructing a transmission line can change landscape appearance and accelerate and alter the natural processes, such as vegetation composition and maturity.

6.12.5 Identification of Potential Effects and Mitigation

The main way by which the proposed Project could adversely affect visual quality is through altering land cover, which will commence during the construction phase. This will persist through the operations and maintenance phase, but the effect will diminish over time as vegetation along the ROW is re-established.

The potential visual effects for each baseline observation point were rated using the Hassell Matrix, a system developed for assessing visual impacts (Hassell 2005). The matrix uses criteria listed in Section 7.13.5 of the EAC Application. Each visual aspect is rated and an accumulative value is provided for the potential visual effect from the four selected viewpoints. Tables 7.13-2 to 7.13.7 in the EAC Application describe the visual aspects modelled (i.e. visual character, degree of visual modification, horizontal visual effect, vertical visual effect, distance of visual effect) and the final effects rating (i.e., accumulative value).

6.12.5.1 Phase 1: Construction and Restoration

Constructing the proposed transmission corridor will require vegetation clearing, which may also be required along temporary and permanent access roads. Removing vegetation could lead to increased visibility in certain areas. Much of the Bell-Irving route is subject to past and recent timber harvesting, so the extent of alteration to visual quality will vary upon construction of ROW across such a landscape. The altered land cover along the proposed route and permanent access roads will persist into the operations and maintenance phase. Temporary construction sites will be reclaimed and re-vegetated. The altered land cover along the proposed ROW and permanent access roads will remain throughout the life of the Project and is therefore discussed in the operations and maintenance phase.

6.12.5.2 Phase 2: Operations and Maintenance

There are a number of potential Project-related effects on visual quality that may be caused by the ongoing presence of the cleared ROW and infrastructure during the operations and maintenance phase, particularly:

- visual setting and aesthetics of the transmission line and structures; and
- vegetation maintenance within the ROW.

For the Bell-Irving route, the landscape features will likely be affected by the proposed Project. However, the baseline landscape features for this route include several clearcuts as well as secondary forested sections. It is conservatively assumed that the landscape within the entire length of the ROW will be managed to a height of 3 m. This is a conservative assumption as not all areas within the ROW will require such management. Details on the proposed vegetation management are described in detail in Chapter 4 of the EAC Application. Of the total access roads required for the Bell-Irving route, 67% will be existing access roads. Thus, reducing the amount of affected landscape will consequently avoid incremental visual effects to current conditions.

Identification and mitigation of potential effects on visual quality are in Table 7.13-8 of the EAC Application.

Increase in Visual Disturbance

Table 6.12-1 provides a summary of the results of the potential visual effects using the Hassell Matrix for each observation point. The degree of visual effects were rated as moderate to slight for three of the four view points. The Bell-Irving route will not be visible from the fourth viewpoint (the rest stop on Hwy 37 just north of Bell-Irving Bridge). As no visual effects were rated as substantial, images using the Visual Nature Studio 3 were not generated.

6.12.6 Potential Residual Effects and Significance

6.12.6.1 Phase 1: Construction and Restoration

Adverse residual effects to visual quality are likely to occur from the permanent alteration of land cover that will occur during the construction and restoration phase of the Project. Some portions of the construction phase, such as temporary roads, will be reclaimed and re-vegetated and therefore residual effects are unlikely.

For other Project components (i.e. new permanent access roads and ROW) the likely residual adverse effects will occur over the Project's lifetime, and therefore they are assessed under the operations and maintenance phase.

6.12.6.2 Phase 2: Operations and Maintenance

Potential adverse residual effects on visual quality are likely for three of the four observation points assessed:

- Nass River;
- Bell-Irving River; and
- 00208NASR Lake.

The Bell-Irving route will not be visible from the rest stop on Highway 37 just north of the Bell-Irving bridge, thus no residual effects are likely for this observation point.

The significance of the potential residual effects was assessed following the methodology found in Chapter 5 of the EAC Application. Definitions of the evaluation criteria used in assessing the visual quality are generally consistent with those presented in Table 5.8-1 of the EAC Application.

Where evaluation criteria definitions were altered to be more appropriate for the assessment of visual quality, the altered definition is provided in the following sections.

Magnitude of Potential Residual Effects

The overall potential effect of the cleared ROW is likely to have a low magnitude effect for the three observation points based on Table 7.13-10 of the EA Application.

Extent of Potential Residual Effect

Based on Table 7.13-11 of the EAC Application, the extent of the adverse residual effects are likely to be local for three of the four field sites. The transmission line will be directly above the Nass River and Bell-Irving River, which will affect recreational users travelling downstream or fishing. The east side of 00208NASR Lake is 500 m from the transmission line. There is very little visibility from the east side of the lake to the transmission line as there is a visual barrier of trees. The transmission line will be visible from the west side of the lake, which is over 1,000 m from the proposed route.

Duration of Potential Residual Effect

The duration of potential adverse residual effects on visual quality will depend on the perception of the people living in and travelling through the area. The duration will be short-term for one-time visitors to the area, whereas residents may find the duration extends into the far future. At this time there are only a very few residents within 10 km of the Bell-Irving route, at Ellsworth Camp, which is a temporary residential site.

Frequency of Potential Residual Effect

The frequency of potential adverse residual effects on visual quality will depend on the perception of the people living in and travelling through the area. The frequency will be a one-time event for visitors to the area, whereas residents may find the residual effect to be continuous.

Reversibility of Potential Residual Effect

The reversibility of potential adverse residual effects on visual quality will depend on the location of the residual effect. The Nass River and Bell-Irving River inspection sites are in areas where the proposed transmission line will cross a waterbody. Because of their location, the potential effects are most likely irreversible. The 00208NASR Lake inspection site is close to a forested area that will grow over time, and therefore the potential effects are likely to be reversible over the long term. The overall potential effects of the cleared ROW are likely reversible over the long term with the growth of trees and vegetation.

Resilience of Potential Residual Effect

The resilience of potential adverse residual effects will depend on the perception of the people living in and travelling through the area and is not applicable for visual quality, and was therefore not assessed.

Significance of Potential Residual Effect

Primarily considering the magnitude and extent of the residual effects on visual quality, the significance of the potential effects are likely to be not significant. The residual effects will not be significant because only a small percentage of the VEC will be affected over the length of the Bell-Irving route.

Likelihood of Potential Residual Effect

The probability of potential residual effects on visual quality for any given inspection site depends on the topography and vegetation cover present and the public perception of the disturbance. For the

cleared ROW, as well as for the inspection sites that are likely to have a negligible magnitude, the probability of potential residual visual effects is low, recognizing that the effect is not likely to occur.

6.13 SOCIAL, ECONOMIC AND CULTURAL

6.13.1 Environmental Setting

Potential social, economic and cultural effects, are assessed in detail in Sections 7.11 (Land and Resource Use) and 7.12 (Socio-economics) of the EAC Application. In the EAC Application, the social, economic and cultural effects are generally assessed for the entire Project rather than for specific routes or segments and it is anticipated that most potential effects identified previously, will also be applicable to the Bell-Irving route – with the exception that private property along this segment has not be identified, and as such is not addressed.

Hunting, fishing, gathering (considered in Section 6.11 of this report) have significant roles in culture, and social and economic aspects of First Nations, Nisga'a Citizens and any others who access the area. As such, both Sections 6.11 and 6.13 of this report should be read together to understand potential social, economic and cultural effects.

As a measure of the proportionate difference, if one considers the relative difference of the NTL Project assessed in the EAC Application with the proposed Bell-Irving route versus the prior assessed route; the difference is < 2%.

6.13.2 Spatial and Temporal Boundaries

6.13.2.1 Spatial Boundaries

The social, economic and cultural assessment in the EAC Application involved evaluation of potential effects of the Project at local, regional, provincial, and Aboriginal levels, as defined by:

- **Provincial:** British Columbia
- **Regional:** RDKS; Stikine Region
- **Local:** City of Terrace; District Municipality of Stewart; rural settlements

The EAC Application addressed the Nisga'a and all First Nations whose treaty area or asserted traditional territories the NTL ROW crossed. For this report on the Bell-Irving route, the focus is limited to only those Nations for which the Bell-Irving ROW would cross:

- **Nisga'a Nation:** Nisga'a Nation citizens; Nass Area and Nass Wildlife Area.
- **First Nations:** Membership and traditional territories of potentially affected First Nations: Gitanyow Nation (Wilp Gamlaxyeltxw, Wilp Wii'litsxw, and Wilp Malii); and Skii km Lax Ha

The study area for the NTL social, economic and cultural effects assessment is illustrated in Figure 7.12-1 of the EAC Application.

6.13.2.2 Temporal Boundaries

Potential social, economic and cultural effects are evaluated for two distinct phases of development. The construction and restoration phase of 2-3 years will involve construction activities (and associated employment). For the purposes of the effects assessment, the operations and maintenance phase was assumed to last indefinitely (>50 years). However, it is expected that any effect predictions will manifest well within that temporal boundary.

6.13.3 Issues Scoping

The BC Environmental Assessment Office (BC EAO) recognizes social, economic and cultural effects as important considerations within the environmental assessment process for both aboriginal and non-aboriginal populations.

The principal issues regarding developments and their effects on social, economic and cultural values relate to job creation, economic opportunities and community effects, such as community well-being, community, infrastructure and services, and cultural activities.

6.13.4 Valued Environmental Components

Potential social, economic and cultural values that were identified for the EAC Application (through baseline research, media, the Application Information Requirements (AIR), and public, First Nations, Nisga'a Nation and government consultation, etc.) include:

- Employment
- Income generation
- Business opportunities
- Economic development
- Education, training, and skills development
- Population and demographic stability
- Capacity/performance of local infrastructure, including roads and telecommunications
- Capacity of local services, including health, emergency, and protection services
- Capacity of local housing and accommodation
- Value of local properties, and associated economic components (e.g., businesses)
- Community well-being

All these values have been included in the determination of social, economic and cultural VECs (with the exception of roads and telecommunications, which are addressed in Section 7.15 of the EAC Application. Table 6.13-1 describes the selected social, economic and cultural VECs for the Bell-Irving route.

Table 6.13-1. Social, Economic and Cultural VECs for the Bell-Irving Route

VEC	Description
Economic Opportunities	Includes employment, income, business opportunities, economic development, and education/skills/training. Also includes government revenues, and potential revenues and impact-benefit agreements for First Nations and Nisga'a Nation.
Population, Infrastructure, and Services	Includes potential in-migration and capacity of local infrastructure, housing, and health and emergency services.
Nisga'a Nation and First Nations	Includes social, economic and cultural interests for the Nisga'a Nation and First Nations, drawing from the assessment of the other VECs, in the context of each of the Aboriginal Groups. Includes potential employment, business, training, and income opportunities.

Potential effects on these VECs are identified and evaluated, along with mitigation or enhancement strategies, for construction and restoration (Section 7.12.5.1 of the EAC Application) and operations and maintenance phases (Section 7.12.5.2 of the EAC Application).

Potential social, economic cultural, and community effects on the Nisga'a Nation and First Nations are also evaluated, building upon the assessment of non-Aboriginal interests. Recognizing that Aboriginal residents may experience effects of a different nature and/or scale than non-Aboriginal populations, and that approaches to mitigation or enhancement of effects may differ, potential effects of the Project on the Nisga'a Nation and First Nations are discussed separately in Section 7.12.5.3 of the EAC Application and in Chapters 7 and 8 of this report.

Community well-being was suggested as a potential VEC in the Project AIR (BCTC 2009d). However, through the issues scoping process, it was determined that the primary potential adverse effect related to community well-being was the potential disturbance of environmental or aesthetic characteristics (such as increased noise and dust during construction) for residents adjacent to the proposed Project route – of which there are none as this is a remote segment. Human health is also considered an aspect of community well-being, and is addressed in Section 6.14. Finally, the continued use of traditional territories, for economic, cultural, and sustenance purposes, also contributes to community well-being, and is addressed in Section 6.13.

6.13.5 Identification of Potential Effects and Mitigation

This section describes potential effects related to each of the social, economic and cultural VECs, as well as any mitigation or enhancement measures (to lessen adverse effects and increase local benefits) that may be applicable. Following the application of mitigation or enhancement, the potential for residual effects (adverse or beneficial) is identified, the significance of which are assessed in EAC Application (Section 7.13.6).

6.13.5.1 Construction and Restoration

Economic Opportunities

Economic opportunities could be associated with the Project during construction and restoration. These opportunities would be beneficial, and apply to communities and residents along the entire length of the Project. Economic opportunities at local, regional, and provincial scales could include employment; business opportunities; income, training, and skills development; government revenues; and economic development. In addition, the Nisga'a Nation and First Nations could experience specific economic and revenue-generating opportunities. The analysis in the this section and the EAC Application is based on the benefits that may flow from construction and operation of the Project, independent of any business arrangements, including impact benefit agreements or other Project agreements that BC Hydro may ultimately conclude with the Nisga'a Nation or First Nations. No material changes to the effects identified in the EAC Application would be expected using the Bell-Irving route.

Increased Business Opportunities

Business opportunities could be created in response to Project-related demands for goods and services, including direct and indirect opportunities related to construction of the Project (including the Bell-Irving route). While specialized services related to the power engineering construction industry could be required from other parts of BC and Canada, local and regional businesses could be well placed to meet Project needs related to the supplies and services required for construction activities, the operation of construction camps, transportation, forestry-related activities (e.g., timber removal and ROW clearing), and other areas. Potential employment generated by these industries is included in the discussion of potential employment effects, above. However, a desire for local businesses to benefit from construction of the Project has been clearly expressed by public, government, and the Aboriginal Groups; thus, an assessment of potential business opportunities is included separately.

While many aspects of construction will be assigned to one or more general contractors, there are a number of services that could be locally sourced. This includes services related to ROW clearing, truck driving, surveying, storage and machine operations, environmental services, trades, catering and camp services, traffic control, and first aid (BCTC 2009b). The industrial nature of the local and regional economy, particularly in terms of services related to forestry and mining, indicates that many of the required services are available locally. One of the most substantial opportunities for local ventures to be involved in the Project will likely be through timber removal and clearing of the ROW, which local contractors in this area are well positioned to provide. BC Hydro will pursue direct awards for a portion of the clearing contracts to the Nisga'a Nation and First Nations. As with employment, most contracts will likely be temporary and short-term.

BC Hydro will advertise all publicly available contracts on BC Bid. Such contracts will be open to all qualified businesses, including local ventures and First Nations. BC Hydro will pursue a substantial number of the clearing contracts as direct awards to First Nations and Nisga'a Nation contractors.

No material changes to the effects identified in the EAC Application would be expected using the Bell-Irving route.

Increased Income

As with employment and business opportunities, it is not possible to predict how much of this income will be generated within local and regional areas, and how much will be distributed across (or beyond) the province. Using the 30% approximation for local and regional labour, the corresponding income generation could be $33 million for direct Project employees, plus $7 million for employees of direct suppliers. Potential income generation is expected to be largely short-term and temporary, corresponding with the nature of employment during construction. To enhance local involvement in the Project, publicly available employment and business (procurement) opportunities will be advertised on BC Bid. No material changes to the effects identified in the EAC Application would be expected using the Bell-Irving route.

Increased Training and Skills Development Opportunities

BC Hydro has initiated a series of 'boot camps' (short and intense information sessions) to assist the Nisga'a Nation and First Nations on what skills and capacity would likely be required to pursue contracting opportunities related to right of way clearing for the Project. Other than this, it is not anticipated that there will be additional specific training programs for the Project, and additional opportunities for training will depend on individual initiative. No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route. Overall, no potential residual benefit is likely.

Increased Government Revenues

The economic activity associated with the proposed Project (including that of BC Hydro, its contractors, its suppliers, and all associated employees) is anticipated to positively contribute to government net revenues. The majority of government net revenue will be derived through the payment of personal income taxes, followed by the payment of corporate income taxes and commodity taxes (net of subsidies). No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route.

Increased Economic Development

Increased economic development (at local, regional, and provincial scales) may be associated with industrial development supported by the proposed Project. Local communities, the Aboriginal Groups, and the RDKS have all expressed a desire for local and regional economic development, which will be

supported by Project-related employment and business opportunities, as discussed above. No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route.

Population, Infrastructure, and Services

The economic opportunities discussed above may lead to an influx of people to the Project area, including employees and contractors, job seekers, and their families. This potential population increase may, in turn, increase the pressure on local services and infrastructure. In particular, Project-related hazards may also increase pressure on local emergency services, including fire, ambulance, and police.

These potential effects are considered adverse, with the exception of population growth, which is considered positive in light of recent population decline throughout the region. It is likely that any population growth would be focused on the regional centre of Terrace, as well as Stewart. During consultation and through their official community plans, both communities have expressed a desire for population growth. No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route.

Increased Population

No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route.

Increased Demand on Housing and Accommodation

The maximum potential in-migration associated with Project construction is estimated to be around 330 people (at any given time). To mitigate potential accommodation constraints arising from the temporary in-migration of employees, BC Hydro's contractors could use[6] a number of existing construction camps along the proposed Project route. These camps have been developed to support local industrial activity, including forestry. No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route.

Increased Demand on Health and Emergency Services

Representatives of municipal and regional governments, and the Nisga'a Nation, have expressed concern that activities related to construction and restoration could increase demand for existing health and emergency services. This may arise from potential accidents, malfunctions, worker injuries, and/or other unplanned events, which may require responses from emergency medical personnel, fire services, and/or police.

As the potential for in-migration of workers during construction and restoration is expected to be negligible (as discussed above), the potential for increased pressure on local health services (e.g., hospitals, clinics) arising from in-migrants is also expected to be negligible. The estimated number of in-migrating workers (i.e., maximum 330 at any given time) will compose less than two percent of the existing population of the Terrace Local Health Area (BC Stats 2008).

[6] As specified in EAC Section 4.3, the final selection of accommodation options, including construction camps, will be made by applicable construction contractors. Pre-selection of these areas has been done to minimize environmental effects. Once the details of the construction schedule are finalized by the construction contactor, a detailed area analysis of the pre-selected areas will be conducted.

No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route.

Private Properties

No private properties have been identified along the Bell-Irving route.

6.13.5.2 Operations and Maintenance

Potential effects associated with the operations and maintenance phase will be quite different than those anticipated for construction, as the nature of Project activities will be limited to ROW maintenance and inspections, as well as the general existence of the transmission line and corridor. Where construction activities will provide a variety of jobs and business opportunities, the maintenance of the line and ROW will be notably less active. Potential environmental disturbances typically associated with construction activities (such as noise, air emissions from slash burning, fugitive dust along access roads, earthworks, and traffic, etc.) will also be correspondingly less during the operations and maintenance phase of the Project.

During the operation and maintenance phase of the Project, potential concerns include public health, and potential effects related to EMF and EAC Application of herbicides to maintain the ROW. These concerns are addressed in the human health assessment (Section 6.14 of this report).

Economic Opportunities

Economic opportunities may be associated with the long-term operation and maintenance of the Project. These opportunities are beneficial, and apply to the entire life of the Project. Potential effects on economic opportunities (at local, regional, and provincial scales) include employment for maintenance and operations of the transmission line and ROW infrastructure, and income and contracting opportunities associated with this employment.

Increased Employment and Business Opportunities

Employment opportunities are expected to increase from operations and maintenance workforce needs. Contracts will be required to perform regular maintenance activities, primarily involving vegetation management along the ROW. Vegetation management activities are expected to occur annually but given cycle lengths for a segment of circuit of five to seven years, the volume of work is not constant each year. Vegetation management contracts will be put out to tender on a province-wide basis and are based on open competitive bid. Contracts are usually awarded for multi-year terms of up to five years.

No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route.

Increased Income and Skills Development Opportunities

As the employment benefit identified for the operations and maintenance phase (as discussed above), is not expected to result in a residual benefit, no residual benefit is identified for employment-generated income or training and skills development opportunities. Project expenditures related to employment, supplies, and services will also be minimal in comparison with the construction phase, and are also expected to be negligible. Overall, no potential residual benefit is likely for increased income and skills development opportunities.

Increased Government Revenues

No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route.

Increased Economic Development

No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route.

Population, Infrastructure and Services

As no considerable increase in employment is expected to be generated during the operations and maintenance phase, because of the low workforce requirements for operation and maintenance of the Project, there is not expected to be any related change in population, or pressures on housing and accommodation. No material changes are expected employing the Bell-Irving route. No resulting demand on health and emergency services is expected and no potential residual effects are likely.

Increased Environmental/Aesthetic Disturbance

Potential aesthetic effects are expected to be substantially lower than during construction as land clearing and heavy construction activities will not occur (or will occur infrequently). During the operations phase, the transmission line will be a static feature. ROW clearing vegetation maintenance will be infrequent, averaging approximately once every five to seven years. Section 6.12 has a further discussion on visual resources.

6.13.5.3 Nisga'a Nation and First Nations

6.13.5.4 The Nisga'a Nation and First Nations (as per footnote in EAC Application Section 7.12.1.1) have expressed strong interest in a variety of potential social, economic and cultural benefits and opportunities associated with the proposed Project, including a desire for employment, training, business ventures, and revenues. Many of these have been discussed in general above, and will be applicable to any of the potential effected Aboriginal Groups. In addition, some First Nations also expressed concerns that valued aspects of their culture will be ignored or diminished through Project activities.

With respect to the *Nisga'a Final Agreement*, there are two sections of the agreement in particular that apply to this section of the report:

Under c. 10(8)(e) of the NFA, assessment authorities are required to determine whether the NTL Project can reasonably be expected to have adverse environmental effects on:

- residents of Nisga'a Lands;
- Nisga'a Lands; and
- Nisga'a interests set out in the NFA.

Where effects are expected, the assessment authorities must also make recommendations for mitigation.

Under c. 10(8)(f), assessment authorities are required to determine whether the NTL Project will have effects on the existing and future economic, social and cultural well-being of Nisga'a citizens.

In this section, an assessment of specific potential social, economic and cultural benefits for each of the Nisga'a Nation and First Nations (3 Gitanyow wilp and Skii km La Hax) is provided.

With respect to cultural considerations, it is evident that the way each of the Aboriginal Groups defines itself could have implications for any future negotiations or distribution of Project benefits. Concerns in this area have been expressed to date by the Gitanyow Hereditary Chiefs, who place great importance in their traditional hereditary system of governance and have emphasized the need for Project-related discussions to occur at the *Wilp* (hereditary house) level, rather than at the Band, Indian Reserve, or Nation level.

Potential land and resource based effects on the Nisga'a Nation and First Nations are discussed in detail in EAC Application Section 7.11 (Land and Resource Use) and in Chapters 7 and 8 of this report, including potential effects related to potential Treaty settlement lands, and harvesting activities. In addition, all Nisga'a Nation and First Nations considerations (based on identified interests and concerns) are summarized in Chapters 9 and 10, of the EAC Application, respectively. No material changes to the effects identified in the EAC Application would be likely if the Bell-Irving route is chosen over the Hanna-Tintina route.

Potential Adverse Effects

With respect to the Nisga'a Nation and First Nations, potential adverse effects commonly associated with other major industrial projects in rural areas (including those in northern BC) are not likely for the proposed Project. For example, high-paying jobs associated with mining and other resource industries can be linked with social problems such as drug use, while fly-in/fly-out operations can lead to various types of familial and community stress. However, as only short-term, temporary employment will be created by construction of the proposed Project, these adverse effects are not likely. These effects parallel those identified in the EAC Application.

Enhancement of Social, Economic and Cultural Benefits

BC Hydro will advertise all publicly available contracts through the BC Bid system. Such contracts will be open to all qualified businesses, including local ventures, the Nisga'a Nation, and First Nations. In addition, BC Hydro's Aboriginal Business Development program outlines specific mechanisms through which it provides procurement, contracting, and business development opportunities associated with the NTL project for Nisga'a Nation and First Nations. For the NTL Project BC Hydro will pursue direct award of a portion of the clearing contracts to the First Nations. Employment, training, business, and/or other opportunities related to both phases could be enhanced through further discussions with BC Hydro, depending on the specific objectives of the NLG.

No material changes to the effects identified in the EAC Application are likely for the Bell-Irving route.

Nisga'a Nation

Slightly more than half of the proposed Bell-Irving route crosses through the Nass Wildlife Area, with the remainder crossing the Nass Area. The potential loss or changes to Nisga'a land use sites/activities for the original Hanna-Tintina as considered in the EAC Application are addressed in Section 7.11 of the EAC Application. The Bell-Irving route is evaluated as having a smaller environmental footprint. This is especially true for the diminished risk to fish, especially sockeye salmon, and fish habitat values in the Hanna and Tintina watersheds as a result of avoiding these watersheds in favour of the proposed Bell-Irving route. This would better support the Nisga'a fisheries interests as outlined in the Nisga'a Final Agreement (1998) and as addressed in the EAC.

The Nisga'a Nation has expressed an interest in contracting opportunities and other economic benefits that may be associated with the Project. They have also expressed concerns regarding increased EMF

exposure and implications for health. They are interested in negotiating an agreement with BC Hydro to enhance Project benefits.

No material changes to the effects identified in the EAC Application are likely for the Bell-Irving route.

With high unemployment (i.e., around 400 unemployed in 2006), and local skills and experience related to forestry (and perhaps other sectors), it is expected that the Nisga'a population could have an available workforce to meet at least a portion of the anticipated Project labour force and/or contracting requirements. Nisga'a businesses could also provide services to the Project. Additional training and capacity building related to Project activities could be required to enable Nisga'a residents to fully take advantage of these opportunities.

BC Hydro is committed to supporting Nisga'a involvement in the construction of the proposed Project. Nisga'a individuals and businesses will have opportunities to apply for jobs and to bid on contracted services related to Project construction, as well as vegetation management and maintenance activities during the operations and maintenance phase. For the NTL Project, BC Hydro will pursue to direct award of a portion of the clearing contracts to the Nisga'a Nation. Employment, training, business, and/or other opportunities related to both phases could be enhanced through further discussions with BC Hydro, depending on the specific objectives of the NLG.

The following potential residual benefit is likely: potential employment, training, business, and income opportunities will be available to the Nisga'a Nation and its members. No material changes to the effects identified in the EAC Application are likely if the Bell-Irving route is chosen over the Hanna-Tintina route.

Gitanyow Hereditary Chiefs

In total, the proposed Bell-Irving route will cross 43 km of Gitanyow traditional territory. The Gitanyow have expressed a desire for potential impacts and benefits related to the Project to be assessed based on the three potentially affected Gitanyow *Wilp*:

- *Wilp* Gamlaxyeltxw: total distance of 15 km
- *Wilp* Malii: total distance of 16 km
- *Wilp* Wii'litsxw: total distance of 12 km

Potential loss or changes to the traditional territory and land use sites/activities of the three potentially affected Gitanyow *Wilp* are addressed in Section 7.11 of the EAC Application. They have also expressed interest in opportunities for business contracts and other economic benefits, and will also like to have *Wilp* members act as environmental monitors during construction on their territory. Concerns have also been expressed regarding potential health effects related to herbicide use and EMF; these issues are addressed in Sections 7.8 and 7.14 of the EAC Application and Section 6.14 of this report.

A variety of degrees and diplomas are reported amongst *Wilp* members, and on-the-job training and work experience is noted to be very important, particularly with respect to construction and forestry. It is expected that skills and experience relevant to Project construction and maintenance activities are available within the three *Wilp*. Unemployment has increased in recent years with the decline in forestry activity, including the closure of mills in Kitwanga and throughout the region, and it is expected that the potentially affected *Wilp* membership may have capacity to meet some of the Project's labour force and servicing requirements.

BC Hydro is committed to supporting First Nations involvement in the construction of the proposed Project. Gitanyow individuals and businesses will have opportunities to apply for jobs and to bid on contracted services related to Project construction, as well as vegetation management and maintenance activities during the operations and maintenance phase. Employment, training, business, and/or other opportunities related to both phases could be enhanced through further discussions with BC Hydro, depending on the specific objectives of the three *Wilp*.

The following potential residual benefits are likely: potential employment, training, business, and income opportunities will be available to the potentially affected Gitanyow *Wilp* (Gamlaxyeltxw, Malii, and Wii'litsxw) and their members. The Hereditary Chiefs may choose to partake in ongoing discussions with BC Hydro separately for each affected *Wilp*, or together for the three *Wilp*. No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route.

Skii km Lax Ha

The proposed Project will cross 60 km of the asserted traditional territory of the Skii km Lax Ha,[7] Potential loss or changes to Skii km Lax Ha's asserted traditional territory, and land use sites/activities are addressed in Section 6.11 of this report and section 7.11 of the EAC Application.

Skii km Lax Ha's members make up a labour force of twelve, eleven of whom were employed in 2009. Tsetsaut Ventures is the economic branch of the Skii km Lax Ha and provides construction, transportation, and camp services to mining exploration camps in the region. The Skii km Lax Ha have expressed a strong desire for employment and training opportunities to build capacity within their membership, particularly to enhance opportunities for youth.

BC Hydro is committed to supporting First Nations involvement in the construction of the proposed Project. Skii km Lax Ha members and Tsetaut Ventures will have opportunities to apply for jobs and to bid on contracted services related to Project construction, as well as vegetation management and maintenance activities during the operations and maintenance phase. Employment, training, business, and/or other opportunities related to both phases could be enhanced through further discussions with BC Hydro, depending on the specific objectives of the Skii km Lax Ha.

The following potential residual benefits are likely: potential employment, training, business, and income opportunities will be available to the Skii km Lax Ha and its members. No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route.

6.13.6 Potential Residual Effects and Significance

The following section describes the potential social, economic and cultural effects that are likely to remain following the application of the mitigation and enhancement measures described above. The description of these potential residual effects considers the parameters described in Section 5.8 of the EAC Application, including magnitude, geographic extent, duration, frequency, reversibility, and the resilience of the affected population as a basis for predicting significance.

[7] This distance is calculated for the Skii km Lax Ha's territory, as asserted by the Skii km Lax Ha in their view as a distinct First Nation, and not as a house of the Gitxsan Nation. As a house of the Gitxsan Nation, 59.7 km of Wilp Skii km Lax Ha's territory will be crossed by the Project, including line Segments 12 and 13.

6.13.6.1 Construction and Restoration

Economic Opportunities

The following four potential effects on economic opportunities were identified to remain as potential residual effects: increased employment opportunities; increased business opportunities; increased income; and increase government revenues. Other potential effects (including training, skills development, and economic development) were not determined to have potential for residual effects.

Increased Employment Opportunities

As discussed in Section 7.12.5.1 of the EAC Application, a total of approximately 710 to 860 FTE (Full Time Equivalent jobs) of employment will be directly created by the Project during the construction and restoration phase, plus approximately 550 FTE amongst direct suppliers (including camps/catering, trucking, and other support services). For the regional community, it is anticipated that approximately 70 to 85 FTE of Project employment will be available annually, plus around 55 FTE with direct supply industries (all though jobs may not necessarily equate with full-time employment).

With this level of potential job development, the Project will be a major employer during construction, in an area with relatively high unemployment and noted job losses in recent years. However, most of these jobs are expected to be short-term contracts for a temporary and finite duration. In addition, the majority of work (70%) is expected to employ people from outside the region.

Therefore, a relatively low increase in employment opportunities is expected for the regional area for the duration of construction. Employment opportunities are considered reversible in the short-term, as opportunities will end upon completion of construction and restoration activities. The resulting potential effect of these opportunities ending will depend on the economic climate at the time, such as whether there will be additional job opportunities available with other employers. Overall, the benefit of increased employment opportunities, for local and regional residents, is likely to be not significant in the broader context of local and regional employment. No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route.

It is believed that this potential effect has a medium probability of occurring as described in the EAC Application, as actual hiring and contract allocation has not been determined and the assessment is based on preliminary estimates from BC Hydro. BC Hydro will pursue direct awards to some of the clearing contracts to First Nations and Nisga'a Nation. The confidence level of this assessment is intermediate.

Increased Business Opportunities

The proposed Project will create local and regional business opportunities for the provision of goods and services to support construction and restoration activities. Through BC Hydro's procurement process, opportunities will be open to businesses and contractors across (as well as outside) the province, and will not be limited to local suppliers and services. No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route.

Because of the uncertainty around the number and size of contracts that will be obtained by local and regional businesses, the magnitude of this potential effect is conservatively predicted to be low. As with employment, business opportunities will benefit the regional community in the medium term (i.e., duration of construction and restoration), and will be reversible upon completion of this phase.

Because BC Hydro cannot preferentially allocate potential contracts to local and regional business, this potential benefit is likely to be not significant.

It is believed that this potential beneficial effect has a medium probability of occurring as described in the EAC Application, as actual hiring and contract allocation has not been determined and the assessment is based on preliminary estimates from BC Hydro. The confidence level of this assessment is intermediate.

Increased Income

Project-related employment will generate income for workers. Income generation for residents of the northwestern BC region from direct employment with the proposed Project is expected to total $33 million over three years of construction. New income-generating opportunities will likely be welcomed by the region, which has experienced considerable job losses in recent years. No material changes are expected employing the Bell-Irving route. However, because most jobs will be temporary and short-term, and easily reversible, the magnitude of the potential overall effect is expected to be low. The potential benefit of increased income is likely to be not significant.

It is believed that this potential beneficial effect has a medium probability of occurring as described in the EAC Application, as actual hiring and contract allocation has not been determined and the assessment is based on preliminary estimates from BC Hydro. The confidence level of this assessment is intermediate.

Increased Government Revenues

Construction and restoration activities will generate fiscal benefits for provincial and federal governments, amounting to a total of approximately $55 million (including revenues derived directly from the proposed Project and those derived indirectly from supply industries). No material changes are expected employing the Bell-Irving route. Relative to the size of existing government budgets and total tax revenues, the Project-derived input will be relatively minor. Thus, the magnitude of the potential effect is determined to be low. Overall, the potential benefit of increased government revenues is likely to be not significant.

It is believed that this potential beneficial effect has a high probability of occurring as described in the EAC Application, as Project expenditures and their relationship to government revenues are relatively well understood. The confidence level of this assessment is high.

Population, Infrastructure, and Services

The only potential residual effect of the Project expected on population, infrastructure, and services is that of increased population. The other identified potential effects (including increased demands on housing and emergency services) will likely not result in potential residual effects following implementation of the described mitigation measures.

Increased Population

No material changes are expected employing the Bell-Irving route. Assuming that approximately 30% of the required workforce will be hired from the northwestern BC region, it is anticipated that approximately 165 to 200 workers from outside the region could be employed directly by the Project at any given time. In addition, up to 130 people may be employed by jobs in direct supply industries. This influx of workers is not expected to result in material pressure on housing or other services. Relative to the regional and local populations, the influx is expected to be small, but noticeable. It will also only persist for the duration of the construction phase, and will be fully reversible at the end of construction and restoration activities. Due to the stated capacity of local services and housing

resources, the resilience of the region to this potential in-migration is considered high. The overall significance of the potential effect (which may be beneficial or adverse, depending on perspective) is likely to be not significant.

It is predicted that this potential effect has a medium probability of occurring as described, as actual hiring and contract allocation (and related in-migration) has not been determined. The confidence level of this assessment is intermediate.

6.13.6.2 Operations and Maintenance

A potential benefit for government revenues is the only likely residual effect identified for the operations and maintenance phase of the Project.

Economic Opportunities

Government Revenues

No material changes, to the effects described in the EAC Application, are expected employing the Bell-Irving route. It is estimated that the proposed Project will contribute approximately $1,512,500 annually in school taxes, and $1,890 annually in grants, based on the proposed infrastructure (including the transmission circuit, upgrading of the Skeena Substation, and establishment of a new substation at Bob Quinn). This contribution will be long-term in duration, continuous, beyond regional in geographic extent, and not easily reversible. However, in the context of the provincial budgets and total property taxes generated by the Province, the magnitude of this effect is expected to be negligible. This potential effect is likely to be not significant.

It is believed that this potential beneficial effect has a high probability of occurring, as Project expenditures and their relationship to government revenues are relatively well understood. The confidence level of this assessment is high.

6.13.6.3 Nisga'a Nation and First Nations

The extent of potential residual benefits (including potential employment, training, business, and income opportunities), beyond those discussed for the broader population, will be enhanced by BC Hydro's Aboriginal Business Development program. Any particular focus of benefits (e.g., on business opportunities, training, etc.) will largely depend on the preferences of each of the Aboriginal Groups as to which areas they may choose to focus their efforts. Further potential enhancement measures and/or agreements may be developed through ongoing discussions with BC Hydro.

No material changes, to the effects described in the EAC Application, are expected employing the Bell-Irving route. In general, the majority of employment, business, and training opportunities directly related to the Project will be confined to the construction and restoration phase. Opportunities will likely be negligible during operations and maintenance, as maintenance activities such as ROW clearing will not be conducted every year. Thus, benefits are expected to have medium-term duration (i.e., approximately three years of construction and restoration activities).

For the Nisga'a Nation and First Nations, the magnitude of potential social, economic and cultural benefits is predicted to be medium, because of the potential for additional enhancement of these opportunities for the Nisga'a Nation, potentially affected Gitanyow wilp and the Skii km Lax Ha.

The frequency of potential benefits may also vary, depending on the parameter. For example, benefits related to employment and business opportunities could be continuous during the three-year construction and restoration phase, or may involve less frequent contracts.

Without knowing the outcomes of possible future discussions or agreements between the Aboriginal Groups and BC Hydro, and their potential to further enhance Project benefits, it is not possible to ascertain the significance of these potential effects for each group. Therefore, it is conservatively expected that potential social, economic and cultural benefits will likely be not significant, as most opportunities associated with the proposed Project will be short-term and temporary, and largely limited to the construction and restoration phase. However, it is acknowledged that benefits may, indeed, be significant for some (or all) groups, depending on their interest, capacity, and/or the nature and extent of potential additional enhancement measures that may be developed in partnership with BC Hydro.

The probability of this assessment is expected to be medium, because of the uncertainty described above. The level of confidence of this assessment is intermediate.

6.13.7 Conclusions

The proposed Project will generate a number of direct social, economic and cultural benefits, including employment, business, and income opportunities. These benefits will be largely limited to the three-year construction and restoration phase, as this is when the majority of activities will take place. No material changes to the effects identified in the EAC Application would be expected if the Bell-Irving route is chosen over the Hanna-Tintina route.

6.14 HUMAN HEALTH

Project construction and operation may affect environmental media such as noise levels, drinking water, air quality, and country foods. Project operations may also increase electric and magnetic field (EMF) levels along the Bell-Irving route. This chapter presents an effects assessment of potential adverse effects on public human health as they relate to the environmental media listed above.

These assessments are presented in the following subsections:

- 6.14.1 Noise;
- 6.14.2 Electric and Magnetic Fields;
- 6.14.3 Domestic Water Quality;
- 6.14.4 Local (Country) Foods; and
- 6.14.5 Air Quality.

This human health effects assessment does not address occupational exposures. Safety and human health concerns for workers will be addressed separately in site- and/or activity-specific Health and Safety Plans that will be developed before construction. Rather, this document applies to humans that reside near the Bell-Irving route and to individuals who could enter the study area on an occasional basis (e.g., campers, hunters). Potential adverse effects on the non-health related quality of life were assessed in Section 7.11 of the EAC Application and Section 6.11 of this report.

A desk-based review of permanent and semi-permanent residences near the proposed Bell-Irving route was conducted in August 2010. The desk-based review found no permanent or semi-permanent residences within a 5 km spatial boundary of the proposed Bell-Irving route. Because of the time constraints of this report land use interviews with potential land users were not conducted. Consequently, the findings of the desk-based study, regarding the lack of permanent and semi-permanent residents, have not been verified. However, discussions with the Nisga'a Nation, Gitanyow and the Ski km Lax Ha have indicated that there are areas along the proposed Bell-Irving route which

are used for hunting, fishing, berry picking, and drinking water purposes. Although no permanent or semi-permanent residences were identified, it is assumed that people use the area occasionally and/or seasonally for resource use and/or recreational use activities.

6.14.1 Audible Noise

This section provides an assessment of the potential adverse human health effects from noise levels generated during the construction and operation of the Bell-Irving route.

6.14.1.1 Environmental Setting

The environmental setting for noise for the entire Project is in Section 7.14.1 of the EAC Application. Baseline noise levels were recorded at 10 locations throughout the study area, including locations near roads and highways as well as locations with minimal anthropogenic noise. Methods for collection of the noise information are described in Section 7.14.1 and Appendix 7.14-2 of the EAC Application. The Bell II and future Bob Quinn substation locations are considered to be the most closely representative of the baseline noise levels along the Bell-Irving route.

6.14.1.2 Spatial and Temporal Boundaries

The spatial boundary includes a 5-km zone extending from the centreline of the proposed Bell-Irving route.

This assessment considers two distinct temporal phases of development:

1. Construction and restoration (3 years).
2. Operations and maintenance (>50 years).

Although the construction and restoration period will be three years in total, each construction activity at any one location (i.e., length of 300 m of road clearing, length of 300 m of road construction, and length of 300 m of ROW clearing) will last a week or less on average; foundation installation and structure erection activities will take even less time.

6.14.1.3 Issues Scoping

Land users within or near the study area may be able to detect the noise that will be generated from Project activities (i.e., vehicles, construction equipment, helicopters, electrical sounds from the proposed transmission line, etc.). The principal issue associated with this potential adverse effect is sensory disturbance.

6.14.1.4 Valued Environmental Components

The human VECs that are assessed, with respect to potential adverse health effects from noise of the Project, are individuals that may have problems coping with noise (i.e., sensitive receptors). The rationale for this VEC selection is presented in Section 7.14.1.4 of the EAC Application.

6.14.1.5 Identification of Potential Effects and Mitigation

Phase 1: Construction and Restoration

The main construction activities that could contribute to noise levels include the following:

- access road clearing and preparation (for new roads only);
- access road construction or upgrading;

- transmission line ROW clearing and site preparation;
- foundation installation (with and without helicopter); and
- structure erection (with and without helicopter).

Noise modelling for the construction phase was conducted by BKL Consultants Ltd (Appendix 7.14-2 of the EAC Application). The noise modelling results presented in the EAC Application are considered reflective of the noise that will be generated during construction of the Bell-Irving route. Notably, the noise generated during construction will decrease substantially with distance from the source.

Health Canada recommends using the guidance provided in Michaud et al. (2008) to assess potential health effects from Project-related noise. The approach presented by Michaud et al. is to assess potential adverse health effects based on a change in percent highly annoyed (%H/A_n). A change in %H/A_n refers to the difference in %H/A_n between the steady-state noise environment with the Project and the steady-state noise without the Project. The change in %H/A_n is not intended to assess the immediate response towards a project's initial change in noise levels, but to assess changes that may occur in the long term. Although the noise generated during construction will not be long term and no permanent and semi-permanent receptors were identified, the change in %H/A_n was calculated (Section 7.14.1.5 of the EAC Application). At a distance of 500 m from a construction noise source, the %HA_n for total noise is predicted to be the same as the %H/A_n for baseline noise.

Phase 2: Operations and Maintenance

During operations, audible noise emitted from transmission lines is typically very low. This is, in part, confirmed by some of the baseline measurements taken within existing transmission line ROWs, which were below 30 dBA in the absence of other noise sources (Table 7.14-2 of the EAC Application).

The proposed transmission system will be designed by BC Hydro in accordance with BC Hydro Engineering Standard ES 41-K Section 4.2 to limit corona noise to 55 dBA during heavy rain at the edge of the ROW. Based on this design standard, potential residual effects are unlikely from corona noise during operations.

6.14.1.6 Potential Residual Effects and Significance

At a distance greater than 500 m from a construction noise source, no residual effects are likely. Noise within 500 m of a construction noise source will be mitigated through the use of best available technologies (where practical), consistent flight paths (i.e., same flight path each day), and public awareness of construction activities. With mitigation, residual adverse effects within 500 m of a construction noise source are unlikely.

Overall residual effects are unlikely for the operations and maintenance phase of the Project.

6.14.2 Electric and Magnetic Fields

EMF is produced by both natural and man-made sources that surround people. EMF is found wherever electricity is generated, delivered, or used, including power transmission and distribution lines, wiring in homes, workplace equipment, electrical appliances, power tools, and electric motors. BC Hydro recognizes that there is public concern about EMF and its potential adverse health effects and is committed to addressing these concerns in an open and balanced manner.

Appendix 7.14-4 and 7.14-5 of the EAC Application present summaries of the current state of scientific and public health research data, conclusions, and policy statements (with respect to potential EMF

health effects based on reviews conducted by Exponent Research Inc.). Additional background information on EMF is presented in Section 7.14.2 of the EAC Application.

6.14.2.1 Environmental Setting

The proposed Bell-Irving route does not parallel or cross any existing transmission lines. In addition, the area along the proposed route is used primarily for logging, recreational purposes, and subsistence harvesting. Thus, there are limited sources of EMF along the Bell-Irving route (i.e., vehicles or electrical equipment such as generators).

6.14.2.2 Spatial and Temporal Boundaries

The spatial boundary for this assessment is based on 20 m from the edge of the proposed ROW.

Potential health effects from human receptor exposure to EMF levels are assessed for the operations phase only. Potential health effects were not assessed for the construction phase, as the proposed transmission line will not be energized until it comes into operation.

6.14.2.3 Issues Scoping

Concern for potential human health effects from exposure to EMF was raised during the public, Nisga'a Nation, and First Nations consultation activities during the pre-Application phase of the EAC Application process. The principal issues associated with these potential effects are community development and Aboriginal interests.

6.14.2.4 Valued Environmental Components

The VECs in this assessment include the general public that could be exposed to the EMF levels from the proposed Project. This includes all life stages (e.g., infants, toddlers, adults).

6.14.2.5 Identification of Potential Effects and Mitigation

EMF levels were calculated for peak loads for the proposed 287-kV transmission line (Table 6.14-1). Average magnetic levels were also calculated (Appendix 7.14-4 of the EAC Application).

Table 6.14-1. Calculated Maximum Magnetic Field Levels (mG) and Electric Field Levels (kV/m)

EMF	Max	Edge of ROW	10 m from Edge of ROW	20 m from Edge of ROW
Magnetic Field (mG)	34.21	12.8	6.5	3.79
Electric Field (kV/m)	2.9	1.59	0.63	0.29

A summary of the EMF reference levels is provided in Section 7.14.2.5 of the EAC Application.

The calculated EMF for the proposed Project are well within the limits of the guidelines provided by the International Commission on Non-Ionizing Radiation Protection for short-term exposures to elevated EMF. There are no limits for long-term exposures to low-level EMF, because there is no conclusive scientific evidence that long-term exposure causes adverse health effects(Exponent 2007; 2009; Appendix 7.14-4 and 7.14-5). Overall, no potential residual adverse health effects are likely for the EMF generated by the proposed Project for short-term exposure (i.e., hunting, berry picking, hiking, etc., along the Project route) or long-term exposure (i.e., living adjacent to the ROW).

6.14.2.6 Potential Residual Effects and Significance

Although no residual adverse health effects are likely from potential EMF levels generated from the proposed Project, BC Hydro will take measures to reduce EMF levels where mitigation costs are not significant. These measures are presented in Section 7.14.2.5 of the EAC Application.

6.14.3 Domestic Water Quality

6.14.3.1 Environmental Setting

There are no permanent or semi-permanent residences within 5 km of the Bell-Irving route. First Nations have indicated transient use of surface water sources for drinking water during hunting, trapping, fishing and berry-picking or other traditional gathering activities. The transient drinking water sources are not known, nor their duration or volume of use, which is expected to be quite minor. There are no active forestry camps along the route.

6.14.3.2 Spatial and Temporal Boundaries

The spatial boundary includes a 1-km zone extending from the centreline of the proposed Bell-Irving route. No registered groundwater wells were identified along the Bell-Irving route (Section 6.10), and it is believed that there are no domestic surface water sources because of the lack of permanent or semi-permanent residences.

This assessment considers two distinct temporal phases of development:

3. Construction and restoration (3 years).
4. Operations and maintenance (>50 years).

In addition, the temporal boundaries include both acute and chronic exposures to domestic water. Acute exposure may be from occasional ingestion of water by recreational users, whereas chronic exposure will be from long-term ingestion by people who drink the water daily. Chronic exposure is not expected given that no permanent residences have been identified along the Bell-Irving route.

6.14.3.3 Issues Scoping

The quality of surface water and groundwater resources is important for the health of the public, First Nations, and Nisga'a Nation who may use these resources for drinking water purposes. The key issues or concerns with respect to potential Project-related adverse effects to drinking water quality include potential contamination from sedimentation, spill events, metal leaching and acid rock drainage (ML/ARD), and herbicide use. The principal issue with these potential effects is site contamination.

6.14.3.4 Valued Environmental Components

The valued environmental components in this assessment are the people that rely on the surface water bodies and/or groundwater aquifers for drinking water within the study area. This includes all life stages (e.g., infants, toddlers, adults).

6.14.3.5 Identification of Potential Effects and Mitigation

Phase 1: Construction and Restoration

The water quality may be affected during construction and restoration due to sedimentation, accidental spills and ML/ARD. Details of these potential adverse effects are provided in Section 7.14.3.5 of the EAC Application. To mitigate for these potential effects, BC Hydro will implement an

Erosion and Sediment Control plan, Spill Prevention and Response Plan, an ML/ARD Prediction and Prevention Management Plan and will follow the Approved Work Practices for Managing Riparian Vegetation and Forest Road Engineering Guidebook procedures for road construction. Information on these plans is presented in Chapter 11 of the EAC Application. Despite the proposed mitigation, sedimentation is still possible during periods of high precipitation events and from equipment accidents during construction, reducing water quality in surface waterbodies used for drinking water during construction. In addition, spill events are also possible even with mitigation. Thus, residual effects are likely from sedimentation and spills.

Phase 2: Operations and Maintenance

Once construction and restoration is complete, there is limited potential for surface water or groundwater quality to be affected by Project activities. There is a limited potential for erosion along permanent access roads, which could result in sedimentation and reduction in water quality in adjacent rivers and streams. Potential spills during periodic vegetation management could affect both surface water and groundwater quality, depending on the size of the spill and its proximity to drinking water sources. Mitigation measures will include those presented in the existing BC Hydro Environmental Management and Operational Procedure documents (Chapter 11 of the EAC Application). With mitigation, no residual adverse effects are likely.

As described above, an ML/ARD Prediction and Prevention Management Plan will be implemented during construction so that potentially exposed areas do not result in degraded water quality. Provided this plan is successfully implemented during construction, no potential residual adverse effects are likely as a result of ML/ARD during the operations phase. There are no known metallic mineral occurrences along the Bell-Irving route as the geology is primarily sedimentary in nature and not known to be mineralized. No newly exposed bedrock is anticipated during the operations phase.

Within the strategy for vegetation maintenance of the ROW of the Bell-Irving route will be the use of herbicides. General ROW maintenance tends to take place on an approximate 7 year rotation, using a variety of techniques on a site-specific basis, only one of which is herbicide treatment. The pattern of herbicide use on the existing transmission lines in the NW part of BC historically reflects the periodic need to treat localized areas of dense rapidly growing deciduous targets on these circuits. There has been little herbicide use on the existing 1L381ROW and regular but selective use on the 1L387 ROW, particularly on the southern portion of the circuit towards Terrace where growth rates of deciduous targets are greater. The amount of use has been quite low relative to the right of way area in any given year with the greatest being 10.5% of the ROW treated in 2000 on 1L387 and usually far less than that in other years. Over the time period, there have been many years where no treatments have occurred. Herbicide use has been low on these circuits due to slashing and mowing methods predominantly providing adequate control in the area. These records can be taken as representative of patterns of herbicide use that could be anticipated on the NTL circuits to treat deciduous targets.

Additional details on BC Hydro's vegetation maintenance strategies are presented in the Integrated Vegetation Management Plan (IVMP) for Control of Vegetation in Transmission Rights-of-Way (11.2-1 of the EAC Application). Where herbicide applications do occur, applicators follow label directions, observe requirements related to provincially-mandated pesticide free zones (PFZs) set out in the *BC Integrated Pest Management Act* and Regulation (2008), and BC Hydro's application methods set out in its standard operating procedures. Herbicides will not be applied to any vegetation within a prescribed PFZ of a waterbody or riparian area, with use of additional no treatment zone (NTZ) buffers where necessary to ensure the integrity of the PFZ. Herbicides will not be applied during rain events or when windy. If all label directions are followed along with BC Hydro's application methods and management

strategies, transportation of herbicides to surface water or groundwater is unlikely. Thus, residual effects on drinking water quality are not likely.

6.14.3.6 Potential Residual Effects and Significance

Following mitigation and management, the only potential residual adverse effects identified with respect to drinking water quality will be from potential sedimentation and spills during construction. These potential residual effects will be of low magnitude and geographic extent and will be sporadic and short term in nature. Consequently, these potential effects to drinking water are not likely significant. Potential health effects from exposure to affected drinking water caused by Project activities are not predicted.

6.14.4 Local (Country) Foods

Country foods are defined as animals, plants, or fungi used by people for medicinal or nutritional purposes that are harvested through hunting, gathering, or fishing (Health Canada 2004). Country foods take up chemicals from the environmental media (i.e., water, soil, and vegetation). The quality of these foods is directly related to the chemical or elemental concentrations in the environmental media. Thus, any Project activity that could affect the quality of water, soil, and vegetation could also affect the quality of country foods.

6.14.4.1 Environmental Setting

A list of plants and fungi that may be collected from the ROW of the Bell-Irving route and used for medicinal or nutritional purposes is presented in Table 7.14-21 of the EAC Application. All potential fish and wildlife species that may be harvested from the study area are listed in Section 7.14.4.1 of the EAC Application. The list of country foods that may be harvested from the Bell-Irving route was based on traditional use and traditional knowledge (TU/TK) information from relevant First Nations, desk-based information, and environmental baseline studies for vegetation, wildlife, and fisheries.

6.14.4.2 Spatial and Temporal Boundaries

The spatial boundary for the assessment of country foods includes a 1-km buffer extending from the centreline of the route.

This assessment considers two distinct temporal phases of development:

1. Construction and restoration, (3 years total).
2. Operations and maintenance (>50 years).

In addition, the temporal boundaries include chronic exposures to potential contaminants in country foods. Chronic exposure would be from consuming country foods throughout the year or several years.

6.14.4.3 Issues Scoping

Consultation for the Project indicated that First Nations, Nisga'a Nation, and the public are concerned about potential changes to the quality of county foods in the Project area due to Project development. The principal issue associated with country foods is site contamination.

6.14.4.4 Valued Environmental Components

The VEC for this assessment are people (including all life stages) who consume country foods harvested from the Project area for nutrition or medicinal purposes.

6.14.4.5 Identification of Potential Effects and Mitigation

Phase 1: Construction and Restoration

Soil

Fuel, hydrocarbon, and/or other chemical spills could occur during construction of the Project (i.e., construction of roads and ROW), which in turn could affect the quality of soil. All chemical spills will be remediated as per the Contaminated Sites Regulation and in accordance with the Spill Prevention and Emergency Response Plan (Chapter 11 of the EAC Application). Because the spills and all associated potentially affected soils will be cleaned up and/or remediated, there is limited potential for such spills to affect the quality of country foods (i.e., vegetation or wildlife) during construction.

Water

An effects assessment for water quality was presented in Section 6.10. The potential residual adverse effects identified were classified as not likely significant. Therefore, the potential for changes in water quality to affect country foods are also predicted to be not likely.

Vegetation

During ROW clearing, non-merchantable timber and slash will be burned in piles along the ROW. The duration it takes to burn each pile is expected to be quite short, likely less than a few days per pile. Mitigation for burning is presented in Section 6.14.5.5.

Particulate matter (PM) generated during slash burning is not expected to affect edible vegetation within the Project area because of the limited timeframe during which burning will occur, and because of the controlled burning prescriptions that will be implemented to reduce potential fire hazard risk and air emissions. In addition, because no soil or water quality effects are predicted, there are no other exposure pathways for country foods to potentially be affected by construction activities. Consequently, potential effects to edible vegetation during construction are predicted to be not likely.

Overall, the potential effects on the quality of country foods during construction are predicted to be not likely. Potential effects on decreased or increased availability of vegetation caused by ROW clearing and potential effects to access for hunting during construction are presented in Sections 6.6 and 6.7, respectively.

Phase 2: Operations and Maintenance

Soil

Fuel, hydrocarbon, and/or other chemical spills during operation and maintenance of the transmission line and ROW could affect soil quality. Spills will be remediated as per the Contaminated Sites Regulations, and in accordance with BC Hydro's Spill Response Procedures. Because the spills and all associated affected soils will be cleaned up, it is unlikely for such spills to affect the quality of country foods during operation.

Water

An effects assessment for water quality was presented in Section 6.10. No potential residual effects to water quality were predicted after mitigation. Therefore, the potential for changes in water quality to affect country foods is predicted to unlikely.

Vegetation

As described above in Section 6.14.3.5 (Phase 2: Operations and Maintenance), part of the strategy for vegetation maintenance within the ROW of the Bell-Irving route will be the limited use of herbicides, both spatially and temporally. Additional details on BC Hydro's vegetation maintenance strategies are presented in the Integrated Vegetation Management Plan (IVMP) for Control of Vegetation in Transmission Rights-of-Way (11.2-1 of the EAC Application). All herbicide applications will follow label directions, use of provincially mandated PFZs as required in the *BC Integrated Pest Management Act* and Regulation, and BC Hydro's application methods outlined in standard operating procedures. Herbicides will not be applied to any vegetation within a prescribed PFZ of a waterbody or riparian area, with use of additional NTZ buffers where necessary to ensure the integrity of the PFZ. Herbicides will not be applied during rain events or when windy. If all label directions are followed along with BC Hydro's application methods and management strategies, transportation of herbicides to edible vegetation will not result in concentrations that are unsafe for human consumption. In addition, residual effects from using herbicides are unlikely for drinking water quality. Additional rational for the residual effect determination can be found in Section 7.14.4 of the EAC Application.

Although residual adverse effects are not likely from applying herbicides during operations and maintenance, the *BC Integrated Pest Management Act* and Regulations require public notification and consultation to be conducted by BC Hydro before applying herbicides. Public notification and consultation will involve:

- Postings in newspapers in relevant communities twice in a two-week period during the development of the five-year IVMP for Control of Vegetation in Transmission Rights-of-Way.
- Skii km Lax Ha
- Gitanyow Hereditary Chiefs, including the Gitanyow Hereditary Chiefs Office and the three affected houses (Wiil'litsxw, Malii and Gamlaxyeltxw)
- Direct communication and approval will be required on private lands, treaty lands (i.e., Nisga'a Lands), and reserves.
- Nisga'a Nation, including the Nisga'a Lisims Government, and, more specifically, Lands and Resources.

6.14.4.6 Potential Residual Effects and Significance

Following mitigation and management, no potential residual adverse effects were identified with respect to the quality of country foods affecting human health.

6.14.5 Air Quality

6.14.5.1 Environmental Setting

Air quality is defined by the levels of dust, fine PM, and gases in the atmosphere. The Project setting for air quality is presented in Section 6.9.

6.14.5.2 Spatial and Temporal Boundaries

The spatial boundary includes a 5-km buffer zone extending from the centreline of the ROW.

The temporal boundary for this assessment is the construction and restoration phase, as negligible emissions will be generated during operations (Section 6.9). Although the construction and restoration period will be three years in total, construction activities at one location along the Project will likely take less than one week per 300 m of road and/or ROW clearing, and installation of structures,

stringing, and restoration. Thus, this assessment considers acute exposure to air quality contaminants rather than chronic exposure, which would, in contrast, involve inhalation of air contaminants over an entire year or several years.

6.14.5.3 Issues Scoping

It is expected that the Project's construction phase will result in air emissions from fuel combustion, emissions of fugitive dust caused by movement of construction vehicles and large equipment along access roads and along the transmission line ROW, blasting, and slash burning. Compounds that may be emitted during construction activities include sulphur dioxide (SO_2), oxides of nitrogen (NO_X), carbon monoxide (CO), and particulate matter (PM). Potential adverse effects of the Project on air quality were addressed in Section 6.9 (Atmospheric Environment). However, the evaluation did not consider human receptors within 5 km of the ROW. Consequently, a qualitative assessment of potential effects to human health caused by Project emissions is included in this section. The principal issue with respect to this potential effect is air emissions.

6.14.5.4 Valued Environmental Components

The human VECs that are assessed with respect to air quality are children, seniors, and individuals with pre-existing cardio-respiratory health problems. Rationale for this VEC selection is provided in Section 7.14.5.4 of the EAC Application.

6.14.5.5 Identification of Potential Effects and Mitigation

Air emissions during the Project construction phase could result in adverse human health effects. These potential effects will be mitigated through adopting BMPs. As with any pollution management activity, the most effective control mechanism is prevention. Particularly with dust emissions, once dust is generated and airborne, it is more difficult to mitigate. An Air Quality and Dust Control Plan will be developed to reduce emissions (Chapter 11 of the EAC Application). Adopting BMPs for mitigating fugitive dust from vehicle activity and heavy equipment movement will considerably reduce total PM (up to as much as 90%).

Air emissions from Project construction are not likely to result in adverse health effects from exposure to SO_2, NO_X, and CO with this mitigation. This is largely based on the short period that construction activities will take in any one location, which will result in very short exposure durations. As such, no potential residual health effects are likely from the emissions of SO_2, NOx, and CO for people using the areas adjacent to the construction activities for recreational or subsistence activities.

Mitigation for emissions from open burning will include:

- Develop and implement Project-specific slash management and disposal measures in the environmental management program.
- Include procedures within the slash management and disposal measures to ensure compliance with the Open Burning Smoke Control Regulation (2003).

Additional mitigation for permanent receptors within 500 m of the ROW is presented in Section 7.14.5 of the EAC Application. If permanent receptors are identified along the Bell-Irving route then this mitigation will also apply.

6.14.5.6 Residual Effects and Significance

Despite the mitigation, VECs may be exposed to PM from burning vegetation following the clearing for roads and the ROW. After mitigation, the magnitude of the adverse effect is considered low, as the concentrations will be within the range of natural variation and/or within the range of levels caused by

past projects or activities. The spatial extent of the effect will be limited to individuals. The frequency of the effect could be one time to continuous, depending on the type of health effect resulting from the exposure to the PM. The reversibility of the effect could be reversible short term to irreversible depending on the type of health effect. Because the VEC assessed is a sensitive individual, the resilience to exposure of increased PM is low. Overall, the potential for increased PM to result in adverse health effects is not likely significant. This is primarily because PM increases are transient, short term, and therefore not likely to result in measurable health effects.

6.14.5.7 Likelihood of Effects

The likelihood that a significant health effect will occur is low, due to the mitigation measures proposed. However, because the actual concentrations at the receptor locations cannot be modeled with certainty, a quantitative human health risk assessment cannot be completed, and thus the confidence in this assessment is low.

6.15 TRANSPORTATION AND UTILITIES

The Project could potentially affect transportation and utilities along the Bell-Irving route, including roads and highways, aviation, and navigable waters. The proposed Bell-Irving route will not cross any railways or known utilities. Potential adverse effects on roads, highways, aviation and navigable waters are assessed in this Section. The methods for the assessment are presented in Chapter 5 of this report and Chapter 5 of the EAC Application.

6.15.1 Roads and Highways

6.15.1.1 Environmental Setting

In August 2010 BC Hydro and its consultants conducted a review of the existing access roads that will intersect or overlap with the Bell-Irving route. The review found that the Bell-Irving route will not intersect or parallel any existing highways, although Highway 37 will be used to access secondary roads that lead to the route. The existing roads that may be used to access the Bell-Irving corridor are primarily forest service roads (FSRs), including Orenda, Windfall, Gleason, Dome, and Kotcho. Approximately 67% of the access roads for the route will be existing roads.

6.15.1.2 Spatial and Temporal Boundaries

The spatial boundary includes all roads extending 2 km on either side of the proposed Bell-Irving route that could potentially be affected by Project activities. This boundary includes the roads listed above. Potential adverse effects to highways were assessed in the EAC Application and will not be repeated in this report.

The assessment considered two Project phases: (1) construction and restoration, and (2) operations and maintenance.

6.15.1.3 Issues Scoping

During public consultation, the primary concern raised regarding roads and highways was the potential adverse effect of Project construction and operations on public use of highways. Although the Bell-Irving route does not cross or intersect highways, the use of secondary roads along the route may affect the access for forestry companies that use the roads for logging. The principal issue associated with these effects is access.

In addition, during the review period MOTI raised concern that construction of the ROW may increase the potential for avalanche. This potential effect is assessed in Section 6.4 of this report.

6.15.1.4 Valued Environmental Components

The VEC for roads and highways is maintenance of transportation along roads, with respect to traffic volumes, flow, and safety.

6.15.1.5 Identification of Potential Effects and Mitigation

Phase 1: Construction and Restoration

During the construction and restoration phase of the proposed Project, there will be a temporary increase in road traffic due to transport of materials and personnel to and from construction sites along the Bell-Irving corridor. However, traffic volume on existing FSRs is expected to remain within the baseline levels experienced when active logging took place. Project-related traffic volume will vary at different points along the corridor. During construction, peak traffic volumes are expected to be in the mornings and evenings, at the beginning and end of the workday. Higher traffic volumes could mean an increased risk of traffic accidents and increased risk to public or worker safety.

The construction of the transmission line will require the construction of additional access roads and the expansion or improvement of existing FSRs and trails. The location of these roads will be dependent on the final construction plans. As neither the Nass or Bell-Irving Rivers will have bridges constructed across them, there will likely be a need to extend existing FSRs or trails to the spanning structure locations; although it has not yet been determined what the approach locations will be, or indeed if they will be required should helicopter support for spanning structure location be alternately used.

Section 7.15.1.5 and Chapter 11 of the EAC Application present mitigation for the potential adverse effects due to the use and improvement of existing FSRs and trails. Primary mitigation will include the following:

- compliance with WorkSafeBC's Operational Health and Safety Regulation and BC Hydro's Safety Management System;
- the Traffic Management Plan;
- the Public Communications Plan; and
- Access Plan

With mitigation, no residual effects are likely.

Phase 2: Operations and Maintenance

Potential adverse effects associated with the operations and maintenance phase will be different from those anticipated for construction, as the nature of Project activities will be limited to maintenance and inspections. Project-related traffic during the operations and maintenance phase is expected to be light overall, with the potential for a nominal local increase in traffic related to maintenance and repair activities. BC Hydro typically uses vehicles for inspections up to four times per year (M. Guite, pers. comm.). These inspections are to check for geotechnical, road, and structure stability, and to monitor vegetation growth. Additional traffic will be expected in years where vegetation maintenance is required (i.e., every five to seven years). Consequently, Project-related traffic during typical operations and maintenance activities will be light, sporadic/infrequent of short duration. During operations and maintenance, BC Hydro and their contractors will comply with WorkSafeBC's Operational Health and Safety Regulation and BC Hydro's Safety Management System. No residual

effects (i.e., increased vehicle volume, increased risk of vehicle accidents, and decreased public safety) are likely during regular scheduled operations and maintenance of the Project.

6.15.1.6 Potential Residual Effects and Significance

Following mitigation, no residual effects are likely during both Project phases.

6.15.2 Aviation

6.15.2.1 Environmental Setting

Existing operating airstrips in the region are located at Bob Quinn Lake/Air Strip, the Terrace Airport, Dease Lake, Iskut, Telegraph Creek, Stewart, Prince Rupert, and Smithers. Bell II has an active helicopter pad approximately 25 km from the northern end of the Bell-Irving route. In addition, several gravel airstrips were used historically for industrial developments.

6.15.2.2 Spatial and Temporal Boundaries

The spatial boundary for the effects assessment includes a 1 km zone extending on either side of the proposed Project route. This spatial boundary was determined as the area for which Project activities could have an effect on aviation.

The assessment considered two Project phases: (1) construction and restoration, and (2) operations and maintenance.

6.15.2.3 Issues Scoping

Project infrastructure and use of helicopters during construction may affect the existing flight paths and result in an inconvenience or safety hazard. The principal issue associated with these potential adverse effects is access.

6.15.2.4 Valued Environmental Components

The VEC for aviation is maintenance of aviation.

6.15.2.5 Identification of Potential Effects and Mitigation

Phase 1: Construction and Restoration

Although the established airports and airstrips are more than 25 km from the proposed Project corridor, it is possible that the flight paths from these airports could overlap with the airspace used by helicopters during the Project construction. The main construction activities that could use helicopters include:

- transmission line ROW clearing and site preparation (in areas not accessible by road, if any);
- foundation installation:
  - structure erection; and
  - conductor stringing (select areas).

The Kitimat region Visual Flight Rules (VFR) navigation chart presents the current established airspace boundaries and visual flight paths in the region (Figure 1.15-2 of the EAC Application). The VFR from Terrace does not parallel the Bell-Irving route; however, it may cross the southern tip of the route.

Flight paths for the construction activities will be established with NAV Canada and Transport Canada, such that they will not interfere with established aircraft paths. By following standard flight protocols, no residual effects are likely.

Phase 2: Operations and Maintenance

During operations and maintenance of the Project, limited helicopter use will be required. It is anticipated that the entire line will be inspected by helicopter once per year (M. Guite, pers. comm.). In addition, helicopters will be used to perform maintenance in areas not accessible by road (if any). For any Project-related flights during operations and maintenance, NAV Canada and Transport Canada will be notified of any temporary helicopter activities. Flight paths will be chosen for inspections or maintenance so as not to interfere with established aircraft paths. If standard flight protocols are followed, no residual effects are likely.

The southern tip of the Bell-Irving route may cross the VFR from Terrace or Smithers; however, the aircraft using this air space will be at altitudes much higher than the Project infrastructure. Overall, Project infrastructure is not likely to result in residual effects to established airstrips or airspace.

The transmission line could pose a hazard to aircrafts in areas requiring long spans over rivers or other obstacles where normal spacing of structures is not feasible. The transmission line and support structures will be clearly marked in such locations, in accordance with BC Hydro operating standards and federal aeronautics requirements outlined by Transport Canada (Transport Canada 2009).

6.15.2.6 Potential Residual Effects and Significance

Following mitigation, no residual effects are likely for the VEC (maintenance of aviation paths) during the construction or operations phases of the Project.

6.15.3 Navigable Waters

6.15.3.1 Project Setting

Along the proposed Bell-Irving route, 81 stream crossings have been identified. Details on each of these crossings are provided in Appendix 6.2-2, with individual site data including photos provided in Appendix 6.2-1. In accordance with Transport Canada requirements, watercourses along the Project corridor at access road or transmission line crossings are considered potentially navigable if their bankfull width is ≥3 m and their bankfull depth is ≥0.5 m. Transport Canada will make the final determination of navigability (considering additional criteria, such as access). Using the present criteria, seven potentially navigable streams were identified (Table 6.15-1). Many of the streams that would intersect the transmission line are narrow (<3 m wide), shallow, or ephemeral, thus severely limiting their navigable value as recreational or commercial waterways. Additional work will be required to determine whether existing, new, or replacement crossing structures will cross potentially navigable watercourses once the Bell-Irving route is finalized and access road locations are determined. This information will be provided to Transport Canada during the detailed design phase, in accordance with applicable engineering standards.

Watercourses that cross the proposed route may be used for recreational and commercial navigational purposes, additional details on watercourse use are provided in Section 7.11 of the EAC Application. The proposed Bell-Irving route will cross the Bell-Irving River (≥120 m width) and the Nass River (≥70 m width), which are considered major waterways. The remaining five watercourses will likely not be considered navigable by Transport Canada due to their gradient or morphology, which includes numerous falls and cascades.

Table 6.15-1. Summary of Channel Statistics for All Potentially Navigable Streams by Watershed

Site Number	Watershed	Gazetted Name	Mean Width		Mean Gradient (%)	Mean Depth	
			Bankfull (m)	Wetted (m)		Bankfull (m)	Pool (m)
7002	Bell-Irving	Bell-Irving River	120	8	1	2	-
7003	Nass	Nass River	70	25	1	0	-
7010	Bell-Irving	-	3.4	1.6	2.5	0.7	0.3
7015	Bell-Irving	-	3.5	2.1	17	1.0	0.3
9006	Nass	Wolverine Creek	5.1	2.4	3	0.6	0.7
9014	Nass	Gleason Creek	9.5	3.6	4	1.1	0.2
9020	Nass	-	3.6	1.3	25	0.6	0.3

Bankfull width: distance between the top crest of the left and right banks of a stream.
Wetted width: distance between the wetted portion of the left and right stream banks.
Gradient: angle of inclination of a stream bed.
Bankfull depth: Vertical distance between the deepest part of the stream bed and the top crest of the banks.
Pool Depth: Average maximum depth of all pools in the stream section.

6.15.3.2 Spatial and Temporal Boundaries

Spatial Boundary

The Bell-Irving route passes numerous streams that drain into major local water bodies. Therefore, the general spatial boundary for the effects assessment is comprised of the two watersheds bisected by the transmission line (Bell-Irving and Nass watersheds). For the navigable waters section of the effects assessment, a narrower spatial boundary was used, encompassing an area 50 m upstream and downstream of each crossing location.

Temporal Boundary

The assessment considered two Project phases: (1) construction and restoration, and (2) operations and maintenance.

6.15.3.3 Issues Scoping

The navigable waters effects assessment was designed to address the potential adverse effects of the Project on the navigability of waterways in the area. The main concern identified was the potential effect of the construction of the proposed transmission line and infrastructure on the navigability of streams. The principal issues associated with this concern are access and First Nations interests.

6.15.3.4 Valued Environmental Components

Navigable waters were selected as a VEC because navigable waterways must be protected in the Project area, as per the *Navigable Waters Protection Act*. In addition, navigable waterways are important for traditional forms of travel.

6.15.3.5 Identification of Potential Effects and Mitigation

Phase 1: Construction and Restoration

Construction of the Project could potentially affect watercourse navigation during conductor stringing and bridge construction activities over navigable watercourses by disrupting recreational and commercial vessel traffic. Where the existing roads cross potentially navigable streams, their bridge

crossings are assumed to meet all requirements of the *Navigable Waters Protection Act*, through prior approvals. If any new access roads and spur roads are required, they will be oriented to avoid crossing streams wherever practicable. The Nass and Bell-Irving Rivers will not likely be affected by any bridge crossings, but conductors will be strung across these waterways.

Temporary closures of watercourses to navigable vessels will occur due to potential safety concerns associated with operation of heavy equipment and other construction activities over the waterway. During these periods, navigability of the waterway at the crossing location will be limited or prohibited, necessitating temporary avoidance of the area by the general public or use of exit/entry points before and after the crossing location to avoid passage through the area. Conductor stringing could be expected to affect navigation for approximately one to two days at each watercourse crossing location, while bridge construction is expected to affect navigation for approximately two to five days.

Any new bridges constructed for Project roads would be designed with sufficient freeboard to ensure navigability is not impeded as per the British Columbia Ministry of Transportation and Infrastructure requirements. For navigable watercourses where crossing information is not currently available, detailed design drawings, for specific aerial transmission lines and bridges, consistent with Transport Canada's requirements under the *Navigable Waters Protection Act*, would be included with submissions for formal approvals, following submission of the Application, but prior to construction. Drawings would include the watercourse name and number (if applicable), crossing width, height to the transmission line from bankfull width or height to the bridge measured from the high water mark, bankfull depth, longitude, and latitude.

Phase 2: Operations and Maintenance

During the operation phase of the Project, if transmission lines and/or bridges were not constructed to minimize or avoid potential adverse effects to all navigable vessels potentially using each watercourse, navigation at these locations by certain vessels could be limited or prevented for the life of the Project. However, the transmission line access routes would be planned, designed, constructed, and maintained in accordance with accepted Transport Canada standards to prevent any on-going adverse effects to navigation. Therefore, potential effects of the Project on navigation during operation activities would likely be limited to temporary closures associated with bridge maintenance or replacement activities. Routine maintenance of bridges would ensure unimpeded navigation for a crossing. Transmission line and ROW management and maintenance would occur over the life of the Project.

6.15.3.6 Potential Residual Effects and Significance

The majority (93%) of the 83 streams that would be crossed by the transmission line and maintenance access roads are less than 3 m in width and 0.5 m depth. The planned height of transmission lines above larger, navigable waterways would vary in total height to accommodate the waterway. Because of these design considerations, the Project's effect on navigable waters along the proposed transmission line route is not likely significant. Table 7.15-14 in EAC Application presents a summary of the navigable waters effects assessment for the entire Project, and is applicable to the Bell-Irving Route.

6.16 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Effects of the environment on the Project describe the environmental factors that could affect the construction, infrastructure, and operational performance of the Project and identifies measures to avoid, mitigate, or manage potential adverse effects of these environmental factors. The assessment is consistent with Section 2(1)(c) of the *Canadian Environmental Assessment Act* (CEA Act; 1992), which

defines “environmental effects,” in part, as “any change to the Project that may be caused by the environment, whether any such change or effect occurs within or outside Canada.”

The following environmental factors that could affect the Project were considered in the assessment:

- geophysical effects;
- flooding effects;
- wildfire hazards; and
- climate and meteorology effects.

A full assessment of the effects of the environment on the Project is presented in Chapter 8 of the EAC Application. The objective of Chapter 8 of the EAC Application was to recommend infrastructure design, construction, and operation measures for the Project that consider appropriate planning and engineering design solutions to avoid or minimize potential effects of the environment on the Project. The information regarding environmental factors that could affect the Project is presented in the EAC Application and is applicable across the entire length of the proposed NTL, including the Bell-Irving route. Thus it is not repeated here. However, information specific to the Bell-Irving route is presented herein.

6.16.1 Geophysical Effects

This section describes and assesses the potential adverse effects of terrain hazards on the construction and operation of the proposed Project, using the Bell-Irving route.

The following types of geophysical hazards were assessed in terms of their likelihood of occurrence, severity, potential effect on the Bell-Irving route, and mitigation or management measures planned to minimize their effect: landslides, snow avalanches, channel debris flows, earthquakes, and volcanic activity.

Flood hazards associated with seasonal rain, snow, or rain-on-snow events are discussed in Section 6.16.2. Potential flooding associated with debris flow events, including flash floods, are discussed in Section 6.16.1.3.

6.16.1.1 Landslides

Slope Stability

Landslides and slope stability conditions along the Bell-Irving route are discussed in Section 6.4 of this report. The section summarizes the terrain conditions, topography, and geological features along the route based on terrain stability classification maps that have been prepared for the Bell-Irving route. The locations of identified landslides are show on terrain stability maps in Figures 6.4-1 to 6.4-3 of this report.

Potential Effects

Most of the terrain within the Bell-Irving route is stable to moderately stable. Sections of river and creek banks at the Nass River, Gleason Creek, Spruce Creek, and two unnamed creeks are potentially unstable (Class IV or Class V) where the banks are moderately steep to steep.

The distribution of landslides near the Bell-Irving route appears to be limited to local areas of instability on steep creek banks where minor rock fall, rock ravelling, or shallow soil movement are

encountered. Landslide features have been identified on the northern bank of Gleason Creek upstream of the route and at two creek gullies on the northern side of the Nass River where steep-sided gullies have eroded into bedrock. A large landslide has also been identified on the hillside below a forestry access road approximately 9 km NNW of Gleason Creek and about 400 m to the west of the alignment.

Mitigation Measures

Mitigation measures employed along the Bell-Irving route will be consistent with those in Section 8.1.1.3 of the EAC Application.

6.16.1.2 Snow Avalanches

The potential for snow avalanches along the Bell-Irving route has been reviewed by Chris Stethem & Associates Ltd. Based on the study there is no apparent snow avalanche hazard along the this route.

6.16.1.3 Channel Debris Flows

There are no known reports of channel debris flows along the Bell-Irving route, and the route does not cross terrain that displays a history of recurrent debris flow events. Thus, channel debris flows are not expected to affect Project infrastructure along the proposed route. However, general mitigation measures that will be employed to reduce the exposure of the Project to channel debris flows outlined in Section 8.1.3.3 of the EAC Application are also relevant to the Bell-Irving route.

6.16.1.4 Earthquakes

The potential hazards, effects, and mitigation measures related to seismic hazards along the Bell-Irving route are consistent with those presented in the Section 8.1.4 of the EAC Application. The Bell-Irving route is in an area of low seismic activity. It is unlikely that earthquakes within the Project area or from remote earthquake events would be sufficient to cause damage to well-constructed structures, or to initiate large-scale landslides or rockfalls that could affect the proposed transmission line or infrastructure.

6.16.1.5 Volcanic Activity

The potential hazards and effects related to volcanic activity along the Bell-Irving route are consistent with those presented in the Section 8.1.5 of the EAC Application. The Bell-Irving route is located within the Stikine Volcanic Belt an area that has been active in recent history with an eruption at the Tseax Cone near New Aiyansh in the year 1775. The Bell-Irving route is located over 80 km from nearest volcano and therefore not likely to be directly affected by future eruption.

6.16.2 Floods

The transmission line will be constructed to protect the most important infrastructure, such as transmission structures, from any flood and ice impacts. While there will be potential for flood effects on access road stream crossings, the potential for flood effects on transmission structures will be limited to the large river crossings where infrastructure may need to be placed within the floodplain. The two largest crossings along the Bell-Irving route will be the Bell-Irving and Nass rivers. The channels at both of these crossings are relatively confined with limited floodplain areas. The conceptual project design at this time indicates that no structures will be exposed to flood risks at either of the crossings. The potential hazards, effects, and mitigation measures related to floods at smaller transmission line crossings and potential access roads along the Bell-Irving route is consistent with information presented in Section 8.2 of the EAC Application.

6.16.3 Wildfire Hazards

A wildfire is an unplanned or unwanted natural or anthropogenic fire that requires suppression. The potential hazards, effects, and mitigation measures related to wildfires along the Bell-Irving route are consistent with those presented in the Section 8.1.5 of the EAC Application. There are no additional wildfire effects specific to the Bell-Irving route beyond information provided in the EAC Application.

6.16.4 Climate and Meteorology

Several climatological and meteorological parameters could affect the construction and operation phases of the Project. Meteorological hazards include wind, snow loading, ice loading, and lightning. Potential effects from each of these hazards along the Bell-Irving route are evaluated below. Additional information is provided in Section 8.4 of the EAC Application.

6.16.4.1 Potential Effects

Specific climatological and meteorological hazards include lightning strikes; loading from ice, wind, and snow; and creep from snow or permafrost. Each of these hazards could temporarily interrupt or cause serious damage to the transmission line infrastructure. Areas along the proposed route that are near ridgelines or in areas of high wind and weather exposure would be the most subject to climatological hazards. The integrity of the transmission line structures and its durability to withstand these extreme meteorological conditions will rely on sufficient engineering standards and appropriate planning.

Wind, Snow, and Ice

Historically, icing events have caused a considerable amount of damage to transmission lines and are common in most northern countries, including Canada. Independent extreme wind events are not anticipated to be hazardous to the Project but combined with rime ice (i.e., white or opaque ice with entrapped air) or wet snow loading events, they could be destructive. In northwestern BC, especially in higher elevations (>1,000 m) with exposed ridges, and coastal regions, icing events are caused by a combination of snow, wind, and ice loading. Ice loading normally occurs either as rime ice or as wet snow. The Bell-Irving route is considered to be within a coastal influenced area that is generally subjected to greater icing than interior environments. Wet snow is also more prevalent at elevations between 700 and 1,000 m than at lower elevations. The majority of the Bell-Irving route will be at or below 700 m elevation.

BC Hydro Engineering assessed ice and wind loads along the original proposed transmission line route and developed segment-specific design criteria. The same assessments will be completed along the Bell-Irving route before construction. Assessments evaluated expected increased loading from ice and wind for a 1-in-100 return period (i.e., the maximum load produced by an extreme weather event that occurs only once in a hundred years). Two different loading scenarios were developed for each segment including loading from ice glaze and loading from both ice and wind.

Snow depth will have an effect on structure height/and or span length. Where snow depths are expected to be greater than 1 m, the clearance would need to be increased. Snow depths along the Bell-Irving route are expected to exceed 1 m in depth regularly. The potential hazards, effects, and mitigation measures related to snow creep (continuous, slow, downhill movement of snow) along the Bell-Irving route are consistent with those presented in the Section 8.1.2.2 of the EAC Application.

Lightning

Lightning poses a major threat to transmission line reliability and is a common cause of power outage. It can affect transmission lines directly through striking transmission or substation infrastructure, or indirectly through ignition of wildfires, which in turn may threaten the operation of the bulk transmission line system. Of all the Canadian provinces, BC experiences the lowest frequency of lightning strikes. Approximately 0 to 0.2 lightning strikes per year per square kilometre occur in the Project area of northwestern BC. For comparison, some areas of southern Saskatchewan and Manitoba experience about two lightning strikes per year per square kilometre (Environment Canada 2010).

6.16.4.2 Mitigation Measures

Mitigation measures to reduce the potential effect the above climatological events may have on the Bell-Irving route are consistent with those presented in the Section 8.4.2 of the EAC Application. With the exception of the route-specific design presented for the ice, snow, and wind loading, there are no mitigation measures specific to the Bell-Irving route beyond information provided in the EAC Application.

6.17 CUMULATIVE EFFECTS

An assessment of the cumulative effects of the NTL Project using the Bell-Irving route is not included in this report. NTL Supplemental Cumulative Effects Assessment report contains an assessment of the potential cumulative effects of the NTL Project using the Bell-Irving route.

6.18 SUMMARY

This chapter presented an assessment of potential environmental, social, economic, heritage and human health effects of the Bell-Irving route. The VECs assessed were summarized in Table 5.6-1.

All mitigation measures and management strategies presented in this chapter are consistent with the mitigation presented in the EAC Application and no new mitigation is required specifically for the Bell-Irving route.

With mitigation taken into account, all potential residual effects were identified and the significance of each potential residual effect of the Bell-Irving route was determined. A residual effect was considered significant if there was an expectation that it will affect the viability of the VEC. Viability is defined as the ability to continue to work and function over time within the defined spatial and temporal boundary. For this assessment, following mitigation, all residual effects are unlikely to cause significant adverse effects.

7. Nisga'a Nation Considerations

Rescan™
Engineers and Scientists

7. Nisga'a Nation Considerations

7.1 INTRODUCTION

The Nisga'a Nation is a treaty nation and is distinct from other First Nations as a result of the Nisga'a Nation's rights and title having been defined in the Nisga'a Final Agreement (NFA). The rights and title of the Nisga'a Nation under the NFA are protected by the *Constitution Act*, 1982.

This chapter:

- summarizes the context and setting of the Nisga'a Nation,
- presents the issues identified by the Nisga'a Nation with respect to the proposed Bell-Irving route ,
- summarizes the potential effects of the proposed Bell-Irving route on those issues, and
- describes how BC Hydro has considered and, where necessary, has addressed or will mitigate the potential effects.

This chapter also summarizes any potential residual effects from Project activities on the Bell-Irving route, following mitigation.

For the EAC Application, Nisga'a Nation concerns were identified through consultation and a contemporary Nisga'a information desk-based study. For this report it has been assumed that many of the Nisga'a Nation concerns presented in the EAC Application, will be the same as for the Bell-Irving route. Nisga'a Nation issues are considered in multi-disciplinary environmental and social effects assessments of this report. The process and results of consultation and engagement with the Nisga'a Nation is described in Chapter 2 of the EAC Application and in section 4.3 of this report.

The *Report on Contemporary Nisga'a Information* (Appendix 9.1-1, of the EAC Application) summarizes sections of the NFA that are relevant to the NTL Project with respect to contemporary Nisga'a land use, interests, and values to inform an assessment of Project effects. Information was derived from publicly available desk-based research. The Nisga'a Lisims Government (NLG) confirmed that the report does not require site-specific qualitative and quantitative data. The report draws on existing land and resource information, in particular the NFA and the Nisga'a Land Use Plan. The Bell-Irving route will only cross the Nass Area and the Nass Wildlife Area as defined under the NFA (and not Nisga'a Lands). Information on the NFA, the *Nisga'a Fisheries and Wildlife Act*, Nisga'a land use and land use planning, and current Nisga'a use of economic resources is presented in the EAC Application.

This is a summary chapter. All information in this chapter has been taken directly from individual sections of this report, or applicable EAC Application sections, without additional interpretation or analysis. Cross-references are provided to the relevant sections for the reader to obtain more details.

7.2 METHODOLOGY

7.2.1 Overview

BC Hydro Aboriginal Relations and Negotiation Department (BCH ARN) and Rescan Environmental Services Ltd. (Rescan) compiled Nisga'a Nation information collected throughout the EA pre-Application process and incorporated it into EAC Application.

Information was also gathered during the consultation process and during the environmental and social baseline studies conducted since the EA process began.

7.2.2 Context

Socio-economic baseline information is summarized in the Nisga'a Nation Setting section of the EAC Application (Section 9.2) to provide context about the demographics, geographic location, and distinct governance structure of the Nisga'a Nation. This information is not repeated in this report.

7.2.3 Identification of Issues

Nisga'a Nation considerations were identified in two processes, in consultation with Nisga'a Nation representatives and in research conducted for the *Report on Contemporary Nisga'a Information* (Appendix 9.1-1 of the EAC Application).

7.2.3.1 Consultation

BCH ARN carried out Aboriginal consultation responsibilities for the proposed Bell-Irving route, which included assisting all parties to understand the issues and interests of the Aboriginal communities that may be affected by the Project and to facilitate avoidance, mitigation, or accommodation of significant effects on those interests.

BCH ARN began a consultation and information sharing program with the NLG in February, 2007 in advance of the BC EAO process. The purpose of these early meetings was to share information, to provide a broad overview of the proposed NTL Project, and to solicit input from the Aboriginal Groups regarding their desired level of involvement in the environmental assessment and preferences for consultation. Issues raised by each consultation group were communicated to the relevant environmental and social assessment disciplines for consideration in their effects assessments.

Additional information regarding consultation is presented in Chapter 4 of this report.

7.2.3.2 Contemporary Nisga'a Information

Information relating to issues extracted from the *Report on Contemporary Nisga'a Information* (Appendix 9.1-1 of the EAC Application) is also considered in herein. This report focuses on the NFA, and also considers the Nisga'a Land Use Plan and publicly available Nisga'a documents and web sites.

The position of the NLG is that a traditional use and traditional knowledge (TU/TK) or other similar Nisga'a-directed studies were not necessary for the NTL Project (including the Bell-Irving route) because Nisga'a rights are set out in the NFA.[1]

Nisga'a land use, fish, and wildlife interests potentially affected by the NTL Project were identified through desk-based studies that focused specifically on the Nisga'a Nation.

[1] Letter to the BC EAO dated 19 January 2009; letters to the BCH ARN dated 29 May 2009 and 27 August 2009.

Further information regarding the Nisga'a Nation, and Nisga'a governance, society, and land use can be found in the *Socio-economic Baseline Study Report* (Appendix 7.12-1 of the EAC Application), the *Land and Resource Use Baseline* (Appendix 7.11-1 of the EAC Application), and the *Report on Nisga'a Contemporary Information* (Appendix 9.1-1 of the EAC Application). BC Hydro is currently seeking additional social economic and cultural information from the Nisga'a to augment the assessment presented in this report. Any information that the Nisga'a choose to provide in this regard, will be considered in developing the more detailed design aspects of the NTL Project (including the Bell-Irving route) prior to construction, subject to receiving the an EA Certificate.

Information from the *Report on Contemporary Nisga'a Information* was communicated and distributed to relevant discipline specialists, who then incorporated it, where relevant, into their respective environmental and social effects assessments.

Similarly, information provided and issues raised by the Nisga'a Nation have been considered and incorporated into the various effects assessments, and proposed mitigation measures. These are summarized in this chapter in order to demonstrate how the issues identified were considered and addressed.

7.2.4 Consideration of Obligations Outlined in the Nisga'a Final Agreement

Considerations and obligations outlined in the NFA that are applicable to the proposed NTL Project, including the Bell-Irving route are summarised in this chapter and in Section 9.1.4 of the EAC Application.

7.2.5 Effects Assessments and Mitigation

Issues identified during consultation (conducted prior to submission of the EAC Application) were grouped by discipline to be considered in issues scoping, VEC selection, and effects assessments. The relevant findings set out in the *Report on Contemporary Nisga'a Information* (Appendix 9.1-1 of the EAC Application) were also considered in VEC selection, issues identification and prioritization, assessment of trends with respect to VECs, identification and justification of potential effects, effects ratings, mitigation measures, and management plans (as illustrated in Figure 9.2-1).

Preparation of this chapter involved the following steps:

- compilation of issues identified by the Nisga'a Nation
- cross-referencing of each issue with relevant effects assessment areas (wildlife and wildlife habitat, fish and fish habitat, human health, land and resource use, etc.) and EA Application sections
- compilation and summary of the effects assessments and the mitigation, management, and monitoring plans developed for the proposed Bell-Irving route for each relevant issue identified by the Nisga'a Nation

7.3 NISGA'A NATION SETTING

The Nisga'a people reside in the Nass River Valley of northwestern British Columbia. The Bell-Irving route intersects the Nass Area and Nass Wildlife Area (NWA). Section 9.2 of the EAC Application describes the setting of the Nisga'a Nation with respect to the Nisga'a Lisims Government system, populations and communities. In addition, detailed information on Nisga'a communities and the Nisga'a Nation with respect to the NFA, land use, socio-economics and culture, is addressed in the *Report on Contemporary Nisga'a Information* (Appendix 9.1-1 of the EAC Application), the *Socio-economic*

Baseline Study Report (Appendix 7.12-1 of the EAC Application), and the *Land and Resource Use Baseline* (Appendix 7.11-1 of the EAC Application).

The Bell-Irving route will overlap 30.6 km the Nass Wildlife Area and 29.5 km of the Nass Area.

7.4 CONSIDERATION OF IDENTIFIED ISSUES

A summary of issues identified by the Nisga'a Nation and/or included in the NFA is presented in Table 7.4-1. Some of the issues identified from the NFA were not specifically raised by the Nisga'a in relation to the proposed Bell-Irving route, but represent an assessment by BC Hydro and Rescan of the areas in which the Bell-Irving route is likely to interact with Nisga'a interests under the NFA.

Table 7.4-1. Summary of Nisga'a Nation Issue Identification and Resolution

Nisga'a Issue*	Identified Through	Section/Chapter in which the Issue was Considered
Climate change	Consultation	6.9 Atmospheric Environment 6.16 Flood Effects 6.16 Climate/Meteorology
Emergency response plan	Consultation	Chapter 11 (Environmental management program) of the EAC Application Chapter 13 (Accidents and malfunctions) of the EAC Application
Project costs and employment requirements	Consultation	Section 4.4 (Capital costs) of the EAC Application 6.13 Socio-economics
Contracting opportunities and other economic benefits	Consultation	6.13 Socio-economics
Impacts on migratory bird, wildlife and fish availability, including subsistence use, culturally important species and species at risk	Consultation NFA	6.2 Fish and Aquatic habitat 6.7 Wildlife and Wildlife Habitat 6.11 Land and Resource Use 6.14 Human Health Chapter 12 (Environmental Monitoring and Follow-up) of the EAC Application Chapter 13 (Accidents and malfunctions) of the EAC Application
Nisga'a Nation land use and resource planning	Consultation NFA	6.11 Land and Resource Use
Contaminated sites	Consultation	6.9 Atmospheric Environment 6.4 Terrain, Surficial Materials, and Soils 6.2 Fish and Aquatic Habitat 6.7 Wildlife and Wildlife Habitat 6.14 Human Health Chapter 13 (Accidents and malfunctions) of the EAC Application
Best practice use in management plans	Consultation	Chapter 11 (Environmental management program) of the EAC Application
Electromagnetic field (EMF) levels	Consultation	6.7 Wildlife and Wildlife Habitat 6.14 Human Health
Effects on NWA	NFA	6.7 Wildlife and Wildlife Habitat 6.11 Land and Resource Use

(continued)

Table 7.4-1. Summary of Nisga'a Nation Issue Identification and Resolution (completed)

Nisga'a Issue	Identified Through	Section/Chapter in which the Issue was Considered
Forests and vegetation, forest resources (including botanical forest products, timber), pine mushrooms, forest health	NFA	6.8 Wetlands 6.6 Terrestrial Ecosystems and Vegetation 6.11 Land and Resource Use 6.14 Human Health
Fish and fisheries	NFA	6.5 Terrain, Surficial Materials, and Soils 6.2 Fish and Aquatic Habitat
Investment and economic development	NFA	6.13 Socio-economics
Environmental protection	NFA	Chapter 11 (Environmental management program) of the EAC Application Chapter 12 (Environmental Monitoring and Follow-up) of the EAC Application
Water quality and supply	NFA	6.10 Surface Water and Groundwater Resources 6.4 Terrain, Surficial Materials, and Soils 6.2 Fish and Aquatic Habitat 6.14 Human Health Chapter 13 (Accidents and malfunctions) of the EAC Application
Utilities	NFA	No utilities were identified, as such, not evaluated in this report
Hydroelectric potential	NFA	Not relevant to an assessment of Project effects, and, as such, not addressed in this report
Cultural resources, artefacts, heritage, historic sites, archaeological polygons	NFA	6.3 Archaeology and Heritage Resources Chapter 11 (Environmental management program) of the EAC Application Chapter 12 (Environmental Monitoring and Follow-up) of the EAC Application

** Issue identified through the review of the NFA.*

The remainder of this section contains a description of the effects assessments made with respect to each issue in relevant sections of this report (primarily Chapter 6), how the issues were considered and addressed through mitigation and any residual effects and their associated significance determination. The issues discussed below are only those that were considered in the effects assessments. Nisga'a Nation issues concerning the EA process, capacity funding and consultation are discussed in Chapter 2 of the EAC Application.

Cumulative effects were also identified as a concern of the Nisga'a Nation. Cumulative effects have been evaluated in the Cumulative Effects Assessment supplemental report.

7.4.1 Climate Change

7.4.1.1 Consideration in Atmospheric Effects Assessment

Atmospheric environment is a VEC assessed in Section 6.9. Potential effects on the atmospheric environment along the entire route of the proposed Bell-Irving route include increased greenhouse gases (GHGs) resulting from emissions during construction activities and a reduction in the carbon sink. The potential adverse effect on the climate and meteorology from the incremental increase in atmospheric GHGs from any single source cannot be quantified (CEA Agency 2003). Therefore, the significance of the

proposed Bell-Irving route's effects on the climate and meteorology is assessed by comparing projected proposed Bell-Irving route emissions to national and provincial standards.

Mitigation measures include a regular maintenance program for diesel equipment, minimization of the length and duration of helicopter flights, minimization of engine idling, restriction of speed limits for mobile diesel equipment, air filtration systems in driver cabins, use of slash burning procedures and protocols based on air quality index, weather conditions, limiting the size and number of slash piles to be burned concurrently, and the use of modern machinery with pollution-control technology, and use of low sulphur fuels.

The residual effect of contributing to the global GHG inventory is not likely significant.

7.4.1.2 Consideration in Flood Effects Assessment

Climate change is discussed briefly in Section 6.16.2 in terms of the adverse effects of climate change-related flooding on the proposed Bell-Irving route. While there will be potential for flood effects on access road stream crossings, the potential for flood effects on transmission structures will be limited to the large river crossings where infrastructure may need to be placed within the floodplain. The two largest crossings along the Bell-Irving route will be the Bell-Irving and Nass rivers. The channels at both of these crossings are relatively confined with limited floodplain areas. The transmission line will be constructed to protect the most important infrastructure, such as transmission structures, from any flood and ice impacts. The conceptual proposed Bell-Irving route design at this time indicates that no structures will be exposed to flood risks at either of the crossings.

7.4.1.3 Consideration in Climate and Meteorology Assessment

The potential adverse effects of climate change on the proposed Bell-Irving route are discussed in Section 6.16.4 (Climate and Meteorology). Specific climatological and meteorological hazards include lightning strikes; loading from ice, wind, and snow; and creep from snow or permafrost. Each of these hazards could temporarily interrupt or cause serious damage to the transmission line infrastructure. Areas along the proposed route that are near ridgelines or in areas of high wind and weather exposure would be the most subject to climatological hazards. The integrity of the transmission line structures and its durability to withstand these extreme meteorological conditions will rely on sufficient engineering standards and appropriate planning. There are no mitigation measures specific to the Bell-Irving route beyond information provided in the EAC Application (Section 8.4.2).

7.4.2 Emergency Response Plan

7.4.2.1 Consideration in Environmental Management Program

The Environmental Management Program (EMP), which includes the environmental management plans and emergency response plans, is described in detail in Chapter 11 of the EAC Application. The EMP will also be applicable to the Bell-Irving route.

7.4.2.2 Consideration in Accidents and Malfunctions Assessment

In addition to preventive actions, emergency response planning is discussed in Chapter 13 (Accidents and Malfunctions) of the EAC Application. These plans will also be applicable to the Bell-Irving route.

7.4.3 Proposed Bell-Irving Route Costs and Employment Requirements

7.4.3.1 Consideration in Project Description

Chapter 4 of the EAC Application addresses Project costs and anticipated labour force. These costs would not change significantly if the Bell-Irving route is selected.

7.4.3.2 Consideration in Socio-economics Assessment

Potential socio-economic effects are discussed in Section 6.13 of this report and Section 7.12 of the EAC Application. The socio-economic effects are generally assessed for the entire Project rather than specific routes or segments. Thus, the potential effects identified previously, would also be applicable to the Bell-Irving route.

7.4.4 Contracting Opportunities and Other Economic Benefits

7.4.4.1 Consideration in Socio-economics Assessment

Potential socio-economic effects are discussed in Section 6.13 of this report and Section 7.12 of the EAC Application. The socio-economic effects are generally assessed for the entire Project rather than specific routes or segments. Thus, the potential effects identified previously, are also applicable to the Bell-Irving route.

7.4.5 Impacts on Migratory Bird, Wildlife and Fish Availability, Including Subsistence Use, Culturally Important Species and Species at Risk

The interests of Nisga'a provided for under the NFA which might reasonably be expected to be adversely affected by the Bell-Irving route are the Nisga'a interests in fish and wildlife. Under the NFA, those interests are defined as shares in a resource, a right to harvest wildlife and various species of fish subject to certain restrictions as to use of the harvest, as to quantity, or both. For example, subject to certain conditions[2] Nisga'a citizens are entitled to harvest[3] a percentage [4] of salmon (chinook, chum, coho, sockeye, pink) originating in the Nass area.[5] The Nisga'a interest in wildlife[6] is defined as a right of Nisga'a citizens to harvest wildlife[7] in the Nass Wildlife Area for domestic[8] purposes (including trade amongst aboriginal people).[9] For certain designated wildlife species,[10] Nisga'a citizens are entitled to harvest a percentage of the total allowable harvest of each.[11]

The NFA contains provisions for the protection of the interests of the Nisga'a Nation in the fish and wildlife resources, including, i) Nisga'a Nation participation in the management of those resources and, ii) of immediate concern in this process, a requirement that assessment authorities assess reasonably expected adverse environmental effects of projects on those interests.

In conducting an assessment of Bell-Irving route, BC Hydro has investigated and assessed the potential impacts on those resources throughout the full length of the proposed transmission line including

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[2] for example, escapement limits: NFA, c. 8(11)
[3] NFA, c. 8(1), c. 8(13)
[4] NFA, c. 8(14) – (20); Schedules A – C of c. 8
[5] NFA, c.1, "Nass salmon"; NFA, c. 8(13)
[6] NFA, c. 9
[7] NFA, c. 9(1)
[8] For example, see c. 9(2)
[9] NFA, c. 68 - 70
[10] Including moose, grizzly bear and mountain goat: NFA, c. 9(15)
[11] NFA, c. 9(24); c. 9, Schedule A, ss. 2, 3 and 4

impacts on fisheries in the Nass Area and wildlife within the Nass Wildlife Area. BC Hydro has assessed the likelihood of adverse effects, has identified mitigation measures, has identified any residual effects, and considered whether those effects will be significant. The adverse residual effects that BC Hydro considers likely are identified in the both this report for the Bell-Irving route and the EAC Application for the NTL Project. For the reasons discussed in Chapters 6 and 7 of this report addressing the Bell-Irving route, and Chapters 7 and Chapter 9 of the EAC Application (for the NTL Project),[12] BC Hydro has concluded that, with appropriate mitigation, the Bell-Irving route is unlikely to result in a significant adverse effect, i.e. an effect which would affect viability, on fish and fish habitat.[13] Accordingly, the Project is unlikely to have a significant adverse effect on the harvest of fish nor, accordingly, on the proportionate share of that harvest reserved for the Nisga'a under the NFA.

Similarly, BC Hydro assessed the potential impact of the NTL Project on wildlife species, among them the species designated under c. 9(15) of the NFA (moose,[14] mountain goats,[15] and grizzly bears[16]), and has concluded that, taking into account recommended mitigation measures, any residual impact to those wildlife resources is not likely to be significant.[17] That conclusion, applicable to wildlife resources as a whole, is applicable to the proportionate share of those resources reserved for harvesting by the Nisga'a under the NFA.

7.4.5.1 Consideration in Fish and Aquatic Habitat Assessment

Fish and aquatic habitat VECs in the Bell-Irving area are assessed in Section 6.1 (Fish and Aquatic Habitat) of this report. VECs include Dolly Varden (*Salvelinus malma*) and bull trout (*Salvelinus confluentus*); rainbow trout/steelhead (*Oncorhynchus mykiss*); anadromous (migratory) Pacific salmon, including coho (*O. kisutch*), chinook (*O. tshawytscha*) and sockeye (*O. nerka*); and fish habitat. With mitigation (Chapters 11 and 12 of the EAC Application) all potential residual effects are likely not significant in terms of the viability of the VECs.

7.4.5.2 Consideration in Wildlife and Wildlife Habitat Assessment

Potential effects on wildlife and wildlife habitat are assessed in Section 6.7 of this report. The effects assessment focuses on wildlife VECs including ungulates (moose and mountain goat), bears (grizzly and Kermode), furbearers (American marten and fisher), birds (waterfowl, raptors and forest birds), and amphibians (western toad). Potential residual adverse effects to these species are likely not significant, if the mitigation measures are implemented. A brief overview of the primary concerns with respect to wildlife VECs is provided below.

Ungulates

The primary concern is increased access to ungulate winter ranges, resulting in a re-distribution of hunting effort into these important areas and possibly an increase in unregulated hunting, which may lead to increase off-take of female moose. Mitigation measures built into the location of the line would reduce the amount of new areas made available for recreation and hunting. The overall potential Bell-Irving route-related residual adverse effect on local moose populations are predicted to not affect the sustainability of the VEC and is likely not significant.

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[12] EAC Application, Chapter 9, "Summary of Nisga'a Nation Considerations"
[13] EAC Application, Chapter 9, page 9 - 14
[14] Summarized in EAC Application, Chapter 9, pages 9-14, 9- 15
[15] Summarized in EAC Application, Chapter 9, pages 9-15, 9- 16
[16] The potential impact to Kermode bears was also considered
[17] Summarized in EAC Application, Chapter 9, page 9-22

Bears

Overall, the primary concern on the local grizzly bear and Kermode (i.e., black) bear populations is increased access due to the ROW and access roads, and associated increases in human activity and hunting pressure. Potential secondary adverse effects include those from habitat alteration, direct mortality associated with wildlife-vehicle strikes and felling of trees with active dens, noise disturbance, and odour-causing attractants during construction. The overall potential adverse effect on the local grizzly bear and Kermode bear population is predicted to cause a small shift from baseline conditions but will not likely affect the sustainability of the local bear populations. As such, the overall potential residual effect on grizzly bear and Kermode bear populations is likely not significant.

Furbearers

The primary concern is increased access and resulting increases in trapping pressure and direct mortality from clearing large cottonwoods and/or spruce trees during birthing periods. The overall potential Bell-Irving route-related residual adverse effect on the local American marten and fisher populations is predicted to cause a minor change from baseline conditions for a short time but not affect the sustainability of the local furbearer populations. It is thus likely not significant.

Birds

Potential adverse effects on waterfowl, raptors and forest birds include direct habitat alteration, noise disturbance, direct mortality, and indirect habitat alteration. With mitigation, the potential residual effects on birds, considering all potential effects, is likely not significant.

Amphibians

Potential adverse effects on western toad in and around wetlands during construction activities include 1) direct habitat alteration affecting wetland function and extent as a result of vegetation clearing, construction activities, and/or other indirect effects (siltation); and 2) direct mortality of western toads during periods of high concentration close to wetlands i.e. spring breeding and late summer emergence. With mitigation, residual effects are not likely. No potential effects were identified or evaluated for amphibians for the operations phase of the Bell-Irving route.

7.4.5.3 Consideration in Land and Resource Use assessment

Potential adverse effects on Nisga'a harvest and use of wildlife, fish, and other culturally important species are considered in Section 6.11 (Land and Resource Use) of this report.

7.4.5.4 Consideration in Human Health Assessment

Country foods are considered in Section 6.14 (Human Health) of this report. Country foods can take up chemicals from the environment, for example from water, soil, and vegetation. Thus, the quality of the food is related to the concentrations of the chemicals in those parts of the environment. The effects assessment presented in Section 6.14 found no likely residual effects to human health from consuming country foods along the ROW.

7.4.5.5 Consideration in Environmental Monitoring and Follow-up

The environmental monitoring and follow-up program for the Project, including aspects relevant to wildlife and fish, is described Chapter 12 of the EAC Application. The Environmental Monitoring Program for the proposed Project will also be applicable to the Bell-Irving route.

7.4.5.6 Consideration in Accidents and Malfunctions Assessment

Chapter 13 of the EAC Application describes the potential adverse effects of accidents and malfunctions associated with construction, operation, and maintenance of the proposed NTL Project following implementation of the mitigation measures identified in Chapters 7, 8, and 11 of the EAC Application. All potential accidents and malfunctions as well as the mitigation measures identified for ROW construction and operation are also be applicable to the Bell-Irving route and therefore are not re-evaluated here.

7.4.5.7 Consideration in Access Assessment

During the operations and maintenance phase, increased access to remote areas may result from the establishment and maintenance of the ROW and new, permanent access roads. It is noted that most access will be by means of existing roads, thereby reducing the potential for impact.

Mitigation will include the deactivation and/or natural regeneration of temporary construction roads, while basing more permanent roads (i.e., those for inspection and maintenance) on existing roads wherever practical, and avoiding the creation of circle routes. BC Hydro is in the process of developing an access plan for the NTL Project (including the proposed Bell-Irving route), in collaboration with MOE, MOFR, and interested Aboriginal groups.

The potential for increased access to remote areas, is likely to result in a residual adverse effect. However, while localized reductions in wildlife are possible, the potential for regional level effects on wildlife populations (and the Nisga'a land users who use and rely on these resources) is likely not significant.

7.4.6 Nisga'a Nation Land Use and Resource Planning

7.4.6.1 Consideration in Land and Resource Use Assessment

Potential effects on land and resource use are assessed in Section 6.11 of this report. VECs in Section 6.11 include Nisga'a Nation land and resource use, access, quality of land use activities, and forestry.

Nisga'a Nation Land and Resource Use

Potential adverse effects of the proposed Bell-Irving route on Nisga'a Nation land and resource use during the construction phase of the Bell-Irving route include the following:

- Removal of pine mushroom habitat during ROW clearing may adversely affect Nisga'a pine mushroom harvesters; however, the area of vegetation removal is relatively small compared to the available areas for harvesting (Section 6.6 presents the model results for loss of pine mushroom habitat). As such, the residual effect of the Bell-Irving route on Nisga'a land users are likely not significant.
- Nisga'a commercial interests (including tourism and forestry) may experience access complications and delays and/or diminished quality of experience (i.e., visual and noise), if an overlap with the Bell-Irving route corridor exists. However, without information on the location of these interests, the effects of the Bell-Irving route are unknown.
- During the operations and maintenance phase of the Bell-Irving route, the following potential adverse effects may be experienced by Nisga'a land users:
  - While there is potential for the Bell-Irving route effects to result in changes to localized wildlife populations, this is not likely to affect annual wildlife allocations.

- Given that the residual adverse effects on fish, including salmon, are likely not significant, it is anticipated that the Bell-Irving route would likely not result in residual effects on Nisga'a annual salmon harvest allocation.

There are several mitigation measures to address the potential adverse effects identified for construction and operations phases, including:

- If there is a particularly important area of pine mushroom harvesting within the final ROW and the NLG provides the location of this area(s) before construction, BC Hydro and its contractors would coordinate with the NLG to avoid or minimize, as appropriate, the adverse effects of the Bell-Irving route.
- If the NLG provides commercial and/or forestry tenure information before construction of the proposed Bell-Irving route, BC Hydro would discuss and negotiate agreeable mitigation measures at that time. The only Nisga'a interests in commercial forestry are through the Sim Gan Forest Corporation whose operating area is not traversed by the Bell-Irving route, refer to foresty section in this chapter.

Through ongoing consultations and negotiations with NLG, BC Hydro would discuss relevant and appropriate mitigation measures to avoid or minimize Bell-Irving route-related adverse effects on Nisga'a land and resource use, including those recommended in Table 7.11-1.

Access

Construction of the Bell-Irving route could result in the use of access roads and forest service roads for Project-related construction. To mitigate construction related adverse traffic effects, BC Hydro and their contractors will communicate with relevant authorities, traffic control/management, and provide signage and information for land users in affected areas. If required, a protocol for shared road use will be developed. With mitigation, no residual effects are likely.

During the operations and maintenance phase, increased access to remote areas may result from the establishment and maintenance of the ROW and new, permanent access roads.

Mitigation will include the deactivation and/or natural regeneration of temporary construction roads, while basing more permanent roads (i.e., those for inspection and maintenance) on existing roads wherever practical, and avoiding the creation of circle routes. BC Hydro is in the process of developing an access plan for the NTL Project (including the Bell-Irving route), in collaboration with MOE, MOFR, and interested Aboriginal groups.

The potential for increased access to remote areas is likely to have a potential residual effect. However, while localized reductions in wildlife are possible, the potential for regional level effects on wildlife populations (and the Nisga'a land users who use and rely on these resources) is likely not significant.

Quality of Land Use Activities

Aesthetic disturbances during construction (e.g., noise, dust) and operations (e.g., visual quality) could affect Nisga'a members' appreciation of land use activities. In addition, land-based harvests of wildlife and vegetation could potentially also be affected. These adverse effects are assessed in Section 6.11 of this report as well as EAC Section 7.11.

The mitigation of biophysical effects for the Bell-Irving route is addressed in the relevant sections of this report, including Fish and Aquatic Habitat (Section 6.2), Terrestrial Ecosystems and Vegetation (Section 6.6), Wildlife and Wildlife Habitat (Section 6.7), Human Health (Country Foods - Section 6.14.4), and Land and Resource Use (Section 6.11). In addition, Chapter 11 of the EAC Application summarizes the mitigation and management plans for the NTL Project. Following mitigation, effects to the quality of land use activities are likely not significant.

Noise and dust related to construction activities is a likely potential residual effect, the extent of which would depend on an individual's proximity to construction activities, as well as personal tolerance; in general, these effects are expected to be short-term, reversible, and likely not significant. Visual disturbance once the line is established would also depend on individual tolerance, and is similarly likely not significant.

Potential biophysical disruptions—including pine mushroom harvests (construction/restoration), and moose and grizzly bear harvests (operations/maintenance)—also have potential residual adverse effects. The anticipated change in pine mushroom habitat is expected to comprise a very minor part of regional pine mushroom resources, and is therefore likely not significant. The anticipated changes of moose and grizzly harvests/availability is also likely not significant, although this may vary with individual sensitivities to fluctuations in wildlife populations.

Following NLG review during the Application review period, further discussions may occur between BC Hydro and NLG to confirm the Bell-Irving route residual effects following mitigation, and address any issues as may be required to fully meet provisions of the NFA. With mitigation, no residual effects are likely with respect to Nisga'a land and resource use.

Forestry

SIm Gan Forest Corporation, in which the Nisga'a Nation has an interest, holds a Forest License (volume based) within the TSA. The operating area for this Forest License is not crossed by the Bell-Irving ROW, but any changes in the AAC of the Timber Supply Area (resulting from ROW construction) could potentially affect that license.

The adverse effects on forestry from the two Bell-Irving route phases (Construction/Restoration and Operations and Maintenance) are evaluated in section 6.11 of this report and section 7.11 of the EAC. The clearing of the ROW that will occur during the construction and restoration phase will have an impact on the AAC. Loss of AAC is directly related to the loss of THLB. As the THLB decreases, all things being equal, the AAC associated with the original area also decreases. Approximately 44,570m^3 of operable merchantable timber volume and 61,477m^3 of total volume is estimated to be harvested from the proposed ROW (including the one-time clearing width) (Fortech 2010). These volumes are associated with both THLB and operable merchantable forests outside of the THLB.

The long term timber volume loss differs from the existing timber volume within the Bell-Irving route ROW in that volume within the THLB is calculated as potential long term loss and the existing timber volume includes THLB and area outside of the THLB. The long term timber volume loss is estimated to be 45,366 m^3. This volume is based on the average Mean Annual Increment for the Nass TSA, a 100 year rotation age and the THLB overlap area.

As outlined in Section 60 of the *Forest Act* (1996a), there will be no compensation for forest licensees by the Crown as a result of this reduction, as the reduction will not exceed 5% of the current AAC.

The potential adverse effects have two timelines; (a) medium- to long-term and (b) short-term.

- Medium- to long-term: The main medium to long-term effect from the clearing of the proposed Bell-Irving ROW will be a potential loss to the AAC. Major licensees and BC Timber Sales have a combined AAC of 865,000 m3 for the Nass TSA (MoFR 2002). This AAC is 1.25% of the total provincial AAC. This includes an apportionment of 200,000 m3 for the upper Nass TSA in which the proposed Bell-Irving route does not cross through. The next AAC review will be undertaken prior to July, 2012. In recent years a substantial undercut has occurred. Based on a 100 year rotation, the estimated AAC impact is less than 0.06% of the total Nass TSA AAC. This converts to a harvesting activity of approximately 10 - 12 logging truck loads (assuming $50m^3$ load) annually. In the context of the larger industry the effect is considered negligible therefore no mitigation measures are proposed for medium to long-term effects.
- Short-term: The short-term effect consists of overlaps between the Bell-Irving route ROW and forest licensee proposed cut blocks. One method to mitigate short-term effects will be to have affected licensees harvest the ROW instead of planned cut blocks within their respective chart areas. It is anticipated that since BC Hydro will construct any new or temporary roads and replanting of the ROW will not be necessary, savings could be realized by the licensees. If the timber to be harvested is not of sufficient value or quantity to cover harvesting costs, the companies will be compensated for the difference based on a formula agreeable to both parties. This will fully mitigate expected losses, and no potential residual effect is likely.

When alignment of the proposed Bell-Irving route is finalized, consultation with the licensees will be required to determine which areas are of interest to the licensees at that time for clearing. This consultation will also provide the opportunity for licensees to supply an updated list of overlapping proposed blocks.

7.4.7 Contaminated Sites

7.4.7.1 Consideration in Atmospheric Environment Assessment

Air quality was assessed in Section 6.9 of this report and EAC Section 7.2 (Atmospheric Environment). This summary has been included under the assumption that Nisga'a concerns regarding site contamination also include potential contamination of air. Potential adverse effects include increased air emissions of carbon monoxide, oxides of nitrogen, sulphur dioxide and particulate matter. Air emissions resulting from Bell-Irving route activities were predicted for the EAC Application using an air quality model combined with the background concentrations. The air quality model was not location specific, and therefore air emissions are anticipated to be similar for the Bell-Irving route. Activities during the construction phase of the Bell-Irving route will lead to increased criteria air contaminant concentrations over the short-term but residual adverse effects are likely not significant. Mitigation measures to minimize air emissions are presented in Chapter 11 of the EAC Application.

7.4.7.2 Consideration in Terrain, Surficial Materials, and Soils Assessment

Potential soil contamination effects were assessed in Section 6.5 of this report. For construction, the concrete foundations for the line structures may be poured on-site, or pre-cast foundations may be used. Concrete spills and washings could cause minor, localized soil degradation. During construction and operations, spills of fuel or lubricants from vehicles can contaminate surrounding soil. The potential for soil contamination will be mitigated following the mitigation presented in EAC Section 7.4.5 and Chapter 11 of the EAC Application. With mitigation, no residual effects are likely.

Vegetation management in the ROW could, as an option, include the use of herbicides. Mitigation of any adverse effect will follow approved permit condition application procedures and application rates according to the instructions and permit conditions. As the herbicides that will be used are regulated

and approved in Canada, and in consideration of the common practice of treating the ROW every seven years, with good management, no residual effects are likely.

7.4.7.3 Consideration in Fish and Aquatic Habitat Assessment

Potential sedimentation, spills, release of nitrates and ML/ARD effects on fish and aquatic habitat are assessed in Section 6.2 of this report. Mitigation measures to avoid adverse effects from potential sedimentation, spills, release of nitrates and ML/ARD are presented in the EAC Application (Section 7.6.5.2, Chapter 11, and Chapter 12). In addition, Table 7.6-4 in the EAC Application lists the operating windows for various fish species. With mitigation no significant residual effects are likely.

7.4.7.4 Consideration in Wildlife and Wildlife Habitat Assessment

Effects from herbicide contamination were excluded from the wildlife and wildlife habitat effects assessment because it was determined that there are no potential adverse effects of herbicides on wildlife and wildlife habitat that require assessment. Rational for this determination is provided in Section 7.9.3 of the EAC Application. No other potential contamination effects were considered in the wildlife and wildlife habitat effects assessment.

7.4.7.5 Consideration in Human Health Assessment

This summary has been included with the assumption that Nisga'a concerns regarding site contamination also include potential contamination of country foods, air, and water. Section 6.14 of this report presents an effects assessment of these media with respect to human health. With mitigation (Chapter 11 of the EAC Application), no significant adverse health effects are likely.

7.4.7.6 Consideration in Accidents and Malfunctions Assessment

Potential adverse effects of accidents and malfunctions, including potential site contamination, are discussed in Chapter 13 (Accidents and Malfunctions). All potential accidents and malfunctions as well as the mitigation measures identified for construction and operation are also applicable to the Bell-Irving route and therefore are not re-evaluated here.

7.4.8 Best Practice Use in Management Plans

7.4.8.1 Consideration in Environmental Management Program

Best management practises are described in the EAC Application (Chapter 11, Environmental Management Program). These practises will also apply to the Bell-Irving route.

7.4.9 Electric and Magnetic Field (EMF) Levels

7.4.9.1 Consideration in Wildlife and Wildlife Habitat Assessment

The issue raised concerning potential adverse effects of electromagnetic fields (EMF) on wildlife was considered during the wildlife issues scoping process in preparation for the wildlife and wildlife habitat effects assessment (Section 7.9 of the EAC Application). As a result of the issue scoping, the potential effect of EMF was excluded from the wildlife and wildlife habitat effects assessment. The rationale for this exclusion is presented in the EAC Application. Overall, it was determined that there will be no potential adverse effects of EMF on wildlife that would necessitate an assessment for the proposed NTL Project. This conclusion is applicable to the Bell-Irving route. However, BC Hydro will continue to review current research on EMF as per the commitments presented in the EAC Application.

7.4.9.2 Consideration in Human Health Assessment

Potential adverse health effects from human receptor exposure to electromagnetic field (EMF) levels are assessed in Section 6.14 (Human Health) of this report and EAC section 7.14. Overall, no adverse health effects are likely from the EMF generated from the proposed Bell-Irving route. Although no residual adverse health effects are likely from potential EMF levels generated from the proposed Project, BC Hydro will take measures to reduce EMF levels where mitigation costs are not significant. These measures are presented in Section 7.14.2.5 of the EAC Application.

7.4.10 Effects on Nass Wildlife Area (NWA)

7.4.10.1 Consideration in Wildlife and Wildlife Habitat Assessment

The Nass Wildlife Area and Nass Area were considered in the wildlife and wildlife habitat assessment in Section 6.7 of this report and EAC Section 7.9, particularly with respect to direct alteration of moose habitat and indirect mortality of ungulates (e.g., moose and mountain goat). A summary of the effects assessment is provided in Section 9.4.5.2 of the EAC Application. Ranges and core areas, including winter range, used by moose in the Nass Wildlife Area and Nass Area are assessed in EAC Section 7.9. Because Nisga'a hunters in the Nass Wildlife Area are regulated by annual allocations, they are unlikely to see an increase in overall hunting effect due to the Project, but may see an increase in the area over which the moose hunt occurs, due to increased access to high quality moose habitat that would be provided by the ROW.

7.4.10.2 Consideration in Land and Resource Use Assessment

Section 6.11 of this report assessed the potential adverse effects of the Bell-Irving route on the Nass Wildlife Area and Nass Area from a land and resource use perspective. In addition, potential adverse effects on Nisga'a land and resource use in general are summarized in Section 7.4.6.1 above. While there is potential for the Bell-Irving route effects to result in changes to localized wildlife populations (in particular moose and grizzly bears) this is not likely to impact Nisga'a annual wildlife allocations, and is reduced with the Bell-Irving route over the Hanna-Tintina alternative. The overall Bell-Irving route-related residual effect on raptors and waterfowl is likely to cause a minor change from baseline conditions for a short time but will not likely affect the sustainability of the local bird populations and thus likely not significant. Potential effects of the Bell-Irving route on fish, including salmon species, are also likely not significant, as it is anticipated that the Bell-Irving route would have a minimal adverse effect on Nisga'a annual salmon harvest allocation. Potential effects on wildlife and wildlife habitat are assessed in Section 6.7 and summarized in Section 7.4.5.2 of this report. Potential adverse effects of the Bell-Irving route on fish, including salmon species, are assessed in Section 6.2 (Fish and Aquatic Habitat) and summarized in Section 7.4.5.1 of this report.

7.4.11 Forests and Vegetation, Forest Resources (including Botanical Forest Products and Timber), Pine Mushrooms, Forest Health

7.4.11.1 Consideration in Wetlands Assessment

Wetland extent and wetland function VECs are assessed in Section 6.8 (Wetlands) of this report. It is anticipated that a residual adverse effect of a loss of local wetland extent and function is likely along the Bell-Irving route as a result of the Project activities. Implementing pre-construction surveys and recording the area of wetlands and the types of wetland communities lost will aid in identifying wetland associations that may require compensation. Although the exact extent of wetland loss is not known, the effect of the Project on wetlands along the Bell-Irving route is not likely to be significant provided mitigation measures, pre-construction surveys, and wetland compensation procedures, if required, are developed and followed.

7.4.11.2 Consideration in Terrestrial Ecosystems and Vegetation Assessment

Section 6.6 (Terrestrial Ecosystems and Vegetation) of this report assesses listed ecosystems tracked by the BC Conservation Data Centre; species or groups of cultural, social, or economic importance (pine mushroom, country foods, cedar trees, and Old Growth Management Areas [OGMAs]); sensitive ecosystems (riparian areas, floodplain forests, and old forests); and unlisted terrestrial ecosystems as VECs. Wetlands are evaluated in Section 6.8.

Considerable amounts of vegetation will be altered and disturbed during Bell-Irving route construction and operation; however, no particular type or group of vegetation is likely to be affected such that its viability is affected.

Potential effects of the proposed Bell-Irving route during construction and operations fall into two categories: the primary effects of vegetation or habitat alteration (removal) to produce the right-of-way (ROW) and one-time clearing areas; and secondary effects such as introduction or spread of invasive species, increased risk of fire caused by tree felling, and edge effects such as windthrow. Most potential effects on ecosystems and vegetation are predicted to occur during the vegetation clearing aspect of the construction phase. The other effects may act additively or synergistically on ecosystems. Two potential effects of note were not considered in the ecosystems and vegetation effects assessment: but, forest habitat fragmentation is addressed in Section 6.7 of this report and EAC Section 7.9 (Wildlife and Wildlife Habitat) and the effects of herbicide use are addressed in Section 6.14 of this report and EAC Section 7.14 (Human Health).

Potential adverse effects on pine mushrooms are likely along the Bell-Irving ROW crossing the Nass Wildlife Area and the Nass Area. The residual adverse effect is rated as low magnitude because a relatively small portion of available pine mushroom habitat in the area will be removed. This is addressed in more detail in Section 6.6 of this report. No effects on the harvest of cedar are likely as the Bell-Irving is too far north to support merchantable cedar.

There are no mitigation measures for the adverse effects of permanent or temporary vegetation alteration on rare ecosystems, pine mushroom, country foods, riparian areas, floodplain forests, old forests or unlisted terrestrial ecosystems. Mitigation measures for other potential adverse effects related to invasive species, fires, and edge effects consist of vegetation and invasive species management plans, including a management plan to minimize disturbance to sensitive ecosystems. Details of management plans are provided in Chapter 11: Environmental Management Program of the EAC Application.

Two ecosystems (Wet Shrub-ICHvc/52, Dry forest- ICHmc1/02) listed by the BC CDC were mapped in the study area, of which 15 ha would be altered – this represents <5% of the area identified as having these two ecosystems. There is no mitigation planned for the permanent and temporary alteration of rare ecosystems. Any alteration of a listed ecosystem is of concern because that ecosystem is at risk (blue-listed). Residual effects due to the permanent and temporary alterations of rare ecosystems are likely. The alteration represents a considerable difference from baseline conditions that is beyond the range of natural variation. Thus, these likely effects are of high magnitude.

A residual adverse effect is expected for pine mushroom during construction because of the area removed (up to 30 ha from the 1,392 ha total), including permanent habitat alteration due to removal of mature forests. The residual effect is assessed to be not significant (Section 6.6.6.2 of this report), because the transmission line would remove a relatively small percentage of the mapped area of pine mushroom habitat in the study area (2 %). No further residual effects are likely during operations and maintenance.

Country foods are not likely to incur a residual effect during the construction phase, because of the relatively small proportion (4.2%) of area altered and the relatively low density of country food plants in the understory community (Section 6.6.6.2 of this report). Although vegetation will be altered and disturbed during construction and operation of the Bell-Irving route, no particular type or group of vegetation is expected to be affected such that its viability is affected. Regarding effects on berry producing shrubs, complete clearing will be limited to new access roads and tower structures, and substation. In some areas no clearing will be required at all (full retention). In all other areas, it is unlikely that vegetation will need to be cleared to a height less than 3 m. During operations and maintenance, an increase of berry shrubs is expected in areas where forests are cleared; however, this beneficial effect is not likely to be significant, because any berry-producing plants in this area would eventually be replaced by later-seral species of shrubs and trees.

Cedar will likely not be removed during ROW clearing and in the one-time clearing areas (Section 6.6.6.2 of this report) where present. Hence, negative effects are not likely during construction and restoration, nor during operations and maintenance.

Assuming that directives from the BC MOFR District Manager are followed, there will likely be no potential residual effect of the Bell-Irving route on OGMAs.

For this assessment riparian forests were defined as occurring within 40 m from streams, wetlands, and lakes. Management during construction and operations will be based on site-specific information gathered during preconstruction surveys. There are 178 ha of riparian area that is predicted to be permanently or temporarily affected during construction and operation. Mitigation measures will involve specialized tree felling methods to minimize the amount of vegetation cleared. However, no mitigation measures are planned to completely offset the permanent and temporary alteration of riparian ecosystems. Thus, potential adverse residual effects on riparian ecosystems are likely. Riparian ecosystems are fast growing and temporary alteration of riparian vegetation will likely result in a residual effect of lower magnitude than permanent alteration. The magnitude of this temporary effect is rated as medium due to the relatively large area of this sensitive ecosystem that is predicted to be altered during vegetation clearing.

There is one floodplain forest ecosystem type in the study area, covering 3.9 ha. To reduce the potential adverse effects on this floodplain forest from Project development, surveys will be conducted before clearing and site preparation activities begin to help delineate and establish sensitive area boundaries. Where it is not practical to avoid the floodplain forest during construction, a site-specific plan will be developed to minimize potential effects to this ecosystem. This plan may involve low-impact vegetation clearing techniques such as hand clearing and erosion prevention and bank stabilization techniques to minimize secondary loss of trees. Temporary and permanent vegetation alteration could likely result in a potential residual effect on floodplain forests because mitigation cannot offset the loss altogether. This potential effect is rated as low magnitude during construction due to the relatively small amount of floodplain forests that are predicted to be altered.

Old forests will likely experience two potential adverse residual effects after mitigation (Section 6.6.6.3 of this report): forest clearing and edge effects. Given the time required for re-growth, both of these potential effects are considered permanent. This potential effect is of continuous frequency and is irreversible in nature, and is rated with medium magnitude because of the large area that will be altered and the ecological and cultural significance of this ecosystem type. However, as the sustainability of this VEC will not be threatened, the effect is likely not significant.

Edge effects during the first years after construction may lead to an increased loss of old forest area. Edge effects will be continuous in nature, will last into the far future, and be local in extent. These potential adverse effects are low in magnitude because only a small area will be affected.

The combined potential effects on old forests during construction are likely not significant because the proportion of area affected will not be large enough to constitute a real threat to the sustainability of old forests in the study area. This rating has a medium probability and intermediate confidence.

A residual adverse effect is likely for unlisted terrestrial ecosystems during construction due to the 202 ha of mature forests within the ROW and one-time clearing area removed (Section 6.6.6.4 of this report). Permanent vegetation alteration is a likely residual effect that is irreversible in nature, while temporary vegetation alteration is reversible in the long-term. In both cases, the effect will be continuous in nature and last into the far future. Given the relatively moderate size of the area affected, the permanent and temporary alterations of these ecosystems are given low magnitude ratings. These potential residual adverse effects are likely not significant because the sustainability of these ecosystems is not threatened.

The potential adverse effect of increased invasive species is not likely to have any residual effects on any of the VECs. However, invasive species would likely produce an additive or synergistic effect on ecosystems during the operations phase. This effect was considered when assigning the effects ratings for each VEC.

The potential adverse effect of increased fire risk is not likely to have any significant residuals because BC Hydro will control fuel loads in the ROW and one-time clearing area to limit the potential for increased forest fire risk in these areas.

7.4.11.3 Consideration in Land and Resource Use Assessment

Potential adverse effects on forest resources, including forestry and pine mushrooms, are assessed in Section 6.11 (Land and Resource Use) and summarized in Section 7.4.6.1 of this report.

7.4.11.4 Consideration in Human Health Assessment

Country foods are considered in Section 6.14 (Human Health) of this report. Country foods can take up chemicals from the environment, for example from water, soil, and vegetation. Thus, the quality of the food is related to the concentrations of the chemicals in those parts of the environment. The effects assessment presented in Section 6.14 found that residual adverse effects to human health from consuming country foods along the ROW are unlikely.

Although adverse human health effects are not predicted from applying herbicides to trees, public notification and consultation will be conducted by BC Hydro before applying herbicides, and will include the Nisga'a Nation.

Despite the results of the human health effects assessment, the perceived risk from harvesting country foods from the ROW due to the potential use of herbicides may affect the Nisga'a use of the area. This potential adverse effect is assessed in the land use effects assessment under quality of land use activities (Section 6.11 of this report).

7.4.12 Fish and Fisheries

The Bell-Irving route option is anticipated to have a smaller ecological footprint than the Hanna-Tintina route proposed in the EAC application.

The importance of salmon to Nisga'a is noted in EAC Section 7.6.4.1 and is discussed in EAC Appendix 9.1-1. For instance, Section 4.4.3 of the report in Appendix 9.1-1 states:

> *Fishing is a central part of the Nisga'a way of life. The Nisga'a homeland includes both marine and freshwater ecosystems with an abundance of associated wildlife. The Nass River watershed supports species of salmon, steelhead, eulachon, halibut, herring, groundfish, trout, crab and shellfish, which were part of traditional Nisga'a diets and economies and continue to be important today.*
>
> *The Nass River is presently the third largest salmon-bearing river in British Colombia and supports significant salmon runs of five species of Pacific salmon, including sockeye, Chinook, Coho, chum and pink (INAC, 1999). There were many Nisga'a fishing camps along the Nass River and its tributaries. Fishing camps were typically located at salmon spawning sites (McNeary, 1976). For example, E.N. Mercer, "Chief of the Aiyansh" and member of the Nisga'a Land Committee, described 17 fishing camps in detail at the Nisga'a Barton-Mercer Delegation of 1916 (Sterritt et al., 1998:149). Salmon were traditionally dried and packed into boxes and used as food in the winter (McNeary, 1976).*

A summary of Nisga'a Nation issue identification is provided in Table 9.3-1 of the EAC Application. Impacts to fish are specifically referenced in this table. Five species of pacific salmon are identified in the baseline studies as being present and are considered in the effects assessment in Section 7.6 of the EAC Application. In Table 7.6-8, protection of salmon streams is noted as an issue identified during community consultation.

This report demonstrates that the Bell-Irving route option is not likely to have a significant adverse effect on fish habitat. The EAC Application (for the NTL Project) demonstrates that the NTL Project is not likely to have a significant adverse effect on fish habitat. Consequently, it is not likely to have a significant adverse effect on Nass watershed salmon. In particular, with reference to the allocation of Nass salmon provided for in the Nisga'a Final Agreement, the EAC Application concludes that the NTL Project will not harm the salmon productivity of the Nass River nor, consequently:

- the returns of salmon described in Schedules A or B of Chapter 8
- the minimum escapement levels as may be determined by the Minister under c. 8(11);
- the relative abundance of the Nass salmon species (c. 8(19) – 8(20));
- the quantity of salmon that might be available for harvesting under a Harvest Agreement (c. 8(21) – 8(27);
- the quantity of "surplus salmon" (c.8(28) – 8(30)); and
- the efficacy of any salmon enhancement program that the Nisga'a Nation may undertake (c 8(34) – 8(37).

7.4.12.1 Consideration in Terrain, Surficial Materials, and Soils Assessment

The assessment of terrain, surficial materials, and soils in Section 6.5 of this report includes potential effects on fish habitat. A summary is provided in Section 7.4.5.1 of this report.

7.4.12.2 Consideration in Fish and Aquatic Habitat Assessment

Fish and aquatic habitat VECs in the Project area are assessed in Section 6.2 (Fish and Aquatic Habitat), and summarized in Section 7.4.5.1 of this report.

7.4.13 Investment and Economic Development

7.4.13.1 Consideration in Socio-economics Assessment

Potential socio-economic effects are discussed in Section 6.13 of this report and Section 7.12 of the EAC Application. The socio-economic effects are generally assessed for the entire Project rather than specific routes or segments. Thus, the potential effects identified previously, would also be applicable to the Bell-Irving route.

7.4.14 Environmental Protection

7.4.14.1 Consideration in Environmental Management Program

The Environmental Management Program (EMP), which includes the environmental management plans and emergency response plans, is described in detail in Chapter 11 of the EAC Application. The EMP will also be applicable to the Bell-Irving route.

7.4.14.2 Consideration in Environmental Monitoring and Follow-up

The Environmental Monitoring Program for the proposed Project is described in Chapter 12 of the EAC Application. The Environmental Monitoring Program for the Proposed Project will also be applicable to the Bell-Irving route.

7.4.15 Water Quality and Supply

7.4.15.1 Consideration in Surface Water and Groundwater Resources Assessment

VECs in the assessment of surface water and groundwater resources (Section 6.10 of this report) included surface hydrology (water quantity) and groundwater quantity and quality.

Surface Hydrology

Residual adverse effects to surface hydrology are expected from the sustained alteration to land cover that will occur initially during the construction and restoration phase. However, these effects will likely occur over a long period; therefore, they are assessed under the operations and maintenance phase. No other residual effects are likely to surface water hydrology during the construction and restoration phase. Residual effects on surface water hydrology are likely for 42 streams crossed (of 82) along the proposed Bell-Irving route because of the percentage of the area of the stream crossing watersheds that will be cleared for the transmission line ROW or for new sustained access roads. Considering primarily the magnitude and extent of the residual effects on surface water hydrology, the potential residual effects are likely not significant. The Bell-Irving route will be approximately 60 km long; its effect on surface hydrology will be divided into 82 separate local watersheds, such that the effect at any specific stream crossing will likely not be significant. In addition, because potential residual effects will be primarily at a local scale and will diminish with distance downstream from the route, the collective effect on the watersheds is also likely not significant.

Groundwater

It is anticipated that any changes to the groundwater flow regime caused by the Project along the Bell-Irving route will be temporary, localized, and minor. As a result, the magnitude of any residual effects

on groundwater quantity is likely to be low and highly localized to the vicinity of the construction sites. These residual adverse effects are likely not significant.

It is not likely that there will be residual effects caused by the operations and maintenance programs with respect to groundwater quantity. Adverse effects on groundwater quality from operations and maintenance will be limited to accidents and spills. Response plans will be put in place by BC Hydro to ensure that spills are addressed immediately. Adverse effects from the use of herbicide, or other similar products, are not considered likely. More detail on accidents and malfunctions can be found in Chapter 13 of the EAC Application.

7.4.15.2 Consideration in Terrain, Surficial Materials, and Soils Assessment

The assessment of terrain, surficial materials, and soils in Section 6.5 of this report includes a discussion of sedimentation and water quality. A summary is provided in Section 7.4.7.2 of this report.

7.4.15.3 Consideration in Fish and Aquatic Habitat Assessment

Potential adverse effects on fish and fish habitat are assessed in Section 6.2 of this report, and summarized in Section 7.4.5.1 of this report.

7.4.15.4 Consideration in Human Health Assessment

Drinking water quality is assessed in Section 6.14 of this report. Following mitigation and management, the only likely residual effects identified with respect to drinking water quality will be from potential sedimentation and spills during construction. These potential residual adverse effects will be of low magnitude and geographic extent and will be sporadic and short term in nature. Consequently, these potential effects to drinking water are likely not significant. Potential health effects from exposure to affected drinking water caused by Project activities are not likely.

7.4.15.5 Consideration in Accidents and Malfunctions Assessment

Chapter 13 of the EAC Application describes the potential adverse effects of accidents and malfunctions associated with construction, operation, and maintenance of the proposed Project following implementation of the mitigation measures identified in Chapters 7, 8, and 11 of the EAC Application. All potential accidents and malfunctions as well as the mitigation measures identified for ROW construction and operation are also be applicable to the Bell-Irving route and therefore are not re-evaluated here.

7.4.16 Cultural Resources, Artefacts, Heritage, Historic Sites, and Archaeological Polygons

7.4.16.1 Consideration in Archaeology and Heritage Resources Assessment

Potential adverse effects of the proposed Bell-Irving route on archaeological and heritage resources are assessed in Section 6.3 of this report. An archaeological impact assessment (AIA) of the Bell-Irving footprint was conducted as part of the effects assessment. The archaeological assessment found no previously recorded archaeological sites near the route. The field work conducted in 2010 included a total of 171 shovel tests at 24 locations along the route. However, no new archaeological sites were identified. Because no archaeological sites were identified during the study, no adverse residual effects to archaeological sites and designated heritage sites are likely should the Bell-Irving route be selected along its current proposed alignment.

No AIA fieldwork was conducted for ancillary components, such as temporary construction infrastructure and access roads, because final design has not yet been completed. If further archaeological assessment is undertaken as recommended, and if any sites identified in that process are avoided or if other mitigation measures are taken, it is likely that there will be no residual effects.

7.4.16.2 Consideration in Environmental Management Program

An Archaeological Impact Management Plan and an Archaeological Chance Find Recovery Procedure for the proposed Project are described in the EAC Application (Chapter 11, Environmental Management Program). The Archaeological Impact Management Plan and an Archaeological Chance Find Recovery Procedures presented in the EAC Application will also apply to the Bell-Irving route.

While the proposed Bell-Irving corridor has been subject to an Archaeological Impact Assessment (AIA), if any re-alignments are considered, based on consultation with the Nisga'a, these areas would require an AIA before construction activity, thus additional archaeology studies may be conducted prior to construction.

7.4.16.3 Consideration in Environmental Monitoring and Follow-up

The Environmental Monitoring Program for the proposed Project is described in Chapter 12 of the EAC Application. The Environmental Monitoring Program for the Proposed Project will also be applicable to the Bell-Irving route.

8. First Nations Considerations

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8. First Nations Considerations

8.1 INTRODUCTION

This chapter provides an overview of the issues identified by the First Nations potentially affected by the proposed Bell-Irving route. The Bell-Irving route is located in the Nass Area and the Nass Wildlife Area in which the Nisga'a Nation hold Treaty Rights, and the asserted traditional territory of the Gitanyow Wilp Wii'litsxw, Wilp Malii, and Wilp Gamlaxyeltxw, and the Skii km Lax Ha[1]. The purpose of this chapter is to summarize the context and setting of the Gitanyow Wilp and Skii km Lax Ha affected by the proposed Bell-Irving route, present the issues raised by these First Nations with respect to the proposed route alternative, summarize the potential effects of the proposed route alternative on those issues, and describe how BH Hydro has considered and, where necessary, has addressed or will mitigate the potential effects. This chapter also summarizes any potential residual effects of the proposed route alternative, following mitigation. This chapter is a supplement to Chapter 10 of the EAC Application. In order to avoid repetition, reference to the EAC Application is made throughout this chapter.

First Nations' issues regarding the proposed route alternative were identified through general engagement, consultation and traditional use and traditional knowledge (TU/TK) studies, and considered in multi-disciplinary environmental, social, economic, health and heritage and effects assessments. The process and results of consultation and engagement with First Nations are described in Chapter 4 of this report as well as Chapter 2 of the EAC Application. For this report it was assumed that many of the Gitanyow and Skii km Lax Ha concerns presented in the EAC Application are the same as for the Bell-Irving route. Gitanyow and Skii km Lax Ha are currently working on completing TU/TK reports describing Bell-Irving route specific considerations; however, at the time writing this report, the TU/TK reports were not yet available. Thus, some considerations presented herein were based on preliminary discussions with the Gitanyow and Skii km Lax Ha regarding site-specific TU/TK information. In addition, information was derived from a combination of publicly available sources and, where possible, from local knowledge holder interviews.

During effects assessments (Chapter 6), valued environmental components (VECs) were identified through issue scoping endeavours, which took into consideration baseline conditions, data from desk-top research, field studies, literature reviews, legislation, and consultation with representatives of First Nations, the Nisga'a Nation and other government bodies.

This is a summary chapter. All information in this chapter has been taken directly from individual effects assessment chapters without additional interpretation or analysis. Cross-references are provided to the relevant sections of this report as well as the EAC Application for the reader to obtain additional details.

[1] (The Section 13 Procedural Order clarifies that the Crown considers Skii km Lax Ha to be a Wilp of the Gitxsan Nation. BC Hydro understands that the Skii km Lax Ha considers itself independent of the Gitxsan Nation, and that the Skii km Lax Ha has contested the BC EAO's understanding of its relationship to the Gitxsan Nation.

8.2 METHODOLOGY

8.2.1 First Nations' Setting

The First Nations' Setting section below describes the Gitanyow and Skii km Lax Ha potentially affected by the Project.

8.2.2 Identification of Issues

8.2.2.1 Consultation

BC Hydro ARN's (Aboriginal Relations and Negotiations) role is to undertake Aboriginal consultation for the proposed Project, although consultation incorporates efforts by the BC EAO, BC Hydro and their consultants. BC Hydro ARN's efforts have included facilitating Gitanyow and Skii km Lax Ha input into the Bell-Irving route alternative selection process; facilitating access to information; identifying and documenting interests raised by the Gitanyow and Skii km Lax Ha, documenting BC Hydro's response thereto, including responses related to any mitigation of potential adverse effects. Details on this process can be found in Chapter 4, Information Exchange and Consultation of this report.

To date consultation has included: i) on-going communication, and negotiations related to capacity funding agreements; ii) identification of interests and concerns pertaining to the Project as a whole but also the Bell-Irving route; and, iii) consideration of the extent to which the Project as a whole, but also the Bell-Irving route may affect the Aboriginal rights or title asserted by Gitanyow and Skii km Lax Ha. Consultation has informed this supplemental report and many of the Project-wide concerns were assumed to be applicable to the Bell-Irving route because the Bell-Riving route falls within the larger study area that was addressed in the EAC application and similar activities and concerns would be expected.

8.2.2.2 Traditional Use and Knowledge

In response to requests from Gitanyow to undertake Traditional Use/Traditional Knowledge studies BC Hydro provided funding for Gitanyow to undertake its Wilp-based Cultural Resource Inventory, Analysis and Planning Exercise on Project area overlapping their territory. This TK/TU work was expanded to include the Bell-Irving route. It is expected that the full report will be available sometime in late September 2010.

On August 20th, the Gitanyow Hereditary Chiefs Office consented to preliminary use of certain aspects of the TU/TK work to assist in this report's effects assessment, and the Gitanyow worked with Rescan during the week of August 23rd and August 30th to undertake this integration of knowledge (wildlife and vegetation), and some preliminary site specific information was emailed to Rescan by the Gitanyow Hereditary Chiefs Office September 1, 2010 which indicates a fishing site and medicinal site in the approximate area of the corridor.

The Skii km Lax Ha are currently in the process of finalizing their Bell-Irving route TU/TK report. However, at the time that this report was written the TU/TK information was not available for incorporation, but we are aware that there were no identified sites that were located on the Bell-Irving route corridor.

Consequently, limited Gitanyow site specific TU/TK information was incorporated into the effects assessment. However, several concerns/issues identified in the TU/TK studies from the EAC Application were assumed to be the same for the Bell-Irving route (Appendix 10.10-1 for Gitanyow and 10.11-1 for Skii km Lax Ha in the EAC Application).

8.2.3 Effects Assessments and Mitigation

First Nation issues (specific to the three Gitanyow wilps and Skii km Lax Ha affected by the Bell-Irving route) identified through consultation and TU/TK studies (earlier conducted for the EAC) were distributed to the relevant disciplinary teams preparing this report to be considered in their issues scoping, VEC selection, effects assessments, and development of mitigation measures, including management and monitoring plans and Proponent commitments, where relevant. First Nation issues, and relevant effects assessments and mitigation measures are summarized in this section.

8.2.4 First Nation Land Use Planning

First Nations land use planning, particularly the Gitanyow's land use plan(s) are discussed in Section 6.11; however, effects *on* land and resource management planning are not assessed; instead, the assessment recognises the objectives of these plans. Information regarding the specific goals and objectives of the land use plans were considered where available.

The Environmental Management Program (Chapter 11 of the EAC Application) considers the management direction and objectives of relevant Land and Resource Management Plans (LRMPs), Sustainable Resource Management Plans (SRMPs, and land use plans. The Environmental Management Program ensures the Project is developed in accordance with BC Hydro's environmental and safety principles, as well as relevant provincial and federal legislation, policies, and best practices guidelines.

8.2.5 Review of Alternatives

Several First Nation groups raised route alternatives and alternatives to the Project as an issue. Alternative means to supplying power to Northwest BC and the rationale for the Project is discussed is Chapter 3 of the EAC Application.

The Bell-Irving route was proposed as an alternative to the Hanna-Tintina route as a result of consultations between BC Hydro, various government agencies, the Nisga'a Nation, and First Nations, as well as a desk-top analysis of existing information and the preparation of the Hanna-Tintina Route alternatives Evaluation Report described earlier in this report. As a result of the route alternatives evaluation exercise, it is expected that use of the Bell-Irving route would result in a lower likelihood of adverse effects from the Project compared to use of the Hanna-Tintina route. Although, this report presents an assessment of the Bell-Irving route, the exact alignment has not been finalised. Ongoing consultation has indicated that specific areas along the Bell-Irving route be avoided. It is expected that these areas will be formally suggested to BC Hydro following the submission of the TU/TK studies which are pending from the Gitanyow and Skii km Lax Ha.

8.3 FIRST NATIONS SETTING

This section provides a very brief description of the potentially affected Gitanyow and Skii km Lax ha.

Information about each First Nation is presented in the Traditional Use and Knowledge reports for the Gitanyow and Skii km Lax Ha (Appendices 10.10-1 and 10.11-1 of the EAC Application, respectively), the Land and Resource Use Baseline (Appendix 7.11-1 of the EAC Application) and the Socio-economic Baseline Report (Appendix 7.12-1 of the EAC Application).

The approximate lengths of the Bell-Irving route that will traverse each of the Gitanyow and Skii km Lax Ha asserted traditional territories are presented in Table 8.3-1. These calculations are based on electronic shape files provided by First Nations or the BC Treaty Commission. In some instances, there are slight inconsistencies between First Nation boundaries and Wilp boundaries. The result is slight

discrepancies between First Nation and Wilp totals, due to inconsistencies between the source shapefiles provided.

Table 8.3-1. Bell-Irving Route Overlap with First Nations' Asserted Traditional Territories

Aboriginal Group /Wilp	Length of overlap (km)
Gitanyow - Wilp Wii'litsxw	12
Gitanyow - Wilp Malii	16
Gitanyow Wilp Gamlaxyeltxw	15
Skii km Lax Ha	60

8.3.1 Gitanyow Hereditary Chiefs

Wilp Wii'litsxw, Wilp Malii, and Wilp Gamlaxyeltxw of the Gitanyow Nation, were identified as having territory that overlaps with the Bell-Irving route (Figure 8.3-1). These three Wilp are included in this assessment because the proposed Bell-Irving route intersects their Wilp territories and therefore they are the most likely to be potentially affected by activities to construct and maintain the Project.

Although the traditional territory of Wilp Watakhayetsxw will not be affected by the Bell-Irving route, this Wilp was included in the consultation that was undertaken by BC Hydro in respect of the Bell-Irving route. Additional information pertaining to the Gitanyow is presented in Section 10.3.6 of the EAC Application.

8.3.2 Skii km Lax Ha

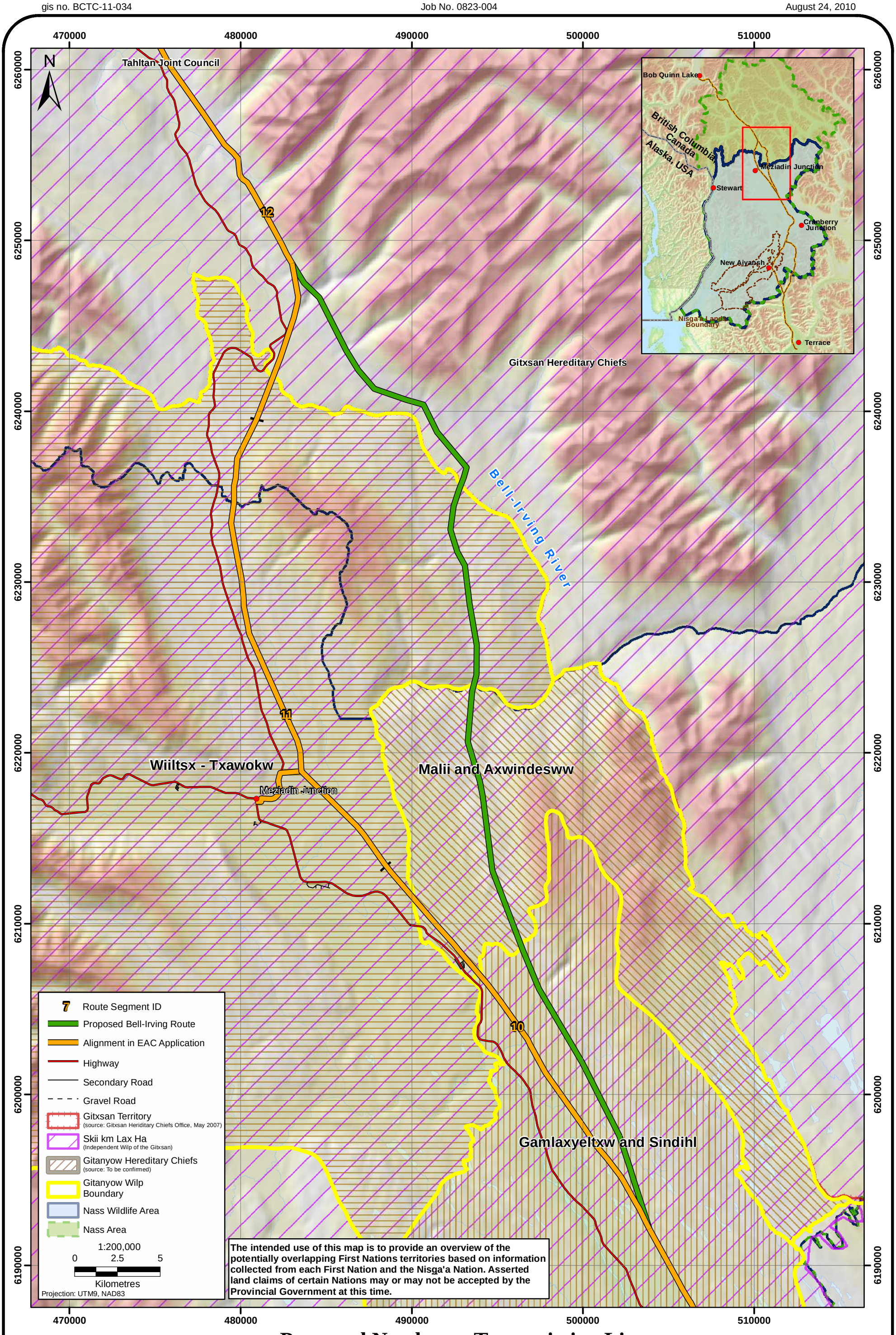
The Skii km Lax Ha asserted territory extends from the north side of Cranberry River, along the Nass River, then the Bell-Irving River, past Bell I and II to Ningunsaw Pass, with the northernmost extent of their asserted territory being Beaver Pond (Ningunsaw Pass). The entire 60 km Bell-Irving route overlaps their asserted territory. Additional information regarding the Skii km Lax Ha is presented in the EAC Application (Section 10.3.7 and Appendix 10.11-1).

8.4 CONSIDERATION OF IDENTIFIED FIRST NATION ISSUES

Summarized below are the issues that the Gitanyow and Skii Km Lax Ha identified through consultation and TU/TK studies (from the EAC Application), the assessment of potential effects on them (as appropriate), the mitigation measures developed and any residual effects and associated significance ratings. This information was primarily summarized from Chapter 6 in this report. A synopsis of this information is presented as a table for each First Nation. Other issues identified by First Nations, for example those concerning the Environmental Assessment process, capacity funding, and logistical matters are discussed in Section 2 of the EAC Application (Information Distribution and Consultation).

8.4.1 WILP WII'LITSXW, WILP MALII, WILP GAMLAXYELTXW of the Gitanyow Nation

A summary of issues identified by the Gitanyow are presented in Table 8.4-1.



Proposed Northwest Transmission Line
Bell-Irving Route,
Nisga'a, Gitanyow Wilps and Skii km Lax Ha

FIGURE 8.3-1

Table 8.4-1. Summary of Issues -Wilp Wii'litsxw, Wilp Malii, and Wilp Gamlaxyeltxw

Issue	Section in which the Issue was Considered
Effects on traditional and current land use (fishing, hunting, trapping, and mushroom and plant harvesting sites), including effects from increased access	6.8 Wetlands 6.6 Terrestrial ecosystems and vegetation 6.7 Wildlife and wildlife habitat 6.11 Land and resource use 6.14 Human health Section 13.4 of the EAC Application addressed access concerns
Grizzly bear habitat	6.7 Wildlife and wildlife habitat
Archaeological and cultural resources	6.3 Archaeology and heritage resources 6.11 Land and resource use Chapter 11 (Environmental management program) and Chapter 12 (Environmental monitoring and follow-up) of the EAC Application
Fisheries (e.g. Sockeye, steelhead)	6.5 Terrain, surficial materials, and soils 6.2 Fish and aquatic habitat 6.11 Land and resource use Chapter 12 (Environmental monitoring and follow-up) of the EAC Application Chapter 13 (Accidents and malfunctions) of the EAC Application
Integrity, connectivity and sustainability of wildlife habitat and ecosystem (in particular, moose, grizzly bear, and canyon mountain goat)	6.6 Terrestrial ecosystems and vegetation 6.7 Wildlife and wildlife habitat Chapter 12 (Environmental monitoring and follow-up) of the EAC Application Chapter 13 (Accidents and malfunctions) of the EAC Application
Ecosystem networks and old growth that provide high value wildlife habitat (goat, moose, grizzly bear) as identified in the Gitanyow Land Use Plan.	7.8 Terrestrial ecosystems and vegetation of the EAC Application 7.9 Wildlife and Wildlife Habitat of the EAC Application
Water quality (in general, and for fish, vegetation, and wildlife health)	6.10 Surface water and groundwater resources 6.4 Terrain, surficial materials, and soils 6.2 Fish and aquatic habitat 6.14 Human health Chapter 13 (Accidents and malfunctions) of the EAC Application
Water management units	6.10. Surface water and groundwater resources 6.2 Fish and aquatic habitat 6.6 Terrestrial ecosystems and vegetation
Effects on Gitanyow Land Use Plan and Sustainable Resource Management Plan	6.11 Land and resource use

(continued)

Table 8.5-1. Summary of Issues - Wilp Wii'litsxw, Wilp Malii, and Wilp Gamlaxyeltxw (completed)

Issue	Section in which the Issue was Considered
Effects of herbicides on human health, biodiversity and habitat	6.6 Terrestrial ecosystems and vegetation 6.7 Wildlife and wildlife habitat 6.14 Human health Chapter 12 (Environmental monitoring and follow-up) of the EAC Application Chapter 13 (Accidents and malfunctions) of the EAC Application
Contracting opportunities and other economic benefits	6.13 Socio-economics
Potential health effects of electromagnetic fields on humans, wildlife, fish, and vegetation	6.7 Wildlife and wildlife habitat 6.14Human health
Gitanyow Wilp tenure system in resource management and decision making	6.11 Land and resource use
Traditional use sites (e.g. fishing areas, cabin sites, potential petroglyph sites, trapping areas, harvest areas for medicinal plants, mushroom collecting areas and cultural and spiritual sites, including burials)	6.11 Land and Resource Use
Particularly sensitive area at Gleason Creek crossing	6.10 Surface Water and Groundwater Resources
Effects of planned IPP interconnects with the Project on critical fishing areas.	6.2 Fish and Aquatic Habitat 6.11 Land and Resource Use
Effects on cedar	6.6 Terrestrial Ecosystems and Vegetation
Terrain stability for water quality and integrity of spawning areas	6.4 Geotechnical Stability 6.2 Fish and Aquatic Habitat

8.4.1.1 Asserted Aboriginal Rights and Title

During consultation and through the TU/TK study (EAC Application), Wilp Wii'litsxw, Wilp Malii, and Wilp Gamlaxyeltxw expressed concern with respect to the Project's potential infringement on their asserted Aboriginal rights and title. BC Hydro ARN, engaged in consultation with the potentially affected Gitanyow Wilp during the EAC pre Application period, and has continued to engage in consultation with these Gitanyow Wilp during the EA Application review period, in order to identify and better understand the potential adverse effects of the Project on their asserted Aboriginal rights and title. The consultation process engaged in by BC Hydro ARN and the Gitanyow Wilp with respect to the Bell-Irving route is described in Chapter 4 of this report.

The potential adverse effects of the Bell-Irving route on specific asserted Aboriginal interests identified by the Gitanyow Wilp are considered in this Report and summarized in this Section. Where appropriate, these effects will be avoided, minimized, or otherwise accommodated. Potential adverse effects that are not specifically related to the Bell-Irving route are not included in this summary but are presented in Table 10.10-1 and Section 10.10.1 of the EAC Application.

8.4.1.2 Effects on Traditional and Current Land Use (Fishing, Hunting, Trapping, and Mushroom and Plant Harvesting Sites), including Effects from Increased Access

<u>Consideration in Wetlands Assessment</u>

Wetland VECs are assessed in Section 6.8 (Wetlands) of this report. Potential effects, primarily anticipated during construction activities, may include a loss or alteration of both wetland extent and

wetland function. However, with mitigation (Chapters 11 and 12 of the EAC Application) any residual adverse effects are likely not significant because they are expected to be local and of low magnitude.

Mitigation plans and practices during the construction process include avoiding treed and tall shrub wetlands (where possible); inventorying and mapping cleared wetland extent; developing a wetland compensation plan; selecting the eastern route option; monitoring wetland function; and following the Riparian Area and Vegetation Management standard operating procedures SOPs. Although these mitigation practices may reduce the magnitude of potential effects; potential residual adverse effects from the construction phase of the Project on wetlands are likely. With the proposed mitigation practices these residual effects are likely not significant because they are expected to be local extent and of low magnitude overall.

Mitigation plans during operations and maintenance will be carried out in accordance with Best Management Practices and the Approved Work Practices for Managing Riparian Vegetation (BC Hydro, 2003) developed in conjunction with the Ministry of Environment. With mitigation, residual effects are not likely for the operations and maintenance phase.

Residual adverse effects are likely for the ROW and access road construction, water course crossing, and proposed ROW clearing activities during construction. Water course crossings could cause effects where watercourses adjacent to or within wetlands will need to be crossed, thereby manifesting as a loss of wetland community. Line clearing activities could result in residual effects to tree or tall shrub wetlands (i.e., tall shrub and Spruce-Skunk cabbage swamp), because the vegetation in these communities will change, resulting in alterations of wetland extent and function.

Consideration in Terrestrial Ecosystems and Vegetation Assessment

Section 6.6 (Terrestrial Ecosystems and Vegetation) of this report assesses listed ecosystems tracked by the BC Conservation Data Centre; species or groups of cultural, social, or economic importance (pine mushroom, country foods, cedar trees, and Old Growth Management Areas [OGMAs]); sensitive ecosystems (riparian areas, floodplain forests, and old forests); and unlisted terrestrial ecosystems as VECs. Wetlands are evaluated in Section 6.8.

Potential effects of during construction and operations fall into two categories: the primary effects of vegetation or habitat alteration (removal) to produce the right-of-way (ROW) and one-time clearing areas; and secondary effects such as introduction or spread of invasive species, increased risk of fire caused by tree felling, and edge effects such as windthrow. Most potential effects on ecosystems and vegetation are predicted to occur during the vegetation clearing aspect of the construction phase. The other effects may act additively or synergistically on ecosystems. Two potential effects of note were not considered in the ecosystems and vegetation effects assessment: forest habitat fragmentation is addressed in Section 6.7 (Wildlife and Wildlife Habitat) and the effects of herbicide use are addressed in section 6.14 (Human Health).

Although vegetation will be altered and disturbed during construction and operation of the Bell-Irving route, no particular type or group of vegetation is expected to be affected such that its viability is affected. Regarding effects on berry producing shrubs, complete clearing will be limited to new access roads and tower structures, and substation. In some areas no clearing will be required at all (full retention). In all other areas, it is unlikely that vegetation will need to be cleared to a height less than 3 m. Consequently, the residual effects on all low lying vegetation will likely be insignificant. Consequently, significant effects are unlikely for all vegetation VECs.

There are no mitigation measures for the adverse effects of permanent or temporary vegetation alteration on rare ecosystems, pine mushroom, country foods, riparian areas, floodplain forests, old forests or unlisted terrestrial ecosystems – effects not likely significant. Mitigation measures for other potential adverse effects related to invasive species, fires, and edge effects consist of vegetation and invasive species management plans, including a management plan to minimize disturbance to sensitive ecosystems. Details of management plans are provided in Chapter 11 of the EAC Application.

Consideration in Wildlife and Wildlife Habitat Assessment

Potential effects on wildlife and wildlife habitat are assessed in Section 6.7. The effects assessment focuses on wildlife VECs including ungulates (moose and mountain goat), bears (grizzly and Kermode), furbearers (American marten and fisher), birds (waterfowl, raptors and forest birds), and amphibians (western toad). Potential residual adverse effects to these species are likely not significant, if the mitigation measures are implemented. A brief overview of the primary concerns with respect to wildlife VECs is provided below.

Ungulates

The primary concern is increased access to ungulate winter ranges, resulting in a re-distribution of hunting effort into these important areas and possibly an increase in unregulated hunting, which may lead to increase offtake of female moose. Mitigation measures built into the location of the ROW will reduce the amount of new areas made available for recreation and hunting. The overall potential Project-related residual effects on local moose populations are likely to not affect the sustainability of the VEC and are likely not significant.

Bears

Overall, the primary concern on the local grizzly bear and Kermode (i.e., black) bear populations is increased access due to the ROW and access roads, and associated increases in human activity and hunting pressure. Potential secondary adverse effects include effects from habitat alteration, direct mortality associated with wildlife-vehicle strikes and fell of trees with active dens, noise disturbance, and odour-causing attractants during construction. The overall potential Project effect on the local grizzly bear and Kermode bear population is predicted to cause a small shift from baseline conditions but not to affect the sustainability of the local bear populations. As such, the overall potential residual effect on grizzly bear and Kermode bear populations is likely not significant.

Furbearers

The primary concern is increased access and resulting increases in trapping pressure and direct mortality from clearing large cottonwoods and/or spruce trees during birthing periods. The overall potential Project-related residual adverse effect on the local American marten and fisher populations is predicted to cause a minor change from baseline conditions for a short time but not affect the sustainability of the local furbearer populations. It is thus is likely not significant.

Birds

Potential effect on waterfowl, raptors and forest birds include direct habitat alteration, noise disturbance, direct mortality, and indirect habitat alteration. With mitigation, the potential residual effect on birds, considering all potential effects, is likely not significant.

Amphibians

Direct mortality is also considered for wildlife during the construction phase. Many species, such as moose, can avoid the construction area, but less mobile species or species with a fixed breeding location such as western toads are more vulnerable to this adverse effect. Mitigation for each of these

species (forest birds, raptors, and western toads) includes 1) preferred work periods for vegetation clearing to limit the potential for removing breeding locations. If these preferred work windows cannot be used for logistical reasons, 2) pre-construction surveys will be used to determine the locations of breeding sites and 3) no work buffers will be enacted at breeding sites during the breeding season. Clearing will then occur outside the breeding period, using methods which reduce ground disturbance near raptor and toad breeding sites within a defined management buffer. More background on the adverse effects of direct mortality is presented in Section 7.9.5.2 of the EAC Application and details of the mitigation measures are presented in the Environmental Management Plan (Chapter 11 of the EAC Application). With implementation of suggested mitigation, residual effects of direct mortality on toads are not likely.

Consideration in Land and Resource Use Assessment

Potential effects on land use are assessed in Section 6.11 of this Application. VECs include access, quality of land use activities, forestry, and First Nations land and resource use.

Potential adverse effects of the Project on Gitanyow land and resource use include potential interruptions and delays in conducting traditional use activities and accessing traditional use areas, and diminished quality of land use experience. Precise information regarding site locations is not available. To identify and mitigate potential adverse effects on these valued features, BC Hydro will continue to engage with the Gitanyow Hereditary Chiefs to further address identified adverse effects on their land and resource interests. Discussions may include measures to avoid or minimize the potential effects, and/or communication protocols for dissemination of information on the timing and activities related to construction and operation.

Potential residual adverse effects during construction and restoration include potential interruptions or delays when accessing land use areas and/or pursuing land use activities; as well as potential removal or damage to culturally valued cabins and/or landscape features. However, these effects are expected to have a low magnitude following the proposed mitigation. They are likely not significant.

During operations and maintenance, members of the three potentially affected Gitanyow Wilp may experience a residual adverse effect related to wildlife harvests. This is an indirect effect of potential increased access and its effects on wildlife resources. However, while localized reductions in wildlife are possible, the potential for regional level effects on wildlife populations (and the Gitanyow members who use and rely on these resources) is likely not significant.

Access

Construction of the Bell-Irving route could result in the use of access roads and forest service roads for Project-related construction. To mitigate of construction related traffic effects, BC Hydro and their contractors will communicate with relevant authorities, traffic control/management, and provide signage and information for land users in affected areas. If required, a protocol for shared road use will be developed. With mitigation, no residual effects are likely.

During the operations and maintenance phase, increased access to remote areas may result from the establishment and maintenance of the ROW and new, permanent access roads.

Mitigation will include the deactivation and/or natural regeneration of temporary construction roads, while basing more permanent roads (i.e., those for inspection and maintenance) on existing roads wherever practical, and avoiding the creation of circle routes. BCTC is in the process of developing an access plan for the NTL Project, in collaboration with MOE, MOFR, and interested Aboriginal groups.

The potential for increased access to remote areas, including within the Gitanyow territory, is determined to have a potential residual adverse effect. However, while localized reductions in wildlife are possible, the potential for regional level effects on wildlife populations (and the Gitanyow land users who use and rely on these resources) is likely not significant.

Quality of Land Use Activities

Aesthetic disturbances during construction (e.g., noise, dust) and operations (e.g., visual quality) could affect Gitanyow members' appreciation of land use activities. Land-based harvests of wildlife and vegetation could potentially also be affected. These adverse effects are assessed in Section 6.11.

The mitigation of biophysical effects is addressed in the relevant sections of this report, including Fish and Aquatic Habitat (Section 6.2), Terrestrial Ecosystems and Vegetation (Section 6.6), Wildlife and Wildlife Habitat (Section 6.7), Human Health (Country Foods - Section 6.14.4), and Land Use (Section 6.11). In addition, Chapter 11 of the EAC Application summarizes the mitigation and management plans for the Project. Following mitigation, adverse effects to the quality of land use activities are likely not significant.

Forestry

The Gitanyow Hereditary Chiefs have been offered a Forest and Range Agreement but have not activated the license. Forest and Range Agreements have a five year term, and most associated tenures are non-replaceable and subject to renewal of the Forest and Range Agreement. If the Gitanyow were to activate the license in the future, then changes in the Timber Supply Area could potentially affect that license.

The adverse effects on forestry from the two Project phases (Construction/Restoration and Operations and Maintenance) are evaluated in section 6.11 of this report and section 7.11 of the EAC. The clearing of the ROW that will occur during the construction and restoration phase will have an impact on the AAC. Loss of AAC is directly related to the loss of THLB. As the THLB decreases, all things being equal, the AAC associated with the original area also decreases. Approximately 44,570m^3 of operable merchantable timber volume and 61,477m^3 of total volume is estimated to be harvested from the proposed ROW (including the one-time clearing width) (Fortech 2010). These volumes are associated with both THLB and operable merchantable forests outside of the THLB.

The long term timber volume loss differs from the existing timber volume within the Project ROW in that volume within the THLB is calculated as potential long term loss and the existing timber volume includes THLB and area outside of the THLB. The long term timber volume loss is estimated to be 45,366 m^3. This volume is based on the average Mean Annual Increment for the Nass TSA, a 100 year rotation age and the THLB overlap area.

As outlined in Section 60 of the *Forest Act* (1996a), there will be no compensation for forest licensees by the Crown as a result of this reduction, as the reduction will not exceed 5% of the current AAC.

The potential adverse effects have two timelines; (a) medium- to long-term and (b) short-term.

- Medium- to long-term: The main medium to long-term effect from the clearing of the proposed Bell-Irving ROW will be a potential loss to the AAC. Major licensees and BC Timber Sales have a combined AAC of 865,000 m3 for the Nass TSA (MoFR 2002). This AAC is 1.25% of the total provincial AAC. This includes an apportionment of 200,000 m3 for the upper Nass TSA in which the proposed Bell-Irving route does not cross through. The next AAC review will be undertaken prior to July, 2012. In recent years a substantial undercut has occurred. Based on a 100 year

rotation, the estimated AAC impact is less than 0.06% of the total Nass TSA AAC. This converts to a harvesting activity of approximately 10 - 12 logging truck loads (assuming 50m^3 load) annually. In the context of the larger industry the effect is considered negligible therefore no mitigation measures are proposed for medium to long-term effects.

- Short-term: The short-term effect consists of overlaps between the Project ROW and forest licensee proposed cut blocks. One method to mitigate short-term effects will be to have affected licensees harvest the ROW instead of planned cut blocks within their respective chart areas. It is anticipated that since BC Hydro will construct any new or temporary roads and replanting of the ROW will not be necessary, savings could be realized by the licensees. If the timber to be harvested is not of sufficient value or quantity to cover harvesting costs, the companies will be compensated for the difference based on a formula agreeable to both parties. This will fully mitigate expected losses, and no potential residual effect is likely.

When alignment of the proposed Bell-Irving route is finalized, consultation with the licensees will be required to determine which areas are of interest to the licensees at that time for clearing. This consultation will also provide the opportunity for licensees to supply an updated list of overlapping proposed blocks.

8.4.1.3 Consideration in Human Health Assessment

Country foods are considered in Section 6.14 (Human Health) of this Application. Country foods can take up chemicals from the environment, for example from water, soil, and vegetation. Thus, the quality of the food is related to the concentrations of the chemicals in those parts of the environment. Based on the effects assessment presented in Section 6.14 residual effects to human health from consuming country foods along the ROW are unlikely.

Herbicide is one of the vegetation control options that is used only in specific circumstances. Although human health effects are not likely from applying herbicides to trees, public notification and consultation will be conducted by BC Hydro before applying herbicides, and will involve the Gitanyow Hereditary Chiefs, including the Gitanyow Hereditary Chiefs Office and the three affected Wilp (Wii'litsxw, Malii and Gamlaxyeltxw) as well as the Skii km Lax Ha and Nisga'a.

Despite the results of the human health effects assessment, the perceived risk from harvesting country foods from the ROW due to the potential use of herbicides may affect the Gitanyow's use of the area. This potential adverse effect is assessed in the land use effects assessment under quality of land use activities (Section 6.11).

8.4.1.4 Consideration in Access Assessment

Construction of the Bell-Irving route could result in the use of access roads and forest service roads for Project-related construction. To mitigate of construction related traffic effects, BC Hydro and their contractors will communicate with relevant authorities, traffic control/ management, and provide signage and information for land users in affected areas. If required, a protocol for shared road use will be developed. With mitigation, no residual effects are likely.

During the operations and maintenance phase, increased access to remote areas may result from the establishment and maintenance of the ROW and new, permanent access roads.

Mitigation will include the deactivation and/or natural regeneration of temporary construction roads, while basing more permanent roads (i.e., those for inspection and maintenance) on existing roads wherever practical, and avoiding the creation of circle routes. BC Hydro is in the process of developing

an access plan for the NTL Project, in collaboration with MOE, MOFR, and interested Aboriginal groups. The access plan will include the avoidance of sensitive areas. In addition, most of the access roads for the Bell-Irving route will be existing roads, thereby reducing the likelihood for any adverse effects.

The potential for increased access to remote areas, including within Gitanyow territory, is determined to have a potential residual effect. However, while localized reductions in wildlife are possible, the potential for regional level effects on wildlife populations (and the Gitanyow land users who use and rely on these resources) is likely not significant.

8.4.1.5 Grizzly Bear Habitat

Consideration in Wildlife and Wildlife Habitat Assessment

Potential adverse effects on grizzly bear habitat are considered in Section 6.7 (Wildlife and Wildlife Habitat). Areas of critical habitat, including grizzly habitat, can be an important salmon spawning reaches, and will be considered when developing long-term maintenance roads, where practical. Mitigation cannot completely minimize access and associated disturbance and indirect mortality on bear, thus a potential adverse residual effect likely; however, it is likely not significant.

8.4.1.6 Archaeological and Cultural Resources

Consideration in Archaeology and Heritage Resources Assessment

Potential adverse effects of the proposed Bell-Irving route on archaeological and heritage resources are assessed in Section 6.3. An archaeological impact assessment (AIA) of the Bell-Irving footprint was conducted as part of the effects assessment. The archaeological assessment found no previously recorded archaeological sites near the route. The field work conducted in 2010 included a total of 171 shovel tests at 24 locations along the route. However, no new archaeological sites were identified. Because no archaeological sites were identified during the study, no adverse residual effects are likely to archaeological sites and designated heritage sites are anticipated should the Bell-Irving route be selected along its current proposed alignment. Although no new sites were identified along the proposed route, chance find protocols will be applied during construction of the route, as described in Chapter 11 of the EAC Application.

Consideration in Land and Resource Use Assessment

Cultural values are presented in the Hanna-Tintina Route Alternatives Report. In addition, during discussions with the Gitanyow they have indicated that an additional TU/TK report they are preparing for the Bell-Irving route will include a section on cultural resources.

Consideration in Environmental Management Program

An Archaeological Impact Management Plan and an Archaeological Chance Find Recovery Procedure for the proposed Project are described in the EAC Application (Chapter 11, Environmental Management Program). The Archaeological Impact Management Plan and an Archaeological Chance Find Recovery Procedures presented in the EAC Application will also apply to the Bell-Irving route.

While the proposed Bell-Irving route has been subject to an Archaeological Impact Assessment (AIA), if any re-alignments are considered, based on consultation with the Gitanyow, these areas will require an AIA before construction activity, thus additional archaeology studies may be conducted prior to construction.

Consideration in Environmental Monitoring and Follow-up

The Environmental Monitoring Program for the proposed Project, including monitoring with respect to archaeological sites, is described in Chapter 12 of the EAC Application. Environmental Monitoring Program for the proposed Project will also be applicable to the Bell-Irving route.

8.4.1.7 Fisheries (e.g. Sockeye, Steelhead), with Particular Interest in Spawning Areas

Consideration in Terrain, Surficial Materials, and Soils Assessment

The assessment on terrain, surficial materials, and soils (Section 6.5) includes soil sensitivity (to erosion and structural degradation). Construction or upgrading of roads could expose soils that could be susceptible to water erosion at road or bridge crossings, potentially delivering sediment to waterways, which could affect water quality and fish habitat. With best management practices followed, as detailed in the Sediment and Erosion Control Plan (Chapter 11 of the EAC Application), no residual effects are likely.

Consideration in Fish and Aquatic Habitat Assessment

Fish and aquatic habitat VECs in the Bell-Irving area are assessed in Section 6.2 (Fish and Aquatic Resources). VECs within Skii km Lax Ha territory include **Dolly Varden** (*Salvelinus malma*) and **bull trout** (*Salvelinus confluentus*); **rainbow trout/steelhead** (*Oncorhynchus mykiss*); anadromous (migratory) **Pacific salmon**, including coho (*O. kisutch*), chinook (*O. tshawytscha*) and sockeye (*O. nerka*); and fish habitat. With mitigation (Chapters 11 and 12 of the EAC Application) all potential residual effects are likely not significant in terms of the viability of the VECs.

Consideration in Land and Resource Use Assessment

Gitanyow land and resource use values associated with the Bell-Irving route are described in the Hanna-Tintina Route Alternatives Evaluation Report and in Section 6.11 of this report. With respect to fish and fish harvests, no potential residual effects are likely (Section 6.2).

Consideration in Environmental Monitoring and Follow-up

The Environmental Monitoring Program for the proposed Project is described in Chapter 12 of the EAC Application. The Environmental Monitoring Program for the proposed Project will also be applicable to the Bell-Irving route.

Consideration in Accidents and Malfunctions Assessment

Chapter 13 of the EAC Application describes the potential adverse effects of accidents and malfunctions associated with construction, operation, and maintenance of the proposed Project following implementation of the mitigation measures identified in Chapters 7, 8, and 11 of the EAC Application. All potential accidents and malfunctions as well as the mitigation measures identified for ROW construction and operation are also be applicable to the Bell-Irving route and therefore are not re-evaluated here.

8.4.1.8 Integrity, Connectivity and Sustainability of Wildlife Habitat and Ecosystem

The Gitanyow are particularly concerned about moose, grizzly bear, and canyon mountain goat.

Consideration in Terrestrial Ecosystems and Vegetation

Potential adverse effects on terrestrial ecosystems are assessed in Section 6.6 (Terrestrial Ecosystems and Vegetation).

Consideration in Wildlife and Wildlife Habitat Assessment

Potential adverse effects on wildlife habitat integrity, including alteration of moose, grizzly bear, mountain goat, and amphibian habitat, are considered in Section 6.7 (Wildlife and Wildlife Habitat) of this report.

Consideration in Accidents and Malfunctions Assessment

Chapter 13 of the EAC Application describes the potential adverse effects of accidents and malfunctions associated with construction, operation, and maintenance of the proposed Project following implementation of the mitigation measures identified in Chapters 7, 8, and 11 of the EAC Application. All potential accidents and malfunctions as well as the mitigation measures identified for ROW and road construction and operation are also be applicable to the Bell-Irving route and therefore are not re-evaluated here.

8.4.1.9 Forest Ecosystem Networks

Consideration in Terrestrial Ecosystems and Vegetation Assessment

Potential effects on forest ecosystems are addressed in Section 6.6 (Terrestrial Ecosystems and Vegetation). Overall, no significant effects are likely for the vegetation VECs.

Consideration in Environmental Monitoring and Follow-up

The Environmental Monitoring Program for the proposed Project is described in Chapter 12 of the EAC Application. The Environmental Monitoring Program for the Proposed Project will also be applicable to the Bell-Irving route.

8.4.1.10 Ecosystem Networks and Old Growth that Provide High Value Wildlife (Goat, Moose, Grizzly Bear) Habitat as Identified in the Gitanyow Land Use Plan

Consideration in Terrestrial Ecosystems and Vegetation Assessment

Potential adverse effects on forest ecosystems and old growth areas are addressed in Chapter 6.6 of this report. Approximately 2680 ha of OGMA's were identified; however much of this area is outside of the 2 km baseline study area and less than 25 ha fall on the ROW. Table 6.6-7 presents the OGMA's that overlap with the Bell-Irving route ROW. BC Hydro will work with the BC Ministry of Forests and Range (BC MOFR) District Manager and the relevant licensees, depending on the status of the OGMAs affected by construction, to work out suitable replacements, if required. BC Hydro intends to follow directives from the BC MOFR District Manager and, as a result, no potential residual effects on OGMAs are likely. Additional details on potential effects on ecosystems are presented in Section 6.6. Overall, no significant effects are likely for the vegetation VECs.

Consideration in Wildlife and Wildlife Habitat Assessment

Potential adverse effects on wildlife habitat, including that for goat, moose and grizzly bear, are addressed in Section 6.7 of this report and in the EAC in Section 7.9 (Wildlife and Wildlife Habitat) and summarized above in Section 8.5.2.3.

8.4.1.11 Water Quality (In General and for Fish, Vegetation, and Wildlife Health)

Consideration in Surface Water and Groundwater Resources Assessment

VECs in the assessment of surface water and groundwater resources (Section 6.10) included surface hydrology (water quantity) and groundwater quantity and quality.

Surface Hydrology

Residual adverse effects to surface hydrology are expected from the sustained alteration to land cover that will occur initially during the construction and restoration phase. However, these effects will occur over a long period; therefore, they were assessed under the operations and maintenance phase. No other residual effects are likely on surface water hydrology during the construction and restoration phase. Residual effects on surface water hydrology are expected for 42 streams crossed (of 82) along the proposed Bell-Irving route because of the percentage of the area of the stream crossing watersheds that will be cleared for the transmission line ROW or for new sustained access roads. The low magnitude and extent of the residual effects on surface water hydrology indicated that the potential residual effects are not likely to be significant. The Bell-Irving route will be approximately 60 km long; its effect on surface hydrology will be divided into 82 separate local watersheds, such that the effect at any specific stream crossing is not likely to be significant. In addition, because residual effects will be primarily at a local scale and will diminish with distance downstream from the route, the collective effect on the watersheds is also likely to be not significant.

Groundwater

It is anticipated that any changes to the groundwater flow regime caused by the Project along the Bell-Irving route will be temporary, localized, and minor. As a result, the anticipated magnitude of any residual adverse effects on groundwater quantity is expected to be low and highly localized to the vicinity of the construction sites. These residual effects are likely not significant.

It is not likely that there will be residual effects caused by the operations and maintenance programs with respect to groundwater quantity. Effects on groundwater quality from operations and maintenance will be limited to accidents and spills. Response plans will be put in place by BC Hydro to ensure that spills are addressed immediately. With proper spill management, the effects will be spatially limited and thus likely not significant. Effects from the use of herbicide, or other similar products, are not considered likely. More detail on accidents and malfunctions can be found in Chapter 13 of the EAC Application.

Consideration in Terrain, Surficial Materials, and Soils Assessment

The assessment on terrain, surficial materials, and soils (Section 6.5) includes soil sensitivity (to erosion and structural degradation). Construction or upgrading of roads could expose soils that could be susceptible to water erosion at road or bridge crossings, potentially delivering sediment to waterways, which could affect water quality and fish habitat. With best management practices followed, as detailed in the Sediment and Erosion Control Plan (Chapter 11 of the EAC Application), no residual effects are likely.

Consideration in Fish and Aquatic Habitat Assessment

Fish and aquatic habitat VECs in the Bell-Irving area are assessed in Section 6.1 (Fish and Aquatic Habitat). VECs within Skii km Lax Ha territory include **Dolly Varden** (*Salvelinus malma*) and **bull trout** (*Salvelinus confluentus*); **rainbow trout/steelhead** (*Oncorhynchus mykiss*); anadromous (migratory) **Pacific salmon**, including coho (*O. kisutch*), chinook (*O. tshawytscha*) and sockeye (*O. nerka*); and fish habitat. With mitigation (Chapters 11 and 12 of the EAC Application) all potential residual effects are likely not significant in terms of the viability of the VECs.

Consideration in Accidents and Malfunctions Assessment

Chapter 13 of the EAC Application describes the potential adverse effects of accidents and malfunctions associated with construction, operation, and maintenance of the proposed Project following implementation of the mitigation measures identified in Chapters 7, 8, and 11 of the EAC

Application. All potential accidents and malfunctions as well as the mitigation measures identified for ROW construction and operation are also be applicable to the Bell-Irving route and therefore are not re-evaluated here.

8.4.1.12 Water Management Units

Water management units comprise a special resource management zone under the Nass South Sustainable Resource Management Plan (SRMP), which was developed in collaboration with the Gitanyow Hereditary Chiefs and whose purpose is the sustainable management of water.

Consideration in Surface Water and Groundwater Resources

VECs in the assessment of surface water and groundwater resources (Section 6.10) included surface hydrology (water quantity) and groundwater (quantity and quality). A summary of the assessment on these VECs is presented above in Section 8.5.9.1.

Consideration in Fish and Aquatic Habitat Assessment

The Fish and Aquatic Habitat assessment was informed by the fisheries objectives and management direction outlined in the Nass South (draft) SRMP. Potential adverse effects on fish and aquatic habitat are assessed in Section 6.2 and summarized in Section 8.5.5.2.

Consideration in Terrestrial Ecosystems and Vegetation Assessment

Potential issues identified in the Terrestrial Ecosystems and Vegetation assessment were informed by the Nass South (draft) SRMP. Potential effects on terrestrial ecosystems are addressed in Section 6.6 and summarized in Section 8.5.2.2.

8.4.1.13 Effects on Gitanyow Land Use Plan and Sustainable Resource Management Plan

Consideration in Land and Resource Use Assessment

Land and resource management plans, including the Nass South Sustainable Resource Management Plan (SRMP), which was developed in collaboration with the Gitanyow Hereditary Chiefs, is detailed in Section 7.11.1.1 of the EAC Application and is summarised in Section 6.11 of this report. Effects on land and resource management planning are not assessed; instead, the assessment recognises the objectives of these plans.

8.4.1.14 Effects of Herbicides on Human Health, Biodiversity and Habitat

Consideration in Terrestrial Ecosystems and Vegetation Assessment

Herbicide use is discussed in Section 6.6 (Terrestrial Ecosystems and Vegetation) of this report and in Section 7.8 and Section 7.14 of the EAC. During operations, BC Hydro is required by the *Wildfire Act* (2004) to control and mitigate any increased risk of fire and is responsible for forest fires that have propagated within the ROW (including on First Nations land). Hence, BC Hydro will manage vegetation during operations in such a manner as to minimize any risk of increased fires. In most areas, this will involve ring-barking saplings with herbicides, which minimizes the amount of potential fuel compared to other management options. Alternate methods include mowing small trees and chipping the stems or stacking in such a way as to maximize decomposition.

Consideration in Wildlife and Wildlife Habitat Assessment

Adverse effects from herbicide contamination were excluded from the wildlife and wildlife habitat effects assessment because it was determined that there are no potential adverse effects of herbicides

on wildlife and wildlife habitat that require assessment. Rational for this determination is provided in Section 7.9.3 of the EAC Application.

Consideration in Land and Resource Use Assessment

Potential adverse health effects from the use of herbicides during vegetation maintenance were assessed in 6.14. The human health assessment concludes that a potential residual adverse health effect as a result of herbicide use is unlikely. However, the effect of public perception of potential health effects from exposure to herbicides may be that some people avoid or limit land use in these areas. No mitigation is proposed to reduce this public perception, thus residual effects on the quality of land use activities are likely.

Consideration in Human Health Assessment

Potential adverse effects of herbicides are discussed in Chapter 6.14, particularly in the context of country foods and drinking water. Overall, with respect to herbicide use, residual effects to human health from consuming country foods are unlikely. In addition, following mitigation, significant adverse health effects on domestic water quality are not likely. Rational for this determination is provided in Section 6.14.3 and 6.14.4.

Consideration in Accidents and Malfunctions

Chapter 13 of the EAC Application describes the potential adverse effects of accidents and malfunctions associated with construction, operation, and maintenance of the proposed Project following implementation of the mitigation measures identified in Chapters 7, 8, and 11 of the EAC Application. All potential accidents and malfunctions as well as the mitigation measures identified for ROW construction and operation are also be applicable to the Bell-Irving route and therefore are not re-evaluated here.

8.4.1.15 Contracting Opportunities and Other Economic Benefits

Consideration in Socio-economics Assessment

Potential socio-economic effects are assessed in Section 6.13 of this report and Section 7.12 of the EAC Application. The socio-economic effects are generally assessed for the entire Project rather than specific routes or segments. Thus, the potential effects identified previously, are also applicable to the Bell-Irving route.

8.4.1.16 Potential Health Effects of Electric and Magnetic Fields on Humans, Wildlife, Fish, and Vegetation

Consideration in Wildlife and Wildlife Habitat Assessment

The issue raised concerning potential adverse effects of electromagnetic fields (EMF) on wildlife was considered during the wildlife issues scoping process in preparation for the wildlife and wildlife habitat effects assessment (Section 7.9 of the EAC Application). As a result of the issue scoping, the potential effect of EMF was excluded from the wildlife and wildlife habitat effects assessment. The rationale for this exclusion is presented in the EAC Application. Overall, it was determined that there will be no potential effects of EMF on wildlife that would necessitate an assessment for the proposed Project. This conclusion is applicable to the Bell-Irving route.

Consideration in Human Health Assessment

Potential adverse health effects from human receptor exposure to electromagnetic field (EMF) levels are assessed in Section 6.14 (Human Health). Overall, adverse health effects are not likely from the EMF generated from the proposed Bell-Irving route. Although no residual adverse health effects are likley from potential EMF levels generated from the proposed Project, BC Hydro will take measures to reduce EMF levels where mitigation costs are not significant. These measures are presented in Section 7.14.2.5 of the EAC Application.

8.4.1.17 Gitanyow Wilp tenure system in resource management and decision making

Consideration in Land and Resource Use Assessment

The importance of the Wilp-based tenure system is identified and described in Section 7.11.1.10 of the EAC Application. Potential effects of the Bell-Irving route on the three potentially affected Gitanyow Wilp are described in Section 6.11 of this report. The Hereditary Chiefs of these Wilp have expressed concern that culturally valued land uses and landscape features may be adversely affected. Precise information regarding site locations is not currently available. To identify and mitigate potential adverse effects on these valued features, BC Hydro will continue to consult with the relevant Hereditary Chiefs. Potential adverse effects are discussed in Section 6.11 and were determined to be likely not significant.

8.4.1.18 Traditional Use Sites

The Gitanyow Bell-Irving route TU/TK report was not available at the time when this supplemental assessment was prepared. However, upon receipt and review of the Gitanyow Bell-Irving route TU/TK report BC Hydro will consider any potential adverse effects on sites of particular importance prior to construction. Such sites may include cabins, camps, hunting/trapping areas, multi-use sites, plant gathering sites, fishing areas and trails. The following presents a summary of the effects assessments conducted in the absence of site specific TU/TK information.

Consideration in Archaeology and Heritage Resources Assessment

Potential adverse effects of the proposed Bell-Irving route on archaeological and heritage resources are assessed in Section 6.3. An archaeological impact assessment (AIA) of the Bell-Irving footprint was conducted as part of the effects assessment for this report. The archaeological assessment found no previously recorded archaeological sites near the route. The field work conducted in 2010 included a total of 171 shovel tests at 24 locations along the route. However, no new archaeological sites were identified. Because no archaeological sites were identified during the study, adverse residual effects to archaeological sites and designated heritage sites are not likely should the Bell-Irving route be selected along its current proposed alignment.

No AIA fieldwork was conducted for ancillary components, such as temporary construction infrastructure and access roads, because final design has not yet been completed. If further archaeological assessment is undertaken as recommended, and if any sites identified in that process are avoided or if other mitigation measures are taken, it is expected that there will be no residual effects.

Consideration in Land and Resource Use Assessment

Cultural values presented in the Hanna-Tintina Route Alternatives Report, in addition, discussions with the Gitanyow have indicated that their TU/TK report for the Bell-Irving route will include a section on cultural resources.

Consideration in Environmental Management Program

An Archaeological Impact Management Plan and an Archaeological Chance Find Recovery Procedure for the proposed Project are described in the EAC Application (Chapter 11, Environmental Management Program). The Archaeological Impact Management Plan and an Archaeological Chance Find Recovery Procedures presented in the EAC Application will also apply to the Bell-Irving route.

While the proposed Bell-Irving route has been subject to an Archaeological Impact Assessment (AIA), if any re-alignments are considered, based on consultation with the Gitanyow, these areas will require an AIA before construction activity, thus additional archaeology studies may be conducted prior to construction.

Consideration in Environmental Monitoring and Follow-up

The Environmental Monitoring Program for the proposed Project is described in Chapter 12 of the EAC Application. The Environmental Monitoring Program for the Proposed Project will also be applicable to the Bell-Irving route.

8.4.2 Effects on Cedar

Consideration in Terrestrial Ecosystems and Vegetation Assessment

Potential adverse effects on cedar are assessed in Section 6.6 (Terrestrial Ecosystems and Vegetation) and no significant effects are likely.

8.4.3 Skii km Lax Ha

8.4.3.1 Skii km Lax Ha Asserted Aboriginal Rights and Title

The Skii km Lax Ha Traditional Use and Knowledge study for the Bell-Irving route was not yet available at the time this report was prepared. However, in their TU/TK report included in the EAC Application the Skii km Lax Ha expressed the importance of validating the Skii km Lax Ha understanding of their territorial extent and strength of claim for asserted Aboriginal rights and title, and the value of ethno-historical documentation for proving such strength of claim (Appendix 10.11 of the EAC Application). BC Hydro will take into account Skii km Lax Ha TU/TK information that is available at the design-build stage of the Project.

BC Hydro has continued to engage in consultation with the Skii km Lax Ha during the EAC Application review period, in order to identify and better understand the potential adverse effects of the Project, including the Bell-Irving route on the Skii km Lax Ha's interests. The consultation process engaged in by BC Hydro and the Skii km Lax Ha during the review period is summarised in Chapter 4.

The potential adverse effects of the Project on specific asserted Aboriginal interests identified by the Skii km Lax Ha are considered in this report and summarized in this Section. Where appropriate, these effects will be avoided, minimized, or otherwise accommodated.

A summary of issues identified by the Gitanyow are presented in Table 8.4-2.

Table 8.4-2. Summary of Skii km Lax Ha Issue Identification

Skii km Lax Ha Issue	Identified Through	Section in which the Issue was Considered
Continued use of their territory for subsistence hunting, trapping, berry/plant/mushroom harvesting, and fishing	Consultation Skii km Lax Ha TU/TK report	6.1 Fish and aquatic habitat 6.8 Wetlands 6.6 Terrestrial ecosystems and vegetation 6.7 Wildlife and wildlife habitat 6.11 Land and resource use 6.14 Human health Chapter 13 of the EAC Application
Concern regarding herbicide use in the Right of Way	Consultation	6.6 Terrestrial ecosystems and vegetation 6.7 Wildlife and wildlife habitat 6.11 Land and resource use 6.14 Human health Chapters 12 and 13 of the EAC Application
Training and skills development: capacity building	Consultation	6.13 Socioeconomics
Cultural and historic sites	Skii km Lax Ha TU/TK report	6.3 Archaeology and heritage resources 6.11 Land and resource use Chapters 11 (Environmental management program) and 12 (Environmental monitoring and follow-up) of the EAC Application
Location and protection of culturally modified trees	Skii km Lax Ha TU/TK report	6.3 Archaeology and heritage resources Chapters 11 (Environmental management program) and 12 (Environmental monitoring and follow-up) of the EAC Application
Effects of climate change on weather and water bodies	Skii km Lax Ha TU/TK report	6.9 Atmospheric environment

8.4.3.2 Continued Use of their Territory for Subsistence Hunting, Trapping, Berry/Plant/Mushroom Harvesting, and Fishing

Consideration in Fish and Aquatic Habitat Assessment

Fish and aquatic habitat VECs in the Bell-Irving area are assessed in Section 6.1 (Fish and Aquatic Habitat). VECs within Skii km Lax Ha territory include **Dolly Varden** (*Salvelinus malma*) and **bull trout** (*Salvelinus confluentus*); **rainbow trout/steelhead** (*Oncorhynchus mykiss*); anadromous (migratory) **Pacific salmon**, including coho (*O. kisutch*), chinook (*O. tshawytscha*) and sockeye (*O. nerka*); and fish habitat. With mitigation (Chapters 11 and 12 of the EAC Application) all potential residual adverse effects are considered likely not significant in terms of the viability of the VECs.

Consideration in Wetlands Assessment

The Skii km Lax Ha identified wetlands as important areas for trapping. Wetland VECs are assessed in Section 6.8 (Wetlands) of this report. Potential adverse effects, primarily anticipated during construction activities, include a loss or alteration of both wetland extent and wetland function.

However, with mitigation (Chapters 11 and 12 of the EAC Application) any residual effects are not likely significant because they are expected to be local and of low magnitude.

Consideration in Terrestrial Ecosystems and Vegetation Assessment

Terrestrial Ecosystems and Vegetation VECs are assessed in Section 6.6. The VECs assessed included:

- Rare ecosystems (those listed ecosystems tracked by the BC Conservation Data Centre)
- Species or groups of cultural, social, or economic importance (pine mushroom, country foods, cedar trees, and Old Growth Management Areas [OGMAs]);
- Sensitive ecosystems (riparian areas, floodplain forests, and old forests); and
- Unlisted terrestrial ecosystems.

Potential effects during construction and operations fall into two categories: the primary effects of vegetation or habitat alteration (removal) to produce the ROW and one-time clearing areas; and secondary effects such as introduction or spread of invasive species, increased risk of fire caused by tree felling, and edge effects such as windthrow. Most potential effects on ecosystems and vegetation are predicted to occur during the vegetation clearing aspect of the construction phase. The other effects may act additively or synergistically on ecosystems.

Mitigation of potential effects is presented in Chapters 11 and 12 of the EAC Application. With mitigation no significant adverse effects are likely.

Consideration in Wildlife and Wildlife Habitat Assessment

Potential effects on wildlife and wildlife habitat are assessed in Section 6.7. The effects assessment focuses on wildlife VECs including ungulates (moose and mountain goat), bears (grizzly and Kermode), furbearers (American marten and fisher), birds (waterfowl, raptors and forest birds), and amphibians (western toad). With proposed mitigation measures, residual adverse effects to these species are likely not significant. A brief overview of the primary concerns with respect to wildlife VECs is provided below.

Ungulates

The primary concern is increased access to ungulate winter ranges, resulting in a re-distribution of hunting effort into these important areas and possibly an increase in unregulated hunting, which may lead to increase offtake of female moose. Mitigation measures built into the location of the line will reduce the amount of new areas made available for recreation and hunting. The overall potential Project-related residual adverse effect on local moose populations are not likely to affect the sustainability of the VEC and are thus not likely significant.

Bears

Overall, the primary concern on the local grizzly bear and Kermode (i.e., black) bear populations is increased access due to the ROW and access roads, and associated increases in human activity and hunting pressure. Potential secondary adverse effects will include effects from habitat alteration, direct mortality associated with wildlife-vehicle strikes and fell of trees with active dens, noise disturbance, and odour-causing attractants during construction. The overall potential adverse effect on the local grizzly bear and Kermode bear population is likely to cause a small shift from baseline conditions is not likely to effect the sustainability of the local bear populations. As such, the overall potential residual effect on grizzly bear and Kermode bear populations is not likely significant.

Furbearers

The primary concern is increased access and resulting increases in trapping pressure and direct mortality from clearing large cottonwoods and/or spruce trees during birthing periods. The overall potential Project-related residual adverse effect on the local American marten and fisher populations is predicted to cause a minor change from baseline conditions for a short time but not affect the sustainability of the local furbearer populations. It is thus likely not significant.

Birds

Potential effect on waterfowl, raptors and forest birds include direct habitat alteration, noise disturbance, direct mortality, and indirect habitat alteration. With mitigation, the potential residual effect on birds, considering all potential effects, is likely not significant.

Amphibians

Potential adverse effects on western toad in and around wetlands during construction activities include 1) direct habitat alteration affecting wetland function and extent as a result of vegetation clearing, construction activities, and/or other indirect effects (siltation); and 2) direct mortality of western toads during periods of high concentration close to wetlands i.e. spring breeding and late summer emergence. With mitigation, potential residual effects are not likely. No potential effects were identified or evaluated for amphibians for the operations phase of the Project.

Consideration in Land and Resource Use Assessment

Potential adverse effects on subsistence harvesting are assessed under the Quality of Land Use Activities VEC in Section 6.11 while access to the land for harvesting is addressed under the Access VEC. In addition, potential adverse effects specific to the Skii km Lax Ha land use are identified in 6.11 of this report and Section 7.11.6 of the EAC.

Potential adverse effects of the Project specifically on Skii km Lax Ha land and resource use include possible interruptions to and delays in conducting traditional use activities and accessing traditional use areas that overlap with the Bell-Irving route. Specific areas will be identified upon receipt and review of the Skii km Lax Ha Bell-Riving route TU/TK report. BC Hydro will consider any potential adverse effects on identified sites of particular importance prior to construction.

BC Hydro will continue to engage with the Skii km Lax Ha to further address identified adverse effects on their land and resource interests. Discussions may include measures to avoid or minimize effects, and/or communication protocols for dissemination of information on the timing and activities related to construction and operation. The outcomes of these discussions are expected to address most of the effects, thus potential residual effects are not likely.

Access

Construction of the Bell-Irving route could result in the use of access roads and forest service roads for Project-related construction. To mitigate of construction related adverse traffic effects, BCTC and their contractors will communicate with relevant authorities, traffic control/ management, and provide signage and information for land users in affected areas. If required, a protocol for shared road use will be developed. With mitigation, residual effects are unlikely.

During the operations and maintenance phase, increased access to remote areas may result from the establishment and maintenance of the ROW and new, permanent access roads.

Mitigation will include the deactivation and/or natural regeneration of temporary construction roads, while basing more permanent roads (i.e., those for inspection and maintenance) on existing roads wherever practical, and avoiding the creation of circle routes. BCTC is in the process of developing an access plan for the NTL Project, in collaboration with MOE, MOFR, and interested Aboriginal groups.

The potential for increased access to remote areas, including within the Skii km Lax Ha territory, is likley to have a potential residual adverse effect. However, while localized reductions in wildlife are possible, the potential for regional level effects on wildlife populations (and the Skii km Lax Ha land users who use and rely on these resources) is likely not significant.

Quality of Land Use Activities

Aesthetic disturbances during construction (e.g., noise, dust) and operations (e.g., visual quality) could affect Skii km Lax Ha members' appreciation of land use activities. Land-based harvests of wildlife and vegetation could potentially also be affected.

The mitigation of biophysical effects is addressed in the relevant sections of this application, including Fisheries and Aquatic Resources (Section 6.2), Terrestrial Ecosystems and Vegetation (Section 6.6), Wildlife and Wildlife Habitat (Section 6.7), and Human Health (Country Foods - Section 6.14.4). In addition, Chapter 11 of the EAC summarizes the mitigation and management plans for the Project. Following mitigation, adverse effects to the quality of land use activities are likely not significant.

8.4.3.3 Concern Regarding Herbicide Use in the Right of Way

Consideration in Terrestrial Ecosystems and Vegetation Assessment

Herbicide use is discussed in Section 6.6 (Terrestrial Ecosystems and Vegetation) and Section 7.8 and Section 7.14 of the EAC. During operations, BC Hydro is required by the *Wildfire Act* (2004) to control and mitigate any increased risk of fire and is responsible for forest fires that have propagated within the ROW (including on First Nations land). Hence, BC Hydro will manage vegetation during operations in such a manner as to minimize any risk of increased fires. In most areas, this will involve ring-barking saplings with herbicides, which minimizes the amount of potential fuel compared to other management options. Alternate methods include mowing small trees and chipping the stems or stacking in such a way as to maximize decomposition.

Consideration in Wildlife and Wildlife Habitat Assessment

Effects from herbicide contamination were excluded from the wildlife and wildlife habitat effects assessment because it was determined that there are no potential adverse effects of herbicides on wildlife and wildlife habitat that require assessment. Rational for this determination is provided in Section 7.9.3 of the EAC Application.

Consideration in Land and Resource Use Assessment

Potential adverse health effects from the use of herbicides during vegetation maintenance were assessed in 6.14. The human health assessment concludes that potential residual health effect as a result of herbicide use is unlikely. However, the effect of public perception of potential health effects from exposure to herbicides may be that some people avoid or limit land use in these areas. No mitigation is proposed to reduce this public perception, thus residual adverse effects on the quality of land use activities are predicted.

Consideration in Human Health Assessment

Potential adverse effects of herbicides are discussed in Chapter 6.14, particularly in the context of country foods and drinking water. Overall, with respect to herbicide use, residual effects to human health from consuming country foods are unlikely. In addition, following mitigation, significant adverse health effects on domestic water quality are unlikely. Rational for this determination is provided in Section 6.14.3 and 6.14.4.

Consideration in Environmental Monitoring and Follow-up

The Environmental Monitoring Program for the proposed Project is described in Chapter 12 of the EAC Application. The Environmental Monitoring Program for the Proposed Project will also be applicable to the Bell-Irving route.

Consideration in Accidents and Malfunctions Assessment

Chapter 13 of the EAC Application describes the potential adverse effects of accidents and malfunctions associated with construction, operation, and maintenance of the proposed Project following implementation of the mitigation measures identified in Chapters 7, 8, and 11 of the EAC Application. All potential accidents and malfunctions as well as the mitigation measures identified for ROW construction and operation are also be applicable to the Bell-Irving route and therefore are not re-evaluated here.

8.4.3.4 Training and Skills Development: Capacity Building

Consideration in Socio-economics Assessment

Potential socio-economic effects are assessed in Section 6.13 of this report and Section 7.12 of the EAC Application. The socio-economic effects are generally assessed for the entire Project rather than specific routes or segments. Thus, the potential effects identified previously, will also be applicable to the Bell-Irving route.

Cultural and Historic Sites

The Skii km Lax Ha Bell-Irving route TU/TK report was not available at the time when this supplemental assessment was prepared. Thus, specific cultural and historical sites could not be assessed. However, upon receipt and review of the Skii km Lax Ha Bell-Irving route TU/TK report any potential adverse effects on sites of particular importance will be considered prior to construction. Such sites my include cabins, camps, burial, sites, hunting/trapping areas, multi-use sites, plant gathering sites, fishing areas and trails. The following presents a summary of the effects assessments conducted in the absence of site specific TU/TK information.

Consideration in Archaeology and Heritage Resources Assessment

Potential adverse effects of the proposed Bell-Irving route on archaeological and heritage resources are assessed in Section 6.3. An archaeological impact assessment (AIA) of the Bell-Irving footprint was conducted as part of the effects assessment. The archaeological assessment found no previously recorded archaeological sites near the route. The field work conducted in 2010 included a total of 171 shovel tests at 24 locations along the route. However, no new archaeological sites were identified. Because no archaeological sites were identified during the study, adverse residual effects to archaeological sites and designated heritage sites are not likely should the Bell-Irving route be selected along its current proposed alignment.

Consideration in Land and Resource Use Assessment

The cultural value of land use activities and natural resources are anticipated to be presented in the Skii km Lax Ha TU/TK report for the Bell-Irving route as well as through on going consultation. Once the cultural values are identified, BC Hydro will continue to engage with the Skii km Lax Ha to address any identified adverse effects on their land and resource interests where practical. Discussions may include measures to avoid or minimize effects, and/or communication protocols for dissemination of information on the timing and activities related to construction and operation. Residual effects are not likely.

Consideration in Environmental Management Program

An Archaeological Impact Management Plan and an Archaeological Chance Find Recovery Procedure for the proposed Project are described in the EAC Application (Chapter 11, Environmental Management Program). The Archaeological Impact Management Plan and an Archaeological Chance Find Recovery Procedures presented in the EAC Application will also apply to the Bell-Irving route.

While the proposed Bell-Irving route has been subject to an Archaeological Impact Assessment (AIA), if any re-alignments are considered, based on consultation with the Skii km Lax Ha, these areas will require an AIA before construction activity, thus additional archaeology studies may be conducted prior to construction.

Consideration in Environmental Monitoring and Follow-up

The Environmental Monitoring Program for the proposed Project, including monitoring with respect to archaeological sites, is described in Chapter 12 of the EAC Application. The Environmental Monitoring Program for the proposed Project will also be applicable to the Bell-Irving route.

8.4.3.5 Location and Protection of Culturally Modified Trees

Consideration in Archaeology and Heritage Resources Assessment

Potential adverse effects of the proposed Bell-Irving route on archaeological and heritage resources, including culturally modified trees, are assessed in Section 6.3. Because no archaeological sites were identified during the study, adverse residual effects to archaeological sites and designated heritage sites are not likely should the Bell-Irving route be selected along its current proposed alignment.

Consideration in Environmental Management Program

An Archaeological Impact Management Plan and an Archaeological Chance Find Recovery Procedure for the proposed Project are described in the EAC Application (Chapter 11, Environmental Management Program). The Archaeological Impact Management Plan and an Archaeological Chance Find Recovery Procedures presented in the EAC Application will also apply to the Bell-Irving route.

While the proposed Bell-Irving route has been subject to an Archaeological Impact Assessment (AIA), if any re-alignments are considered, based on consultation with the Skii km Lax Ha, these areas will require an AIA before construction activity, thus additional archaeology studies may be conducted prior to construction.

Consideration in Environmental Monitoring and Follow-up

The Environmental Monitoring Program for the proposed Project, including monitoring with respect to archaeological sites, is described in Chapter 12 of the EAC Application. Environmental Monitoring Program for the proposed Project will also be applicable to the Bell-Irving route.

8.4.3.6 Effects of Climate Change on Weather and Water Bodies

Consideration in Atmospheric Environment Assessment

Atmospheric environment is a VEC assessed in Section 6.9. Potential adverse effects on the atmospheric environment along the entire route of the proposed Project include increased greenhouse gases (GHGs) resulting from emissions during construction activities and a reduction in the carbon sink. The Skii km Lax Ha have indicated concern that increased rainfall and snowfall during the winter and a decrease in the number of streams and lakes that completely freeze over during the winter near the Project are related to climate change. The adverse effect on the climate and meteorology from the incremental increase in atmospheric GHGs from any single source cannot be quantified (CEA Agency 2003). Therefore, the significance of the proposed Project's adverse effects on the climate and meteorology is assessed by comparing projected Project emissions to national and provincial standards.

Mitigation measures include a regular maintenance program for diesel equipment, minimization of the length and duration of helicopter flights, minimization of engine idling, restriction of speed limits for mobile diesel equipment, air filtration systems in driver cabins, use of slash burning procedures and protocols based on air quality index, weather conditions, limiting the size and number of slash piles to be burned concurrently, and the use of modern machinery with pollution-control technology, and use of low sulphur fuels.

Any residual effects, are not likely significant, is contribution to the global GHG inventory.

9. Environmental Management and Monitoring Programs

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9. Environmental Management and Monitoring Programs

9.1 INTRODUCTION

The Environmental Management Programs and Environmental Monitoring Programs that will apply to the entire Project are presented in Chapters 11 and 12 of the EAC Application, respectively. These programs will also apply to the Bell-Irving route. In addition, supplemental information collected for the Bell-Irving route will be reviewed and incorporated into the environmental management and monitoring programs, where applicable.

Rather than repeat the information provided in Chapters 11 and 12 of the EAC Application, a synopsis of the chapters is provided in the following two sections. However, for a more complete understanding of the Environmental Management Program and Environmental Monitoring Program, refer to Chapters 11 and 12 of the EAC Application.

9.2 ENVIRONMENTAL MANAGEMENT PROGRAM

The purpose of the Environmental Management Program is to provide information to assist BC Hydro and its contractors in adhering to applicable environmental legislation and standards, as well as its internal policies and procedures during construction, operations, and maintenance of the proposed Project. Environmental Management Program documentation for the entire Project will consist of a construction Environmental Management Plan (construction EMP), as well as existing BC Hydro environmental management policies and procedures. The Environmental Management Program is designed to be adaptive, effective, and achievable in its implementation. All aspects of the Environmental Management Program are intended to be consistent with BC Hydro's Environmental Responsibility Principles and Environmental Management System (Section 11.1.2 of the EAC Application), BC Hydro's Safety Principles and Safety Management System (Section 11.1.3, of the EAC Application), and relevant regulatory requirements, standards, and guidelines (Section 11.1.4, of the EAC Application). The Program will also consider land management plan objectives specified in the EAC Application (Section 11.1.5). The Environmental Management Program will follow the adaptive management approach of BC Hydro's Environmental Management System framework whereby mitigation measures and monitoring components can be adjusted in response to outcomes from management and monitoring studies and concerns or issues that emerge during the course of project design and construction. Once in operation, the proposed Project will be subject to existing BC Hydro environmental policies and procedures, which are reviewed and updated from time to time in response to changing conditions and legal and environmental practice standards. Adaptive management provides flexibility to identify and implement new mitigation measures or to modify existing ones during the life of a project (CEA Agency 2009).

The Environmental Management Program for the NTL Project will be divided into three Project phases: construction environmental management (Section 11.2, of the EAC Application), operational environmental management (Section 11.3, of the EAC Application), and decommissioning management (Section 11.4, of the EAC Application). Section 11.2 of the EAC Application provides a framework for the construction EMP. As preparation for completing a final construction EMP, BC Hydro has developed a draft conceptual construction EMP for review by the EAO, federal Responsible Authorities and the EAO Technical Working Group, including the Nisga'a Nation and First Nations. The final construction

EMP will be developed before commencing construction in consultation with relevant permitting agencies, the Nisga'a Nation, and First Nations. Relevant, site-specific field information collected for the Bell-Irving route will be incorporated into the final construction EMP for the Project. Section 11.3 of the EAC Application provides a list and high-level summary of existing BC Hydro environmental management and operational procedure documents that will be followed and adapted during the operations and maintenance phase of the Project. Decommissioning management (Section 11.4 of the EAC Application) will be addressed before future decommissioning activities, in accordance with the regulatory regime and environmental sensitivities at that time. A schematic showing the proposed Environmental Management Program for the proposed Project is provided in Figure 11.1-1 of the EAC Application.

9.3 ENVIRONMENTAL MONITORING PROGRAM

The purpose of the Environmental Monitoring Program is to inspect, evaluate, and report on the environmental protection measures during construction of the Project (including the Bell-Irving route) and to provide a process for recommending improvements and adjusting mitigation as necessary throughout all Project phases. The Environmental Monitoring Program will be an integral part of the Environmental Management Program and will help ensure the implementation and development of the Project in accordance with BC Hydro's Environmental Responsibility Principles (Section 11.1.2) as well as conditions of the Environmental Assessment Certificate and the Canadian Environmental Assessment Agency Screening Report.

The Environmental Monitoring Program will identify the type and frequency of monitoring and inspections, data collection requirements, methodologies to employ, and protocols to follow. The focus of the monitoring will be on determining whether BC Hydro's contractors are meeting terms and conditions of the construction EMP and regulatory approvals. For each of the two major proposed Project components, transmission lines and substations, the Environmental Monitoring Program will be in place to evaluate the performance of the environmental mitigation and compensation strategies in achieving regulatory compliance, and in mitigating potential adverse effects. The Environmental Monitoring Program will also detail applicable reporting requirements. Environmental monitoring will be carried out in construction and post-construction phases of the Project (Sections 12.2 and 12.3 of the EAC Application, respectively).

10. Conclusions

10. Conclusions

The potential environmental, heritage, social, economic and health effects of the NTL Project using the Bell-Irving route have been assessed:

- The environmental, social, economic, heritage and human health effects that will potentially arise using the Bell-Irving route have been identified;
- Where potential adverse effects to VECs have been identified, measures to avoid, minimize, or otherwise mitigate those identified potential adverse effects have been identified; and
- The significance of residual effects has been assessed.

10.1 POTENTIAL EFFECTS AND MITIGATION

During the construction of the NTL Project, using the Bell-Irving route, there is potential for adverse effects to arise from ROW clearing and from construction of, and improvements to, access roads. During the operation and maintenance of the transmission line, there is potential for adverse effects to arise from vegetation management along the ROW and from maintenance of the associated infrastructure.

Potential Project-related effects can be mitigated through careful selection of structure locations in consultation with potentially affected First Nations, the Nisga'a Nation, regulatory agencies, and tenured Crown land interests. Implementation of a Construction Environmental Management Plan (CEMP) will provide a structured approach for implementation of mitigation measures during construction of the proposed Project. During the operation of the transmission line using the Bell-Irving route, adherence to BC Hydro's existing environmental management and protection protocols and procedures for ROW, substation and access road maintenance, and to any subsequent updates, will mitigate potential adverse effects. The existing protocols and procedures are described in the EAC Application (Chapter 11 and Appendix 11.2-1).

Although, this report presented an effects assessment of the Bell-Irving route, the route in itself is considered a form of mitigation to the potential adverse effects of the NTL Project by avoiding potential impacts to higher ecological and cultural values in the Hanna and Tintina watersheds.

10.2 SUMMARY OF SIGNIFICANCE OF POTENTIAL RESIDUAL EFFECTS

In this report each potential environmental, social, economic, heritage and human health effect has been assessed separately (Chapter 6). With mitigation taken into account, potential residual effects have been identified and the significance of each potential residual effect of the Project has been determined. A residual effect is considered significant if there is an expectation that it would affect the viability of the VEC. Viability is defined as the ability to continue to work and function over time within the defined spatial and temporal boundary. Use of the Bell-Irving route for the NTL Project is likely to result in several adverse residual effects, but none are likely to be significant.

10.3 COMMITMENTS AND ASSURANCES

In Table 14.2-1 of the EAC Application, BC Hydro presents a list of proposed Commitments and Assurances, in order to ensure that the NTL Project is unlikely to result in a significant adverse effect. The objective of the commitments and assurances is to avoid, reduce or otherwise mitigate potential

adverse effects of the proposed Project where current standards of due diligence and best practices will not result in satisfactory mitigation.

The commitments and assurances set out in Table 14.2.1 of the EAC Application are both appropriate and sufficient to ensure that significant adverse effects are unlikely to result if the Bell-Irving route is used.

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Appendix 6.2-1

Fish Habitat Assessment and Sampling Details for Individual Site Crossings

Rescan™
Engineers and Scientists

FDIS Site Card

Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	Reach #	ILP Map #	ILP #	Site
	1.0	104A.025	7002	1

PROJECT

Project Name: NTL 2010 Field Work
Stream Name (gaz.): BELL-IRVING RIVER
Project Code: 20255
Project Watershed Code: 560-000000-00000-00000-0000-0000-000-000-000-000-000-000

WATERSHED

Gazetted Name:
Local Name: Bell Irving
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000
ILP Map#: 104A.025 ILP #: 7002 NID Map #: 104A.025 NID #: 70003 Reach #: 1.0 Site #: 1
Field UTM (Z.E.N): .. Method: Site Lg: 300 Method: GE Access: H
GIS UTM (Z.E.N): 9.492829.6235686 Ref. Name:
Date: 2010/08/21 Time: 15:00 Agency: C660 Crew: GK RD Fish Crd?: ☐ Incomplete: ☑

CHANNEL

	Mtd	width	width	width	width	width	width	width	width	width	width	Avg
Channel Width (m):	T	120.00										120.00
Wetted Width (m):	MS	8.00										8.00
Pool Depth (m):	MS											0.00

	Gadient %		Mtd	Avg
Method I:	1.0		C	1.00
Method II:			C	

Wb Depth:	2.0		

Avg: 2.00 Method: MS Stage: L ☐ M ☑ H ☐
No Vis.Ch.: ☐ Intermittent: ☐
Dw: ☐ Tribs.: ☐

COVER Total: T

Type:	SWD	LWD	B	U	DP	OV	IV
Amount:	N	N	S	N	D	N	N
Loc: P/S/O:	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑

CROWN CLOSURE
1 1-20%
INSTREAM VEG: N ☑ A ☐ M ☐ V ☐

LWD: N DIST: NA

LB SHP: S
Texture: F ☑ G ☑ C ☐ B ☐ R ☐ A ☐
RIP: D
STG: MF

RB SHP: S
Texture: F ☑ G ☑ C ☐ B ☐ R ☐ A ☐
RIP: D
STG: MF

WATER

EMS:
Temp: 9 Method: T5
pH: Method: P2
Flood Signs: Method: GE

Req #:
Cond.: Method:
Turb.: T ☑ M ☐ L ☐ C ☐ Method: GE

MORPHOLOGY

Bed Material: Dominant: G Subdom: F
D95: D (cm): 10.00 Morph: LC
Pattern: SI
Islands: O
Coupling: DC
Confinement: UN
FSZ: ☐

DISTURBANCE INDICATORS

O1	B1	B2	B3	D1	D2	D3
☐	☐	☐	☐	☐	☐	☐

C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
☑	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bars: N ☐ SIDE ☑ DIAG ☐ MID ☐ SPAN ☐ BR ☐

HABITAT QUALITY

Name	Comments
OverWinter Habitat	GOOD - Big river, good flow, won't freeze
Rearing Habitat	FAIR -
Spawning Habitat	POOR - Turbid, no riffle-pool breaks

PHOTOS

Photo				Foc Lg	Dir	Comments
R:	7002	F:	0310		U	Upstream 330 degrees
R:	7002	F:	0311		D	Downstream 140 degrees

FDIS Site Card

	Reach #	ILP Map #	ILP #	Site
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	1.0	104A.025	7002	1

COMMENTS	
Section	Comments
CHANNEL	S1 - Critical habitat, migration to vast upstream spawning and habitat. Please note that there are many additional images of this river all from Roll 7003 numbering between 0319 - 0331

Stream/ILP: 7002 Image: 0310 Comment: Upstream, Upstream 330 degrees. 8/21/2010.

Stream/ILP: 7002 Image: 0311 Comment: Downstream, Downstream 140 degrees. 8/21/2010.

FDIS Site Card

Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	Reach #	ILP Map #	ILP #	Site
	1.0	104A.015	7003	1

PROJECT

Project Name: NTL 2010 Field Work
Stream Name (gaz.): NASS RIVER Project Code: 20255
Project Watershed Code: 500-000000-00000-00000-0000-0000-000-000-000-000-000-000

WATERSHED

Gazetted Name: Local Name: Nass
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000
ILP Map#: 104A.015 ILP #: 7003 NID Map #: 104A.015 NID #: 70004 Reach #: 1.0 Site #: 1
Field UTM (Z.E.N): .. Method: Site Lg: 300 Method: GE Access: H
GIS UTM (Z.E.N): 9.493426.6223991 Ref. Name:
Date: 2010/08/21 Time: 16:00 Agency: C660 Crew: GK RD Fish Crd?: ☐ Incomplete: ☑

CHANNEL

	Mtd	width	width	width	width	width	width	width	width	width	width	Avg
Channel Width (m):	T	70.00										70.00
Wetted Width (m):	MS	25.00										25.00
Pool Depth (m):	MS											0.00

	Gadient %		Mtd	Avg
Method I:	1.0		C	1.00
Method II:			C	

Wb Depth: Avg: 0.00 Method: MS Stage: L ☐ M ☑ H ☐
No Vis.Ch.: ☐ Intermittent: ☐
Dw: ☐ Tribs.: ☐

COVER Total: T

Type:	SWD	LWD	B	U	DP	OV	IV
Amount:	N	N	S	N	D	N	N
Loc: P/S/O:	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑

CROWN CLOSURE
1 1-20%
INSTREAM VEG: N ☑ A ☐ M ☐ V ☐

LWD: N DIST: NA

LB SHP: V
Texture: F ☐ G ☐ C ☐ B ☐ R ☑ A ☐
RIP: D
STG: YF

RB SHP: V
Texture: F ☐ G ☐ C ☐ B ☐ R ☑ A ☐
RIP: D
STG: YF

WATER

EMS: Req #:
Temp: Method: T5 Cond.: Method: S3
pH: Method: P2
Turb.: T ☑ M ☐ L ☐ C ☐ Method: GE
Flood Signs: Method: GE

MORPHOLOGY

Bed Material: Dominant: Subdom:
D95: D (cm): Morph: LC
Pattern: SI
Islands: N
Coupling: CO
Confinement: EN
FSZ: ☐

DISTURBANCE INDICATORS

O1	B1	B2	B3	D1	D2	D3
☐	☐	☐	☐	☐	☐	☐

C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bars: N ☑ SIDE ☐ DIAG ☐ MID ☐ SPAN ☐ BR ☐

HABITAT QUALITY

Name	Comments
OverWinter Habitat	FAIR
Rearing Habitat	POOR
Spawning Habitat	NONE -

PHOTOS

Photo				Foc Lg	Dir	Comments
R:	7003	F:	0321		D	PHOTO 250 DEGREES
R:	7003	F:	0323		U	PHOTO 90 DEGREES

FDIS Site Card

	Reach #	ILP Map #	ILP #	Site
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	1.0	104A.015	7003	1

COMMENTS	
Section	Comments
CHANNEL	S1 UNKNOWN BED MATERIAL PROBABLY BEDROCK OR BOULDER/COBBLE (GUESSING). SEVERAL ADDITIONAL PHOTOS AVAILABLE ON ROLL 7003 - NUMBERED 0319 - 0331

Stream/ILP: 7003 Image: 0321 Comment: Downstream, Photo 90 Degrees. 8/21/2010.

Stream/ILP: 7003 Image: 0323 Comment: Upstream, Photo 90 degrees. 8/21/2010.

FDIS Site Card

	Reach #	ILP Map #	ILP #	Site
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	1.0	104A.034	7008	1

PROJECT

Project Name: NTL 2010 Field Work
Stream Name (gaz.): BELL-IRVING RIVER
Project Code: 20255
Project Watershed Code: 560-000000-00000-00000-0000-0000-000-000-000-000-000-000

WATERSHED

Gazetted Name: Local Name:
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000
ILP Map#: 104A.034 ILP #: 7008 NID Map #: 104A.034 NID #: 70005 Reach #: 1.0 Site #: 1
Field UTM (Z.E.N): .. Method: Site Lg: 100 Method: GE Access: H
GIS UTM (Z.E.N): 9.487292.6241883 Ref. Name:
Date: 2010/08/22 Time: 12:14 Agency: C660 Crew: GK RD Fish Crd?: ☐ Incomplete: ☑

CHANNEL

	Mtd	width	width	width	width	width	width	width	width	width	width	Avg
Channel Width (m):	T											0.00
Wetted Width (m):	MS											0.00
Pool Depth (m):	MS											0.00

	Gadient %		Mtd	Avg
Method I:			C	0.00
Method II:			C	

Wb Depth: Avg: 0.00 Method: MS Stage: L ☐ M ☐ H ☐
No Vis.Ch.: ☐ Intermittent: ☐
Dw: ☐ Tribs.: ☐

COVER Total:

Type:	SWD	LWD	B	U	DP	OV	IV
Amount:							
Loc: P/S/O:	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐

CROWN CLOSURE

INSTREAM VEG: N ☐ A ☐ M ☐ V ☐

LWD: DIST:

LB SHP:
Texture: F ☐ G ☐ C ☐ B ☐ R ☐ A ☐
RIP:
STG:

RB SHP:
Texture: F ☐ G ☐ C ☐ B ☐ R ☐ A ☐
RIP:
STG:

WATER

EMS: Req #:
Temp: Method: Cond.: Method:
pH: Method:
Flood Signs: Method: Turb.: T ☐ M ☐ L ☐ C ☐ Method:

MORPHOLOGY

Bed Material: Dominant: Subdom:
D95: D (cm): Morph:
Pattern:
Islands:
Coupling:
Confinement:
FSZ: ☐

DISTURBANCE INDICATORS

O1	B1	B2	B3	D1	D2	D3
☐	☐	☐	☐	☐	☐	☐

C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bars: N☐ SIDE☐ DIAG☐ MID☐ SPAN☐ BR☐

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 7008 F: 0333		D	
R: 7008 F: 0334		U	

COMMENTS

Section	Comments
CHANNEL	NCD - Dry

Stream/ILP: 7008 Image: 0333 Comment: Downstream, . 8/22/2010.

Stream/ILP: 7008 Image: 0334 Comment: Upstream, . 8/22/2010.

FDIS Site Card

Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	Reach #	ILP Map #	ILP #	Site
	1.0	104A.035	7009	1

PROJECT

Project Name: NTL 2010 Field Work
Stream Name (gaz.): BELL-IRVING RIVER
Project Code: 20255
Project Watershed Code: 560-000000-00000-00000-0000-0000-000-000-000-000-000-000

WATERSHED

Gazetted Name: Local Name:
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000
ILP Map#: 104A.035 ILP #: 7009 NID Map #: 104A.035 NID #: 70006 Reach #: 1.0 Site #: 1
Field UTM (Z.E.N): .. Method: Site Lg: 50 Method: GE Access: V4
GIS UTM (Z.E.N): 9.488087.6241211 Ref. Name:
Date: 2010/08/22 Time: 12:54 Agency: C660 Crew: GK RD Fish Crd?: ☐ Incomplete: ☑

CHANNEL

	Mtd	width	width	width	width	width	width	width	width	width	width	Avg
Channel Width (m):	T											0.00
Wetted Width (m):	MS											0.00
Pool Depth (m):	MS											0.00

	Gadient %		Mtd	Avg
Method I:				0.00
Method II:				

No Vis.Ch.: ☐ Intermittent: ☐
Dw: ☐ Tribs.: ☐

Wb Depth:			

Avg: 0.00 Method: Stage: L ☐ M ☐ H ☐

COVER Total:

Type:	SWD	LWD	B	U	DP	OV	IV
Amount:							
Loc: P/S/O:	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐

CROWN CLOSURE

INSTREAM VEG: N ☐ A ☐ M ☐ V ☐

LWD: DIST:

LB SHP:
Texture: F ☐ G ☐ C ☐ B ☐ R ☐ A ☐
RIP:
STG:

RB SHP:
Texture: F ☐ G ☐ C ☐ B ☐ R ☐ A ☐
RIP:
STG:

WATER

EMS:
Temp: Method:
pH: Method:
Flood Signs: Method: GE

Req #:
Cond.: Method:
Turb.: T ☐ M ☐ L ☐ C ☐ Method:

MORPHOLOGY

Bed Material: Dominant: Subdom:
D95: D (cm): Morph:
Pattern:
Islands:
Coupling:
Confinement:
FSZ: ☐

DISTURBANCE INDICATORS

O1	B1	B2	B3	D1	D2	D3
☐	☐	☐	☐	☐	☐	☐

C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bars: N☐ SIDE☐ DIAG☐ MID☐ SPAN☐ BR☐

PHOTOS

Photo				Foc Lg	Dir	Comments
R:	7009	F:	0335		U	
R:	7009	F:	0336		D	Culvert

COMMENTS

Section	Comments
CHANNEL	NCD

Stream/ILP: 7009 Image: 0335 Comment: Upstream, . 8/22/2010.

Stream/ILP: 7009 Image: 0336 Comment: Downstream, Culvert. 8/22/2010.

FDIS Site Card

Reach #	ILP Map #	ILP #	Site
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	1.0	104A.035	7010	1

PROJECT

Project Name: NTL 2010 Field Work
Stream Name (gaz.): BELL-IRVING RIVER Project Code: 20255
Project Watershed Code: 560-000000-00000-00000-0000-0000-000-000-000-000-000-000

WATERSHED

Gazetted Name: Local Name:
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000
ILP Map#: 104A.035 ILP #: 7010 NID Map #: 104A.035 NID #: 70007 Reach #: 1.0 Site #: 1
Field UTM (Z.E.N): .. Method: Site Lg: 100 Method: GE Access: V4
GIS UTM (Z.E.N): 9.488487.6241095 Ref. Name:
Date: 2010/08/22 Time: 13:12 Agency: C660 Crew: GK RD Fish Crd?: ☐ Incomplete: ☐

CHANNEL

	Mtd	width	width	width	width	width	width	width	width	width	width	Avg
Channel Width (m):	T	4.00	4.10	2.90	4.00	2.50	3.00					3.42
Wetted Width (m):	MS	1.50	1.90	1.80	1.70	1.20	1.30					1.57
Pool Depth (m):	MS	0.40	0.30	0.20	0.30	0.30						0.30

	Gadient %		Mtd	Avg
Method I:	2.0	3.0	C	2.33
Method II:	2.0		C	

Wb Depth:	.8	.7	.6

Avg: 0.70 Method: MS Stage: L ☐ M ☑ H ☐
No Vis.Ch.: ☐ Intermittent: ☐
Dw: ☐ Tribs.: ☐

COVER Total: A

Type:	SWD	LWD	B	U	DP	OV	IV
Amount:	T	D	N	S	N	S	N
Loc: P/S/O:	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑

CROWN CLOSURE
4 71-90%
INSTREAM VEG: N ☐ A ☐ M ☑ V ☐

LWD: F DIST: E

LB SHP: U
Texture: F ☑ G ☐ C ☐ B ☐ R ☐ A ☐
RIP: M
STG: MF

RB SHP: S
Texture: F ☑ G ☑ C ☐ B ☐ R ☐ A ☐
RIP: M
STG: MF

WATER

EMS:
Temp: 10 Method: T5
pH: 7.4 Method: P2
Flood Signs: NONE Method: GE

Req #:
Cond.: Method:
Turb.: T ☐ M ☐ L ☐ C ☑ Method: GE

MORPHOLOGY

Bed Material: Dominant: G Subdom: C
D95: 30.0 D (cm): 5.00 Morph: RP
Pattern: IR
Islands: N
Coupling: DC
Confinement: UN
FSZ: ☐

DISTURBANCE INDICATORS

O1	B1	B2	B3	D1	D2	D3
☐	☐	☐	☐	☐	☐	☐

C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bars: N ☐ SIDE ☑ DIAG ☐ MID ☐ SPAN ☐ BR ☐

HABITAT QUALITY

Name	Comments
OverWinter Habitat	POOR - No deep pools / slow flow
Rearing Habitat	GOOD - Small resident fish
Spawning Habitat	FAIR - For small resident fish nice small riffles out of pools. Rip. Func.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 7010 F: 0337		D	With Ryan
R: 7010 F: 0338		U	With Ryan

FDIS Site Card

	Reach #	ILP Map #	ILP #	Site
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	1.0	104A.035	7010	1

COMMENTS	
Section	Comments
CHANNEL	S3 - Default. No culvert: Old log crib bridge - ie. No barrier at road crossing. Check for Grad and Barriers at mian steam confluence.

Stream/ILP: 7010 Image: 0337 Comment: Downstream, With assistant. 8/22/2010.

Stream/ILP: 7010 Image: 0338 Comment: Upstream, With assistant. 8/22/2010.

FDIS Site Card

Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	Reach #	ILP Map #	ILP #	Site
	1.0	104A.035	7011	1

PROJECT

Project Name: NTL 2010 Field Work
Stream Name (gaz.): BELL-IRVING RIVER Project Code: 20255
Project Watershed Code: 560-000000-00000-00000-0000-0000-000-000-000-000-000-000

WATERSHED

Gazetted Name: Local Name:
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000
ILP Map#: 104A.035 ILP #: 7011 NID Map #: 104A.035 NID #: 70008 Reach #: 1.0 Site #: 1
Field UTM (Z.E.N): .. Method: Site Lg: 100 Method: GE Access: V4
GIS UTM (Z.E.N): 9.488538.6241167 Ref. Name:
Date: 2010/08/22 Time: 14:00 Agency: C660 Crew: GK RD Fish Crd?: ☐ Incomplete: ☐

CHANNEL

	Mtd	width	width	width	width	width	width	width	width	width	width	Avg
Channel Width (m):	T	3.00	2.00	2.50	2.40	3.50						2.68
Wetted Width (m):	MS	1.00	0.70	1.00	1.20	1.00						0.98
Pool Depth (m):	MS	0.20	0.20									0.20

	Gadient %		Mtd	Avg
Method I:	3.0	3.0	C	3.00
Method II:				

Wb Depth:	.9	.6	.7

Avg: 0.73 Method: MS Stage: L ☐ M ☑ H ☐
No Vis.Ch.: ☐ Intermittent: ☐
Dw: ☐ Tribs.: ☐

COVER Total: A

Type:	SWD	LWD	B	U	DP	OV	IV
Amount:	D	S	N	T	N	S	N
Loc: P/S/O:	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑

CROWN CLOSURE
4 71-90%
INSTREAM VEG: N ☐ A ☐ M ☑ V ☐

LWD: F DIST: E

LB SHP: S
Texture: F ☑ G ☑ C ☐ B ☐ R ☐ A ☐
RIP: S
STG: SHR

RB SHP: V
Texture: F ☑ G ☑ C ☐ B ☐ R ☐ A ☐
RIP: S
STG: SHR

WATER

EMS:
Temp: 10 Method: T5
pH: 7.4 Method: P2
Flood Signs: Method: GE

Req #:
Cond.: Method:
Turb.: T ☐ M ☐ L ☐ C ☑ Method: GE

MORPHOLOGY

Bed Material: Dominant: G Subdom: C
D95: 15.0 D (cm): 5.00 Morph: RP
Pattern: IR
Islands: N
Coupling: DC
Confinement: UN
FSZ: ☐

DISTURBANCE INDICATORS

O1	B1	B2	B3	D1	D2	D3
☐	☐	☐	☐	☐	☐	☐

C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bars: N ☐ SIDE ☑ DIAG ☐ MID ☐ SPAN ☐ BR ☐

HABITAT QUALITY

Name	Comments
OverWinter Habitat	POOR -
Rearing Habitat	GOOD - Small resident fish
Spawning Habitat	FAIR - Only for small resident fish

PHOTOS

Photo				Foc Lg	Dir	Comments
R:	7011	F:	0339		D	
R:	7011	F:	0340		U	

FDIS Site Card

	Reach #	ILP Map #	ILP #	Site
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	1.0	104A.035	7011	1

COMMENTS	
Section	Comments
CHANNEL	S3 - Default. Joins 7010 just upstream of road crossing. Check mainstream confluences for grad/barrier

Stream/ILP: 7011 Image: 0339 Comment: Downstream, . 8/22/2010.

Stream/ILP: 7011 Image: 0340 Comment: Upstream, . 8/22/2010.

FDIS Site Card

Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	Reach #	ILP Map #	ILP #	Site
	1.0	104A.035	7012	1

PROJECT

Project Name: NTL 2010 Field Work
Stream Name (gaz.): BELL-IRVING RIVER Project Code: 20255
Project Watershed Code: 560-000000-00000-00000-0000-0000-000-000-000-000-000-000

WATERSHED

Gazetted Name: Local Name:
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000
ILP Map#: 104A.035 ILP #: 7012 NID Map #: 104A.035 NID #: 70009 Reach #: 1.0 Site #: 1
Field UTM (Z.E.N): .. Method: Site Lg: 30 Method: GE Access: V4
GIS UTM (Z.E.N): 9.488610.6241024 Ref. Name:
Date: 2010/08/22 Time: 14:20 Agency: C660 Crew: GK RD Fish Crd?: ☐ Incomplete: ☑

CHANNEL

	Mtd	width	width	width	width	width	width	width	width	width	width	Avg
Channel Width (m):	T											0.00
Wetted Width (m):	MS											0.00
Pool Depth (m):	MS											0.00

	Gadient %		Mtd	Avg
Method I:			C	0.00
Method II:			C	

Wb Depth: Avg: 0.00 Method: MS Stage: L ☐ M ☐ H ☐
No Vis.Ch.: ☐ Intermittent: ☐
Dw: ☐ Tribs.: ☐

COVER Total:

Type:	SWD	LWD	B	U	DP	OV	IV
Amount:							
Loc: P/S/O:	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐

CROWN CLOSURE

INSTREAM VEG: N ☐ A ☐ M ☐ V ☐

LWD: DIST:

LB SHP:
Texture: F ☐ G ☐ C ☐ B ☐ R ☐ A ☐
RIP:
STG:

RB SHP:
Texture: F ☐ G ☐ C ☐ B ☐ R ☐ A ☐
RIP:
STG:

WATER

EMS: Req #:
Temp: Method: Cond.: Method:
pH: Method: Turb.: T ☐ M ☐ L ☐ C ☐ Method:
Flood Signs: Method: GE

MORPHOLOGY

Bed Material: Dominant: Subdom:
D95: D (cm): Morph:
Pattern:
Islands:
Coupling:
Confinement:
FSZ: ☐

DISTURBANCE INDICATORS

O1	B1	B2	B3	D1	D2	D3
☐	☐	☐	☐	☐	☐	☐

C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bars: N☐ SIDE☐ DIAG☐ MID☐ SPAN☐ BR☐

PHOTOS

Photo				Foc Lg	Dir	Comments
R:	7012	F:	0341		U	Pond
R:	7012	F:	0342		D	

COMMENTS

Section	Comments
CHANNEL	NCD - Water seeping thru road (old collasped culvert) small puddle / pond upstream side of road.

Stream/ILP: 7012 Image: 0341 Comment: Upstream, Pond. 8/22/2010.

Stream/ILP: 7012 Image: 0342 Comment: Downstream, . 8/22/2010.

FDIS Site Card

Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	Reach #	ILP Map #	ILP #	Site
	1.0	104A.035	7013	1

PROJECT

Project Name: NTL 2010 Field Work
Stream Name (gaz.): BELL-IRVING RIVER Project Code: 20255
Project Watershed Code: 560-000000-00000-00000-0000-0000-000-000-000-000-000-000

WATERSHED

Gazetted Name: Local Name:
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000
ILP Map#: 104A.035 ILP #: 7013 NID Map #: 104A.035 NID #: 70010 Reach #: 1.0 Site #: 1
Field UTM (Z.E.N): .. Method: Site Lg: 50 Method: GE Access: V4
GIS UTM (Z.E.N): 9.488678.6241066 Ref. Name:
Date: 2010/08/22 Time: 14:40 Agency: C660 Crew: GK RD Fish Crd?: ☐ Incomplete: ☑

CHANNEL

	Mtd	width	width	width	width	width	width	width	width	width	width	Avg
Channel Width (m):	T											0.00
Wetted Width (m):	MS											0.00
Pool Depth (m):	MS											0.00

	Gadient %		Mtd	Avg
Method I:			C	0.00
Method II:			C	

Wb Depth: Avg: 0.00 Method: MS Stage: L ☐ M ☐ H ☐
No Vis.Ch.: ☐ Intermittent: ☐
Dw: ☐ Tribs.: ☐

COVER Total:

Type:	SWD	LWD	B	U	DP	OV	IV
Amount:							
Loc: P/S/O:	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐	☐☐☐

CROWN CLOSURE

INSTREAM VEG: N ☐ A ☐ M ☐ V ☐

LWD: DIST:

LB SHP:
Texture: F ☐ G ☐ C ☐ B ☐ R ☐ A ☐
RIP:
STG:

RB SHP:
Texture: F ☐ G ☐ C ☐ B ☐ R ☐ A ☐
RIP:
STG:

WATER

EMS: Req #:
Temp: Method: T5 Cond.: Method: S3
pH: Method: P2
Flood Signs: Method: GE Turb.: T ☐ M ☐ L ☐ C ☐ Method: GE

MORPHOLOGY

Bed Material: Dominant: Subdom:
D95: D (cm): Morph:
Pattern:
Islands:
Coupling:
Confinement:
FSZ: ☐

DISTURBANCE INDICATORS

O1	B1	B2	B3	D1	D2	D3
☐	☐	☐	☐	☐	☐	☐

C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bars: N ☐ SIDE ☐ DIAG ☐ MID ☐ SPAN ☐ BR ☐

PHOTOS

Photo				Foc Lg	Dir	Comments
R:	7013	F:	0343		U	With Ryan
R:	7013	F:	0344		D	With Ryan

COMMENTS

Section	Comments
CHANNEL	NCD - OK Culvert at Road Crossing

Stream/ILP: 7013 Image: 0343 Comment: Upstream, With assistant. 8/22/2010.

Stream/ILP: 7013 Image: 0344 Comment: Downstream, With assistant. 8/22/2010.

FDIS Site Card

Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	Reach #	ILP Map #	ILP #	Site
	1.0	104A.035	7014	1

PROJECT

Project Name: NTL 2010 Field Work
Stream Name (gaz.): BELL-IRVING RIVER Project Code: 20255
Project Watershed Code: 560-000000-00000-00000-0000-0000-000-000-000-000-000-000

WATERSHED

Gazetted Name: Local Name:
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000
ILP Map#: 104A.035 ILP #: 7014 NID Map #: 104A.035 NID #: 70011 Reach #: 1.0 Site #: 1
Field UTM (Z.E.N): .. Method: Site Lg: 100 Method: GE Access: V4
GIS UTM (Z.E.N): 9.489142.6240857 Ref. Name:
Date: 2010/08/22 Time: 14:59 Agency: C660 Crew: GK RD Fish Crd?: ☐ Incomplete: ☐

CHANNEL

	Mtd	width	width	width	width	width	width	width	width	width	width	Avg
Channel Width (m):	T	1.60	0.90	1.40	1.40	1.00						1.26
Wetted Width (m):	MS	1.40	0.50	1.00	0.70	0.70						0.86
Pool Depth (m):	MS	0.20	0.10	0.10								0.13

	Gadient %		Mtd	Avg
Method I:	3.0	4.0	C	3.00
Method II:		2.0	C	

Wb Depth:	.4	.9	.4

Avg: 0.57 Method: MS Stage: L ☐ M ☑ H ☐
No Vis.Ch.: ☐ Intermittent: ☐
Dw: ☐ Tribs.: ☐

COVER Total: A

Type:	SWD	LWD	B	U	DP	OV	IV
Amount:	S	T	N	N	N	D	N
Loc: P/S/O:	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑

CROWN CLOSURE
5 >90%
INSTREAM VEG: N ☑ A ☐ M ☐ V ☐

LWD: F DIST: E

LB SHP: V
Texture: F ☑ G ☐ C ☐ B ☐ R ☐ A ☐
RIP: S
STG: SHR

RB SHP: V
Texture: F ☑ G ☐ C ☐ B ☐ R ☐ A ☐
RIP: S
STG: SHR

WATER

EMS:
Temp: 10 Method: T5
pH: 7.7 Method: P2
Flood Signs: NONE Method: GE

Req #:
Cond.: Method: S3
Turb.: T ☐ M ☐ L ☐ C ☑ Method: GE

MORPHOLOGY

Bed Material: Dominant: G Subdom: F
D95: 5.00 D (cm): 5.00 Morph: RP
Pattern: IR
Islands: N
Coupling: DC
Confinement: OC
FSZ: ☐

DISTURBANCE INDICATORS

O1	B1	B2	B3	D1	D2	D3
☐	☐	☐	☐	☐	☐	☐

C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bars: N ☐ SIDE ☑ DIAG ☐ MID ☐ SPAN ☐ BR ☐

HABITAT QUALITY

Name	Comments
OverWinter Habitat	NONE -
Rearing Habitat	FAIR - Lots of cover (ov)
Spawning Habitat	NONE -

PHOTOS

Photo				Foc Lg	Dir	Comments
R:	7014	F:	0345		U	With book
R:	7014	F:	0346		D	With book

FDIS Site Card

Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	Reach #	ILP Map #	ILP #	Site
	1.0	104A.035	7014	1

COMMENTS	
Section	Comments
CHANNEL	S4 - Default. Old log crib (no culvert) bridge at rd. crossing (no barrier). Creek thru cutblock = no new lwd for sometime.

Stream/ILP: 7014 Image: 0345 Comment: Upstream, Book for scale. 8/22/2010.

Stream/ILP: 7014 Image: 0346 Comment: Downstream, Book for scale. 8/22/2010.

FDIS Site Card

Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	Reach #	ILP Map #	ILP #	Site
	1.0	104A.035	7015	1

PROJECT

Project Name: NTL 2010 Field Work
Stream Name (gaz.): BELL-IRVING RIVER Project Code: 20255
Project Watershed Code: 560-000000-00000-00000-0000-0000-000-000-000-000-000-000

WATERSHED

Gazetted Name: Local Name:
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000
ILP Map#: 104A.035 ILP #: 7015 NID Map #: 104A.035 NID #: 70012 Reach #: 1.0 Site #: 1
Field UTM (Z.E.N): .. Method: Site Lg: 100 Method: GE Access: V4
GIS UTM (Z.E.N): 9.489686.6240700 Ref. Name:
Date: 2010/08/22 Time: 15:52 Agency: C660 Crew: GK RD Fish Crd?: ☑ Incomplete: ☐

CHANNEL

	Mtd	width	width	width	width	width	width	width	width	width	width	Avg
Channel Width (m):	T	4.50	4.00	4.20	2.50	2.40						3.52
Wetted Width (m):	MS	2.00	1.00	3.50	2.80	2.00	1.50					2.13
Pool Depth (m):	MS	0.40	0.30	0.30								0.33

	Gadient %		Mtd	Avg
Method I:	18.0	15.0	C	16.67
Method II:	17.0		C	

Wb Depth:	1.1	.8	

Avg: 0.95 Method: MS Stage: L ☐ M ☑ H ☐
No Vis.Ch.: ☐ Intermittent: ☐
Dw: ☐ Tribs.: ☐

COVER Total: A

Type:	SWD	LWD	B	U	DP	OV	IV
Amount:	D	S	T	T	N	S	N
Loc: P/S/O:	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑

CROWN CLOSURE
4 71-90%
INSTREAM VEG: N ☑ A ☐ M ☐ V ☐

LWD: A DIST: E

LB SHP: V
Texture: F ☐ G ☑ C ☑ B ☐ R ☐ A ☐
RIP: C
STG: MF

RB SHP: V
Texture: F ☑ G ☐ C ☑ B ☐ R ☐ A ☐
RIP: C
STG: MF

WATER

EMS:
Temp: 10 Method: T5
pH: 7.6 Method: P2
Flood Signs: NONE Method: GE

Req #:
Cond.: Method:
Turb.: T ☐ M ☐ L ☐ C ☑ Method: GE

MORPHOLOGY

Bed Material: Dominant: C Subdom: G
D95: 60.0 D (cm): 30.00 Morph: SP
Pattern: IR
Islands: N
Coupling: CO
Confinement: EN
FSZ: ☐

DISTURBANCE INDICATORS

O1	B1	B2	B3	D1	D2	D3
☐	☐	☐	☐	☐	☐	☐

C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bars: N ☐ SIDE ☑ DIAG ☐ MID ☐ SPAN ☐ BR ☐

FEATURES

NID Map	NID	Type	Hgt	Method	Lg	Method	Photo	AirPhoto	UTM (Z/E/N)	Method
104A.035	70013	C	1.0	MS			R: 7015 F: 0347	L: #:	9.489688.6240604	GP3

Comments: Non-permanent barrier or at least restricts fish movement just below rd crossing

HABITAT QUALITY

Name	Comments
OverWinter Habitat	FAIR -
Rearing Habitat	GOOD - Lots of cover for small resident fish
Spawning Habitat	POOR

FDIS Site Card

	Reach #	ILP Map #	ILP #	Site
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	1.0	104A.035	7015	1

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 7015 F: 0350		U	With Ryan
R: 7015 F: 0351		D	With Ryan
R: 7015 F: 0352		U	

COMMENTS

Section	Comments
CHANNEL	S3 - Old log crib bridge at road crossing no barrier to fish. Small log jam falls + small chutes upstream throughout the reach not permanent barriers but proabably restrict fish movement.

Stream/ILP: 7015 Image: 0350 Comment: Upstream, With assistant. 8/22/2010.

Stream/ILP: 7015 Image: 0351 Comment: Downstream, With assistant. 8/22/2010.

FDIS Site Card

Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	Reach #	ILP Map #	ILP #	Site
	1.0	104A.035	7016	1

PROJECT

Project Name: NTL 2010 Field Work
Stream Name (gaz.): BELL-IRVING RIVER
Project Code: 20255
Project Watershed Code: 560-000000-00000-00000-0000-0000-000-000-000-000-000-000

WATERSHED

Gazetted Name: Local Name:
Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000
ILP Map#: 104A.035 ILP #: 7016 NID Map #: 104A.035 NID #: 70014 Reach #: 1.0 Site #: 1
Field UTM (Z.E.N): .. Method: Site Lg: 100 Method: GE Access: V4
GIS UTM (Z.E.N): 9.489727.6240634 Ref. Name:
Date: 2010/08/22 Time: 16:42 Agency: C660 Crew: GK RD Fish Crd?: ☐ Incomplete: ☐

CHANNEL

	Mtd	width	width	width	width	width	width	width	width	width	width	Avg
Channel Width (m):	T	1.30	0.70	2.20	0.80	1.10						1.22
Wetted Width (m):	MS	0.40	0.40	0.30	0.10	0.20						0.28
Pool Depth (m):	MS											0.00

	Gadient %		Mtd	Avg
Method I:	19.0	28.0	C	23.50
Method II:				

No Vis.Ch.: ☐ Intermittent: ☑
Dw: ☐ Tribs.: ☐

Wb Depth:			

Avg: 0.00 Method: MS Stage: L ☐ M ☐ H ☐

COVER Total: M

Type:	SWD	LWD	B	U	DP	OV	IV
Amount:	D	S	N	N	N	S	N
Loc: P/S/O:	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑	☑☑☑

CROWN CLOSURE
3 41-70%
INSTREAM VEG: N ☑ A ☐ M ☐ V ☐

LWD: F DIST: E

LB SHP: V
Texture: F ☐ G ☐ C ☐ B ☐ R ☑ A ☐
RIP: C
STG: MF

RB SHP: V
Texture: F ☐ G ☐ C ☑ B ☑ R ☐ A ☐
RIP: C
STG: MF

WATER

EMS: Req #:
Temp: 11 Method: T4 Cond.: Method: S3
pH: 7.3 Method: P2
Turb.: T ☐ M ☐ L ☐ C ☑ Method: GE
Flood Signs: NONE Method: GE

MORPHOLOGY

Bed Material: Dominant: C Subdom: G
D95: 50.0 D (cm): 30.00 Morph: SP
Pattern: IR
Islands: N
Coupling: CO
Confinement: EN
FSZ: ☐

DISTURBANCE INDICATORS

O1	B1	B2	B3	D1	D2	D3
☐	☐	☐	☐	☐	☐	☐

C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Bars: N☐ SIDE☑ DIAG☐ MID☐ SPAN☐ BR☐

FEATURES

NID Map	NID	Type	Hgt	Method	Lg	Method	Photo	AirPhoto	UTM (Z/E/N)	Method
104A.035	70015	CV	.3	MS		MS	R: 7016 F: 0356	L: #:	9.489727.6240634	GP3

Comments: Culvert drops 30 cm below road with no pool

HABITAT QUALITY

Name	Comments
OverWinter Habitat	NONE
Rearing Habitat	POOR - There is water so I guess a small fish could live in it.
Spawning Habitat	NONE -

FDIS Site Card

Watershed Code: 000-000000-00000-00000-0000-0000-000-000-000-000-000-000	Reach #	ILP Map #	ILP #	Site
	1.0	104A.035	7016	1

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 7016 F: 0353		U	With Book
R: 7016 F: 0354		D	With Ryan
R: 7016 F: 0355		U	With Ryan

COMMENTS

Section	Comments
CHANNEL	S4 - No bankfull, entrentched. Lots of dry sections little isolated pools less than 10 cm drop. But slope could restrict access.

Stream/ILP: 7016 Image: 0353 Comment: Upstream, Book for scale. 8/22/2010.

Stream/ILP: 7016 Image: 0354 Comment: Downstream, With assistant. 8/22/2010.