10 EFFECTS ASSESSMENT METHODOLOGY

The potential adverse effects of the Project have been assessed using the methodology set out in Section 8 of the EIS Guidelines (The Minister of the Environment of Canada and the Executive Director of the BCEAO 2012). The methodology is outlined in Figure 10.1 at the end of this section and described in detail in the sections below.

The scope of the Project in relation to which the potential environmental effects have been assessed in accordance with the method described below is the Project, as proposed by BC Hydro in the Project Description Report (BC Hydro 2011) except to the extent that the descriptions of the components are superseded by those set out in Volume 1 Section 4 Project Description. In order to predict certain potential changes to the environment and to assess certain effects resulting from the Project, detail beyond that set out in Section 4 was required. The circumstances where further detail was required is described at various points in Volume 2 Section 11 Environmental Background, Volume 2 Sections 12 to 15, Volume 3 Sections 16 to 27, and Volume 4 Sections 28 to 33.

10.1 Technical Studies and Planning

To conduct an effects assessment of the Project, planning and technical studies, including a review of background information, were undertaken, resulting in the preparation of technical reports. This work was completed as a preliminary step in the effects assessment process. With this information in hand, it was possible to identify and assess potential project effects on valued components (VCs).

The planning and technical studies fall within these general categories:

- Reports summarizing consultation with government agencies, Aboriginal groups, and the public
- Investigations that documented baseline conditions
- Traditional land use studies
- Predictive studies
- Project engineering, planning, and conceptual design to derive estimates used to complete the effects assessment, such as estimates of labour requirements
- A framework for environmental management to be implemented during construction and operation of the Project

10.2 Selection of Valued Components

Valued components (VCs) have been identified in accordance with the three-step process set out in Section 8.3 of the EIS Guidelines. The decision process for the selection of VCs is described below (Sections 10.2.1 to 10.2.3) and illustrated in Figure 10.2.

VCs are aspects of the Project's biophysical and human setting that are considered important by BC Hydro, Aboriginal groups, the public, the scientific community, and government agencies. For the purpose of formal effects assessment in British Columbia,

VCs can be categorized under what are referred to as the five "pillars": 1) environmental, 2) economic, 3) social, 4) heritage, and 5) health, which are referred to in BCEAA. The term "valued components" in the EIS incorporates and is consistent with the federal government's terminology of "valued ecosystem components".

The three steps are described below. The results of the three-step process are presented in Volume 2 Appendix A Project Interaction Matrix, Table 1.

10.2.1 Identification of Candidate Valued Components – Step 1

Step 1 in the process was to identify candidate VCs. In doing so, BC Hydro identified components that are valued:

- For environmental, economic, social, heritage, or human health reasons
- As land or resources currently used by Aboriginal persons for traditional purposes
- As land or resources reasonably anticipated to be used in the future by Aboriginal persons for traditional purposes

To help generate a list of candidate VCs, the following questions were considered:

- What are the interests and concerns raised by Aboriginal groups that may be affected by the Project?
- What are the interests and concerns raised by the public that may be affected by the Project?
- What are the interests and concerns raised by federal, provincial, and local governments that may be affected by the Project?
- What is the regulatory status, if any, of the candidate VC?
- What is the protected status, if any, of the candidate VC?
- How does the candidate VC contribute to the preservation of biodiversity?
- Is the candidate VC rare or does it have special federal or provincial status?
- Is the candidate VC sensitive to disturbance or pollution?
- What important ecological role does the candidate VC play?
- Are there transboundary issues to consider?
- Might human health be affected, and if so, how?

Candidate VCs were identified during development and final issuance of the EIS Guidelines. Identification of candidate VCs was also based on interests and concerns raised by the public, government agencies, and Aboriginal groups, and on input from the Agency and the BCEAO that was obtained during consultation with the public, government agencies, and Aboriginal groups during preparation of the EIS (see Volume 1 Section 9 Information Distribution and Consultation). The list of candidate VCs identified in step 1 is provided in Volume 2 Appendix A Project Interaction Matrix, Table 1.

10.2.2 Project Interaction Identification – Step 2

In step 2, the list of candidate VCs was screened to determine if there was a potential interaction with the Project. To determine whether there would be a potential interaction, the following steps were undertaken:

1. Project components and activities were identified
2. Project components and activities were mapped
3. Candidate VCs were located temporally and spatially
4. Potential interactions between the candidate VC and project components or activities were identified

After taking these factors into account, if a potential interaction was identified, the candidate VC was carried forward to step 3. In the absence of a potential interaction, a candidate VC was excluded from further evaluation.

In some cases, potential interactions between some candidate VCs and project components or activities have been aggregated. For example, the interaction between the Project and local government revenue is best understood by considering the interaction with the Project as a whole, rather than the interaction with separate project components or activities.

In the Project Interaction Matrix (Volume 2 Appendix A Project Interaction Matrix, Table 1), a potential interaction between the candidate VC and the Project is indicated by "✓". The absence of interaction between a candidate VC and the Project is indicated with a "0".

Candidate VCs with an interaction, indicated by "✓"were carried forward into step 3 of the VC selection process.

10.2.3 Selection of Valued Components – Step 3

Step 3 involved the determination of whether the effect of an interaction on each candidate VC carried through to this point in the selection process could be effectively assessed under a separate and related, but more appropriate, candidate VC. For all candidate VCs, the result of this determination is set out in the last column in Volume 2 Appendix A Project Interaction Matrix, Table 1.

A key consideration in determining whether a more appropriate candidate VC exists is whether, given the nature of the candidate VC, it falls within the same effects pathway as another candidate VC.

For example, air quality and human health, both of which are candidate VCs, could be affected due to the effects pathway from the combustion of project-related woody debris. The combustion may lead to an increase in airborne particulates, which may result in an adverse effect on human health. Therefore, human health, rather than air quality, was selected as the VC.

The candidate VCs that were not rejected in steps 1, 2, and 3 and that could not be assessed under another VC have been taken forward as VCs in the effects assessment. A list of VCs that were identified and carried forward is provided in Table 10.2 below.

Descriptive information and technical data collected, analyzed, and modelled for aspects of the environment that were identified as candidate VCs are presented in Volume 2 Section 11 Environmental Background. This technical data have been taken into account in the assessment of potential effects on the VCs.

10.3 Assessment Boundaries

10.3.1 Spatial Boundaries

The spatial boundaries delineate areas within which the potential effects of the Project on VCs have been assessed. Where the appropriate spatial boundary is an administrative or technical boundary, such as a management area, this is explained. The spatial boundaries are presented and described in the spatial boundary tables in the VC-specific effects assessment sections of this EIS. Each of these sections provides the scientific justification for the selection of relevant spatial boundaries.

Study boundaries have been defined taking into account as applicable the appropriate scale and spatial extent of potential changes, and as available, community and Aboriginal traditional knowledge, current land and resource use by Aboriginal groups, and ecological, technical, and social considerations.

The spatial boundaries have been defined based on applicable discipline guidance documents (BCMOE 2008, BCOGC 2009). Spatial boundary descriptors are listed in Table 10.1.

Table 10.1 Spatial Boundary Descriptors

Spatial Boundary	Details of Spatial Boundary
Technical study area	This is the physical extent of the data collection program, or the physical boundaries for the technical modelling program.
Project activity zone	This is the area within which the project components and activities will be located or will occur, but this does not include existing transportation infrastructure that will be used without modification to transport materials or personnel required for the Project[a]
Local Assessment Area	The Local Assessment Area, or LAA, is the area within which the potential adverse effects of the Project will be assessed.
Regional Assessment Area	The Regional Assessment Area, or RAA, is the area within which projects and activities, the residual effects of which may combine with residual effects of the Project, will be identified and taken into account in the cumulative effects assessment.

NOTES:

[a] Transportation infrastructure that will be used without modification to transport materials or personnel required for the Project is excluded from the Project activity zone because Project-related traffic will be within the design capacity of that infrastructure.

10.3.1.1 Local Assessment Areas

The Local Assessment Area (LAA) boundaries vary depending upon the VC. The LAA for each VC has been determined independently based on the nature or characteristics of each VC. For each VC, the LAA has been defined in consideration of the expected maximum geographic extent of the potential for the Project to cause an adverse effect

on the VC. Consistent with the method employed to identify potential interactions, the LAA for each VC was identified by taking into account the following:

- The nature of the VC and its susceptibility to various influences (e.g., emissions, noise, total suspended solids, loss of habitat)
- The expected maximum range of the potential for the Project to interact with the VC (e.g., dispersion of emissions, amount and range of noise levels, clearing requirements, labour requirements)

Table 10.2 summarizes the LAA for each VC. Figures depicting the LAAs for each VC are provided in each effects assessment section (Sections 12 to 33).

Table 10.2 Local Assessment Areas

Valued Component	Local Assessment Area
Fish and Fish Habitat	The Peace River in the proposed reservoir area; tributaries entering the proposed reservoir; the Peace River downstream of the proposed Site C dam to Many Islands, Alberta; watercourses and waterbodies within the transmission line and roadway rights-of-way; watercourses and waterbodies within the Project activity zone (construction materials); riparian areas adjacent to identified watercourses and waterbodies.
Vegetation and Ecological Communities	The Project activity zone, buffered by an additional 1,000 m, including new roads, roads requiring sizable upgrades, quarries, the dam site, and the transmission line. For the proposed reservoir the Erosion Impact Line has a 1,000 m buffer. The LAA also extends downstream from the dam to the Alberta border, and includes a 1,000 m buffer on both the south and north banks of the Peace River
Wildlife Resource	Vegetation and Ecological Communities LAA, as described above.
Greenhouse Gases	A 30 m buffer zone around the maximum reservoir elevation to describe greenhouse gas emissions from land conversion, and the Project activity zone to characterize emissions associated with construction activities.
Local Government Revenue	City of Fort St. John, District of Taylor, District of Hudson's Hope, District of Chetwynd, City of Dawson Creek, and Peace River Regional District
Labour Market	Peace River Regional District, and Northern Rockies Regional Municipality
Regional Economic Development	Peace River Regional District, and Northern Rockies Regional Municipality
Current Use of Lands and Resources for Traditional Purposes	Fish and Fish Habitat LAA and Wildlife Resources LAA, as described above.

Valued Component	Local Assessment Area
Agriculture	Agricultural land and individual farm operators LAA – Project activity zone and the remainder of the farm operations that are within the Peace River valley and that overlap the Project activity zone Agricultural economy and food production and consumption LAA – Peace River Regional District and the Northern Rockies Regional Municipality, which comprise the Peace River Agricultural Region (Statistics Canada Agricultural Region 8[a])
Forestry	Project activity zone and area within 5-year Beach Line
Oil, Gas, and Energy	Project activity zone, area within 5-year Beach Line and Spectra Energy's Taylor water intake
Minerals and Aggregates	Project activity zone and area within 5-year Beach Line
Harvest of Fish and Wildlife Resources	Project activity zone, the area within reservoir impact lines, and the Peace River downstream to the Alberta border.
Outdoor Recreation and Tourism	Project activity zone, within the reservoir impact lines and downstream to Peace Island Park
Navigation	Navigation - Project activity zone, downstream to Peace Island Park, and the Shaftesbury and Tompkins Landing ice bridges Aviation – North Peace Regional Airport (Fort St John airport) and the associated obstacle limitation surfaces
Visual Resources	Site C reservoir, Site C dam site, and transmission corridor, plus an 8 km buffer as well as the sites for quarried and excavated materials and worker accommodation, plus a 1 km buffer
Population and Demographics	Peace River Regional District
Housing	Peace River Regional District
Community Infrastructure and Services	City of Fort St John, District of Taylor, District of Hudson's Hope, District of Chetwynd, City of Dawson Creek, and Peace River Regional District
Transportation	Road and rail networks within the Project activity zone and Highway 97 between Taylor and Hudson's, and the North Peace Regional airport
Heritage Resources	Project activity zone
Human Health	LAA corresponds to relevant technical study areas for air quality, noise, water quality, electric and magnetic fields, country foods, and mercury.

NOTES:

[a] Statistics Canada Census Division 55 in Agricultural Region 8 – Peace River encompasses the organized areas of Hudson's Hope, Chetwynd, Tumbler Ridge, Pouce Coupe, Dawson Creek, Fort St. John, Taylor, and the Electoral Areas D, C, B, and E in the Peace River Regional District.

10.3.2 Temporal Boundaries

Specific temporal boundaries have been set for the assessment of potential effects on each VC. The temporal boundaries span the following phases of the project: construction, operation, maintenance, and foreseeable modifications where appropriate.

Operation and maintenance are addressed under “Operations” in the EIS. There are no foreseeable modifications to the Project.

The temporal boundaries have been determined based on consideration of the following:

- Timing and duration of Project components and activities
- Natural cycles of activity of VCs (e.g., sensitive life cycle periods, such as breeding, nesting, rearing, and overwintering) and relevant human cycles (e.g., seasonal variations in economic or recreational activity), where these are relevant to the assessment of potential effects

The schedule for the Project is discussed in Volume 1 Section 4 Project Description. In summary, construction will occur over an eight-year period, and the Project is intended to be operated and maintained over the long term with no future decommissioning contemplated. As required by Section 3.3.11 of the EIS Guidelines, the following are described in this EIS:

- Off-site components of the Project to be retained and maintained as part of the ongoing maintenance of the Project
- Decommissioning of temporary construction facilities and any associated reclamation
- BC Hydro’s commitment to address a plan for decommissioning and restoration in accordance with applicable regulations at that time, should a proposal be made in the future to decommission the Site C dam and generating station

10.4 Effects Assessment Methods

The potential effects of the Project on VCs have been assessed in accordance with the requirements of Section 8.5 of the EIS Guidelines.

10.4.1 Baseline Conditions

For each VC carried through the assessment, the baseline conditions are described in the EIS. For each VC:

- The relevant legal framework is described
- Methods used to collect the baseline data are explained
- Sources of baseline information are identified
-
- The extent to which Aboriginal traditional knowledge has been obtained and has been considered in the EIS is explained
- An overall baseline description is provided

10.4.2 Description of Potential Adverse Effects on Valued Components

Potential project interactions have been evaluated and ranked as follows, and are presented in Volume 2 Appendix A Project Interaction Matrix, Table 2:

- A rank of “0” was given where no interaction is predicted between a project component or activity and a VC

- A rank of "1" was given where an adverse effect may result from an interaction, but the effect is well understood and standard measures to avoid or minimize the potential effect are available and are well understood to be effective, resulting in no or negligible residual effects
- A rank of "2" was given where interactions may result in an adverse effect and the nature of the effect and/or the effectiveness of mitigation measures is uncertain

In some cases, in Table 2 described above, the potential interaction between an activity or component and a VC is marked "N/A". This indicates that the interaction was considered as an interaction with the Project component or with the Project as a whole, and was not evaluated at the activity level.

VCs subject to an interaction ranking of "2" were carried forward in the effects assessment process. Potential interactions rated "0" or "1" were not further assessed because there is no interaction or the interaction can be avoided or minimized by implementing mitigation, these industry standard mitigation measures are understood to be effective, and any residual effects are negligible. Rationale for a ranking of "0", and mitigation measures taken into account in determining a rating of "1", are summarized in the EIS and in the interaction matrix provided in Volume 2 Appendix A Project Interaction Matrix, Table 2.

In some cases, potential interactions between some VCs and project activities were aggregated. For example, interactions between the visual resources VC and separate dam and generating station construction activities (e.g., installation of temporary facilities, relocation of surplus material) were indistinguishable. Accordingly, it was more appropriate to consider the potential interaction between visual resources and the dam and generating station in aggregate. Similarly, in some cases, potential interactions with some VCs are more appropriately considered in relation to the Project in its entirety. For example, the interaction with the local government revenue VC is better understood by considering the interaction with the Project as a whole, rather than the interaction with separate project components or activities.

In this EIS, for each VC carried through the effects assessment, the potential adverse project effects are identified, described, and analyzed. The analyses conducted are described separately for each VC in Volume 2 Sections 12 to 15, Volume 3 Sections 16 to 27, and Volume 4 Sections 28 to 33, of this EIS.

10.4.2.1 Identification of Mitigation Measures

In this EIS, the terms "mitigation" and "mitigation measures" both have the meaning defined for "mitigation measures" in Section 2(1) of CEAA 2012:

> *"mitigation measures" means measures for the elimination, reduction or control of the adverse environmental effects of a designated project, and includes restitution for any damage to the environment caused by those effects through replacement, restoration, compensation or any other means.*

Technically and economically feasible mitigation measures, including compensation measures that BC Hydro is proposing to use to mitigate adverse effects of the Project are described separately for each VC in Volume 2 Sections 12 to 15, Volume 3 Sections 16 to 27 and Volume 4 Sections 28 to 33, of this EIS. The measures proposed by BC Hydro include measures that have been integrated into project planning and

design, such as site and route selection, scheduling, and construction practices, as well as technological features that serve to avoid or minimize potential adverse effects.

10.4.2.2 Characterizing Residual Effects

Residual adverse effects are the effects of the Project that may remain after taking into account the implementation of mitigation measures, including compensation.

Potential residual adverse effects that may result from the Project are characterized objectively as required by Section 8.5.2.3 and Table 8.3 of the EIS Guidelines. In Volume 5 Section 38 Summary of the Potential Residual Effects of the Project, as summary of the residual effects in relation to the following, as required by Section 23 of the EIS Guidelines, is provided

- Changes to the environment
- Changes to components of the environment within federal jurisdiction
- Changes to the environment that would occur on federal or transboundary lands
- Changes to the environment that are directly linked or necessarily incidental to federal decisions
- Effects of changes to the environment on Aboriginal peoples
- Effects of changes to the environment that are directly linked or necessarily incidental to federal decisions

The criteria set out in the EIS Guidelines are shown in Table 10.3, below.

Where possible, these criteria are described quantitatively. When residual effects cannot be characterized quantitatively, they are characterized qualitatively. Definitions are provided when qualitative terms are used.

The manner in which the characterization criteria provided in Table 10.3 are applied is described separately for each VC in Volume 2 Sections 12 to 15, Volume 3 Sections 16 to 27, and Volume 4 Sections 28 to 33, of this EIS.

Table 10.3 Residual Effects Characterization

Criteria	Description
Direction	This refers to the ultimate long-term trend of the environmental, social, economic, heritage, or health effect (e.g., increase, decrease, or neutral).
Magnitude	This refers to the amount of change in a key indicator or variable relative to baseline case (e.g., low, moderate, high); consideration is given to factors such as the uniqueness of the effect, and the comparison to natural or background variation.
Geographic extent	This refers to the geographic area in which an environmental, social, economic, heritage, or health effect occurs (e.g., site-specific, local, regional, provincial, national, international).
Duration	The period of time required until the valued component returns to its baseline condition, or until the effect can no longer be measured or otherwise perceived (e.g., short term, medium term, long term, permanent).

Criteria	Description
Frequency	The number of times during a project or a specific project phase that an environmental, economic, social, heritage, or health effect may occur (e.g., once, daily, weekly, monthly, continuous).
Reversibility	This refers to the degree to which existing baseline conditions can be re-established after the factors causing the effect are removed. Effects can be reversible or irreversible.
Context	This refers to the extent to which the area within which an effect may occur has already been adversely affected by human activities and/or is ecologically fragile and has little resilience and resistance to imposed stresses.
Probability	The likelihood that an adverse effect will occur (e.g., low, high, or unknown).
Level of confidence	This is an evaluation of the scientific certainty one has in the review of project-specific data, relevant literature, and professional opinion; the EIS will include a statement on the level of confidence in the assessment of direction, magnitude, extent, duration, frequency, and reversibility.

10.4.2.3 Significance of Residual Effects

The significance determination for residual adverse effects, and its rationale, has been evaluated by taking into account the objective characterization of each criteria described above and other factors including relevant guidance published by the Agency and the BCEAO (FEARO 1994, Agency 1999, Hegmann et al. 1999, and BCEAO 2010).

The manner in which the significance of potential residual adverse effects have been assessed is described separately for each VC in Volume 2 Sections 12 to 15, Volume 3 Sections 16 to 27, and Volume 4 Sections 28 to 33, of this EIS. A summary of potential residual adverse effects is provided in table format in each section.

In addition, Volume 5 Section 38 Summary of the Potential Residual Effects of the Project summarizes the significant adverse environmental effects identified in relation to:

- Changes to the environment
- Changes to components of the environment within federal jurisdiction
- Changes to the environment that would occur on federal or transboundary lands
- Changes to the environment that are directly linked or necessarily incidental to federal decisions
- Effects of changes to the environment on Aboriginal peoples
- Effects of changes to the environment that are directly linked or necessarily incidental to federal decisions

10.4.2.4 Follow-up Programs

BC Hydro has, in accordance with Section 23.5 of the EIS Guidelines, proposed certain follow-up programs to verify the accuracy of the assessment or the effectiveness of mitigation measures. Follow-up programs are described separately, and as required, for each VC in Volume 2 Sections 12 to 15, Volume 3 Sections 16 to 27, and Volume 4 Sections 28 to 33, and summarized in Volume 5 Section 39, of this EIS.

Follow-up programs have been developed where the likelihood, nature or extent of a predicted adverse residual effect on a VC or the effectiveness of a recommended mitigation measure is uncertain. Technically feasible, cost-effective and environmentally sound measures (e.g., alternative mitigation method, adaptive management) are proposed.

10.5 Cumulative Effects Assessment

An assessment of the cumulative effects that are likely to result from the Project in combination with other projects or activities that have been or will be carried out has been conducted in accordance with Section 8.5.3 of the EIS Guidelines and is provided in this EIS. As required by Section 8.5.3, assessment of the potential cumulative effects of the Project on a VC has been conducted if a potential residual adverse effect of the Project on that VC has a spatial and temporal overlap with a residual effect of another project or activity.

10.5.1 Spatial and Temporal Boundaries

10.5.1.1 Spatial Boundaries: Regional Assessment Areas

To conduct a cumulative effects assessment, a Regional Assessment Area (RAA) has been identified for each VC. The RAA boundaries for each VC are set out in Table 10.4 and illustrated in a figure in each VC-specific effects assessment section (Sections 12 to 33). Each of the VC effects assessment sections provides the rationale for the selection of spatial boundaries.

Table 10.4 Regional Assessment Areas

Valued Component	Regional Assessment Area
Fish and Fish Habitat	Peace River from Peace Canyon Dam, B.C. to Vermilion Chutes, Alberta, which is a distance of approximately 865 km.
Vegetation and Ecological Communities	The proposed dam, reservoir, transmission line, Highway 29 realignment, temporary access roads, and quarries occur within five Wildlife Management Units - designated 7-31, 7-32, 7-33, 7-34, and 7-35, which includes most of the Peace Lowlands ecosection.
Wildlife Resource	Vegetation and Ecological Communities RAA, as described above.
Greenhouse Gases	National
Local Government Revenue	City of Fort St. John, District of Taylor, District of Hudson's Hope, District of Chetwynd, City of Dawson Creek, and Peace River Regional District
Labour Market	Peace River Regional District, Northern Rockies Regional Municipality, and Fraser-Fort George Regional District
Regional Economic Development	Peace River Regional District, Northern Rockies Regional Municipality, and Fraser-Fort George Regional District
Current Use of Lands and Resources for Traditional Purposes	Fish and Fish Habitat RAA and Wildlife Resources RAA, as described above.

Valued Component	Regional Assessment Area
Agriculture	Peace River Regional District and the Northern Rockies Regional District; Peace River Agricultural Region (Statistics Canada Agricultural Region 8[a]
Forestry	Dawson Creek Timber Supply Area, Fort St. John Timber Supply Area, Peace River supply block of Timber Forest Licence 48
Oil, Gas, and Energy	Project activity zone, area within 5-year Beach Line and Spectra Energy's Taylor water intake
Minerals and Aggregates	Fort St. John, District of Hudson's Hope, District of Taylor, Peace River Regional District, Area "C"
Harvest of Fish and Wildlife Resources	Peace River Regional District
Outdoor Recreation and Tourism	Peace River Regional District
Navigation	Navigation - Project activity zone, downstream to Peace Island Park, and the Shaftesbury and Tompkins Landing ice bridges Aviation – Area from the North Peace Regional Airport (Fort St John airport) to the crest of the potential Project construction site
Visual Resources	LAA and Visual Landscape Inventory viewpoints within or adjacent to Project activity zone
Population and Demographics	Peace River Regional District
Housing	Peace River Regional District
Community Infrastructure and Services	City of Fort St John, District of Taylor, District of Hudson's Hope, District of Chetwynd, City of Dawson Creek, and Peace River Regional District
Transportation	Peace River Regional District
Heritage Resources	Project activity zone
Human Health	Consistent with LAA. RAA corresponds to relevant technical study areas for air quality, noise, water quality, electric and magnetic fields, country foods, and mercury.

NOTES:

[a] Area C is a regional district electoral area in the Peace River Regional District. The electoral area covers the area of Fort St. John.

10.5.1.2 Temporal Boundaries: The Cases

To assess the cumulative effects that may result from the Project in combination with other future foreseeable projects or activities that have been or will be carried out, the following are presented in the EIS:

Baseline Case: The Baseline Case describes the current status of the VC. In doing so, it reflects the residual effects of projects and activities that have been and are being carried out.

Future Case without the Project: To identify the potential adverse effects of other projects and activities that will be carried out, the Future Case without the Project was developed to predict the status of the VC by taking into account the Baseline Case and projects and activities that are at least as foreseeable as the Project. This demonstrates

the potential residual effects of projects and activities that have been and will be carried out.

September 5, 2012 was chosen to demarcate the Baseline Case from the future cases because 1) the EIS Guidelines are dated September 5, 2012 ~~this was the date the EIS Guidelines were~~ (they were issued by the federal Minister of Environment and the Executive Director of the BCEAO on September 7, 2012), and 2) by September 5, 2012,~~this date,~~ BC Hydro had already substantially developed the assessment of potential effects and cumulative effects of the Project.

Project Case: To demonstrate the cumulative effects that are likely to result from the Project, the Project Case demonstrates the predicted status of the VC, taking into account the residual effects of the Project combined with those due to other projects and activities as identified in the Future Case without the Project.

Effects from potentially overlapping projects or activities that are recently operational may not be fully reflected in baseline conditions. Those projects and activities have been evaluated in the VC cumulative effects sections to determine whether they should be included in Baseline Case or the Future Case without the Project and the Project Case.

10.5.2 Projects and activities included in the cumulative effects assessment

10.5.2.1 Sources of Information about Potential Projects and Activities

The following information sources were reviewed to identify other projects and activities located within the largest RAA to be taken into account in the Future Case without the Project and in the Project Case:

- Registered active projects listed on the BCEAO and Agency websites, including hydroelectric projects such as the Dunvegan Hydroelectric Project (Section 10.5.2.2 and 10.5.2.10)
- Registered oil and gas applications listed on the British Columbia Oil and Gas Commission or National Energy Board websites (Section 10.5.2.4)
- Registered water licence applications listed on the Ministry of Environment Water Stewardship Division website (Section 10.5.2.5)
- Projects or activities associated with existing or “accepted” applications for land tenure under the B.C. *Land Act* or the B.C. *Range Act* (e.g., range tenures, grazing licenses, wind, gravel) as provided by GeoBC (Section 10.5.2.6)
- Current harvest plans associated with tenured forest operations and timber sales (Section 10.5.2.7)
- Official Community Plans, and parks and recreation plans (Section 10.5.2.8)
- Large waste discharges into the Peace River from Peace Canyon Dam to Vermilion Chutes, Alberta (Section 10.5.2.9)

A list of these projects and activities is provided below. The locations of the other projects and activities are shown in Figure 10.3, Figure 10.4, Figure 10.5, and Figure 10.6.

10.5.2.2 Criteria for Identification of Specific Projects for Consideration in the Cumulative Effects Assessment

To determine whether specific projects or activities identified from the information sources were to be taken into account in the cumulative effects assessment, project-wide spatial and temporal criteria were developed (Table 10.5). Those criteria were used to develop a conservative list of candidate projects and activities found within the largest RAA. To assess the potential cumulative effects on particular VCs, this list of projects and activities was reviewed to identify specific projects and activities to be taken into account.

Table 10.5 Screening Criteria Used to Identify Other Projects and Activities for Consideration in the Cumulative Effects Assessment

Type of Overlap	Excluded	Included
Spatial	– Project or activity is outside the largest RAA. By using a conservatively large RAA, all potential cumulative effects for VCs were captured. – Project or activity is located in Alberta beyond 100 m of the Peace River high water mark or further downstream than Fort Vermilion (i.e., downstream of the RAA boundary of the Fish and Fish Habitat VC).	– Project or activity is within the largest RAA. – Project or activity is located in Alberta within 100 m of Peace River high water mark and as far downstream as Fort Vermilion.
Temporal	– Project was in operation or activity was occurring prior to September 5, 2012; therefore, associated residual effects may be reflected in baseline case conditions.[a] – Project or activity is not reasonably foreseeable (i.e., not as likely to proceed as Site C Clean Energy Project).	– Active projects in federal or provincial environmental assessment or other regulatory process. – Approved projects and activities that are: o not constructed o under construction or o constructed, but not operational – Project or activity is reasonably foreseeable (i.e., at least as likely to proceed as the Site C Clean Energy Project).

NOTES:

[a] Effects from potentially overlapping projects or activities that are recently operational may or may not be fully reflected in baseline conditions. Those projects and activities have been evaluated in the VC cumulative effects sections to determine whether they should be included in Baseline Case or the Future Case without the Project and the Project Case.

The process of identification of projects and activities from the various sources is discussed in the sections that follow.

10.5.2.3 Active Projects on Registry Websites

Potential projects located in northeast B.C. and northwest Alberta were identified based on an initial search of federal and provincial online databases and registries, which was conducted up to and including September 5, 2012, the date of ~~the issuance of~~ the EIS Guidelines. The information gathered during this search was compiled and sorted by project name, approval agency, proponent name, location, regulatory status, Internet source, and brief project description.

Publicly accessible information was reviewed, and the spatial and temporal screening criteria identified in Table 10.5 were applied to each project. Spatially, all projects and activities located within the largest RAA, which had been identified as of September 5, 2012, that is, the RAAs for the Labour Market VC and Regional Economic Development VC, were selected. This area consists of the Peace River Regional District, the Northern Rockies Regional Municipality, and the Fraser-Fort George Regional District. In addition, because the RAA for Fish and Fish Habitat extends downstream along the Peace River to Fort Vermilion, Alberta, projects and activities that satisfied the spatial criteria shown in Table 10.5 with respect to that unique RAA were also selected. The area described above is the area considered in the cumulative effects assessment, where there are potential cumulative effects for some VCs.

Location co-ordinates for each project were input to a GIS database and plotted or manually digitized on a map with the boundary of the cumulative effects assessment area of interest. The temporal criteria shown in Table 10.5 were applied to identify those projects located within the cumulative effects assessment area of interest that are currently in or have recently completed an environmental assessment; therefore, they are at least as likely to proceed as the proposed Project. Projects and activities that met both the spatial and temporal criteria described in Table 10.5 were selected for consideration in the cumulative effects assessment.

10.5.2.4 Registered Oil and Gas Project and Applications

Information regarding registered oil and gas projects and activities in northeastern British Columbia was compiled based on a review of the following sources:

- BC Oil and Gas Commission database for pipelines, facility sites, and access roads, as well as individual proponent websites
- National Energy Board Regulatory Document Index

Relevant Alberta oil and gas projects were captured by the process described in Sections 10.5.2.2 and 10.5.2.10.

The methods used to extract information from each of these sources, including summaries and recommendations for further investigation, are described below.

British Columbia Oil and Gas Commission Database

BC Hydro extracted GIS data layers from the British Columbia Oil and Gas Commission website for applications for pipelines, facilities sites, and roads associated with oil and gas projects as well as activities proposed for Crown land within the largest RAA. Facilities include battery sites, cathodic or anode sites, compressor stations, dehydrator sites, flaresites, and meter sites.

The locations of pipelines, facilities, and roads included in the British Columbia Oil and Gas Commission data were plotted with respect to the area considered in the cumulative effects assessment.

National Energy Board Website and Regulatory Document Index

Project applications in the National Energy Board's Regulatory Document Index were searched for projects not already captured by the review of the Agency and BCEAO project registries. Some projects were included on both the Agency website and the National Energy Board's Regulatory Document Index. It was noted that relevant documents are included in the National Energy Board registry that may not be included in the Agency registry; therefore, these documents were provided for consideration in the cumulative effects assessment.

10.5.2.5 Registered British Columbia Water Licences and Applications

The British Columbia database of registered water licences and applications was reviewed to identify the nature and volume of current and proposed domestic and industrial water use or water withdrawals from the area considered in the cumulative effects assessment. This list of applications was sorted by applicant and watershed, plotted in a GIS layer (Figure 10.6), and vetted for inclusion or exclusion in the Future Case scenarios (Table 10.7). Water licence applications that fall within the Peace River watershed within the cumulative effects area of interest were considered in the cumulative effects assessment.

10.5.2.6 British Columbia Land Tenure Applications

A Geo BC (Geo BC 2012) land tenure dataset dated soon after the issuance of the EIS Guidelines (September 18, 2012) was searched for applications for tenure under the B.C. *Land Act* and the B.C. *Range Act* located within the area considered in the cumulative effects assessment. From this list, a sub-list was compiled consisting only of those tenure applications included in the "accepted" or "offered" category, meaning those that are active in the application process. Applications that were categorized as temporary, for investigative use, renewals of existing tenures, or expressions of interest in land were not considered further in the cumulative effects assessment because the use of the land or resource would be short term, low effect, reflected in baseline conditions, or is associated with projects that are less certain than the Project.

Land uses or tenure purposes that were already captured through the screening process outlined in Sections 10.5.2.2 and 10.5.2.4 were filtered from the list of land and range tenure applications. Low-effect to zero-effect land uses were filtered from the list of tenure applications (e.g., environmental protection, fish and wildlife management, greenbelt, land claim settlement). Applications that are related to the feasibility stage of projects were excluded because these were considered less certain than the Project.

For consideration in the cumulative effects assessment, a total of 699 land tenure applications were included, comprising 236,794.34 ha and 14 land use purposes as defined by the Province of British Columbia (Table 10.6). From Table 10.6, over 86% of the tenure application area consists of land earmarked for commercial recreation, while the smallest area contributions are from commercial, communication, and community land use purposes defined categories.

Table 10.6 Summary of Considered Land Tenure Applications, Land Use Purposes, and Area under Application

Land Use Purpose	Land Use Sub-purpose	Number of Applications	Total ha in Land Tenure Application	% of Total ha
Agriculture	Extensive, grazing	33	3,196.26	1.35%
Alpine skiing	General, lifts, miscellaneous	3	648.13	0.27%
Commercial	General, miscellaneous, commercial 'a', commercial wharf	8	25.00	0.01%
Commercial/ recreational	Cat skiing, fishing camps, guided nature viewing, heli-hiking, hunting camps, multiple use, private camps, trail riding	148	204,873.44	86.52%
Communication	Communication sites, combined sites	12	24.06	0.01%
Community	Trail maintenance, community facility, miscellaneous	8	13.05	0.01%
Energy production	Campsite, general, inlet site, land farms	49	106.66	0.05%
Industrial	General, heavy industrial, industrial camp, light industrial, log handling/storage, miscellaneous	201	11,241.56	4.75%
Institutional	Miscellaneous, waste disposal site	2	1.77	0.00%
Miscellaneous land uses	Other	2	274.23	0.12%
Quarrying	Pozzolan, clay, diatoms; sand and gravel; miscellaneous; rock for crushing	86	12,347.28	5.21%
Residential	Miscellaneous, private moorage, recreational residential, remote residential, rural residential, urban residential	23	375.80	0.16%
Transportation	Airport/airstrip, railway, roadway	15	2,742.33	1.16%
Utility	Electric power line, miscellaneous, telecommunication line, water line	109	924.79	0.39%
Total		**699**	**236,794.34**	**100.00%**

All established tenures overlapping the Project RAAs are included in the baseline conditions. Active tenures that are associated with non-operating project that may potentially operate in the future are captured through the evaluation process outlined in Section 10.5.2.2.

10.5.2.7 Current Harvest Plans Associated With British Columbia Tenured Forest Operations And Timber Sales

Timber harvest in northeast B.C. is conducted pursuant to various types of forest licences, including:

- Replaceable forest licences
- Non-replaceable forest licences
- Tree farm licences
- Pulpwood agreements
- Woodlot licences
- Community forests

A timber supply review is pending for the Peace Forest District, the results of which will not be available prior to the submission of the EIS. Timber harvest plans are developed by timber harvesting companies every five years and they are based on the province's timber supply review, and thus the volume of timber available in a given area. Because this information will not be available, the characterization of future timber harvest activities and potential interactions is based on publicly available tenure and licence information, which is summarized in Figure 10.6.

10.5.2.8 British Columbia Official Community Plans, and Parks and Recreation Plans

The cumulative effects assessment considered Official Community Plans for the following communities, rural areas, and districts located within the cumulative effects area of consideration (year of plan shown in brackets):

- District of Chetywnd (2010)
- City of Dawson Creek (2009)
- City of Fort St. John (2011)
- District of Hudson's Hope (2011)
- District of Mackenzie (1996 - 2010)
- Northern Rockies Regional Municipality (2011)
- South Peace Fringe Area, Peace River Regional District (2009 - 2012)
- Dawson Creek Rural Area (1986)
- Rural Area, PRRD (2011)
- North Peace Fringe Area (2009)
- West Peace (1997)

- Village of Pouce Coup (2010)
- District of Taylor (1995)
- District of Tumbler Ridge (2005)

In assessing potential cumulative effects, the Official Community Plans for communities located in the particular RAA for each VC were considered.

An online search was also conducted to identify proposed parks and recreation plans in the RAAs. The proposed Peace Boudreau Park is considered in the cumulative effects assessment, as its long-standing status as a proposed protected area has long influenced local land use decisions. Consequently, the proposed park is considered as an existing activity for the purpose of assessing the potential cumulative effects of the Project.

No other new or proposed parks or park extensions or modifications were identified during the course of this review.

10.5.2.9 Large Waste Discharges into Peace River Watershed

Based on a database search of Geo BC (Geo BC 2012) conducted by BC Hydro, no new proposed large waste discharges were identified in the RAA of interest. The existing discharges identified are:

- Outfall from Peace River Regional District
- Outfall from Fort St. John
- Outfall from Spectra Gas Inc. in Taylor
- Outfall from town of Peace River, Alberta

As these are all existing discharges, they are considered in the Baseline Case.

10.5.2.10 Alberta Projects and Activities

As previously noted, the Fish and Fish Habitat RAA extends into Alberta because the residual effects of projects within this RAA may overlap spatially and temporally with potential residual adverse effects of the Project on Fish and Fish Habitat. Thus, Alberta environment and land tenures were searched for projects and activities located between the Peace Canyon Dam and Vermilion Chutes, Alberta, and those situated within 100 m of the Peace River high water mark. Projects and activities identified within this area of potential residual effect overlap were considered in the cumulative effects assessment.

The 2012 Major Project Inventory prepared by Alberta Enterprise and Advanced Education, Alberta's Oil Sands Projects and Upgraders prepared by Alberta Energy, the National Energy Board's website, the Agency's online public project registry, and individual proponent websites were all reviewed to assemble information regarding the scope, likelihood, timing, and environmental issues associated with existing and future foreseeable projects and activities within this RAA. Following the review of these sources, five projects were identified, two of which are existing and three of which have been included in the inclusion list for consideration in the assessment of potential cumulative effects of the Project on Fish and Fish Habitat.

10.5.3 Projects and Activities for Consideration in the Cumulative Effects Assessment

An overall list of projects and activities for consideration in the assessment of the potential cumulative effects of the Project on VCs (Table 10.7) was compiled based on a review of the seven types of projects and activities listed in Section 10.5.2. The list was used during preparation of the discipline-specific cumulative effects assessments. For each VC, only those other projects and activities whose residual effects are considered likely to interact cumulatively with the residual effects of the Project are included in the VC-specific cumulative effects assessment.

Table 10.7 List of other Projects and Activities for Consideration in the Cumulative Effects Assessments

Project Name	
Alliance Pipeline Sunrise Meter Station Relocation*	Moberly River Pipeline Replacement Project*
Babkirk Secure Landfill Project	Montney Gas Play
Project Name	
Cabin Gas Plant Project*	Mount George Wind Park
Carbon Creek Coal Mine	Mt. Milligan Gold-Copper Project (Town of Mackenzie Rail Loadout Facility Options)
Dawson Creek-Chetwynd Area Transmission	Murray River Coal Project
Dawson Creek Processing Plant*	Northern Gateway Pipeline Project
Dokie Wind Project Phases I* and II	Northern Rockies Secure Landfill*
Dunvegan Hydroelectric Project	Ojay Pipeline Project*
Farrell Creek 88-I South Gas Plant	Provident Beatton River Replacement *
Fort Nelson Processing Plant*	Pacific Trail Pipeline Project
Fortune Creek Gas	Quality Wind Project
Gething Coal Project	Quintette Coal Project
Giscome Quarry and Lime Project	Rocky Creek Energy Project
Groundbirch East Receipt Meter Station*	Roman Coal Mine
Groundbirch Mainline Project*	Septimus Pipeline Project*
Hackney Hills Wind Project	Thunder Mountain Wind Project
Heritage Secure Landfill Project	Transmission North 2011 Pipeline Project*
Hermann Mine Project	Transmission North 2012 Pipeline Project
Horizon Mine Coal Project	Tumbler Ridge Wind Energy Project
Horn River Basin Gas Play	Wartenbe Wind Energy Project
Komie North Extension Pipeline Project	Wildmare Wind Energy Project
McGregor/Herrick Hydroelectric Project	Wolverine Secure Landfill Project
Meikle Wind Energy Project	
*These projects have been in operation since 2010, 2011, or 2012, so residual effects on VCs may be reflected in baseline conditions. However, the determination of whether these projects were included in the baseline conditions or future case scenarios and the supporting rationale will vary for VCs, and is described in Sections 12 to 33.	

Administrative Plans	
City of Dawson Creek Official Community Plan (2009)	North Peace Fringe Area Bylaw No. 1870 (2009)
District of Chetwynd Official Community Plan Bylaw No. 919 (2010) and Amendments	Peace River Regional District, Dawson Creek Rural Area Official Community Plan Bylaw No. 477 (1986)
District of Hudson's Hope Official Community Plan Amendment Bylaw No. 804 (2011)	Peace River Regional District, Rural Area Official Community Plan Bylaw No. 1940 (2011)
District of Mackenzie Official Community Plan and Amendments (1996 - 2010)	Peace River Regional District, West Peace Official Community Plan Bylaw No. 1986 (1997)
District of Taylor Official Community Plan Bylaw No. 509 (1995)	Peace River Boudreau Protected Area
District of Tumbler Ridge Official Community Plan Bylaw No. 498 (2005)	South Peace Fringe Area Official Community Plan (2009 - 2012)
Fort St. John Official Community Plan Bylaw No. 2076 (2011)	Village of Pouce Coupe Official Community Plan Bylaw No. 930 (2010)
Northern Rockies Regional Municipality, Fort Nelson, Official Community Plan	
Water Licences	
Crew Energy Oilfield Injection, Pine River, 25 km west of Septimus pipeline	Refer to Figure 10.6 Forestry and Water Use Tenure Applications Considered in the Cumulative Effects Assessment
Tenure Applications	
Refer to Figure 10.5 British Columbia Land Tenure Applications Considered in the Cumulative Effects Assessment	Refer to Figure 10.6 Forestry and Water Use Tenure Applications Considered in the Cumulative Effects Assessment
Timber Harvesting	
Refer to Figure 10.6 Forestry and Water Use Tenure Applications Considered in the Cumulative Effects Assessment	
Spatially Relevant Existing Waste Discharges	
Fort St. John's treated sewage outfall	Spectra Gas Inc. refinery outfall in Taylor
Peace River Regional District's outfall	Town of Peace River, Alberta treated sewage outfall

10.5.4 Identification and Description of Cumulative Effects

For each VC for which for which residual adverse effects are predicted, the potential cumulative effects of the Project on that VC have been assessed taking into account the following information:

- other project(s) or activity(ies) found with the RAA for each VC, the residual effects of which may interact cumulatively with the residual effects of the Project
- status of the other project(s) or activity(ies)

- the potential residual effects of the other project(s) or activity(ies)

In order to identify the other projects and activities for consideration in assessing the potential cumulative effects of the Project on a VC, each discipline-specific environmental assessment team has reviewed the overall list of other projects and activities, and has identified a subset of projects and activities found within the RAA and which may result in adverse residual effects which may overlap temporally and spatially with residual adverse effects of the Project. The potential cumulative effects of the Project on various VCs that have been predicted are described in the respective VC cumulative effects assessment sections.

10.5.5 Identification of Cumulative Effects Mitigation Measures

BC Hydro has recommended a number of possible regional approaches to mitigation. These mitigation measures may involve government departments and/or third parties in independent and/or collaborative initiatives. The potential adverse cumulative effects and possible regional approaches to mitigation are discussed in the respective sections of this EIS where the potential effects of the Project on those VCs are discussed.

10.5.6 Characterizing Residual Cumulative Effects

Residual cumulative effects have been characterized using the approach outlined for the Project-specific effects assessment described in Section 10.4.2.2 and the criteria provided in Table 10.3. The potential residual adverse cumulative effects are discussed in the respective VC cumulative effects assessment sections.

10.5.7 Significance of Residual Cumulative Effects

A determination of the significance of the potential residual adverse cumulative effects that may result from the Project, in combination with other projects and activities, and its rationale for the determination is provided in the respective VC cumulative effects assessment sections.

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