Evaluating Cumulative Effects Assessment in Environmental Impact Assessment: A Case Study on the Pacific Northwest LNG Project

by

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Abstract

As new projects are being developed in various sectors throughout British Columbia and Canada, there is an increased need to assess how these projects collectively impact the environment. While environmental impact assessment is the process used to analyze and assess the environmental impacts from a single project, cumulative effects assessment (CEA) analyzes and assesses the environmental impacts from multiple projects and activities over space and time. I evaluate the quality of CEA through a case study analysis on the Pacific NorthWest LNG project, using a defined set of best practice criteria for CEA. The evaluation specifically focuses on the assessment of the eight biophysical valued components included in the environmental assessment application for the project. Based on the results of the evaluation, I identify strengths and weaknesses in the CEA and provide recommendations for improvement.

Keywords: Cumulative effects, Cumulative effects assessment, Environmental Assessment, Best practices

With all of my heart, to my Mother, Sister, Nana,

Grandpa, Uncle Mike, and Bryn.

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List of Acronyms

BC	British Columbia
BCEAO	British Columbia Environmental Assessment Office
BCF	Billion Cubic Feet
BC MOE	British Columbia Ministry of Environment
BP	Best Practice
CE	Cumulative Effects
CEA	Cumulative Effects Assessment
CEAA	Canadian Environmental Assessment Agency
CEAM	Cumulative Effects Assessment and Management
CEF	Cumulative Effects Framework
CNSC	Canadian Nuclear Safety Commission
dAIR	Draft Application Information Requirements
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
FLNRO	BC Ministry of Forests, Lands and Natural Resource Operations
GIC	Governor In Council
LAA	Local Assessment Area
LNG	Liquefied Natural Gas
MFN	Metlakatla First Nation
MOE	Minister of Environment and Climate Change
MOU	Memorandum of Understanding
MTPA	Million Tonnes Per Annum
NEB	National Energy Board
NGO	Non-Governmental Organization
PDA	Project Development Area
PETRONAS	Petroliam Nasional Berhad
PNW	Pacific NorthWest LNG
PRGT	Prince Rupert Gas Transmission
PRPA	Prince Rupert Port Authority
PY	Person Year

RA	Responsible Authority
RAA	Regional Assessment Area
SARA	Species at Risk Act
TCF	Temporary Construction Facility
TK	Traditional Knowledge
US	United States
VC	Valued Component
WCSB	Western Canada Sedimentary Basin
WHCP	Wetland Habitat Compensation Plan

Glossary

Cumulative Effects	The spatial and temporal accumulation of impacts in an environment from multiple sources (Smit & Spaling, 1995). The effects may be additive, synergistic, or antagonistic, and may result from individually minor activities that become significant when considered collectively (Noble, 2010).
Cumulative Effects Assessment	The process of systematically analyzing and assessing cumulative environmental change and identifying the total environment effects and pathways that leads to these effects, in order to avoid or mitigate stressors that cause cumulative effects (Noble, 2010).
Cumulative Effects Assessment and Management	The process of systematically analyzing, assessing, and mitigating cumulative environmental change and utilizing that information to guide decisions about the potential implications of future land and resource use and planning options (Noble, 2013).
Cumulative Effects Framework	A tool to support objectives and the management of cumulative effects (BCEAO, 2012). A cumulative effects framework should contain four main components: scoping, analysis, mitigation, monitoring, and documentation (Lucchetta et al., 2016).
Environmental Impact Assessment	The process of systematically analyzing, identifying and considering the impacts of an action (i.e., physical project or non-physical projects and policies) (Hanna, 2005).
Indicator	A metric used to measure and report on the condition and trend of a valued component and/or the process(es) impacting the valued component (BC MOE, 2012).
Liquefied Natural Gas	Natural gas that has been cooled to -160 degrees Celsius to liquid form for ease of storage and transport (BC Ministry of Energy, Mines and Natural Gas, 2013).
Major Project	In BC, the provincial government defines a major project as a development project that entails more than $15 million (CDN) in capital costs (BC JTST, 2015).
Precautionary Principle	Various definitions of the precautionary principle exist, but in this report it is defined as follows: Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing measures to prevent environmental degradation (Forest Practices Board, 2011).
Proponent	A person or an organization that proposes to undertake a reviewable project (*BCEAA 2002*).

Reasonably Foreseeable	A project or physical activity that is expected to proceed; e.g. the proponent has publically disclosed its intention to seek the necessary environmental assessment or other authorizations (CEAA, 2015a).
Valued Component	Components of the natural and human environment that are considered by the proponent, public, Aboriginal groups, scientists, technical specialists or government agencies to have scientific, ecological, economic, social, cultural, archaeological, historical, or other importance (BCEAO, 2013).

Chapter 1.

Introduction

1.1. Introduction

As of December 2015, there are 888 major projects proposed for development within the province of British Columbia (BC) (Government of British Columbia, 2015). These projects will impact the environment and other values deemed to be important to the public, scientists, government agencies, industry proponents, and Aboriginal groups (BCEAO, 2013).

The principal means of identifying, predicting, evaluating and mitigating the potential negative effects from proposed projects and activities is through environmental impact assessment (EIA) (IAIA & EIA, 1999). EIA is conducted prior to project approval to understand the potential effects from the project and propose mitigation measures to avoid or minimize negative effects from occurring, thereby making EIA a useful environmental management tool (Glasson, Thérivel, & Chadwick, 2005; IAIA & EIA, 1999). In British Columbia, EIA is conducted at the federal level under the *Canadian Environmental Assessment Act,* S.C. 2012, c.19, s.52 (*CEAA 2012*) and at the provincial level under British Columbia's *Environmental Assessment Act,* S.B.C. 2002, c.43 (*BCEAA 2002*).

It is important to note that while an individual project may cause effects to the environment, the spatial and temporal accumulation of effects from a combination of past, present, and future projects can result in much greater environmental impacts (Hegmann et al., 1999; Porter & Murray, 2010; Smit & Spaling, 1995). This concept is known as cumulative effects. To systematically analyze and assess cumulative effects from projects and activities over time, cumulative effects assessment (CEA) is employed. The primary mechanism for conducting CEA in Canada is through EIA. At the federal level, CEA is

conducted through the federal environmental assessment (EA) process and has a legislative basis under *CEAA 2012*. CEA may be conducted through the provincial EA process under *BCEAA 2002*, but it is not legislatively required for all projects that undergo a provincial EA.

Over the years, CEA has been criticized by many academics and EA practitioners on many fronts including the methodology used to approach CEA, the inconsistent application of CEA across development projects, and the overall effectiveness of CEA within EA (Baxter, Ross, & Spaling, 2001; Clogg & Carlson, 2013a; MacDonald, 2000; Noble, 2010). Furthermore, questions still exist as to how the results of CEA are used in the decision-making process when deciding whether or not to approve a project, and if stakeholder concerns are fully factored into this decision (CCME, 2009; Lawe & Wells, 2005).

For these aforementioned reasons, an assessment of the current approach to CEA is required to determine if the current approach and process for CEA is effective in achieving its goals. This comes at an important time in BC with the rise of the liquefied natural gas (LNG) sector. To date, there are 20 LNG projects that have been proposed in BC, the majority of which are located on the North Coast as well as the Lower Mainland and Vancouver Island (Government of BC, 2016). So far, only three LNG facilities have been approved for development by the provincial and federal government— Kitimat LNG, LNG Canada, and Woodfibre LNG. There are growing concerns over the environmental effects from LNG projects and how they will interact with other projects and activities in a region and affect the environment over time.

1.2. Purpose and Objectives

The purpose of this research is to evaluate the quality of CEA in EIA in Canada through a case study analysis of the Pacific NorthWest LNG project (PNW). The objectives of this research are to apply the best practice (BP) criteria developed by Lucchetta, Steffensen, Gunton, Broadbent & Rutherford (2016) to evaluate the CEA for PNW—as outlined in Stantec Consulting Ltd.'s (2014) EA application— and to determine the degree to which BP criteria are met. This research focuses on strictly examining the CEA

conducted for the eight biophysical VCs included in the EA application for PNW to scope the evaluation to a manageable level. Based on the results of the evaluation, strengths and weaknesses will be identified and recommendations to improve CEA will be provided. Overall, this research will provide the first comprehensive evaluation of CEA in EIA for a major project in BC.

1.3. Structure of the Report

In the second chapter, I begin by describing EA and how it has evolved in Canada. Next, I describe the federal and provincial (BC) EA processes including the legislative basis for EA and the leading agencies responsible for conducting EAs under each jurisdiction. I conclude the chapter with general observations about the federal and provincial EA processes.

In Chapter 3, I begin by providing an overview of CEA, including its main components and its overall goals and benefits. Next, I identify the legislative basis for CEA in Canada under both federal and BC legislation along with current initiatives to develop cumulative effects frameworks (CEFs). I conclude the chapter by discussing the current issues with the application of CEA.

Chapter 4 provides background on the PNW project. I begin by providing an overview of the LNG sector and the current state of Canada's natural gas resources. Next, I provide an overview of the PNW project, outlining the location, key project components, project design, costs, and employment estimates. Next, I provide an overview of how PNW was assessed in the provincial and federal EA processes as well as the methodology used to conduct CEA for PNW. Finally, I identify the predicted environmental effects and cumulative effects from PNW as described in the EA application.

In Chapter 5, I introduce and describe the 17 BP criteria and 52 sub-criteria used to evaluate the EA application for PNW. These BP criteria and sub-criteria are based on the criteria developed in Lucchetta et al., (2016). I conclude the chapter by providing a summary of the BP criteria.

In Chapter 6, I outline the methodology I used to evaluate the eight biophysical VCs from the EA application for PNW. These eight biophysical VCs were included in the Stantec Consulting Ltd. (2014) EA application for PNW (and are described in Section 4.10 of this report). This research focused on examining only the biophysical VCs included in the EA application to scope the evaluation to a manageable level. Next, I present the results of the evaluation, describe the degree to which the sub-criteria are met for all eight VCs, and provide rationales for these ratings. I conclude the chapter by identifying the degree to which the overall BP criteria are met.

In Chapter 7, I provide a summary of my findings and provide recommendations to improve the practice of CEA. Finally, I state the limitations of this study and identify avenues for future research.

Chapter 2.

The Provincial and Federal Environmental Assessment Processes

2.1. Introduction

In this chapter, I begin by describing EA and how it has evolved in Canada. Next, I describe the federal and provincial (BC) legislative basis for EA, and outline their respective EA review processes and the leading agencies responsible for conducting EAs under each jurisdiction. Finally, I conclude the chapter with general observations about the EA review processes.

2.2. Environmental Assessment

EA is a process that is used to predict the environmental effects of proposed projects, activities, or initiatives prior to being carried out (CEAA, 2011). EAs are conducted by the federal government as well as by the provinces and territories across Canada. The provincial and territorial EA processes vary across jurisdictions, but they all have a common goal to determine if major projects and activities should proceed and, if so, under which terms and conditions (BCEAO, 2015). Over the years, EA has become a powerful instrument for guiding environmental management practices in Canada and is largely used as a planning and decision-making tool (Glasson et al., 2005; IAIA & EIA, 1999). EA is used to minimize or avoid adverse environmental effects from designated projects and activities by incorporating environmental factors into decision-making (CEAA, 2015a).

Within an EA, the potential environmental effects from a project on valued components (VCs) are considered and assessed. Ideally, EA should be conducted as early as the project planning stage to allow proponents to design and implement a plan that meets the interests of all stakeholders. This proactive mindset allows proponents to identify adverse environmental effects that may occur and to develop plans to avoid or

minimize adverse effects to the best degree possible. This also reduces the risk of environmental harm or disasters, increases protection of human health, reduces project costs and delays, and provides opportunities for public participation and Aboriginal consultation (CEAA, 2015a).

2.3. The Evolution of EA in Canada

EA became increasingly popular in the early 1970's, after the development of EA provisions in the *National Environmental Policy Act* in the United States (US). In the initial stages of EA development in Canada, EA was largely policy-based but eventually developed into a legislated assessment process as a result of advances in provincial and territorial EA processes, federal reviews of the EA process, court rulings, case studies, academic literature, and the overall increase in environmental awareness (Gibson & Hanna, 2009). Table 2.1 outlines a few of the most important events that contributed to the advancement of EA in Canada.

Table 2.1. Major Milestones in the Development of EA in Canada

Event	Description	Result
1972: Federal Cabinet decision	All federally initiated projects and those under federal jurisdiction were screened for potential pollution effects. If it was found that a project will contribute to significant adverse effects, it was referred to the Department of the Environment for further assessment.	Introduction of EA in a policy-based format.
1973: First legislated assessment process established	The Ontario Environmental Assessment Act covered social, economic, cultural and biophysical effects, required the examination of alternatives, and introduced public hearings.	First legislated EA process.
1977: Mackenzie Valley Pipeline inquiry	The Berger Report (1977) investigated the social, economic, and environmental impact of a natural gas pipeline through the Northwest Territories and the Yukon and concluded that the impacts would be significant.	Set the standard for the public assessment of proposed development options.

Event	Description	Result
1982: Federal EA process is reviewed	The Minister of Environment asked Cabinet to strengthen the current EA process. Cabinet ordered a review of the effectiveness of the existing EA process.	Findings include that the implementation of EA was uneven and that there was a large disinterest in the federal agencies in adopting this type of assessment; pressure for improvement mounts.
1989: Rafferty Alameda Dam court ruling	The Federal Court of Canada ruled in the Rafferty- Alameda Dam case that the Cabinet Guidelines Order for EA is legally binding.	Supreme Court of Canada upheld the ruling in the *Oldman River Dam* case (1992); federal government works on developing a legislated process.
1990: Bill introduced	The federal government introduced a bill to establish the *Canadian Environmental Assessment Act.*	Federal government initiated a non-legislated process; no strategic level application in the act (policies and programs); environmental groups participated in the parliamentary review of proposed legislation.
1992: *CEAA 1992* introduced	The *Canadian Environmental Assessment Act, 1992* (*CEAA* 1992) receives legislative approval, but does not come into force.	Environmental groups participated in the parliamentary review of proposed legislation. A new government makes further amendments in 1994.
1995: *CEAA* 1992 is proclaimed in force along with a new set of key regulations	New definition of *environment* omitted direct socio-economic and cultural effects and EA is left as a largely advisory exercise. However, *CEAA 1992* provides the opportunity to evaluate alternatives and needs, supports intervenor funding, and introduces CEA.	*CEAA* 1992 aims to mitigate adverse environmental effects.
1998: Accord on provincial-federal EA harmonization signed	A review of the EA process is conducted to address concerns about duplication, inefficiency; federal government signs bilateral agreements with provinces agreeing to joint assessments where jurisdictions overlap.	Federal government addressed these issues that have been prolonged throughout the process; joint assessment introduced.

Event	Description	Result
2003: The amended *CEAA 1992* receives royal assent	*CEAA 1992* is amended and introduces an improved approach to EA.	Improvements focused on inefficiencies (including a greater focus on class screenings), eliminated public hearings from those under the comprehensive study stream, introduced a federal EA coordinator to improve communication between agencies, improved monitoring, strengthened compliance provisions, increased public participation, provided public access to EA information, and recognized Aboriginal Traditional Knowledge (ATK) and community knowledge in the process.
2011: House of Commons Committee on the Environment and Sustainable Development (CESD) began a review of *CEAA 1992*	The CESD issued a report after a short hearing process outlining recommendations for *CEAA 2012*. The recommendations focused on increasing efficiency in the EA process through coordination and consolidation with the provincial and federal governments, reducing the application of EA, and focusing on economic growth and environmental benefits of development.	CESD recommendations were carried forward into *CEAA 2012.*
2012: Bill C-38 introduced	Bill C-38 repeals *CEAA 1992* and introduces *CEAA 2012*.	Changes to EA and environmental regulation.
2012: *CEAA 2012* introduced	*CEAA 2012* introduced new provisions of substitution and equivalency, updated timelines, and increased efficiency in EA reviews. CEA is introduced as a purpose in the Act. However, the number and scope of federal EAs is reduced and the definition of "environmental effects" is restricted to effects on fish, aquatic species at rick, migratory birds and federal lands.	Change in the scope, procedures and types of EA.
2016: The federal government launched a review of environmental and regulatory processes	The review will focus on reviewing the federal EA processes as well as modernizing the NEB and restoring lost protections and introducing safeguards to the *Fisheries Act* and the *Navigation Protection Act*.	To be determined.

Note: Adapted from Hanna et al., 2009.

2.4. Federal Environmental Impact Assessment

2.4.1. Legislative Basis

The legislative basis for the federal practice of EA in Canada is established through *CEAA 2012*. Section 4 describes the purpose of *CEAA 2012*:

> **4(1)** The purposes of this Act are:
>
> a) to protect the components of the environment that are within the legislative authority of Parliament from significant adverse environmental effects caused by a designated project;
>
> b) to ensure that designated projects that require the exercise of a power or performance of a duty or function by a federal authority under any Act of Parliament other than this Act to be carried out, are considered in a careful and precautionary manner to avoid significant adverse environmental effects;
>
> c) to promote cooperation and coordinated action between federal and provincial governments with respect to environmental assessments;
>
> d) to promote communication and cooperation with aboriginal peoples with respect to environmental assessments;
>
> e) to ensure that opportunities are provided for meaningful public participation during an environmental assessment;
>
> f) to ensure that an environmental assessment is completed in a timely manner;
>
> g) to ensure that projects, as defined in section 66, that are to be carried out on federal lands, or those that are outside Canada and that are to be carried out or financially supported by a federal authority, are considered in a careful and precautionary manner to avoid significant adverse environmental effects;
>
> h) to encourage federal authorities to take actions that promote sustainable development in order to achieve or maintain a healthy environment and a healthy economy; and
>
> i) to encourage the study of the cumulative effects of physical activities in a region and the consideration of those study results in environmental assessments.

CEAA 2012 aims to protect environmental components that are within federal jurisdiction from any significant adverse effects stemming from development projects, including any cumulative environmental effects (CEAA, 2015a). Section 5 of *CEAA 2012*

describes the environmental effects that must be considered under federal jurisdiction, including changes to:

- fish and fish habitat;
- aquatic species;
- migratory birds;
- federal lands;
- effects that cross provincial or international boundaries;
- aboriginal peoples from a change in the environment including health and socio-economic conditions, physical and cultural heritage, current use of lands and resources for traditional purposes, and any structure or site of historical, archaeological, paleontological or architectural significance; and
- the environment that are directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a function that would permit the project, including socio-economic and other impacts arising from such changes.

2.4.2. The Federal EA Process

Under *CEAA 2012*, there are three responsible authorities (RAs) that are responsible for conducting federal EAs. The RAs include the National Energy Board (NEB), the Canadian Nuclear Safety Commission (CNSC), and the Canadian Environmental Assessment Agency (CEAA). The NEB is responsible for conducting EAs of interprovincial and international oil and gas pipelines, the CNSC is responsible for conducting EAs of nuclear projects, and CEAA is responsible for conducting any other large development project requiring a federal EA (as per the *Regulations Designating Physical Activities* under *CEAA 2012*). In this context, CEAA acts as the RA on LNG projects.

In an EA led by CEAA, CEAA reviews project documents submitted by a proponent and incorporates advice provided by federal and provincial agencies, stakeholders, the public and First Nations groups. This advice is considered by CEAA and is incorporated into CEAA's own findings and conclusions from which they prepare an EA report. The EA report is then considered by decision-makers, including the Minister of Environment and Climate Change (MOE) (and potentially the Governor in Council (GIC)) when making a decision on whether or not to approve a project and also to inform project conditions. In

total, an EA led by CEAA has a government timeline of 365 days, not including the time required by the proponent to provide additional information requested by CEAA. Additionally, these timelines can be extended by the MOE up to three months and an additional three months by the GIC. The process in which the NEB or the CNSC conducts an EA varies from that of CEAA; however these EA processes are not outlined in this report.

In an EA conducted by a review panel, the MOE appoints individuals to a panel who then review the EA as well as advice from federal and provincial agencies, stakeholders, the public, and First Nations groups and provide recommendations to the MOE. The members are selected based on their knowledge, experience and expertise, and must be free from bias or conflict of interest relative to the designated project (CEAA, 2016a). Within 60 days of the commencement of an EA, the MOE may refer the project to a review panel if the MOE determines that it is in the public interest[1]. In total, an EA conducted by a review panel has a government timeline of 24 months. Again, this does not include the time required by the proponent to submit additional information as requested by the review panel.

[1] The MOEs determination regarding whether the referral of the EA of the project to a review panel is in the public interest must include a consideration of the following factors: a) whether the designated project may cause significant adverse environmental effects; b) public concerns relates to the significant adverse environmental effects that the project may cause; and c) opportunities for cooperation with any jurisdiction that has powers, duties, or functions in relation to the assessment of the designated project or any part of it (*CEAA 2012*, s. 38(2)).

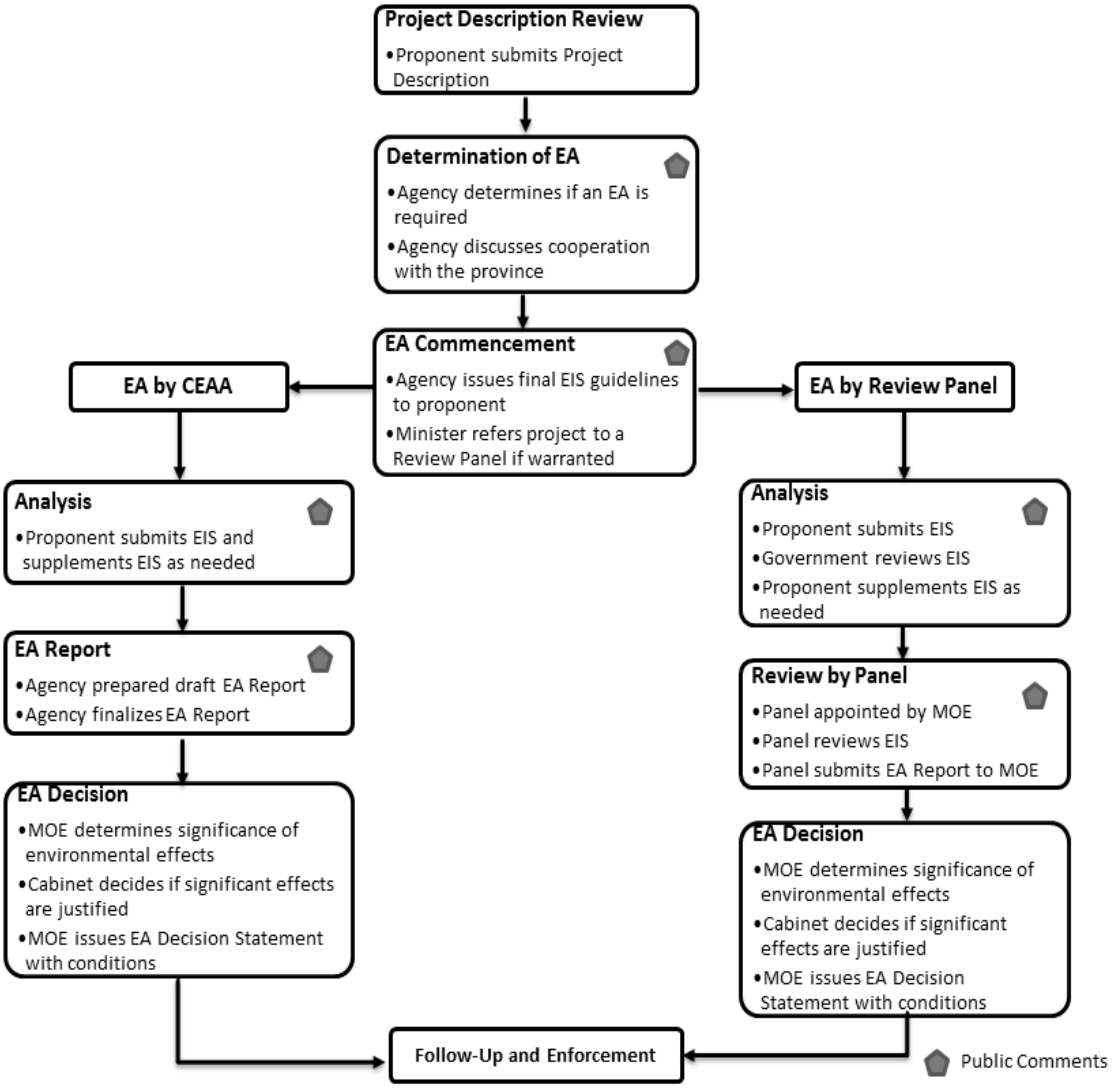

Figure 2.1. The Federal EA Process.
Note: Adapted from CEAA (2013).

To determine if a project will receive EA approval, the federal government must first decide if the designated project is likely to cause significant adverse effects. Section 52 of *CEAA 2012* outlines the regulatory approval criteria that must be considered by the MOE or the GIC before a final decision statement is issued.

> **52 (1)** For the purposes of sections 27, 36, 47 and 51, the decision maker referred to in those sections must decide if, taking into account the implementation of any mitigation measures that the decision maker considers appropriate, the designated project

> **(a)** is likely to cause significant adverse environmental effects referred to in subsection 5(1); and
>
> **(b)** is likely to cause significant adverse environmental effects referred to in subsection 5(2).
>
> **(2)** If the decision maker decides that the designated project is likely to cause significant adverse environmental effects referred to in subsection 5(1) or (2), the decision maker must refer to the Governor in Council the matter of whether those effects are justified in the circumstances.
>
> **(3)** If the decision maker is a responsible authority referred to in any of paragraphs 15(a) to (c), the referral to the Governor in Council is made through the Minister responsible before Parliament for the responsible authority.
>
> **(4)** When a matter has been referred to the Governor in Council, the Governor in Council may decide
>
> **(a)** that the significant adverse environmental effects that the designated project is likely to cause are justified in the circumstances; or
>
> **(b)** that the significant adverse environmental effects that the designated project is likely to cause are not justified in the circumstances.

While the EA is underway, the proponent is prohibited from proceeding with any aspect of the designated project that will affect any environmental component under federal jurisdiction until a decision statement is issued by the federal government. Section 67 of *CEAA 2012* indicates that a project may be carried out if the MOE has issued a decision statement indicating that the project is unlikely to cause significant adverse effects, or if the GIC indicates that for projects which have a likelihood of significant adverse effects, that these effects are justifiable given the circumstances, and if the proponent has complied with all the conditions of the decision statement (CEAA, 2016a).

2.4.3. The Canadian Environmental Assessment Agency

Established in 1994, CEAA is responsible for the overall administration of the federal EA process under *CEAA 2012*. CEAA acts as an RA and leads the EA process for projects that are not within the jurisdiction of other RAs (i.e. the NEB or CNSC). Other than providing expertise in the EA process, CEAA works to coordinate EA reviews and seek scientific and technical advice from federal departments and agencies, coordinates

aspects of Aboriginal consultation and public participation, and provides administrative and advisory support for review panels. Furthermore, CEAA conducts research to advance the science and practice of EA in Canada (CEAA, 2016a).

Ultimately, CEAA is not the decision-maker in the federal EA review process. At the end of the assessment of a project or activity, CEAA prepares an assessment report that outlines the findings of the EA review. This report is then referred to the MOE (and possibly the GIC) who decide whether or not to issue an environmental assessment certificate and what conditions to attach to the certificate if the project is approved.

2.5. Provincial Environmental Assessment

2.5.1. Legislative Basis

BCEAA 2002 provides the legislative basis for the provincial EA review process and sets out the responsibilities for the EA of projects where provincial government decision-making is involved. *BCEAA 2002* outlines the environmental assessment process, administration, application, and special provisions under the act.

A proposed project may become reviewable under *BCEAA 2002* in three ways. The first mechanism in which a project becomes reviewable is if the project meets the criteria under the *Reviewable Projects Regulation.* The *Reviewable Projects Regulation* is supported under *BCEAA 2002*. Typically, the following types of projects are deemed to be reviewable if they meet certain thresholds such as size or production volume: industrial, energy, mining, water management, waste disposal, food processing, transportation, and tourist destinations and resorts. A proposed project may also become reviewable under *BCEAA 2002* if it receives Ministerial Designation from the provincial Minister of Environment, who has the authority to direct the review of projects that are not triggered under the *Reviewable Projects Regulation*. Finally, a proposed project may also become reviewable if the proponent requests a review of their proposed project and the BCEAO concurs with the review.

2.5.2. The Provincial EA Process

The provincial EA process conducts an assessment across five pillars in which significant adverse effects can occur, including biophysical, economic, social, heritage and health (BCEAO, 2015). This EA process is proactive in ensuring that the review includes the following:

- opportunities for the involvement of all interested parties;
- consultations with First Nations;
- technical studies to identify and examine potential significant adverse effects;
- strategies to prevent, or reduce, adverse effects; and
- development of comprehensive reports summarizing input and findings.

An overview of the EA process is presented in Figure 2.2 and is further explained below.

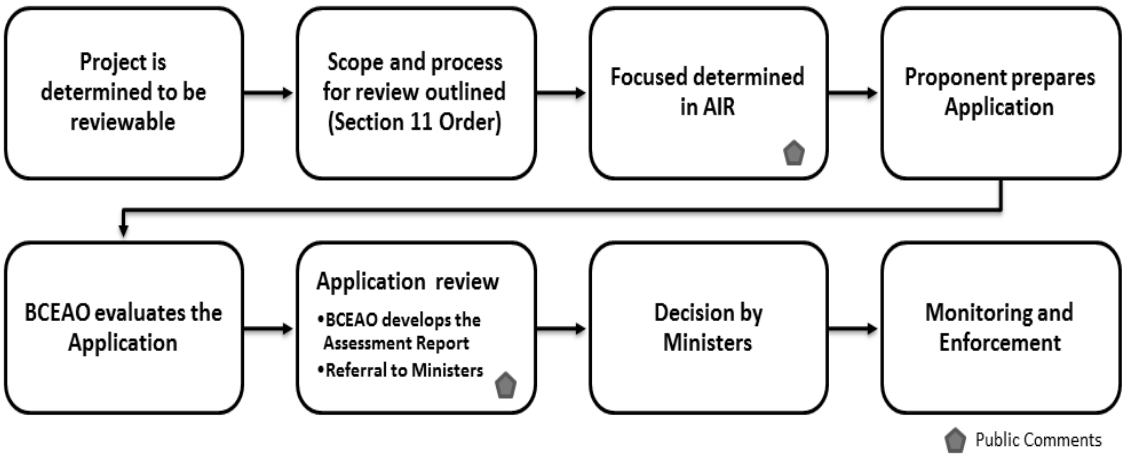

Figure 2.2. The Provincial EA Process.
Note: Adapted from BCEAO (2015).

In the provincial process, an EA is conducted in two stages. The first stage is the pre-application stage, which begins once a proponent submits a project description. The BCEAO reviews the document to determine if the project or activity is reviewable under *BCEAA 2002* and the *Reviewable Projects Regulation*. If the project or activity triggers an EA, the proponent identifies the potential areas in which significant adverse effects may occur from the project and selects VCs under which these effects will be assessed in the EA application. The choice of VCs is formalized in a VC selection document. This VC

selection document receives input from consultation with the BCEAO and stakeholders such as government agencies, First Nations, and the public. Next, the proponent generates the draft Application Information Requirements (dAIR) document, which acts as a Terms of Reference that describes what information must be included in the EA application. The BCEAO provides a dAIR template on their website that proponents must adhere to in order to keep all EAs consistent. After submitting the dAIR to the BCEAO, the BCEAO reviews it and holds a public comment period where all stakeholders in the process can provide feedback on the dAIR and raise issues or concerns that they may have with the project or activity. The pre-application stage ends when the BCEAO approves the final application information requirements (AIR) and when the proponent has completed all required baseline studies.

The second stage of the provincial EA process is the application review stage where the proponent submits the EA application for review. The BCEAO reviews the EA application to determine if the required information from the AIR has been provided in the EA application. Once the EA application is found to contain all the required information, the EA application is accepted. At this point, the regulatory timeline begins, and an EA should be completed in approximately 180 days. Another public comment period begins to identify any potential issues or concerns that stakeholders may have with the proposed project or activity. The BCEAO reviews the comments from stakeholders and facilitates discussions with the objective of resolving any outstanding issues. Once the review is completed, the BCEAO prepares an EA report outlining their findings and recommendations and submits it to the relevant Ministers.

The decision-making authority rests with two Ministers (the Provincial/Territorial Minister of Environment and one other relevant minister – depending on the type of project or activity being proposed). The EA concludes when the Ministers make a decision on whether or not to issue an EA Certificate for the proposed project or activity.

An EA Certificate is required before a reviewable project is undertaken and before authorizations and approvals are provided by other provincial agencies. EA Certificates are valid for three to five years from the date of issuance and during this time, a proponent

must substantially start the project before the certificate expires. Proponents may also apply for an extension of the certificate for up to five years.

2.5.3. The BC Environmental Assessment Office

Established in 1995, the BCEAO is a provincially established authority that is responsible for conducting and managing the review of proposed major projects in BC as required under *BCEAA 2002*. The BCEAO also acts to verify compliance with the regulations under BCEAA and to verify compliance and enforcement for the conditions of EA certificates. The BCEAO works collaboratively with stakeholders including First Nations, the public, federal government departments, and project proponents in an iterative process throughout the EA.

Ultimately, the BCEAO is not the decision-maker in the provincial EA review process. At the end of the assessment of a project or activity, the BCEAO prepares an assessment report, which outlines the findings of the review. This report is then referred to two government Ministers (including the Minister of the Environment) who collectively decide whether or not to issue an environmental assessment certificate and, if so, attaches conditions in accordance with the results of the EA.

2.5.4. Working with the federal government

A key provision of *CEAA 2012* is that there are two mechanisms through which the federal and provincial RAs can work together in conducting an EA for a project. The BCEAO and CEAA can work together by either entering into a substitution agreement or through a coordinated approach to complete the review of the proposed project.

In a substitution agreement, the federal process is replaced with the provincial EA process. From this EA Report, two decisions (federal and provincial) are made on the project. A substitution agreement may only occur for an EA review by CEAA or through a review panel, and not by the other RAs (NEB or CNSC). A Memoranda of Understanding (MOU) concerning substituted EAs was jointly signed by CEAA and the BCEAO in 2013.

In a coordinated, or “harmonized”, approach, the federal and provincial governments both review the proposed project but the assessment takes place through a coordinated process. The assessment may lead to a single EA report or two separate reports, but in either event there will be two decisions. In 2004, the federal and provincial governments jointly signed the Canada-BC Agreement on Environmental Assessment Cooperation to help guide the coordinated approach. That agreement provides an opportunity for consultation between the federal and provincial governments to determine their respective EA responsibilities and provides guidelines to determine a leading agency responsible for the administration of a coordinated review.

2.6. General Observations

Despite the evolution of EA both federally and provincially over the years, many authors believe that there are still serious ongoing issues related with federal and provincial approaches to EA (Doelle, 2008; Gibson, 2012). Some of the deficiencies identified in the academic literature include:

1. Both federal and provincial EAs are conducted on a project-by-project basis which focuses on the impacts from an individual project (Duinker & Greig, 2006; Noble, 2013).
2. Only projects that are large enough, and of a type to trigger the federal or provincial EA requirements, undergo an EA. Smaller projects or certain types of projects or activities are not assessed, but may contribute to environmental effects.
3. EAs are conducted using different methodologies for federal, provincial, and territorial EAs which follow different requirements for EAs, leading to inconsistencies and varying quality of EAs (Gibson, 2012).
4. Timelines for federal and provincial EAs are short, providing an insufficient amount of time for data collection and the analysis of potential environmental impacts (Van Hinte, Gunton, & Day, 2007).
5. EAs often have not fully conducted meaningful public engagement and have not incorporated community or traditional knowledge. There may be a lack of resources, knowledge and capacity to participate in the EA process (Booth & Skelton, 2011; Gibson, 2012; Plate, Foy, & Krehbiel, 2009).
6. Decision-making in both federal and provincial EAs has not been transparent (Gibson, 2012).

7. Both federal and provincial EAs seek project approval, rather than working towards a desired outcome such as sustainability (Duinker & Greig, 2006; Galbraith, Bradshaw, & Rutherford, 2007).

Chapter 3.

Cumulative Effects Assessment

3.1. Introduction

In this chapter, I discuss CEA. I begin by describing cumulative effects and CEA, including the main components of CEA and its overall goals and benefits. Next, I identify how CEA is carried out under both federal and provincial EA reviews and outline current initiatives to develop CEA frameworks. I conclude the chapter by discussing the current limitations of CEA in Canada.

3.2. What are Cumulative Effects?

Multiple definitions of cumulative effects exist amongst EA practitioners, government agencies, and academics. Broadly, cumulative effects are defined as the spatial and temporal accumulation of impacts from multiple sources (Smit & Spaling, 1995). The sources of these impacts are the combination of past, present and future activities in a region that when considered collectively, contribute to impacts on biophysical, social, economic and cultural values or VCs (Hegmann et al., 1999). These effects can be additive— where the combined effects result from the sum of individual effects; synergistic— where the combined effects are greater than the sum of the individual effects; or antagonistic— where the combined effects are less than the sum of the individual effects (Noble, 2010; Seitz, Westbrook, & Noble, 2011).

Cumulative effects are not always harmful; they can result in positive effects as well. For example, the development of a mine in a rural area may stimulate economic development and lead to an increase in employment. Alternatively, negative environmental effects from the mine may impact the health of residents or may impact water quality. Cumulative effects are also not caused solely by human activity— they can be a result of natural drivers in the environment acting along with human activities (Indian and Northern Affairs Canada, 2007). When assessing cumulative effects, this may

become problematic if natural drivers in the environment are not accounted for as they may act in combination with anthropogenic activities can contribute to greater environmental impacts (Forest Practices Board, 2011).

In practice, it is difficult to predict cumulative effects; however there are multiple models and scenarios that can help develop a range of different futures that can be examined (e.g. through geographic information systems, simulation modelling, scenario development, and regression analyses) (Lucchetta et al., 2016; Nitschke, 2008; Noble, 2013; Smit & Spaling, 1995). Examining these effects under a wide range of development scenarios can help inform decision-makers in making responsible resource management decisions.

3.3. What is Cumulative Effects Assessment?

To analyze the effects that are additive or interactive that result from multiple activities over time, CEA is employed. Within CEA, environmental effects from multiple projects and activities are identified along with the sources and pathways that lead to those effects (Baxter et al., 2001; Noble, 2010; Smit & Spaling, 1995). These effects have the ability to impact various environmental, socioeconomic and cultural VCs via multiple mechanisms including physical and chemical transport, the gradual disturbance and loss of land over time, spatial and temporal crowding when there is concentrated development in an area in a short period of time, and through feedback effects where initial activities induce other activities to occur (Hegmann et al., 1999). Once these sources of impact are identified, methods or mitigation measures to avoid these effects from occurring are proposed and implemented.

In CEA, sources of these impacts are assessed on a broad temporal scale and include any past, current, and potentially foreseeable projects or activities that will occur in a given region. In terms of spatial scale, CEA can be assessed in two main ways: a project-level CEA or a regional CEA. Project-level CEAs focus on predicting cumulative effects connected to a specific project, whereas regional CEA focuses on measuring the existing condition of VCs or accumulated state from multiple projects relative to a baseline condition (Noble, 2010). Regional CEAs are often the preferred method of assessment as

they expand both the temporal and spatial boundaries of the assessment to include impacts from past, present, and future activities on a regional scale (Noble, 2010).

In practice, CEA is typically conducted within EA. In Canada, CEA is mandatory for all EAs at the federal level under *CEAA 2012*. At the provincial level, the *BCEAA 2002* states that an assessment *may* be required to include cumulative effects. Within EAs, CEA often follows five steps: scoping, analysis, mitigation, determining significance, and follow-up (BCEAO, 2015). Overall, the quality of the CEA varies by project and proponent and there is no consistent methodology used to assess CEA (Clogg & Carlson, 2013a; Noble, 2010; Parkins, 2011).

3.3.1. Cumulative Effects Framework (CEF)

To properly assess cumulative effects from multiple projects and activities over space and time, a CEF is employed. The goal of a CEF is to protect and enhance environmental, social, economic and/or cultural valued components through the establishment of key goals, targets and objectives and using specific procedures and tools to assess them (BCEAO, 2012; Lucchetta et al., 2016). Many CEFs have been developed in recent years and can be sector-specific to a broader regional CEF (Dubé, 2003; Franks, Brereton, Moran, Sarker, & Cohen, n.d.; Nielsen, 2010; NWT CEAM Steering Committee, 2010). Some CEFs also expand beyond assessing environmental and socioeconomic components to address cultural VCs related to First Nation's interests (Lucchetta et al., 2016; Porter & Murray, 2010). While these CEFs may assess different values and VCs, they all have similar components that are used to assess CEA including: scoping, analysis, monitoring and mitigation, and documentation. The main components of a typical CEF are presented in Table 3.1. The CEF approach normally does not include the step of determining significance. Significance is usually determined as part of the EA process, which uses the results from the CEA to assess whether or not residual and cumulative effects resulting from projects and activities would be significant.

Table 3.1. Major Components of a CEF

Components	Purpose
Scoping	• Develop a list of candidate VCs • Set management goals, objectives, targets and thresholds • Set spatial and temporal boundaries
Analysis	• Identify the current condition of VCs • Forecast and estimate cumulative effects (stressors, vulnerability, cause-and-effect)
Monitoring and Mitigation	• Monitor the state of the VCs • Incorporate mitigation strategies as needed to meet targets and thresholds
Documentation	• Document and use information to inform the next iteration of assessment

Note: Adapted from Lucchetta et al. (2016)

More recently, there have been advancements in the development of CEFs. For example, in BC, initiatives are being led by the BC Ministry of Forests, Lands and Natural Resource Operations (FLNRO) to assess cumulative effects within the Lower Mainland, North Coast and Northeast portions of the province where many major development projects are proposed (FLNRO, 2014).

3.4. Benefits of CEA

There are many benefits to conducting CEA. Most importantly, a proper CEA will act as an effective regional planning tool that can be used to improve resource management and decision-making. Through establishing strategic-level direction and proactively assessing and managing environmental issues, it is possible to ensure that targets and objectives are being achieved (Clogg & Carlson, 2013a; Heemskerk, 2012). CEA also promotes that indicators and parameters are monitored over time, allowing for adaptive management practices to be implemented (e.g. the adjustment of mitigation measures). Additionally, when performed correctly, CEA will improve transparency and effectively incorporate the values and needs of stakeholders and First Nations.

While the above description is what CEA ideally should be, CEA is not currently at this stage of development in Canada, or anywhere in the world (Hanna, 2009). The

following sections will outline the development of CEA in Canada and the current challenges we are facing with implementation.

3.5. CEA Development in Canada

CEA increased in popularity in Canadian research and practice shortly after the foundation of the Canadian Environmental Assessment Research Council in 1984, which marked the beginning of a series of CEA developments in Canada (Duinker & Greig, 2006). In these early stages, CEA focused on a stressor-based approach that predicted the impacts from a single project in a region (Dubé, 2003). At this time, CEA was also regarded as a voluntary practice as it was not legally mandatory to assess CEA and there was little guidance on how to conduct CEA. As research within this field continued to develop and the need for CEA became apparent, many federal agencies (including Parks Canada, CEAA, and the Department of Indian Affairs and Northern Development) began developing guidance and recommendations on how to conduct CEA in a regional planning context (Duinker & Greig, 2006; Greig, Duinker, Everitt & Pawley, 2003; Hegmann et al., 1999; Kingsley, 1997).

Further to this agency guidance, there have been many advances in the field of CEA from the work of academics, First Nations groups, and non-governmental organizations (NGOs) that have developed methodologies and best practices for conducting CEA. This research focuses on assessing cumulative effects on large-scale regional assessments and for field-specific research (Dubé, 2003; Forest Practices Board, 2011; Noble, 2008; Sheelanere, Noble, & Patrick, 2013; Spaling, Zwier, Ross, & Creasey, 2000).

The development of CEA has also been influenced by judicial decisions. For example, in *West Moberly First Nation v British Columbia* (2011), the Supreme Court of Canada found that CEA is part of the Crown's duty to consult and accommodate Aboriginal peoples and requires the consideration of cumulative effects of past and future activities. Since the ruling in 2011, this court case established a precedent for CEA in Canada through the EA process and outside of formal EA.

3.5.1. Federal Legislation

Cumulative effects assessment was first introduced in federal legislation in the *Canadian Environmental Assessment Act*, S.C. 1992 c.37 (*CEAA 1992*). At this time, the consideration of cumulative effects was somewhat basic, considering any cumulative environmental effects that would be likely to result from the designated project. Many academics agree that the approach to addressing CEA under *CEAA 1992* was complicated by the cumbersome EA process that involved dozens of departments, poor harmonization with provinces and territories, inefficient timelines, and poor compliance and enforcement measures (Gibson, 2012; Hanna, 2009). These difficulties arose in part from reluctant participation of federal authorities and the overlapping assignment of federal and provincial constitutional responsibilities in addressing environmental concerns (Gibson, 2012). Since then, CEA has changed substantially and has received greater attention in the federal EA process. In 2012, CEA was written into *CEAA 2012* and is one of the nine purposes of *CEAA 2012:*

> **4(1)** The purposes of this Act are:
> i) to encourage the study of **cumulative effects** of physical activities in a region and the consideration of those study results in environmental assessments **[Emphasis added].**

CEA is also mentioned under section 19(1)(a) which outlines that an EA must take CEA into account:

> **19(1)** The environmental assessment of a designated project must take into account the following factors:
> a) the environmental effects of the designated project, including the environmental effects of malfunctions or accidents that may occur in connection with the designated project and any **cumulative environmental effects** that are likely to result from the designated project in combination with other physical activities that have been or will be carried out; **[Emphasis added].**

CEA is also supported through guidance documents such as CEAA's *Operational Policy Statement on Assessing Cumulative Effects under CEAA 2012* (OPS) (2015) and CEAA's *Technical Guidance for Assessing Cumulative Environmental Effects under CEAA 2012* (2015). The OPS supports the federal legislation by outlining the general requirements and approach to assessing cumulative environmental effects to ensure that

the requirements under *CEAA 2012* are fully met. This document also provides support to proponents when they are preparing environmental impact statements and to CEAA when interacting with those who are engaged in the federal EA process for a designated project (CEAA, 2015a). The Technical Guidance (2015) provides methodological options and considerations for each part of the EA process and for cumulative effects.

3.5.2. Provincial Legislation

Cumulative effects were first introduced into British Columbia's provincial legislation through *BCEAA 2002*. This legislation replaced the *Environmental Assessment Act* 1996, which did not mention cumulative effects. *BCEAA 2002* discusses cumulative effects in section 11, outlining the executive director's discretion for determining assessment scope, procedures and methods. An excerpt from the legislation is provided below.

> **(2)** The executive director's discretion under subsection (1) includes but is not limited to the discretion to specify by order one or more of the following:
>
> a) the facilities at the main site of the reviewable project, any of its off-site facilities and any activities related to the reviewable project, which facilities and activities comprise the reviewable project for the purposes of the assessment;
>
> **b)** the potential effects to be considered in the assessment, **including potential cumulative environmental effects** [Emphasis added].

According to this legal text, *BCEAA 2002* allows but does not require assessment of cumulative effects for project-specific EAs. However, CEA is undertaken quite frequently for large projects that trigger EAs and is assessed based on provincial guidance. For smaller projects that do not trigger an EA, CEA is not performed. There are many issues surrounding this as the cumulative impact of these small projects may be quite large in combination (Clogg & Carlson, 2013a).

3.6. Issues with CEA

Scholars have pointed out that many problems exist regarding how cumulative effects are addressed in Canada (Baxter et al., 2001; Duinker & Greig, 2006; Noble, 2010). The main overarching issue with CEA is that it is usually conducted only for projects that trigger EAs in the first place. Many projects that trigger EAs are large in scale and have the potential to cause a significant adverse effect on one or multiple VCs. While CEA may be conducted for these large scale projects, it is not conducted for small projects (e.g. road construction or urban development) (Forest Practices Board, 2011). Realistically, if small projects are being authorized on a regular basis, they are likely to eventually have a cumulative impact on a VC. The problem is that there is no inventory of the impacts that multiple small-scale projects are having on a VC, and thresholds are not being set or monitoring is not conducted to assess effects. This concept of assessing all impacts in a region—small or large— is fundamental to CEA, and yet it is not being practiced.

Another issue related to CEA involves the scoping of the spatial boundaries used in the CEA. In practice, many CEAs are performed at a project-level scale, a spatial scale that is too small to fully capture the effects from multiple projects and activities in a region. Individual projects contribute only a small amount of impact or disturbance to resources and ecosystem functioning in relation to the interacting processes and complex pathways that occur in a region (Duinker & Greig, 2006; Noble, Hill, & Nielsen, 2011; Seitz et al., 2011). CEA must go beyond the evaluation of site-specific, direct and indirect project impacts to encompass sources of cumulative environmental change; however, in current practice, the proponent is not required to do this far beyond the project footprint (CCME, 2009; Gunn & Noble, 2011)

Similarly to spatial scoping, temporal scoping in CEA is often narrow, which makes the predicted cumulative effects highly uncertain. Ideally, all the impacts from past, present, and reasonably foreseeable projects and activities should be scoped into the CEA. Scoping past projects and activities into the CEA and quantitatively or qualitatively describing their impacts proves to be difficult as there is often little to no historical data available on baseline conditions and the degree to which past projects and activities impacted the environment. Because of this, temporal scales are normally set back to the

oldest project or activity in a region for which baseline data is available, which may not adequately capture all past effects. Furthermore, assessing future projects and activities in a region is also difficult as these projects and activities and their cumulative impacts are often uncertain. It may be possible to predict what types of projects and activities a region will see in the future based on current and projected development trends, regional planning, or simulation modelling. However, it is difficult to determine the impacts that the combination of these projects and activities will have on certain VCs, and in practice, these impacts are often not adequately considered. Overall, the failure to adequately scope projects and activities into the CEA, either spatially or temporally, and quantify their effects accurately results in a poor CEA.

Baseline data collection is another large issue in CEA. The definition of baseline conditions is regularly debated in the literature and in practice. On one hand, baseline conditions can be considered as present day conditions (i.e. that have been impacted by past projects) or can be interpreted as past conditions (i.e. where VCs have not been impacted, representing pristine conditions). In practice, baseline conditions are often defined as present-day conditions and therefore the CEA does not take into account the original state of the VC. In this approach, CEA is conducted in a system that has not been recognized as being affected by other projects or activities that have occurred in the past.

Additionally, there is often a lack of baseline data for many VCs. Data may not exist or may be difficult to collect and it is up to the proponent to collect the data themselves. Proponents may do a poor job with data collection in terms of methodology, sample sizes, or length of time for completing a study, as long-term baseline studies are time consuming and expensive. Having a small amount of baseline data or having incorrect baseline data compromises the CEA as the actual conditions of the VC are not being assessed, and therefore cumulative effects predictions will ultimately be incorrect. Furthermore, proponents may argue that collecting baseline data for cumulative effects in a region is outside their responsibility, as their single project is only part of the region that may be impacted (Duinker & Greig, 2006). This issue with insufficient baseline data is further complicated due to jurisdictional issues, lack of monitoring programs or initiatives in regions, and poor documentation.

Finally, it is apparent that cumulative effects may go unchecked when decisions are being made about proposed development actions. CEA is performed on a project- by-project basis and does not proactively consider the desired future of a region (Noble, 2010). Overall, these elements must be linked together by a supportive policy framework that ensures that the goals of CEA are being achieved and that responsible decisions are being made. There is little consensus on the appropriate methodology for conducting CEA or in considering decisions for future developments (MacDonald, 2000).

Chapter 4.

Project Background

4.1. Introduction

In this chapter, I provide a background on the PNW project that I use for this case study evaluation. I begin by providing an overview of the LNG market in Canada and the current state of Canada's natural gas resources. Next, I provide an overview of the PNW project, outlining the location, key project components and project design, costs, and employment. I then provide an overview of the provincial and federal EA processes and discuss how the PNW project was assessed in each process. Finally, I identify the CEA methodology used by the proponent as well as project-specific environmental effects and cumulative effects from the PNW project.

4.2. What is LNG?

LNG is natural gas that has been cooled to a liquefied state. Natural gas is a naturally occurring hydrocarbon that is composed primarily of methane and often contains trace amounts of ethane, butane, propane and pentene (Natural Resources Canada, 2016). Other impurities such as mercury, water, oxygen, carbon dioxide and sulphur compounds may also be present in the natural gas and are removed during the processing phases (Natural Resources Canada, 2016). To convert natural gas to liquefied natural gas it is chilled to -162 degrees Celsius and becomes a clear, colorless, odourless liquid that is 1/600th of its original volume (Natural Resources Canada, 2016). The cooled gas is stored in insulated tanks at a LNG facility until it is ready to be transported. LNG can be transported via pipelines and trucks or through the use of LNG carriers. Once the LNG arrives at its destination, the LNG is offloaded to a regasification plant where it is heated, returning it to its gaseous state. The natural gas is then transported via pipelines to customers, providing energy for homes and industry.

4.2.1. Canada's Natural Gas Resources and Reserves

Natural gas is found in underground rock formations of porous rocks. The natural gas is sealed within these porous formations under impermeable caprock, and usually remains underground until extracted. Natural gas is found in conventional reserves that can be extracted through drilling wells and in unconventional reserves (such as shale gas, tight gas, sour gas, and coal bed methane) that require specific extraction techniques such as fracking (Holz, Richter, & Egging, 2015).

The majority of Canada's natural gas deposits are found in the Western Canada Sedimentary Basin (WCSB), located in northeastern BC along the BC/Alberta border (Figure 4.1) (Gomes, 2015). The WCSB holds approximately 90% of Canada's natural gas reserves which can produce a combined total of 748 trillion cubic feet of natural gas (CAPP, 2015; Gomes, 2015). As of 2010, 95% of Canada's natural gas production is from conventional sources, and the remainder is from unconventional sources (such as tight gas, shale gas and coal bed methane) (Natural Resources Canada, 2016).

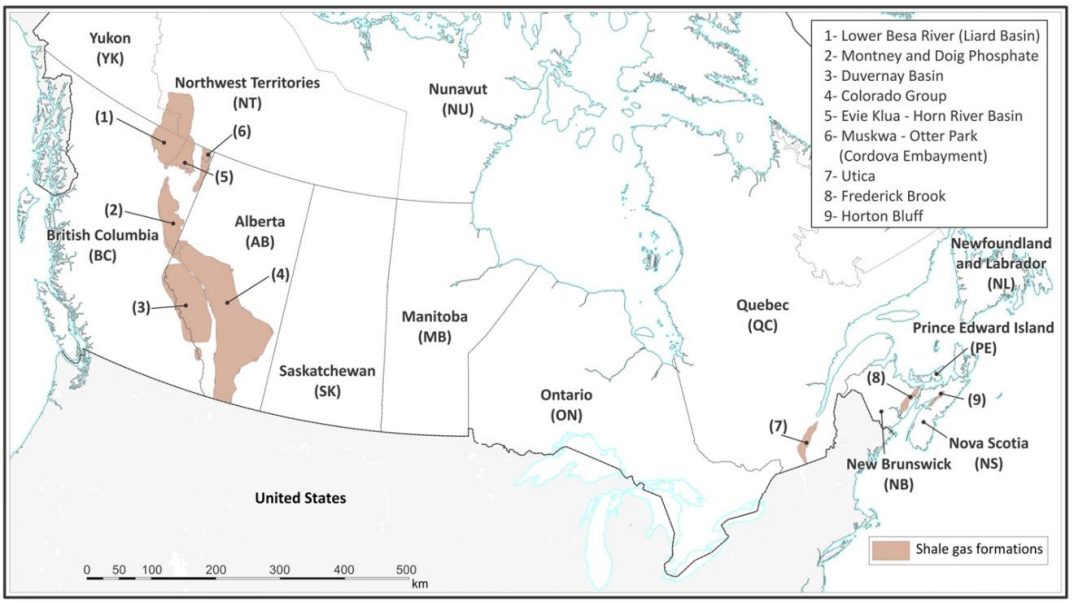

Figure 4.1. Shale Gas Reserves in Canada
Source: Rivard et al. (2014)

4.2.2. Canada's Natural Gas Market

Since the 1980's the domestic demand for natural gas has been steadily increasing (Statistics Canada, 2013). In 2013, there were six billion natural gas consumers in the residential, industrial and commercial markets who consumed a combined total of approximately 3,000 billion cubic feet (BCF) of natural gas (Gomes, 2015; CAPP, 2015, Statistics Canada, 2013). Internationally, there is a demand for natural gas for similar residential, industrial and commercial purposes. Currently, Canada's only natural gas export market is the US, to which Canada supplied 2,700 BCF in 2013 (CAPP, 2015). Natural gas is shipped from Canada to the US Northeast, Midwest and California markets via multiple major pipelines (Figure 4.2) (CAPP, 2015).

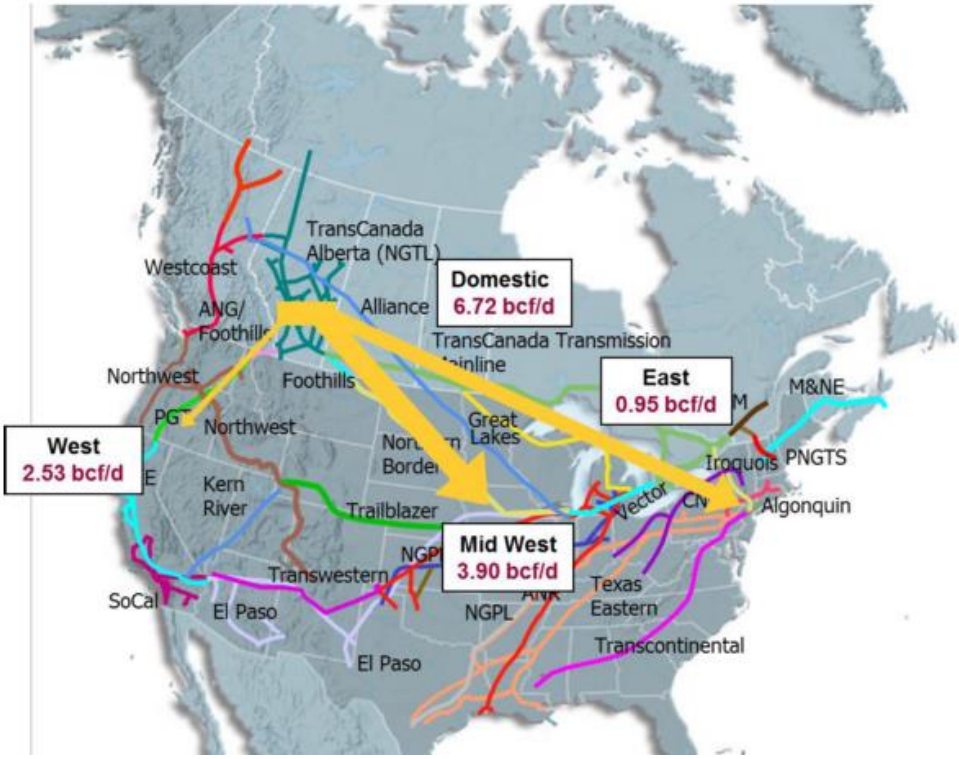

Figure 4.2. North American Natural Gas Export and Import Routes.
Source: CAPP (2015)

In recent years, the North American natural gas market has changed significantly. Canada's natural gas exports to the US have declined 20% from 2010-2014 due to increased production of natural gas in the US, and construction and wider distribution of pipelines (Gomes, 2015; Canadian Gas Association & Statistics Canada, 2015) (Figure

4.3). Major US pipelines are now able to transport natural gas to markets that were traditionally supplied by Canadian natural gas, thereby creating competition. Furthermore, due to the proximity of US natural gas pipelines to provinces such as Ontario and Quebec, consumers in these regions have begun to enter into short-term agreements with US gas suppliers, resulting in a lower cost compared to natural gas sourced and transported from the WCSB (CAPP, 2015). This decrease in consumption from the WCSB has resulted in portions of the TransCanada Mainline system operating at as low as 50% capacity (CAPP, 2015).

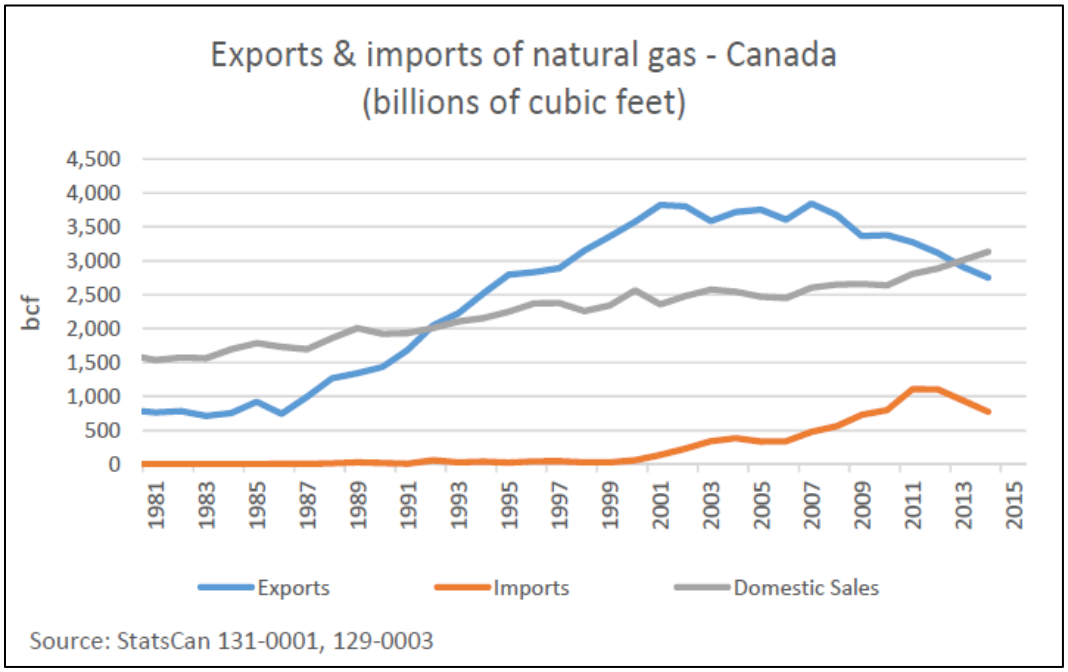

Figure 4.3. Natural Gas Export and Import Rates in Canada.
Source: Canadian Gas Association & Statistics Canada (2015)

4.3. The Rise of LNG in Canada

In 2012, the BC provincial government announced its plans to develop the LNG sector in BC. These plans aim to grow and strengthen the economy by developing new LNG projects thereby creating jobs and diversifying natural gas markets (BC Ministry of Energy and Mines, 2012). In addition to keeping BC competitive in the global LNG market, the plan also seeks to maintain BC's leadership on climate change and clean energy and

to keep energy rates affordable for families, communities and industry (BC Ministry of Energy and Mines, 2012).

Canada is currently exploring alternative markets for natural gas export, with a focus on Asian markets. In recent years, the natural gas price in Asia has exceeded prices in North America (Figure 4.4). This price differential has motivated producers to attempt to meet the growing demand for LNG in Asia and make stable, long-term agreements for LNG export.

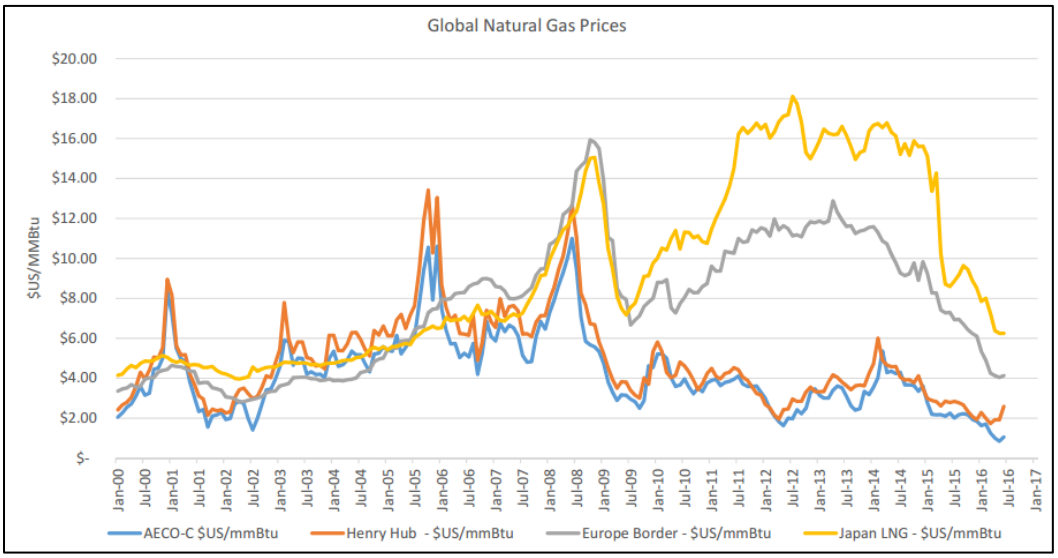

Figure 4.4. Global Natural Gas Prices.
Source: Canadian Gas Association, US Federal Reserve & World Bank (2016)

As of 2015, there were 20 LNG projects proposed for BC. The majority of the projects are located on the North Coast of BC, particularly near Kitimat and Prince Rupert. Table 4.1 provides the details of each of the proposed LNG projects. As of June 2016, three LNG projects have received an Environmental Assessment Certificate by the federal and provincial government— Kitimat LNG, LNG Canada and Woodfibre LNG.

Table 4.1. LNG Facilities Proposed in BC

Project	Location	Production (MTPA)	Projected In Service Date	Cost ($ billion CAD)
Malahat LNG	Bamberton	6	TBD	TBD
Sarita LNG	Port Alberni	24	2022	30
Discovery LNG	Campbell River	20	2021	2
WesPac Tilbury	Delta	3.5	2018	0.175
Woodfibre LNG	Squamish	2.1	2018	0.160
Cedar LNG	Kitimat	14.5	2020	TBD
BC LNG (Douglas Channel) LNG	Kitimat	5.5	2018	0.600
Kitimat LNG	Kitimat	10	TBD	4.5
LNG Canada	Kitimat	30	2022	25
Triton LNG	Kitimat	2.3	2019	TBD
Kitsault Energy Project	Kitsault	20	2018	34
Pacific NorthWest LNG	Prince Rupert	18	2019	11.4
Prince Rupert LNG	Prince Rupert	21	2020	10
Aurora LNG	Prince Rupert	24	2023	3.5
Grassy Point LNG	Prince Rupert	20	2021	10
New Times Energy Ltd.	Prince Rupert	12	2019	TBD
Orca LNG	Prince Rupert	24	2019	TBD
Watson Island LNG	Prince Rupert	TBD	TBD	TBD
WCC LNG Ltd.	Prince Rupert	30	2023	25
Canada Stewart Energy Project	Stewart	30	2025	TBD
Total:				**156.335**

Source: BC Ministry of Jobs, Tourism and Skills Training (2015)

To supply natural gas to the LNG facilities, multiple natural gas pipelines are proposed. As of 2015, six major natural gas pipelines were proposed in BC. Table 4.2 provides the details on the proposed natural gas pipelines. It is important to note that as part of the EA process, natural gas pipelines are assessed separately from the facilities that they aim to serve. Additionally, if the pipelines cross provincial boundaries, the regulatory authority is the NEB rather than the BCEAO or CEAA.

Table 4.2. Natural Gas Pipelines Proposed in BC

Project	Location	Length (km)	Projected In Service Date	Cost ($ billion CAD)
Eagle Mountain—Woodfibre Gas Pipeline	Coquitlam to Squamish	52	TBD	0.350
Coastal GasLink Pipeline Ltd.	Dawson Creek to Kitimat	670	2019	4
Pacific Northern Gas Looping Project	Summit Lake to Kitimat	525	2016	0.130
Pacific Trails Pipeline Project	Summit Lake to Kitimat	463	TBD	1.3
Prince Rupert Gas Transmission Project	Hudson's Hope to Prince Rupert	900	2019	5
Westcoast Connector Gas Transmission Project	Northeast BC to Prince Rupert	850	2020	6
Total:				**16.780**

Source: BC Ministry of Jobs, Tourism and Skills Training (2015)

While the LNG industry will provide economic benefits and employment opportunities for Canadians, it also has the potential to contribute to negative environmental, socioeconomic and cultural impacts. Collectively, these impacts will be seen in all aspects of the project including extracting natural gas, pipeline and facility construction, and decommissioning.

4.4. PNW Project Location

PNW is located in northwestern British Columbia on Lelu Island (Figure 4.5). This small, 192-hectare island is situated within the Skeena River estuary between Ridley Island to the north, Stapledon Island to the east, and Smith Island to the south. Lelu Island is located on Crown land and is under the jurisdiction of the Prince Rupert Port Authority (PRPA). PNW is also located within the District of Port Edward. While Lelu Island is uninhabited, PNW is adjacent to local commercial and recreational fishing areas as well

as major infrastructure such as the Prince Rupert Airport, the Port of Prince Rupert, and the CN railway (Stantec Consulting Ltd., 2014).

PNW is also located within the claimed traditional territory of five First Nations who assert Aboriginal rights within the area. These include: the Metlakatla First Nation, Lax Kw'alaams First Nation, Gitxaala Nation, Kitselas First Nation, and Kitsumkalum First Nation (Halpin & Seguin, 1990). The closest reserve is that of the Metlakatla First Nation, which is located approximately 10 kilometers northwest of Lelu Island. Lelu Island is also recognized as an important site for food, social and ceremonial purposes by these First Nations as it is used for hunting, fishing, and gathering purposes as well as cultural and spiritual purposes. This region also has heritage purposes as it contains archaeological sites including culturally modified trees (Stantec Consulting Ltd., 2014).

PNW is situated in the Coastal Western Hemlock Very Wet Hypermaritime biogeoclimatic zone, which receives the most precipitation of any zone in BC on average. The vegetation in this region is dominated by western hemlock, western red cedar, and Douglas fir (Pojar, Klinka & Demarchi, 1991). PNW's project site is situated on, or in close proximity to, wetlands, bogs, marshes, and freshwater streams that support various amphibian and reptile species, including western toad (listed on the *Species at Risk Act* (SARA) Schedule 1). Within the Prince Rupert region, approximately 359 species of terrestrial mammals, amphibians and birds have been recorded (Radcliffe et al., 1994). Mammals whose range overlaps with the impacts of the PNW project include grizzly bear, grey wolf, coyote, black-tailed deer, Pacific marten, red squirrel, and various bat species. The region is also within the ranges of multiple terrestrial and marine bird species, including species at risk such as marbled murrelet (SARA Schedule 1). In the marine environment surrounding PNW's project site, there exist many sheltered areas that contain soft substrates that provide ideal habitat for bivalves and eelgrass (Stantec Consulting Ltd., 2014). Eelgrass habitat can be found in Flora Bank and Agnew Bank, located west and southeast of Lelu Island, respectively. These eelgrass beds have various ecological roles including supporting the rearing juvenile salmon and crustaceans such as Dungeness crab and *Pandalus* shrimp and are classified to have a high environmental value (AECOM, 2011). Deep water areas found just off Lelu Island are dominated by unconsolidated mud, sand, and gravel and are interspersed with rocky reefs that support

fish, crabs and marine mammals such as harbour porpoise, whales, and sea lions (Stantec Consulting Ltd., 2014).

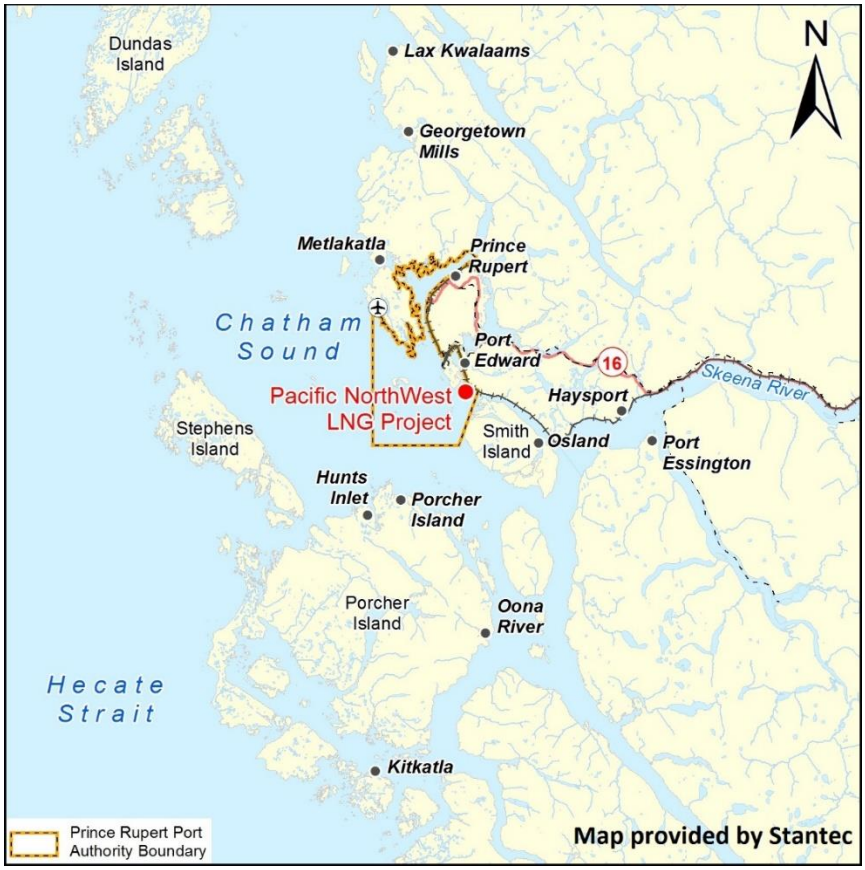

Figure 4.5. Location of PNW.
Source: Stantec Consulting Ltd. (2014)

4.5. Project Layout and Design

If approved, PNW will have a project development area (PDA) of 261 hectares (Stantec Consulting Ltd., 2014). Approximately 160 hectares (84%) of Lelu Island will be used to construct the LNG facility, 100 hectares will be used to construct the marine terminal, and one hectare will be used to construct a bridge and road system connecting Lelu Island to the mainland (Stantec Consulting Ltd., 2014).

The original design of PNW included three LNG trains, three LNG storage tanks, a marine terminal with a trestle and two berths, a material off-loading facility (MOF), a bridge and road network, administrative buildings, and a work camp at full build-out.

However during the EA process, the design and project components for PNW have been modified based on recommendations from the provincial and federal governments and to address key concerns from stakeholders and First Nations that were involved in the process. As a result, the proponent made several design changes to reduce the effects from PNW (Table 4.3). As part of the ongoing federal review of the project, the locations of each of these project components still remain subject to change (Figure 4.6).

Table 4.3. Project Design Changes as a Result of the BCEAO and CEAA's EA

Project Feature	Project Change	Purpose of Change
Site Layout	A vegetated riparian buffer would be maintained that extends 30 m inland from the high-water mark around Lelu Island	• Avoids removal of culturally modified trees • Provides visual barrier for the Project • Maintains some habitat on Lelu Island
Main flare tank	Moved to southeast location	• Moved to southeast location
Gas turbines	Switched from industrial gas turbines to aero-derivative gas turbines	• Reduces GHG air emissions
Bunker fuel	Bunker refueling removed	• Eliminates risk of bunker fuel spill while refueling • Eliminates potential effect on marine and terrestrial species and habitats
Propane Use and Storage	Propane use and storage removed from the Project design	• Reduces the quantity of hazardous materials stored on site • Reduces the complexity and safety risks associated with unloading of propane from marine vessels • Reduces marine traffic
Marine Terminal	Increased clearance near Lelu Island to 11.3 m	• Allows passage of gillnetters and smaller vessels • Reduces navigational effects of terminal
Marine Terminal	Suspension bridge span of jetty over Flora Bank	• Eliminates dredge of Flora Bank, and associated disposal at sea of sediment • Reduces marine traffic effects during construction • Avoiding effects on marine resources
Marine Terminal	Lengthened from 2.4 km to 2.7 km	• Eliminates dredge of marine terminal for construction or maintenance, and associated disposal at sea of sediment • No armoring required at the berth • No breakwaters required

Project Feature	Project Change	Purpose of Change
		• Reduces marine traffic effects during construction • Reducing effects on marine resources
Bridge from Lelu Island to mainland	Increased clearance to 11.3 m	• Allows passage of gillnetters and smaller vessels • Reduces navigational effects of bridge
Worker Camp	Construction worker camp to be third party owned and operated, and located in Port Edward and/or Prince Rupert area	• Eliminates need for utility lines to be trenched through Lelu Slough • Eliminates need for generators to supply power to worker camp

Note: Adapted from Stantec Consulting Ltd. (2014) and BCEAO (2014)

Figure 4.6. PNW Site Layout and Project Components.
Source: Pacific NorthWest LNG (2016)

The project proponent (PETRONAS) indicated that it placed a high importance on the environmental design and performance of PNW (PETRONAS, 2014). PETRONAS committed to reducing GHG emissions, employing the latest technologies, adopting a zero venting and flaring philosophy, and optimizing plant layout master planning in accordance with local topography, environmental issues and archaeological values on Lelu Island (Stantec Consulting Ltd., 2014). According to PETRONAS, its Technical Standards will also be employed at PNW to ensure an optimal engineering design and to meet health, safety and environment standards at the facility. These Technical Standards include: air emission management, GHG monitoring, reporting and verification, wastewater management, environmental incident prevention and control implementation, spill contingency planning, and decommissioning, remediation, and reclamation (PETRONAS, 2014; Stantec Consulting Ltd., 2014).

Overall, PNW will be designed to allow for continuous operation— 24 hours a day, 365 days a year (Stantec Consulting Ltd., 2014). Routine inspections, testing, and system maintenance will be conducted by trained and certified staff on an ongoing basis for safety, performance, and efficiency measures.

4.6. Key Project Components & Project Design

Due to the size of the project, PNW's components will be constructed in two phases (Table 4.4). As per industry standards, the LNG facility will be divided into manufacturing and non-manufacturing areas which consist of different project components (Stantec Consulting Ltd., 2014). Manufacturing areas will include components such as LNG trains, LNG storage tanks, and utilities and offsite. Non-manufacturing areas will consist of components such as administration and maintenance buildings (Stantec Consulting Ltd., 2014). During construction, temporary construction facilities (TCFs) will be built to service the delivery and storage of construction materials and will be removed once the project is complete.

Table 4.4. PNW Project Phases

Component	Phase 1	Phase 2
LNG Trains	• Two trains (12.8 MTPA)	• Third train added (6.4 MTPA)
LNG Storage and Offloading	• Two 180,000 m^3 storage tanks • Trestle with two berths • 2.7 km cable suspension bridge • 1.1 km jetty from Lelu Island to Chatham Sound	• One additional 180,000 m^3 storage tank
Utilities and Offsite	• Utilities and offsite developed to cater two trains	• Utilities and offsite expanded to cater the third train
Non-Manufacturing Facilities	• MOF • Bridge and roads	• MOF may be refurbished depending on delay between Phase 1 and Phase 2
Temporary Construction Facilities	• TCFs developed to support construction and commissioning of two trains	• Some TCFs to be developed and some may be refurbished from Phase 1, depending on time gap

Note: Adapted from Stantec Consulting Ltd. (2014) and BCEAO (2014)

4.6.1. LNG Trains

LNG trains are used to receive, convert, and purify natural gas. The LNG trains will receive natural gas from the Prince Rupert Gas Transmission (PRGT) and will convert and purify the gas using multiple units (Table 4.5). From there, the treated natural gas will be stored in cryogenic storage tanks and will be loaded onto LNG vessels at one of the two berths. During Phase 1 of the project, two LNG trains will be constructed and a third train will be added in Phase 2. Each LNG train will be capable of producing 6 MPTA of LNG with a combined total 18 MTPA at full build-out.

Table 4.5. Main Process Units of a LNG Train.

Unit	Purpose
Feed gas receiving unit	Receives natural gas supplied by the PRGT and connects it to PNW's system
Pressure let down unit	Regulates potentially fluctuating pipeline pressure
Gas treatment unit	Removes carbon dioxide and other contaminants using a water-based solvent of activated methyl diethanolamine
Gas dehydration unit	Prevents freezing in the cryogenic sections of the LNG train
Mercury removal unit	Removes traces of mercury from the gas through the use of sulfur impregnated activated carbon or metal hydride based catalysts

Unit	Purpose
Fractionation unit	Recovers fractions of methane, butane, propane and butane that are recycled and used to drive the facility
Liquefaction unit	Cools LNG to a liquid (at -160°C)

Note: Adapted from Stantec Consulting Ltd (2014)

4.6.2. LNG Storage and Off-loading

Once the LNG trains process the natural gas, it will be stored in LNG storage tanks (Stantec Consulting Ltd., 2014). The LNG storage tanks will be situated just north of the LNG trains and will be made of reinforced concrete, with an inner tank made of 9% nickel steel that will support cryogenic uses. The inner and outer tanks will be liquid and vapour-tight and will contain instruments that monitor the levels of LNG, pressure, temperature, leak/gas detection, cool down control, and fire detection (Stantec Consulting Ltd., 2014). Two LNG storage tanks are to be built in Phase 1 and one additional tank will be added in Phase 2.

4.6.3. Marine Infrastructure

Marine infrastructure for PNW covers approximately 100 hectares and consists of multiple components including a marine trestle, a marine terminal, and a MOF. The marine trestle is a bridge-like structure that will be built off the southwest portion of Lelu Island, over Flora Bank to attach project components on Lelu Island to the marine terminal. The purpose of the marine trestle is to transport LNG from LNG storage tanks to the LNG carriers at berths via pipes, known as loading and vapour return arms. The marine trestle has been designed with sufficient height to allow vessels to pass underneath (approximately 11 meters in height) and to reduce the effects of shading on sensitive eelgrass habitat below.

At the end of the marine trestle will be the marine terminal, approximately 2.4 kilometers southwest of Lelu Island. The marine terminal will include a field control room, LNG carrier berths, loading arms, and insulated cryogenic piping. Two LNG carrier berths will be constructed to allow for the docking and receiving of LNG from the facility. These berths will be able to accommodate two LNG carriers up to 315 meters in length with

storage capacities of 217,000 m^3 (Stantec Consulting Ltd., 2014). Construction of the marine terminal, access channels, and the associated turning basin require dredging an estimated 7 million m^3 of marine substrate. This dredging covers an area of 84.6 ha, to a depth of 15.6 meters (Stantec Consulting Ltd., 2014).

The MOF will be constructed on the north end of Lelu Island in Porpoise Channel and will be used to aid in lifting heavy equipment and will help transport materials required for construction (Stantec Consulting Ltd., 2014). Construction of the MOF and the associated turning basin requires dredging an estimated 690,000 m^3 of marine substrate. This dredging covers an area of 5.4 ha, to a depth of 10 meters (Stantec Consulting Ltd., 2014). Construction of the MOF will use drilled piles and will continue year-round until complete.

4.6.4. Marine Shipping

LNG carriers that will load and transport LNG from PNW will use shipping routes established by the Pacific Pilotage Authority and BC Coast Pilots into the Port of Prince Rupert. The LNG carriers will use existing routes used by current deep sea vessels that enter north coast waters north of Haida Gwaii, through the Dixon Entrance and continue north of Stephens Island into the Port of Prince Rupert (Stantec Consulting Ltd., 2014). From there, LNG carriers will be escorted to Lelu Island using tug boats— the size and number of which will be determined by the PRPA's policies and procedures.

The responsible party for the transport of LNG is yet to be determined and will be based on contractual agreements that will be signed between PNW and its customers (Stantec Consulting Ltd., 2014). PNW may retain or transfer the ownership of the LNG through the signing of an ex-ship delivery agreement or a free-on-board delivery agreement, respectively. The ex-ship delivery agreement will make PNW responsible for its transport to the customer's port and have liability until the LNG is offloaded (Stantec Consulting Ltd., 2014). Alternatively, the free-on-board delivery agreement will allow PNW to transfer ownership of the LNG as the LNG is loaded onto LNG carriers and leaves the terminal. The customer will therefore be responsible for supplying a vessel, either its own or one owned by a third-party (Stantec Consulting Ltd., 2014).

4.7. Project Costs

The construction cost for PNW has been budgeted at $11.4 billion CAD (2013 dollar), and is part of a larger $36 billion CAD (2013 dollar) undertaking to ship LNG from Canada to Pacific-Rim markets (Stantec Consulting Ltd., 2014). Project costs estimated by Stantec Consulting Ltd. (2014) are considered to be accurate within ±40% for Phase 1 of the project. For the construction phase, 60% of the cost will be spent by the prime contractor in obtaining material, equipment, and labour to build PNW, 20% will be spent by sub-contractors for site preparation, construction of marine facilities, storage tanks, and buildings, and the final 20% will consist of owner's costs (Stantec Consulting ltd., 2014). The costs of Phase 2 have not been assessed in the Stantec Consulting Ltd. (2014) report. Overall, it is estimated that 32% of the labour, goods, and services required for engineering, procurement, construction, and commissioning will be procured from Canadian sources and will represent a total expenditure of $3.4 billion CAD (Stantec Consulting Ltd., 2014).

Operational costs over the lifetime of the project are estimated to be approximately $2.8 billion CAD (Stantec Consulting Ltd., 2014). Project construction and transportation of natural gas to PNW are estimated to account for 54% of the total operational costs and various municipal, provincial and federal taxes, while direct labour and maintenance will represent the remaining 46% of the costs (Stantec Consulting Ltd., 2014). Decommissioning costs are currently unknown as the final costs will depend on decommissioning requirements at cessation of operations and will be dependent on the state of the facility and the lease agreement with the PRPA (Stantec Consulting Ltd., 2014).

4.8. Employment

Pacific NorthWest LNG (2016) estimates that PNW will create 4,500 jobs over the four-year construction phase, 330 long-term jobs during operations, and approximately 300 local spin-off jobs in nearby communities such as Port Edward and Prince Rupert. These estimates are slightly different than the employment estimation submitted in Stantec Consulting Ltd. (2014) which suggests that 4,000 construction jobs and 464

operations jobs will be created from PNW (Stantec Consulting Ltd., 2014). Overall, it is estimated that the majority of these job will be created for Canadian workers.

The direct, indirect and induced employment for the construction and operation phases of PNW is outlined in Table 4.6. In total, PNW is expected to provide 44,820 person years (PYs) of employment for Canada and 27,455 for BC throughout the two phases. Table 4.6 shows that for every direct employment job in the construction phase, 1.4 indirect PYs in Canadian business will be required to provide goods and services for construction. During the operation phase, 6.5 indirect jobs in Canadian businesses would be created. Stantec Consulting Ltd (2014) notes that these numbers may largely be due to the fact that the majority of the operations jobs will be related to the purchasing and the transport of natural gas from northeast BC to Lelu Island. As a result, 2,030 indirect jobs in natural gas exploration and production of natural gas in BC would be required (Stantec Consulting Ltd., 2014). Induced employment results from consumer spending by people who are directly and indirectly employed on project construction (Stantec Consulting Ltd., 2014). For Canada, there would be 0.4 PYs of induced employment for every direct and indirect PY during the construction and operation phases, resulting in 54% and 61% of induced employment in BC, respectively.

Table 4.6. Estimated Employment Generated from PNW.

Project Phase	Employment	Canada (PYs)	British Columbia (PYs)
Construction	Direct	8,000	8,000
	Indirect	18,890	8,655
	Induced	11,045	5,995
	Total	**37,935**	**22,650**
Operation	Direct	650	650
	Indirect	4,205	2,915
	Induced	2,030	1,240
	Total	**6,885**	**4,805**

Note: Adapted from Stantec Consulting Ltd. (2014)

4.9. The Regulatory Review Process for PNW

PNW underwent a coordinated environmental review administered by CEAA and the BCEAO in which each government reviewed the project and made a separate decision on the issuance of an EA Certificate. The Stantec Consulting Ltd. (2014) report formed the basis of both the federal and provincial EA reviews. While the provincial review was a relatively short process, the federal review has been long and complex, and is ongoing as of June 2016. The environmental review process of PNW under the provincial and federal governments will be outlined below.

The application review for PNW began in March 2014. The provincial review went relatively smoothly throughout the application review period, without any major stops. On the 163rd day of the review, the BCEAO requested a 45-day extension to review additional information and address concerns raised by stakeholders, government agencies and First Nations groups, thereby extending the review period until November 5, 2014. On November 5, 2014, the BCEAO referred the project to the Ministers to decide on whether to issue an EA Certificate. On November 25, 2014, the Ministers granted the EA Certificate.

The federal review was long, complex and is still ongoing. As of June 2016, the federal review has paused six times since the submission of the Environmental Impact Statement (EIS) due to information requests from government. Table 4.7 outlines the federal timeline for PNW. The federal review from the beginning of the application review stage to the EA decision stage typically takes 12 months if it is conducted by CEAA. PNW has taken 27 months to date. This does not include the three month extension period granted by the MOE into account.

Table 4.7. Federal Timeline for the Review of PNW.

Date	Description of Event
June 7, 2013	The timeline was paused with CEAA issued the EIS Guidelines to the proponent.
August 21, 2013	The timeline resumed when CEAA held an extended comment period on the EIS Guidelines from August 21 to September 20, 2013.
September 27, 2013	The timeline was paused when CEAA notified the proponent that no changes were required to the EIS Guidelines previously issued
February 28, 2013	The timeline resumed when the proponent submitted the EIS to CEAA
May 9, 2014	The timeline was paused when an information request regarding project effects on fish habitat and modelling was issued to the proponent by CEAA.
December 12, 2014	The timeline resumed when the proponent responded to the information request.
February 23, 2015	The timeline paused when further information on sediment transport, hydrodynamic changes, and effects to fish and fish habitat was requested by CEAA.
May 10, 2015	The timeline resumed when the proponent responded to the information request.
June 2, 2015	The timeline paused with CEAA issued a follow-up letter to the proponent requesting outstanding information from previous requests.
November 10, 2015	The proponent responded to the follow-up letter.
December 11, 2015	The timeline resumed when CEAA determined that a final response provided by the proponent adequately responded to the June 2 follow-up letter.
March 18, 2016	The timeline paused when an information request regarding impacts to fish and fish habitat was submitted by CEAA to the proponent. Additionally, the MOE granted a 90-day extension for the project review once the proponent submitted the required information to CEAA.
June 17, 2016	The proponent responded to the information request.
June 27, 2016	The timeline resumed when CEAA determined that a final response provided by the proponent adequately addressed the information request.

4.10. Assessment of Project Effects and Cumulative Effects

Stantec Consulting Ltd. (2014) assessed a wide range of potential project effects from PNW in the EA application, including cumulative effects. The Stantec Consulting Ltd. (2014) report reviews the biophysical, social, economic, cultural, and heritage VCs identified in the application throughout all the project phases including construction,

operation and decommissioning. As previously mentioned, the biophysical VCs are the main focus of this evaluation and are summarized in Table 4.8.

Table 4.8. Overview of Project Effects from PNW.

VC	Potential Project Effects	Significance (Confidence)
Air Quality	Increase in CAC concentrations	Not significant (High)
GHG Management	Emission of GHG gasses (CO_2, CH_4, N_2O) from LNG facility	Not significant (*)
Acoustic Environment	Increase in noise levels	Not significant (Moderate)
Ambient Light	Increase in ambient lighting	Not significant (High)
Vegetation and Wetland Resources	Change in abundance of plant species of interest	Not significant (Moderate)
	Change in abundance or condition of ecological communities	Not significant (Moderate)
	Change in wetland functions	Not significant (High)
Terrestrial Wildlife and Marine Birds	Change in wildlife habitat availability	Not significant (Moderate)
	Risk of mortality	Not significant (Moderate)
	Alteration of movement or behaviour patterns	Not significant (High)
Freshwater Aquatic Resources	Change in (permanent alteration or destruction) of fish habitat	Not significant (High)
	Change in food and nutrient content	Not significant (High)
	Increased risk of fish mortality	Not significant (High)
Marine Resources	Change in sediment or water quality	Not significant (Moderate)
	Change in (permanent alteration or destruction) of fish habitat	Not significant (High)
	Direct mortality or physical injury to fish or marine mammals	Not significant (Moderate)
	Change in behaviour of fish or marine mammals	Not significant (Moderate)

Note: * No confidence determination was made in the Stantec Consulting Ltd. (2014) report for the GHG Management VC.

In terms of the project effects, all of the biophysical VCs that were assessed were shown to have residual effects, however Stantec Consulting Ltd. (2014) concluded that these effects would not be significant. The GHG Management VC was not assessed for residual effects as per CEAA guidance (2003). The guidance indicates that based on the CEAA method for incorporating GHG considerations in environmental assessments, the environmental assessment process cannot consider the bulk of GHG emitted from already

existing developments. Furthermore, unlike most project-related environmental effects, the contribution of an individual project to climate change cannot be measured (CEAA, 2003).

4.10.1. CEA Methodology used in the PNW Application

The CEA for PNW uses the approach outlined in the CEAA's *Operational Policy Statement Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act* (2007). The CEA considers the baseline effects that have resulted from past projects or activities, the cumulative contribution of residual environmental effects from PNW, and the cumulative contribution of other known or reasonably foreseeable projects and activities (Stantec Consulting Ltd., 2014).

The application indicates that a detailed CEA is only included for VCs that are shown to have residual effects and if all three following conditions are met:

- The Project results in a demonstrable or measurable residual effect on a component of the biophysical or human environment
- The project-specific residual effect on that VC does, or is likely to, act in a cumulative fashion with the effects of other past, existing or future projects and activities in the area (i.e., there is an overlap of effects)
- There is a reasonable expectation that the combined cumulative effects of all other projects and the project-specific effects, together, will adversely affect the resource value in a meaningful way.

If all three of these conditions are met, the CEA follows the process outlined in Figure 4.7.

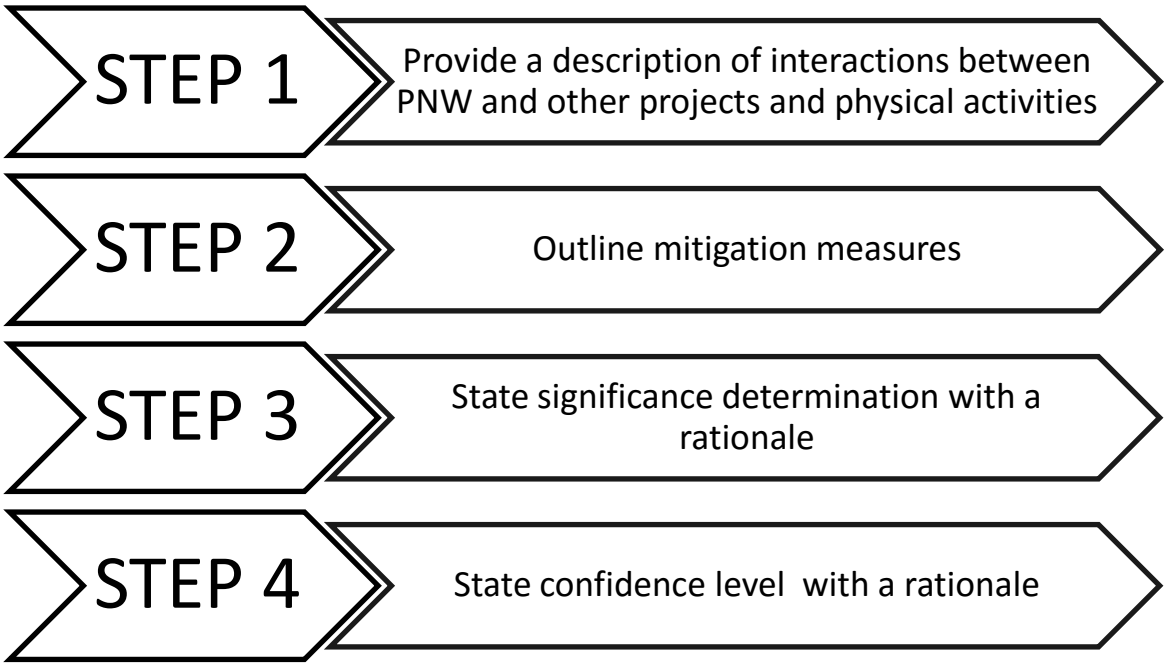

Figure 4.7. CEA Methodology used in the EA application for PNW.

As per this methodology, where no residual effects are predicted, a CEA is not performed. Overall, Stantec Consulting Ltd. (2014) determined that the cumulative effects predicted for the PNW project are not significant (Table 4.9). The only case in which a CEA was not conducted was for the GHG Management VC. Stantec Consulting Ltd. (2014) noted that the contribution of an individual project to climate change cannot be measured (as stated in CEAA (2003)). CEAA acknowledged that the effects of GHGs from a project in a particular location cannot be measured and that the environmental effects are global in nature in CEAA's Draft Environmental Assessment Report for PNW (2016). However, with the amount of GHGs predicted to be released from PNW[2], CEAA concluded that the PNW GHG emissions are likely to cause significant adverse cumulative effects.

[2] PNW would result in 5.28 million tonnes CO_2e per year (0.27 tonnes of CO_2e per tonne of LNG), an increase of GHG emissions of 8.5 % at the provincial level and 0.75% at the national level. Upstream GHG emissions associated with PNW of 6.5 to 8.7 million tonnes CO_2e per year would represent 10 to14% of provincial emissions and 0.90 to 1.2% of national emissions based on 2013 levels (CEAA, 2016b; ECCC, 2016).

Table 4.9. Cumulative Effects Rationales for Biophysical VCs in the PNW Application.

VC	Cumulative Effects Findings	Significance
Air Quality	The project is expected to have residual effects from the increase in criteria air contaminants (CACs) in the area. The cumulative effects case dispersion modelling indicates that overlaps with reasonably foreseeable future projects have an effect on the project site.	Not significant
	Maximum predicted concentrations of SO_2, NO_2, CO, PM_{10} and $PM_{2.5}$ generally increase in localized areas, but only incrementally compared to existing conditions. Contributions for these events originate from existing regional sources and are located far from the project site.	
GHG Management	No CEA.	N/A
Acoustic Environment	Residual effects are located within the LAA due to geographical extent and are expected to attenuate below background level within 5 km of their source.	Not significant
	Past, present and reasonably foreseeable projects and activities in combination with residual effects from the project do not exceed regulatory thresholds on a persistent basis and are expected to meet regulatory guidelines.	
Ambient Light	There is potential for the project to contribute to increased spillover light in the RAA cumulatively with other sources, but with mitigation and adherence to design standards these are not expected to be substantial.	Not significant
	Suggests that other industries must subscribe to energy efficient and reduced lighting design guidelines to make this cumulative effect not significant.	
Vegetation and Wetland Resources	The project will result in residual effects from the loss of traditional use plants and ecological communities of management concern and has the potential to interact cumulatively with other past, present and foreseeable future projects/activities. However, these losses represent very small proportions of the ecological communities in the RAA (1%). These losses are justified based on regional planning objectives that have set management targets allowing for a 30-40% loss of these communities.	Not significant
Terrestrial Wildlife and Marine Birds	The project will result in residual effects and will contribute to cumulative effects on habitat availability, mortality, and alteration of movement for a small portion of the regional population. Past, present and foreseeable future projects will interact cumulatively.	Not significant
	The project will result in the removal of 241 ha of terrestrial and marine habitat and will be mitigated through wetland habitat compensation and fish habitat offsetting.	

VC	Cumulative Effects Findings	Significance
	Compliance with applicable federal and provincial regulation and implementation of mitigation measures, the residual effect on change in mortality and movement will be low in magnitude and therefore cumulative effects will not influence the long-term sustainability of regional populations.	
Freshwater Aquatic Resources	The project is not expected to result in a net loss of the productive capacity of freshwater habitat, a loss of nutrient contribution or fish mortality and will therefore not result in direct cumulative effects.	Not significant
	Two watercourses on Lelu Island were identified as having marginal habitat quality and therefore unlikely to support resident or anadromous fish species.	
Marine Resources	Project activities will result in residual effects. These include in-water construction activities (that will result in the loss or alteration of fish habitats and the injury and mortality of sedentary marine organisms), underwater sounds produced during construction and operations (that may result in the avoidance of some areas by fish and marine mammals). These will act cumulatively with other projects in the area.	Not significant
	Prince Rupert harbour and the shorelines of Kaien and Ridley Islands have been affected from coastal development, which has led to the loss of marine habitat. However, these areas of habitat loss are a small fraction of what is available in the region. Given the limited amount of development and abundance of habitat, cumulative effects are not expected to occur.	
	Dredging and disposal of materials at Brown Passage will result in residual effects on sediment and water quality and can interact with other projects using this disposal site. In compliance with water quality guidelines, testing for contamination will decrease these effects.	
	Localized losses of sedentary marine organisms will be temporary and are expected to quickly recolonize the area. Sensory disturbance from underwater noise will be temporary and marine mammals are expected to return upon cessation.	

Note: Adapted from Stantec Consulting Ltd. (2014)

Chapter 5.

Best Practice Criteria

5.1. Introduction

In this chapter, I introduce the 17 best practice criteria used to evaluate the EA application for PNW and describe each of them in detail. These BP criteria are based on the BP criteria developed by Lucchetta et al. (2016).

5.2. Best Practice Criteria

Best practices (BPs) are defined as methodologies, strategies, procedures, practices and/or processes that consistently provide successful results in achieving set goals and objectives[3] (Plate, Foy, & Krehbiel, 2009; Province of British Columbia, 2013). Over the years, BP criteria have been developed at the federal, provincial, ecosystem and project-specific levels to conduct and manage CEA and are constantly evolving to improve the practice of CEA (CEAA, 2014; BCEAO, 2013).

The first step in evaluating the CEA was to develop a set of BP criteria. The BP criteria from Lucchetta et al. (2016) are used in this evaluation. These BPs were developed from a literature review of existing CEFs and guidance documents, from which BP were identified. A list of BPs was compiled from the literature review and was sorted to fit in either of the following categories: VC-specific, process-specific and policy specific. The VC-specific BP criteria address the methodology used to evaluate the VCs in the CEA, the process-specific BPs address the overall process of CEA, and the policy-specific BPs address the legal and policy foundations supporting CEA.

[3] The term “best practices” has been used interchangeably with the term ‘good practices’ throughout the literature (Joseph, 2013). Some analysts use the term good practices because the practices have not been fully tested to conclude with certainty that they are the best practices (Joseph, 2013; Vesely, 2011). However, given the common use of the term best practices, I will use this throughout the report.

In total, 17 BPs are identified along with 52 sub-criteria (Appendix A). Sub-criteria are included to capture key requirements of the BPs and to allow for a more systematic and fine-scale basis for evaluation. To determine the degree to which BPs were met when evaluating the biophysical VCs in the EA application for PNW, five qualitative measures were developed, based on those used in Lucchetta et al. (2016) (Table 5.1). These qualitative measures are defined by criteria, specifically the number of weaknesses that are exhibited with a sub-criterion or BP.

Table 5.1. Qualitative Ratings Used to Assess Best Practice Criteria and Sub-Criteria

Rating	Symbol	Criteria
Fully Met	+++	0 weaknesses
Largely Met	++	1 weakness
Partially Met	+	2 weaknesses
Not Met	-	3 weaknesses
Unknown	UK	Information provided is insufficient

Note: Adapted from Lucchetta et al. (2016)

5.2.1. Identifying Goals, Objectives, Targets and Thresholds

In conducting CEA, it is important to outline goals, objectives, targets, and thresholds for each VC that is assessed to provide a basis for evaluating impacts and determining the efficacy of mitigation and management actions (Lucchetta et al., 2016). Goals and objectives should align with regional policy or planning objectives to ensure consistency in the region of assessment (Cooper, 2004). Targets are more specific quantified outcomes to identify what one wants to achieve for a particular VC and thresholds are critical points at which the condition of the VC may be threatened if exceeded.

It is imperative that both targets and thresholds are measureable and set for short, medium, and long-term time horizons to track the status of a VC over time. Setting short, medium, and long-term thresholds in a tiered approach is also essential for understanding and comparing the potential risks under different scenarios to determine how much future development could occur without causing impacts to certain values or VCs (AXYS Environmental Consulting Ltd. et al., 2003). When setting thresholds, regulators should

build in a safety margin below the point where irreversible or unwanted effects could occur, thereby taking a precautionary approach (AXYS Environmental Consulting Ltd. et al., 2003). Furthermore, targets and thresholds should be defined by indicators, which are used to determine if the targets and thresholds are met (Wilson, 2014). Indicators should be measurable and quantifiable, be relevant to the VC being assessed, be established in reference to credible scientific evidence, and be based on existing regulation and policy (Cardinale & Greig, 2013).

5.2.2. Providing Rationales for the Selection of Values and Indicators

A process and methodology for selecting VCs and indicators should be identified in the EA application along with a rationale for the selection of a VC and its associated indicator(s). Overall, the VCs and indicators that are selected for assessment should be relevant, measurable, produce useful data, are verified to be important to stakeholders and First Nations, and be compatible with regulatory requirements, existing initiatives or management plans (BCEAO, 2013; Salmo Consulting Inc., 2006). Outlining the process and methodology for selecting VCs and indicators allows for greater transparency in the decision-making process and provides documentation and a rationale as to why VCs and indicators were or were not selected in the assessment.

5.2.3. Analysis of Baseline Conditions

Assessing baseline conditions is an integral component to CEA as it determines the current state of the selected VC. Baseline conditions are often estimated based on present-day conditions, which have already experienced the cumulative effects of past projects and activities (CEAA, 2015a). Historical trends of the VC should be included to determine how the VC has changed over time and to provide context for understanding current conditions (Compass Resource Management Ltd. et al., 2012). From this assessment, one can infer the overall change in the VC from its original state and can set targets and thresholds based on this information to effectively manage the VC in the future. Furthermore, baseline conditions should be assessed at appropriate spatial and temporal scales to incorporate all past, present, and reasonably foreseeable projects in a

region (CEAA, 2015a). If information is unknown, a conservative approach is recommended to assess the potential effects on the VCs. This assessment should also incorporate Traditional Knowledge (TK) where information is available.

Drivers of change should be identified to understand and predict how VCs may change under the influence of external factors (Duinker & Greig, 2007). Drivers of change may be the result of human activities or may be the result of natural changes in the environment (e.g. climate change) (Indian and Northern Affairs Canada, 2007). Drivers of change may further impact the VC over time and should be identified in the CEA to proactively account for possible changes to the VC.

5.2.4. Identifying Mitigation Strategies and Measures

As a central component to CEA, mitigation strategies and/or measures are used to actively address potential cumulative effects from projects, activities and natural disturbances on each VC (Lucchetta et al., 2016). A discussion on the effectiveness of these mitigation strategies is required to determine if the mitigation strategies and/or measures will be effective once they are applied. If the mitigation strategies and/or measures are not proven to be effective or if their effectiveness is largely uncertain, alternative strategies should be recommended as a precautionary approach (Cardinale & Greig, 2013; Cooper, 2004). Overall, mitigation strategies should be based on the precautionary principle and should be used to avoid significant adverse effects (CEAA, 2015a).

5.2.5. Developing Monitoring Programs

To ensure that goals, objectives, targets, and thresholds are being met in CEA, monitoring is required. The development of monitoring programs will ensure that VCs are being assessed throughout all phases of the project and beyond decommissioning. Overall, these monitoring plans should verify and assess the effectiveness of mitigation measures and residual cumulative effects and should contain provisions and obligations to implement remedial action if mitigation measures are not performing as expected (Cooper, 2004). This will lead to increased accountability of the proponent to ensure that

targets and thresholds are being met, even after the project has been completed. Furthermore, to avoid potential conflict or bias regarding the project or monitoring strategies, a monitoring program should be managed by an independent agency (Therivel & Ross, 2007). Monitoring information should also be made publically available to help reduce duplication in data collection, aid in the sharing of knowledge and information about the VC or region being assessed, and to ensure accountability of the proponent in mitigating any adverse effects that arise.

5.2.6. Conducting Ecosystem-Based Assessment

Ecosystems are complex in that they are made up of interconnected systems and components that are constantly interacting and affecting each other (Stiff, 2001). In considering the potential cumulative effects that could occur, CEA should be based on ecosystem-based boundaries to allow for broader ecosystem and species relationships to be considered along with potential cumulative effects—particularly for biophysical VCs (Wilson, 2014). CEA for biophysical VCs should not be based on administrative or technical boundaries as ecosystem and species relationships are likely to span across these boundaries. However, ecosystem-boundaries may not be appropriate for all VCs, and will largely depend on the VC that is assessed (Walker, Johnston, Napier, & Clark, 1999). Non-biophysical VCs (e.g. health, cultural and socio-economic) are more likely to be assessed using administrative or technical boundaries as these data are often collected within demographic regions.

5.2.7. Scenario Development and Analysis

Scenario-based assessments are key to predicting the potential cumulative impacts from current and future development projects and activities on a VC. To deal with uncertainties surrounding the effects on VCs from these projects and activities, a range of scenarios should be developed to predict VC response from a variety of sources or stressors (Duinker & Greig, 2007; Lucchetta et al., 2016). Overall, the range of scenarios should include all relevant past, present and future projects and activities within a defined region and should cover a spectrum of possible development activities defined by development trends. Furthermore, defining scenarios also provides an opportunity to

inform management objectives and strategies for a VC as well as its respective targets and thresholds (Duinker & Greig, 2007). Additionally, the range of scenarios should be developed based on specific criteria and should be disclosed in the application to increase transparency in the CEA.

5.2.8. Identifying Assumptions and Uncertainties and their Effects on the Analysis

Effects of projects and interacting activities are often uncertain (Walker et al., 1999). Any assumptions made in the CEA should be stated along with their impact on the analysis. Assumptions can be made throughout the CEA including in the methodology used to estimate cumulative effects, data used in the assessment, identifying impacts from other projects and drivers of change, the effectiveness of mitigation measures, and in decision-making. Where data gaps are identified, they should be described along with their effect on the analysis including potential limitations (CEAA, 2015a). Finally, where there is uncertainty on the potential impacts on a VC, a sensitivity analysis should be completed to predict the effects that could occur (MacDonald, 2000).

5.2.9. Process Efficiency

Identifying and prioritizing information gaps based on explicit criteria and setting appropriate time limits and resource requirements are key to making the CEA (and EA) process more efficient (Lucchetta et al., 2016). Furthermore, prioritizing information gaps also aids in identifying where information is missing and its overall impact on the CEA.

5.2.10. Adequate and Meaningful Participation

It is important that a comprehensive stakeholder participation process is used to assist in the preparation of the CEA (CEAA, 2014, 2015; FLNRO, 2014). Through a participative process, stakeholders from a variety of backgrounds are able to provide feedback, interact with other stakeholders and ask questions, and contribute to the dialogue that will result in the development of the CEA. Without adequate tools and resources to participate, stakeholders will not be able to fully participate in the CEA and

the CEA will not reflect the input and views of the public. For many projects in BC, First Nations participation is particularly important due to the duty to consult and treaty rights and title. Furthermore, this participation should be meaningful (Booth & Skelton, 2011). Overall, stakeholder engagement is essential to ensure that the CEA reflects public concerns and values, improve the quality of information and analysis, and increase the credibility of the CEA with stakeholders.

5.2.11. Conducting Comprehensive Reviews

It is imperative that the assessment is comprehensive in that all environmental, social, economic, cultural and heath aspects of VCs are incorporated in the assessment to ensure that all possible impacts from the project or activity are considered (CEAA, 2015; FLNRO, 2014; Stiff, 2001). Furthermore, it is imperative that interrelationships amongst VCs are recognized and addressed as VCs are interrelated (and perhaps dependent on each other) in the physical environment.

5.2.12. Using Credible Expertise

It is ideal that analysts undertaking CEA are independent experts to minimize bias in the assessment. Quite frequently, analysts that are undertaking CEA for projects are not fully independent as they are directly hired by proponents to conduct research and produce relevant EA and CEA documents in which biases can occur. Furthermore, the CEA should be subject to independent checks and peer review to account for potential biases and identify deficiencies that occur (IAIA & EIA, 1999; Stiff, 2001).

5.2.13. Identifying Leadership and Accountability

It is imperative that a leading agency is identified to ensure that the CEA is completed accurately and to ensure efficiency and accountability (Van Hinte et al., 2007). The leading agency should have sufficient resources and capacity to ensure that the CEA is completed and have clearly defined roles and responsibilities in the process to ensure accountability for completion of the CEA (Lucchetta et al., 2016).

5.2.14. Transparency in Decision-Making

Transparency is integral in the assessment of cumulative effects in that it provides rationales and decision-making criteria to support decisions that are being made (CEAA, 2015; Office of the Auditor General of British Columbia, 2015). Without transparency, the rationales for making decisions would be unknown and the decisions could not be properly evaluated. In EA and CEA, decisions are made in regards to the significance of effects and significance of cumulative effects through an assessment of six criteria: magnitude, duration, extent, frequency, reversibility, and resiliency. Furthermore, decisions are also made in regards to the likelihood of adverse effects from a project and from cumulative effects occurring after mitigation, and if these are justified in the circumstances. Having clear criteria in these decision-making stages will contribute to rationality and increased transparency.

5.2.15. Establishing a Central Database of Information and Information Sharing

Providing a central database of information is important aspect of CEA. The database should contain all data relevant to projects and activities in a region, trends of VCs, monitoring program initiatives and/or results and cumulative effects, among others. This information should be publically available to ensure that data used in the CEA are consistent and correct. By establishing a central database of information, the transparency and accountability of the proponent or leading agency and CEA process will be increased. Additionally, if information is shared and is accessible to the public, this will likely reduce duplication of efforts to collect data and will provide opportunities for analysis to further contribute to the development and evaluation of the CEA (Johnson et al., 2011).

5.2.16. Legal Foundation Supporting CEA

To operationalize CEA and ensure that CEA is consistent in its application, all key elements (Table 6.18) of CEA should be established in law and should be mandatory. CEA should be supported by a mandatory legal and policy foundation to ensure that it is performed consistently across all projects and activities, that all requirements are outlined, and decision criteria are clearly described (Clogg & Carlson, 2013b).

5.2.17. Policy and Program Review

A good CEA process should include policy and program review. As new information is gained, it is imperative that findings are analyzed and incorporated into the assessment in a iterative process, whether they are successful or unsuccessful (Cardinale & Greig, 2013; Hegmann et al., 1999). This ensures that the appropriate changes are being made, thereby improving the overall CEA over time. Ensuring that these reviews and updates are performed on a regularly scheduled basis will ensure that knowledge and findings are kept up to date.

5.3. Summary

Overall, there are 17 BPs and 52 sub-criteria that guide the assessment of CEA. The BPs and sub-criteria aim to cover all aspects of CEA including: the methodology used to assess cumulative effects on VCs, the process for conducting CEA, and the policy and legal framework supporting CEA. A summary of the BP criteria and sub-criteria can be found in Appendix A. In the following chapter, the BP criteria and sub-criteria will be used to evaluate the CEA within the EA application for PNW.

Chapter 6.

Evaluation of the PNW CEA

6.1. Introduction

In this chapter, I outline the methodology used to evaluate the eight biophysical VCs from PNW's EA application (Stantec Consulting Ltd., 2014) and provide an overview of the results of the CEA evaluation. As previously stated, only the eight biophysical VCs included in Stantec Consulting Ltd.'s (2014) report were assessed to manage the scope of this evaluation. I provide a summary of the evaluation results at the end of this chapter.

6.2. Methodology

I began the evaluation by reviewing the PNW EA application to the BCEAO (Stantec Consulting Ltd., 2014). I examined all of the material in the application related to the eight biophysical VCs as listed in Table 4.8. To scope my evaluation to a manageable level, I did not examine the socioeconomic and cultural VCs included in the assessment. Other relevant project documents (i.e. project descriptions, addendums, application information requirements, plans for Aboriginal consultation, etc.) that were posted on the BCEAO's e-Pic website prior to February 2014 were reviewed to provide context and additional information on the project and/or process. Relevant legislation was also reviewed. A list of all relevant project information and legislation that was reviewed in the evaluation can be found in Appendix B.

Next, I determined the degree to which BP criteria are met. Three calculations were required. First, I calculated the degree to which each sub-criterion was met. In total, there are 52 sub-criteria used in this assessment. I used the qualitative methodology outlined in Table 6.1 to assign individual ratings to each sub-criterion across all eight VCs for the BPs that are VC specific. For the BPs that are not VC specific, one rating was assigned for the overall CEA. In total, 283 ratings were made and rationales for each rating are provided in Appendix C. Points were then assigned to each rating using the criteria in Table 6.1 and

were averaged across all VCs for each sub-criterion to determine the overall rating for each sub-criterion. As there are 52 sub-criteria in total, 52 sub-criteria ratings were made and are provided in Appendix D. Finally, these sub-criteria ratings were used to calculate an overall average score for each BP by calculating the average points for the sub-criteria. The average point score was then translated into an overall qualitative rating for each BP based on the average point range scale in Table 6.1. It should be noted that while the average qualitative and numerical ratings for each BP and the overall CEA provide a summary assessment, it is more important to focus on individual strengths and weaknesses identified under each sub-criterion to identify what changes are required to improve the CEA. Overall, the objective should be to mitigate all deficiencies so that each sub-criterion is fully met.

Table 6.1. Point Scale for Qualitative Ratings

Rating	Symbol	Criteria	Points	Average Point Range
Fully Met	+++	0 weaknesses	3	3
Largely Met	++	1 weaknesses	2	1.5 – 2.9
Partially Met	+	2 weaknesses	1	0.5 – 1.49
Not Met	-	3 weaknesses	0	0 - 0.49
Unknown	UK	Information provided is insufficient	NA	NA

6.3. Evaluation Results

6.3.1. Identifying Goals, Objectives, Targets and Thresholds

None of the VC assessments in the application identify goals and objectives for the CEA. While goal and objective statements can be inferred from the EA application (e.g. avoid significant or negative cumulative effects), these are not formally stated. For this reason, this sub-criterion is not met.

Measurable targets and thresholds for CEA are identified for the following six out of eight VCs in the application: Air Quality, GHG Management, Acoustic Environment, Ambient Light, Vegetation and Wetland Resources, and Marine Resources. This criterion is rated as fully met for five of these VCs but is rated as only largely met for the Marine

Resources VC because although there are targets and thresholds provided for Marine Resources, they do not address the potential change in fish habitat. Targets and thresholds are not provided for the Terrestrial Wildlife and Marine Birds VC and the Freshwater Aquatic Resources VC, as guidance is not fully developed or does not contain targets and thresholds in these areas of study. Overall, these two sub-criteria are rated as largely met.

Short-, medium-, and long-term targets and thresholds are not identified for any of the VCs; therefore this sub-criterion is not met.

Finally, targets and thresholds are established in reference to credible scientific evidence and studies for six out of eight VCs. These include: Air Quality, GHG Management, Acoustic Environment, Ambient Light, Vegetation and Wetland Resources, and Marine Resources. These targets and thresholds are developed in relation to federal, provincial, municipal, or international guidelines, policy, and regulations, which have been developed by credible scientific agencies (e.g. Environment and Climate Change Canada (ECCC), BC Ministry of Environment (BC MOE), FLNRO). Therefore this sub-criterion is fully met for these six VCs. This sub-criterion is not met for the Terrestrial Wildlife and Marine Birds VC and the Freshwater Aquatic Resources VC, since targets and thresholds are not identified in the application. Overall, this sub-criterion is rated as largely met.

Table 6.2. Ratings for Identifying Goals, Objectives, Targets and Thresholds Criteria

Sub-criteria	VC								Point Average and Rating
	Air Quality	GHG Manage-ment	Acoustic Env.	Ambient Light	Vegetation & Wetland Resources	Terrestrial Wildlife & Marine Birds	Fresh-water Aquatic Resources	Marine Resources	
1. The assessment identifies specific goals and objectives for each VC	-	-	-	-	-	-	-	-	0 NM
2. The assessment identifies measurable targets for each VC	+++	+++	+++	+++	+++	-	-	++	2.1 LM
3. The assessment identifies measurable thresholds for each VC	+++	+++	+++	+++	+++	-	-	++	2.1 LM
4. Each VC is defined by short-, medium-, and long-term targets and thresholds to ensure effective management over time	-	-	-	-	-	-	-	-	0 NM
5. Targets and thresholds for each VC are established in reference to credible scientific evidence and studies or social and/or community values	+++	+++	+++	+++	+++	-	-	+++	2.3 LM
Overall Rating:									**1.3** **Partially Met**

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.2. Providing Rationales for the Selection of Valued Components and Indicators

The application fully meets the sub-criterion of providing rationales for the selection of VCs and indicators. The rationales vary depending on the VC that is assessed, with the majority of the rationales being founded on requirements from legislation, regulations, or policy that is applicable to areas of federal and provincial jurisdiction. To a lesser degree, the rationales also identify concerns from First Nations and local communities.

Despite the indication that the VCs and indicators are selected based on consultation with the EA working group, through public input, and with direction from the BCEAO and the CEAA, the methodology and process used to generate the list of VCs and indicators is unclear. Disclosing this information in the application is important to provide transparency on how VCs and indicators were developed and why certain values were grouped together under one VC (e.g. Terrestrial Wildlife and Marine Birds), to identify how input from stakeholders and First Nations was used in the process, and to determine if their concerns were adequately incorporated into the assessment. Since this information is unclear, this sub-criterion is not met.

Table 6.3. Ratings for Values and Indicators Criteria

Sub-criteria	VC								Point Average and Rating
	Air Quality	GHG Manage-ment	Acoustic Env.	Ambient Light	Vegetation & Wetland Resources	Terrestrial Wildlife & Marine Birds	Fresh-water Aquatic Resources	Marine Resources	
1. A rationale is provided for the selection of VCs and indicators	+++	+++	+++	+++	+++	+++	+++	+++	3 FM
2. The rationale for the selection of each VC follows a transparent process and methodology	-	-	-	-	-	-	-	-	0 NM
Overall Rating:									**1.5** **Largely Met**

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA = Unknown

6.3.3. Analysis of Baseline Conditions

Baseline conditions in the application are determined at different spatial scales depending on the VC that is being assessed. Certain VCs are scoped within ecosystem boundaries, while others are scoped according to administrative or technical boundaries. The application states that the spatial boundaries include all current and future projects in the region that could impact the VC being assessed. No independent verification of this statement is provided and I did not evaluate the accuracy of this statement. Nonetheless, this criterion is rated as a fully met based on the assurance provided in the application.

The application does not identify drivers of change that could impact VCs. The most prominent drivers of change that are likely to impact these biophysical VCs in this region include climate change and urban development; however these effects are not discussed in the application and, therefore, this sub-criterion is not met.

The application successfully identifies past projects and activities that may affect the VC and effectively scopes these into the assessment as appropriate. However, the application fails to document or analyze how these VCs have changed over time. For this reason, this sub-criterion is not met.

A conservative approach was taken when data in baseline studies were limited or unknown for all VCs. These approaches varied across the VCs depending on the amount and type of data limitations that existed. For example, the Marine Resources VC used a conservative approach in assessing impacts from PNW and other projects and activities based on worst-case scenarios and through additional research (as required by CEAA in information requests). The analysis of Terrestrial Wildlife and Marine Birds VC identified that data that were initially collected could be limited based on the species that were observed during field sampling. To accommodate this, areas that have the potential habitat to support species in which species were not observed during field sampling were included in the assessment. The rationales for the remaining VCs are included in Appendix C. Based on this evaluation, this sub-criterion is fully met.

Finally, TK was incorporated into the CEA for two out of eight VCs: Vegetation and Wetland Resources and Terrestrial Wildlife and Marine Birds. While there was potential to

incorporate TK into other VCs in the assessment, there is no indication that TK was used. For these reasons, this sub-criterion is only partially met.

Table 6.4. Ratings for Baseline Condition Criteria

Sub-criteria	VC								Point Average and Rating
	Air Quality	GHG Manage-ment	Acoustic Env.	Ambient Light	Vegetation & Wetland Resources	Terrestrial Wildlife & Marine Birds	Fresh-water Aquatic Resources	Marine Resources	
1. Baseline conditions for each VC are assessed on an appropriate spatial scale for VCs *	+++	+++	+++	+++	+++	+++	+++	+++	3 FM
2. Drivers of change are identified and described for each VC	-	-	-	-	-	-	-	-	0 NM
3. Historical trends documenting the condition of the VC over time are analyzed and considered in the assessment	-	-	-	-	-	-	-	-	0 NM
4. Where data in baseline studies is limited or unknown, a conservative approach is taken to assess potential effects for each VC	+++	+++	+++	+++	+++	+++	+++	+++	3 FM
5. Traditional Knowledge is considered and incorporated into baseline conditions for each VC	-	-	-	-	+++	+++	-	-	0.8 PM
Overall Rating:									**1.1** **Partially Met**

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.4. Identifying Mitigation Strategies and Measures

Mitigation strategies and measures are identified to address cumulative effects for six out of eight VCs. For most VCs, mitigation measures address direct impacts from PNW as well as impacts from other past, present and reasonably foreseeable future projects.

There are two exceptions: the Vegetation and Wetlands Resources VC and Freshwater Aquatic Resources VC. While mitigation measures are proposed for these VCs, they are restricted to mitigate effects directly related to PNW and not from any other projects and activities in the region. For example, the Wetland Habitat Compensation Plan (WHCP) only identifies wetland restoration, securement, and enhancement relative to what will be lost from PNW. A total of 119.2 ha of wetland habitat will be lost from PNW and is expected to be replaced at a ratio of 2:1 (wetland functions replaced: wetland functions lost)[4]. This does not address cumulative impacts on the VC nor does it consider natural disturbances or drivers of change in the compensation plan. For these reasons, this sub-criterion is not met for these two VCs. Impacts from other projects and activities are outlined for the remaining six VCs and mitigation measures are suggested. However, mitigation measures for natural disturbances were not identified in the application for any of the VCs. For these reasons, this sub-criterion is rated as largely met.

Where mitigation strategies and measures are provided, there was no comprehensive or evidence-based discussion verifying the potential effectiveness of the proposed mitigation measures for six out of eight VCs. The potential effectiveness of some of the mitigation measures for the Terrestrial Wildlife and Marine Birds VC and Freshwater Aquatic Resources VC are discussed, however the effectiveness of other mitigation measures proposed for these VCs are not discussed. For this reason, the sub-criterion ratings for these two VCs are partially met. The effectiveness of mitigation measures is not discussed for the remaining six VCs and is therefore not met. Overall, this sub-criterion is not met.

Furthermore, it is unclear if mitigation strategies and measures presented for any of the VCs are based on the precautionary principle. Very few details are provided in discussing mitigation measures for all VCs and in some cases, plans are not developed in full, or mitigation measures do not relate to cumulative effects. It is therefore unclear if

[4] Despite the loss of wetlands on the North Coast of BC, the WHCP suggests restoration in Burns Bog in Delta, British Columbia. This was in part due to the few opportunities that exist on the North Coast and the amount of time required to accumulate peat that is sufficient to sustain bog habitat (Stantec Consulting Ltd., 2014).

the precautionary principle was being used for CEA, and for this reason, this sub-criterion was not met.

Table 6.5. Ratings for Mitigation Criteria

Sub-criteria	VC								Point Average and Rating
	Air Quality	GHG Manage-ment	Acoustic Env.	Ambient Light	Vegetation & Wetland Resources	Terrestrial Wildlife & Marine Birds	Fresh-water Aquatic Resources	Marine Resources	
1. Mitigation strategies and/or measures are identified to address potential cumulative impacts of other activities and natural disturbances on each VC	++	++	++	++	-	++	-	++	1.5 LM
2. The assessment contains a comprehensive, evidence-based discussion of the potential effectiveness of proposed mitigation measures for each VC	-	-	-	-	-	+	+	-	0.3 NM
3. Mitigation strategies and/or measures are based on the precautionary principle: *The measures deal with uncertainty, anticipate and prevent serious, irreversible risks, and err on the side of caution*	-	-	-	-	-	-	-	-	0 NM
Overall Rating:									**0.6** **Partially Met**

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.5. Developing Monitoring Programs

The application states that programs will be established to monitor the conditions for all VCs with the exception of the Acoustic Environment VC. Stantec Consulting Ltd. (2014) suggests that cumulative noise effects will not overlap with past and present

projects and activities in the RAA and will not exceed regulatory thresholds on a persistent basis, and therefore no monitoring is required. With the uncertainties identified in the application and lack of knowledge in this field about how acoustics from construction and operations from PNW and existing projects and activities will impact species, it is questionable as to why no monitoring program was developed. Nonetheless, given that monitoring is proposed for all other VCs, this sub-criterion is largely met.

The application states that monitoring of the effectiveness of mitigation measures will be conducted for three out of eight VCs. The WHCP developed for the Vegetation and Wetland Resources VC states that compliance monitoring will be used to ensure that compensatory habitats that are constructed as a result of PNW are functioning as intended, and therefore this sub-criterion is fully met for this VC. Multiple monitoring programs are developed for the Freshwater and Aquatic Resource VC and Marine Resources VC. However, effectiveness monitoring will only be conducted for some of the monitoring programs suggested. No effectiveness monitoring is proposed for the remaining five VCs and they are therefore rated as not met. Overall, this sub-criterion is rated as partially met.

The application states that monitoring programs will include an obligation to implement remedial action if mitigation measures are not performing as expected for only two of the eight VCs: the Marine Resources VC and the Freshwater and Aquatic Resources VC. Since the remaining six VCs either did not suggest remedial action or did not have a monitoring program established, the sub-criterion is not met.

Establishing monitoring programs that are conducted by an independent agency was explicitly recommended for two out of eight VCs: GHG Management VC and Vegetation and Wetland Resources VC. Therefore, this sub-criterion is fully met for these two VCs. For the Freshwater Aquatic Resources and Marine Resources VCs, the application states that an expert with a minimum of three years of experience and a graduate degree in the subject will conduct monitoring. However, it is unclear if the expert will be independent. Therefore this sub-criterion is not met for these two VCs. No proposal for independent monitoring is made for the remaining five VCs and therefore, this criterion's overall rating is only partially met.

The application explicitly states that monitoring data will be publically available for only one out of eight VCs. The GHG Management VC was the only VC to meet this sub-criterion as the application indicates that monitoring data will be posted on the BC GHG Inventory and National Inventory Report websites as it becomes available. For the remaining VCs, no explicit commitment was made to make the data publically available. For these reasons, this sub-criterion is only partially met.

Finally, the application states that monitoring will be conducted on a regularly scheduled basis for four out of eight VCs: GHG Management, Vegetation and Wetland Resources, Freshwater Aquatic Resources, and Marine Resources. The monitoring schedule for these four VCs varies. For example, the WHCP developed for the Vegetation and Wetland Resources VC indicates that monitoring will be conducted every five years while the GHG management monitoring will be conducted on an annual basis. As monitoring is conducted on a regularly scheduled basis, this criterion is rated as fully met for these two VCs. The Marine Resources VC and Freshwater Aquatic Resources VC contain multiple monitoring programs. The only monitoring program that is proposed to occur on a regular basis for both VCs is the Fish Habitat Offsetting Strategy, which will occur once every five years. Since the other monitoring programs suggested for these VCs did not indicate that monitoring will be conducted on a regular basis or did not discuss timing, the sub-criterion is rated as partially met. Overall, this sub-criterion is only partially met.

Table 6.6. Ratings for Monitoring Criteria

Sub-criteria	VC								Point Average and Rating
	Air Quality	GHG Manage-ment	Acoustic Env.	Ambient Light	Vegetation & Wetland Resources	Terrestrial Wildlife & Marine Birds	Fresh-water Aquatic Resources	Marine Resources	
1. A program will be established to monitor the condition of each VC to ensure goals, objectives, targets and thresholds are met	+++	+++	-	+++	+++	+++	+++	+++	2.9 LM
2. The monitoring program(s) will include monitoring of the effectiveness of mitigation measures	-	-	-	-	+++	-	+	+	0.6 PM
3. The monitoring program will include an obligation to implement remedial action if mitigation measures are not performing as expected	-	-	-	-	-	-	+	+	0.3 NM
4. Monitoring is conducted by an independent agency	-	+++	-	-	+++	-	-	-	0.8 PM
5. The results of monitoring and all data collected are publically available	-	+++	-	-	-	-	-	-	0.4 NM
6. Monitoring is completed on a regularly scheduled basis	-	+++	-	-	+++	-	+	+	1 PM
Overall Rating:									**1** **Partially Met**

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.6. Conducting Ecosystem-Based Assessment

Ecosystem boundaries are used to define the spatial boundaries for four out of the eight VCs identified in the application. The spatial boundary for the Vegetation and Wetland Resources VC is set in accordance with the Kaien Landscape Unit, a land-use

planning boundary that corresponds to management objectives for terrestrial wildlife species and their ranges in the area. The spatial boundary for the Freshwater Aquatic Resources VC was defined partly by watershed areas and the distribution of fish that use aquatic habitat. The spatial boundary for the Marine Resources VC considered the biogeographic context of species movement and interactions over a larger area. Since these three VCs incorporate ecosystem boundaries in the assessment, this sub-criterion for these VCs is fully met. The Terrestrial Wildlife and Marine Birds VC is rated as largely met because ecosystem boundaries are only partially used to define the spatial boundaries for the assessment. The terrestrial component of the RAA includes the ecosystem-based Kaien Landscape Unit while the marine component of the RAA was defined by the Prince Rupert Port Authority (PRPA) boundary, which is an administrative boundary. For this reason, this sub-criterion was only largely met. The remaining four VCs did not use explicit ecosystem boundaries and did not meet this sub-criterion. The spatial boundaries are either based on administrative boundaries, guidelines, or are developed by the proponent without justification. Therefore, this sub-criterion is partially met.

Furthermore, broader ecosystem and species relationships are only explicitly considered for two out of eight VCs. These relationships are considered for the Freshwater Aquatic Resources VC as the RAA boundary encompasses Chatham Sound—which is under the influence of the Skeena and Nass River outflows. Additionally, the geographic areas beyond the defined RAA for the Marine Resources VC are scoped to account for life stages of fish and marine mammals. While the Vegetation and Wetland Resources VC and the Terrestrial Wildlife and Marine Birds VC did use ecosystem boundaries in the assessment, it is unclear if any broader species relationships are considered. All other VCs considered in this assessment did not meet this sub-criterion as they did not consider broader ecosystem and species relationships. Overall, this BP criterion is rated as partially met.

Table 6.7. Ratings for Ecosystem-Based Criteria

Sub-criteria	VC								Point Average and Rating
	Air Quality	GHG Manage-ment	Acoustic Env.	Ambient Light	Vegetation & Wetland Resources	Terrestrial Wildlife & Marine Birds	Fresh-water Aquatic Resources	Marine Resources	
1. Ecosystem boundaries are used to define the spatial boundaries for the assessment for each VC	-	-	-	-	+++	++	+++	+++	1.4 PM
2. Broader ecosystem and species relationships are considered along with potential impacts to those relationships	-	-	-	-	-	-	+++	+++	0.8 PM
Overall Rating:									**1.1** **Partially Met**

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.7. Scenario Development and Analysis

The application did not use a scenario-based approach for any of the VCs identified in the application; therefore this BP is rated as not met.

Table 6.8. Ratings for Scenario-Based Criteria

Sub-criteria	VC								Point Average and Rating
	Air Quality	GHG Manage-ment	Acoustic Env.	Ambient Light	Vegetation & Wetland Resources	Terrestrial Wildlife & Marine Birds	Fresh-water Aquatic Resources	Marine Resources	
1. A range of scenarios defining the inventory of past, present and reasonably foreseeable future activities is developed	-	-	-	-	-	-	-	-	0 NM
2. The range of scenarios covers the spectrum of possible activities that could interact spatially and temporally with each VC	-	-	-	-	-	-	-	-	0 NM
3. The range of scenarios (defining the inventory of past, present and foreseeable activities) is developed based on specific criteria	-	-	-	-	-	-	-	-	0 NM
4. Potential effects on the VC are assessed under each scenario	-	-	-	-	-	-	-	-	0 NM
Overall Rating:									**0** **Not Met**

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.8. Identifying Assumptions and Uncertainties and their Effect on the Analysis

Assumptions are made in analysing cumulative effects for all of the VCs assessed in the application. The application identifies assumptions for each of the VCs, and is therefore rated as fully met for this sub-criterion.

The degree to which sources of uncertainty and data gaps are identified and described varies across VCs. The Air Quality VC and the GHG Management VC are rated as fully met since the sources of uncertainty (e.g. project interactions and emissions) and

data gaps (e.g. meteorological data) are discussed relative to their effect on the analysis of potential effects and cumulative effects. The remaining six VCs are rated as largely met since assumptions and data gaps are identified; however, their impact on the analysis of cumulative effects is not described. Interestingly, where sources of uncertainty are identified (e.g. cumulative effects from PNW and other projects and activities) the application attempts to justify that the predicted effects are not significant without providing sufficient rationale for this conclusion.

Limitations of analytical methods are identified for three out of eight VCs: Air Quality, GHG Management, and Vegetation and Wetland Resources. The Terrestrial Wildlife and Marine Birds, Freshwater Aquatic Resources, and the Marine Resources VCs are rated as partially met since limitations are only described for field sampling methods, and not for analytical methods used in the assessment. Finally, the Acoustic Environment VC and the Ambient Light VC are rated as not met since limitations of the methods used for the VC are not described in the application. Overall, this sub-criterion is rated as largely met.

Finally, sensitivity analyses are conducted in the application for one out of the eight VCs. A sensitivity analysis for soil acidification and eutrophication is provided for the Vegetation and Wetland Resources VC to identify effects on nearby soils that may arise from air emissions during project operation. Since this analysis addresses uncertainties related to this VC, it is rated as fully met. All other VCs included in this assessment did not provide sensitivity analyses and therefore are rated as not met. Overall, this sub-criterion is rated as not met.

Table 6.9. Ratings for Analysis Criteria

Sub-criteria	VC								Point Average and Rating
	Air Quality	GHG Manage-ment	Acoustic Env.	Ambient Light	Vegetation & Wetland Resources	Terrestrial Wildlife & Marine Birds	Fresh-water Aquatic Resources	Marine Resources	
1. Assumptions used in the impact analysis are clearly stated	+++	+++	+++	+++	+++	+++	+++	+++	3 FM
2. Sources of uncertainty and data gaps are identified and described relative to their effect on the analysis of potential effects	+++	+++	++	++	++	++	++	++	2.3 LM
3. Limitations of analytical methods are described	+++	+++	-	-	+++	+	+	+	1.5 LM
4. A sensitivity analysis of potential impacts on each VC is completed to incorporate uncertainty in assessing impacts	-	-	-	-	+++	-	-	-	0.4 NM
Overall Rating:									**1.8** **Largely Met**

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.9. Process Efficiency

The application did not identify and prioritize information gaps based on explicit criteria for any VCs. Where information gaps do occur, it appears that these gaps are largely filled with assumptions, and the effect of the assumptions on the analysis is not fully described. Therefore, this sub-criterion is rated as not met. Furthermore, it is unclear if appropriate time limits and resource requirements are provided for this CEA. These are rated as being “unknown” and would need to be assessed through a survey administered to all participants in the process.

Table 6.10. Ratings for Efficiency Criteria

Sub-criteria	VC								Point Average and Rating
	Air Quality	GHG Manage-ment	Acoustic Env.	Ambient Light	Vegetation & Wetland Resources	Terrestrial Wildlife & Marine Birds	Fresh-water Aquatic Resources	Marine Resources	
1. Information gaps are identified and prioritized based on explicit criteria (i.e. indicator species)	-	-	-	-	-	-	-	-	0 NM
2. Appropriate time limits and resource requirements are specified for the assessment	UK	UK	UK	UK	UK	UK	UK	UK	NA
Overall Rating:									**0** **Not Met**

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.10. Adequate and Meaningful Participation

As part of the EA process, the proponent consulted with a variety of government agencies and committed to an open consultation program with the public and First Nations groups (as per *CEAA, 2012* 5(1)(c)) throughout the EA process. The proponent held open houses, workshops, and presentations, and provided materials for public comment. Stakeholders were able to participate in the four public comment periods as part of the EA process (30 days), and did so on numerous occasions during the project review (BCEAO, 2014; CEAA, 2016b). Tracking tables are used in the EA process to address comments raised by various stakeholders and First Nations and the responses and rationales provided by the proponent.

One indicator of the effectiveness of participation is whether the choice of VCs reflects community priorities. In a separate study, Kwon (2016) identified the key marine biophysical VCs and indicators for the Metlakatla First Nation (MFN) for a CEF for their traditional territory. The MFN is heavily involved in the review and participation process for PNW as the project is situated in their traditional territory. Interestingly, none of the indicators that were selected by the MFN to be most important in their CEF were fully incorporated or included in the application for PNW. While the differences between

Metlakatla VC priorities and the PNW EA application suggest that the stakeholder involvement process was not as effective as it should have been, a more comprehensive analysis would have to be done to determine whether the overall public engagement process was meaningful and adequate and to what degree public input was incorporated into the analysis and project design and management. Additionally, even though resources were provided to stakeholders to participate in the process including participant funding, I could not determine if these resources were sufficient with the information provided in the application. Therefore, this criterion is rated as unknown.

Table 6.11. Ratings for Participative Criteria

Sub-criteria	Point Average and Rating
1. First Nations and stakeholders are provided with the opportunity to meaningfully participate in each step of the assessment process	NA
2. Adequate resources are provided to First Nations and stakeholders to participate in each step of the assessment (i.e. Participant funding)	NA
3. Input from First Nations and stakeholders is incorporated in a deliberate and transparent manner throughout the process	NA
Overall Rating:	**NA**
	Unknown

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.11. Conducting Comprehensive Reviews

Overall, the CEA included assessments of all five parameters: biophysical, social, economic, cultural and health. Therefore, this criterion is rated as fully met.

Table 6.12. Ratings for Comprehensive Criteria

Sub-criteria	Point Average and Rating
1. The CEA includes an assessment of the following parameters: a) Biophysical b) Social c) Economic d) Cultural and Aboriginal Traditional Knowledge e) Health	3 FM
Overall Rating:	**3**
	Fully Met

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.12. Using Credible Expertise

The proponent relied on Stantec Consulting Ltd. to develop the EA application for the project, which was then assessed by the BCEAO and CEAA. Since Stantec Consulting Ltd. was hired by the proponent (PETRONAS) to conduct the assessment, they are not considered to be independent experts. For this reason, this sub-criterion is not met.

The BCEAO and CEAA are responsible for conducting reviews of the CEA; however, these bodies are not fully independent— they are regulators in the review process and are subject to varying degrees of direction from the governments that established them. Stakeholders and other public participants have an opportunity to review the information in the application and provide feedback during public comment periods. However it is unclear if stakeholders have sufficient resources to conduct a comprehensive review and it is unclear how their findings are incorporated in the review of the project. To a degree, the collective reviews conducted by the BCEAO, CEAA, stakeholders, and the public are independent in the sense that experts who are not controlled by the project proponent conduct them. Therefore this sub-criterion is rated as partially met.

The federal and provincial governments have outlined comprehensive guidelines for conducting CEA for EA reviews (BCEAO, 2015; CEAA, 2015). The methodology for conducting CEA for PNW is fully disclosed in the application and uses the approach outlined in the CEAA's *Operational Policy Statement Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act* (2007). The methodology used in the application follows the scoping, analysis, mitigation, and significance steps as outlined in CEAA's guidance, although rationales for conclusions are not always provided. Even though these guidelines are not mandatory, the proponent complied with them to meet the requirements. For these reasons, this sub-criterion is largely met.

Table 6.13. Ratings for Credible Criteria

Sub-criteria	Point Average and Rating
1. Analysts undertaking CEA are independent experts	0 NM
2. The CEA is subject to independent checks, peer review and verification	1 PM
3. Methods of CEA are identified and comprehensive guidelines for applying these methods are provided	3 FM
4. Compliance with CEA guidelines is mandatory	0 NM
Overall Rating:	**1.3** **Partially Met**

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.13. Identifying Leadership and Accountability

The BCEAO and CEAA are the leading agencies in the EA process, and are responsible for analyzing the CEA for projects. These agencies provide overall management in the EA process by administering relevant legislation to conduct EAs and by managing the EA and CEA processes with all relevant agencies, stakeholders and First Nations groups. The BCEAO and CEAA are also accountable for decisions that are made within the processes.

As part of an EA under *CEAA 2012*, the proponent is required to prepare an application that includes CEA and CEAA reviews the application to ensure that all elements of CEA are included. If certain elements are missing, the CEAA may ask the proponent to provide supplemental information or additional analyses to support the CEA. Alternatively, as part of an EA under *BCEAA 2002*, proponents are not required by legislation to provide a CEA, but in practice the BCEAO typically includes such a requirement. When a CEA is provided, the BCEAO reviews it to ensure it is complete and may ask for additional information. Since these leading agencies are responsible for ensuring CEA is completed and their role and responsibilities are clearly defined (CEAA, 2014), these two sub-criteria are fully met.

Despite the clear roles and responsibilities of the leading agencies, it is unclear if sufficient resources and capacity are provided to lead this assessment. An analysis would need to be conducted via internal reviews and surveys of individuals involved in the EA and CEA processes to assess the adequacy of resources and capacity. For these reasons, this sub-criterion is rated as unknown.

Table 6.14. Ratings for Leadership and Accountability Criteria

Sub-criteria	Point Average and Rating
1. A lead agency has overall responsibility for ensuring completion of the CEA is identified	3 FM
2. Roles and responsibilities for completing the CEA process are clearly defined	3 FM
3. The leading agency has the resources and capacity to lead the assessment and ensure that the CEA is completed.	NA
Overall Rating:	**3**
	Fully Met

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.14. Transparency in Decision-Making

Transparency is required throughout the EA process to support decisions that are made on project approval. As part of the decision-making process, decision-makers must determine the significant adverse environmental effects from the project and if cumulative effects are likely to occur after mitigation. To determine if significant adverse effects are likely to occur, specific decision-making criteria are employed in both provincial and federal EAs (Table 6.15). These criteria can be assessed qualitatively or quantitatively, and rationales must be provided in the application to justify conclusions about significance. However, there is no clear combination of these criteria that triggers the determination that an effect is significant. Instead, the effects are defined and rationales are provided for each decision about significance. There is a lot of uncertainty and subjectivity with this approach in that the rationales that are made to determine whether an effect is significant are largely based on assumptions and judgements without clear decision-making criteria provided to support them.

The second major step in decision making under *CEAA 2012* is to determine if any likely adverse effects from the project and from cumulative effects occurring after mitigation are justified in the circumstances. The criteria for determining whether an adverse effect is justified in the circumstances are vague and consequently the determination is characterized by a high degree of subjectivity (Figure 6.1). On the provincial side, there are no clearly articulated criteria for the decision by the Ministers about whether or not to issue an environmental assessment certificate approving the project. As these decision-making criteria exist, but are relatively unclear, this sub-criterion is rated as partially met.

Table 6.15. Significance Criteria used in the Evaluation of Residual and Cumulative Effects Assessments for PNW

Criteria	Description
Context	Refers primarily to the current and future sensitivity and resilience of the VC to change caused by the project. Consideration of context draws heavily on the description of existing conditions of the VC, which reflect cumulative effects of other projects, and activities that have been carried out, and especially information about the impact of natural and human-caused trends in the condition of the VC. (i.e., low, medium or high resilience).
Magnitude	Refers to the expected size or severity of the residual effect. When evaluating the magnitude of residual effects, the proportion of the VC affected within the spatial boundaries and the relative effect (i.e., negligible, low, moderate, high) is considered.
Extent	Refers to the spatial scale over which the residual effect is expected to occur (i.e., within the PDA, LAA, or RAA)
Duration	Refers to the length of time the residual effect persists—which may be longer than the duration of the physical work or activity that is anticipated to cause the residual effect (i.e., short-term, medium-term, long-term, permanent)
Reversibility	Pertains to whether or not the residual effect on the VC can be reversed once the physical work or activity causing the disturbance ceases (i.e., reversible or irreversible)
Frequency	Refers to how often the residual effect occurs and is usually closely related to the frequency of the physical work or activity causing the residual effect (i.e., single event, multiple irregular events, multiple regular events, continuous)

Note: Adapted from Stantec Consulting Ltd. (2014)

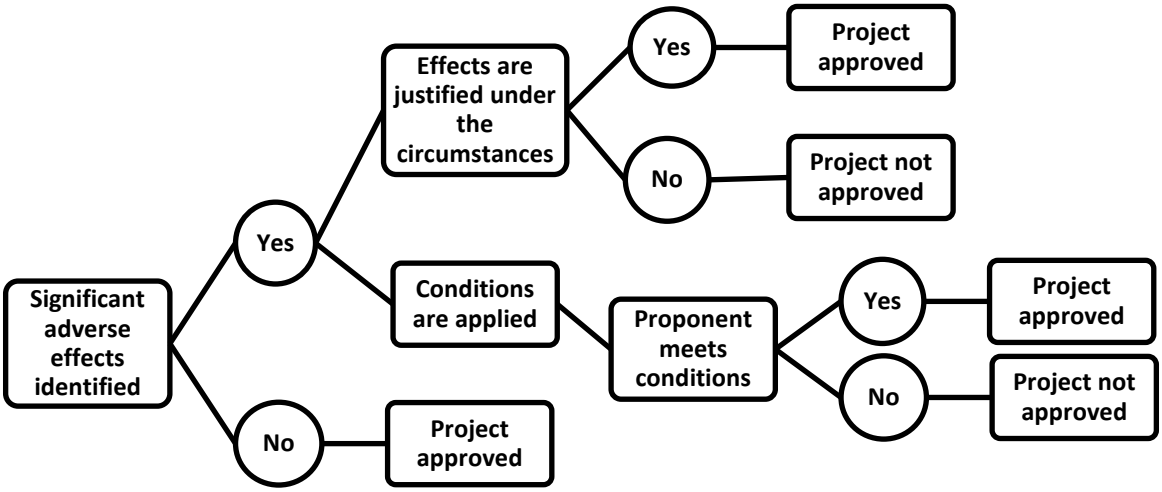

Figure 6.1. Decision-Making Process Used in *CEAA 2012* to determine Project Approval

The application does provide an explicit rationale for the evaluation of cumulative effects. CEA is considered for each VC that is shown to have residual effects. These residual effects are characterized and evaluated using the same criteria listed in Table 6.15. A detailed CEA is only conducted for VCs if it meets all three of the following criteria: 1) the project results in a demonstrable or measurable residual effect on a VC, 2) the residual effect is likely to act in a cumulative fashion with effects of other past, existing or future projects and activities in an area, and 3) where there is an expectation that the combined cumulative effects will adversely affect the resource value in a meaningful way (Stantec Consulting Ltd., 2014). While these rationales are provided in the application, they are narrow in scope and do not present a high degree of detail for conclusions that are made (e.g. when determining cumulative effects, likelihood, and confidence). For this reason, this sub-criterion is rated as partially met.

Table 6.16. Ratings for Transparency Criteria

Sub-criteria	Point Average and Rating
1. There are clear criteria that identify factors that are to be taken into account in decision-making	1 PM
2. There is an explicit rationale provided for the evaluation of cumulative effects	1 PM
Overall Rating:	**1** **Partially Met**

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.15. Establishing a Central Database of Information and Information Sharing

The BCEAO's e-Pic website and the CEAA's Registry website act as databases to store relevant project information. These websites contain relevant project information including a projects EA application, public comments, and proponent responses to information requests. While both of these websites are publically accessible and contain project information, certain data and information may be excluded. Most often, baseline data, monitoring data, and cumulative effects data, and calculations that are relied on in support of the application are not posted on these websites. Additionally, while TK may be used in the CEA, it is often not included on these websites as these data are often confidential. Since environmental impact databases exist and are publically available but do not contain all data relevant to the project, these sub-criteria are rated as largely met.

Table 6.17. Ratings for Central Database of Information and Information Sharing Criteria

Sub-criteria	Point Average and Rating
1. A central database exists and contains data and information used in all phases of the CEA	2 LM
2. All data from the CEA are publically available	2 LM
Overall Rating:	**2** **Largely Met**

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.16. Legal Foundation Supporting CEA

To operationalize CEA, the key elements of CEA must be included within a legal context, both at the federal and provincial levels. The key elements of CEA are largely based on the BP criteria and sub-criteria used in this assessment and are listed in Table 6.18 along with an assessment of whether there they are specified or provided for in *CEAA 2012* and *BCEAA 2002*. While all of these key elements may not belong specifically in *CEAA 2012* or *BCEAA 2002*, they should be supported through a legal mechanism, such as in the form of mandatory regulations or policy. Furthermore, depending on the specificity of the key element, it may need to be formulated in relation to a specific regional setting and for each VC. Overall, while a few key elements are established or are partially met in legislation, the majority of the key elements are not established.

Table 6.18. Key Elements of CEA and their Requirements under *CEAA 2012* and *BCEAA 2002*.

Key Element of CEA	Specified in *CEAA 2012*	Specified in *BCEAA 2002*	Reference
1. Setting goals and objectives	No	No	NA
2. Setting targets and thresholds	No	No	NA
3. Providing rationales for selection of VCs and indicators	No	No	NA
4. Analyzing baseline conditions using all available information	No	No	NA
5. Collecting baseline data if insufficient information is available	Yes	Partially	*CEAA 2012*- s.23(2) *BCEAA 2002*- s.16 (2)(3)
6. Analyzing data at a regional scale	No	No	NA
7. Implementing mitigation measures and determining effectiveness	Yes	No	*CEAA 2012*- Definitions & s.19 (1)(e)
8. Adjusting mitigation measures based on performance	Partially	No	*CEAA 2012*- s.4(a)(ii)

Key Element of CEA	Specified in *CEAA 2012*	Specified in *BCEAA 2002*	Reference
9. Implementing monitoring/ follow up strategies	Yes	No	*CEAA 2012*- Definitions, s.19(1)(e), s.29(1)(b)
10. Using ecosystem-based assessments where applicable	No	No	NA
11. Development of a range of scenarios	No	No	NA
12. Identifying methodologies for developing a range of scenarios	No	No	NA
13. Identifying assumptions and uncertainties	No	No	NA
14. Employing the use of the precautionary principle for assumptions and uncertainties	Yes	No	*CEAA 2012*- s.4(1)(b, g), s.4(2)
15. Conducting comprehensive assessments (includes biophysical, social, economic, cultural and health parameters)	Yes	Yes	*CEAA 2012*- s.5(1)(a, c), s.5(2) *BCEAA 2002*- s.6(1)(a)
16. Outlining time limits	Yes	Yes	*CEAA 2012*- s.27, s.30(2), s.38 (3,4,5), s.54 *BCEAA 2002*- s.24
17. Identifying linkages of effects across parameters	No	No	NA
18. Requiring meaningful public participation	Yes	Partially	*CEAA 2012*- s.4(1)(e), 19(1)(c) *BCEAA 2002*- 11(2)(f)
19. Integrating and addressing public comments within the assessment	No	No	NA
20. Identifying lead agencies and their roles and responsibilities	Partially	Partially	*CEAA 2012*- s.14(4), s.15 *BCEAA 2002*- s.2

Key Element of CEA	Specified in *CEAA 2012*	Specified in *BCEAA 2002*	Reference
21. Collaborating with lead agencies, the public, and First Nations	No	No	NA
22. Using transparent decision-making criteria	Partially	Partially	*CEAA 2012*- s.10, s.27(1), s.31(1), s.52(1,4) *BCEAA 2002*- s.17(3)
23. Providing public access to all data	Yes	Yes	*CEAA 2012*- s.34 (1)(c), s.43(1)(b), s.78(1) *BCEAA 2002*- s.11(2)(f), s.25(1)
24. Updating key elements of CEA on a regular basis	No	No	NA

Note: NA= Not applicable

Additionally, there is a difference between federal and provincial legislation in terms of when CEA is required. Section 4(1) and 19(1)(a) of *CEAA 2012* define CEA and require CEA to be conducted within environmental assessments. CEA is referenced in section 11(2) of *BCEAA 2002*, but the legislation does not require CEA to be conducted within EAs. Overall, since many key elements are not provided within legislation and the CEA is not mandatory to be conducted as part of the provincial EA process, this sub-criterion is partially met.

Table 6.19. Ratings for Legal Foundation Criteria

Sub-criteria	Point Average and Rating
1. All key elements of the CEA are established in law and are required to be conducted	1 PM
2. CEA is mandatory	1 PM
Overall Rating:	**1** **Partially Met**

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.3.17. Policy and Program Review

Neither the application nor government policies for the CEA process state that components of the CEA will be modified or updated with new information, nor are reviews and updates scheduled on a regular basis. Therefore these sub-criteria are not met.

Table 6.20. Ratings for Policy and Program Review Criteria

Sub-criteria	Point Average and Rating
1. Components of the CEA are modified and updated with new information	0 NM
2. Reviews and updates are scheduled on a regular basis	0 NM
Overall Rating:	**0** **Not Met**

Note: FM= Fully Met, LM= Largely Met, PM= Partially Met, NM= Not Met, NA= Unknown

6.4. Evaluation Summary

Overall, the results of the evaluation show that three best practices are fully met, three best practices are largely met, eight best practices are partially met, and two best practices are not met. Only one best practice is rated as unknown. The overall score for this evaluation is 15.2 out of 48, or 32% (Table 6.21). These results reveal that there are multiple inadequacies with the approach to CEA used for the PNW EIA review. In the next chapter, I provide a list of recommendations that aim to improve CEA within EIA.

Table 6.21. Summary of Ratings for Best Practice Criteria

Best Practice	Point Average Score	Overall Rating
Identifying Goals, Objectives, Targets and Thresholds	1.3	Partially Met
Providing Rationales for the Selection of Values and Indicators	1.5	Largely Met
Analysis of Baseline Conditions	1.1	Partially Met
Identifying Mitigation Strategies and Measures	0.6	Partially Met
Developing Monitoring Programs	1	Partially Met
Conducting Ecosystem-Based Assessment	1.1	Partially Met
Scenario Development and Analysis	0	Not Met
Identifying Assumptions and Uncertainties and their Effect on the Analysis	1.8	Largely Met
Process Efficiency	0	Not Met
Adequate and Meaningful Participation	UK	Unknown
Conducting Comprehensive Reviews	3	Fully Met
Using Credible Expertise	1.3	Partially Met
Identifying Leadership and Accountability	3	Fully Met
Transparency in Decision-Making	1	Partially Met
Establishing a Central Database of Information and Information Sharing	2	Largely Met
Legal Foundation supporting CEA	1	Partially Met
Policy and Program Review	0	Not Met
Score:	**15.2/48**	**32%**

Chapter 7.

Conclusion

7.1. Research Summary

There are many concerns that exist regarding the potential for cumulative effects to occur as a result of the interactions of multiple projects over time. With the recently announced plans from the provincial government to develop the LNG industry in the province, there is a potential for LNG projects to interact with past and existing projects and activities and contribute to impacts on the environment. As part of the EIA process, CEA is conducted to provide an analysis of the environmental impacts from proposed projects in combination with past, existing, and future projects and activities in a region. My research objective is to evaluate the quality of CEA through a case study analysis of the EA application for the PNW project. BP criteria were adopted from Lucchetta et al. (2016) and were applied against the eight biophysical values in the EA application to evaluate the degree to which these BP criteria were met. The results of the evaluation indicate that two best practices are fully met, three best practices are largely met, eight best practices are partially met, three best practices are not met, and one best practice is rated as unknown. The results indicate that there are major deficiencies in the CEA process. Due to the potential for negative cumulative effects to occur from PNW and other projects and activities, these deficiencies need to be addressed to achieve an effective CEA and to improve future resource and environmental management practices.

7.2. Recommendations

From the results of the evaluation, it is clear that deficiencies exist in three main areas: 1) in the approach and methodology used by the proponent to conduct CEA, 2) in the process used by the proponent and leading agencies to conduct CEA, and 3) in the overall policy and legal foundation to support CEA within EIA. Based on the results of this evaluation, 31 recommendations are made to improve the practice of CEA within EIA (Table 7.1). These recommendations are directed at the federal and provincial

government and regulatory agencies (CEAA and BCEAO) that are responsible for overseeing that CEA is conducted properly.

Table 7.1. Summary of Key Weaknesses in the CEA for PNW and Recommendations for Improvement

Best Practice	Key Weaknesses	Recommendations for Improvement
VC-Specific		
Identifying Goals, Objectives, Targets and Thresholds	• Goals and objectives for CEA are not clearly stated • Targets and thresholds are not identified for all VCs in the assessment	1. The provincial/federal government should identify goals and objectives for CEA on a regional basis; these should align with existing regional policy or planning objectives and be developed in consultation with stakeholders and First Nations (CCME, 2009; Clogg & Carlson, 2013b; Noble, 2008). 2. The provincial and federal government should identify short-, medium-, and long-term targets and thresholds for specific VCs in regional management areas in partnership with stakeholders and First Nations. The proponent should comply and attempt to meet these targets and thresholds in their application. 3. The regulatory agencies should verify that targets and thresholds are identified across all VCs for each project application.
Providing Rationales for the Selection of Values and Indicators	• The process and methodology for the selection of VCs and indicators is not provided	4. The regulatory agencies should develop process and comprehensive methodological guidelines for the selection of VCs and indicators and require that these be described and followed in the application.

Best Practice	Key Weaknesses	Recommendations for Improvement
Analysis of Baseline Conditions	• Lack of data on historical trends for VCs • No requirement to address drivers of change for VCs (e.g. climate change) in CEA • Poor incorporation of TK in CEA	5. The provincial and federal government should establish baseline data collection programs (either independently or in partnerships with NGOs or First Nations) for VCs and/or require proponents to provide baseline data that document the condition and trends in VCs over time. 6. The regulatory agencies should require that drivers of change are identified for VCs (e.g. climate change). 7. Proponents should be required to include TK in the CEA and the regulatory agencies should provide comprehensive guidelines on how to assess and include TK in CEA.
Identifying Mitigation Strategies and/or Mitigation Measures	• Lack of discussion of the potential effectiveness of proposed mitigation measures • Poor identification of precautionary measures used in CEA	8. The regulatory agencies should require that documentation of the effectiveness of mitigation measures is provided in the application and verify through monitoring programs that these measures are effective in practice. 9. The regulatory agencies should require that mitigation strategies and/or mitigation measures follow the precautionary approach.

Best Practice	Key Weaknesses	Recommendations for Improvement
Developing Monitoring Programs	• Few monitoring programs for CEA are established • Monitoring programs that are established do not contain provisions to implement remedial action if mitigation measures are not performing as expected • Few monitoring programs are led by independent agencies • Information from monitoring programs is not always publically available • Few monitoring programs occur on a regularly scheduled basis	10. The provincial and federal government should establish regional monitoring programs to monitor VCs over time; these programs should contain provisions to implement remedial action if the proposed mitigation measures are not performing as expected; these programs should be conducted on a regular basis and monitoring results should be publically available. 11. The provincial and federal government should establish monitoring programs that are conducted by a credible independent agency (e.g. federal or provincial agency, stakeholder committee, NGO, First Nations, or third party contractors).
Conducting Ecosystem-Based Assessments	• Poor use of ecosystem based assessment in CEA • Lack of consideration of ecosystem and species relationships within and across VCs	12. The regulatory agencies should require that ecosystem-based boundaries and assessments be used to assess VCs (as appropriate). 13. The regulatory agencies should require the proponent to provide a discussion on ecosystem and species relationships within and across VCs.
Scenario Development and Analysis	• Lack of development of scenarios to assess cumulative effects • Scenarios do not cover the possible range of projects and human activities and cumulative impacts on a VC	14. The regulatory agencies should require the proponent to develop a range of development scenarios to assess the cumulative impacts on a VC. 15. The regulatory agencies should require that all relevant projects and activities (past, present and reasonably foreseeable) are included and identified in these scenarios and are updated accordingly throughout the EA process. 16. The federal and provincial government should develop guidance on how to develop these scenarios and should include specific criteria that proponents are required to follow.

Best Practice	Key Weaknesses	Recommendations for Improvement
Identifying Assumptions and Uncertainties and their Effect on the Analysis	• Limitations of analytical methods used to determine cumulative effects are not disclosed in the application • Few sensitivity analyses are conducted	17. The regulatory agencies should require the proponent to identify all assumptions that are made in the application and to provide rationales for these assumptions for the analysis of all VCs. The regulatory agencies should require the proponent to state limitations in analytical methods used in the CEA. 18. The regulatory agencies should require proponents to conduct sensitivity analyses for all VCs impacts in the CEA.
Process Efficiency	• Information gaps are not prioritized based on explicit criteria • Unclear if appropriate time limits and resource requirements are provided in the review	19. The regulatory agencies should require proponents to identify and prioritize where gaps in information occur in the CEA; proponents should be required to work with the regulatory authorities and other agencies to fill these gaps. 20. The federal and provincial government should conduct an audit on the EA process to determine if time limits and resource requirements are provided to ensure a thorough, yet efficient evaluation.
Process-Specific		
Adequate and Meaningful Participation	• Unclear if adequate resources are provided to First Nations and stakeholders to participate and if participation is meaningful • Unclear if input from stakeholders and First Nations are incorporated in the CEA	21. The provincial and federal government should verify that stakeholders and First Nations have the resources to participate in the assessment (time, knowledge, capacity, etc.) and should address any resource and capacity deficiencies that exist. 22. Comprehensive guidelines for stakeholder and First Nations consultation should be developed that include measures to ensure that stakeholder input is incorporated in decision-making and these guidelines should be enforced by the regulatory agencies.

Best Practice	Key Weaknesses	Recommendations for Improvement
Conducting Comprehensive Reviews	• Cumulative effects that cross multiple parameters are not connected and discussed	23. The regulatory agencies should ensure that the proponent provides a discussion on the cumulative effects across all parameters (including environmental, social, economic, cultural, and health) and that all appropriate connections between the VCs are made.
Using Credible Expertise	• Analysts undertaking the CEA may not be fully independent • Compliance with CEA guidelines is not mandatory	24. The provincial and federal government should create independent agencies to review the CEA; analysts should be independent and have no bias 25. The provincial and federal government should develop methodologies and best practices for CEA and require proponents to follow them for all EA projects
Identifying Leadership and Accountability	• Unclear if leading agencies have the resources and capacity to ensure CEA is completed	26. The federal and provincial government should conduct an audit to ensure that the regulatory agencies have sufficient resources and capacity to conduct CEA; additional resources should be provided to address any deficiencies identified.
Transparency in Decision-Making	• There exists no clear criteria for decision-making within CEA (including in decisions on significance for cumulative effects and for project approval)	27. The provincial and federal government should develop clear decision-making criteria for both significance decisions and for decision-makers when approving or not approving projects 28. The criteria should be transparent and should be provided in the EA application (significance decisions) and in the decision statements (project approval)
Central Database of Information and Information Sharing	• All relevant data and information are not always publically available	29. The regulatory agencies should provide all non-confidential information to the public through free and easily accessible central databases.
Policy-Specific		
Legal Foundation	• CEA may not be required legally	30. The provincial and federal government should make CEA a legal requirement for all EAs and ensure that all components of CEA are provided for in legislation and regulations.

Best Practice	Key Weaknesses	Recommendations for Improvement
Policy and Program Review	• CEA frameworks are not modified and updated as new information becomes available	31. The provincial and federal government should conduct audits on a regularly scheduled basis to determine the effectiveness of CEA frameworks and guidance and revise CEA frameworks accordingly.

7.3. Research Limitations and Future Research

There are several limitations to this study. First, the study is limited in the fact that only the biophysical VCs from one case study were evaluated. Limiting the evaluation to only biophysical VCs from one case study does not provide a comprehensive review of CEA. While the focus of this research was specific to biophysical VCs due to scoping reasons, a complete assessment of the social, economic, cultural, and heath VCs across a number of case studies is warranted to determine the overall quality of CEA.

Second, limitations exist in measuring the degree to which each BP is met, due to insufficient information. For example, some of the BP criteria and sub-criteria (e.g. Adequate and Meaningful Participation) are rated to be “unknown” since the necessary information to evaluate the BPs is not provided in the EA application. Future research within these areas with insufficient information could be conducted to fully assess the degree to which these BP criteria were met.

Third, while the BP criteria were defined and rated as clearly as possible, there is still a degree of subjectivity in rating the degree to which the BPs are met and in the identification of deficiencies in the CEA. Different assessors may come to different conclusions on the degree to which the BPs are met based on their interpretation of the EA application. Therefore, it may be useful to utilize a larger panel of experts to evaluate the degree to which CEA best practices are met.

Fourth, while the BP criteria have been tested to varying degrees, more testing of the BP criteria developed for the evaluation is warranted to assess their effectiveness in achieving CEA objectives. Finally, this research project focuses on evaluating CEA and not the overall EA process. While the BPs and evaluation are relevant to many aspects of EA, they are not intended to address all aspects of the EA process. In particular, it is not

clear what the relationship between CEA and EA should be and whether CEA should be undertaken as part of a broader program of environmental management or as part of project based environmental assessment. More research on the relationship between CEA and EA and the optimal organizational structure for undertaking CEA would be desirable.

References

AXYS Environmental Consultants Ltd., Salmo Consulting Inc., Diversified Environmental Services, Paragon Environmental Consulting, Limnotek Research and Development et al., (2003). *A cumulative effects assessment and management framework (CEAMF) for northeast British Columbia*.

Baxter, W., Ross, W, A., & Spaling, H. (2001). Improving the practice of cumulative effects assessment in Canada. *Impact Assessment and Project Appraisal*, *19*(4), 253–262. Retrieved from http://www.tandfonline.com/doi/pdf/10.3152/147154601781766916

BC Environmental Assessment Office (BCEAO). (2013). *Guideline for the selection of valued components and assessment of potential effects*. Retrieved from British Columbia Environmental Assessment Office website: http://www.eao.gov.bc.ca/VC_Guidelines.html

BC Environmental Assessment Office (BCEAO). (2014). *Pacific NorthWest LNG project assessment report*. Retrieved from British Columbia Environmental Assessment Office website: http://a100.gov.bc.ca/appsdata/epic/documents/p396/d38287/1416938658943_l0pwJ01QhLtT3GnJwRzm12YHRq5BWhTshGjgHWg3xz3KJ7Qs770T!-231679769!1416934832825.pdf

BC Environmental Assessment Office (BCEAO). (2015). *Environmental assessment office user guide: An overview of environmental assessment in British Columbia*. Retrieved from BCEAO website: http://www.eao.gov.bc.ca/ea_process.html

BC Ministry of Energy and Mines. (2012). *Liquefied natural gas: A strategy for BC's Newest Industry*. Retrieved from the Province of BC website: http://www.gov.bc.ca/ener/natural_gas_strategy.html

BC Ministry of Environment. (BC MOE) (2006). *British Columbia approved water quality guidelines*. Retrieved from Government of BC website: http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines

BC Ministry of Environment. (BC MOE) (2008). *Guidelines for air quality dispersion modelling in British Columbia*. Retrieved from: http://www.bcairquality.ca/reports/pdfs/air_disp_model_08.pdf

BC Ministry of Jobs, Tourism and Skills Training (BC JTST). (2015). *BC major projects inventory December 2015*. Retrieved from the Province of BC website: http://www2.gov.bc.ca/gov/content/employment-business/economic-development/industry/bc-major-projects-inventory

Beanlands, G. E., & Duinker, P. N. (1983). *An ecological framework for environmental impact assessment in Canada*. Report prepared for Federal Environmental Assessment Review Office.

Booth, A. L., & Skelton, N. W. (2011). Improving First Nations participation in environmental assessment processes: Recommendations from the field. *Impact Assessment and Project Appraisal*, *29*(1), 49–58. doi:10.3152/146155111X12913679730395

Canadian Association of Petroleum Producers (CAPP). (2015). *An overview of the world LNG market and Canada's potential for exports of LNG: An update.* Retrieved from CAPP website: http://www.capp.ca/publications-and-statistics/publications/266489

Canadian Council of Ministers of the Environment. (CCME) (2009). *Regional strategic environmental assessment in Canada: Principles and guidance.* Retrieved from Canadian Council of Ministers of the Environment website: http://www.ccme.ca/files/Resources/enviro_assessment/rsea_principles_guidance_e.pdf

Canadian Council of Ministers of the Environment. (CCME) (2013). *Canadian environmental quality guidelines summary table*. Retrieved from Canadian Council of Ministers of the Environment website http://st- ts.ccme.ca/

Canadian Environmental Assessment Agency (CEAA). (2003). *Incorporating climate change considerations in environmental assessment: General guidance for practitioners*. Retrieved from the CEAA website: http://www.ceaa.gc.ca/default.asp?lang=En&n=A41F45C5-1

Canadian Environmental Assessment Agency (CEAA). (2007). *Operational policy statement: Assessing cumulative environmental effects under the Canadian Environmental Assessment Act*. Retrieved from the CEAA website: http://www.ceaa.gc.ca/default.asp?lang=En&n=1F77F3C2-1

Canadian Environmental Assessment Agency (CEAA). (2011). *Canadian environmental assessment act: An overview*. Retrieved from the CEAA website: http://www.ceaa.gc.ca/default.asp?lang=En&n=0DF82AA5-1

Canadian Environmental Assessment Agency (CEAA). (2013*). Environmental assessment process mandated by the agency.* Retrived from the CEAA website: http://www.ceaa.gc.ca/Content/B/0/5/B053F859-4895-45A9-8A3A-E74CBE58912A/EA_processes.pdf

Canadian Environmental Assessment Agency (CEAA). (2014). *Technical guidance for assessing cumulative environmental effects assessment under the Canadian Environmental Assessment Act, 2012*. Retrieved from the CEAA website: http://www.ceaa.gc.ca/default.asp?lang=En&n=B82352FF-1

Canadian Environmental Assessment Agency (CEAA). (2015a). *Operational policy statement: Assessing cumulative environmental effects under the Canadian Environmental Assessment Act, 2012*. Retrieved from the CEAA website: http://www.ceaa.gc.ca/default.asp?lang=En&n=1DA9E048-1

Canadian Environmental Assessment Agency (CEAA). (2016a). *Frequently asked questions*. Retrieved from the CEAA website: http://www.ceaa.gc.ca/default.asp?lang=en&n=CE87904C-1#wsAD37D83B

Canadian Environmental Assessment Agency (CEAA). (2016b). *Pacific NorthWest LNG draft environmental assessment report*. Retrieved from the CEAA website: http://www.ceaa-acee.gc.ca/050/document-eng.cfm?document=104785

Canadian Gas Association, US Federal Reserve & World Bank (2016). Gas stats-Natural gas prices. Retrieved from the Canadian Gas Association website: http://www.cga.ca/gas-stats/

Cardinale, P., & Greig, L. A. (2013). *Cumulative impact assessment and management: Guidance for the private sector in emerging markets.* Report prepared for International Finance Corporation.

Clogg, J., & Carlson, D. (2013a). *Regional cumulative effects assessment in British Columbia: A legal discussion paper*. Paper prepared for West Coast Environmental Law. Retrieved from http://bvcentre.ca/files/integrated/Who_Owns_Regional_Cumulative_Effects_Management_WCEL_October_2013.pdf

Clogg, J., & Carlson, D. (2013b). *Who owns regional cumulative effects management? A legal discussion paper*. Paper prepared for West Coast Environmental Law. Retrieved from http://wcel.org/resources/publication/who-owns-regional-cumulative-effects-assessment-presentation

Compass Resource Management Ltd., Pierce Lefebvre Consulting & Value Scope Research (2012). *Refining effect assessment in BC: An internal discussion paper*. Prepared for the BC Environmental Assessment Office.

Cooper, L. (2004). *Guidelines for cumulative effects assessment in SEA of plans*. EPMG Occasional Paper 04/LMC/CEA, Imperial College London.

Dubé, M. G. (2003). Cumulative effects assessment in Canada: A regional framework for aquatic ecosystems. *Environmental Impact Assessment Review*, *23*(6), 723–745. doi:10.1016/S0195-9255(03)00113-6

Duinker, P. N., & Greig, L. A. (2006). The impotence of cumulative effects assessment in Canada: Ailments and ideas for redeployment. *Environmental Management*, *37*(2), 153–61. doi:10.1007/s00267-004-0240-5

Duinker, P. N., & Greig, L. A. (2007). Scenario analysis in environmental impact assessment: Improving explorations of the future. *Environmental Impact Assessment Review*, *27*(3), 206–219. doi:10.1016/j.eiar.2006.11.001

Environment and Climate Change Canada (ECCC) (2016). National inventory report 1990-2014: Greenhouse gas sources and sinks in Canada- Executive summary. Retrieved from ECCC website: https://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=662F9C56-1

Forest Practices Board. (2011). *Cumulative effects: From assessment towards management*. Retrieved from Forest Practices Board website: https://www.bcfpb.ca/reports-publications/reports/cumulative-effects-assessment-towards-management/

Franks, D. M., Brereton, D., Moran, C. J., Sarker, T., & Cohen, T. (2010). *Cumulative impacts: A good practice guide for the Australian coal mining industry*. Centre for Social Responsibility in Mining & Centre for Water in the Minerals Industry, Sustainable Minerals Institute, The University of Queensland. Australian Coal Association Research Program. Brisbane.

Galbraith, L., Bradshaw, B., & Rutherford, M. B. (2007). Towards a new supraregulatory approach to environmental assessment in Northern Canada. *Impact Assessment and Project Appraisal*, *25*(1), 27–41. doi:10.3152/146155107X190596

Gibson, R. B. (2012). In full retreat: The Canadian government's new environmental assessment law undoes decades of progress. *Impact Assessment and Project Appraisal*, *30*(3), 179–188. doi:10.1080/14615517.2012.720417

Glasson, J., Thérivel, R., & Chadwick, A. (2005). *Introduction to environmental impact assessment*. Routledge. doi:10.4324/9780203023068

Gomes, I. (2015). *Natural gas in Canada: What are the options going forward?* Report Prepared for the Oxford Institute for Energy Studies.

Greig, L. A., Duinker, P. N, Everitt, R. R., & Pawley, K. (2003). *Scoping for cumulative effects assessment*. Prepared for Indian and Northern Affairs Canada Environment Directorate, Whitehorse, Yukon Territory. ESSA Technologies Ltd., Richmond Hill, Ontario.

Gunn, J., & Noble, B. F. (2011). Conceptual and methodological challenges to integrating SEA and cumulative effects assessment. *Environmental Impact Assessment Review*, *31*(2), 154–160. doi:10.1016/j.eiar.2009.12.003

Halpin, M. M., & Seguin, M. (1990). Tsimshian peoples: Southern Tsimshian, Coast Tsimshian, Nishga, and Gitksan. In W. Suttles (Ed.), *Handbook of North American Indians: Northwest Coast* (Vol. 7, pp. 267–284). Washington, D.C.: Smithsonian Institute. Retrieved from http://faculty.arts.ubc.ca/menzies/anth220/a_Tsmshian_Overview.pdf

Hanna, K.S. (2009). *Environmental impact assessment practice and participation*. Canada: Oxford University Press.

Health Canada (2011). *Health Canada guidance for evaluating human health impacts in environmental assessment: Noise (Draft)*. Retrieved from Health Canada website: https://a100.gov.bc.ca/appsdata/epic/documents/p362/1317422106563_a22c828c0165766ce0c88793d3560e7592b8c9c2d4d66fd304957e875703f18b.pdf

Heemskerk, B. (2012). Building a cumulative effects assessment framework in BC: Examples from the Northwest & Okanagan demo pilot projects. FLNRO. [Powerpoint Slides]. Retrieved from: http://bvcentre.ca/files/Conferences/proceedings/27-Heemskerk.pdf

Hegmann, G., Cocklin, C., Creasey, R., Dupuis, S., Kennedy, A., Kingsley, L.,… Stalker, D. (1999). Cumulative effects assessment practitioners guide. Prepared by AXYS Environmental Consulting Ltd. and the CEA Working Group for the Canadian Environmental Assessment Agency.

Holz, F., Richter, P. M., & Egging, R. (2015). A global perspective on the future of natural gas: Resources, trade, and climate constraints. *Review of Environmental Economics and Policy*, *9*(1), 85–106. doi:10.1093/reep/reu016

Indian and Northern Affairs Canada. (2007). *A citizen's guide to cumulative effects*. Retrieved from: http://www.aadnc-aandc.gc.ca/eng/1100100023719/1100100023763

International Association for Impact Assessment and Institute of Environmental Assessment (IAIA & EIA). (1999). Principles of Environmental Impact Assessment Best Practice. Retrieved from: https://www.eianz.org/document/item/2744

International Commission on Illumination. (2003). *Guide on the limitation of the effects of obtrusive light from outdoor lighting installations*. Retrieved from: http://www.cie.co.at/index.php/Publications/Technical+Reports+and+Guides

Johnson, D., Lalonde, K., McEachern, M., Kenney, J., Mendoza, G., Buffin, A., & Rich, K. (2011). Improving cumulative effects assessment in Alberta: Regional strategic assessment. *Environmental Impact Assessment Review*, *31*(5), 481–483. doi:10.1016/j.eiar.2011.01.010

Joseph, C.T.B. (2013). *Megaproject review in the megaprogram context: Examining Alberta bitumen development*. Doctoral Dissertation, School of Resource and Environmental Management, Simon Fraser University, Burnaby, BC.

Kingsley, L. (1997). *A Guide to environmental assessments: Assessing cumulative effects*. Prepared for Parks Canada, Department of Canadian Heritage, Hull, Quebec.

Kwon, K. (2016). *Grounded in values, informed by local knowledge and science: The selection of valued components for a First Nation's regional cumulative effects management system*. Master's Thesis, School of Resource and Environmental Management, Simon Fraser University, Burnaby, BC.

Lawe, L. B., & Wells, J. (2005). Cumulative effects assessment and EIA follow up: A proposed community-based monitoring program in the oil sands region, northeastern Alberta. *Impact Assessment and Project Appraisal*, *23*(3), 205–209. Retrieved from http://www.tandfonline.com/doi/abs/10.3152/147154605781765508#.U-f2LPldXfg

Lucchetta, M., Steffensen, M., Gunton, T., Rutherford, M., & Broadbent, S. (2016). *Cumulative effects assessment and management: A framework for the Metlakatla First Nation*. Unpublished manuscript, School of Resource and Environmental Management, Simon Fraser University, Burnaby, BC.

MacDonald, L. (2000). Evaluating and managing cumulative effects: Process and constraints. *Environmental Management*, *26*(3), 299–315. doi:10.1007/s002670010088

Natural Resources Canada (NRCan) (2016). Additional statstics on energy. Retrieved from NRCan website: http://www.nrcan.gc.ca/publications/statistics-facts/1239

Nielsen, J. (2010). *A cumulative effects approach to wetland mitigation*. Doctoral Dissertation, Department of Geography and Planning, University of Saskatchewan, Saskatoon, SK. Retrieved from http://ecommons.usask.ca/bitstream/handle/10388/etd-03252010-173407/Jesse_Nielsen_MSc._Thesis.pdf

Nitschke, C. R. (2008). The cumulative effects of resource development on biodiversity and ecological integrity in the Peace-Moberly region of northeast British Columbia, Canada. *Biodiversity and Conservation, 17*(7), 1715-1740. doi:10.1007/s10531-008-9376-6

Noble, B. F. (2008). Strategic approaches to regional cumulative effects assessmet: A case study of the Great Sand Hills, Canada. *Impact Assessment and Project Appraisal*, *26*(2), 78–90. doi:10.3152/146155108X316405

Noble, B. F. (2010). Cumulative environmental effects and the tyranny of small decisions: Towards meaningful cumulative effects assessment and management. *Natural Resources and Environmental Studies Institute Occasional Paper No. 8, University of Northern British Columbia, Prince George, B.C., Canada.*, (8), 23. Retrieved from http://www.unbc.ca/assets/nres/nresi_op_08_noble_2010.pdf

Noble, B. F., Hill, M., & Nielsen, J. (2011). Environmental assessment framework for identifying and mitigating the effects of linear development to wetlands. *Landscape and Urban Planning*, *99*(2), 133–140. doi:10.1016/j.landurbplan.2010.09.004

Noble, B. F. (2013). *Development of a cumulative effects monitoring framework: Review and options paper*. Report prepared for the Department of Indian Affairs and Northern Development Canada.

Northwest Territories Cumulative Effects Assessment and Management Steering Committee (NWT CEAM Steering Committee). (2007). *A blueprint for implementing the cumulative effects assessment and management strategy and framework in the NWT and its regions*.

Office of the Auditor General of British Columbia (BC OAG) (2015). *Managing the cumulative effects of natural resource development in B.C.* Retrieved from Office of the Auditor General of British Columbia website: http://www.bcauditor.com/pubs/2015/managing-cumulative-effects-natural-resource-development-bc

Pacific NorthWest LNG (2016). The project- Facility design. Retrieved from the PNW website: http://www.pacificnorthwestlng.com/the-project/facility-design/

Parkins, J. R. (2011). Deliberative democracy, institution building, and the pragmatics of cumulative effects assessment. *Ecology and Society*, 16(3),12. doi: 10.5751/ES-04236-160320

Petroliam Nasional Berhad (PETRONAS). (2014). *PETRONAS Corporate profile*. Retrived from PETRONAS website: http://www.petronas.com.my/about-us/Documents/PETRONAS%20Corporate%20Profile.pdf

Plate, E., Foy, M., & Krehbiel, R. (2009). *Best practices for First Nation involvement in environmental assessment reviews of development projects in British Columbia*. Retrieved from http://fnbc.info/sites/default/files/documents/First Nations Environmental Assessment Best Practices Report_1.pdf

Porter, M., & Murray, C. (2010). Cumulative effects assessment (CEA) workshop proceedings (January 25 & 26, 2010). Prepared for Watershed Watch Salmon Society in collaboration with Stó:lō Nation (Sumas Band) by ESSA Technologies Ltd., Vancouver, BC.

Rivard, C., Lavoie, D., Lefebvre, R., Séjourné, S., Lamontagne, C., & Duchesne, M. (2014). An overview of Canadian shale gas production and environmental concerns. *International Journal of Coal Geology*, *126*, 64–76. doi:10.1016/j.coal.2013.12.004

Salmo Consulting Inc. (2006). *Developing and implementing thresholds in the Northwest Territories – A discussion paper*. Prepared for Environment Canada, Northern Division.

Seitz, N. E., Westbrook, C. J., & Noble, B. F. (2011). Bringing science into river systems cumulative effects assessment practice. *Environmental Impact Assessment Review*, *31*(3), 172–179. doi:10.1016/j.eiar.2010.08.001

Sheelanere, P., Noble, B. F., & Patrick, R. J. (2013). Institutional requirements for watershed cumulative effects assessment and management: Lessons from a Canadian trans-boundary watershed. *Land Use Policy*, *30*(1), 67–75. doi:10.1016/j.landusepol.2012.03.001

Smit, B., & Spaling, H. (1995). Methods for cumulative effects assessment. *Environmental Impact Assessment Review*, 15(1), 81–106. doi: 10.1016/0195-9255(94)00027-X

Spaling, H., Zwier, J., Ross, W., & Creasey, R. (2000). Managing regional cumulative effects of oil sands development in Alberta, Canada. *Journal of Environmental Assessment Policy and Management*, *02*(04), 501–528. doi:10.1142/S1464333200000461

Stantec Consulting Ltd. (2014). *Application for an environmental assessment certficate for the Pacific NorthWest LNG Project*. Preapared for BCEAO. Retrieved from the BCEAO website: http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_document_396_37423.html

Stiff, K. (2001). *Cumulative effects assessment and sustainability: Diamond mining in the Slave Geological Province*. Masters Thesis, University of Waterloo, Waterloo, ON.

Therivel, R., & Ross, B. (2007). Cumulative effects assessment: Does scale matter? *Environmental Impact Assessment Review*, 27(5), 365–385. doi:10.1016/j.eiar.2007.02.001

Van Hinte, T., Gunton, T. I., & Day, J. C. (2007). Evaluation of the assessment process for major projects: A case study of oil and gas pipelines in Canada. *Impact Assessment and Project Appraisal*, *25*(2), 123–137. doi:10.3152/146155107X204491

Vesely, A.. (2011). Theory and methodology of best practice research: A critical review of the current state. *Central European Journal of Public Policy,* 5 (2):98-117.

Walker, L, J., Johnston, J., Napier, H., & Clark, D. (1999). *Guidelines for the assessment of indirect and cumulative impacts as well as impact interactions*. Retrieved from: http://gis.csi.it/Interact/PrototypeProposal/Docs/guidel.pdf

Wilson, S. F. (2014). *A cumulative effects assessment framework for the North Pacific Coast*. Prepared for the Marine Planning Partnership for the North Pacific Coast.

Statutes and Regulations

BC Environmental Assessment Act. (R.S.B.C. 1996, c. 119). Retrieved from the Canadian Legal Information Institute: http://www.canlii.org/en/bc/laws/stat/rsbc-1996-c-119/latest/rsbc-1996-c-119.html?autocompleteStr=environmenta&autocompletePos=3

BC Environmental Assessment Act. (S.B.C. 2002, c. 43). Retrieved from BC Ministry of Justice and Legislative Assembly website: http://www.bclaws.ca/civix/document/id/complete/statreg/02043_01

Bill 18 – 2008 Greenhouse Gas Reduction (Cap and Trade) Act. (S.B.C. 2008) Retrieved from: http://www.leg.bc.ca/38th4th/1st_read/gov18-1.htm

Canadian Environmental Assessment Act. (S.C. 1992, c. 37). Retrieved from the Canadian Legal Information Institute: http://www.canlii.org/en/ca/laws/stat/sc-1992-c-37/latest/sc-1992-c37.html?autocompleteStr=canadian%20environmental%20assessment%20act&autocompletePos=1

Canadian Environmental Assessment Act. (S.C. 2012, c. 19, s. 52). Retrieved from the Department of Justice Canada website: http://laws-lois.justice.gc.ca/eng/acts/c-15.21/

Canadian Environmental Protection Act. (S.C. 1999, c. 33). Retrieved from the Canadian Legal Information Institute: http://www.canlii.org/en/ca/laws/stat/sc-1999-c-33/latest/sc-1999-c-33.html

Oil and Gas Activities Act (S.B.C. 2008, c. 36). Retrieved from the Canadian Legal Information Institute: http://www.canlii.org/en/bc/laws/stat/sbc-2008-c-36/latest/sbc-2008-c-36.html

Regulations Designating Physical Activities, (SOR/2012-147). Retrieved from the Department of Justice Canada website: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2012-147/

Reviewable Projects Regulation, BC Reg 370/2002. Retrieved from BC Ministry of Justice and Legislative Assembly website: http://www.bclaws.ca/Recon/document/ID/freeside/13_370_2002

Cases Cited

West Moberly First Nations v. British Columbia (Chief Inspector of Mines). 247 British Columbia Court of Appeals. (2011). Retrieved from the Canadian Legal Information Institute: https://www.canlii.org/en/bc/bcca/doc/2011/2011bcca247/2011bcca247.html

Appendix A.

Best Practice Criteria and Sub-Criteria

Criteria	Description	Sub-Criteria
VC-Specific		
Identify goals, objectives, targets and thresholds	The CEA identifies goals and objectives and establishes short, medium, and long-term quantitative targets and thresholds through a scientifically sound methodology for all valued components (VCs).	1. The assessment identifies specific goals and objectives for each VC 2. The assessment identifies measurable targets for each VC 3. The assessment identifies measurable thresholds for each VC 4. Each VC is defined by short-, medium-, and long-term targets and thresholds to ensure effective management over time 5. Targets and thresholds for each VC are established in reference to credible scientific evidence and studies or social and/or community values
Providing Rationales for the Selection of Values and Indicators	The CEA identifies and follows a process and methodology for selecting VCs and indicators, and a rationale is provided for the selection of each VC and indicator	1. A rationale is provided for the selection of VCs and indicators 2. The rationale for the selection of each VC follows a transparent process and methodology
Analysis of Baseline Conditions	Baseline conditions are determined for all VCs at appropriate spatial and temporal scales. Drivers of change and historical trends are considered.	1. Baseline conditions for each VC are assessed on an appropriate spatial scale based on ecosystem boundaries for VCs 2. Drivers of change are identified and described for each VC 3. Historical trends documenting the condition of the VC over time are analyzed and considered in the assessment 4. Where data in baseline studies is limited or unknown, a conservative approach is taken to assess potential effects for each VC 5. Traditional Knowledge is considered and incorporated into baseline conditions for each VC

Criteria	Description	Sub-Criteria
Identifying Mitigation Strategies and Measures	Mitigation strategies/measures are identified for adverse impacts and are based on the precautionary principle.	1. Mitigation strategies and/or measures are identified to address potential cumulative impacts of other activities and natural disturbances on each VC 2. The assessment contains a comprehensive, evidence-based discussion of the potential effectiveness of proposed mitigation measures for each VC 3. Mitigation strategies and/or measures are based on the precautionary principle: *The measures deal with uncertainty, anticipate and prevent serious, irreversible risks, and err on the side of caution*
Developing Monitoring Programs	The CEA includes monitoring of implementation progress and the effectiveness in meeting CEA goals, objectives and targets, baseline conditions, and social, economic and environmental parameters. Monitoring is conducted by an independent agency on a regularly schedules basis and monitoring results and data are available to the public.	1. A program will be established to monitor the condition of each VC to ensure goals, objectives, targets and thresholds are met 2. The monitoring program(s) will include monitoring of the effectiveness of mitigation measures 3. The monitoring program will include an obligation to implement remedial action if mitigation measures are not performing as expected 4. Monitoring is conducted by an independent agency 5. The results of monitoring and all data collected are publically available 6. Monitoring is completed on a regularly scheduled basis
Conducting Ecosystem-Based Assessments	The CEA uses ecosystem boundaries to define the spatial boundaries for the assessment. Broader ecosystem and species relationships are considered.	1. Ecosystem boundaries are used to define the spatial boundaries for the assessment for each VC 2. Broader ecosystem and species relationships are considered along with potential impacts to those relationships
Scenario Development and Analysis	The CEA uses a range of scenarios/alternatives that covers the spectrum of possible development trends associated with different initiatives, management plans, or courses of action. There are clear criteria for choosing scenarios.	1. A range of scenarios defining the inventory of past, present and reasonably foreseeable future activities is developed 2. The range of scenarios covers the spectrum of possible activities that could interact spatially and temporally with each VC 3. The range of scenarios (defining the inventory of past, present and foreseeable activities) is developed based on specific criteria 4. Potential effects on the VC are assessed under each scenario

Criteria	Description	Sub-Criteria
Identifying Assumptions and Uncertainties and their Effect on the Analysis	A range of potential effects is estimated for each VC. Assumptions, limitations, and sources of uncertainty are disclosed, as well as their relative impact on the analysis of potential effects	1. Assumptions used in the impact analysis are clearly stated 2. Sources of uncertainty and data gaps are identified and described relative to their effect on the analysis of potential effects 3. Limitations of analytical methods are described 4. A sensitivity analysis of potential impacts on each VC is completed to incorporate uncertainty in assessing impacts
Process Efficiency	The CEA considers all available information and identifies and prioritizes information gaps within the appropriate time and resource constraints specified for the CEA.	1. Information gaps are identified and prioritized based on explicit criteria (i.e. indicator species) 2. Appropriate time limits and resource requirements are specified for the assessment
Process-Specific		
Adequate and Meaningful Participation	Stakeholders from a variety of backgrounds are involved in the collaborative CEA process. Adequate resources are provided to stakeholders to participate.	1. First Nations and stakeholders are provided with the opportunity to meaningfully participate in each step of the assessment process 2. Adequate resources are provided to First Nations and stakeholders to participate in each step of the assessment (i.e. Participant funding) 3. Input from First Nations and stakeholders is incorporated in a deliberate and transparent manner throughout the process
Identifying Mitigation Strategies and Measures	The CEA includes an assessment of all relevant social, economic, environmental, cultural, and health parameters and incorporates Aboriginal traditional knowledge in the analysis.	1. The CEA includes an assessment of the following parameters: a) Biophysical b) Social c) Economic d) Cultural and Aboriginal Traditional Knowledge e) Health

Criteria	Description	Sub-Criteria
Using Credible Expertise	The CEA is led and managed by an independent review body at arm's length from government and the proponent. Analysts undertaking the CEA are independent experts and have appropriate qualifications certified by the lead agency. The CEA is subject to independent checks, peer review and verification.	1. Analysts undertaking CEA are independent experts 2. The CEA is subject to independent checks, peer review and verification 3. Methods of CEA are identified and comprehensive guidelines for applying these methods are provided 4. Compliance with the guidelines is mandatory
Identifying Leadership and Accountability	A lead agency for undertaking CEA is identified. The lead agency has the resources and capacity to manage the assessment and support the independent analysts undertaking the assessment. Roles and responsibilities for the lead agency responsible for the component(s) of the CEA process are clearly defined.	1. A lead agency has overall responsibility for ensuring completion of the CEA is identified 2. Roles and responsibilities for completing the CEA process are clearly defined 3. The leading agency has the resources and capacity to lead the assessment and ensure that the CEA is completed.
Transparency in Decision-Making	The CEA framework has clear and easily understood requirements, provides clear and comprehensive guidelines to practitioners on how the CEA is to be done, and includes clear decision-making criteria. The CEA is publically available and provides a defensible rationale for all decision-making.	1. There are clear decision-making criteria that identify factors that are to be taken into account in decision- making 2. There is an explicit rationale provided for the evaluation of residual cumulative effects
Establishing a Central Database of information/ information sharing	A central database exists and contains all relevant data. All data is available in publically available documentation and user guides are available to all parties to ensure the consistent and accurate use of the data.	1. A central database exists and contains data and information used in all phases of the CEA 2. All data from the CEA are publically available
Policy-Specific		

Criteria	Description	Sub-Criteria
Legal Foundation Supporting CEA	The CEA process, requirements, and decision-making criteria are clearly defined in legislation.	1. All key elements of the CEA are established in law and is required to be conducted 2. CEA is mandatory
Policy and Program Review	The CEA framework is modified and updated with new information as it is gained. Reviews and updates are scheduled on a regular basis.	1. Components of the framework are modified and updated with new information 2. Reviews and updates are scheduled on a regular basis

Appendix B.

Project Documents and Legislation Reviewed

Document/Legislation	Source	Date Posted
Project Documents		
Pacific NorthWest LNG Draft Environmental Assessment Report	CEAA Registry	February 2016
Pacific NorthWest LNG Project Assessment Report	BCEAO e-Pic	November 5, 2014
Reasons for Ministers' Decision in the Matter of the Pacific NorthWest LNG Project	BCEAO e-Pic	November 25, 2014
Application for an Environmental Assessment Certificate received from Pacific NorthWest LNG Limited Partnership	BCEAO e-Pic & CEAA Registry	March 25, 2014
Aboriginal Consultation Report and Addendum from Pacific NorthWest LNG Limited Partnership for the proposed Pacific NorthWest LNG Project, October 7, 2014	BCEAO e-Pic	October 8, 2014
Addendum to the application for an Environmental Assessment Certificate from Pacific NorthWest LNG Limited Partnership for the proposed Pacific NorthWest LNG Project, October 6, 2014	BCEAO e-Pic	October 6, 2014
Approved Application Information Requirements for the proposed NorthWest LNG Project dated Feb 20/14	BCEAO e-Pic	February 20, 2014
Plan for Procedural Aspects of Aboriginal Consultation	BCEAO e-Pic	February 3, 2014
Order under section 13 of the Act amending the section 11 Order for the proposed Pacific NorthWest LNG Project dated Nov 5/13	BCEAO e-Pic	November 6, 2013
Order issued under section 11 of the Act which defines the scope of the Project, scope of the assessment and review procedures dated Sept 17/13	BCEAO e-Pic	September 18, 2013
Order issued under section 10(1)(c) of the Act which confirms Pacific Northwest LNG Limited has entered the environmental assessment process dated July 16/13	BCEAO e-Pic	July 6, 2013
Project Description for the proposed Pacific NorthWest LNG Project submitted by Pacific NorthWest LNG Limited dated July 12/13	BCEAO e-Pic	July 16, 2013
Project Description Errata	BCEAO e-Pic	August 23, 2013
Legislation		
Canadian Environmental Assessment Act, S.C. 2012, c. 19, s. 52		
British Columbia Environmental Assessment Act, S.C.B. 2002, c. 43		
Regulations Designating Physical Activities, SOR/2012-147		
Reviewable Projects Regulation, BC Reg 370/2002		

Appendix C.

VC Evaluations and Rationales

VC-Specific Criteria

Air Quality

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Identify goals, objectives, targets and thresholds	1. The assessment identifies specific goals and objectives for each VC	-	The application does not identify goals and objectives related to CEA.	
	2. The assessment identifies measurable targets for each VC	+++	Targets are based on the BC MOE Guidelines for Air Quality Dispersion Modelling in British Columbia (BC MOE 2008) and are measurable.	6.2.1 Appendix C
	3. The assessment identifies measurable thresholds for each VC	+++	Multiple measurable thresholds for air emissions are based on BC MOE Guidelines (2008).	Appendix C
	4. Each VC is defined by short-, medium-, and long-term targets and thresholds to ensure effective management over time	-	Short-, medium-, and long-term targets and thresholds for emission rates are not identified in the application.	
	5. Targets and thresholds for each VC are established in reference to credible scientific evidence and studies or social and/or community values	+++	Targets are established based on guidance outlined by the federal and provincial government. These are supported by scientific evidence and studies during development of the documents. The thresholds that are established are formulated in reference to credible scientific evidence and studies.	6.2.7
	1. A rationale is provided for the selection of VCs and indicators	+++	A rationale for the inclusion of this VC is identified in Table 4-1 of the application. A rationale for the selection of the indicators is identified in Table 16-1 of the application.	4.1.1 6.2.2

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Providing Rationales for the Selection of Values and Indicators	2. The rationale for the selection of each VC follows a transparent process and methodology	-	A variety of considerations were used to develop the VCs of interest, however no methodology is provided. The VCs considered in this application were finalized after consultation with members of the PNW Working Group, in consideration of input received from the public during the public comment period on the dAIR, and direction from the BCEAO and the CEAA. The VC selection was also influenced by regulatory issues, guidelines, and the professional judgment of the study team. Indicators for this VC were identified through discussions with CEAA, the BCEAO, the working group, and Aboriginal groups throughout project development and planning. While this is clearly stated, the process and methodology for selecting these indicators is not provided.	4.1.1 6.2.4
Analysis of Baseline Conditions	1. Baseline conditions for each VC are assessed on an appropriate spatial scale	+++	Baseline conditions are assessed within the PDA, LAA and RAA account for the potential effects on the VC. The RAA is set to include a 50 km by 50 km area centered on the project footprint.	6.3.2
	2. Drivers of change are identified and described for each VC	-	Drivers of change are not identified for the VC.	
	3. Historical trends documenting the condition of the VC over time are analyzed and considered in the assessment	-	The application considers historical projects and determines if they will have an impact on the VC but does not document or analyze the trends of historical impacts on the VC.	
	4. Where data in baseline studies is limited or unknown, a conservative approach is taken to assess potential effects to VCs	+++	Where detailed information is unknown in the application, a conservative approach was used in assessing potential effects. Air quality models (e.g. CALPUFF) used a conservative approach in assessing emissions and are likely overestimated in the assessment.	6.5.1.2
	5. Traditional Knowledge is considered and incorporated into baseline conditions for each VC	-	Traditional knowledge was not considered in analyzing the baseline conditions for the VC.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Identifying Mitigation Strategies and Measures	1. Mitigation strategies and/or measures are identified to address potential cumulative impacts of other activities and natural disturbances on each VC	++	Mitigation strategies and measures are identified for the potential effects that are expected to result in cumulative effects. The mitigation measures for this VC are outlined in Table 6-11 of the application. Mitigation measures are not identified for natural disturbances that could impact the VC.	6.5.3
	2. The assessment contains a comprehensive, evidence-based discussion of the potential effectiveness of proposed mitigation measures for each VC	-	The effectiveness of the proposed mitigation measures is not discussed.	
	3. Mitigation strategies and/or measures are based on the precautionary principle: *The measures deal with uncertainty, anticipate and prevent serious, irreversible risks, and err on the side of caution*	-	The mitigation strategies/measures for the identified potential effects are not discussed in detail and therefore it is uncertain if these are based on the precautionary principle.	
Developing Monitoring Programs	1. A program will be established to monitor the condition of each VC to ensure goals, objectives, targets and thresholds are met	+++	Monitoring programs for this VC will be defined by the BC MOE and BC Oil and Gas Commission as a permit condition.	6.7
	2. The monitoring program(s) will include monitoring of the effectiveness of mitigation measures	-	It is unclear if these monitoring programs will include the monitoring of the effectiveness of mitigation measures as they are currently not developed in full.	
	3. The monitoring program will include an obligation to implement remedial action if mitigation measures are not performing as expected	-	It is unclear if other monitoring programs will contain provisions and obligations to implement remedial actions if mitigation measures are not performing as expected, as the monitoring program is not developed.	
	4. Monitoring is conducted by an independent agency	-	It is unclear what agency will conduct monitoring as the monitoring program is not developed.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	5. The results of monitoring and all data collected are publically available	-	It is unclear if the results from monitoring will be publically available.	
	6. Monitoring is completed on a regularly scheduled basis	-	It is unclear if monitoring will be conducted on a regularly scheduled basis, as the monitoring program is not developed.	
Conducting Ecosystem-Based Assessments	1. Ecosystem boundaries are used to define the spatial boundaries for the assessment for each VC	-	Air quality modelling was conducted following the BC MOE Guidelines (2008). The BC MOE Guidelines do not use ecosystem boundaries to define the spatial boundaries for the assessment of this VC. Spatial boundaries (for the RAA) were set based on a 50-kilometer radius from the project location. Boundaries were limited by the accuracy of datasets used as model inputs.	6.2.5.2
	2. Broader ecosystem and species relationships are considered along with potential impacts to those relationships	-	Broader ecosystem and species relationships are considered in the assessment as the spatial boundaries were limited by the accuracy of datasets used as model inputs.	
Scenario Development and Analysis	1. A range of scenarios defining the inventory of past, present and reasonably foreseeable future activities is developed	-	An inventory of past, present and reasonably foreseeable projects is provided in Table 6-12. However, the proponent did not consider a range of scenarios that incorporate past, present, and reasonably foreseeable projects/activities in the application.	6.6.2.1
	2. The range of scenarios covers the spectrum of possible activities that could interact spatially and temporally with each VC	-	A range of scenarios was not developed.	6.6.2.1
	3. The range of scenarios (defining the inventory of past, present and foreseeable activities) is developed based on specific criteria	-	A range of scenarios was not developed.	6.6.2.1
	4. Potential effects on each VC are assessed under each scenario	-	A range of scenarios was not developed.	6.6.2.1

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Identifying Assumptions and Uncertainties and their Effect on the Analysis	1. Assumptions used in the impact analysis are clearly stated	+++	The assumptions associated with the methodology used in the assessment are fully disclosed in Appendix C of the application. The application also concludes that the assumptions underlying the modelling results are conservative.	6.5.1.2 6.7 Appendix C
	2. Sources of uncertainty and data gaps are identified and described relative to their effect on the analysis of potential effects	+++	Sources of uncertainty and data gaps are identified in the application. These include: inputs to air quality models (e.g. physical parameters such as stack height, exit temperature and velocity), variations of actual emissions from hour to hour, and meteorological events used in models. The effect on the analysis is described in Appendix C of the application.	6.5.1.2 Appendix C
	3. Limitations of analytical methods are described	+++	Limitations of analytical methods are described in Appendix C of the application.	Appendix C
	4. A sensitivity analysis of potential impacts on each VC is completed to incorporate uncertainty in assessing impacts	-	A sensitivity analysis was not conducted.	
Process Efficiency	1. Information gaps are identified and prioritized based on explicit criteria (i.e. indicator species)	-	Information gaps are filled with assumptions. The application does not indicate that these gaps are prioritized or based on explicit criteria.	
	2. Appropriate time limits and resource requirements are specified for the assessment	UK	The time limits are specified in the overall EA process. The provincial process takes approximately 12 months to complete, whereas the federal process may take up to 24 months. Even though these timelines are provided, we cannot determine if these are appropriate for the decisions that are being made. Resource requirements for these processes are unknown.	

Greenhouse Gas Management

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Identify goals, objectives, targets and thresholds	1. The assessment identifies specific goals and objectives for each VC	-	The application does not identify goals and objectives related to CEA.	
	2. The assessment identifies measurable targets for each VC	+++	Targets are based on international, federal and provincial climate change regulations and policy (CEPA, 1999; OGAA, 2008). These targets are measurable.	7.2.1
	3. The assessment identifies measurable thresholds for each VC	+++	Thresholds are outlined under climate change policies including international, federal and provincial regulation. These thresholds are measurable in respect to current conditions and the influence of previous projects and activities in the area. These thresholds are measurable.	7.2.7
	4. Each VC is defined by short-, medium-, and long-term targets and thresholds to ensure effective management over time	-	Short-, medium-, and long-term targets and thresholds are not identified in the application.	
	5. Targets and thresholds for each VC are established in reference to credible scientific evidence and studies or social and/or community values	+++	Targets are established based on climate change policies including international, federal and provincial regulation. These are supported by scientific evidence and studies during development of the documents. The thresholds that are established are formulated in reference to credible scientific evidence and studies.	7.2.7
	1. A rationale is provided for the selection of VCs and indicators	+++	A rationale for the inclusion of this VC is identified in Table 4-1 of the application. A rationale for the selection of the indicators is identified in section 7.2.4 of the application.	4.1.1 7.2.2

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Providing Rationales for the Selection of Values and Indicators	2. The rationale for the selection of each VC follows a transparent process and methodology	-	A variety of considerations were used to develop the VCs of interest, however no methodology is provided. The VCs considered in this application were finalized after consultation with members of the PNW Working Group, in consideration of input received from the public during the public comment period on the dAIR, and direction from the BCEAO and the CEAA. The VC selection was also influenced by regulatory issues, guidelines, and the professional judgment of the study team. Indicators for this VC were identified through discussions with Aboriginal groups, government departments (e.g., the Climate Action Secretariat), and the public. While this is clearly stated, the process and methodology for selecting these indicators is not provided.	4.1.1 7.2.4
Analysis of Baseline Conditions	1. Baseline conditions for each VC are assessed on an appropriate spatial scale	+++	The spatial scale is defined by government jurisdictional policies and span to the political boundaries (i.e. borders) of BC and Canada.	7.2.5
	2. Drivers of change are identified and described for each VC	-	Drivers of change are not identified for the VC.	7.2
	3. Historical trends documenting the condition of the VC over time are analyzed and considered in the assessment	-	Based on CEAA's method for incorporating GHG considerations in environmental assessments, the environmental assessment process cannot consider the bulk of GHG emitted from already existing developments. Furthermore, unlike most project-related environmental effects, the contribution of an individual project to climate change cannot be measured (CEAA, 2003). Therefore historical trends are not considered in the application and does not document or analyze the trends of historical impacts on the VC.	7.2.5
	4. Where data in baseline studies is limited or unknown, a conservative approach is taken to assess potential effects to VCs	+++	Where detailed information is unknown, a conservative approach was taken to assess the potential effects of the VC.	7.1

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	5. Traditional Knowledge is considered and incorporated into baseline conditions for each VC	-	Traditional knowledge was not considered in analyzing the baseline conditions for the VC.	
Identifying Mitigation Strategies and Measures	1. Mitigation strategies and/or measures are identified to address potential cumulative impacts of other activities and natural disturbances on each VC	++	The GHG Management Plan proposes mitigation strategies/ measures and is identified where cumulative effects may occur. Mitigation measures are not identified for natural disturbances that could impact the VC.	24.4.1
	2. The assessment contains a comprehensive, evidence-based discussion of the potential effectiveness of proposed mitigation measures for each VC	-	The GHG Management Plan has not been developed in full; therefore it is unclear if it contains a comprehensive, evidence-based discussion of the potential effectiveness of proposed mitigation measures.	
	3. Mitigation strategies and/or measures are based on the precautionary principle: *The measures deal with uncertainty, anticipate and prevent serious, irreversible risks, and err on the side of caution*	-	The GHG Management Plan has not been developed in full; therefore it is unclear if it will be based on the precautionary principle.	
Developing Monitoring Programs	1. A program will be established to monitor the condition of each VC to ensure goals, objectives, targets and thresholds are met	+++	PNW LNG will comply with provincial and national GHG emission reporting requirements, which will include third party verification of emissions accounting. Monitoring will also be a part of the GHG Management Plan as per the monitoring requirements defined by the BC MOE and the BC Oil and Gas Commission.	24.4.1

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	2. The monitoring program(s) will include monitoring of the effectiveness of mitigation measures	-	The GHG Management Plan has not been developed in full; therefore it is unclear if it will include the monitoring of the effectiveness of mitigation measures.	
	3. The monitoring program will include an obligation to implement remedial action if mitigation measures are not performing as expected	-	It is unclear if other monitoring programs will contain provisions and obligations to implement remedial actions if mitigation measures are not performing as expected, as the monitoring program is not developed.	
	4. Monitoring is conducted by an independent agency	+++	Because it is expected that emissions from the project will exceed 50,000 t CO2e/year, the project will report emissions to the BC MOE (10,000 t CO2e threshold) by March 31 for the preceding year of operations, and will also have the report verified by an accredited third party by March 31 (25,000 t CO2e threshold). The annual emissions will also be reported to EC as required by June 1 following each reporting year (50,000 t CO2e/y threshold).	7.7.1
	5. The results of monitoring and all data collected are publically available	+++	Provincial and national total GHG estimates are available from the BC GHG Inventory and the National Inventory Report websites.	7.3.1
	6. Monitoring is completed on a regularly scheduled basis	+++	Provincial and national total GHG estimates are reported annually on the BC GHG Inventory and the National Inventory Report websites.	
Conducting Ecosystem-Based Assessments	1. Ecosystem boundaries are used to define the spatial boundaries for the assessment for each VC	-	Ecosystem boundaries were not used to define the spatial boundaries for the assessment of this VC. Spatial boundaries for the assessment are defined by government jurisdictional policies. Administrative boundaries that are relevant to the spatial boundary include the borders of BC and Canada.	
	2. Broader ecosystem and species relationships are considered along with potential impacts to those relationships	-	Broader ecosystem and species relationships are not considered. . Spatial boundaries for the assessment are defined by government jurisdictional policies and administrative boundaries.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Scenario Development and Analysis	1. A range of scenarios defining the inventory of past, present and reasonably foreseeable future activities is developed	-	A range of scenarios was not developed.	
	2. The range of scenarios covers the spectrum of possible activities that could interact spatially and temporally with each VC	-	A range of scenarios was not developed.	
	3. The range of scenarios (defining the inventory of past, present and foreseeable activities) is developed based on specific criteria	-	A range of scenarios was not developed.	
	4. Potential effects on each VC are assessed under each scenario	-	A range of scenarios was not developed.	
Identifying Assumptions and Uncertainties and their Effect on the Analysis	1. Assumptions used in the impact analysis are clearly stated	+++	The assumptions made in the application include assumptions on emission estimates from PNW and other projects, models, and baseline conditions. The effects of these assumptions on the analysis are disclosed in Appendix C of the application.	Appendix C
	2. Sources of uncertainty and data gaps are identified and described relative to their effect on the analysis of potential effects	+++	Sources of uncertainty and data gaps include inputs for emission estimates from PNW and other projects, models, and baseline conditions. The effect on the analysis is described in Appendix C of the application.	Appendix C
	3. Limitations of analytical methods are described	+++	Limitations of analytical methods are described in Appendix C of the application.	
	4. A sensitivity analysis of potential impacts on each VC is completed to incorporate uncertainty in assessing impacts	-	A sensitivity analysis was not conducted.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Process Efficiency	1. Information gaps are identified and prioritized based on explicit criteria (i.e. indicator species)	-	Information gaps are filled with assumptions. The application does not indicate that these gaps are prioritized or based on explicit criteria.	
	2. Appropriate time limits and resource requirements are specified for the assessment	UK	The time limits are specified in the overall EA process. The provincial process takes approximately 12 months to complete, whereas the federal process may take up to 24 months. Even though these timelines are provided, we cannot determine if these are appropriate for the decisions that are being made. Resource requirements for these processes are unknown.	

Acoustic Environment

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Identify goals, objectives, targets and thresholds	1. The assessment identifies specific goals and objectives for each VC	-	The application does not identify goals and objectives related to CEA.	8.1 8.6
	2. The assessment identifies measurable targets for each VC	+++	Targets are based on federal guidelines (Heath Canada, 2011), provincial guidelines (BC OGC, 2009), and municipality guidelines (District of Port Edward Noise Control Bylaw No. 520; 2011). These targets are measurable.	8.2.1
	3. The assessment identifies measurable thresholds for each VC	+++	Thresholds are based on federal, provincial and municipality guidelines and are identified in the application. These thresholds are measurable.	8.2.7
	4. Each VC is defined by short-, medium-, and long-term targets and thresholds to ensure effective management over time	-	Short-, medium-, and long-term targets and thresholds are not identified in the application.	
	5. Targets and thresholds for each VC are established in reference to credible scientific evidence and studies or social and/or community values	+++	These targets and thresholds are based on federal, provincial and municipal guidelines that have been developed using credible scientific evidence and scientific studies.	
	1. A rationale is provided for the selection of VCs and indicators	+++	A rationale for the inclusion of this VC is identified in Table 4-1 of the application. A rationale for the selection of the indicators is identified in Table 8-1 of the application.	4.1.1 8.2.2

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Providing Rationales for the Selection of Values and Indicators	2. The rationale for the selection of each VC follows a transparent process and methodology	-	A variety of considerations were used to develop the VCs of interest, however no methodology is provided. The VCs considered in this application were finalized after consultation with members of the PNW Working Group, in consideration of input received from the public during the public comment period on the dAIR, and direction from BCEAO and the CEAA. The VC selection was also influenced by regulatory issues, guidelines, and the professional judgment of the study team. Indicators for this VC were identified through consultations with Aboriginal groups, the public and other stakeholders and through professional judgment and experience of the study team. While this is clearly stated, the process and methodology for selecting these indicators is not provided.	4.1.1 8.2.4
Analysis of Baseline Conditions	1. Baseline conditions for each VC are assessed on an appropriate spatial scale	+++	Baseline conditions are assessed within the PDA, LAA and RAA account for the potential effects of noise. The RAA extends 5 kilometers from the LNG facility fence and 2 km along each side of the marine shipping route.	8.2.5
	2. Drivers of change are identified and described for each VC	-	Drivers of change are not identified for the VC.	
	3. Historical trends documenting the condition of the VC over time are analyzed and considered in the assessment	-	The application considers historical projects and determines if they will have an impact on the VC but does not document or analyze the trends of historical impacts on the VC.	8.2.5
	4. Where data in baseline studies is limited or unknown, a conservative approach is taken to assess potential effects to VCs	+++	Where detailed information is unknown in the application, a conservative approach was used in assessing potential effects. This included taking a conservative approach for habitat modelling, species-specific effects, and species occurrence and distribution. Species with uncertain occurrence records (e.g., species whose range overlaps with the RAA but whose habitat requirements are not well understood, or have low occurrence records) are included in the assessment where there is potential for interaction with the project.	11.5.1.2

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	5. Traditional Knowledge is considered and incorporated into baseline conditions for each VC	-	Traditional knowledge is not considered in analyzing the baseline conditions for the VC.	
Identifying Mitigation Strategies and Measures	1. Mitigation strategies and/or measures are identified to address potential cumulative impacts of other activities and natural disturbances on each VC	++	Mitigation strategies and measures are identified for the potential effects that are expected to result in cumulative effects. The mitigation measures for this VC are outlined in Table 18-20. Mitigation measures are not identified for natural disturbances that could impact the VC.	8.5.3 8.6
	2. The assessment contains a comprehensive, evidence-based discussion of the potential effectiveness of proposed mitigation measures for each VC	-	The effectiveness of the proposed mitigation measures is not discussed.	
	3. Mitigation strategies and/or measures are based on the precautionary principle: *The measures deal with uncertainty, anticipate and prevent serious, irreversible risks, and err on the side of caution*	-	The mitigation strategies/measures for the identified potential effects are not discussed in detail and therefore it is uncertain if these are based on the precautionary principle. Furthermore, this is only conducted for project effects directly related to PNW and not cumulative effects.	
Developing Monitoring Programs	1. A program will be established to monitor the condition of each VC to ensure goals, objectives, targets and thresholds are met	-	There are no monitoring programs for this VC.	8.7
	2. The monitoring program(s) will include monitoring of the effectiveness of mitigation measures	-	There are no monitoring programs for this VC.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	3. The monitoring program will include an obligation to implement remedial action if mitigation measures are not performing as expected	-	There are no monitoring programs for this VC.	
	4. Monitoring is conducted by an independent agency	-	There are no monitoring programs for this VC.	
	5. The results of monitoring and all data collected are publically available	-	There are no monitoring programs for this VC.	
	6. Monitoring is completed on a regularly scheduled basis	-	There are no monitoring programs for this VC.	
Conducting Ecosystem-Based Assessments	1. Ecosystem boundaries are used to define the spatial boundaries for the assessment for each VC	-	Ecosystem boundaries were not used to define the spatial boundaries for assessment. The boundaries were based on the distance from the project and alignment along shipping routes.	8.2.5.2
	2. Broader ecosystem and species relationships are considered along with potential impacts to those relationships	-	Broader ecosystem and species relationships are not considered.	
Scenario Development and Analysis	1. A range of scenarios defining the inventory of past, present and reasonably foreseeable future activities is developed	-	An inventory of past, present and reasonably foreseeable projects is provided in Table 8-21. However, the proponent did not consider a range of scenarios that incorporate past, present, and reasonably foreseeable projects/activities in the application.	8.6.2
	2. The range of scenarios covers the spectrum of possible activities that could interact spatially and temporally with each VC	-	A range of scenarios was not developed.	
	3. The range of scenarios (defining the inventory of past, present and foreseeable activities) is developed based on specific criteria	-	A range of scenarios was not developed.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	4. Potential effects on each VC are assessed under each scenario	-	A range of scenarios was not developed.	
Identifying Assumptions and Uncertainties and their Effect on the Analysis	1. Assumptions used in the impact analysis are clearly stated	++	The assumptions were disclosed in section 8.5.1.2 and in Appendix D of the application.	8.5.1.2 Appendix D
	2. Sources of uncertainty and data gaps are identified and described relative to their effect on the analysis of potential effects	++	There exists some sources of uncertainty and lack of data due to assumptions that have been made in analyzing this VC. This includes noise attenuation levels for PNW and other projects scoped into the assessment, and noise from shipping activities associated with other projects. Their effects on the analysis of potential effects are not described in the application.	
	3. Limitations of analytical methods are described	-	Limitations of analytical methods are not described in the application.	
	4. A sensitivity analysis of potential impacts on each VC is completed to incorporate uncertainty in assessing impacts	-	A sensitivity analysis was not conducted.	
Process Efficiency	1. Information gaps are identified and prioritized based on explicit criteria (i.e. indicator species)	-	Information gaps are filled with assumptions. The application does not indicate that these gaps are prioritized or based on explicit criteria.	
	2. Appropriate time limits and resource requirements are specified for the assessment	UK	The time limits are specified in the overall EA process. The provincial process takes approximately 12 months to complete, whereas the federal process may take up to 24 months. Even though these timelines are provided, we cannot determine if these are appropriate for the decisions that are being made. Resource requirements for these processes are unknown.	

Ambient Light

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Identify goals, objectives, targets and thresholds	1. The assessment identifies specific goals and objectives for each VC	-	The application does not identify goals and objectives related to CEA.	
	2. The assessment identifies measurable targets for each VC	+++	Targets are broadly captured under the guidance from the International Commission on Illumination (2003) and are measurable.	9.2.1
	3. The assessment identifies measurable thresholds for each VC	+++	Thresholds are based on the International Commission on Illumination (2003) targets, and are measurable in respect to current conditions.	9.2.7
	4. Each VC is defined by short-, medium-, and long-term targets and thresholds to ensure effective management over time	-	Short-, medium-, and long-term targets and thresholds are not identified in the application.	
	5. Targets and thresholds for each VC are established in reference to credible scientific evidence and studies or social and/or community values	+++	Targets and thresholds are based on guidance by the International Commission on Illumination (2003). This guidance is developed in reference to credible scientific evidence and studies.	
	1. A rationale is provided for the selection of VCs and indicators	+++	A rationale for the inclusion of this VC is identified in Table 4-1 of the application. A rationale for the selection of the indicators is identified in Table 9-5 of the application.	4.1.1 9.2.2

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Providing Rationales for the Selection of Values and Indicators	2. The rationale for the selection of each VC follows a transparent process and methodology	-	A variety of considerations were used to develop the VCs of interest, however no methodology is provided. The VCs considered in this application were finalized after consultation with members of the PNW Working Group, in consideration of input received from the public during the public comment period on the dAIR, and direction from the BCEAO and the CEAA. The VC selection was also influenced by regulatory issues, guidelines, and the professional judgment of the study team. Indicators for this VC were identified through consultation. While this is clearly stated, the process and methodology for selecting these indicators is not provided.	4.1.1 9.2.4
Analysis of Baseline Conditions	1. Baseline conditions for each VC are assessed on an appropriate spatial scale	+++	Baseline conditions are assessed within the PDA, LAA and RAA account for the potential effects from ambient light. The RAA includes a view shed of 8 km.	9.6
	2. Drivers of change are identified and described for each VC	-	Drivers of change are not identified for the VC.	
	3. Historical trends documenting the condition of the VC over time are analyzed and considered in the assessment	-	The application considers historical projects and determines if they will have an impact on the VC but does not document or analyze the trends of historical impacts on the VC.	9.6
	4. Where data in baseline studies is limited or unknown, a conservative approach is taken to assess potential effects to VCs	+++	The final design of the project has not been determined. However, lighting design standards pertaining to the types of lighting and mitigation proposed will be implemented. These standards represent a conservative approach to the reduction of project-related light pollution.	9.5.1.2
	5. Traditional Knowledge is considered and incorporated into baseline conditions for each VC	-	Traditional knowledge was not considered in analyzing the baseline conditions for the VC.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Identifying Mitigation Strategies and Measures	1. Mitigation strategies and/or measures are identified to address potential cumulative impacts of other activities and natural disturbances on each VC	++	Mitigation strategies and measures are identified for the potential effects that are expected to result in cumulative effects. The mitigation measures for this VC are outlined in Table 9-9. Mitigation measures are not identified for natural disturbances that could impact the VC.	9.5.2.2 9.6
	2. The assessment contains a comprehensive, evidence-based discussion of the potential effectiveness of proposed mitigation measures for each VC	-	The effectiveness of the proposed mitigation measures is not discussed.	
	3. Mitigation strategies and/or measures are based on the precautionary principle: *The measures deal with uncertainty, anticipate and prevent serious, irreversible risks, and err on the side of caution*	-	The mitigation strategies/measures for the identified potential effects are not discussed in detail and therefore it is uncertain if these are based on the precautionary principle. Furthermore, this is only conducted for project effects directly related to PNW and not cumulative effects.	
Developing Monitoring Programs	1. A program will be established to monitor the condition of each VC to ensure goals, objectives, targets and thresholds are met	+++	The proponent will develop an environmental monitoring program to address light concerns.	9.7
	2. The monitoring program(s) will include monitoring of the effectiveness of mitigation measures	-	It is unclear if these monitoring programs will include the monitoring of the effectiveness of mitigation measures as they are currently not developed in full.	
	3. The monitoring program will include an obligation to implement remedial action if mitigation measures are not performing as expected	-	It is unclear if monitoring programs will contain provisions and obligations to implement remedial actions if mitigation measures ae not performing as expected as the monitoring program is not developed in full.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	4. Monitoring is conducted by an independent agency	-	An environmental monitor will be appointed to oversee general construction and any other activities that could be disruptive concerning light. The environmental monitor will monitor the implementation of mitigation measures outlined in the environmental management plan (including light mitigation). Compliance monitoring during all phases will be on a complaint-driven basis so specific light spill issues can be addressed. It is unclear if this environmental monitor will be independent.	
	5. The results of monitoring and all data collected are publically available	-	It is unclear if the results from monitoring will be publically available.	
	6. Monitoring is completed on a regularly scheduled basis	-	It is unclear if monitoring will be conducted on a regularly scheduled basis, as the monitoring program is not developed.	
Conducting Ecosystem-Based Assessments	1. Ecosystem boundaries are used to define the spatial boundaries for the assessment for each VC	-	Ecosystem boundaries were not used to define the spatial boundaries for assessment. The boundaries were based on viewpoints of the project and areas where project lighting would be visible once operation begins.	9.2.5.2
	2. Broader ecosystem and species relationships are considered along with potential impacts to those relationships	-	Broader ecosystem and species relationships are not considered.	
Scenario Development and Analysis	1. A range of scenarios defining the inventory of past, present and reasonably foreseeable future activities is developed	-	An inventory of past, present and reasonably foreseeable projects is provided in Table 9-10. However, the proponent did not consider a range of scenarios that incorporate past, present, and reasonably foreseeable projects/activities in the application.	9.6.2
	2. The range of scenarios covers the spectrum of possible activities that could interact spatially and temporally with each VC	-	A range of scenarios was not developed.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	3. The range of scenarios (defining the inventory of past, present and foreseeable activities) is developed based on specific criteria	-	A range of scenarios was not developed.	
	4. Potential effects on each VC are assessed under each scenario	-	A range of scenarios was not developed.	
Identifying Assumptions and Uncertainties and their Effect on the Analysis	1. Assumptions used in the impact analysis are clearly stated	++	Assumptions for this VC primarily relate to the final design of PNW and the incorporation of lighting design standards. While these are described to be conservative, the effect on the analysis is not disclosed.	9.5.1.2
	2. Sources of uncertainty and data gaps are identified and described relative to their effect on the analysis of potential effects	++	Sources of uncertainty and data gaps include the final design of PNW and the incorporation of lighting standards. While these are identified, they are not described relative to their effect on the VC.	
	3. Limitations of analytical methods are described	-	Limitations of analytical methods are not described.	
	4. A sensitivity analysis of potential impacts on each VC is completed to incorporate uncertainty in assessing impacts	-	A sensitivity analysis was not conducted.	
Process Efficiency	1. Information gaps are identified and prioritized based on explicit criteria (i.e. indicator species)	-	Information gaps are filled with assumptions. The application does not indicate that these gaps are prioritized or based on explicit criteria.	
	2. Appropriate time limits and resource requirements are specified for the assessment	UK	The time limits are specified in the overall EA process. The provincial process takes approximately 12 months to complete, whereas the federal process may take up to 24 months. Even though these timelines are provided, we cannot determine if these are appropriate for the decisions that are being made. Resource requirements for these processes are unknown.	

Vegetation and Wetland Resources

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Identify goals, objectives, targets and thresholds	1. The assessment identifies specific goals and objectives for each VC	-	The application does not identify goals and objectives related to CEA.	
	2. The assessment identifies measurable targets for each VC	+++	The application uses the Central and North Coast Ministerial Order's targets for red- and blue-listed ecosystems and old forest retention in the Kaien Landscape Unit and the Federal Policy on Wetland Conservation's no net loss policy for wetlands. These targets are measurable.	10.2.1
	3. The assessment identifies measurable thresholds for each VC	+++	Thresholds are set for communities of red- and blue-listed ecological communities, old forest units and wetland functions (no net loss). These thresholds are measurable.	10.2.7
	4. Each VC is defined by short-, medium-, and long-term targets and thresholds to ensure effective management over time	-	Short-, medium-, and long-term targets and thresholds are not identified in the application.	
	5. Targets and thresholds for each VC are established in reference to credible scientific evidence and studies or social and/or community values	+++	Targets and thresholds are established based on policy and a Ministerial Order developed by the federal and provincial governments. This policy and Order were developed in collaboration with scientific government agencies (ECCC and BC MOE).	
	1. A rationale is provided for the selection of VCs and indicators	+++	A rationale for the inclusion of this VC is identified in Table 4-1 of the application. A rationale for the selection of the indicators is identified in Table 10-2 of the application.	4.1.1 10.2.2

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Providing Rationales for the Selection of Values and Indicators	2. The rationale for the selection of each VC follows a transparent process and methodology	-	A variety of considerations were used to develop the VCs of interest, however no methodology is provided. The VCs considered in this application were finalized after consultation with members of the PNW Working Group, in consideration of input received from the public during the public comment period on the dAIR, and direction from the BCEAO and the CEAA. The VC selection was also influenced by regulatory issues, guidelines, and the professional judgment of the study team. Indicators for this VC were identified through consultations with Aboriginal groups and other stakeholders, and through professional judgment and experience of the study team. While this is clearly stated, the process and methodology for selecting these indicators is not provided.	4.1.1 10.2.4
Analysis of Baseline Conditions	1. Baseline conditions for each VC are assessed on an appropriate spatial scale	+++	Baseline conditions are assessed within the PDA, LAA and RAA account for the potential effects on vegetation and wetland resources. The RAA is set to the extent of the Kaien Landscape Unit outlined by the Central and North Coast Ministerial Order.	10.6
	2. Drivers of change are identified and described for each VC	-	Drivers of change are not identified for the VC.	
	3. Historical trends documenting the condition of the VC over time are analyzed and considered in the assessment	-	The application considers historical projects and determines if they will have an impact on the VC but does not document or analyze the trends of historical impacts on the VC.	
	4. Where data in baseline studies is limited or unknown, a conservative approach is taken to assess potential effects to VCs	+++	Where detailed information is unknown a conservative approach was used in assessing potential effects to this VC. For example, the application acknowledges that sampling errors could have affected the baseline information on species at risk or invasive plant species in the area. The application suggest that areas with the potential to support species but are not seen in field sampling are still included in the assessment.	10.5.1.2

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	5. Traditional Knowledge is considered and incorporated into baseline conditions for each VC	+++	Traditional knowledge is considered in analyzing the baseline conditions for this VC in terms of Traditional Use Plants.	2.2.6-Appendix E
Identifying Mitigation Strategies and Measures	1. Mitigation strategies and/or measures are identified to address potential cumulative impacts of other activities and natural disturbances on each VC	-	Mitigation strategies and measures are identified for the potential effects from the project including a Wetland Habitat Compensation Plan (WHCP). The WHCP does not address cumulative impacts from other projects (PNW only). Additionally, mitigation measures are not identified for natural disturbances that could impact the VC.	10.5.2 Appendix F
	2. The assessment contains a comprehensive, evidence-based discussion of the potential effectiveness of proposed mitigation measures for each VC	-	The effectiveness of the proposed mitigation measures is not discussed.	Appendix F
	3. Mitigation strategies and/or measures are based on the precautionary principle: *The measures deal with uncertainty, anticipate and prevent serious, irreversible risks, and err on the side of caution*	-	The mitigation strategies/measures for the identified potential effects are not discussed in detail and therefore it is uncertain if these are based on the precautionary principle. Furthermore, this is only conducted for project effects directly related to PNW and not cumulative effects.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Developing Monitoring Programs	1. A program will be established to monitor the condition of each VC to ensure goals, objectives, targets and thresholds are met	+++	Monitoring programs for this VC will be developed through Ducks Unlimited Canada. This program will consist of compliance monitoring to ensure that compensatory habitats are constructed in accordance with the plan and five years of effectiveness monitoring to ensure that the compensatory habitats are functioning as intended after construction. Annual monitoring reports will be prepared by Ducks Unlimited Canada for ECCC and PNW to guide adaptive management actions to ensure the long-term performance of compensatory habitats.	Appendix F
	2. The monitoring program(s) will include monitoring of the effectiveness of mitigation measures	+++	This program will consist of compliance monitoring to ensure that compensatory habitats that are constructed are functioning as intended after construction.	Appendix F
	3. The monitoring program will include an obligation to implement remedial action if mitigation measures are not performing as expected	-	It is unclear if the monitoring program will contain provisions and obligations to implement remedial actions if mitigation measures are not performing as expected as the monitoring program is not fully developed.	Appendix F
	4. Monitoring is conducted by an independent agency	+++	Monitoring programs for this VC will be developed through Ducks Unlimited Canada.	Appendix F
	5. The results of monitoring and all data collected are publically available	-	It is unclear if the results from monitoring will be publically available.	
	6. Monitoring is completed on a regularly scheduled basis	+++	The application indicates that monitoring will be conducted for 5 years.	Appendix F
	1. Ecosystem boundaries are used to define the spatial boundaries for the assessment for each VC	+++	Ecosystem boundaries were used to define the spatial boundaries for the assessment of this VC. The RAA boundary is based on the Kaien Landscape Unit, which provides a landscape-scale context for assessing potential effects on this VC.	10.2.5.2

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Conducting Ecosystem-Based Assessments	2. Broader ecosystem and species relationships are considered along with potential impacts to those relationships	-	It is unclear if broader ecosystem and species relationships are considered even though the spatial scale was defined by ecosystem boundaries.	
Scenario Development and Analysis	1. A range of scenarios defining the inventory of past, present and reasonably foreseeable future activities is developed	-	An inventory of past, present and reasonably foreseeable projects is provided in Table 10-18. However, the proponent did not consider a range of scenarios that incorporate past, present, and reasonably foreseeable projects/activities in the application.	10.6.2
	2. The range of scenarios covers the spectrum of possible activities that could interact spatially and temporally with each VC	-	A range of scenarios was not developed.	
	3. The range of scenarios (defining the inventory of past, present and foreseeable activities) is developed based on specific criteria	-	A range of scenarios was not developed.	
	4. Potential effects on each VC are assessed under each scenario	-	A range of scenarios was not developed.	
Identifying Assumptions and Uncertainties and their Effect on the Analysis	1. Assumptions used in the impact analysis are clearly stated	++	The assumptions were disclosed in the application and mainly pertain to sampling errors when collecting baseline information. The application indicates that while sampling was high in the LAA, it is possible that listed plant species, invasive plant species, and SARA-listed wildlife species may not have been detected. The effect on the analysis is not disclosed for plant species and invasive species; however it was discussed for SARA-listed species.	10.5.1.2 Appendix F
	2. Sources of uncertainty and data gaps are identified and described relative to their effect on the analysis of potential effects	++	Sources of uncertainty and data gaps are identified and relate to limitations in scientific information, data analyses and interpretation. While these are identified, their effects on the analysis of potential effects are not described.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	3. Limitations of analytical methods are described	+++	Limitations of analytical methods are described for the VC, particularly with limitation in scientific information, data analyses and interpretation of data.	10.2.5.3
	4. A sensitivity analysis of potential impacts on each VC is completed to incorporate uncertainty in assessing impacts	+++	A sensitivity analysis was conducted to address soil acidification and eutrophication. The results of this analysis provide additional information to address uncertainties.	Appendix G
Process Efficiency	1. Information gaps are identified and prioritized based on explicit criteria (i.e. indicator species)	-	Information gaps are filled with assumptions. The application does not indicate that gaps are prioritized or based on explicit criteria.	
	2. Appropriate time limits and resource requirements are specified for the assessment	UK	The time limits are specified in the overall EA process. The provincial process takes approximately 12 months to complete, whereas the federal process may take up to 24 months. Even though these timelines are provided, we cannot determine if these are appropriate for the decisions that are being made. Resource requirements for these processes are unknown.	

Terrestrial Wildlife and Marine Birds

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Identify goals, objectives, targets and thresholds	1. The assessment identifies specific goals and objectives for each VC	-	The application does not identify goals and objectives related to CEA.	
	2. The assessment identifies measurable targets for each VC	-	No targets are developed for the VC.	
	3. The assessment identifies measurable thresholds for each VC	-	No thresholds are developed for the VC.	
	4. Each VC is defined by short-, medium-, and long-term targets and thresholds to ensure effective management over time	-	Short-, medium-, and long-term targets and thresholds are not identified in the application.	
	5. Targets and thresholds for each VC are established in reference to credible scientific evidence and studies or social and/or community values	-	Since the targets and thresholds are not developed, this sub-criterion is not met.	
	1. A rationale is provided for the selection of VCs and indicators	+++	A rationale for the inclusion of this VC is identified in Table 4-1 of the application. A rationale for the selection of the indicators is identified in Table 11-2 of the application.	4.1.1 11.2.3

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Providing Rationales for the Selection of Values and Indicators	2. The rationale for the selection of each VC follows a transparent process and methodology	-	A variety of considerations were used to develop the VCs of interest, however no methodology is provided. The VCs considered in this application were finalized after consultation with members of the PNW Working Group, in consideration of input received from the public during the public comment period on the dAIR, and direction from the BCEAO and the CEAA. The VC selection was also influenced by regulatory issues, guidelines, and the professional judgment of the study team. Indicators for this VC were identified through discussions with ECCC, consultations with Aboriginal groups, and through professional judgment and experience of the study team. While this is clearly stated, the process and methodology for selecting these indicators is not provided.	4.1.1 11.2.4
Analysis of Baseline Conditions	1. Baseline conditions for each VC are assessed on an appropriate spatial scale	++	Baseline conditions are assessed within the PDA, LAA and RAA account for the potential effects on terrestrial wildlife and marine birds. The land-based RAA is set to the extent of the Kaien Landscape Unit as outlined by the Central and North Coast Ministerial Order, while the marine-based RAA is set based on the administrative boundary of the PRPA and 10 km to both sides of the marine shipping route.	11.6
	2. Drivers of change are identified and described for each VC	-	Drivers of change are not identified for the VC.	
	3. Historical trends documenting the condition of the VC over time are analyzed and considered in the assessment	-	The application considers historical projects and determines if they will have an impact on the VC but does not document or analyze the trends of historical impacts on the VC.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	4. Where data in baseline studies is limited or unknown, a conservative approach is taken to assess potential effects to VCs	+++	Where detailed information is unknown in the application, a conservative approach was used in assessing potential effects. This included taking a conservative approach for habitat modelling, species-specific effects, and species occurrence and distribution. Species with uncertain occurrence records (e.g., species whose range overlaps with the RAA but whose habitat requirements are not well understood, or have low occurrence records) are included in the assessment where there is potential for interaction with the project.	11.5.1.2
	5. Traditional Knowledge is considered and incorporated into baseline conditions for each VC	+++	Traditional knowledge is considered in analyzing the baseline conditions for the VC.	11.3.1
Identifying Mitigation Strategies and Measures	1. Mitigation strategies and/or measures are identified to address potential cumulative impacts of other activities and natural disturbances on each VC	++	Mitigation strategies and measures are identified for the potential effects that are expected to result in cumulative effects. The mitigation measures for this VC are outlined in Table 11-11. Mitigation measures are not identified for natural disturbances that could impact the VC.	11.5.5 11.6
	2. The assessment contains a comprehensive, evidence-based discussion of the potential effectiveness of proposed mitigation measures for each VC	+	The effectiveness of the proposed mitigation measures are only discussed for certain mitigation measures identified in the application (e.g. Fish Habitat Offsetting Strategy). However, the application does not provide a detailed discussion as to why this is the case where discussed.	11.5.5.

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	3. Mitigation strategies and/or measures are based on the precautionary principle: *The measures deal with uncertainty, anticipate and prevent serious, irreversible risks, and err on the side of caution*	-	The mitigation strategies/measures for the identified potential effects are not discussed in detail and therefore it is uncertain if these are based on the precautionary principle. Furthermore, this is only conducted for project effects directly related to PNW and not cumulative effects.	
Developing Monitoring Programs	1. A program will be established to monitor the condition of each VC to ensure goals, objectives, targets and thresholds are met	+++	Monitoring programs for this VC will be developed through further consultation with ECCC and Aboriginal groups and will include acidification and eutrophication assessment and monitoring the effects of acidification and eutrophication of freshwater systems on amphibians.	11.7
	2. The monitoring program(s) will include monitoring of the effectiveness of mitigation measures	-	It is unclear if these monitoring programs will include the monitoring of the effectiveness of mitigation measures, as they are currently not developed.	
	3. The monitoring program will include an obligation to implement remedial action if mitigation measures are not performing as expected	-	It is unclear if other monitoring programs will contain provisions and obligations to implement remedial actions if mitigation measures are not performing as expected, as the monitoring program is not developed.	
	4. Monitoring is conducted by an independent agency	-	It is unclear what agency will conduct monitoring practices.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	5. The results of monitoring and all data collected are publically available	-	It is unclear if the results from monitoring will be publically available.	
	6. Monitoring is completed on a regularly scheduled basis	-	It is unclear if monitoring will be conducted on a regularly scheduled basis, as the monitoring program is not developed.	
Conducting Ecosystem-Based Assessments	1. Ecosystem boundaries are used to define the spatial boundaries for the assessment for each VC	++	Ecosystem boundaries were partially used to define the spatial boundaries for the assessment of this VC. The terrestrial component of the RAA includes the Kaien Landscape Unit, which is a land-use planning boundary that corresponds to management objectives for terrestrial wildlife species and their ranges in the area. Alternatively, the marine component of the RAA is defined by the PRPA boundary, which is not based on ecosystem boundaries for marine wildlife.	11.2.5.2
	2. Broader ecosystem and species relationships are considered along with potential impacts to those relationships	-	It is unclear if broader ecosystem and species relationships are considered even though the spatial scale was defined by ecosystem boundaries.	
Scenario Development and Analysis	1. A range of scenarios defining the inventory of past, present and reasonably foreseeable future activities is developed	-	An inventory of past, present and reasonably foreseeable projects is provided in Table 13-14. However, the proponent did not consider a range of scenarios that incorporate past, present, and reasonably foreseeable projects/activities in the application.	11.6.2

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	2. The range of scenarios covers the spectrum of possible activities that could interact spatially and temporally with each VC	-	A range of scenarios was not developed.	
	3. The range of scenarios (defining the inventory of past, present and foreseeable activities) is developed based on specific criteria	-	A range of scenarios was not developed.	
	4. Potential effects on each VC are assessed under each scenario	-	A range of scenarios was not developed.	
Identifying Assumptions and Uncertainties and their Effect on the Analysis	1. Assumptions used in the impact analysis are clearly stated	++	The assumptions disclosed in the application primarily relate to the collection of baseline data, habitat models, and the final design of PNW. While these are identified, their effect on the analysis was not disclosed.	11.5.1.2 Appendix H
	2. Sources of uncertainty and data gaps are identified and described relative to their effect on the analysis of potential effects	++	There exists a lack of data for certain portions of the assessment of this VC (e.g. species with uncertain occurrence records). However, their effects on the analysis of potential effects are not described.	
	3. Limitations of analytical methods are described	+	Limitations of analytical methods are described for the field-sampling component only. Other limitations of analytical methods are not described.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	4. A sensitivity analysis of potential impacts on each VC is completed to incorporate uncertainty in assessing impacts	-	A sensitivity analysis was not conducted.	
Process Efficiency	1. Information gaps are identified and prioritized based on explicit criteria (i.e. indicator species)	-	Information gaps are filled with assumptions. The application does not indicate that these gaps are prioritized or based on explicit criteria.	
	2. Appropriate time limits and resource requirements are specified for the assessment	UK	The time limits are specified in the overall EA process. The provincial process takes approximately 12 months to complete, whereas the federal process may take up to 24 months. Even though these timelines are provided, we cannot determine if these are appropriate for the decisions that are being made. Resource requirements for these processes are unknown.	

Freshwater Aquatic Resources

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Identify goals, objectives, targets and thresholds	1. The assessment identifies specific goals and objectives for each VC	-	The application does not identify goals and objectives related to CEA.	
	2. The assessment identifies measurable targets for each VC	-	No targets are developed for the VC.	
	3. The assessment identifies measurable thresholds for each VC	-	No thresholds are developed for the VC.	
	4. Each VC is defined by short-, medium-, and long-term targets and thresholds to ensure effective management over time	-	Short-, medium-, and long-term targets and thresholds are not identified in the application.	
	5. Targets and thresholds for each VC are established in reference to credible scientific evidence and studies or social and/or community values	-	Since the targets and thresholds are not developed, this sub-criterion is not met.	
	1. A rationale is provided for the selection of VCs and indicators	+++	A rationale for the inclusion of this VC is identified in Table 4-1 of the application. A rationale for the selection of the indicators is identified in Table 12-1 of the application.	4.1.1 12.2.3 12.2.4

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Providing Rationales for the Selection of Values and Indicators	2. The rationale for the selection of each VC follows a transparent process and methodology	-	A variety of considerations were used to develop the VCs of interest, however no methodology is provided. The VCs considered in this EIS/application were finalized after consultation with members of the PNW Working Group, in consideration of input received from the public during the public comment period on the dAIR, and direction from the BCEAO and the CEAA. The VC selection was also influenced by regulatory issues, guidelines, and the professional judgment of the study team. Indicators for the Freshwater Aquatic Resources VC include: • Change in (permanent alteration or destruction of) fish habitat • Change in food and nutrient content • Increased fish mortality and risk The application does not state how these indicators were developed.	4.1.1 12.2.3 12.2.4
Analysis of Baseline Conditions	1. Baseline conditions for each VC are assessed on an appropriate spatial scale	+	Baseline conditions are assessed within the PDA, LAA and RAA and account for fish habitat characteristics, fish species composition and distribution, and the presence/absence of fish species of management concern. The RAA includes the waters of Chatham Sound.	12.2.5
	2. Drivers of change are identified and described for each VC	-	Drivers of change are not identified for the VC.	12.3.2
	3. Historical trends documenting the condition of the VC over time are analyzed and considered in the assessment	-	The application considers historical projects and determines if they will have an impact on the VC but does not document or analyze the trends of historical impacts on the VC.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	4. Where data in baseline studies is limited or unknown, a conservative approach is taken to assess potential effects to VCs	+++	The assessment of Freshwater Aquatic Resources in watercourses on Lelu Island follows a conservative approach so that relevant aspects of Freshwater Aquatic Resources are considered in the assessment. This includes the identification of two watercourses as fish-bearing streams. Although these watercourses do not meet some of the criteria of fish-bearing watercourses (i.e., the presence of permanent connection to downstream foreshore habitat and flow) and may be classified as non-classified drainage, this assessment is based on their classification as fish-bearing streams as a conservative measure.	12.5.1.2
	5. Traditional Knowledge is considered and incorporated into baseline conditions for each VC	-	Traditional knowledge is not considered in analyzing the baseline conditions for the VC.	N/A
Identifying Mitigation Strategies and Measures	1. Mitigation strategies and/or measures are identified to address potential cumulative impacts of other activities and natural disturbances on each VC	-	Mitigation measures are proposed however these only act to mitigate effects from PNW, not other projects or activities in the region. Additionally, mitigation measures are not identified for natural disturbances that could impact the VC.	12.6.2.4
	2. The assessment contains a comprehensive, evidence-based discussion of the potential effectiveness of proposed mitigation measures for each VC	+	The proposed mitigation methods are considered to be effective. However, the application only discusses the effectiveness of the Fish Habitat Offsetting Strategy, and indicates that further studies are required to confirm the potential for cumulative effects.	12.6.2.4

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	3. Mitigation strategies and/or measures are based on the precautionary principle: *The measures deal with uncertainty, anticipate and prevent serious, irreversible risks, and err on the side of caution*	-	Some mitigation strategies are based on the precautionary principle. For example, the WHCP for the Vegetation and Wetland Resources VC identifies that a 2:1 ratio is used to replace wetland habitat that will be lost from PNW. This ratio effectively offsets the impacts on wetlands from PNW and aims to provide additional wetland habitat in the event that some areas in which habitat offsetting is conducted fails. However, this is only conducted for project effects directly related to PNW and not cumulative effects.	13.5.1.1
Developing Monitoring Programs	1. A program will be established to monitor the condition of each VC to ensure goals, objectives, targets and thresholds are met	+++	Two monitoring programs will be developed: • Fish Habitat Offsetting Strategy monitoring (Appendix K in application) • Monitoring of the effects from acidification and eutrophication of freshwater systems on fish habitat	13.7 Appendix K, Section 4.1.2
	2. The monitoring program(s) will include monitoring of the effectiveness of mitigation measures	+	The Fish Habitat Offsetting Strategy will include the monitoring of the effectiveness of the mitigation measures. It is unclear if the eutrophication and acidification monitoring program will include the monitoring of mitigation measures.	
	3. The monitoring program will include an obligation to implement remedial action if mitigation measures are not performing as expected	+	The Fish Habitat Offsetting Strategy will run for 5 years. If these programs do not meet the objectives after the fifth year, contingency plans will be implemented. It is unclear of the eutrophication and acidification monitoring program will include obligations to take remedial action as it is not developed.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	4. Monitoring is conducted by an independent agency	-	Monitoring for the Fish Habitat Offsetting Strategy will be conducted by an expert with 3 years of experience and a graduate degree in the subject and info will be reviewed by DFO). It is unclear if this expert will be independent. Additionally, it is unclear if an independent agency will be used to conduct monitoring for the effects of acidification and eutrophication.	
	5. The results of monitoring and all data collected are publically available	-	It is unclear if the results from both monitoring programs will be publically available.	
	6. Monitoring is completed on a regularly scheduled basis	+	Monitoring for the Fish Habitat Offsetting Strategy will be conducted every 5 years. It is unclear whether or not other the eutrophication and acidification monitoring program will be completed on a regularly scheduled basis.	
Conducting Ecosystem-Based Assessments	1. Ecosystem boundaries are used to define the spatial boundaries for the assessment for each VC	+++	The spatial boundaries for the assessment of Freshwater Aquatic Resources VC are defined partly by watershed areas of affected watercourses and partly by the distribution (area) of fish that use aquatic habitat.	
	2. Broader ecosystem and species relationships are considered along with potential impacts to those relationships	+++	Broader ecosystem and species relationships are considered in the scoping of the RAA boundary that encompasses Chatham Sound, and which is under the influence of the Skeena and Nass River outflows. This area covers the riverine and estuarine plume areas and Chatham Sound waters that are under the riverine influence that are used by freshwater species.	
Scenario Development and Analysis	1. A range of scenarios defining the inventory of past, present and reasonably foreseeable future activities is developed	-	An inventory of past, present and reasonably foreseeable projects is provided in Table 12-9. However, the proponent did not consider other scenarios of past, present, and reasonably foreseeable projects/activities in the application.	12.6.2

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	2. The range of scenarios covers the spectrum of possible activities that could interact spatially and temporally with each VC	-	A range of scenarios was not developed.	
	3. The range of scenarios (defining the inventory of past, present and foreseeable activities) is developed based on specific criteria	-	A range of scenarios was not developed.	
	4. Potential effects on each VC are assessed under each scenario	-	A range of scenarios was not developed.	
Identifying Assumptions and Uncertainties and their Effect on the Analysis	1. Assumptions used in the impact analysis are clearly stated	++	The assumptions pertain to the identification of fish-bearing watercourses, levels of disturbance to these watercourses, reduction of available habitat and food for species, and cumulative effects from other projects and activities. While these assumptions were made, the effect on the analysis is not disclosed.	
	2. Sources of uncertainty and data gaps are identified and described relative to their effect on the analysis of potential effects	++	Sources of uncertainty also pertain to the identification of fish-bearing watercourses, levels of disturbance to these watercourses, reduction of available habitat and food for species, and cumulative effects from other projects and activities. However, their effects on the analysis of potential effects are partially described and further precautionary measures (mitigation and monitoring) are proposed.	12.2.5.3
	3. Limitations of analytical methods are described	+	Limitations of analytical methods are described for the field-sampling component only. Other limitations of analytical methods are not described.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	4. A sensitivity analysis of potential impacts on each VC is completed to incorporate uncertainty in assessing impacts	-	A sensitivity analysis was not conducted.	
Process Efficiency	1. Information gaps are identified and prioritized based on explicit criteria (i.e. indicator species)	-	Information gaps are filled with assumptions. The application does not indicate that these gaps are prioritized or based on explicit criteria.	
	2. Appropriate time limits and resource requirements are specified for the assessment	UK	The time limits are specified in the overall EA process. The provincial process takes approximately 12 months to complete, whereas the federal process may take up to 24 months. Even though these timelines are provided, we cannot determine if these are appropriate for the decisions that are being made. Resource requirements for these processes are unknown.	

Marine Resources

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Identify goals, objectives, targets and thresholds	1. The assessment identifies specific goals and objectives for each VC	-	The application does not identify goals and objectives related to CEA.	
	2. The assessment identifies measurable targets for each VC	++	Targets are only provided to address noise impacts on marine mammals and for sediment and water quality (CCME, 2013 and BC guidelines). No targets are developed to address change in fish habitat.	13.2.1
	3. The assessment identifies measurable thresholds for each VC	++	Thresholds are provided to address noise impacts on marine mammals and for sediment and water quality (BC MOE, 2006; CCME, 2013). No thresholds are developed to address change in fish habitat.	13.6
	4. Each VC is defined by short-, medium-, and long-term targets and thresholds to ensure effective management over time	-	Short-, medium-, and long-term targets and thresholds are not identified in the application.	
	5. Targets and thresholds for each VC are established in reference to credible scientific evidence and studies or social and/or community values	+++	Targets and thresholds are developed through the collaboration of scientific provincial and federal agencies and are supported by credible scientific evidence and studies.	
	1. A rationale is provided for the selection of VCs and indicators	+++	A rationale for the inclusion of this VC is identified in Table 4-1 of the application. A rationale for the selection of the indicators is identified in Table 13-2 of the application.	4.1.1 13.2.3 13.2.4

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Providing Rationales for the Selection of Values and Indicators	2. The rationale for the selection of each VC follows a transparent process and methodology	-	A variety of considerations were used to develop the VCs of interest, however no methodology is provided. The VCs considered in this EIS/Application were finalized after consultation with members of the PNW Working Group, in consideration of input received from the public during the public comment period on the dAIR, and direction from the BCEAO and the CEAA. The VC selection was also influenced by regulatory issues, guidelines, and the professional judgment of the study team. Indicators for the Marine Resources VC were identified through discussions with ECCC and DFO, consultation with Aboriginal groups, public consultation, and professional judgment and experience of the study team. While this is clearly stated, the process and methodology for selecting these indicators is not provided.	4.1.1 13.2.3 13.2.4
Analysis of Baseline Conditions	1. Baseline conditions for each VC are assessed on an appropriate spatial scale	+++	Baseline conditions are assessed within the PDA, LAA and RAA and account for species migration patterns (i.e. salmon). The RAA is set to the extent of the PDA plus 10 km on both sides of the marine shipping route.	13.3.2 13.5
	2. Drivers of change are identified and described for each VC	-	Drivers of change are not identified for the VC.	
	3. Historical trends documenting the condition of the VC over time are analyzed and considered in the assessment	-	The application considers historical projects and determines if they will have an impact on the VC but does not document or analyze the trends of historical impacts on the VC.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	4. Where data in baseline studies is limited or unknown, a conservative approach is taken to assess potential effects to VCs	+++	Where detailed information is unknown in the application, a conservative approach was used and made assumptions based on worst-case scenarios (i.e. Scenarios where project effects would be of greater magnitude or duration).	13.5.1.1
	5. Traditional Knowledge is considered and incorporated into baseline conditions for each VC	-	Traditional knowledge is not considered in analyzing the baseline conditions for the VC.	N/A
Identifying Mitigation Strategies and Measures	1. Mitigation strategies and/or measures are identified to address potential cumulative impacts of other activities and natural disturbances on each VC	++	Mitigation strategies and measures are identified for the potential effects that are expected to result in cumulative effects. The mitigation measures for this VC are outlined in Table 13-13. Mitigation measures are not identified for natural disturbances that could impact the VC.	13.6.2
	2. The assessment contains a comprehensive, evidence-based discussion of the potential effectiveness of proposed mitigation measures for each VC	-	Mitigation methods for sediment and water quality, direct mortality and physical injury to fish and marine mammals, and change in fish habitat are considered to be effective. However, the effectiveness of these proposed mitigation measures are not discussed.	13.5.2.6 13.5.3.6 13.5.4.6 13.5.5.6

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	3. Mitigation strategies and/or measures are based on the precautionary principle: *The measures deal with uncertainty, anticipate and prevent serious, irreversible risks, and err on the side of caution*	-	The mitigation strategies/measures for the identified potential effects were based on regulations or industry standards. When there was a medium level of confidence assigned to the Marine Resources VC (medium was the lowest assigned for this VC), it does not appear that the proposed mitigation strategies were considered using the precautionary principle. Furthermore, this is only conducted for project effects directly related to PNW and not cumulative effects.	13.5.1.1
Developing Monitoring Programs	1. A program will be established to monitor the condition of each VC to ensure goals, objectives, targets and thresholds are met	+++	Monitoring programs for the marine resource VC will occur before, during, and after the construction of the project, with details to be further determined collaboratively with Aboriginal groups, communities, stakeholders, and government departments including DFO and ECCC.	13.7 Appendix K, Section 4.1.2
	2. The monitoring program(s) will include monitoring of the effectiveness of mitigation measures	+	Two of the monitoring programs suggested will include the monitoring of the effectiveness of the mitigation measures (Fish Habitat Offsetting Strategy, monitoring underwater noise). The rest of the monitoring programs suggested do not appear to include the monitoring of effectiveness of the mitigation measures.	
	3. The monitoring program will include an obligation to implement remedial action if mitigation measures are not performing as expected	+	Fish Habitat Offsetting Strategy will run for 5 years. If the program does not meet the objectives after the fifth year, contingency plans will be implemented. It is unclear if other monitoring programs will contain provisions and obligations to implement remedial actions if mitigation measures are not performing as expected.	
	4. Monitoring is conducted by an independent agency	-	It is unclear if the agency conducting the monitoring will be independent.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	5. The results of monitoring and all data collected are publically available	-	It is unclear if the results from monitoring will be publically available.	
	6. Monitoring is completed on a regularly scheduled basis	+	It is unclear if monitoring will be conducted on a regularly scheduled basis. For additional monitoring strategies (FHOS), monitoring will be done every 5 years. It is unclear whether or not other monitoring programs will be completed on a regularly scheduled basis.	
Conducting Ecosystem-Based Assessments	1. Ecosystem boundaries are used to define the spatial boundaries for the assessment for each VC	+++	The boundaries of the RAA and the LAA provide the biogeographic context for assessing effects on populations of fish and marine mammals. Geographic areas beyond the RAA are considered, where appropriate, in order to provide a full description of key life-history stages.	
	2. Broader ecosystem and species relationships are considered along with potential impacts to those relationships	+++	Geographic areas are considered to account for key life-history stages of fish and marine mammal populations.	
Scenario Development and Analysis	1. A range of scenarios defining the inventory of past, present and reasonably foreseeable future activities is developed	-	An inventory of past, present and reasonably foreseeable projects is provided in Table 13-14. However, the proponent did not consider other scenarios of past, present, and reasonably foreseeable projects/activities in the application.	13.6.1
	2. The range of scenarios covers the spectrum of possible activities that could interact spatially and temporally with each VC	-	A range of scenarios was not developed.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	3. The range of scenarios (defining the inventory of past, present and foreseeable activities) is developed based on specific criteria	-	A range of scenarios was not developed.	
	4. Potential effects on each VC are assessed under each scenario	-	A range of scenarios was not developed.	
Identifying Assumptions and Uncertainties and their Effect on the Analysis	1. Assumptions used in the impact analysis are clearly stated	++	The assumptions for this VC pertain to the final design of PNW, the data collected during baseline studies, behavioral changes to marine mammals, and underwater noise effects from other projects in the region. Where detailed information was unknown, a conservative approach was taken using worst-case scenarios. While these assumptions are identified, their effect on the analysis is not disclosed.	13.5.1.1
	2. Sources of uncertainty and data gaps are identified and described relative to their effect on the analysis of potential effects	++	Sources of uncertainty and data gaps also pertain to the final design of PNW, data collected during field studies, behavioral changes on marine mammals, and underwater noise effects from other projects in the region. While these uncertainties are identified, their effect on the analysis is not discussed in the application.	
	3. Limitations of analytical methods are described	+	Limitations of analytical methods are described for the field-sampling component only. Other limitations of analytical methods are not described.	
	4. A sensitivity analysis of potential impacts on each VC is completed to incorporate uncertainty in assessing impacts	-	A sensitivity analysis was not conducted.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Process Efficiency	1. Information gaps are identified and prioritized based on explicit criteria (i.e. indicator species)	-	Information gaps are filled with assumptions. The EA does not indicate that these gaps are prioritized or based on explicit criteria.	
	2. Appropriate time limits and resource requirements are specified for the assessment	UK	The time limits are specified in the overall EA process. The provincial process takes approximately 12 months to complete, whereas the federal process may take up to 24 months. Even though these timelines are provided, we cannot determine if these are appropriate for the decisions that are being made. Resource requirements for these processes are unknown.	

Process-Specific Criteria

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Adequate and Meaningful Participation	1. First Nations and stakeholders are provided with the opportunity to meaningfully participate in each step of the assessment process	UK	PNW LNG has initiated consultation with a variety of government agencies, and is committed to an open consultation program with the public and First Nations groups (as per CEAA, 2012 5(1) (c)) throughout the environmental assessment process. PNW LNG has held open houses, workshops, presentations, and has provided public comment materials. Stakeholders are able to participate in the public comment periods (30 days) as indicated in the federal and provincial EA processes as well. Even though stakeholders are provided with the opportunity to participate in the process, we cannot determine if the process was in fact meaningful.	3.2 3.3
	2. Adequate resources are provided to First Nations and stakeholders to participate in each step of the assessment (i.e. Participant funding)	UK	Resources such as public open houses, workshops, presentations and public comment materials (retrieved online) are provided to stakeholders to participate in the process. Participant funding is also offered to support individuals, non-profit organizations and Aboriginal groups interested in participating in federal environmental assessments. While stakeholders have been granted these resources, we cannot determine if these resources were of high enough quality to fully participate in the process.	
	3. Input from First Nations and stakeholders is incorporated in a deliberate and transparent manner throughout the process	UK	Stakeholder input is incorporated throughout the EA process including what VCs are selected, key issues that are assessed, among others. Tracking tables are used throughout the process to address comments raised by various stakeholders and the rationales provided by the proponent. Even though this is done, it is difficult to determine how well input is incorporated.	
Conducting Comprehensive Reviews	1. The CEA includes an assessment of the following parameters: a) Biophysical b) Social c) Economic	+++	The CEA includes the assessment of all parameters as per the approach outlined by the BCEAO and CEAA.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	d) Cultural and Aboriginal Traditional Knowledge e) Health			
Using Credible Expertise	1. Analysts undertaking CEA are independent experts	-	Stantec Consulting Ltd. developed the CEA for the project, which is then assessed by the leading agency (BCEAO/CEAA). Stantec Consulting Ltd. was hired by PETRONAS to conduct the assessment and is not fully independent.	
	2. The CEA is subject to independent checks, peer review and verification	+	The leading agency conducts a review of the CEA. However, these bodies are not independent— they are regulators in the review process. Stakeholders and other public participants also have an opportunity to review the information in the application and provide comment; however it is unclear if sufficient resources and capacity exists for these groups to fully participate. Reviews conducted by the BCEAO/CEAA, stakeholders, and the public are independent in the sense that experts who are not controlled by the project proponent conduct them.	
	3. Methods of CEA are identified and comprehensive guidelines for applying these methods are provided	+++	The methodology for conducting CEA for PNW is fully disclosed in the application and uses the approach outlined in the CEAA's OPS (2007).	
	4. Compliance with the guidelines is mandatory	-	Compliance with guidelines is not mandatory. However, PNW actively complied with CEAA guidance.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Identifying Leadership and Accountability	1. A lead agency for that has overall responsibility for ensuring completion of the CEA is identified	+++	The BCEAO and the CEAA are the leading agencies in the EA process, including CEA. As part of EA, the proponent is required to prepare an application that includes a CEA. To ensure the completion of the CEA for a project, the leading agency reviews the application to ensure that all elements of CEA are included. If certain elements are missing, the leading agency may ask the proponent to provide supplemental information or additional analyses to support the CEA. As part of an EA, the proponent is required to hire a consultant to undertake the assessment including CEA. Stantec Consulting Ltd. acted as a consultant for the proponent, PETRONAS, and undertook CEA as part of the EA. The EA application is then reviewed by the BCEAO/ CEAA to ensure completion.	
	2. Roles and responsibilities for completing the CEA process are clearly defined	+++	It is the overarching role of the leading agency to ensure that CEA is completed for the project and to ensure that it is accurate. The BCEAO and CEAA rely on specific guidelines for CEA (CEAA, 2014; FLNRO, 2014) to ensure a comprehensive assessment of cumulative effects.	
	3. The leading agency has the resources and capacity to lead the assessment and ensure that the CEA is completed	UK	Cannot be assessed.	
Transparency in Decision-Making	1. There are clear decision-making criteria that identify factors that are to be taken into account in decision-making	+	The application identifies criteria that identify factors that must be considered in decision-making for CEA however these are largely unclear.	

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
	2. There is an explicit rationale provided for the evaluation of cumulative effects and their conclusions	+	The application does provide an explicit rationale for the evaluation of cumulative effects. However, rationales are narrow in scope and do not present a high degree of detail for conclusions that are made (residual effects, likelihood and confidence).	
Establishing a Central Database of information/ information sharing	1. A central database exists and contains data and information used in all phases of the CEA	++	The BCEAO's e-Pic website and CEAA's Registry website act as databases to store relevant project information. These websites contain relevant project information including a projects EA application, public comments, and proponent responses to information requests. Some data and information are excluded from these websites.	
	2. All data from the CEA are publically available	++	These websites are both publically accessible, however may not contain all relevant project information.	

Policy-Specific Criteria

BP Criteria	Sub-Criteria	Rating	Rationale	Reference
Legal Foundation supporting CEA	1. All key elements of the CEA are established in law	-	*CEAA 2012* recognizes CEA under section 4(1) and 19(1) (a). *BCEAA 2002* recognizes CEA under section 11(2). While cumulative effects are recognized, only some of the elements of CEA are outlined in legislation.	*CEAA 2012* *BCEAA 2002*
	2. CEA is mandatory	+	CEA is mandatory to be assessed under *CEAA 2012*, but is not mandatory under *BCEAA 2002*.	*CEAA 2012* *BCEAA 2002*
Policy and Program Review	1. Components of the CEA framework are modified and updated with new information	-	The application does not state if components of the CEA framework will be modified or updated with new information.	
	2. Reviews and updates are scheduled on a regular basis	-	No reviews and updates are scheduled for the project at this time; however, the CEA is occurring in the context of a project review process. The provincial government is also in the process of implementing its CEF. Even though the CEF is not operational, it is unclear how the CEF will impact project reviews.	

Appendix D.

Evaluation Results

BP Criteria	Sub-Criteria	VCs							
		Air Quality	GHG Manage-ment	Acoustic Environment	Ambient Light	Vegetation and Wetland Resources	Terrestrial Wildlife + Marine Birds	Fresh Water Aquatic Resources	Marine Resources
VC-Specific									
Identify goals, objectives, targets and thresholds	1. The assessment identifies specific goals and objectives for each VC	-	-	-	-	-	-	-	-
	2. The assessment identifies measurable targets for each VC	+++	+++	-	+++	+++	-	-	++
	3. The assessment identifies measurable thresholds for each VC	+++	+++	-	+++	+++	-	-	++
	4. Each VC is defined by short-, medium-, and long-term targets and thresholds to ensure effective management over time	-	-	-	-	-	-	-	-
	5. Targets and thresholds for each VC are established in reference to credible scientific evidence and studies or social and/or community values	+++	+++	-	+++	+++	-	-	+++
Providing Rationales for the Selection of Values and Indicators	1. A rationale is provided for the selection of VCs and indicators	+++	+++	+++	+++	+++	+++	+++	+++
	2.The rationale for the selection of each VC follows a transparent process and methodology	-	-	-	-	-	-	-	-

BP Criteria	Sub-Criteria	VCs							
		Air Quality	GHG Manage-ment	Acoustic Environment	Ambient Light	Vegetation and Wetland Resources	Terrestrial Wildlife + Marine Birds	Fresh Water Aquatic Resources	Marine Resources
Analysis of Baseline Conditions	1. Baseline conditions for each VC are assessed on an appropriate spatial scale	+++	+++	+++	+++	+++	++	+	+++
	2. Drivers of change are identified and described for each VC	-	-	-	-	-	-	-	-
	3. Historical trends documenting the condition of the VC over time are analyzed and considered in the assessment	-	-	-	-	-	-	-	-
	4. Where data in baseline studies is limited or unknown, a conservative approach is taken to assess potential effects to VCs	+++	+++	+++	+++	+++	+++	+++	+++
	5. Traditional Knowledge is considered and incorporated into baseline conditions for each VC	-	-	-	-	+++	+++	-	-
Identifying Mitigation Strategies and Measures	1. Mitigation strategies and/or measures are identified to address potential cumulative impacts of other activities and natural disturbances on each VC	++	++	++	++	-	++	-	++
	2. The assessment contains a comprehensive, evidence-based discussion of the potential effectiveness of proposed mitigation measures for each VC	-	-	-	-	-	+	+	-
	3. Mitigation strategies and/or measures are based on the precautionary principle: *The measures deal with uncertainty, anticipate and prevent serious, irreversible risks, and err on the side of caution*	-	-	-	-	-	-	-	-

BP Criteria	Sub-Criteria	VCs							
		Air Quality	GHG Manage-ment	Acoustic Environment	Ambient Light	Vegetation and Wetland Resources	Terrestrial Wildlife + Marine Birds	Fresh Water Aquatic Resources	Marine Resources
Developing Monitoring Programs	1. A program will be established to monitor the condition of each VC to ensure goals, objectives, targets and thresholds are met	+++	+++	-	+++	+++	+++	+++	+++
	2. The monitoring program(s) will include monitoring of the effectiveness of mitigation measures	-	-	-	-	+++	-	+	+
	3. The monitoring program will include an obligation to implement remedial action if mitigation measures are not performing as expected	-	-	-	-	-	-	+	+
	4. Monitoring is conducted by an independent agency	-	+++	-	-	+++	-	-	-
	5. The results of monitoring and all data collected are publically available	-	+++	-	-	-	-	-	-
	6. Monitoring is completed on a regularly scheduled basis	-	+++	-	-	+++	-	+	+
Conducting Ecosystem-Based Assessments	1. Ecosystem boundaries are used to define the spatial boundaries for the assessment for each VC	-	-	-	-	+++	++	+++	+++
	2. Broader ecosystem and species relationships are considered along with potential impacts to those relationships	-	-	-	-	-	-	+++	+++

BP Criteria	Sub-Criteria	VCs							
		Air Quality	GHG Manage-ment	Acoustic Environment	Ambient Light	Vegetation and Wetland Resources	Terrestrial Wildlife + Marine Birds	Fresh Water Aquatic Resources	Marine Resources
Scenario Development and Analysis	1. A range of scenarios defining the inventory of past, present and reasonably foreseeable future activities is developed	-	-	-	-	-	-	-	-
	2. The range of scenarios covers the spectrum of possible activities that could interact spatially and temporally with each VC	-	-	-	-	-	-	-	-
	3. The range of scenarios (defining the inventory of past, present and foreseeable activities) is developed based on specific criteria	-	-	-	-	-	-	-	-
	4. Potential effects on each VC are assessed under each scenario	-	-	-	-	-	-	-	-
Identifying Assumptions and Uncertainties and their Effect on the Analysis	1. Assumptions used in the impact analysis are clearly stated	+++	+++	++	++	++	++	++	++
	2. Sources of uncertainty and data gaps are identified and described relative to their effect on the analysis of potential effects	+++	+++	++	++	++	++	++	++
	3. Limitations of analytical methods are described	+++	+++	-	-	+++	+	+	+
	4. A sensitivity analysis of potential impacts on each VC is completed to incorporate uncertainty in assessing impacts	-	-	-	-	+++	-	-	-
Process Efficiency	1. Information gaps are identified and prioritized based on explicit criteria (i.e. indicator species)	-	-	-	-	-	-	-	-

BP Criteria	Sub-Criteria	VCs							
		Air Quality	GHG Manage-ment	Acoustic Environment	Ambient Light	Vegetation and Wetland Resources	Terrestrial Wildlife + Marine Birds	Fresh Water Aquatic Resources	Marine Resources
	2. Appropriate time limits and resource requirements are specified for the assessment	UK	UK	UK	UK	UK	UK	UK	UK
Process-Specific									
Participative	First Nations and stakeholders are provided with the opportunity to meaningfully participate in each step of the assessment process	UK							
	Adequate resources are provided to First Nations and stakeholders to participate in each step of the assessment (i.e. Participant funding)	UK							
	Input from First Nations and stakeholders is incorporated in a deliberate and transparent manner throughout the process	UK							
Comprehensive	1. The CEA includes an assessment of the following parameters: a) Biophysical b) Social c) Economic d) Cultural and Aboriginal Traditional Knowledge e) Health	+++							
Credible	1. Analysts undertaking CEA are independent experts	-							

BP Criteria	Sub-Criteria	VCs							
		Air Quality	GHG Manage-ment	Acoustic Environment	Ambient Light	Vegetation and Wetland Resources	Terrestrial Wildlife + Marine Birds	Fresh Water Aquatic Resources	Marine Resources
	2. The CEA is subject to independent checks, peer review and verification	+							
	3. Methods of CEA are identified and comprehensive guidelines for applying these methods are provided	+++							
	4. Compliance with the guidelines is mandatory	-							
Leadership and Accountability	1. A lead agency for that has overall responsibility for ensuring completion of the CEA is identified	+++							
	2. Roles and responsibilities for completing the CEA process are clearly defined	+++							
	3. The leading agency has the resources and capacity to lead the assessment and ensure that the CEA is completed.	UK							
Transparency	1. There are clear decision-making criteria that identify factors that are to be taken into account in decision- making	+							
	2. There is an explicit rationale provided for the evaluation of cumulative effects and residual cumulative effects and their conclusions	+							
	1. A central database exists and contains data and information used in all phases of the CEA	++							

BP Criteria	Sub-Criteria	VCs							
		Air Quality	GHG Manage-ment	Acoustic Environment	Ambient Light	Vegetation and Wetland Resources	Terrestrial Wildlife + Marine Birds	Fresh Water Aquatic Resources	Marine Resources
Central Database of information/ information sharing	2. All data from the CEA are publically available	++							
Policy-Specific									
Legal Foundation	1. All key elements of the CEA are established in law	-							
	2. CEA is mandatory	+							
Policy and Program Review	1. Components of the CEA framework are modified and updated with new information	-							
	2. Reviews and updates are scheduled on a regular basis	-							