Appendix J
Environmental Management Plan

Appendix J.1
Environmental Management Plan Overview

ENVIRONMENTAL MANAGEMENT PLAN

Pacific NorthWest LNG Project

Prepared for:
Pacific NorthWest LNG Limited Partnership
Oceanic Plaza, Suite 1900 – 1066 West Hastings Street
Vancouver, BC V6E 3X1

Prepared by:
Stantec Consulting Ltd.
4370 Dominion Street, 5th Floor
Burnaby, BC V5G 4L7
Tel: (604) 436-3014
Fax: (604) 436-3752

December 12, 2014

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1.0 INTRODUCTION

This report provides a comprehensive construction and operations Environmental Management Plan (EMP) for works that will be undertaken by Pacific NorthWest LNG Limited Partnership (PNW LNG) and their Engineering Procurement Construction and Commissioning (EPCC) Contractor for the Pacific NorthWest LNG Project (the Project).

The EMP provides a framework of PNW LNG's legislative and environmental responsibilities, and high-level component management plans to support the detailed environmental work plans to be developed by the EPCC Contractor. PNW LNG will update this preliminary EMP once the EPCC Contractor is selected. Additional project and site-specific measures will be developed through final engineering design.

A separate decommissioning and abandonment EMP will be required at the end of the project life cycle and will be developed in accordance with the lease agreement with the Prince Rupert Port Authority (PRPA).

1.1 PURPOSE

This EMP has been developed to provide guidance to all personnel, contractors and third party service providers involved in the construction and operation of the Project, to ensure that safe, compliant, environmentally and socially responsible actions are taken to mitigate potential project effects on the environment. This EMP is designed to comply with legislative requirements and conditions of environmental approvals.

This EMP identifies and outlines:

- Site and activity-specific environmental management and monitoring plans designed to protect the human and ecological environment (referred to herein as the component EMPs, or component plans; Appendices J.4 through J.16)
- Key construction and operations activities, applicable environmental mitigation measures, and best management practices (BMPs)
- Environmental monitoring, reporting, and regulatory compliance requirements.

Each component plan of the EMP is presented as a standalone document that includes written procedures, specifications, and controls within a standalone document (see Appendices J.4 through J.16). Project personnel will be required to comply with the EMP, or provide a suitable alternative approach that can be incorporated into an updated EMP, if necessary.

1.2 ENVIRONMENTAL MANAGEMENT PLAN STRUCTURE

1.2.1 Health, Safety and Environmental Management System

PNW LNG's Health, Safety and Environment Management System (HSE MS) is the "umbrella" document that includes the structure and components of both the health and safety program, and the environmental program for the Project. The HSE MS is a separate document from this preliminary EMP, and is guided by PNW LNG's Health and Safety Policy Statement and its Environment Policy Statement. The HSE MS will be developed prior to construction. This draft EMP forms a part of the overall HSE MS. An element of the HSE MS is the Emergency Preparedness and Response Program, which contains a number of emergency plans to address natural disasters, accidents and incidents. While the Emergency Preparedness and Response Program within the HSE MS references an Environmental Emergency Preparedness and Response Plan (EEPRP), the specific details of the EEPRP are contained within the EMP (Appendix J.6 of the EIS Addendum).

1.2.2 Environmental Management Plan

This EMP is part of PNW LNGs overall HSE MS. The EMP includes component plans for specific project activities and components of the environment (Figure 1-1). The EMP applies to all aspects of the Project. The EMP components shown within the green portion of Figure 1-1 outline the management plans relevant to construction, while the blue portion of Figure 1-1 outlines the EMP components relevant to operations. Table 1-1 provides an overview of each section of the EMP.

Table 1-1: Overview of the EMP Document Structure

Main Section Headings	Purpose
Section 1.0—Introduction Section 1.2—EMP Structure Section 1.3—Regulatory Context	Section 1.0 outlines the purpose and organization of the EMP with respect to the regulatory context. Broadly summarizes individual management plans and identifies where information can be found within the larger EMP document.
Section 2.0—Commitments Section 2.1—Comprehensive EIS Section 2.2—Environmental Compliance Monitoring	Section 2.0 outlines commitments related to the EIS and Application. Further summarizes regulatory requirements and environmental compliance monitoring.
Section 3.0—Roles and Responsibilities Section 3.1—Project Personnel Roles and Responsibilities	Section 3.0 outlines the project proponent and personnel roles, and further categorizes each with specific responsibilities.
Section 4.0—Training and Orientation Section 4.1— Environmental Orientation Training	Section 4.0 provides general and specific training and orientation requirements for project personnel involved in the construction and operations programs. A component of the training and orientation programs will be to communicate project activities to the public in order to foster transparency

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Main Section Headings	Purpose
Section 5.0—Summary of Environmental Considerations	The purpose of Section 5.0 is to define specific environmental considerations, potential effects and mitigation measures to ensure regulatory compliance.
Section 6.0—Environmental Monitoring Section 6.1—Monitoring and Reporting Summary	Section 6.0 defines expected routine requirements, tasks and frequencies of environmental monitoring and reporting. This section further summarizes relevant practices, procedures and responsibilities of environmental monitors during project construction and operation. Section 6.0 is intended to provide a broad overview of potential monitoring requirements further defined in individual discipline-specific plans.
Section 7.0—Public Communication and Issue Resolution Section 7.1—Public and First Nations Issue Resolution Section 7.2—Incident Reporting	Section 7.0 addresses communication and resolution practices in responding to public and Aboriginal groups within the project area.
Appendices (Appendix J.2 to J.15 of the EIS Addendum)	The Appendices include project contacts, approvals and forms potentially required for project development. Each separate standalone component plan includes specific mitigation measures and provide guidance to decision making processes should conditions arise that require implementation of contingency measures.

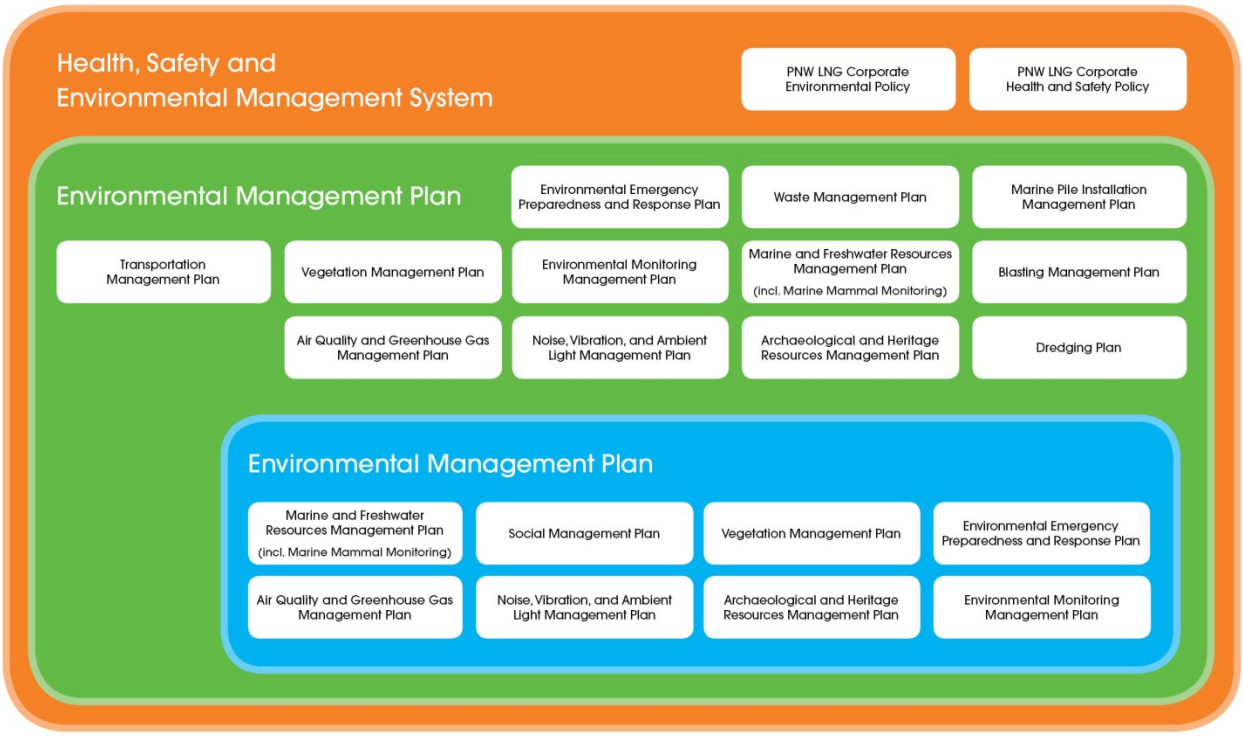

Figure 1-1 Health, Safety and Environmental Management System Framework

The EMP includes all activities within the PNW LNG HSE MS (see Figure 1-1). This plan guides project coordination, execution, and planning during the construction phase of development. The EMP also includes all aspects of environmental monitoring for each construction activity (i.e., blasting, dredging). The component plans are designed to be implemented by project personnel. They are also intended to be updated based on final engineering design and project execution plans developed by the EPCC contractor.

The EMP also includes all aspects of environmental monitoring during project operations. As with aspect of the EMP related to construction, elements related to operations will also be updated based on final engineering design and operations / maintenance philosophies by PNW LNG's Operations team prior to start-up of facility operations.

1.2.2.1 Component Environmental Management Plans

Each component EMP provides details on the BMPs, mitigation measures, monitoring, and reporting requirements for specific activities and environmental components. Table 1-2 provides an overview of each of the component plans.

Table 1-2 Summary of Component Environmental Management Plans

Project Component	Project Phase	Purpose
Air Quality	Construction Operations	The Air Quality and Greenhouse Gas Management Plan provides measures to reduce effects of air emissions, fugitive dust and greenhouse gas release from project activities
Noise, Vibration and Light	Construction Operations	The Noise, Vibration and Ambient Light Management Plan provides mitigation measures for terrestrial-based project construction activities (such as blasting, pile driving) and facility operations with potential to affect local communities and wildlife
Environmental Emergency Preparedness and Response (EEPRP)	Construction Operations	The EEPRP outlines measures to prepare for and respond to any project-related environmental emergencies.
Transportation	Construction Operations	The Transportation Management Plan provides measures to reduce the effects of project traffic on infrastructure; and procedures for the movement of dangerous goods and project personnel
Marine and Freshwater Resources (includes Marine Mammal Monitoring and Protection Plan; MMMPP)	Construction	The Marine and Freshwater Resource Management Plan provides measures to avoid potentially harmful impacts to riparian areas, water quality, and fish habitat
Vegetation	Construction and Operations	The Vegetation Management Plan provides measures to minimize disturbance of native vegetation and soils, reduce the spread of invasive species, and protect ecological communities
Waste Management	Construction Operations	The Waste Management Plan outlines BMPs to manage hazardous and non-hazardous waste products
Blasting	Construction	The Blasting Management Plan outlines mitigation measures to reduce risk of mortality or injury to marine organisms

Project Component	Project Phase	Purpose
Marine Pile Installation	Construction	The Marine Pile Installation Management Plan provides measures to reduce effects of pile installation on marine organisms
Dredging	Construction	The Dredging Management Plan details guidelines for dredging and disposal of marine sediment
Accommodation Plan	Construction Operations	The Accommodation Plan will document practices and procedures on how PNW and the EPCC contractor will interact with the communities and health and safety regulators.
Heritage Resources	Construction Operations	The Archaeological and Heritage Resources Management Plan describes methods to identify and preserve heritage resources
Environmental Monitoring	Construction Operations	The Environmental Monitoring Plan outlines procedures and practices for monitoring effects on the environment

1.3 REGULATORY CONTEXT

The EMP is developed based on the Project Environmental Impact Statement (EIS), applicable legislation and regulations, and relevant standards and guidelines. The following legislative requirements, and BMPs, have been integrated into each relevant component EMP:

- *Canadian Environmental Protection Act*, Disposal at Sea Regulations
- *Transportation of Dangerous Goods Act*
- *Fisheries Act*
- Land Development Guidelines for the Protection of Aquatic Habitat
- Canadian Standards Association (CSA) Z731-03, Emergency Preparedness and Response
- *Environmental Management Act*, Hazardous Waste Regulation: provides requirements for authorized containment, storage/handling, disposal and transportation of substances identified as hazardous waste
- *Environmental Management Act*, Spill Reporting Regulation: identifies and outlines the reporting requirements when a spill occurs
- *Wildlife Act*
- *Species at Risk Act*
- *Migratory Birds Convention Act*
- Migratory Birds Regulations
- *BC Oil and Gas Activities Act*
- *Canada Marine Act*
- *Hazardous Products Act*
- *Weed Control Act*
- *Clean Energy Act*
- PPRA lease conditions
- Port Authorities Operations Regulations
- Canadian Aviation Regulations
- Vessel Pollution and Dangerous Chemicals Regulations
- Habitat Conservation and Protection Guidelines

- Canadian Council of Ministers of the Environment Guidelines
- International Convention for the Prevention of Pollution from Ships
- Policy for the Management of Fish Habitat
- Federal Policy on Wetland Conservation
- Fisheries Protection Policy Statement, 2013
- Archaeological Heritage Policy Framework
- Canadian Ambient Air Quality Standards (effective 2015)
- Operational Statement for Mitigation of Seismic Sound in the Marine Environment.
- Navigation Protection Act
- Port Edward Bylaws

1.3.1 Environmental Compliance Monitoring

Environmental compliance monitoring and reporting is required to inspect, evaluate, and document regulatory compliance with the conditions of the provincial and environmental assessment approvals and any permit conditions.

The EMP describes the roles and responsibilities of individual members of the Project's environmental management team, which includes, but is not limited to:

- The Project's Health, Safety and Environment Team
- The EPCC Contractor
- Designated Environmental Monitors retained by PNW LNG or on-site contractors
- Technical specialists retained by PNW LNG or on-site contractors.

These individuals will be responsible for implementing the EMPs and compliance reporting.

2.0 COMMITMENTS

2.1 ENVIRONMENTAL ASSESSMENT

The Project is a major resource development, storage and shipping facility and was subject to an environmental assessment in accordance with the *Canadian Environmental Assessment Act* (CEAA, 2012) and the *British Columbia Environmental Assessment Act* (BCEAA). In February 2014, PNW LNG submitted an EIS to satisfy the assessment requirements of both jurisdictions. The environmental assessment approvals will include conditions that reflect specific commitments made by PNW LNG in the EIS (refer to Table 28.2 of the EIS). The EMP will help facilitate compliance with these conditions, the conditions of other environmental permits and approvals, and provincial, federal and industry standards.

2.2 ENVIRONMENTAL COMPLIANCE MONITORING

This section provides an overview of the monitoring and reporting program based on legislative requirements and commitments outlined in the EIS. Additional monitoring and reporting requirements may be identified as part of project permit conditions. The EMP will be updated to reflect those conditions.

The compliance monitoring and reporting program is needed to outline the requirements to inspect, evaluate, and report on environmental protection measures implemented against the EMPs, and all applicable permits, approvals, and authorizations. Section 6.0 and Appendix J.16 of the EIS Addendum provide additional details regarding the Environmental Monitoring Plan.

2.2.1 Project Inspections and Audits

Routine environmental inspections and audits during construction will be required to verify compliance with the EMPs, applicable environmental regulations, and approval conditions. In some cases inspections and audits will be undertaken and permit and/or authorization conditions, while in other cases these will be carried out as best management practices by PNW LNG. Environmental inspections will evaluate key elements of the environmental management system, and each component EMP, to determine if they are being implemented effectively and feed into continual improvement plans and programs.

Examples of specific project activities that will be inspected and audited include:

- Air quality including emissions, fugitive dust and greenhouse gas release
- Waste management including hazardous and non-hazardous solid and liquid waste
- Erosion control and vegetation management
- Natural resource management—marine and freshwater.

PNW LNG will also conduct internal audits on the environmental management process to ensure processes and programs are being implemented effectively.

These inspection and audit programs during construction are not the same as the Follow-Up and Monitoring programs described in the EIS and Addendum. Follow-up programs are typically implemented to verify the conclusions of the environmental effects assessment, and are not intended to monitor and report compliance with the EMP and all applicable regulatory permits, approvals and authorizations.

2.2.2 Compliance Reporting

Compliance reporting will include (but is not limited to) inspection and audit reports, and environmental non-compliance (if applicable). Reports may include:

- Documentation including forms, checklists, photographs and permits related to compliance
- Applicable approvals, commitments and assurances
- Application of environmental mitigation practices
- Field and laboratory sample results

- Construction and/or operations activities
- Recommended changes to EMPs (if required).

The details of compliance reporting and frequency will be determined during project permitting, in consultation with the appropriate regulatory agencies.

3.0 ROLES AND RESPONSIBILITIES

The following subsections identify the primary roles and responsibilities of key construction and environmental project team members involved in implementation of the EMP. Section 3.1 provides an overview of the project roles and responsibilities related to health, safety, and environment. An organizational chart outlining roles and responsibilities will be included in the final EMP, once all parties and details are in place.

3.1 PROJECT PERSONNEL ROLES AND RESPONSIBILITIES

3.1.1 PNW LNG

PNW LNG's Health, Safety, and Environment Management System has been developed to ensure PNW LNG complies with all health, safety and environmental requirements and to provide a safe and healthy workplace that minimizes impacts upon the environment.

PNW LNG will take measures to ensure that all employees, contractors and visitors on PNW LNG sites maintain a high level of awareness for health, safety and the environment. Participation in the Health, Safety and Environmental Management will be encouraged and recognized at all levels of the organization. It is essential to PNW LNG that all persons return home at the end of the day in equal health status as when they went to work, free from work induced health issues.

PNW LNG will be responsible to (at a minimum):

- Provide project related guidance to consultants, contractors and regulatory liaisons
- Oversee project construction activities based on input from design engineers, permits and approvals
- Lead public communication and engagement practices
- Include the EMP in the Contractor's contract document and communicate all environmental issues to the Contractor
- Require that the Contractor uphold all commitments in the EMP
- Form an environmental management team, with a lead Environmental Coordinator, to provide oversight and support to the Contractor
- Appoint a Health, Safety and Environment Coordinator (HSE Coordinator) to manage reported incidents and coordinate incident response and investigation
- Notify stakeholders, First Nations, and concerned parties of construction activities and updates.

3.1.2 EPCC Contractor

The responsibilities of the EPCC Contractor will include (but are not limited to):

- Complete all works according to approved project designs
- Keep a current version of the project EMPs, schedule, applicable permits and documentation on site and accessible during all construction activities
- Uphold construction-related environmental commitments of the construction EMP, Proponent HSE plans, permits and approvals (both on behalf of PNW LNG and EPCC's)
- Communicate activities with the site Environmental Monitor
- Provide all project construction staff with orientation and adequate training on environmental mitigation measures
- Provide staff with adequate equipment and supplies to administer the EMP during construction
- Ensure project construction equipment is maintained and in good working condition
- Communicate regularly and effectively with the Proponent and adjust activities to stay in compliance with the requirements of the construction EMP and other project-specific and regulatory environmental requirements
- Notify the HSE Coordinator and the Environmental Monitor of any incidents that have the potential to adversely affect the environment
- Report environmental incidents to the appropriate PNW LNG management as well as to the appropriate regulators.

3.1.3 Environmental Management Team

The Environmental Management Team will be responsible for assessing and reporting on compliance with the terms and conditions of the EIS, as well as all regulatory permits, approvals, licenses and Proponent commitments and assurances related to pre-construction and construction. The team will consist of experienced environmental monitors/inspectors, including technical specialists who are qualified to conduct biological, water quality, archaeological, erosion and sediment control, site restoration, and other project monitoring programs as required during the construction and operations phase of the Project. Independent environmental monitors, separate from the monitors described herein, and their scope of work will be determined during the permitting phase of the Project.

3.1.3.1 Environmental Monitor

The Environmental Monitor(s) will be a qualified professional who is responsible for determining whether work activities are in compliance with environmental obligations (i.e., permits, standards and BMPs). The Environmental Monitor will be retained by PNW LNG or by the on-site contractor(s), as appropriate. A sufficient number of monitors and back up monitors will be available to adequately cover the entire project area under construction.

The Environmental Monitor(s) will:

- Report observations and mitigation measures taken that are related to permits and regulatory requirements
- Maintain a current version of the EMP and be familiar with all aspects of the document
- Have the authority to modify or suspend site activities if environmental mitigation measures are not considered to be effective

- Attend project planning meetings, health and safety meetings and contractors tailgate meetings to communicate potential environmental concerns and requirements
- Monitor contractor construction activity in the marine and terrestrial environments to ensure compliance with the applicable activity-based EMPs, permits, approvals and authorizations
- Conduct field sampling of environmental media (i.e., water, soil etc.) as detailed in the monitoring program overview (Section 6.0) and Environmental Monitoring Management Plan (Appendix J.16 of the EIS Addendum)
- Submit routine environmental monitoring reports including relevant data, forms, photographs and documentation
- Address and closely monitor any non-compliance issues immediately
- Guide clean-up and restoration activities (i.e., after a spill) according to BMPs and standard operating procedures (SOPs).

3.1.3.2 Technical Environmental Specialist

Technical Environmental Specialists will assist the Environmental Monitor with the implementation of specific monitoring programs detailed in each component EMP (i.e., marine mammal observation), as is deemed necessary. Technical Environmental Specialists will be professionals qualified to implement, monitor and address specific components of construction and operations EMPs including archaeological surveys, soil erosion, sediment control, restoration, and other discipline-specific monitoring programs, where specialized technical input is determined by the Environmental Monitor or PNW LNG to be required.

Technical Environmental Specialists will implement mitigation measures presented in activity-based EMPs and help to ensure compliance with the project Proponent's environmental commitments. Technical Environmental Specialists will be responsible for regulatory, permit and authorization field compliance within their area of expertise during third party environmental audits.

4.0 TRAINING AND ORIENTATION

Project and task-specific training programs will be developed and implemented prior to the start of construction and operations. All identified personnel will complete the appropriate training before they enter the active project site.

4.1 ENVIRONMENTAL ORIENTATION TRAINING

Project orientation training programs encompassed within PNW LNG corporate policy are to be developed and implemented prior to the start of construction and operations. A summary of anticipated project orientation and training is presented in Table 4-1. All training will be documented. Where necessary, on-the-job training, rather than formal in-class training will be used as a supplement or as the primary source of specific training. Table 4-1. Additional training requirements will be added as engineering design and project execution methods are developed.

Table 4-1: Training and Orientation Overview

Program Name	Training Program Overview	Personnel Involvement
Project Orientation	Develop a project orientation program detailing Environmental procedures in place including traffic rules, sensitive environmental areas, activity-specific requirements, and wildlife education and awareness training.	All personnel working on the Project including visitors
Environmental Spill Response	Spill response training that will include protocols on how to use spill kits and how to respond to fuel and hazardous material spills including: • Stop the release • Eliminate potential for ignition • Evacuate all individuals • Prevent seepage of the product • Advise supervisor • Conduct site clean-up activities • Conduct remediation	Designated employees
Environmental Emergency Response	Emergency response training will include staff emergency scenario training and practice drills, to ensure rapid and effective response in the event of an emergency situation. This training will include the use of basic fire protection equipment during initial fire response and incident command training.	Designated Employees
Hazardous Materials Storage, Handling and Shipment	Training on handling, storage and record-keeping procedures prior to starting the associated work. Adhere to and provide training for applicable hazardous materials handling legislation (i.e., Workplace Hazardous Materials Handling Information System, Transport of Dangerous Goods)	Personnel who are expected to work with hazardous materials and waste products
Contractor Specific Training Requirements	Contractor-specific protocol orientation for activity-specific EMPs. Orientation Prime Contractor protocols	All personnel involved in the immediate project area including visitors

5.0 SUMMARY OF ENVIRONMENTAL CONSIDERATIONS

The purpose of the EMP is to provide measures to eliminate or reduce environmental damage caused by the project during construction and operations. Table 5-1 outlines key activities, potential project effects and recommended mitigation measures that will reduce the impacts associated with various project activities.

Table 5-1: Environmental Considerations Summary

Environmental Aspect	Project Activity	Potential Project Effects	Recommended Mitigation Measures /Component EMP
Marine Resources Management	Blasting, Pile Driving Dredging	Loss of fish habitat Direct mortality or physical injury to aquatic species Changes to sediment and water quality (e.g., increased suspended sediment or contaminant levels).	Marine and Freshwater Resources Management Plan (Appendix J.8 of the EIS Addendum; Appendix 1 (MMMPP)) Blasting Management Plan (Appendix J.11 of the EIS Addendum) Marine Pile Installation Management Plan (Appendix J.12 of the EIS Addendum) Dredging Management Plan (Appendix J.13 of the EIS Addendum) PRPA Harbour Operations Practices and Procedures (2009)
Freshwater Resources Management	Clearing, Grading and Blasting	Loss fish habitat Direct mortality or physical injury to aquatic species Changes to sediment and water quality (e.g., increased suspended sediment or contaminant levels).	Marine and Freshwater Resources Management Plan (Appendix J.8 of the EIS Addendum) Blasting Management Plan (Appendix J.11 of the EIS Addendum)
Vegetation Resources	Clearing and Grubbing Tree Removal	Loss of wetland communities Weed introductions or changes in moisture and nutrient regime	Vegetation Management Plan (Appendix J.9 of the EIS Addendum), which includes mitigation measures for the management of invasive plants
Archaeological and Heritage Resources	Clearing and Grubbing Tree Removal	Removal of culturally modified trees or archaeological resources	Detailed data collection, including systematic data recovery detailed in the Archaeology and Heritage Resources Management Plan (Appendix J.15 of the EIS Addendum)
Air Quality	Diesel-based emissions Fugitive dust Greenhouse gases	Vegetative injury Ecosystem changes Increases in certain health concerns	Ensure equipment is equipped with catalytic converters and mufflers as per the manufactures requirements/design/specifications Air Quality and Greenhouse Gas Management Plan (Appendix J.4 of the EIS Addendum)
Noise and Vibration	Construction equipment Blasting Pile Driving Dredging	Community annoyance Disturbance of wildlife	Noise, Vibration and Ambient Light Management Plan (Appendix J.5 of the EIS Addendum)
Ambient Light	Construction of Materials Offloading Facility Operational lighting Ship traffic	Community health (i.e., aesthetics and nuisance lighting)	Noise, Vibration and Ambient Light Management Plan (Appendix J.5 of the EIS Addendum)

Environmental Aspect	Project Activity	Potential Project Effects	Recommended Mitigation Measures /Component EMP
Transportation	Marine and land based transportation	Increase in traffic in navigable waters and on roadways in and around Port Edward	Traffic assessments, analysis and plans to manage increased traffic, reduce environmental and safety risks (Appendix J.7 of the EIS Addendum).
Waste Management	All construction activities have the potential to result in waste	Wildlife issues (waste can attract wildlife) Health and safety can be affected (i.e., trips and falls; hazardous wastes stored improperly)	Waste Management Plan (Appendix J.10 of the EIS Addendum) General site housekeeping Proper storage and disposal of wastes
Spill Release	Project construction and operation have the potential to result in accidental spills to the environment	Human and wildlife health risks (explosion, fire, etc.) Contamination to soil, water, sediment	Environmental Emergency Preparedness and Response Plan (Appendix J.6 of the EIS Addendum)

6.0 ENVIRONMENTAL MONITORING

Environmental monitors will be on the Project site during terrestrial and marine construction and ongoing operations activities to monitor and report compliance with the EMP and all applicable regulatory permits, approvals and authorizations. Any other Proponent commitments and assurances related to construction or operations activities including temporary construction-related buildings and facilities are captured within the environmental monitoring and reporting summary (see **Error! Reference source not found.**). Members of local First Nations will be asked to participate in the environmental monitoring programs, where appropriate.

Activity-specific work initiatives are likely to proceed concurrently; therefore, multiple monitors may be required to ensure adequate coverage throughout the project area.

6.1 ENVIRONMENTAL COMPLIANCE MONITORING AND REPORTING

Environmental compliance monitoring for each of the component EMPs (Appendices J.4 – J.15 of the EIS Addendum) is described in Appendix J.16 of the EIS Addendum, Environmental Monitoring Management Plan, unless otherwise indicated. General monitoring practices are described in the following sub-sections. Environmental compliance reporting is described in Appendices J.4 – J.15 of the EIS Addendum; incident reporting is described below (Section 7.2) and in Appendix J.6 of the EIS Addendum, Environmental Emergency Preparedness and Response Plan.

6.1.1 General Construction Monitoring Practices

During project construction, monitors will determine if appropriate environmental mitigation measures are followed and that regulatory requirements are met. Routine daily monitoring activities conducted at the project site will comply with PNW LNG's corporate HSE Policy. If environmental requirements are not met the environmental monitor will work with the PNW LNG Environment Team and the EPPC Contractor to adjust practices accordingly.

General compliance monitoring practices during project construction include:

- Participate in daily environmental compliance meetings with the EPCC Contractor
- Inspect project equipment for leaks, condition, maintenance practices
- Ensure that copies of required permits, project approvals, authorizations and applicable regulatory guidance are kept at the site, on hand and accessible
- Ensure that emergency environmental spill response supplies are maintained and accessible
- Direct Contractor construction activities related to environmental regulatory compliance and permitting requirements
- Provide recommendations to the EPCC Contractor to prevent or correct non-compliant construction activities
- Monitor and document water quality parameters (i.e., turbidity, TSS etc.)
- Observe clearing and grading activities on Lelu Island to ensure minimal disturbance of soils, vegetation and marine riparian habitat.

6.1.2 General Operations Monitoring Practices

During the project operations, monitors will determine if appropriate environmental mitigation measures are being followed and that regulatory requirements are adhered to. Day to day monitoring activities conducted at the project site will comply with the Environmental Monitoring Plan designed by PNW LNG (Appendix J.16 of the EIS Addendum). If environmental requirements are not met the environmental monitor will work with the PNW LNG Environment Team and the EPPC Contractor to adjust practices accordingly.

General compliance monitoring practices during project operations include:

- Participate in environmental compliance meetings with project operations personnel
- Ensure copies of required operating permits, regulatory approvals and applicable authorizations are kept at the site
- Ensure that operational activities affecting component EMPs (i.e., liquid waste storage, spill response) comply with recommended preventative and mitigation measures using BMPs and SOPs
- Direct project operations personnel as required during non-routine maintenance activities and/or those that may impact the environment
- Document and collect data according to operational EMPs (i.e., water quality, facility discharge points)
- The Environmental Monitor will maintain a log of findings for the Environmental Manager according to frequencies defined in the Environmental Monitoring Plan (Appendix J.16 of the EIS Addendum).

6.1.3 Stop Work Authority

In the event of circumstances resulting in non-compliance, the Environmental Monitor, retained by PNW LNG or the on-site contractor(s) will have the authority to stop work until mitigation measures are applied that address the issue(s) or conditions are conducive to continuing with the construction or operations activity. Once a desired result has been achieved, the project activity will be permitted to recommence under the direction of PNW LNG management and / or the Environmental Monitor (or other appropriate personnel depending on the incident), and under close supervision by the Environmental Monitor.

7.0 PUBLIC COMMUNICATION AND ISSUE RESOLUTION

Public communication is an essential component of project development to ensure that information is distributed to those potentially affected by construction and operations activities. Public in this instance refers to, but is not limited to, Aboriginal groups, fishing groups and other recreational users, government agencies, emergency responders, residents and the general public.

7.1 PUBLIC ISSUE RESOLUTION

PNW LNG will develop an Issue Resolution Plan according to corporate relations policy to manage and document project-related complaints or issues raised by the public.

Standard procedures to address complaints associated with the Project will include, but not necessarily be limited to, the following:

- Provide key company and emergency contact information to local elected officials and municipal staff as well as on a company website and through other media such as community newsletters and signage at the entrance to the project property
- Investigate the cause of all complaints and undertake immediate and appropriate corrective action, if necessary, to address the problem
- Maintain a records database of all complaints with the time, date, name, address and telephone number of the individual or group lodging the complaint
- Maintain a record of any cause and action taken to correct the problem as well as the need for follow-up, if required
- Document all complaint-related correspondence and record resolution details, including actions and outcomes.

7.2 INCIDENT REPORTING

Prompt, accurate incident reporting is critical for effective and timely handling of emergencies and other accidents or malfunctions requiring immediate attention. Prompt initial response to emergencies can help to minimize potential effects to health, safety and environment.

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PNW LNG Management team will be notified in a timely manner in the event of any monitoring exceedance, occurrence of non-compliance with terms and conditions of environmental approval, non-conformance with project commitments, or significant event (e.g., a fuel release). The Project Environmental Monitor(s) will be responsible for relaying non-compliance issues to regulators, if required, during construction, while PNW LNG's Environmental Management team will be responsible for this during operations.

Appendix J.2
Project Contact List

J.2 DRAFT PROJECT CONTRACT LIST

Project Contacts	Name/Title	Number
PNW LNG		
Project Contractor(s)	**Name/Title**	**Number**
Environmental Monitor(s)	**Name/Title**	**Number**
Regional/Municipal Contacts	**Name/Title**	**Number**
District of Port Edward		(250) 628-3667
City of Prince Rupert		(250) 627-0960
Canadian National (CN) Railway	CN Police	1-800-465-9239
	Non-emergency	1-800-601-7630
Emergency Services	**Name/Title**	**Number**
Royal Canadian Mounted Police (RCMP)	Emergency	911
	Non-emergency	(250) 627-0700
District of Port Edward Fire Department	Non-emergency	(250) 628-3323
Prince Rupert Fire Department	Emergency	911
Ambulance	Emergency	911
Prince Rupert Regional Hospital	Non-emergency	(250) 624-2171

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Marine Emergency Services	Name/Title	Number
Prince Rupert Port Authority	Port Security Operations Centre	(250) 627-2522
	Harbour Master	(250) 627-2517
	Response after hours	(250) 627-3074
	24 hour service	VHF Channel 16
Canadian Coast Guard Marine Communications and Traffic Services (MCTS)	MCTS	(250) 627-3074
	MCTS Operations/Supervisor	(250) 627-3081
	Officer-in-Charge	(250) 627-3077 (778) 884-1351
	Marine Emergencies/Cellular	*16
	24 hour Radio Service	VHF Channel 71
Canadian Coast Guard Search and Rescue	Toll free (within region)	1-800-567-5111
	(250) 413-8933	
Western Canada Marine Response Corporation (Burrard Clean)	24 Hour Spill Emergency Line	1-855-294-9116
	Prince Rupert Office	250-624-5666
Spill Reporting and Other Agency Reporting	**Name/Title**	**Number**
Emergency Management BC (Provincial Emergency Program)		1-800-663-3456
		(250) 624-5115
CANUTEC	Call collect 24 hours	613-996-6666
Fisheries and Oceans Canada (DFO)		1-800-465-4336
Canadian Coast Guard		1-800-889-8852
BC Oil and Gas Commission		1-888-330-8822 (24-hr)
BC Ministry of Forests, Lands and Natural Resource Operations (report a wildfire)	1-800-663-5555	

Appendix J.3
Monitoring Forms

DAILY MONITORING LOG
PNW LNG Facility

Environmental Monitor:		**Date of Visit:**	
On-Site Supervisor:		**Time of Visit:**	
Weather Conditions:			

Construction Activities and Monitoring

Construction Activities:

Monitoring Observations:

Sampling Information:

Recommendations:

Comments:

ENVIRONMENTAL INCIDENT REPORT
PNW LNG FACILITY

Report Name:		**Report Number:**	
		Date of Report:	
Prepared By:		**Date:**	
Distribution:			
INCIDENT SITE DESCRIPTION			
Location:			
Date of Incident:			
Topography:			
Site Status:			
Weather Conditions:			
DESCRIPTION OF INCIDENT (Location; impacts)			

ACTIONS TAKEN

ENVIRONMENTAL INCIDENT REPORT
PNW LNG FACILITY

INCIDENT ANALYSIS

Cause:

Recommendations:

PHOTOS

Photo Description:

WEEKLY MONITORING REPORT
PNW LNG Facility

Report Details								
Reporting Period:								
Prepared By:						**Date:**		
Report Distribution:								

Site Conditions								
Weather Conditions:	**Date**							
	Weather							
	Temp: Low							
	Temp: High							

Construction Activities and Monitoring			
Location	**Works**	**Date**	**Monitoring / Recommendations**

Comments

WEEKLY MONITORING REPORT
PNW LNG Facility

Photos

Photo Description:

WEEKLY MONITORING REPORT
PNW LNG Facility

Photo Description:

Appendix J.4
Air Quality and Greenhouse Gas Management Plan

J.4 PRELIMINARY DRAFT AIR QUALITY AND GREENHOUSE GAS MANAGEMENT PLAN

1.0 INTRODUCTION

Pacific NorthWest Limited Partnership (PNW LNG) has developed a preliminary draft Air Quality and Greenhouse Gas Management Plan (AQGMP) to address potential environmental concerns during the construction and operation phases of the Pacific NorthWest LNG Project (the Project). The AQGMP is a component of the Environmental Management Plan (EMP) and will be implemented by PNW LNG in conjunction with processes outlined in the EMP Overview.

This preliminary draft plan presents a framework for managing potential adverse environmental effects based on the Environmental Impact Statement (EIS) for the Project and subsequent feedback from regulators, Aboriginal groups, stakeholders and the public. This plan will be updated and refined based on detailed Engineering Procurement Construction and Commissioning (EPCC) Contractor design and permitting requirements.

Roles and responsibilities related to environmental management are generally described in the EMP Overview document, Section 3.0. General information pertaining to compliance monitoring is provided in Section 2.2 of the EMP Overview document.

Criteria air contaminants (CACs) of interest in this AQGMP include sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), hydrogen sulphide (H_2S) and particulate matter (PM). These substances are selected based on the expected project emissions, professional judgment obtained from previous project experience, and the ambient air quality objectives established by Canada and British Columbia (BC) regulatory agencies.

Greenhouse gases (GHGs) are atmospheric gases that absorb and re-emit infrared radiation, producing a thermal blanket for the planet. Increases in GHG concentrations have been indirectly linked to climate change along with a number of other environmental factors (IPCC 2007). The primary GHGs include water vapour (H_2O), carbon dioxide (CO_2), methane (CH_4), ozone (O_3), and nitrous oxide (N_2O). GHG estimates usually incorporate emissions of CO_2, CH_4, and N_2O and are presented in units of carbon dioxide equivalent (CO_{2e}).

1.1 PURPOSE AND SCOPE

The AQGMP focuses on managing CACs, GHGs and fugitive dust emissions during construction and operations phases of the Project. The AQGMP outlines best management practices (BMPs) and mitigation measures which will be used by PNW LNG to reduce potential effects on air quality and GHG management. In general, prevention of emissions is the most practical way to achieve these objectives.

The AQGMP will be adaptive in its approach. PNW LNG will rely on ongoing monitoring and stakeholder consultation programs to provide early warnings of concerns. All air quality issues will be recorded and addressed

in a timely and transparent manner. The information gained from these programs will support further AQGMP improvements and ensure that BMPs and appropriate mitigation responses are enforced.

This plan will work in conjunction with other components of the EMP, including:

- Environmental Emergency Preparedness and Response Plan (see Appendix J.6 of the EIS/Addendum)
- Transportation Management Plan (see Appendix J.7 of the EIS/Addendum)
- Waste Management Plan (see Appendix J.10 of the EIS/Addendum)
- Blasting Management Plan (see Appendix J.11 of the EIS/Addendum).

PNW LNG will be responsible for the execution, implementation and maintenance of the AQGMP during the project construction and operations phase.

2.0 REGULATORY CONTEXT

The preliminary draft AQGMP is based on information presented in Section 6 of the EIS. The final AQGMP will also include the terms and conditions of the environmental assessment certificate, and other project authorizations and permits.

Both Canada and BC have regulatory authority to protect air quality and manage GHGs including:

- *Canadian Environmental Protection Act* (Government of Canada 1999)
- *BC Environmental Management Act* (Government of BC 2003a)
- Waste Discharge Regulation
- *BC Oil and Gas Activities Act* (Government of BC 2008a)
- *Greenhouse Gas Reduction Targets Act* (Government of BC 2007)
- *Greenhouse Gas Reduction (Cap and Trade) Act* (Government of BC 2008b)
- *Clean Energy Act* (Government of BC 2010)
- Sulphur in Diesel Fuel Regulations (EC 2002)
- BC Open Burning Smoke Control Regulation (Government of BC 2003b).

The Project will also observe applicable policies, standards and guidelines including:

- BC Ambient Air Quality Objectives (BC MOE 2013)
- Canadian Ambient Air Quality Standards (Health Canada 2013)
- Canadian Council of Ministers of the Environment Canada (CCME)-wide standards (CCME 2000, CCME 1999))
- International Convention for the Prevention of Pollution from Ships (MARPOL 2008)
- BC Waste Discharge Regulation (Government of BC 2004)

- BC Ministry of Environment (BC MOE) Best Achievable Technology (BC MOE 2012)
- Flaring and Venting Reduction Guideline (BC OGC 2011)
- CCME Keeping Clean Areas Clean (CCME 2007).

Additional detail on key regulations and policies for air quality and GHG management are provided in the following sections.

2.1 AIR QUALITY OBJECTIVES AND STANDARDS

Atmospheric air quality limits are established by government agencies to protect human health and the environment as defined by applicable ambient air quality objectives (AAQOs). AAQOs are generally expressed in terms of a concentration (e.g., micrograms per cubic metre, or parts per billion) averaged over a specific period of time (e.g., one hour, 24 hours or one year). AAQOs are one kind of "criteria" which can also include standards, guidelines and planning goals. AAQOs are non-statutory limits used to guide decisions. They are typically used to assess air quality, develop long-term air-management strategies and evaluate progress.

Under sections 3(2) and 3(3) of the BC *Environmental Management Act* (Government of BC 2003a), any introduction of waste into the environment requires an authorization via permit or approval. Activities that require a permit are prescribed through the *Waste Discharge Regulation* (WDR). The BC *Environmental Management Act* (EMA) has allowed the BC MOE to establish BC AAQO for a number of CACs.

2.2 SULPHUR IN DIESEL FUEL REGULATIONS

The *Sulphur in Diesel Fuel Regulations* (Environment Canada 2002) was amended in June 2012. The Amendments set maximum limits for sulphur in diesel fuel for use in on-road, off-road and stationary engines. Current and upcoming national sulphur limit regulations in diesel fuel are summarized in Table 1.

Table 1: Sulphur Content in Diesel Fuel for On-Road, Off-Road and Stationary Combustion Engines in Canada

Diesel Fuel for use in	Regulated Activity	Sulphur Limit (mg/kg)	Diesel Fuel for use in
On-road vehicles	Production or import	15	Since 2006
Off-road vehicles	sales	15	Since 2010
Large stationary engines	Production or import	1000	June 1, 2014
Small stationary engines	sales	15	June 1, 2014

NOTES:
Source: https://www.ec.gc.ca/energie-energy/default.asp?lang=En&n=7A8F92ED-1.
mg/kg - milligram per kilogram.

2.3 MARINE AIR EMISSIONS REGULATIONS

PNW LNG carriers and assist tugs will be required to comply with the international MARPOL air emission standards (MARPOL 2008). MARPOL Annex VI limits the main air pollutants contained in ship engine exhaust gas, including sulphur oxides (SO_X) and nitrogen oxides (NO_X) and prohibits deliberate emissions of O_3 depleting substances. The 2008 MARPOL Annex VI provides fora gradual reduction in global SO_X, NO_X and PM emissions and introduces emission control areas (ECAs) to further reduce emissions of those air pollutants in designated sea areas.

MARPOL Annex VI Regulation 13 provides for progressive reductions in global marine NO_X emissions by implementing a tiered system for marine diesel engines installed on ocean-going vessels and introducing more stringent limits in designed ECAs such as North America. Tiers of allowable diesel engine NO_X emissions are a function of the ship construction dates. Engines installed before 2000 (Tier I) or from 2011-2015 (Tier II), will be "grandfathered" based on tier limits at the date of construction. Tier II limits will continue to apply outside of the ECAs after 2015, and will be achieved by optimizing process combustion. Within designated ECAs, Tier III limits will apply to marine diesel engines built on or after January 1, 2016.

MAPROL Annex VI Regulation 14 requires that the sulphur content of fuel oil (expressed in terms of weight percent) must be no more than 0.10% sulphur in the North American ECA after January 1, 2015. In practice, ships within the ECA will be required to burn fuel oil of 0.10% sulphur content or be fitted with emission controls approved by MARPOL.

2.4 OPEN BURNING

As part of the *BC EMA* (Government of BC 2003b), the *Open Burning Smoke Control Regulation* (BC Reg 145/93) is meant to encourage the reduction and reuse of vegetative debris, whenever possible. The regulation dictates specific mitigation measures to reduce smoke and odours generated by open burning. The regulation relies on the provincial Ventilation Index to assess potential smoke effects in populated areas. The index incorporates weather conditions, terrain, and residential neighborhoods. If open burning will be required during construction, the Prince Rupert Ventilation Index will be consulted in preparation for open burning. Mitigation measures to minimize air emissions from batch waste incinerators are provided below.

2.5 WASTE INCINERATION

Open burning or incineration of waste or wood residue requires a permit or authorization. Mitigation measures to minimize air emissions from batch waste incinerators are provided in Section 3.

2.6 BEST ACHIEVABLE TECHNOLOGY

In May 2008, the BC MOE adopted an interim policy for "Determining Best Achievable Technology Standards" (BC MOE 2008). The policy is intended to provide guidance to BC MOE staff when setting waste discharge standards, provincial targets, regulations and codes of practice, by using BAT appropriate for the sector. BAT is also to be used by BC MOE staff in the setting of facility-specific permit or approval limits. The interim BAT policy is meant to encourage the scoping of all technology shown to be economically feasible through successful commercial application in a similar facility in the same industry (BC MOE 2012).

2.7 GREENHOUSE GAS REDUCTION POLICIES AND REGULATIONS

2.7.1 Canadian Government

The federal government recognizes that climate change is a global issue requiring a global solution. The federal government has set a 17% reduction target for Canada's total GHG emissions from 2005 levels to be achieved by 2020. This target was announced in early February 2010 following the Copenhagen Accord. At the United Nations Climate Change Conference in Durban (2011), Canada formally announced its intention to withdraw from the Kyoto Protocol. However, this decision is not expected to impact its emissions reduction target.

2.7.2 British Columbia

In 2007, the BC government legislated a provincial GHG reduction target that reaches 33% below 2007 emission levels by 2020 and authorized hard limits ("caps") on GHG emissions through the *Greenhouse Gas Reduction (Cap and Trade) Act* (Government of BC 2008b). An additional provincial target is a reduction of GHG emissions to 80% below the 2007 levels by 2050. All new projects that will generate GHG emissions in BC are assessed against this target. However, the BC government has not yet established industry specific regulations for GHG emission management.

A Natural Gas Climate Action Working Group was established in 2008 to develop strategies to reduce GHG emissions. The group includes representatives from BC Climate Action Secretariat, BC MOE, Ministry of Energy, Mines and Natural Gas and the oil and gas industry. The Natural Gas Climate Action Working Group set GHG reduction targets of 6% below 2007 levels by 2012 and 18% by 2016.

The 2012 and 2016 targets were legally mandated through regulation at the end of 2008. In order to achieve these goals, BC has designed and, in some cases, implemented a suite of policy measures to reduce emissions across the province. These include:

- Provincial carbon tax, which was introduced in 2008 through the *Carbon Tax Act* (Government of BC 2008c)
- Carbon neutrality mandate for all public sector operations (*Carbon Neutral Government Regulation*) (Government of BC 2008d), which is largely achieved through the sourcing of BC-based offsets via the Pacific Carbon Trust (*Emissions Offset Regulation*) (Government of BC 2008e)
- Mandatory GHG reporting program (Reporting Regulation) (Government of BC 2009)
- Proposed cap and trade and compliance offset scheme.

In addition, the BC Oil and Gas Commission (BC OGC) has released venting and flaring requirements under the *Oil and Gas Activities Act* and GHG reduction targets are outlined in the *Clean Energy Act* as part of BC's energy objectives.

Since 1 January 2010, facilities emitting 10,000 tonnes or more of CO_{2e} emissions per year have been required to report their GHG emissions. The reporting of accurate emissions data of consistent quality is essential to the development and implementation of a cap and trade program. If implemented, the BC cap and trade scheme would cover all major sources of GHG emissions such as refineries, industrial facilities, and transportation fuels. A decision on whether or not to proceed with the implementation of a cap and trade scheme is still pending.

Potential future legislation that could affect the Project includes the *GHG Industrial Reporting and Control Act* and the *Liquefied Natural Gas Income Tax Act*.

3.0 ENVIRONMENTAL PROTECTION MEASURES

A number of mitigation measures to reduce project effects on air quality and GHG management have been proposed. These mitigation measures will reduce emissions from combustion sources from diesel-fired construction equipment and fugitive dust from soil disruption and road use. The measures will also support compliance with the AAQOs outlined in Section 2.1. The following sections list the BMPs and mitigation measures that will be implemented by PNW LNG. The AQGMP will be revised to include any additional mitigation and monitoring requirements defined by the BC MOE and BC OGC as permit conditions.

3.1 BEST MANAGEMENT PRACTICES

PNW LNG will implement the following BMPs to reduce CAC and GHG emissions resulting from project construction and operations phase activities:

- Incorporate BAT that is economically viable into project construction and operation for the purpose of reducing air emissions
- Incorporate BMP for Fugitive Emissions Management (CAPP 2007) into everyday project activities
- Heavy-duty on-road vehicles to meet federal, provincial, and regional emission standards
- Heavy-duty off-road vehicles are subject to the *Canadian Environmental Protection Act* and the Environment Canada compression ignition engine emissions standards (EC 2005, EC 2011a)
- Equipment will undergo a regular manufacturer specified maintenance program
- Equipment will operate at optimum rated loads for effective operation
- Equipment emitting excessive exhaust (e.g., qualitative visual observations of excessive black smoke) will be taken out of work rotation until the equipment emissions are adjusted to an acceptable standard
- Heavy-duty diesel vehicles (i.e., licensed vehicles, such as dump trucks) will be in good working order while operating on the project site
- Dust associated with the use of facility roads will be reduced by using dust suppressants, and surface paving
- LNG carriers and assist tugs will use low-sulfur fuel in compliance with applicable marine emission standards (MARPOL 2008).

3.2 MITIGATION MEASURES

3.2.1 Anti-Idling

To reduce air emissions anti-idling procedures will apply to all project equipment. During all phases of the Project, vehicle idling times will be reduced to a minimum. Vehicles will be turned off when not in use or while unattended or unlocked. Vehicles that are exempt from this procedure are:

- Police, fire, ambulance or other emergency vehicles performing emergency duties including training
- Vehicles for which idling is required as part of a repair or regular pre-check maintenance process
- Vehicles idling while passengers are in the course of embarking or disembarking
- Vehicles required to use heating or refrigeration systems powered by the motor or engine for the preservation of perishable cargo
- Vehicles being used as a mobile workshop.

Site orientations, health and safety tailgate and project progress meetings will be used to communicate and encourage project idling reduction initiatives. Vehicle idling policy will be enforced as part of compliance monitoring.

3.2.2 Site Preparation

Site preparation will include excavation, stripping, clearing and grubbing. These activities can result in substantial fugitive dust emissions, especially during dry periods and high winds. The project location has a high frequency of rainfall and the resulting high soil moisture content will provide ample natural mitigation of dust emissions for much of the time during construction. To reduce the dust emission potential during dry periods and high winds, the following site preparation mitigation will be implemented, when possible, and where applicable given the generally wet environmental conditions in the Prince Rupert area:

- Each area of the construction will be graded separately and timed to coincide with actual construction
- Where dry conditions require it, topsoil will be stripped when the ground is frozen or moist (but not saturated) to reduce dust generated by scraper and dozer operations
- The heights from which excavated materials are dropped will be kept as low as practical in order to reduce dust generated by dumping
- In areas where construction earthworks have resulted in exposed soils, wind erosion from surfaces will be treated by soil compaction and concurrent re-vegetation soon after the site is prepared.
- Arid open surfaces will be managed with dust suppressants (i.e., water) if they remain undisturbed for extended periods of time.

During site preparation, vegetation clearing will release GHG emissions when non-merchantable vegetation is burned. In addition, the carbon sequestering potential of the area will be temporarily removed during the construction phase of the Project. To reduce this effect, PNW LNG will re-vegetate impacted areas, where possible.

3.2.3 Road Use

During the construction phase of the Project, management of fugitive dust emissions from unpaved roads will use a combination of protective measures, including:

- Surfacing with low silt materials: Fugitive dust emissions depend on the amount of silt (particles less than 75 microns in diameter) contained within the road surface material. For maintenance on new but unpaved roads, low silt waste rock will be selected as top dressings.
- Road Watering: Water trucks will be used to control potential fugitive dust emissions during dry conditions. Water will be applied to unpaved roads. Watering of unpaved roads can result in 90% reduction of dust emissions if the surface moisture ratio is kept at 4% or more (US EPA 2006).

3.2.4 Open Burning

Land clearing will result in the removal of trees and other vegetation. Any larger non-merchantable trees may be disposed through open burning. The mitigation measures used to control smoke and odour from open burning will comply with the *Open Burning Smoke Control Regulation* (BC Reg 145/93) (Government of BC 2003b). Prior to burning, all possible options to reduce, reuse or recycle as much of the material as possible will be explored. Burning will not be undertaken if the local airflow will cause smoke to have a negative effect on areas critical to wildlife and vegetation, particularly those nearest to the Project.

To reduce the potential effect on air quality of sensitive receptors (i.e., Port Edward), the following mitigation strategies will be implemented, where appropriate and where doing so will result in reduction in smoke levels:

- Material will be burned more than 500 m from identified permanent receptor locations, where practical
- When possible, burning will take place on the same site where the material was gathered
- Only organic matter such as tree stumps, roots, shrubs and branches will be burned
- Vegetation will be allowed to dry to the best extent possible before burning
- Substances that normally emit dense smoke or noxious odours will not be burned
- Materials prohibited by the *Open Burning Smoke Control Regulation* (BC Reg 145/93) will not be burned (Government of BC 2003b)
- Material from offsite will not be burned
- Burns will be kept as small as possible
- A larger number of small burns will be carried out rather than a smaller number of large ones
- Control and feeding of the fire will be ensured such that it does not pose a visibility hazard to the transportation routes
- Burning will take place only when Ventilation Index is “good” on the day that a burn begins and is forecast to be “good” or “fair” on the following day (in agreement with BC Reg 145/93) (Government of BC 2003b), or as per project specific guidance provided by PRPA.

- Burning will only take place when wind direction and speed will ensure that smoke will not impact environmentally sensitive areas
- Near completion, burns will be extinguished to ensure that material does not continue to smolder.

Where multiple small burn areas are not practical with prevailing conditions or where required site works preclude multiple fire locations, the following may be implemented:

- Relocate site debris to a central location for drying. This site will be as far from receptors as possible.
- A single fire, or fire site will be used and will be fed constantly.
- A curtain burner will be used where appropriate to expand the window for burning, allowing for debris to be burned more quickly and more efficiently.

3.2.5 Power Generation

During construction, electricity will likely be produced by diesel generators powered with low sulphur diesel fuel specified on Table 1.

3.2.6 Clean-up and Reclamation

Rapid reclamation of disturbed land is an important mitigation strategy for reducing fugitive dust emissions. Exposed ground surfaces will be re-vegetated through a progressive reclamation program as soon as the areas are no longer needed for construction activities (see Vegetation Management Plan – Appendix J.9 of the EIS/Addendum).

3.2.7 Pipeline Grade Natural Gas as Fuel

During operations, power will be required to operate various facility processing components including the compressor drivers and power generators. Pipeline grade natural gas will be used to power the facility. Prior to being used as fuel for compressor drivers and power generators, pipeline grade natural gas will be pre-treated (e.g., H_2S and VOCs removed from the feed gas, incinerated and resulting gas used as fuel). Thermal oxidizers will operate at maximum efficiency to oxidize all of the H_2S and hydrocarbons in the waste gas stream to SO_2 and CO_2, respectively.

3.2.8 Fugitive Leak Detection

Prior to operations start-up, and if required by permit conditions, PNW LNG will develop and implement a facility-specific Fugitive Emission Management Program (FEMP). The FEMP will meet or improve upon the Canadian Association of Petroleum Producers Best Management Practice for Fugitive Emissions Management (CAPP 2007).

Fugitive emissions will be reduced by implementing a proactive Directed Inspection and Maintenance and Leak Detection and Repair program. The program will be implemented by completing regular facility-wide surveys, inspecting facility components on a regular basis, and deploying the gas detection monitoring system as part of normal operational activities.

4.0 ENVIRONMENTAL COMPLIANCE MONITORING AND REPORTING

4.1 ENVIRONMENTAL COMPLIANCE MONITORING

Project activities and the implementation of the BMPs and mitigation measures in accordance with the EMP and facility permit conditions will be monitored on an ongoing basis by the PNW LNG Environmental Manager or delegate (i.e., Environmental Monitor). Monitoring requirements identified in the environmental assessment certificate or as part of permitting will be incorporated in the final AQGMP. Information outlining compliance monitoring requirements is provided in the Environmental Monitoring Management Plan (see Appendix J.16 of the EIS/Addendum).

4.2 ENVIRONMENTAL COMPLIANCE REPORTING

Environmental monitoring reports will be filed by the Environmental Monitor on a weekly basis. Implemented mitigation measure details, received public complaints and the subsequent follow-up will be submitted to the PNW LNG Environmental Manager accordingly.

4.2.1 Air Quality

Preliminary components of the air quality monitoring program including reporting are summarized in Table 2. Additional reporting requirements identified as part of the BC OGC permitting process will be included in the final AQGMP. The monitoring and reporting frequencies shown here are for information purposes only and are likely to change as permitting advances.

Table 2: Preliminary Air Quality Environmental Monitoring and Reporting

Activity	Parameters	Monitoring Frequency	Reporting	Monitor
Construction Phase				
Site Preparation Wind Erosion	CACs and dustfall	Seasonally or as required	Monthly	Environmental Monitor
Open Burning Waste Incineration	CACs	During burns	Monthly	Environmental Monitor
Power Generation	CACs	Once per day	Monthly	Environmental Monitor
Road Use	Dustfall	Once per day during dry periods	Monthly	Environmental Monitor
Facility Installation	CACs and dustfall	Once per day	Monthly	Environmental Monitor
Clean up and remediation	Dustfall	Once per day	Monthly	Environmental Monitor

Activity	Parameters	Monitoring Frequency	Reporting	Monitor
Operation Phase				
Project Operations	CACs	Once per day	Monthly	Environmental Monitor or PNW LNG personnel
Continuous Emission Monitoring System installed at appropriate location	CACs	Once per day	Monthly	Environmental Monitor or PNW LNG personnel

4.2.2 Greenhouse Gases

PNW LNG will comply with provincial and federal GHG emission reporting requirements and will include:

Table 3: Greenhouse Gas Environmental Monitoring and Reporting

Activity	Parameters	Monitoring Frequency	Reporting	Monitor
Operations Phase				
Project Operations	GHGs	Once per day	Monthly	Environmental Monitor or PNW LNG personnel
Power Generation	GHGs	Once per day	Monthly	Environmental Monitor or PNW LNG personnel
Road Use	GHGs	Once per day or as required by permit(s)	Monthly	Environmental Monitor or PNW LNG personnel

There are no requirements for reporting GHG emissions during construction.

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Appendix J.5
Noise, Vibration and Light Management Plan

J.5 PRELIMINARY DRAFT NOISE, VIBRATION, AND AMBIENT LIGHT MANAGEMENT PLAN

1.0 INTRODUCTION

Pacific NorthWest LNG Limited Partnership (PNW LNG) has developed a preliminary draft Noise, Vibration and Ambient Light Management Plan for the construction and operations of the Pacific NorthWest LNG Project (the Project) that outlines the best management practices and mitigation measures that will be implemented to minimize noise, vibration and light impacts associated with project activities (e.g., pile driving, blasting, facility operations). All noise associated with in-water construction activity is addressed in the following component Environmental Management Plans (EMPs):

- Marine and Freshwater Resources Management Plan (Appendix J.8 of the EIS/Addendum)
- Blasting Management Plan (Appendix J.11 of the EIS/Addendum)
- Marine Pile Installation Management Plan (Appendix J.12 of the EIS/Addendum)
- Dredging Management Plan (Appendix J.13 of the EIS/Addendum).

This preliminary draft plan presents a framework for managing potential adverse environmental effects based on the Environmental Impact Statement (EIS) for the Project and subsequent feedback from regulators, Aboriginal groups, stakeholders and the public. This plan will be updated and refined based on detailed Engineering Procurement Construction and Commissioning (EPCC) Contractor design and permitting requirements.

Roles and responsibilities related to environmental management are generally described in the Environmental Management Plan (EMP) Overview, Section 3.0. General information pertaining to compliance monitoring is provided in Section 2.2 of the EMP Overview.

1.1 REGULATORY CONTEXT

The Province of British Columbia (BC) and the Federal Government do not have standards or regulations in force for noise, vibration or light emissions that are applicable to the Project. The District of Port Edward maintains Noise Control Bylaw No. 520 (2011), which regulates and prohibits the making or causing of noise or nuisance sounds within the District of Port Edward. While there are no Provincial or Federal standards or regulations in force, the following guidelines, in addition to the District of Port Edward's Noise Control Bylaw, are available:

- BC *Oil and Gas Activities Act*, liquefied natural gas (LNG) Facility Regulation:
  - Part 3.7: engineering design must consider the noise effects associated with normal operations on persons inside and outside the project area and that are subject to potential sound emissions from the LNG facility.
  - Part 5.2: ensure that normal operations at the LNG facility do not cause excessive noise.
  - *Note: The above provide qualitative guidelines on noise without any quantitative noise limits.*

- BC Oil and Gas Commission (BC OGC) Noise Control Best Practices Guidelines (BC OGC 2009), a complaint-driven guideline (response to noise emissions depends on public feedback on noise levels). In accordance with the BC OCG Noise Control Best Practices Guidelines, all new facilities should meet a permissible sound level of 40 dBA Leq (nighttime; 10:00 pm – 7:00 am) at the nearest dwelling, or at 1.5 km from the LNG facility fence line, whichever is the lesser distance. Daytime (7:00 am – 10:00 pm) permissible sound levels will also be when adhered to, and are typically adjusted to be 10 dBA Leq above the nighttime.
- Health Canada guidance
- Commission Internationale de L'Eclairage (International Commission on Illumination) guidelines. These have been adopted in the past for industrial projects in Canada.

There are no BC provincial regulations pertaining to vibration, however the following can be referred to:

- For land-based blasting activities, Ontario Ministry of Environment - Guidelines on Information Required for the Assessment of Blasting Noise and Vibration (1985), ground vibration limit of 10 to 12.5 mm/s PPV, air blast limit of 120 to 128 dB

- Municipal (Toronto area) – for land-based construction activities (e.g., road construction) - Construction Vibration Limit ByLaw-514, ground vibration limit of 8 to 25 mm/s PPV, frequency dependent

At the federal level, the Environmental Code of Practice for Metal Mines (2009) can be referred to, and states a ground vibration limit of 12.5 mm/s PPV and air blast limit of 128 dBL for land-based blasting activities.

2.0 MITIGATION PROGRAM

Construction noise and vibrations occur during land clearing, excavation and grading, as well as from rock blasting, pile installation, air compressors, diesel generators, and mobile equipment, disrupting nearby residents and/or businesses. Noise and vibration also occur throughout operations, but tend to be steadier and less impact-based. Light emissions can adversely affect the surrounding environment by reducing darkness levels in the night sky (sky glow), improperly emitting light directly onto neighbouring properties and habitat (light spill), or by introducing intense or contrasting lighting, reducing visibility, and creating a safety hazard (light glare). Detailed mitigation measures for some sources of noise, vibration and light are not practical until the final selection of the EPCC Contractor and equipment is determined.

Table 1 outlines mitigation measures that will be implemented to manage adverse environmental effects to the acoustic, vibratory and light environments:

Table 1 Mitigation Measures – Noise, Vibration and Ambient Light

Best Management Practices and Mitigation Measures	
Noise and Vibration Management – Construction and Operations	Noise will be maintained at an acceptable level at the Site fence line (i.e., acceptable level for project construction is for equipment noise to not exceed 85 dBA at 1 m from source).
	Educational materials will be provided to all employees and contractors to increase awareness of lighting effects on migratory birds. Educational posters will be posted in public locations during peak bird migration periods.
	Nighttime construction activity will be limited to low noise activities (no impact type pile driving or blasting activities).
	All construction equipment with gas or diesel engines will be fitted with a muffler system where feasible; hydraulic or electric controlled units will be used to the extent feasible.
	Regular inspection and maintenance of construction vehicles and equipment will be undertaken, to confirm that they have effective mufflers installed and worn that parts are replaced.
	Only the size and power of tools necessary will be used, to limit noise from power tool operations.
	Vehicle speeds limits will be enforced.
	Access roads will be maintained to limit vehicle noise and vibration.
	Equipment will be turned off when not in use.
	Noisier equipment will be enclosed, and silencers used, where possible, to limit the transmission of noise beyond the construction site.
	Stationary equipment, such as compressors and generators will be located away from noise receptors.
	Equipment parts generating excessive noise will be replaced or repaired.
	Electric motors, pumps and auxiliary equipment that meet current acoustic industrial standards will be used.
	Truck drivers and mobile equipment operators will be informed about not using engine retarder braking in noise-sensitive areas.
	Affected residents and Aboriginal groups will be notified 24 hours before blasting.
	Where appropriate, blasting will be confined to between 0800 and 1900 hours and, where possible. Blasting in the marine environment is addressed in the Blasting Management Plan (Appendix J.11 of the EIS/Addendum).
	Where diesel power generators are required, enclosed units equipped with ventilation, combustion air inlet, and gas exhaust silencers will be considered and used where feasible.
	Vibro-hammer piling equipment will be used where construction conditions permit for onshore piling operations.
	Equipment enclosure doors will be kept closed to the extent possible.
	Exhaust vents will be equipped with commercially available silencers.
	A noise complaint mechanism will be implemented based on BC OGC Noise Control Best Practices Guideline to address noise complaints in a timely manner during all phases of the Project. Additionally, noise complaints will be addressed within EPCC Contractor proposal bids.

Best Management Practices and Mitigation Measures	
	Large machinery (e.g., refrigerant compressors) will be located in enclosures with minimum acoustic sound transmission loss rating. All gas turbines will be located inside compressor sheds.
	Inlet and exhaust silencers will be installed on gas turbines if required to meet regulatory limits, based on results of noise monitoring.
	Acoustic performance of noise emission equipment will be specified to manufacturers or suppliers (not exceeding 85 dBA at 1 m from equipment and 120 dBA for emergencies).
	Building doors and windows will be closed to the extent possible.
	Low altitude flights will be avoided, except as required for the safety and security of the Project, and all air traffic will be restricted to daytime hours.
	Mitigations for the acoustic environment will reduce noise disturbances to adjacent terrestrial and marine habitats.
	If worker shift change occurs during nighttime period, the traffic management plan will include measures to reduce effects of traffic noise from transportation of workers on the community.
Light Management – Construction and Operations	Retain a 30m mature vegetation buffer around Lelu Island to reduce the effects on increased light.
	Light fixtures will be selected in compliance with design specifications. Bridge lighting will be designed to take advantage of energy-saving technologies that will include, where applicable and available, full horizontal cutoff luminaires designed to meet surface lighting requirements without excessive emissions as light spill, glare, or sky glow, subject to marine or aviation safety requirements
	Construction lighting will be selected to reduce spill-over light and will include shielded fixtures, where appropriate.
	Permanent light fixtures will be equipped with “dark sky” shielded fixtures.
	Light will be directed only where it is needed.
	Streetlights along the roadways and bridge will be shielded and will use lights of cut-off design, where appropriate.
	In laydown areas and parking areas, vehicle lighting should be directed so that effects are avoided; vehicles and equipment will avoid pointing headlights toward Port Edward and other visible receptors, where appropriate.
	For stationary facilities, lighting will adhere as closely as is feasible to the CIE guidelines to be adopted for the permanent operating facility.
	Operational lighting will be selected to reduce spill-over light and will include shielded fixtures, where appropriate.
	Design principles (Canada Green Building Council LEED guidelines, LEED 2004) and CIE (2003) will be used where applicable and consistent with overarching requirements of safety and security. This will aid in reducing potential mortality risks to wildlife, as well as reducing effects on nearby residents.
	Use of a centralized lighting control system will selectively turn off lights when not required.

The BC OGC Noise Control Best Practices Guideline provides a Noise Complaint Investigation Form; use of this form will be adopted by PNW LNG to track noise complaints related to the Project.

3.0 ENVIRONMENTAL COMPLIANCE MONITORING AND REPORTING

3.1 ENVIRONMENTAL COMPLIANCE MONITORING

Monitoring for noise, vibration and lighting emissions will be undertaken on a complaint-driven basis; procedures for each are outlined in the Environmental Monitoring Management Plan (Appendix J.16 of the EIS/Addendum). If a noise, vibration or light complaint is received, PNW LNG will address the complaint to come to a mutually agreeable resolution. This preliminary draft Noise, Vibration and Ambient Light Management Plan pertains to the monitoring of land-based noise; in-water noise (management and monitoring) is addressed in:

- Marine and Freshwater Resources Management Plan (Appendix J.8 of the EIS/Addendum)
- Blasting Management Plan (Appendix J.11 of the EIS/Addendum)
- Marine Pile Installation Management Plan (Appendix J.12 of the EIS/Addendum)
- Dredging Management Plan (Appendix J.13 of the EIS/Addendum).

3.2 ENVIRONMENTAL COMPLIANCE REPORTING

Environmental monitoring reports will be filed by the Environmental Monitor(s) on a weekly basis. These reports will include photographs of the construction activities as well as details of any noise and light complaints and the subsequent follow-up action plan(s). The Environmental Monitor(s) will submit the weekly monitoring reports to PNW LNG's Environmental Manager.

Appendix J.6
Environmental Emergency Response Plan

J.6 PRELIMINARY DRAFT ENVIRONMENTAL EMERGENCY PREPAREDNESS AND RESPONSE PLAN

1.0 INTRODUCTION

Pacific NorthWest LNG Limited Partnership (PNW LNG) has developed a preliminary draft Environmental Emergency Preparedness and Response Plan (EEPRP) for construction of the Pacific NorthWest LNG Project (the Project) that outlines emergency response procedures for rapid and effective response in the event of a project related environmental emergency. An environmental emergency is an event or situation that affects the environment and/or the project site; based upon the magnitude a controlled and coordinated response may be required. Other types of emergencies including fire, explosion, ship source spill, off loading terminal spill, and health and safety will be addressed in specific plans that form part of PNW LNG's EEPRP.

This preliminary draft EEPRP is intended to provide a framework for emergency response at the project site, for both construction and operations. The EEPRP framework will be amended as project planning progresses, as permitting requirements are received, and once the Engineering Procurement Construction and Commissioning (EPCC) Contractor is selected. Additional project and site-specific measure will be developed through final engineering design. This document will be developed into a complete, site-specific EEPRP prior to start-up of construction and operations.

1.1 HEALTH, SAFETY AND ENVIRONMENTAL MANAGEMENT SYSTEM

PNW LNG is committed to protecting all workers and visitors at its work sites, and the environment in which they operate. Our number one goal is to ensure workers go home healthy and safe at the end of every day. PNW LNG's Health, Safety and Environment Management System (HSE MS) provides the framework to achieve this objective and to meet or exceed regulatory requirements. This EEPRP forms part of PNW LNG's Environmental Management Plan (EMP) which is a component of PNW LNG's HSE MS.

Although policies will remain firm, practices and safe work procedures are meant to be changed as necessary, consistent with PNW LNG's vision for continuous improvement. The HSE MS is a risk based approach to addressing hazards, built upon a foundation of leadership, communications and involvement of all of PNW LNG's employees and contractors.

The objectives of PNW LNG's HSE MS are:

1. Comply with or exceed health, safety and environmental regulatory requirements
2. To eliminate or reduce the number of incidents, injuries, or environmental accidents
3. To promote openness and participation through communication, engagement and recognition
4. To encourage employee well-being.

1.2 LEGISLATION AND STANDARDS

Several legislative requirements are applicable to environmental emergency planning and response. The response procedures in the final EEPRP will be designed in full compliance with the requirements of the following laws and regulations, as well as any other applicable regulations or guidelines and conditions of regulatory approval:

- BC Occupational Health and Safety Regulation under the *Workers Compensation Act*
- BC Spill Reporting Regulation under the *Environmental Management Act*
- BC Hazardous Waste Regulation under the *Environmental Management Act*
- *Fisheries Act* (section 36; deleterious substances)
- *Canadian Shipping Act,* the Prevention of Pollution from Ships and for Dangerous Chemicals Regulations, and the Ballast Water Control and Management Regulations.
- *Transportation of Dangerous Goods Act*
- Environmental Emergency Regulations under the *Canadian Environmental Protection Act*
- Workplace Hazardous Materials Information Systems (Health Canada).

PNW LNG will implement applicable PETRONAS Technical Standards (PTSs) which address management and response procedures for preventing and mitigating accidents and malfunctions. Examples of PTSs include:

- Emergency Drill and Exercise Planning
- Environmental Incident Prevention and Control Implementation Guide
- Environmental, Social and Health Impact Assessment
- Group Contingency Planning Standard.

2.0 EMERGENCY RESPONSE ROLES AND RESPONSIBILITIES

This section describes the main roles and responsibilities of key emergency personnel involved in responding to and managing on-site emergencies.

A Project Contact List can be found in Appendix J.2 of the EIS/Addendum.

2.1 ON SITE EMERGENCY RESPONSE TEAM

All roles and responsibilities will be further defined by PNW LNG and the EPCC Contractor prior to the construction and operations phases of the Project.

2.1.1 Dedicated Emergency Response Team

A dedicated emergency response team (ERT) will be present at the liquefied natural gas (LNG) facility during both construction and operations. The response team, whether led by the EPCC Contractor during construction, or by PNW LNG during operations, will:

- Be familiar with this EEPRP and will know their individual role(s) in emergency response
- Maintain their emergency response skills by regular training
- Maintain their copy of this EEPRP so that it is complete, updated and readily available
- Liaise with the appropriate authorities, where appropriate (e.g., under the direction of the ERT Leader – see below).

2.1.2 Emergency Response Team Leader

The ERT Leader is assigned to the Head Foreman or nearest Foreman to the incident site. For major incidents, an alternate ERT Leader may be sent to the scene to act as a support to the primary ERT Leader.

The ERT Leader is responsible for supervising and directing the ERT's actions at the incident site. This individual is responsible for responding quickly, safely, and effectively, and in accordance with documented emergency plans and procedures and established response priorities (e.g., protection of life, property, and the environment). The ERT Leader is responsible for:

- Incident Command (see below) will be responsible for verifying that all personal are safe and accounted for (undertaking head count if possible or necessary); the Team Leader will coordinate rescue efforts upon receiving information from Incident Command.
- Assessing the overall situation quickly and accurately and notifying PNW LNG management and site security that an incident has occurred
- Organizing the ERT consisting of qualified personnel on site
- Ensuring that the ERT is properly protected and equipped
- Evacuating all non-essential and unqualified personnel and securing the immediate area around the incident
- Supervising and directing the actions of the on-scene ERT
- Enforcing safety procedures and precautions
- Providing regular situation updates to the Incident Commander
- Identifying types and levels of equipment, personnel and other resources required to respond effectively
- Coordinating the ERT's activities with other responders (e.g., fire department, police, outside contractors)
- Staying alert to the potential need to evacuate personnel or pull back from response if the risk level becomes unacceptable

- The PRT Leader will also participate in a community engagement and liaison role, where determined to be appropriate.

2.1.3 Incident Commander

- The Incident Commander will be a PNW LNG employee who is responsible for planning, managing and directing PNW LNG's response to an emergency. The Incident Commander is responsible for the safe, timely and effective implementation of the response effort. The Incident Commander has the authority to shutdown or evacuate the LNG facility if the situation requires. The Incident Commander is responsible for:
- Assessing the emergency and activating an emergency response
- Deciding whether to shut down and/or evacuate all or some portion of the LNG facility depending on the risk posed by the incident
- Identifying overall priorities and objectives based on the circumstances of the incident
- Providing ongoing direction and guidance to the ERT Leader(s)
- Ensuring that the PNW LNG response management organization is properly staffed by the most qualified personnel available to deal with the incident
- Ensuring that all relevant emergency and government agencies have been properly notified
- Meeting and working with senior representative(s) of key agencies (e.g., police, fire, Coast Guard, etc.)
- Establishing Unified Command with other agencies if required
- Ensuring that all regulatory requirements and laws are satisfied
- Keeping the PNW LNG Executive-in-Charge updated on the situation and status of the response effort.

2.1.4 PNW Emergency Representative

The PNW LNG Emergency Representative is a senior member of PNW LNG, for instance, President, CEO or other Senior Executive who is responsible for:

- Keeping PNW LNG senior management fully apprised of the situation
- Ensuring that key positions in the response team organization (e.g., Incident Commander) are filled quickly by the most qualified PNW LNG personnel available
- Meeting with senior and/or elected government officials as required
- Acting as official company spokesperson for media briefings, press conferences, 'town hall' meetings, and interviews as required or requested
- Meeting with concerned citizen groups, Aboriginal groups, community representatives, and special interest groups as required
- Ensuring that public safety and interests are protected
- Ensuring that all PNW LNG corporate policies and standards are satisfied during the response.

2.2 EXTERNAL RESOURCES

This EEPRP is designed to integrate external resources and capabilities to facilitate an efficient, coordinated emergency response based upon the principles of Unified Command (Incident Command System). A listing of government agencies, emergency services, and contractors and their contact information is provided in the EMP Overview. This list will be updated and finalized prior to construction start-up.

2.2.1 Local Emergency Responders

Local emergency responders from the project area may be required to respond to an emergency at the LNG facility. These responders include:

- Royal Canadian Mounted Police (RCMP) in Prince Rupert (the closest RCMP detachment to the project site)
- Port Edward Fire Department
- Prince Rupert Fire Department
- British Columbia (BC) Ambulance Service in Port Edward and Prince Rupert
- Canadian Coast Guard
- Western Canada Marine Corporation

2.2.2 Government Agencies

Government agencies, including federal, provincial and municipal governments and agencies will provide input to, or will participate, through the mechanism of Unified Command in emergency response efforts with PNW LNG personnel. This EEPRP is intended to work in coordination with the emergency plans of the following agencies:

- Emergency Management BC, which operates the BC Provincial Emergency Program
- Canadian Coast Guard
- Prince Rupert Port Authority (PRPA)
- Environment Canada
- Fisheries and Oceans Canada
- Transport Canada
- BC Ministry of Environment
- The BC Oil and Gas Commission (OGC)
- WorkSafeBC
- The District of Port Edward and the City of Prince Rupert
- Health Canada

- Aboriginal Affairs and Northern Development Canada
- Local First Nations

2.2.3 Contractors

Outside contractors and suppliers may be required to provide specialized personnel, materials and equipment in support of emergency response. A list of potential contractors and suppliers will be developed prior to the start of construction. During construction, the Contractor and subcontractor(s) are responsible for developing and implementing the EEPRPs including the Construction EEPRP. PNW LNG will monitor Contractor responses and participate through Unified Command for major incidents.

3.0 EMERGENCY PLANNING AND PREVENTION

3.1 EMERGENCY RESPONSE PROCEDURES

General emergency response procedures were developed to manage the process of responding to an emergency including a situational assessment, defining and prioritizing critical issues, emergency action planning, and effective deployment of resources and responders. These procedures are detailed in Section 4 of this EEPRP.

Emergency response procedures were developed for potential environmental risks that would have a high impact on operations or worker safety or a high likelihood of occurring, including spills of LNG or general hazardous materials, and marine vessel incidents. Additional emergency response procedures will be developed if or when additional high impact or high probability risks are identified. Fires and explosion are addressed in a stand-alone Fire Preparedness and Response Plan, developed as part of PNW LNG's HSE MS.

3.1.1 Evacuation Planning

Emergency muster stations and evacuation routes will be established prior to the start of construction and operations. Detailed Site Evacuation routes will be developed in future versions of the EEPRP and the specific Emergency Evacuation Plan. These routes will be used in the site orientation process for all employees and outside contractors. General evacuation procedures are provided in Section 4.3. PNW LNG will also install a Plant Annoucements & General Alarm (PAGA) system at the LNG facility.

3.1.2 Emergency Equipment

PNW LNG will take measures to ensure that facilities and equipment required for emergency response and communication are identified, functioning and accessible to the ERT. System equipment, such as alarms and firefighting equipment, will be tested annually, or as required by appropriate regulations, manufacturer's requirements or conditions of use. The plant will be equipped with an ambulance and fire truck as well. An Environmental Emergency Response Equipment List is provided in Appendix 1.

3.2 COMMUNICATIONS AND REPORTING

3.2.1 Communications

A Communications Plan will be prepared that provides direction for undertaking communications with regulatory agencies, First Nations, the public and other external parties during an environmental or other emergency. The Communication Plan will continue to evolve throughout construction and operations of the Project.

Key messages will be created and approved for use by PNW LNG corporate spokesperson(s) in a crisis or potential crisis situation. Key messages are to be simple statements that convey the main points that PNW LNG wants to communicate regarding emergency management and public safety.

Local communities will be involved in Emergency Preparedness and Response Planning to increase transparency and to gather as much relevant information as possible to inform the planning process.

3.2.2 Incident Reporting

A project specific incident reporting procedure will be developed that provides PNW LNG personnel and Contractors specific direction regarding to the appropriate process for environmental incident reporting. These procedures will be developed and incorporated into the EEPRP prior to construction start-up.

Specific guidance regarding spills to the environment exists under the BC *Environmental Management Act.* The Spill Reporting Regulations under this Act require details on the substances and quantities that must be reported to the BC Provincial Emergency Program (PEP) (Appendix 2, Reportable Spills). The PEP is responsible for notifying provincial agencies including the BC Ministry of Environment. All spills into a water body are considered an emergency spill and will require notification to Environment Canada (EC) and Fisheries and Oceans Canada (DFO) in addition to PEP and the Province's Representative.

The following information will be included in all spill reports as required by the Spill Reporting Regulations under the *Environmental Management Act*:

- Type and quantity of substance spilled
- Location and time of the spill
- Details of the area surrounding the spill (possible sensitive habitats, shoreline, weather, tides, current direction, substrate type)
- Cause and effect of the spill
- Details of actions taken to contain the spill
- Details of possible anticipated actions
- Name of agencies notified
- Name of agencies on the scene and times of arrival.

In addition, project spill reports should include the following:

- A general description of the incident
- Source and cause of the incident
- A description of the response effort
- Quantity of the spill and percent recovered
- Itemized cleanup costs
- Recommendations for preventative and mitigation measures
- Plans for upgrading emergency preparedness and response plans.

4.0 TRAINING

All personnel working at the LNG facility will receive the training necessary to allow them to repond competently, and to perform their responsibilities in a safe and effective manner during an emergency situation, during both construction and operations of the Project.

Emergency response training will include desktop instruction as well as practice exercises or drills. These exercises are designed to:

- Allow employees to apply the skills learned during the desktop sessions
- Allow for effective emergency procedures
- Identify potential emergency response improvements or other training opportunities.

PNW LNG will coordinate the training and practice drills with key agencies such as the PRPA, Canadian Coast Guard, EC and other authorities where necessary. Table 1 highlights key training programs that will be implemented.

Table 1: PNW LNG Project Training Programs Applicable to Emergency Response

Training	Purpose	Personnel to be Trained
Spill Response Training	Spill response training will include protocols on how to use spill kits and how to respond to fuel and hazardous material spills including: • Stop the release • Eliminate potential for ignition • Evacuate all individuals • Advise supervisor (who will contact appropriate Agencies, if applicable) • Conduct site clean-up activities • Conduct site remediation.	Designated employees
Emergency Response Training	Emergency response training will include staff emergency scenario training and practice drills, to allow for rapid and effective response in the event of an emergency situation. This training will include the use of basic fire protection equipment during initial fire response.	Designated employees
Hazardous Materials Training	Training on handling and storage procedures prior to starting the associated work.	Personnel who are expected to work with hazardous materials and waste
Task Specific Training	Additional training will be provided to / required for site personnel who have specialized roles or tasks to complete on the Project (e.g., marine works, blasting, construction activities associated with specific environmental values).	As needed

To achieve and maintain a high level of response preparedness, PNW LNG personnel will conduct emergency response exercises. Emergency Scenario exercises involve practicing or performing the physical tasks or actions that would be taken during a real incident. A call down of the emergency call out list is a form of operational exercise. Others include evacuation, notification, emergency communication (radio), and emergency shutdown drills. Table 2 shows the types of exercises that may be conducted by PNW LNG and target exercise frequencies (time and resources permitting). These proposed training exercises are applicable to both construction and operations.

Outside agencies (e.g., response contractors and government agencies) will be invited to participate in these exercises from time to time.

Table 2: Proposed Training Exercises

Type of Exercise	Scope	Frequency
Fire/Evacuation Drill	Evacuation of employees to emergency mustering areas.	Annually as per regulatory requirements
LNG or other Material Spill Response	Simulate most probable spill on water and/or on land and initial response actions including internal/external notification, emergency shutdown/spill containment/use of Personal Protective Equipment (PPE) etc.	Annually

Type of Exercise	Scope	Frequency
Geographic Response	PNW LNG and its Contractors, to the extent applicable, will participate in geographic response planning and exercises, with the goal of ensuring the geographic response plans are in place for areas that could be affected by spills to the marine environment.	As needed basis
Other Emergency Response Drills	Simulate a response to other emergency situations defined in the manual which are not related to fire or oil spills including notification and initial response action.	Annually, as determined by the Safety Manager and the Executive.
Additional Standard Training Exercises	Will include high-angle rescue, confined space entry, medical emergency simulation, and security breach response exercises.	As per regulatory requirements

NOTE:
Some or all of the management exercises may be combined into a more comprehensive response management exercise.

5.0 GENERAL EMERGENCY RESPONSE PROCEDURES

Emergency response requires situational assessment, defining and prioritizing issues, emergency action planning, and effective activation and securing of resources. These activities may take place simultaneously or in a sequence determined by the nature of the emergency. The response may involve multiple responders (site personnel, fire, ambulance, regulatory agencies).

5.1 EMERGENCY EVALUATION

5.1.1 Identifying an Emergency

A “crisis” requiring emergency management is a situation that has the potential to:

- Threaten the health or safety of PNW LNG employees, contractors, and/or the public
- Impact the receiving environment
- Damage PNW LNG reputation; damage or detroy PNW LNG equipment or infrastructure
- Attract significant media interest.

It is the responsibility of PNW LNG and all employees to identify an emergency and to take the appropriate first steps to manage and mitigate the situation.

5.1.2 Classify the Emergency

Once an emergency is identified by PNW LNG personnel, the severity of the incident is classified to determine the appropriate action. Table 3 defines three tiers of emergency typically applied for an LNG facility.

Table 3: Levels of Emergency Situations

Tier 1	Tier 2	Tier 3
Situation		
• LNG facility operations are not seriously threatened • No danger to life • Risk of damage to environment or property is minimal • Can be managed by onsite emergency teams	• LNG facility operations are seriously threatened • Emergency poses a danger to life • Risk of damage to environment or property is extensive • May require support of outside resources	• Emergency with potential for severe damage to multiple facilities and assets, the environment and neighbouring sites/surrounding communities • Incident is beyond the capacity of the Project / Operational resources to control • Requires action from government agencies or other external parties
Actions Required		
• Managed through the Incident Command system • Activate ERT • Manage, monitor situation and escalate incident as required • Normal incident reporting procedure • Notify communications team immediately and monitor for potential media interest	• Managed through the Incident Command system • Monitor situation • Activate ERT • Respond and manage • Monitor situation and escalate incident as required • Normal reporting • Notify stakeholders as needed • Notify communications team immediately and manage media if necessary • Update website, as needed	• Managed through the Incident Command system with Unified Command • Respond and manage • Normal Reporting • Activate ERT • Notify communications team immediately • Notify First Nations, local communities and stakeholders • Gather available information • Proactive media engagement approach • Update website
Examples		
• Minor employee injury on site • Small chemical spill contained on site (i.e., no release to the receiving environment)	• A serious site injury • Reportable spill	• A major accident (chemical fire or explosion) • An on-site fatality • Large reportable spill

Tier 3 emergencies will be managed through the incident command system using unified command with local governments, provincial and federal agencies, and Aboriginal groups, where appropriate.

The ERT Leader will classify the severity of the situation to determine the appropriate action and will:

- Acquire appropriate medical care for any injured person(s)
- Identify appropriate response actions to mitigate risks to personnel and site
- Gather as much information about the situation as possible

- Classify the situation into one of the three Tiers
- Initiate appropriate corporate notification (i.e., notify Incident Commander)
- Establish and update communication methods and timelines.

5.2 EMERGENCY RESPONSE MOBILIZATION PROCEDURES

Any employee or contractor who observes an emergency incident, regardless of the severity, should move immediately to a safe location and report immediately to the Foreman, and initiate the notification process (see Section 3.2).

The following sections provide an example of emergency response mobilization; this section will be updated and finalized prior to construction start-up, once the contractor(s) has been selected and can work with PNW LNG to develop the detailed response plan.

During and following an emergency, site security considerations are related to both the site perimeter and the emergency area. Once an emergency area is defined, part of the emergency plan is the clear demarcation and control of personnel ingress or egress from the defined area (site or area evacuation).

The Incident Commander will be responsible for the implementation of proper security measures with the assistance of the ERT Leader and site security personnel. The following actions will be taken:

- Erect adequate cordons, evacuating all unauthorized personnel from the emergency area
- Maintain proper site radio discipline with concise language being utilized and radio security measures practiced, including use of the PAGA system.
- Establish a limited number of controlled entry points to the emergency area
- Appoint sufficient personnel to adequately secure entry points so that only essential and authorized access is provided.

5.3 SITE EVACUATION PROCEDURES

The evacuation procedures describe the emergency evacuation process that will be followed if all or part of the LNG facility is to be evacuated.

5.3.1 Highest Risk Locations

Some emergency situations will require the partial or total evacuation of the construction site or LNG facility. These situations include:

- Major explosion or fire at the LNG facility
- Large spill or explosion risk
- Bomb threat or risk of sabotage
- Earthquake and/or tsunami.

5.3.2 Emergency Response Procedures

Any PNW LNG supervisor or manager (e.g., Foreman, Superintendent, Manager) has the full authority to stop operation, and evacuate the employees under his/her supervision from any area of risk based on his/her assessment of the situation. The decision to evacuate will always be based on the protection of life and safety as the highest priority following occurrence of an emergency incident.

In the event that the construction site requires evacuation the following procedures will be followed.

5.3.2.1 Initial Response

The Project or Site Supervisor (e.g., Foreman, Superintendent, Manager) is responsible for ensuring the safe and orderly evacuation of all personnel under his/her supervision from the area(s) at risk. The designated Incident Commander is responsible for assessing the overall level of risk posed by an incident, and deciding whether to order a complete evacuation of all or key areas of the LNG facility.

When considering evacuation of personnel from an area at risk because of an emergency incident, the Project or Site Supervisor (e.g., Foreman, Superintendent, Manager) will immediately:

- Stay calm
- Confirm the type, location, and severity of the incident, and assess the real and potential level of risk to employees
- Check wind speed and direction if applicable
- Identify the nearest emergency muster station outside the area of risk, or choose an alternate location as required
- Instruct all employees to proceed immediately to the muster station by the safest direct route
- Notify site Security to clear exits leading off of the site
- Proceed to the muster station and report to PNW LNG management
- Do not leave the emergency muster station until instructed to do so by the Incident Commander. This will allow for accurate head counts and the identification of any missing person(s).
- Conduct a complete head count and report missing person(s) immediately to management
- Identify designated evacuation route(s) off the site
- Safely and promptly follow the evacuation procedures
- Report to management when evacuation has been safely completed.

5.3.2.2 Subsequent Actions

Incident Commander

Where site evacuation is required, the Incident Commander may be required to immediately:

- Assess the situation in consultation with the ERT Leader at the scene of the incident
- Verify that security and/or 911 has been called as required
- Decide whether to evacuate all or part of the LNG facility
- Establish contact with shipboard personnel, where the incident involves a vessel, or where ship crews could be affected by the incident
- Contact all supervisory personnel and provide clear, concise directions on evacuation plan
- Direct evacuation of affected areas to proceed
- Confirm all personnel are safe and accounted for upon completion of the evacuation. Reference and review ERT Leader counts from crew lists. Account for all staff present and obtain confirmation from direct supervisors including executives. The Incident Commander will delegate remedial actions to staff and will advise the Team Leader if any rescue is required.
- Consider need to search for missing person(s) once the evacuation has been completed.

Security

Upon being advised that a full or partial evacuation is underway or is being considered, site security will immediately:

- Call 911 if instructed to do so
- Wait for further instructions
- Control access to jetties or other marine approaches to the teminal
- Evacuate the site as instructed.

Construction and Operation Employees

Upon being instructed to evacuate the work site by radio or in person by the ERT Leader, construction employees will immediately:

- Stay calm
- Shut off equipment as per emergency shutdown procedures
- When safe to do so, properly notify other workers in the immediate area
- Proceed quickly but cautiously to the designated emergency muster station by the most direct route
- Count workers to verify all are present and accounted for
- Report missing person(s) immediately to the ERT Leader
- Evacuate the site using the designated route and exit, when instructed to do so
- Re-count personnel once clear of the area of risk

- Remain at the assembly point and wait for further instructions.

Office Employees

Upon being instructed to evacuate construction offices, the office employees will:

- Stay calm
- Turn off all equipment
- Receptionist will place the switchboard in a nightline mode, if applicable
- Leave office and close door securely
- Not waste time trying to collect personal or business materials
- Proceed quickly to the emergency muster station unless directed elsewhere
- Wait at the muster station for further instructions
- Evacuate the site in a calm and orderly fashion using the route designated by the ERT Leader, when instructed to do so
- Determine whether all persons are present and accounted for once clear of the hazard area
- Report any missing persons to the ERT Leader immediately
- Remain at the assembly point and wait for further instructions.

6.0 SPECIFIC EMERGENCY RESPONSE PROCEDURES

The following sections outline emergency response procedures for specific emergency situations. Further details on emergency response procedures for each of these situations will be included in the final EEPRP once engineering design detail, contractor specifics, and permit conditions are available. As noted previously, specific EEPRPs will be developed separately to address:

- Medical emergencies and evacuations
- Rescue including high angle, confined spaces and marine incidents
- Fire prevention and preparedness
- Earthquakes and tsunamis
- Security threats and breaches
- Explosions
- Extreme weather.

The following actions are applicable to each of the specific situations outlined below, and will be scaled for the severity of the incident:

- Initiate Tier 1 response for the emergency (see Table 3)
- Assessment of the situation with regard to personal and public safety, and evacuate personnel from the hazard area
- Notify immediate supervisor to provide an assessment of incident location, area potentially affected, and other hazards
- Administer first aid as necessary
- Determine the need for escalation to Tier 2 or Tier 3 response measures (see table 3)
- Notify appropriate regulatory agencies, affected stakeholders, First Nations, and local governments, if required
- Assess the need to shut down the LNG facility to reduce risk to personnel and equipment
- Implement control procedures with available personnel and equipment to reduce effects, if risk is deemed low
- Establish an incident command post with required communication between internal and external parties
- Establish and maintain a secure incident scene
- Complete incident reports (internal and external for regulatory authorities, as required).

6.1 FUEL OR HAZARDOUS MATERIALS SPILL

Project activities that may cause sudden or accidental spills or releases include:

- Equipment leaks of malfunctions
- Vehicle or equipment accidents
- Concrete works and wash water
- Fuel spills (e.g., from jerry can or filling station)
- Marine vessel collision resulting in a spill.

Although the components of LNG are considered hazardous materials, an LNG spill is considered separately in Section 6.4 given the unique properties of LNG that govern its fate and behavior when released into the environment.

Smaller spills associated with regular construction activities may occur throughout the life of the Project. Larger, reportable spills greater than 100 L are most likely to occur where hazardous materials (i.e., oil, chemicals) are stored. Construction materials such as fuels, lubricants, concrete, and paints and solvents, will be stored in small quantities during construction.

The basis of fuel or hazardous materials spill management on the Project will include the following hierarchy of implementation:

- Spill Prevention – implementing design techniques to limit the occurrence of spills

- Spill Preparedness – development of plans and strategies that clearly identify actions to be taken to protect pre-determined sensitive environments, resources, infrastructure and archaeological features, and includes exercising the response plans
- Spill Containment – implementing design measures to limit the effect of a spill incident if it occurs
- Spill Emergency Response – implementing procedures to respond to spill incidents should they arise.

6.1.1 Spill Containment

Means of spill containment, once the spill has occurred, include:

- Primary Containment – primary containment is defined as the primary hydrocarbon containing system which is normally designed, constructed and installed to a recognized code of standard to prevent loss of the hydrocarbon (e.g., pipe, tanks, vessels)
- Secondary Containment – secondary containment is defined as an enclosed area around storage vessels (e.g., bunds or dikes).

Containment methods may include the following:

- Bunds (or dikes) – to contain any hydrocarbon liquid release and remove the liquid from the area to a less hazardous location for disposal
- Impounding Basin – To impound accidental release of LNG liquids
- Kerbs – to route any accidental spills around vessels (or containment) to safe disposal location(s).

6.1.2 Spill Response Procedures

A dedicated spill response team, as described in the Roles and Responsibilities section (Section 2.0) shall be present at the LNG facility. In the event of a spill of fuel or hazardous material, the source of the spill or leakage will be identified and isolated immediately, where safe to do so, to prevent further leakage.

This procedure describes the actions that will be taken by PNW LNG personnel in the event of a spill of oil (e.g., diesel, gasoline, lubricating or hydraulic oils, waste oil) or other potentially hazardous materials used during the construction phase.

The spill response procedures are to be implemented to cease and reduce the impacts of the spill on the health and safety of the workers and the environment. These procedures are intended to guide PNW LNG personnel in accordance with legal and regulatory requirements when responding to a spill.

Response to a spill of fuel or hazardous materials will be in accordance with the general measures outlined in Section 5.0, scaled for the severity of the incident, and with the measures outlined in Sections 6.1.2.1 through 6.1.3.3.

6.1.2.1 Fuel or Hazardous Materials Spill Response

Initial Response

In the event of a hazardous materials spill, actions will be initiated to protect human safety as a priority. When and if safe to do so, material will be contained and kept away from drainages, shorelines and other sensitive habitats in the vicinity. If a spill occurs directly into the marine environment, measures will be taken to limit the extent of the material spreading. During operations, engineering controls will be in place to mitigate spills from spreading (e.g., drainage systems, shut off valves). To protect the safety of the responders and other personnel, the ERT Leader will guide the following:

- Stop work immediately at the spill site
- Verify that employees constinue to wear appropriate PPE including hard hat, gloves, high visibility vest, long sleeves, boots, and eye protection (if windy or in danger of splashing)
- Stay calm
- Warn people in the immediate vicinity
- Proceed to the spill site from an upwind direction and assess the situation
- Conduct a head count of personnel
- Determine that there is no immediate risk to health or safety
- Determine the type of material spilled
- Estimate the size and exact location of the spill
- Communicate actions taken so far
- Identify the type and level of assistance required
- Use non-sparking tools and equipment
- Remove all potential sources of ignition (e.g., shutting off any vehicles involved in the accident or malfunction)
- Do not wade or walk through spilled material
- Avoid direct skin contact or exposure to spilled material
- Stay out of low-lying areas (e.g., depressions) and confined spaces.

For spills of gasoline, solvents or other highly flammable materials, of if the type of material spilled is unknown:

- Evacuate the area to a safe distance (i.e., 25 – 50 m in all directions), and stay upwind of the spill site
- Prevent personnel from approaching or entering the spill area, particularly the downwind area
- Report the spill to the Foreman via an intrinsically safe radio and provide type of material, estimated size of spill, time and location
- Wait at a safe distance for further instructions

- If a fuel spill occurs inside any enclosed building or area, evacuate the building immediately, leaving the door(s) open to disperse potential vapours.

For diesel, hydraulic or lubricating oil, or for amine spills:

- Follow spill response safety procedures
- Secure the area around the spill and clear out non-essential personnel
- Contain the spill and limit its spread by using available materials, such as sand, earth, boards, etc.
- Block potential escape points (e.g., storm drains, manholes, ditches) and prevent, as best possible, the spill from entering water.

When possible:

- Close valves, shut off pumps, and secure the hazardous material in its containment vessel to eliminate the source of the release
- Patch tank or transfer material to another tank if original is severely compromised
- Utilize all available resources to contain the spill, including native soil, spill kits, shovels, excavators or any material, equipment or tool that can safely contribute to containment efforts (i.e., placing excavated earth into a ditch to stop downstream flow of a hydrocarbon spill, shoveling dirt or sandbagging in the path or puddle of spilled material)
- Stop the flow or the spill at its source
- Limit access to the spill area
- Prevent unauthorized entry onto the site by securing and marking the area to limit exposure to workers, and vehicle traffic.

Containment

- Prevent spilled material from entering drainage structures using absorbent pads and socks, or marine-specific booms, pads or curtains
- Use spill sorbent material to contain the spill. Or, if that is not possible and the spill volume exceeds the capacity of the spill kit, use native soil, sandbags, straw bales etc
- If necessary, use an emergency dike or any other method to prevent any discharge on-site
- If groundwater is not present, a temporary sump may be excavated to contain or direct spilled liquids
- Take soil or water samples for laboratory testing.

Emergency Response Team Leader

Once notified of an oil or chemical spill on the LNG facility premises, immediately:

- Proceed to the spill site from an upwind direction and assess the situation

- Conduct a head count of all personnel
- Determine that there is no immediate risk to health or safety
- Determine the type of material spilled
- Commucate the actions taken so far (to PNW LNG Management)
- Estimate the size and location of the spill
- Document actions taken so far
- Identify the type and level of assistance required
- Report the spill to the Incident Commander clearly and concisely.

For spills of gasoline, solvents, or other materials known to be highly flammable, or if the identity of the spilled material is unknown

- Confirm that all personnel have been safely evacuated from the area, especially the downwind zone, and the spill site has been cordoned off to prevent entry
- Wait for further instructions, and assistance from the fire department (911), if required
- Form an ERT from available, trained employees
- Obtain emergency spill kits, tools, and other equipment.

Incident Commander

Upon being notified of an oil or chemical spill at the LNG facility, immediately

- Obtain as much information as possible from the ERT Leader at the scene of the spill
- Call 911 if required (i.e., spill of gasoline or similar highly flammable material, or unknown chemical) depending on the incident category (Tier 1, 2 or 3), or as required
- Assess if regulatory reporting is required and if necessary, report the spill to the PEP's 24 hour spill reporting number
- The PEP will notify all other regulatory and government agencies which must be notified by law of an oil spill, including Environment Canada, and BC Ministry of Environment. If the spill has entered the water, PEP will also notify the Canadian Coast Guard (CCG), and the PRPA Harbour Master
- Contact WorkSafeBC as appropriate
- Advise PNW LNG management and form a response management team from available personnel
- Provide ongoing direction to the ERT Leader and provide additional response equipment and personnel as required (e.g., sorbent pads/materials, tools, loaders/Bobcats, storage containers, marine-specific booms, pads or curtains)
- If the spill has entered the water or is likely to enter the water, a Response Organization such as Western Canada Marine Response Corporation (WCMRC) will be contracted to provide assistance

- Be prepared to meet with government officials who may appear at the LNG facility to monitor or assist with spill response efforts and/or to investigate potential regulatory offences
- Co-operate with government officials
- Consult with BC Environment before moving or disposing of oily waste materials off site
- Review incident with PNW LNG management.

6.1.2.2 Spill Response Equipment

Spill response equipment will be provided for use by trained personnel. The response equipment shall contain, at a minimum, the equipment and materials shown in Appendix 1. Equipment will be maintained in accordance with industry best practices and inspected on a regular basis. Results of inspections will be maintained.

6.1.3 Post-Spill Procedures

Following a spill on land or in the marine environment (non-hazardous or hazardous) post-incident procedures will be implemented. These include spill clean-up, and notification and reporting.

6.1.3.1 Non-hazardous Material Spill Clean-Up and Restoration

Following initial response and containment of the non-hazardous spill, the following clean-up and reclamation tasks will be undertaken, as necessary, to restore damaged habitat:

- Remove any debris, taking care to decontaminate any equipment or tools used in the cleanup
- Clean up the affected area, including undertaking confirmatory testing on the cleaned area
- Collect and store waste materials in appropriate containers and storage areas
- Dispose of waste materials at an approved disposal site in accordance with provincial permits and regulations
- Restore site to environmental regulatory standards. Transportation of spill material will likely fall under the federal *Transportation of Dangerous Goods Act* or the Contaminated Site Regulation (BC *Environmental Management Act*) and will require the acquisition of regulatory authorizations and that proper procedures and documentation are followed.

6.1.3.2 Hazardous Material Spill Clean-Up and Restoration

The following clean-up and reclamation tasks will be undertaken by PNW LNG and/or the Contractor, as necessary, following initial response and containment of a hazardouns materials spill, to restore damaged habitats:

- Supervise clean-up of spilled material using on-site supplies and equipment as necessary, and as appropriate for the severity of the incident
- Complete excavation of contaminated soil
- Coordinate clean-up activities so that they do not interfere with normal operations, and take appropriate safety precautions
- Store oily waste materials (e.g., used sorbent pads) in leak proof containers such as sealable drums, heavy duty plastic trash bags (6 mm thickness), or lined dumpster bins to prevent further spillage, and place in a contained storage area.
- Do not move or dispose of waste materials from the spill off of the site until directed to do so by the Incident Commander; disposal of clean-up materials will be at an approved hazardous waste facility.

Habitat compensation works will be implemented for all serious harm to fish habitat (riparian and in-water), and riparian areas will be re-vegetated to pre-spill conditions, where required. An on-site environmental monitor will be present during clean-up and reclamation works. Reclamation and compensation works will be undertaken in accordance with applicable regulatory authorizations (i.e., DFO).

Depending on the severity of the incident, PNW LNG may engage the services of a third-party spill response contractor (i.e., WCMRC) to support the spill response, as necessary.

Monitoring will take place to document environmental recovery. Monitoring specific to the EEPRP is further addressed in the Environmental Monitoring Plan (Appendix J.16 of the EIS/Addendum).

6.2 MARINE VESSEL INCIDENTS

Purpose built LNG carriers will be used to ship the LNG product from the PNW LNG marine terminal on Lelu Island out through Chatham Sound and on to Asian markets. There is the possibility of marine vessel groundings, collisions, or allisions (the act of striking a stationary object, such as the terminal), for which response procedures are established. These types of incidents have the potential to result in the release of fuel oil or LNG to the marine environment.

6.2.1 Marine Incident Response Procedures

PNW LNG has no no jurisdiction over the emergency procedures of a vessel involved in a grounding or collision; however, for such incidents, PNW LNG will assist as and when required. As incidents involving vessel grounding or collision will be managed by the vessel Master, specific PNW LNG response procedures for those incident are not required in the EEPRP.

In the event of an allision occuring at the terminal, PNW LNG will have responsibility for emergency response, in cooperation with the vessel Master.

6.2.1.1 Initial Response

A ship-sourced hazardous materials spill resulting from a vessel allision would involve the same response principles as those outlined in Sections 5.0 and 5.1.

When it has been confirmed that a marine vessel has accidentally discharged fuel or other substances into the marine environment, the ERT Leader will, in addition to the measures outlined in Sections 5.0 and 5.1:

- Notify the CCG to confirm that they have received notification of an accident resulting in pollution from the vessel master or delegate and the Harbour Master
- Confirm notification of appropriate regulatory agencies (i.e., PEP, DFO, Environment Canada), affected stakeholders, and Aboriginal groups has been completed
- Notify site security to allow access and direct responders, by land, to the LNG carrier berths
- Assist emergency responders in gaining access to the site, if required
- Make available any spill response equipment as requested by the CCG or Harbour Master, or responders under their direction
- Notify (immediately) the Incident Commander

The Incident Commander will activate PNW LNG's Communication Response Plan in order to address media attempting to access the site or personnel for information on the incident.

6.2.1.2 Containment

Once the area is secured, spilled material will be contained to prohibit migration from the release site.

6.2.2 Post-Marine Incident Procedures

Following a marine vessel grounding, collision or allision with the release of hazardous material to the marine environment, post-incident procedures will be implemented. These include spill clean-up, and notification and reporting.

6.2.2.1 Marine Incident Clean-Up and Restoration

Once the area is deemed safe an assessment of spill response and clean-up options can be undertaken in conjunction with the appropriate geographic response plan for areas potentially affected by spills to the marine environment. Depending on the severity of the incident, the vessel owner may engage the services of a third-party spill response contractor such as WCMRC, to support the spill response, as necessary. WCMRC currently maintains a spill response vessel and associated equipment adjacent to the Fairview Terminal on Kaien Island, north of Lelu Island.

Spill response and clean-up will include the following, as deemed appropriate for the incident:

- Implementation of spill response and clean-up measures, including:
  - Deployment of absorbent pads or booms
  - Disposal of recovered product at approved hazardous waste facilities

LNG does not persist in the environment, is odourless, non-corrosive, non-toxic, and leaves no residue; therefore, no clean-up actions are anticipated to be necessary as a result of an LNG spill; however, CCG will likely establish exclusion zones in the event of marine incident.

Response to a spill of heavy fuel oil to the marine environment will vary depending on physical and chemical characteristics of the product and the environment at the time, but are likely to include:

- All clean-up and restoration activities will be approved by the appropriate regulatory authorities
- Habitat compensation works will be implemented for habitat that is destroyed or permanently altered, as required

Monitoring will take place to document environmental recovery. Monitoring specific to the EEPRP is further addressed in the Environmental Monitoring Plan (Appendix J.16 of the EIS/Addendum).

6.3 LNG SPILLS

LNG spills associated with the terminal storage or loading facilities could originate from leaks within the upland storage facility, along the loading line, or at the loading arm that connects to the berthed vessels receiving the LNG. These releases could affect the terrestrial or marine environments. There will be multiple engineering controls in place to reduce the impact of an LNG spill, such as double containtment LNG storage tanks, an LNG impounding basin at loading arms and the LNG transfer area. These will assist in limiting a spill from travelling to the marine environment. There will also be gas detectors installed in the plant to provide early warning of a potential leaks.

6.3.1 LNG Spill Response Procedures

As with the other incident types described within this EEPRP, the primary goal in the event of an LNG spill is to protect human safety, and when safe to do so, contain the material at the source and keep it from moving offsite. Actions and best management practices will follow the general steps described previously (Sections 6.0 and 6.1), and scaled for the severity of the incident.

In addition to the procedures outlined in Sections 6.0 and 6.1, emergency response action specific to a spill of LNG would involve:

- Implementation of control procedures
  - Assign available personnel and equipment to the spill site to reduce the effects
  - Use a fire water monitor to disperse the vapour cloud

  - Use water curtains around the source of the leak
  - Use a standby foam generator as a precautionary measure
  - Incident Commander will assess the need for any equipment isolation/depressurization or plant shutdwon in order to minimize and stop the leakage
- If the vapour cloud ignites, the emergency response approach outlined for fire and explosion will be followed.

6.3.2 Post-LNG Spill Procedures

Only once the vapour cloud is fully dispersed and confirmed with a gas test, will corrective action take place to address the leak. Equipment will then be checked and confirmed to be fit for use prior to resuming operations.

As LNG does not persist in the environment; is odourless, colourless and non-corrosive; leaves no residue; and is non-toxic to marine biota, no clean-up actions are typically required following an LNG spill.

The interaction of the cold liquid with the much warmer marine water can result in rapid phase transition (RPT) and associated shock waves. The change of temperature and possibly RPT can affect localized areas of marine habitat (e.g., localized fish kills). If this occurs, the following will take place:

- Areas near the spill will be cordoned off. This will be managed in coordination with PRPA.
- Assessment of affected habitat(s) to determine appropriate restoration or compensation
- Liaison with appropriate regulatory authorities (i.e., DFO, Environment Canada, BC Ministry of Environment) to determine appropriate restoration or compensation measures
- Liaison with appropriate regulatory authorities to determine the appropriate follow-up and monitoring of restoration or compensation measures.

Monitoring will take place as required to document environmental recovery. Monitoring specific to the EEPRP is further addressed in the Environmental Monitoring Plan (Appendix J.16 of the EIS/Addendum).

6.4 EMERGENCY FLARING AND LNG FACILITY SHUTDOWN

Flare stacks are primarily included as a safety measure at LNG facilities to prevent the accumulation of gases that could pose a hazard to humans or the environment. Emergency flaring involves routing the gas stream to one or more flare stacks. Engineering controls are incorporated into the project design for efficient operations that reduce the risk of emergency flaring and LNG facility shutdown.

No emergency response is required during emergency flaring; however, the following is applicable:

- Trip shutdown systems will initiate shutdown of the entire LNG facility
- Transport Canada and the Prince Rupert airport will be notified so that air traffic safety advisory can be issued
- No requirement for further emergency response action to be initiated, unless the cause of emergency flaring results from an LNG spill, fire, or explosion, in which case the procedures outlined in the specific plans that form part of PNW LNG's Emergency Preparedness and Response Program would be followed
- No clean-up or restoration works would be required in an emergency flaring and LNG facility shutdown incident, other than if cause by a spill, fire or explosion
- Monitoring would take place for wildlife mortality and any unusual carcasses would be reported to the Canadian Wildlife Service and/or BC Ministry of Environment.

7.0 SPILL NOTIFICATION AND REPORTING

PNW LNG will meet the notification and reporting requirements, as described in Section 3.2 and Appendix 1, including notifying appropriate agencies and responders, and contacting the appropriate responder(s) and/or agency to produce a post-incident summarizing PNW LNG's response, including resources deployed.

8.0 FIRST AID

Requirements for first aid are set out by the BC Workers Compensation Board. During the operations phase, first aid stations will be maintained and equipped. All site personnel will be informed of the first aid and medical arrangements, and the protocol for activating the emergency procedure. Notices indicating contact details for first aid personnel (or appropriate person), the emergency contact number and/or radio frequency, and the locations of first aid kits will be posted around the site.

PNW LNG wil be further developing their on-site medical response staffing and procedures as the Project advances to construction. PNW LNG will require that, at a minimum, one nurse practitioner and one advanced-care paramedic be on site during the intial stages of construction and increase capacity during the construction phase. Proactive and preventative programs will address chronic health issues a well a address emergency medical and injury cases. These programs will be in place both at the construction site and at the worker camp during construction. Additional details pertaining to PNW LNG's medical program will be included in the overall HSE MS.

Appendix J6-1
Preliminary Draft List of Spill Response Materials and Equipment

Spill Response Materials	1. Spill response materials required at specific locations around the Project site include, but are not limited to: a. appropriate personal protective equipment b. fire extinguishers c. bags of bulk absorbents d. sorbent pads e. synthetic absorbents including pads and booms f. polyethylene rolls or tarps g. heavy plastic bags h. disposable gloves i. nitrile gloves j. shovels k. rakes l. a trash pump with adequate length of hose designed for hydrocarbon transfer m. a container for the temporary storage of excavated contaminated soils n. a tank for temporary storage of recovered hydrocarbons o. communications equipment
	2. Additional equipment, including sorbent booms and skimming equipment may be required near waterbodies. Information about requirements for these situations during construction will be provided by the Environmental Monitor(s).
	3. Fuel and service vehicles will carry a minimum of 25 kg of commercial sorbent material, as well as sorbent pads or sorbent booms suitable for spill containment and clean-up on open water.
	4. The Contractor must maintain an up-to-date inventory of spill response materials in each spill kit and a map identifying the location of spill kits and supplemental spill response materials. The Contractor must have a summary of the number of spill kits and inventory of supplemental spill response materials kept on site, documentation of the use of spill response materials, spill response purchase history, and the location of spill kits and supplemental spill response materials.
Emergency Response Mobile Unit (if determined applicable by PNW LNG and the selected Contractor(s))	5. A fully supplied mobile environmental emergency response unit is recommended and should be strategically located near environmentally sensitive sites during construction. This mobile unit, along with a 24/7 contact list, can be activated during an environmental emergency with a minimal response time. Below is a list of items that should be in the mobile unit including but not limited to: a. a roll of heavy gauge polyurethane b. a roll of woven geotextile c. a box of spill absorbent pads (diapers) d. a 2 or 3 inch new water pump with Fisheries and Oceans Canada (DFO) screened intake hose and 100 m of new discharge hose (DFO 1995) e. heavy duty plastic bags for contaminated soils f. a minimum of 30 m of surfactant booms g. a minimum of 3 rolls of silt fence h. tee bars and pounder i. snow fencing j. a minimum of 3 shovels and fire axes k. fire extinguishers and portable backpack water tanks for grass fires l. water buckets m. a minimum of 2 “Tommy” containment tubs for pumps, etc. n. small tool kit with rope, wire, duct tape, flash lights, pliers, ribbon, etc. o. first aid kit p. clipboard or log book in the unit with an inventory listing all recommended contents, the Contractors 24/7 contacts, spill reports, and Northern Gateway Pipelines reporting protocol and contacts
	6. The outside of the mobile unit should be clearly marked indicating that it is an Environmental Emergency Response Unit. Other items to consider adding in the mobile unit are: a. a spill kit in a barrel b. a small light plant c. a 2 inch submersible pump with 100 m new discharge hose d. non-woven geotextile (filter cloth) e. empty bags for making sand bags

Appendix J6-2 Provincial Emergency Program Reportable Spills

	Substance Spilled	Specified Amount
1	Class 1, Explosives as defined in section 2.9 of the Federal Regulations	Any quantity that could pose a danger to public safety or 50 kg
2	Class 2.1, Flammable Gases, other than natural gas, as defined in section 2.14 (a) of the Federal Regulations	10 kg
3	Class 2.2 Non-Flammable and Non-Toxic Gases as defined in section 2.14 (b) of the Federal Regulations	10 kg
4	Class 2.3, Toxic Gases as defined in section 2.14 (c) of the Federal Regulations	5 kg
5	Class 3, Flammable Liquids as defined in section 2.18 of the Federal Regulations	100 L
6	Class 4, Flammable Solids as defined in section 2.20 of the Federal Regulations	25 kg
7	Class 5.1, Oxidizing Substances as defined in section 2.24 (a) of the Federal Regulations	50 kg or 50 L
8	Class 5.2, Organic Peroxides as defined in section 2.24 (b) of the Federal Regulations	1 kg or 1 L
9	Class 6.1, Toxic Substances as defined in section 2.27 (a) of the Federal Regulations	5 kg or 5 L
10	Class 6.2, Infectious Substances as defined in section 2.27 (b) of the Federal Regulations	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
11	Class 7, Radioactive Materials as defined in section 2.37 of the Federal Regulations	Any quantity that could pose a danger to public safety and an emission level greater than the emission level established in section 20 of the "Packaging and Transport of Nuclear Substances Regulations"
12	Class 8, Corrosives as defined in section 2.40 of the Federal Regulations	5 kg or 5 L
13	Class 9, Miscellaneous Products, Substances or Organisms as defined in section 2.43 of the Federal Regulations	25 kg or 25 L
14	Waste containing dioxin as defined in section 1 of the Hazardous Waste Regulation	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
15	Leachable toxic waste as defined in section 1 of the Hazardous Waste Regulation	25 kg or 25 L
16	Waste containing polycyclic aromatic hydrocarbons as defined in section 1 of the hazardous Waste Regulation	5 kg or 5 L
17	Waste asbestos as defined in section 1 of the Hazardous Waste Regulation	50 kg
18	Waste oil as defined in section 1 of the Hazardous Waste Regulation	100 L
19	Waste containing a pest control product as defined in section 1 of the Hazardous Waste Regulation	5 kg or 5 L

Appendix J6-2 Provincial Emergency Program Reportable Spills

	Substance Spilled	Specified Amount
20	PCB Wastes as defined in section 1 of the Hazardous Waste Regulation	25 kg or 25 L
21	Waste containing tetrachloroethylene as defined in section 1 of the Hazardous Waste Regulation	50 kg or 50 L
22	Biomedical waste as defined in section 1 of the Hazardous Waste Regulation	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
23	A hazardous waste as defined in section 1 of the Hazardous Waste Regulation and not covered under items 1 – 22	25 kg or 25 L
24	A substance, not covered by items 1 to 23, that can cause pollution	200 kg or 200 L
25	Natural gas	10 kg, if there is a breakage in a pipeline or fitting operated above 100 psi that results in a sudden and uncontrolled release of natural gas

Appendix J.7
Transportation Management Plan

J.7 DRAFT TRANSPORATION MANAGEMENT PLAN

1.0 INTRODUCTION

Pacific NorthWest LNG Limited Partnership (PNW LNG) has developed a preliminary draft Transportation Management Plan that outlines the implementation of best management practices and mitigation measures to appropriately manage traffic and potential adverse effects of the Project on transportation infrastructure.

This draft plan presents a preliminary framework for managing potential adverse effects based on the Environmental Impact Statement (EIS) for the Project and subsequent feedback from regulators, Aboriginal groups, stakeholders and the public. This plan will be updated and refined based on detailed Engineering Procurement Construction and Commissioning (EPCC) Contractor design and permitting requirements, feedback from ongoing engagement, and collaborative planning with regulators, Aboriginal groups, and stakeholders.

1.1 OBJECTIVES

The objectives of the Transportation Management Plan include:

- Promote transportation safety
- Outline preferred ground transportation corridors
- Provide policies for the movement of dangerous goods and of heavy, oversized and regular loads
- Provide policies for the movement of workers to and from construction sites and airports
- Outline policies and procedures for the use of the Prince Rupert Airport and the Northwest Regional Airport in Terrace-Kitimat for project related activities
- Provide policies for the movement of construction related vessels within the marine environment to assure safety of other marine users
- Outline engagement strategies with regulators and stakeholders
- Outline reporting mechanisms and requirements.

1.2 REGULATORY CONTEXT

The Project EPCC Contractor(s) will be responsible for complying with applicable law, regulations and industrial standards for transportation and transportation management.

Transportation related legislation applicable to the Project includes:

- BC *Motor Vehicle Act (1996)* administered and enforced by the Insurance Corporation of British Columbia (ICBC) and the police. The Act deals with the safe operation of motor vehicles on BC roads.
- BC *Transportation Act* (2004) and associated regulations, administered by the BC Ministry of Transportation and Infrastructure). The Act deals with public works related to transportation, as well as the planning, design, holding, construction, use, operation, alteration, maintenance, repair, rehabilitation and closing of provincial highways.

- Canadian *Ballast Water Control and Management Regulations (2011)* administered by Transport Canada under the *Canada Shipping Act*. The purpose of the Regulations is to protect waters under Canadian jurisdiction from non-indigenous aquatic organisms and pathogens that can be harmful to ecosystems.
- *Canada Marine Act (1998*) gives the PRPA the authority to administer the lands and waters within the boundaries of the Port in Prince Rupert Harbour. Subject to Section 56 of the Act, the PRPA has developed a Harbour Operations – Practices and Procedures manual, which includes a number of requirements.
- *Canada Shipping Act (2001)* administered by Transport Canada applies to Canadian vessels operating in all waters and to foreign vessels operating in Canadian waters, ranging from canoes and kayaks to cruise ships and tankers.
- *Canada Transportation Act*, administered by Transport Canada. The Act deals, in part, with air transportation.
- *Transportation of Dangerous Goods Act (1992)* and the accompanying Transportation of Dangerous Goods Regulation, administered by Transport Canada. This Act applies to all modes of transportation of dangerous goods in Canada, and includes the transportation of hazardous wastes.
- *Navigation Protection Act (2013*) administered by Transport Canada and applies to designated waterways in Canada. It requires that approval be obtained prior to construction of works in these waterways.

Marine Transportation Security Act (1994. This act deals with preventing unlawful interference with marine transportation, screening for the purpose of protecting persons, goods, vessels and marine facilities, respecting the establishment of restricted areas and associated documentation.

Bylaws, administered by the municipalities in which they lie. Regulations specific to municipal roads are outlined in applicable bylaws, including Official Community Plans.

All project personnel will abide by federal and provincial laws and regulations and company and project specific requirements regarding transportation. Awareness of these requirements will be integrated, as appropriate, into various levels of PNW LNG's overall Social Management Plan.

2.0 ENGAGEMENT STRATEGY

The results of consultation and engagement with stakeholders and regulatory agencies will be incorporated into the final Transportation Management Plan. Table 1 outlines a preliminary list of key contacts and potential topics for discussion. This list will be further developed and refined as project planning and design proceeds.

Table 1 Preliminary Consultation and Engagement Outline

Stakeholder/Regulator	Potential Topics
BC Environmental Assessment Office	• Development and approval of the Transportation Management Plan • Reporting and monitoring on mitigation measures associated with the Transportation Plan

Stakeholder/Regulator	Potential Topics
BC Ministry of Transportation and Infrastructure (MOTI)	• Notification of which roads will be used for project traffic, including heavy or oversized loads • Oversize/overweight vehicle permitting, where applicable • Seasonal weight restrictions, if any • Other restrictions or considerations
Canadian National Railway Company (CNR)	• Notification of project construction activities • Project updates and activities that could influence CNRs operations
Council Members of Prince Rupert and Port Edward	• Preferred routing and timing • Anticipated vehicle traffic
Local Communities	• PNW LNG will engage in ongoing discussions with local communities regarding topics of transportation management.
Ministry of Community, Sport and Cultural Development (CSCD)	• Development and approval of the Transportation Management Plan • Reporting and monitoring on mitigation measures associated with the Transportation Plan
Prince Rupert Airport and Northwest Regional Airport	• Notification of anticipated air passenger traffic • Charter flights • Logistics planning for arrivals and departures during shift changes, including crew van or shuttle bus meeting point(s)
Prince Rupert Port Authority	• Routing, scheduling, or other potential measures to minimize potential conflict between project road-based traffic and port road-based traffic
Royal Canadian Mounted Police	• Project updates and activities that could influence community safety, including traffic-related concerns
Transport Canada	• Project updates and activities that could influence marine navigation and safety marine security; transportation of dangerous goods, civil aviation
Aboriginal Groups	• PNW LNG will engage in ongoing discussions with Aboriginal Groups regarding topics of transportation management.
Marine users, local recreation clubs, Pacific Pilotage Authority, BC Coast Pilots	• Project updates and activities that could influence navigation; in particular the ability the pass underneath the trestle, bridge to Lelu Island from the mainland and the use of safety zones.

3.0 MITIGATION PROGRAM

The preliminary draft Transportation Management Plan establishes guidance for PNW LNG and the EPCC Contractor to manage the transportation of workers, equipment and materials, and waste to and from the Project site. The subsections below outline preliminary measures to manage the potential adverse effects of the Project on transportation. The final management program will incorporate the results of the consultation and engagement as outlined in Table 1. A Marine Communication Plan will be developed, which identifies measures so that all marine traffic is made aware of any project construction activities and that details the local marine communications and project related safety procedures.

3.1 PREFERRED TRANSPORTATION CORRIDORS

Preferred ground transportation corridors, particularly for use by heavy project vehicles, will be identified in more detail in the final Transportation Management Plan. Safety zones will be established during construction with specific “no go” areas. Preferred routing objectives include:

- Use roadways designated suitable for each vehicle type (e.g., heavy vehicles)
- Aim to lower the magnitude of project related heavy vehicle traffic on Skeena Drive
- Avoid school zones, whenever practical
- Avoids or minimizes interactions with CNR operations
- Take in to consideration adjacent land uses such as parks
- Observe seasonal load restrictions, where applicable
- Use designated passage and/or timing windows for movement of vessels in the vicinity of all project marine works
- Ensure safety zones are properly demarcated and communicated to all marine users.

3.2 GOODS MOVEMENT

Specific management may be required for the movement of goods including heavy vehicles, oversized loads, or dangerous goods. Preliminary management measures are as follows:

- Heavy vehicles or goods movement vehicles will use preferred ground transportation corridors as outlined in Section 3.1
- The movement of heavy or oversized loads will be in compliance with local, regional, or provincial regulations and permitting as required
- Transportation of dangerous goods will comply with the *Transportation of Dangerous Goods Act* and applicable regulations. These regulations set out a system of product classification, documentation and labelling; placarding and marking of vehicles; hazard management; notification and reporting; and employee training.
- PNW LNG drivers will be subject to the training requirements outlined in Section 4.0
- Dangerous goods will be handled in accordance with applicable legislation, including Transport Canada’s Emergency Response Assistance Plans.
- Operators of Project-related ground transportation will adhere to posted speed limits.

3.3 WORKER TRANSPORTATION

Increased traffic volumes and risk of traffic incidents due to worker movement will be minimized using the following strategies:

- Site preparation workers residing in Port Edward or Prince Rupert will be transported to and from the Project by bus or crew van. This may be achieved by implementing a park-and-ride facility or designated pickup location in the communities, or by using a carpool-like pickup system.
- Fly-in-fly-out (FIFO) workers will be transported by bus or crew van between the airports and the camp or project site

- Use of charter aircraft to transport fly-in/fly-out workers to Prince Rupert Airport during construction
- Shift changes will be staggered and scheduled to the off-peak hours, whenever practical, to avoid creating additional peak hour congestion on local roads and highways
- Drivers will be subject to the training requirements outlined in Section 4.0
- Work with PRPA and other stakeholders by participating in the Construction Coordination Committee in an effort to minimize the impact of project construction vessel activities on other marine users.

3.4 CONSTRUCTION RELATED VESSELS

Construction related vessels will be managed using the following strategies:

- PNW LNG will communicate the anticipated needs and demands for construction related vessels with marine users and the Prince Rupert Port Authority as outlined in Section 2.0 above
- Construction vessels will access the project area in compliance with applicable legislation, and in accordance with local traffic authorities (i.e., PRPA, Prince Rupert Traffic, Canadian Coast Guard, etc.).
- Operators of Project-related marine transportation will adhere to posted speed limits.

PNW LNG (and their contractor) will be required to participate in a construction coordination committee led by PRPA to address potential effects of construction on marine users within the PRPA boundaries. In addition to other PRPA tenants, commercial fishers will also be invited to participate

3.5 AIRPORTS

Increased demands on airports will be minimized using the following strategies:

- PNW LNG will communicate the anticipated needs and demands on the airports with the Prince Rupert and Northwest Regional Airport authorities as outlined in Section 2.0 above
- PNW LNG will coordinate with the airport authorities regarding Logistics planning for arrivals and departures during shift changes, including crew van or shuttle bus meeting point(s)
- The Project will use chartered flights rather than commercial flights whenever possible to reduce the potential effects on flight availability
- FIFO workers' shift changes will be staggered, as practical, to reduce peak demands on airports
- Capacity of Digby Island Ferry to support logistical requirements will be assessed; alternative transportation solutions will be used when warranted.

4.0 TRAINING

Employees and contractors who drive within, or to and from the worksite will be subject to driver training requirements. Training will be suitable for the nature of driving required, and may be in the form of new worker induction, or a driver safety course. Key topics will include:

- Wildlife awareness
- Driving in adverse weather

- Driving rules and policies, including:
  - Fit for duty (drugs, alcohol, fatigue)
  - Cell phone use
  - Seat belts
  - Speed limits
  - Disciplinary action for violating rules or policies
  - Journey management

Heavy vehicle drivers will also be subject to the above training, rules and policies. In addition, these drivers may require special job- or vehicle-specific training.

5.0 MONITORING AND REPORTING

Monitoring and reporting is required to ensure the effectiveness of the Transportation Management Plan and mitigation measures. The monitoring and reporting protocol of the Transportation Management Plan will be established in conjunction with the Socio-Economic Effects Management Plan in consultation with the Ministry of Community, Sport and Cultural Development and the British Columbia Environmental Assessment Office. Monitoring and reporting protocols will also be developed with the Ministry of Transportation and Infrastructure and other Ministries and organizations as required.

6.0 REFERENCES

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Transportation of Dangerous Goods Act, Statutes of Canada (1992, c. 34). Available at: https://www.tc.gc.ca/eng/acts-regulations/acts-1992c34.htm. Accessed October 8, 2014.

Appendix J.8
Marine and Freshwater Resources Management Plan

J.8 PRELIMINARY DRAFT MARINE AND FRESHWATER RESOURCE MANAGEMENT PLAN

1.0 INTRODUCTION

Pacific NorthWest LNG Limited Partnership (PNW LNG) has developed a preliminary draft Marine and Freshwater Resource Management Plan for the construction and operation of the Pacific NorthWest LNG Project (the Project) that outlines best management practices (BMPs) and mitigation measures that will be implemented to reduce impacts to marine and freshwater organisms associated with Project activities (e.g., land clearing, pile driving, blasting, construction, facility operations). This includes a Marine Mammal Monitoring and Protection Plan (Appendix 1). Project activities associated with potential Impacts to marine and freshwater organisms are further outlined in:

- Vegetation Management Plan (Appendix J.9 of the EIS/Addendum)
- Blasting Management Plan (see Appendix J.11 of the EIS/Addendum)
- Marine Pile Installation Management Plan (see Appendix J.12 of the EIS/Addendum)
- Dredging Management Plan (see Appendix J.13 of the EIS/Addendum).

This preliminary draft plan presents a framework for managing potential adverse environmental effects based on the Environmental Impact Statement (EIS) for the Project and subsequent feedback from regulators, Aboriginal groups, stakeholders and the public. This plan will be updated and refined based on detailed Engineering Procurement Construction and Commissioning (EPCC) Contractor design and permitting requirements.

Roles and responsibilities related to environmental management are generally described in the Environmental Management Plan (EMP) Overview, Section 3.0. General information pertaining to compliance monitoring is provided in Section 2.2 of the EMP Overview.

1.1 REGULATORY CONTEXT

The principal federal and provincial legislation protecting marine and freshwater resources with respect to industrial development are:

- *Fisheries Act* (2005, amended 2013).
  - Section 2(2): For the purposes of this Act, serious harm to fish is considered to be the death of fish or any permanent alteration to, or destruction of, fish habitat
  - Section 35(1): No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery
  - Section 36(3): Subject to subsection (4), no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water.

- Marine Mammal Regulations of the *Fisheries Act*
  - Section 7: No person shall disturb a marine mammal except when fishing for marine mammals under the authority of these regulations.
- *Species at Risk Act (2002)*
  - Section 32(1): No person shall kill, harm, harass, capture or take an individual of a wildlife species that is listed as an extirpated species, an endangered species or a threatened species
  - Section 33: No person shall damage or destroy the residence of one or more individuals of a wildlife species that is listed as an endangered species or a threatened species, or that is listed as an extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada
  - Section 58(1): Subject to this section, no person shall destroy any part of the critical habitat of any listed endangered species or any listed threatened species – or of any listed extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada—if

    a. The critical habitat is on federal land, in the exclusive economic zone of Canada or on the continental shelf of Canada
    b. The listed species is an aquatic species; or
    c. The listed species is a species of migratory birds protected by the *Migratory Bird Convention Act*, 1994.

- *British Columbia Environmental Management Act* (2003).
  - Applicability currently under review with Province of British Columbia (BC) and the Prince Rupert Port Authority (PRPA)
  - Section 6(1): For the purposes of this section, "the conduct of a prescribed industry, trade or business**"** includes the operation by any person of facilities or vehicles for the collection, storage, treatment, handling, transportation, discharge, destruction or other disposal of waste in relation to the prescribed industry, trade or business
  - 6(2) Subject to subsection (5), a person must not introduce or cause or allow waste to be introduced into the environment in the course of conducting a prescribed industry, trade or business
  - 6(3) Subject to subsection (5), a person must not introduce or cause or allow to be introduced into the environment, waste produced by a prescribed activity or operation
  - 6(4) Subject to subsection (5), a person must not introduce waste into the environment in such a manner or quantity as to cause pollution.

Environmental protection permits relevant to marine and freshwater resources required to complete the Project as presented include:

- *Fisheries Act* Authorization (Department of Fisheries and Oceans (DFO))
- PRPA authorization to modify freshwater streams on PRPA lands
- Waste Discharge Authorization (Province of BC; may apply/under discussion)
- Scientific Fish Collection Permit, if required (Fish Salvage) (Province of BC).

Permit requirements and authorizations are subject to regulatory discussions and site-specific construction requirements (i.e., near stream or freshwater channel disturbance requires BC Water Act Section 9 Authorization).

Waste discharge authorization stipulations are dependent on discussions with regulators upon final project design and EPCC contractor plans.

1.2 WORK STANDARDS, GUIDELINES AND BEST PRACTICES

The Federal Government has standards, guidelines or Best Practices for working in and around water and reducing project related impacts on marine and freshwater resources. Provincial guidelines may also be used as BMPs. These include:

- Measures to Avoid Causing Harm to Fish and Fish Habitat. DFO
- Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters. DFO
- Land Development Guidelines for the Protection of Aquatic Life. DFO
- Canadian Environmental Quality Guidelines. Canadian Council of Ministers of the Environment
- Standards and Best Practices for Instream Works. BC Ministry of Environment (MOE) and DFO
- Develop with Care 2014. Environmental Guidelines for Urban and Rural Land Development in BC. BC MOE.

2.0 MITIGATION PROGRAM

The following mitigation measures and best practices are drawn from the Standards and Guidelines listed above as well as the Blasting Management Plan (Appendix J.11 of the EIS/Addendum) and Marine Pile Installation Management Plan (Appendix J.12 of the EIS/Addendum). These measures and practices will be reviewed based on detailed design and receipt of permitting requirements as well as continuing Aboriginal and stakeholder engagement. Project construction mitigation measures are outlined in Table 1.

Adverse effects which cannot be directly mitigated (e.g., infilling of fish habitat freshwater channels, materials off-loading facility (MOF), etc.) will require offsetting under the *Fisheries Act*. An offsetting plan is being developed by PNW LNG for the Project, in consultation with DFO and local Aboriginal groups.

2.1 PROJECT CONSTRUCTION

Construction mitigation measures designed to protect marine and freshwater resources are primarily focused on the loss and degradation of habitat in the project area. Activity-specific components of the Freshwater and Marine Resources Plan are captured within the following plans:

- Vegetation Management Plan (Appendix J.9 of the EIS/Addendum)
- Blasting Management Plan (Appendix J.11 of the EIS/Addendum)
- Marine Pile Installation Management Plan (Appendix J.12 of the EIS/Addendum)
- Dredging Management Plan (Appendix J.13 of the EIS/Addendum)

Table1: Construction Mitigation Measures Overview for Marine and Freshwater Resources Management

	Best Management Practices and Mitigation Measures
Construction—Site Preparation **Clearing and Grading of Land—Removal of Vegetation and Exposure of Soils**	Use a Qualified Professional to establish an effective Work Plan that considers location, timing and construction techniques to avoid erosion and reduce impacts of sediment release.
	A 30 m vegetation buffer will be retained around the perimeter of Lelu Island, except at access points. Sediment and erosion control measures will be used (e.g. sediment fences) for land-based construction, particularly at the shoreline, to reduce total suspended solids inputs into the water.
	A fish salvage conducted by a Qualified Professional to capture, remove and relocate fish from the stream channels that will be infilled. These channels should be screened at their mouths after the salvage and while the infilling is occurring to prevent immigration of fish after the salvage.
	Where practical, effects to the lower sections of watercourses 8/9 and 11 will be avoided. These will be further detailed in the final EMP.
	The infilling of watercourses will be avoided where practical.
	Reduce riparian area disturbed by access activities along the adjacent upland property, and preserve trees, shrubs and grasses near the shoreline.
	Limit machinery and equipment access, and direct disturbance, to shoreline riparian area.
	Remove excavated material and debris from the site to a stable area above the high water mark and preferably outside the riparian zone.
	Stockpile natural soils wherever possible (with a cover to prevent incursion by invasive plant species) and put them back on site during landscaping.
	Protect excavated material from being eroded and reintroduced into waterways. Measures include, but are not limited to, covering material with erosion control blankets or seeding and planting of native vegetation.
	Material such as rock, riprap, or other materials placed on the bank should be inert and free of silt, overburden, debris or other substances deleterious to aquatic life.
	When material is moved offsite, dispose of it in a manner that prevents its entry into any watercourse, floodplain, ravine or storm sewer.
	Temporary storage of materials will be limited to within the project development area (PDA) boundaries.
	Construct any ditches, water bars, or water diversions within the work area so that they do not directly discharge sediment-laden surface flows into natural watercourses. Divert such flows to an adequately vegetated area (vegetated filter strip) where flows can slowly infiltrate.
	Use appropriate instream sediment controls (e.g., silt barriers, coffer dams, retention basins, settling ponds, etc.) in and adjacent to constructed ditches, collection channels and diversion channels.
	Adopt land-based erosion controls and proper construction practices to reduce the amount of deleterious sediment introduced into a watercourse. A Qualified Professional should be onsite during construction/installation of sediment controls.
	Coffer dam installations, if required, should be designed and approved by Qualified Professionals.
	Install sediment traps and appropriate geotextiles along diversions and ditches.
	Diversion ditches should not contain ridges or depressions that may potentially trap fish or initiate erosion of the watercourse bottom.
	Diversion ditch slopes should not exceed a 2:1 (horizontal:vertical) ratio.
	Prevent the release of silt, sediment, sediment-laden raw water, raw concrete, concrete leachate, or any other deleterious substances into any ditch, watercourse, ravine or storm sewer system.
	Store controlled products such as fuels to prevent leaks or spills to the environment.

	Best Management Practices and Mitigation Measures
	Keep a spill containment kit readily accessible on-site in the event of a release of a harmful substance to the environment and confirm that on-site staff are trained in spill response. Immediately report any spill of a substance of reportable quantities that is toxic, polluting, or harmful to aquatic life to the Provincial Emergency Program Environmental Emergency Management Plan Incident Reporting Hotline 1-800-663-3456 and DFO's Observe, Record, and Report Hotline 1-800-465-4336.
	Confirm that equipment and machinery are in good operating condition, clean (power washed), free of leaks, excess oil, and grease prior to initiating daily construction activities. Do not refuel or service equipment with 100 metres of any watercourse or surface water drainage, to the extent possible. Confine fueling and servicing activities to pre-determined boundaries.
	Hydraulic machinery should use environmentally-sensitive hydraulic fluids that are non-toxic to aquatic life and that are readily or inherently biodegradable wherever possible.
Construction—Site Preparation **Clearing and Grading of Land—Terrestrial Blasting**	Do not use ammonium nitrate-fuel oil based mixtures in or near marine or freshwater environments.
	Backfill blasting holes with suitable angular gravel wherever possible to confine the force of the explosion to the target fracture location.
	Reduce flying debris by using rubber blast matting.
	Detonation and handling of explosives should be conducted according to the Blasting Management Plan (Appendix J.11 of the EIS/Addendum).
	Stormwater runoff from plant areas subject to oil contamination will be curbed or diked and collected by a segregated underground oily-water sewer system. This system will drain to an oil-water separator system for oil removal. Runoff water would then be treated through the Port Edward municipal waste water system.
	Runoff from other, non-curbed areas of the LNG facility will be collected by perimeter ditches draining to a first flush basin, which would collect the initial runoff. The excess will be diverted to the clean runoff system.
	Clean runoff water will be collected by surface ditches for discharge to the ocean via pre-disturbance drainage pathways through the wetlands bordering the PDA.
Construction—Onshore Construction	**In addition to above BMPs for Construction—Site Preparation:**
	Due to the large number of workers on site, reduce access points to marine beaches to reduce impact of foot traffic and harvesting of intertidal organisms (mussels, clams, etc.)
Construction—Onshore and Marine Construction **Use of Concrete**	**In addition to above Best Management Practices for Construction—Site Preparation:**
	All works involving the use of concrete, cement, mortars, and/or other Portland cement or lime-containing construction materials will not deposit (directly or indirectly) sediments, debris, concrete, leachate concrete fines, wash or contact water into or about any watercourse.
	Prevent any water that contacts uncured or partly cured concrete (during activities like exposed aggregate wash-off, wet curing, or equipment washing) from directly or indirectly entering any watercourse or stormwater system.
	Isolate and hold any water that contacts uncured or partly cured concrete until the pH is between 6.5 and 8.0 pH units and the turbidity is less than 25 nephleometric turbidity units (NTU), measured to an accuracy of ± 2 NTU
	A carbon dioxide (CO_2) tank with regulator, hose and gas diffuser should be readily available during concrete works to neutralize pH levels should a spill occur. Staff must be trained in its proper use.
	Provide containment facilities for wash-down water from concrete delivery trucks, concrete pumping equipment, and other tools and equipment.
	Cast in place concrete must remain isolated from water inside sealed formed structures until cured (approximately 48-72 hours), as concrete leachate is highly toxic to fish and other aquatic life.
Construction—Dredging	See Dredging Environmental Management Plan (Appendix J.13 of the EIS/Addendum).
	The Marine Mammal Monitoring and Protection Plan (MMMPP) will be implemented as required (Appendix 1).

	Best Management Practices and Mitigation Measures
Construction—Marine Construction Pile Driving	In-water marine pile installation activities will be conducted according to the Marine Pile Installation Management Plan (Appendix J.12 of the EIS/Addendum).
	The MMMPP will be implemented as required (Appendix 1).
Construction—Marine Construction Underwater Blasting	The use of explosives in the marine environment will be conducted according to the Blasting Management Plan (Appendix J.11 of the EIS/Addendum).
	The MMMPP will be implemented as required (Appendix 1).
Construction—Waste Management and Disposal	Solid and liquid waste will be handled according to the Waste Management Plan (Appendix J.10 of the EIS/Addendum).
	Solid and liquid wastes are to be removed, transported and recycled or disposed at approved facilities.
	Hazardous wastes are to be removed, transported and disposed at offsite approved facilities.
Construction—Stormwater	Diversion and collection ditches, and outfalls will be designed to accommodate anticipated "worst-case" high flow scenarios, and in accordance with applicable industry standards.
	Have contingency plans in place to address unforeseen storm events with associated potential overland erosion from rainfall impact and storm water runoff.
	Include appropriate water energy dissipation structures in construction design to aid in erosion control.
	A Qualified Professional will conduct a hydraulic analysis prior to outfall construction so that discharge velocities to watercourses do not produce scour and damage to fish habitat.
	Design outfalls so fish cannot enter them on a high tide and subsequently be trapped within stormwater drainage channels.
	Locate shoreline outfalls a minimum of 30 m from areas identified by a Qualified Professional as sensitive.
	Prevent erosion of outlets by reinforcing them with rip-rap or other appropriate measures.
	Storm sewer outfalls will be routinely inspected (at least twice a year) in the spring, fall and after severe storms to confirm that they remain free-flowing and unclogged.
Construction—Disposal at Sea	See Dredging Environmental Management Plan (Appendix J.13 of the EIS/Addendum).
Construction—Operational Testing and Commissioning	Prior to operational testing and commissioning develop effluent quality objectives consistent with Canadian Environmental Quality Guidelines for release to the marine environment.
	Monitoring of effluent quality for compliance with Waste Discharge Authorization at regular intervals prior to discharge to the marine environment.
	Development and availability of a contingency plan to halt discharge and contain effluent in the event that effluent quality objectives or Waste Discharge Authorization permitted concentrations are exceeded.

	Best Management Practices and Mitigation Measures
Construction—Site Clean-Up and Reclamation	Planned scour protection will be placed around tower platform below mud line through the use of slightly larger substrate sized materials around the perimeter of tower platform where appropriate.
	Hard multi-facetted shoreline protection material (e.g., rip-rap boulders) will be used where needed (e.g., trestle abutment) to promote colonization by marine biota.
	Backfill diversion ditches upon completion of works and re-vegetate the area to a state that enhances the original condition.
	Upon completion of works remove the diversions (collection ditches, diversion ditches) from the upstream end first.
	Grade disturbed areas to a stable angle of repose.
	Vegetate all disturbed soils, banks and riparian areas by seeding and/or planting trees and shrubs in accordance with DFO guidance on riparian re-vegetation. Cover seeded and vegetated area with appropriate measures to prevent soil erosion and to help seeds germinate.
	Post-construction vegetation monitoring will be conducted by a Qualified Professional to document survival and condition.
	Post-construction vegetation monitoring will be conducted by a Qualified Professional to document survival and condition.

2.2 PROJECT OPERATIONS

Mitigation measures designed to protect marine and freshwater resources during Project operations are primarily focused on the management of waste, effluent and monitoring of the marine environment within the Project area. Activity-specific components of the Freshwater and Marine Resources Plan are captured within the following plans:

- Environmental Emergency Preparedness and Response Plan (Appendix J.6 of the EIS/Addendum)
- Waste Management Plan (Appendix J.10 of the EIS/Addendum)

Mitigation measures and practices to protect marine and freshwater resources during Project operations are outlined in Table 2.

Table 2: Operations Mitigation Measures Overview for Marine and Freshwater Resources Management

	Best Management Practices and Mitigation Measures
Operations—LNG Facility and Supporting Infrastructure on Lelu Island	Identification of land-based Project components most likely to interact with the marine environment in the event of equipment failure, loss of power, or accident.
	Develop an Environmental Emergency Preparedness and Response Plan (EEPRP) for land-based LNG components with potential to cause harm to the marine environment (see EEPRP – Appendix J.6 of the EIS/Addendum).
	Maintain sufficient equipment supplies, in good working order, and provide appropriate emergency response training to personnel.
	Develop and adhere to regular inspection and maintenance schedule for land-based PNW LNG components with potential to cause harm to the marine environment.
	Regular environmental monitoring of marine nearshore near outfalls, wharves, docks, and bridge.
Operations—Marine Terminal Use	Identification of marine terminal Project components most likely to interact with the marine environment in the event of equipment failure, loss of power, or accident.
	Develop and EEPRP for LNG facility components with potential to cause harm to the marine environment (see EEPRP – Appendix J.6 of the EIS/Addendum).
	Maintain sufficient equipment, in good working order, and appropriately trained staff at the LNG facility to complete tasks and activities required in the EEPRP (Appendix J.6 of the EIS/Addendum).
	Develop and adhere to a regular inspection and maintenance schedule for LNG facility components with potential to cause harm to the marine environment.
Operations—Shipping	Development of an EEPRP that addresses vessel-based spills or accidents, either striking the marine terminal or collisions between ships.
	Maintain sufficient equipment supplies, in good working order, and provide appropriate emergency response training to personnel.
	All vessels visiting the facility will manage ballast water in compliance with the *Canada Shipping Act*, 2001 Ballast Water Control and Management Practices. Regular biological monitoring for marine invasive species introduced via ballast water will be undertaken (i.e., semi-annual basis or as determined appropriate by the appropriate regulatory authority).
Operations—Waste Management and Disposal	Stormwater infrastructure will be designed and constructed to carry anticipated design flows. Stormwater infrastructure will be regularly inspected and maintained in good working order.
	Disposal of solid wastes recycled or disposed of at approved disposal sites and in compliance with regulatory requirements (see Waste Management Plan – Appendix J.10 of the EIS/Addendum).
	Regular monitoring of treated effluent quality prior to discharge to Port Edward wastewater treatment facility or to the marine environment. Ensure effluent quality consistent with limits of the Canadian Environmental Quality Guidelines and Waste Discharge Authorization.
	Infrastructure in place to halt effluent flow and collect and hold it in the event of failure at the Lelu Island treatment plant, including the ability to hold effluent volume until treatment plant repaired.

Engineering controls will be in place as part of the drainage system. Drainages will be classified as oil-free, accidental oil contaminated, and continuous oil contaminated, depending on the likelihood of contamination at specific areas of the plant. Any potential contamination is treated on-site, with final effluent discharge to Port Edward's facilities. Only clean water systems (i.e., storm drains) are discharged to the marine environment. The final discharge point will be continuously monitored.

3.0 ENVIRONMENTAL COMPLIANCE MONITORING AND REPORTING

3.1 ENVIRONMENTAL COMPLIANCE MONITORING

Consistent with Standards and Best Practices for Instream Works (DFO and BC MOE) construction activities will be monitored full-time during start-up through to project completion and for a project of this scope will include a team of monitors. Monitoring will include marine works as well as those affecting freshwater. BMPs for monitoring, outlined in Standards and Best Practices for Instream Works, will be adhered to, and are presented in the Environmental Monitoring Management Plan (see Appendix J.16 of the EIS/Addendum).

3.2 ENVIRONMENTAL COMPLIANCE REPORTING

Environmental monitoring reports will be filed by the Environmental Monitor(s) on a weekly basis to PNW LNG's Environmental Manager. These reports will include photographs and written description of the construction activities. Required reporting to regulators (DFO) will be determined in consultation with those agencies.

Preliminary Draft Marine Mammal Monitoring and Protection Plan

A Summary of Mitigations, Commitments, and Monitoring Programs to Reduce Potential Effects of the Project on Marine Mammals

Prepared for:
Pacific NorthWest LNG Limited Partnership
Oceanic Plaza, Suite 1900 – 1066 West Hastings Street
Vancouver, BC V6E 3X1

Prepared by:
Stantec Consulting Ltd.
4370 Dominion Street, 5th Floor
Burnaby, BC V5G 4L7
Tel: (604) 436-3014
Fax: (604) 436-3752

December 12, 2014

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1.0 INTRODUCTION

1.1 BACKGROUND

Pacific NorthWest LNG Limited Partnership (PNW LNG) has developed a preliminary draft Marine Mammal Monitoring and Protection Plan (MMMPP) to address environmental concerns during the construction and operation phase of the Pacific NorthWest LNG Project (the Project). The purpose of the preliminary draft MMMPP is to address potential adverse environmental effects resulting from underwater noise caused by marine pile installation, dredging, blasting, other marine construction activities, and project related vessels. This MMMPP also addresses the potential for marine mammal collisions from project vessels. Management of effects on prey species are addressed in the Habitat Offsetting Plan (Appendix G.10 of the EIS Addendum).

This preliminary draft plan presents a framework for managing potential adverse environmental effects based on the Environmental Impact Statement (EIS) for the Project and subsequent feedback from government agencies, Aboriginal groups, stakeholders and the public. This plan will be updated and refined based on detailed Engineering Procurement Construction and Commissioning (EPCC) Contractor design and permitting requirements.

The marine waters surrounding Prince Rupert provide diverse habitats supporting many species, including marine mammals that contribute to the ecological, cultural, and economic well-being of the region. The Project has potential to affect marine mammal habitats and species during all project phases through:

- Direct mortality or physical injury
- Change in behaviour (as a consequence of underwater noise produced by project activities)
- Change in sediment or water quality (leading to potential for toxicological concerns or increased total suspended solids [TSS]).

1.2 PURPOSE

The purpose of the MMMPP is to outline the various commitments, mitigation measures and monitoring programs that PNW LNG will implement to reduce potential adverse project related environmental effects on marine mammals [see Appendix A of the EIS Addendum]. The geographic boundaries of the MMMPP will include the project development area (PDA), local assessment area (LAA) and regional assessment area (RAA) as applied in Appendix A of the EIS Addendum for marine mammals (Figure 1). The MMMPP will address all marine mammal species that could be directly or indirectly affected by routine Project activities within PDA and LAA boundaries, with a focus on species of commercial, recreational, cultural, or conservation concern (e.g., species listed on the *Species at Risk Act* [*SARA*]), and related habitats.

PNW LNG will integrate data collected through the MMMPP into updates to its management plans and operations. Mitigation measures may be refined over the course of the Project, as the result of information learned through this program and ongoing discussions with regulators and Aboriginal groups.

PNW LNG will continue to consult with Aboriginal groups and key government agencies (e.g., Fisheries and Oceans Canada [DFO]), the Prince Rupert Port Authority (PRPA) and other relevant stakeholders in the development of further iterations of the MMMPP.

2.0 MITIGATION MEASURES

During marine construction activities, underwater noise is predicted to change the behaviour of marine mammals. If unmitigated, auditory injuries may occur due to underwater noise produced during blasting and underwater impact pile driving. Blasting can also result in physical injury or direct mortality to marine mammals. Dredging and disposal of sediment at sea can lead to elevated TSS levels during construction, as can vessel maneuvering at the LNG carrier berth during operations; elevated TSS levels can result in avoidance behavior by marine mammals.During operations, LNG carrier transit and berthing will also introduce underwater noise to the marine environment, potentially resulting in temporary behavioural disturbance. An increase in vessel activity in the region also increases the potential for a marine mammal-vessel strike.

Mitigation measures for potential injury or mortality of marine mammals include a Blasting Management Plan (entailing the use of DFO's Blasting Guidelines and a marine mammal observation program) and a Pile Driving Management Plan (entailing the use of vibratory piles, bubble curtains, bubble containment casings, sound level monitoring and marine mammal observation programs; see Appendices J.12 and J.13 of the EIS Addendum). Additional environmental management plans include the Marine and Freshwater Resource Management Plan (see Appendix J.8 of the EIS Addendum), which will detail TSS/turbidity and water quality monitoring, the Waste Management Plan (see Appendix J.10 of the EIS Addendum), the Dredging Management Plan (see Appendix J.13 of the EIS Addendum), and the Environmental Monitoring Management Plan (see Appendix J.16 of the EIS Addendum), which includes details concerning marine mammal observers [MMOs]). Mitigation measures will be used to mitigate potential behavioural effects on marine mammals.

2.1 PILE INSTALLATION

Construction of the materials off-loading facility (MOF) and marine terminal (including the suspension bridge and trestle) will use drilled piles, and will occur year round until complete. Use of low noise pile installation techniques (e.g., vibratory hammers, where technically feasible) will reduce the risk of physical injury to marine mammals and fish and reduces potential effects on behaviour (see Sections 13.5.4.2 and 13.5.5.2 of Appendix A of the EIS). Due to the depths of soft sediment in the area, low noise pile installation techniques can (and will) be the primary

method of pile installation; impact pile driving will likely only be used to seat the piles into bedrock.

2.1.1 Design Measures

Low noise pile installation techniques (i.e., vibratory installation methods) will be used except during seating of some piles into bedrock. To reduce the potential for auditory injury to marine mammals during pile seating and any other instances that an impact pile driver is required, bubble curtains with bubble-containment casing will be used and the impact hammer will be constructed of sound absorbent material. Bubble curtains will also be used during pile installation (i.e., vibratory or impact) at the inner MOF to mitigate for behavioural effects. The exact style of bubble curtain and/or casing used will be determined on a case by case basis, taking into consideration the type of activity (and predicted sound levels) and oceanographic conditions (e.g., current speed). A Pile Driving Management Plan (see Appendix J.12 of the EIS Addendum) will be implemented to outline the pile installation techniques that will be used when low noise installation methods are not technically feasible (e.g., due to unfavourable substrate).

2.1.2 Monitoring

During all pile installation activities (i.e., impact and vibratory), a marine mammal observation program will be implemented. MMOs will monitor a safety zone (this term is used synonymously with the term 'exclusion zone') around pile installation, including during pile seating, and will halt the activities if cetaceans (of any species or status) or other marine mammal species (if listed under *SARA*) enter this zone. Underwater sound source levels will be measured/monitored in-situ during the first seven days of pile installation to field-validate the effectiveness of each style of curtain/casing implemented, monitor underwater sound levels produced, and confirm the proposed size of the pile installation safety zone (currently set at 1.0 km). Different sized safety radii will apply depending on the activity, as the underwater sound pressure levels (SPLs) will also vary according to activity. The current safety zones are set as 500 m for blasting (as per Fisheries and Oceans Canada's Blasting Guidelines) and 1.0 km for pile installation (based on acoustic modelling). However, follow-up studies will measure the SPLs produced during each activity to field-validate the recommended size of the safety zone(s). The exact size(s) of safety zone ultimately implemented will be determined through consultation with DFO but will not be less than 500 m.

Sound levels from blasting and pile installation will be monitored and if they exceed a root mean square SPL (SPLrms) of 160 dB re 1 µPa at the edge of the marine mammal safety zone, the associated construction activities will cease (be halted by the MMO) and additional mitigation measures will be considered in consultation with DFO. Additional measures could include type/configuration of bubble curtain used and size of safety radius monitored for marine mammals.

The Environmental Monitoring Management Plan (see Appendix J.16 of the EIS Addendum) will detail the duties and responsibilities of the MMOs, and will include the following protocols:

- Upon commencement of impact pile installation activities or recommencement after a delay of 30 minutes or more, pile installation will ramp-up by starting with slower, quieter strikes. This is designed to enable any marine mammals that may be in the area time to leave the area prior to attainment of underwater noise levels capable of causing injury
- Prior to commencement of impact pile installation activities and any time there is a pause in impact pile installation for more than 30 minutes, the 1.0 km safety zone will be monitored by the MMO and impact pile installation will not be commenced until (i) any observed cetacean (regardless of status) or other SARA-listed marine mammal is seen leaving the safety zone, or (ii) none have been detected in the safety zone for a period of 30 minutes
- During conditions of low visibility (i.e., when the 1.0 km safety zone cannot be monitored, during foggy conditions or darkness), if pile installation activities have ceased for more than 30 minutes, the MMO will delay recommencement of start-up until visibility improves. Once visibility improves, the safety zone will be monitored for cetaceans or other SARA-listed marine mammals for 30 minutes before commencing impact pile installation.

The MMO will be stationed in such a manner that they can survey the full extent of the safety radius, and the safety radius itself is centered on the underwater sound source. As such, positioning of the MMO will vary based on the activities in question, their location, and the final size of the safety radii as determined through consultation with DFO and in situ field measurements of sound levels. The primary function of the marine mammal safety zone is to prevent physical injury of marine mammals during underwater construction activities.

PNW LNG has also begun a series of dedicated vessel-based line transect surveys to estimate relative abundance of marine mammal species in the PDA and LAA. These will be conducted prior to the start of construction, during construction, during operations, and during decommissioning. The results of the marine mammal surveys will be analyzed to assess periods of elevated usage/presence, and to ensure appropriate mitigation measures are implemented to reduce the potential for harm and change in behaviour. Additional details concerning these surveys are provided in Section 3.0.

2.2 BLASTING

Blasting will be required to remove bedrock prior to dredging at the MOF. Unmitigated, blasting has the potential to displace, injure, or kill marine mammals within close range of the blast area. Management measures for both terrestrial and underwater blasting will be outlined in a Blasting Management Plan (see Appendix J.11 of the EIS Addendum), which will include methods to reduce the risk of mortality and injury to marine mammals and other marine life. The plan will be based on DFO's Blasting Guidelines (Wright and Hopky 1998) and will be developed in consultation with DFO.

Blasting will be conducted within DFO's least-risk timing windows (approximately November 30 to February 15, (DFO 2013); exact dates to be refined to reflect local conditions, based on pre-construction field surveys and in consultation with DFO) to reduce mortality to fish during important lifecycle stages. However, as it is known that certain species of marine mammal (such

as humpback whales) may be present in the LAA during this time period, additional mitigation measures will be implemented, as detailed below.

2.2.1 Design Measures

Project marine blasting activities will comply with DFO's Blasting Guidelines (Wright and Hopky 1998). The blasting design will consider, for example, appropriate measures to reduce overpressure, through the optimum use of explosives for rock blasting. Where possible (i.e., if low tides occur during daylight hours), blasting will be timed with low tides to reduce the number of detonations that occur underwater. Blasting will be conducted within DFO least-risk timing windows (approximately November 30 to February 15, (DFO 2013g); exact dates to be refined to reflect local conditions, based on pre-construction field surveys and in consultation with DFO) to reduce mortality to fish (i.e., potential marine mammal prey species) during important lifecycle stages.

2.2.2 Monitoring

According to DFO's Blasting Guidelines, sounds produced by a 100 kPa blast are unlikely to harm marine mammals that are at least 500 m from the source (Wright and Hopky 1998). As with pile installation, a marine mammal observation program will be implemented, through which trained MMOs will monitor the blasting area for thirty minutes prior to the start of blasting, and throughout blasting operations. The MMOs will be authorized to delay the start or temporarily terminate blasting activities if cetaceans or SARA-listed marine mammals enter the blasting safety radius (i.e., exclusion zone). Blasting will not recommence until the exclusion zone has been clear of such sightings for thirty minutes. Additional information on regulatory permits, exclusion zones, and contacts for blasting will be detailed in the Blasting Management Plan (Appendix J.11 of the EIS Addendum). The exact radius of the exclusion zone (minimum of 500 m) will be determined through consultation with DFO.

Turbidity will be monitored during blasting and, if levels exceed the WQG outside the active work area, further mitigations will be used (rate of blasting reduced, silt curtains installed). Please refer to the Habitat Offsetting Plan (Appendix G.10 of the EIS Addendum) for further information on mitigation measures to reduce project-related effects on fish.

PNW LNG has also begun a series of dedicated vessel-based line transect surveys to identify periods of elevated usage/presence in the PDA and LAA, and to confirm that appropriate mitigation measures are implemented to reduce the potential for harm and change in behaviour of marine mammals. Additional details concerning these surveys are provided in Section 3.0.

2.3 DREDGING

Construction of the MOF will require dredging of approximately 690,000 m^3 of material over an area of less than 60,000 m^2 and to a depth of 12.5 m. Since submission of the EIS, PNW LNG has advanced the project engineering and determined that of the total volume, less than 200,000 m^3 is marine sediment, and the remaining material is rock. The 200,000 m^3 will be dredged with a trailing suction hopper dredge (TSHD) to remove surface sediment and a backhoe dredge to remove blasted rock and sediment. Dredging will occur over a period of approximately six months (October through March). Dredging at the MOF will introduce underwater noise and result in resuspension of marine sediment, leading to increases in TSS levels and potential for dispersal of contaminants from sediment.

In a recent study characterizing underwater sound levels of three TSHDs (the louder of the two dredging methods), source levels (SLs) were found to range from 161 to 177 dB_{rms} re: 1µPa @ 1m (Reine et al. 2014). The upper threshold of these values remain below the NOAA interim permanent auditory injury thresholds of 190 and 180 dB_{rms} for pinnipeds and cetaceans, respectively (Appendix A of the EIS Addendum), and will decrease rapidly with distance from the source.

The Canadian Council of Ministers of the Environment (CCME) sediment and water quality guidelines (WQG) for protection of marine life are used to assess potential effects of contaminants and TSS in sediment and water. The sediment release associated with dredging is estimated to be 1% for the TSHD (from bottom disturbance and release of overflow water from the hopper) and 3% for the backhoe dredge (for sediment; however, the material will be a mix of sediment and rock). During dredging at the MOF, TSS levels are predicted to exceed the WQG for continuous activity (5 mg/L above background) only within the active work area (defined as the immediate area surrounding operating construction equipment within the marine infrastructure footprint) and in isolated areas along the Lelu Island shore to the north and south of the dredge area, again mainly near the bottom of the water column.

Disturbance of small amounts of sediment containing proportionally low amounts of contaminants during dredging would result in dispersal along these areas, and the sediment would settle into areas with similar chemistry and contaminant levels. Furthermore, this area already experiences extended periods of elevated TSS during the Skeena River spring freshet and throughout the year. The naturally high and fluctuating levels of turbidity and TSS within these adjacent coastal waters mean that potential effects of suspended sediment plumes will likely be of little concern for marine mammals. Further information about TSS levels and deposition of sediments from dredging activities is provided in Appendix O of the EIS and Appendix J.8 of the EIS Addendum.

Contaminants associated with dredging are not expected to pose toxicological risks to marine biota. Levels of contaminants measured in sediments within the PDA are consistent with results for other studies in the Prince Rupert area (Fairview Phase II, Canpotex). Sediment meets the criteria provided in the draft Environment Canada (2014) guidance on dioxins and furans in

sediment for disposal at sea at non-dispersive sites and is not expected to cause effects to aquatic life or to consumers of marine organisms. Other contaminant concentrations were below disposal at sea screening criteria in all samples or were naturally occurring (arsenic and copper). Further information about potential bioaccumulation concerns related to dredging is provided in Appendix L of the EIS.

Any project construction related change in sediment or water quality associated with TSS and contaminants (from dredging, disposal at sea, or vessel maneuvering at the LNG carrier berth) are therefore not expected to result in toxicological risks or cause direct mortality, physical injury, or behavioral changes in marine mammals. However, mitigations (including design measures) that will reduce the extent of TSS and contaminant levels are included below.

2.3.1 Design Measures

Dredging operations will be conducted using methods and/or equipment that reduces sediment spill. The EIS considered plans to dredge a further 7 million m^3 of material over an area of approximately 84.6 ha for the marine terminal. As an additional mitigation measure, the marine terminal has been redesigned to avoid the need for this dredging, thus substantially reducing the temporal and spatial extent of potential behavioural effects on marine mammals associated with underwater noise.

2.3.2 Monitoring

Turbidity will be monitored during dredging (as well as during other in-water construction activities such as blasting) and compared to water quality guidelines and to a TSS-turbidity calibration curve to infer TSS levels. In the event that inferred TSS levels exceed modelled TSS levels outside of the active work area, the rate of the activity will be adjusted (e.g., slowed), or additional mitigation measures implemented (e.g., silt curtains) to minimize the spatial extent of elevated turbidity and TSS.

If it is determined that pile installation and dredging need to occur simultaneously, potential underwater noise levels will be modelled to inform mitigation measures, and a monitoring program will be developed.

2.4 DISPOSAL AT SEA

Marine sediment excavated during any project related dredging activities requires disposal. PNW LNG currently anticipates dredging up to 200,000 m^3 of sediment for construction of the MOF, along with up to 490,000 m^3 of rock. Rock will be reused during construction as fill on Lelu Island, where practical. An application will be made to Environment Canada under the Disposal at Sea Regulations of the *Canadian Environmental Protection Act* for disposal of the sediment at the previously used ocean disposal site at Brown Passage. Disposal of dredged material at Brown Passage will result in an increase in TSS levels and potential for dispersal of contaminants from sediment.

Disposal of dredge material from the MOF is expected to occur over approximately six months, with one trip every 18 hours to the disposal site at Brown Passage. Barge capacity is expected to be 3,000 m^3, and will require approximately 85 one-way trips of barges and assisting tugs to ship up to 200,000 m^3 of sediment. Underwater noise produced during vessel transit and disposal at sea activities (including vessel transit) is not likely to cause mortality or physical injury to marine mammals, but may cause behavioural change. Please see Section 3.5 (below) for a discussion of mitigations related to vessel operations.

During disposal of sediment at Brown Passage, TSS levels are expected to meet the WQG in near surface waters (0 to >50 m) but are predicted to be above the WQG in >100 m deep waters for up to six hours after the disposal event. Concentrations at all depths are expected to meet the WQG within 12 hours of the disposal event. After the completion of all disposal operations, TSS levels will decrease to less than 1 mg/L above background within a few days, as the suspended sediment settles out on the seabed and is further dispersed. It is anticipated that the disposal site will rapidly return to near baseline conditions once disposal is complete. Further information about TSS levels and deposition of sediments from disposal activities is provided in Appendix O of the EIS.

Disposal of dredged sediments from the MOF at the disposal at sea site is not expected to pose toxicological risks (i.e., through bioaccumulation) to marine mammals. Dioxins and furans in the dredge material are present at concentrations that are higher than at the disposal site; however, levels are below Environment Canada (2014) draft guidance thresholds for a non-dispersive site (lower action level [LAL] of 9 pg/g TEQ in specific sediment layers and an overall management objective [OMO] of 0.85 pg/g TEQ as a volume-weighted average for the entire dredge volume). Levels are also at least ten times lower than the PEL guideline, and other contaminant concentrations are below disposal at sea screening criteria or, like copper and arsenic, reflect natural background conditions. Further information about potential bioaccumulation concerns related to dioxins and furans at the disposal at sea site is provided in Appendix L of the EIS.

2.4.1 Design Measures

Since submission of the EIS, PNW LNG has advanced the project engineering and determined that of the total volume, less than 200,000 m^3 is marine sediment, and the remaining material is rock (as outlined in Section 3.3.1), which reduces the amount of material to be disposed of at sea. At the disposal site, sediment will be disposed within the approved disposal area. Material from the dredge area that is suitable for construction or habitat offsetting (e.g., rock) will be used rather than disposing of it at sea to reduce the amount of disposal material and associated potential TSS levels. Detailed design engineering has resulted in a decrease in the sediment volume to be disposed of at sea.

2.5 SHIPPING OPERATIONS AND VESSEL MANEUVERING

Approximately 350 LNG carriers will arrive at the marine terminal each year (in Phase 2 of the Project) for at least 30 years. LNG carriers will travel though the LAA between the marine terminal and the Triple Island Pilot Boarding Station (accompanied by one escort tug during both inbound and outbound transits). At full build-out, one LNG carrier per day is expected to call on the marine terminal. Berthing will involve the LNG carrier and up to four tugs. Site decommissioning and clean-up will also require use of vessels.

All vessels associated with construction and operations of the Project have the potential to collide with marine mammals. Depending on the severity of the strike, this may result in recoverable injuries, serious injuries, indirect or direct mortality, or reduced fecundity or fitness. There may also be behavioural effects associated with vessel strike avoidance. While sound levels produced by project related vessels are not predicted to exceed auditory injury levels, underwater noise from movement and berthing of LNG carriers is predicted to result in changes in behaviour to marine mammals (see Appendix A of the EIS Addendum). Underwater noise that exceeds behavioural thresholds could affect localized distributions and communication of marine mammals over the short-term (as potential exposure to the passing vessel will be transient in nature).

2.5.1 Design Measures

LNG carriers for the Project will be piloted between Triple Island and the LNG carrier berth by a qualified marine pilot. Vessels calling on the project terminal will approach Prince Rupert Harbour in designated shipping routes from the open waters north of Haida Gwaii through Dixon Entrance to the pilot station north of Stephens Island. From there they will be guided by pilots and the Coast Guard Marine Communications and Traffic System to avoid collisions with other vessels, hazards of grounding, and where information is available, interaction with marine mammals or concentrations of fishing vessels.

PNW LNG will not own or operate the LNG carriers that will call on the marine terminal and will have no direct control over any vessel other than while at berth; PNW LNG will be able to set requirements on the design and safety requirements of vessels allowed to berth. Estimated speed profiles for LNG carriers described below will reduce the risk of vessel strikes with marine mammals. Additional measures specific to reducing the risk of vessel strikes will include exchange of information on marine mammal activity between pilots, and course alteration if a marine mammal is sighted in the path of a vessel (when and where possible and deemed safe to do so by the vessel master and marine pilot). PNW LNG cannot set speed limits for LNG carrier; this can only be done by the PRPA or Transport Canada and course alterations are at the discretion of the pilot.

Research suggests that the probability and severity of a marine mammal ship strike is positively correlated with vessel speed (Kite-Powell et al. 2007; Vanderlaan and Taggart 2007). Kite-Powell et al. (2007) used right whale diving behaviour and data from observed encounters to model

strike probability based on vessel speed. They determined that a large vessel travelling at 25 knots has a 50% chance of striking a whale travelling in its path, but that this probability is reduced to 30% at a speed of 10 knots. Based on historical records of vessel strikes to large whales between 1885 and 2002, Vanderlaan and Taggart (2007) modelled the probability of severe or lethal injury based on a vessel's speed. At speeds of 18 knots and higher, vessels were predicted to have over a 92% probability of lethality. Probabilities decreased with speed: from 78% at 15 knots, 61% at 13 knots, 31% at 10 knots, to below 12% at speeds of 7 knots or less. Laist et al. (2001) similarly concluded that serious injuries to large whales are infrequent at vessel speeds of less than 14 knots, and are rare below 10 knots. The other important factor in predicting likelihood of a strike is the degree of overlap between shipping traffic and whale presence. Ship strikes are more likely in areas (and times of year) when high densities of traffic and marine mammals overlap.

Generally speaking, underwater noise is also reduced at reduced vessel speeds. Vessels will transit to and from the pilot station at reduced speeds to diminish the amount of underwater noise and the likelihood of serious injury to large cetaceans from a vessel strike. LNG carriers, tugs, and barges will not exceed a speed of 16 knots within the LAA, and LNG carrier vessel speed will be reduced to 4 knots when approaching the Triple Island Pilot Boarding Station. Figure 2 provides an overview of the predicted LNG carrier speeds along the 22 nautical mile southern shipping route within the LAA. The Project will also use tugs with less sediment scour-inducing propulsion systems (e.g., Voith Schneider), which is expected to reduce TSS levels, and may reduce underwater noise.

Elevated TSS levels caused by vessel maneuvering during arrival (berthing) and departure were considered for potential adverse effects. However, modelling of maneuvering associated with the marine terminal design mitigation indicate that increased TSS levels from vessel maneuvering are low, occur over a short time, and dissipate quickly.

2.5.2 Monitoring

In the event of a vessel strike, all pertinent details will be reported to the BC Marine Mammal Response Network (Observe, Record, Report) at 1-800-465-4336.

3.0 Future Initiatives

In November 2014, PNW LNG began a marine mammal field program that will consist of a series of monthly dedicated vessel-based line transect surveys to estimate relative abundance of marine mammal species in the PDA and LAA. These vessel-based line transect surveys will be conducted once per month for one year prior to construction, will each take approximately four days to complete (plus potential weather delays), and will be designed, conducted, and analyzed using generally accepted and statistically rigorous survey protocols and analytical techniques based on distance sampling methods (Buckland et al. 2001). The data collected during the surveys will be used to estimate densities of marine mammal species sighted, given

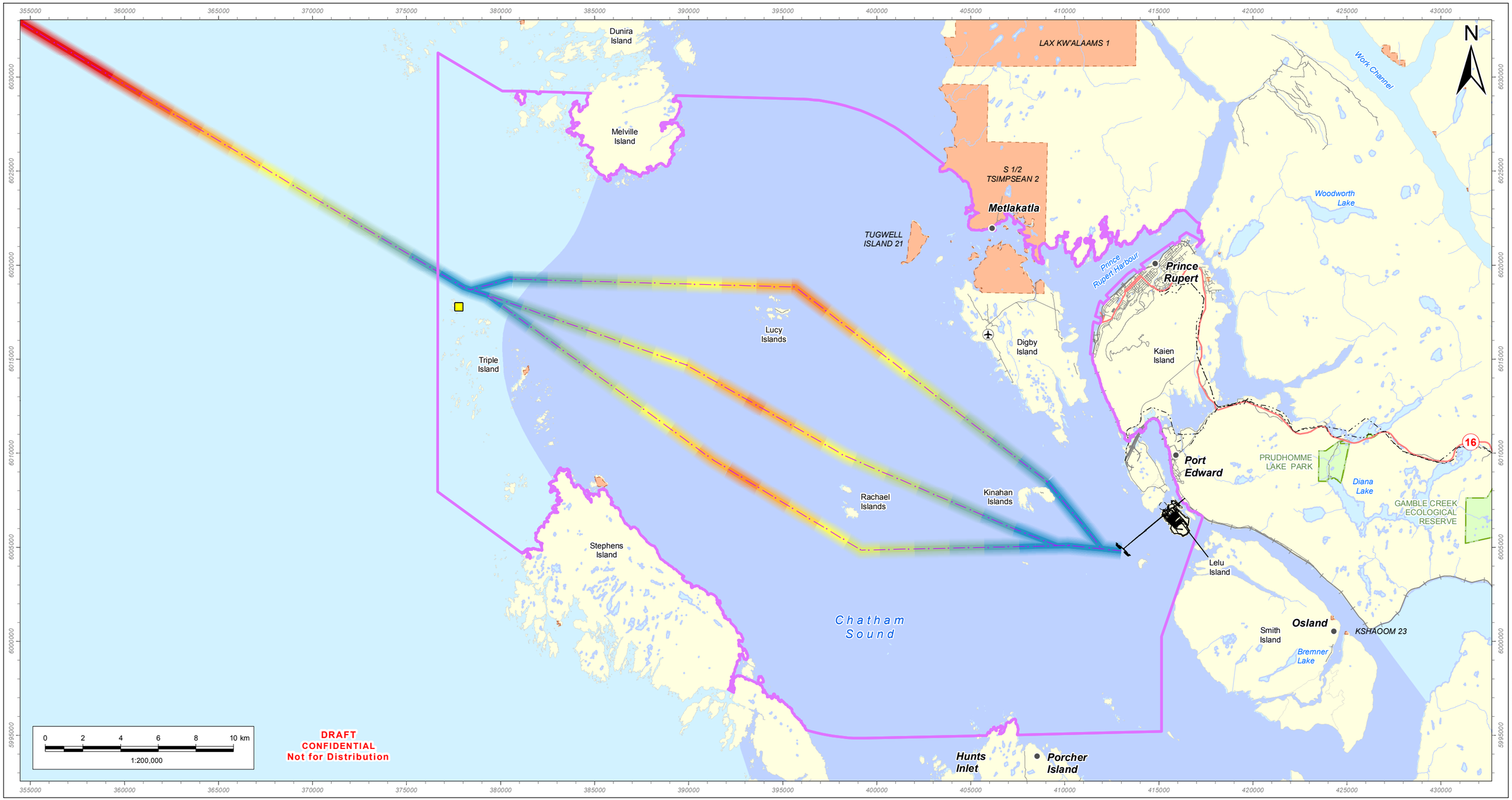
appropriate numbers of sightings. Where possible, density estimates will also be used to produce density surface maps. Results, which will be made publicly available, will be used to further scientific understanding of the densities, seasonal use, and distribution of all marine mammal species present in the study area. An additional finer scale survey of the PDA will be conducted once per month in coordination with fish and fish habitat surveys. The primary purpose of the program is to use survey results to assess and refine mitigation measures, prior to construction activities, to better address the specific needs of local marine mammal populations. For example, further understanding of the time periods for peak densities of marine mammals in the LAA will allow PNW LNG, in consultation with DFO, to identify refined timing windows for marine construction activities, and thus mitigate potential effects. Additional surveys will be conducted during operations (and potentially decommissioning, if deemed necessary at the time.

Underwater sound levels will be measured/monitored in situ during the first seven days of underwater blasting and impact pile driving to acquire baseline data on sound pressure levels produced during each activity. Results will be used to field-validate the effectiveness of bubble curtains and the size of the safety radius (currently set at 500 m for blasting and 1.0 km for pile driving). Monitoring will be conducted at the sound source and at the edge of the marine mammal safety radius (i.e., exclusion zone). Measurements for source levels are made close to the source, typically at a distance of 10 to 100 m. The exact distance and location will depend on several factors, such as source type and amplitude, and water depth. Measurements may be taken at multiple distances simultaneously to assist with confirming the back-propagation function. Should the construction equipment or technique change notably over the course of construction (e.g., pile installation method or material, blasting charge etc.), such that source levels measured at the onset are unlikely to remain representative, new source levels will be acquired. PNW LNG is also investigating options for hydrophone deployment to collect information on vocalizing marine mammal species in the PDA, results of which will be used to supplement the vessel-based visual observation program.

Fisheries and habitat studies will also be conducted between November 2014 and June 2015 and will focus on the project area around Lelu Island, Flora, Agnew and Horsey Banks. These studies may be used to further the understanding of distribution and timing of potential marine mammal prey species. The proposed fisheries work uses a range of methods to quantify the relative abundance, distribution and habitat use of CRA species and forage fish that have been identified as important by DFO, including Pacific salmon, crab, shrimp, herring, eulachon, and flatfish (flounder, sole), and forage fish species (surf smelt, sandlance). The proposed survey program will integrate: hydroacoustic surveys paired with trawls; seining, intertidal and subtidal trapping; collection of oceanographic water property data and physical habitat information; and habitat surveys at a reconnaissance level by site. Based on the results, the fisheries assessment program will be amalgamated into the construction monitoring and compliance follow-up program for the Project and continued for a multi-year program as required. Please refer to the Habitat Offsetting Plan (Appendix G.10 of the EIS Addendum) for further information on future field programs associated with potential marine mammal prey species.

4.0 FIGURES

Please see the following pages.



Marine Resources Local Assessment Area and Regional Assessment Area
Project Component
Project Shipping Route
Pilotage Station

Airport
City or Town
Highway
Secondary Road
Railway
Electrical Power Transmission Line

Watercourse
Water Body
Skeena Estuary
Indian Reserve
Protected Area

Speed (kt)
4
5
6
7
8
9
10
11
12
13
14
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16

Pacific NorthWest LNG

Estimated LNG Carrier Speeds

Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

DATE: 07-OCT-14
FIGURE ID: 123110537-846
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
DRAWN BY: R. COATTA
CHECKED BY: B. BYRD

PREPARED BY: Stantec
PREPARED FOR: Pacific NorthWest LNG
FIGURE NO: 2

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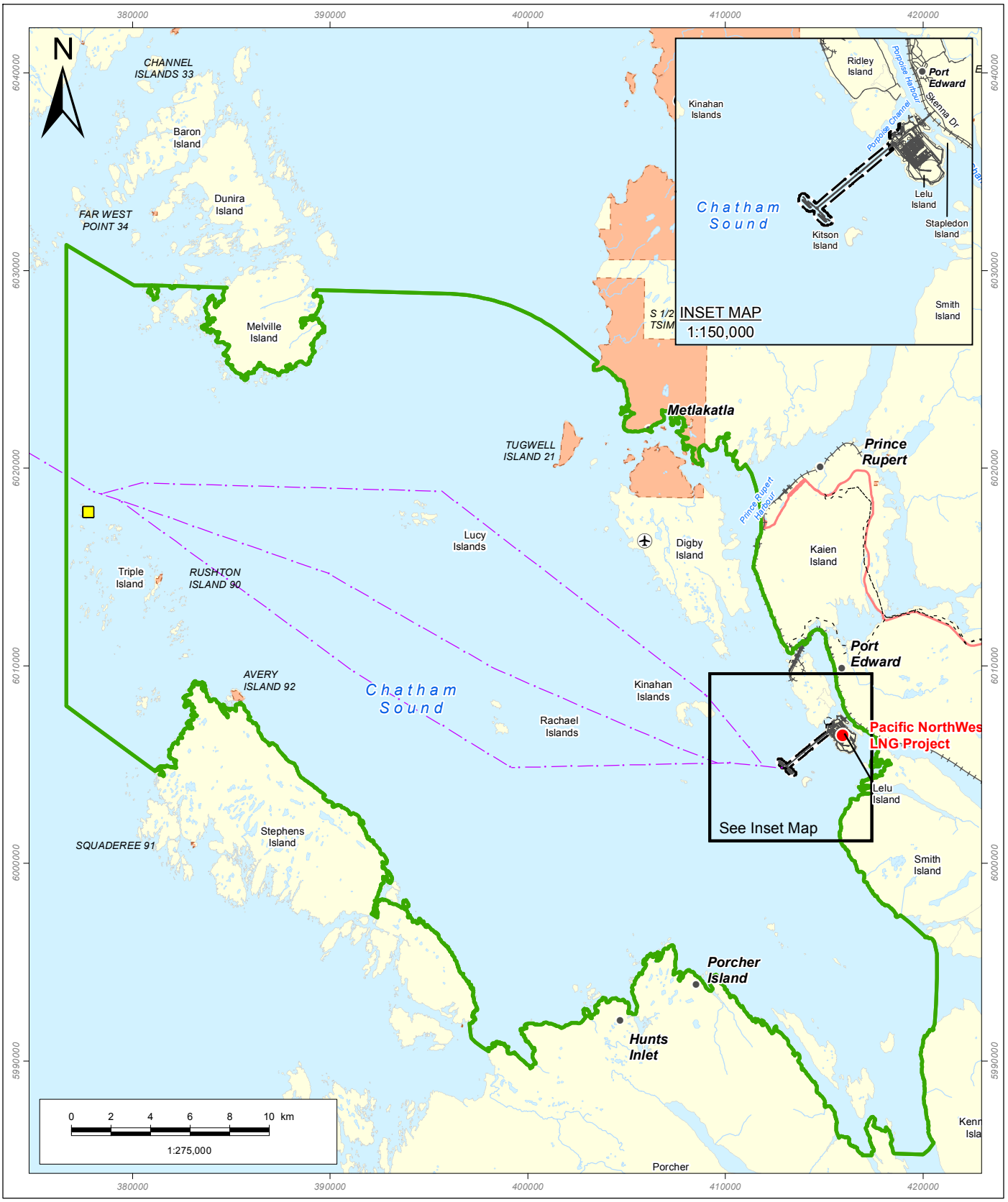

Airport
City or Town
Pilotage Station
Project Location
Electrical Power Transmission Line
Highway or Road
Project Component
Project Shipping Route
Railway
Watercourse
Indian Reserve
Marine Resources Local and Regional Assessment Area
Protected Area
Waterbody

Pacific NorthWest LNG

Marine Resources Local Assessment Area and Regional Assessment Area

Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Fisheries and Oceans Canada, 2011. Commercial Fisheries Data, 2000-2009. Data derived from Pacific Biological Station Stock Assessment Harvest Log Database.

Metadata available through Mapster. http://www.pac.dfo-mpo.gc.ca/gis-sig/maps-cartes-eng.htm

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

DATE: 07-OCT-14
FIGURE ID: 123110537-841
DRAWN BY: T. CARDINAL
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: C. LION

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: 1

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Appendix J.9
Vegetation Management Plan

J.9 PRELIMINARY DRAFT VEGETATION MANAGEMENT PLAN

1.0 INTRODUCTION

Pacific NorthWest LNG Limited Partnership (PNW LNG) has developed a preliminary draft Vegetation Management Plan for the construction phase of the Pacific NorthWest LNG (the Project) that outlines regulatory requirements and commitments in the Environmental Impact Statement (EIS) and best management practices that will be implemented to: reduce the disturbance of sensitive ecological communities and wetlands; protect existing native plants; reduce the introduction or spread of invasive plants; and control the impacts of sedimentation, erosion, soil salvaging and drainage to vegetation within the project area.

This preliminary draft plan presents a framework for managing potential adverse environmental effects based on the EIS for the Project and subsequent feedback from regulators, Aboriginal groups, stakeholders and the public. This plan will be updated and refined based on detailed Engineering Procurement Construction and Commissioning (EPCC) Contractor design and permitting requirements.

Roles and responsibilities related to environmental management are generally described in the Environmental Management Plan (EMP) Overview, Section 3.0. General information pertaining to compliance monitoring is provided in Section 2.2 of the EMP Overview.

1.1 REGULATORY CONTEXT

Vegetation and wetland resources are primarily managed under the *Species at Risk Act* and the *Federal Policy on Wetland Conservation* on federal lands. Provincial legislation relevant to the regulation of these resources includes the *Oil and Gas Activities Act*, the *Forest Act*, and the *BC Weed Control Act* and Weed Control regulations. In particular this legislation and policies address the following:

- *Species at Risk Act*:
  - Prohibits the killing, harming, or taking of federally-listed species
  - Requires identifying potential adverse effects on listed species during the project review process.
- Federal Policy on Wetland Conservation:
  - Commits all federal departments to the goal of no net loss of wetland functions on federal lands and waters and where federal activities affect wetlands designated as ecologically or socioeconomically important to the region.
- *Oil and Gas Activities Act* - Directs proponents conducting oil and gas activities on provincial Crown land to:
  - Avoid operating in wetland or riparian reserve zones (except crossings); when crossing, no deleterious substances will be deposited and mitigation may be required
  - Maintain natural flows, retain vegetation within riparian management areas
  - Prevent transport or establishment of invasive plants as a result of project construction and operations activities
  - Limit alteration of natural surface drainage patterns

Further information regarding the relevance of these aspects will be incorporated into the final Vegetation Management Plan, and will be based on Prince Rupert Port Authority authorization for land clearing and site preparation practices.

- *Forest Act*
  - A master license to cut Crown timber for purposes under the *Oil and Gas Activities Act*. Must be consistent with *Forest and Range Practices Act* (and associated regulations)
- *BC Weed Control Act* and Weed Control Regulations
  - Requires control of designated noxious plants

2.0 MITIGATION PROGRAM

The preparation of site-specific infrastructure for the Project will unavoidably result in the loss of terrestrial and wetland vegetation. Best management practices and mitigation measures will be implemented to manage adverse environmental effects to vegetation, wetlands and soils (see Table 1).

Table 1 Overview of Soils and Vegetation Best Management Practices and Mitigation Measures

Activity	Best Management Practices and Mitigation Measures
Vegetation and Wetlands	
Preparation	A Wetland Habitat Compensation Plan for the restoration and creation of wetland habitat will be developed as a component of compensation plans once EPCC contractor specifics and project design have been confirmed.
	Training and education about sensitive ecological communities and locations will be provided to all relevant parties working on the Project.
	A Species at Risk Discovery Contingency Plan will be developed as part of the final EMP and followed in the event that any species of conservation concern should be discovered during the construction or operational phases of the Project.
	High quality seedlots in all commercial seed mixes will be sourced when re-vegetation is required to reduce the likelihood of invasive species being introduced to the project site.
	Construction limits will be demarcated with signs to alert workers and restrict access to areas containing sensitive ecological communities and / or areas potentially containing provincially or federally-listed ecosystems, during construction.
	Temporary storage of materials will be limited to within the Project development area boundaries; if temporary workspace or storage areas are required beyond the Project development area, they will be located in existing cleared areas to the extent possible.
	Prior to project construction, a complete invasive plant species list, including photographs, will be compiled for easy identification of potential species of concern.
	Locations of shoreline storm water outfalls will be located at least 30 metres form any sensitive wetlands.

Activity	Best Management Practices and Mitigation Measures
	Maintain a 30 metre riparian vegetation buffer around Lelu Island based on the high-water mark, taking into account wind firming the buffer to prevent blow down. This excludes access points (e.g., at the bridge, pioneer dock, marine offloading facility, trestle and pipeline interconnection).
	Permanent fencing will be erected around the Project.
Clearing and Grading	Species identified as being of traditional Aboriginal significance will be used for re-planting wherever possible and practical.
	Guidelines for restricted activity periods to protect wildlife and marine birds will be followed. Clearing activities will occur outside of the breeding season for terrestrial birds, amphibians, and bats (April 9 through August 7), and will avoid the breeding period for raptors (January 5 through September 6). If clearing is required during these breeding periods, bird surveys will be conducted in advance of vegetation clearing by a BC-certified Registered Professional Biologist. Buffers will be established around active nests and clearly marked to show the extent of clearing.
	If raptor nests are identified within the clearing limits of the Project development area and require removal, a permit approval under Section 34 of the BC Wildlife Act would be required, where the Act applies.
	Vegetation cover will be replaced wherever possible once the construction phase is complete.
	Monitoring of soils and vegetation to assess if nitrogen deposition is affecting abundance or distribution of plant species will be undertaken throughout project construction.
	Use of herbicides will be restricted near sensitive ecological communities.
	During construction, and where possible, re-vegetate temporarily inactive areas that are capable of supporting vegetation using interim native grass/legume/forb seed mixtures to prevent invasive plant establishment.
	Refrain from driving through off-site areas infested with invasive plants. Equipment can be inspected by a designated Environmental Monitor to ensure compliance during the project construction phase.
	Avoid wetland ecosystems, especially any provincially or federally-listed communities, during project construction and operational phases. Clearly delineate construction limits using temporary fencing based on final project design and project disturbance area commitments.
	Keep equipment yard and vehicle storage facilities free of invasive plants.
	Use of herbicides will be restricted near sensitive ecological communities.
Operations	Where possible, avoid disturbing existing known locations of native plants and species of conservation concern.
	Keep equipment yard and vehicle storage facilities free of invasive plants.
	Refrain from driving through off-site areas infested with invasive plants
	Train personnel to check and remove plant parts from clothing and equipment to help prevent the spread of invasive plants.
	All staff can identify unwanted plants and report them to the designated Environmental Monitor.
	A weed control program will be implemented to monitor the establishment of weeks within the Project Development Area and adjacent lands.

Activity	Best Management Practices and Mitigation Measures
Soils	
Preparation	Drainage and erosion controls will be put in place to mitigate the direct effects of storm water runoff.
	Implement drainage and erosion controls to maintain the local surface and ground hydrology.
	All soil and sediment fill materials will be inspected at the source and tested for potential contaminants (i.e. metals) prior to being placed at the project site.
	Install erosion control measures including, but not limited to, diversion berms, interception ditches, sedimentation ponds, silt fences and silt curtains.
	Ensure erosion and runoff structures, such as rip-rap, are placed in key locations to mitigate runoff, stabilize slopes and provide marine habitat.
	Do not wash vehicles and equipment within the designated 30 metre riparian buffer zone.
	Install stormwater dissipaters and berms to reduce overland runoff.
	Construct sediment capture ponds with enough capacity to capture runoff and prevent overflow into the marine environment.
	Runoff and storm water laden with fine sediments should be filtered until compliance is achieved with the applicable regulatory guidelines prior to release into marine or freshwater environment (see Marine and Freshwater Environmental Management Plan – Appendix J.8 of the EIS/Addendum).
	Contain and stabilize waste materials (i.e., uprooted logs and plants, construction waste etc.) above the high water mark or cover to prevent significant soil runoff and sedimentation.
	Do not wash vehicles and equipment within the designated 30 metre riparian buffer zone.
Operations	Ensure that a stormwater capture and treatment system is used on Lelu Island during operations to manage increased runoff from impervious surfaces.
	Ongoing maintenance and monitoring of erosion control structures for stability, function and effectiveness.

3.0 ENVIRONMENTAL COMPLIANCE MONITORING AND REPORTING

3.1 ENVIRONMENTAL COMPLIANCE MONITORING

Construction activities will be monitored full-time during start-up through to project completion and for a project of this scope will include a team of monitors. Procedures for monitoring the impact of project activities on vegetation, wetlands and soils are outlined in the Environmental Monitoring Management Plan (Appendix J.16 of the EIS/Addendum).

3.2 ENVIRONMENTAL COMPLIANCE REPORTING

Environmental monitoring reports will be filed by the Environmental Monitor(s) on a weekly basis. These reports will include photographs of the construction activities as well as details of concerns or incidents involving vegetation, wetlands or soil conservation, and the subsequent follow-up. The Environmental Monitor(s) will submit the weekly monitoring reports to PNW LNG's Environmental Manager.

Appendix J.10
Waste Management Plan

J.10 PRELIMINARY DRAFT WASTE MANAGEMENT PLAN

1.0 INTRODUCTION

Pacific NorthWest LNG Limited Partnership (PNW LNG) has developed a preliminary draft Waste Management Plan for the construction and operation of the Pacific NorthWest LNG Project (the Project) that outlines the implementation of best management practices and mitigation measures to appropriately manage wastes.

All project personnel will abide by federal, provincial, company and project specific requirements for the storage, handling, transport, disposal, and reporting of chemicals and waste materials that are potentially deleterious to the environment. Awareness of these requirements will be integrated, as appropriate, into various levels of NW LNG's overall environmental orientation program.

This preliminary draft plan presents a framework for managing potential adverse environmental effects based on the Environmental Impact Statement (EIS) for the Project and subsequent feedback from regulators, Aboriginal groups, stakeholders and the public. This plan will be updated and refined based on detailed Engineering Procurement Construction and Commissioning (EPCC) Contractor design and permitting requirements.

Roles and responsibilities related to environmental management are generally described in the Environmental Management Plan (EMP) Overview, Section 3.0. General information pertaining to compliance monitoring is provided in Section 2.2 of the EMP Overview.

1.1 REGULATORY CONTEXT

The EPCC Contractor will be responsible for complying with applicable permits, codes, regulations and industrial standards for waste management. The Environmental Monitor(s) or other authorized inspectors will audit the implementation of construction and operations waste management policies and procedures for handling and disposing of waste. If a hazardous waste release occurs, the Environmental Emergency Preparedness and Response Plan (EEPRP) will be implemented (see Appendix J.6 of the EIS/Addendum).

The primary legislation around waste management in British Columbia (BC) is the BC *Environmental Management Act*, including the BC Spill Reporting Regulation and the BC Hazardous Waste Regulation. Although the Project is located on federal lands, disposal of wastes off-site will require that these provincial standards be met. Management of spills of both hazardous and non-hazardous wastes is addressed the EEPRP. The *Environmental Management Act* prohibits the introduction of waste into the environment from any activity in a manner or quantity that causes pollution. Pollution is defined in the *Environmental Management Act* as the presence in the environment of substances or contaminants that substantially alter or impair the usefulness of the environment. Waste is broadly defined to include air contaminants, litter, effluent, refuse, biomedical waste, and hazardous waste.

The *Environmental Management Act* establishes a detailed process for managing hazardous wastes. Hazardous wastes include:

- Dangerous goods which are no longer used for their original purpose
- Polychlorinated biphenyl waste
- Biomedical wastes
- Wastes containing dioxin
- Waste oil
- Waste asbestos
- Waste pest control product containers
- Leachable toxic waste
- Waste containing tetrachloroethylene
- Waste containing polycyclic aromatic hydrocarbons.

The Hazardous Waste Regulation sets out siting and operational requirements and performance standards for facilities. These include on-site management facilities dealing with hazardous wastes. Any operation or individual generating hazardous waste must register the waste and apply for a provincial identification number.

The Federal *Transportation of Dangerous Goods Act*, and the accompanying Transportation of Dangerous Goods Regulation, applies to all modes of transportation of dangerous goods in Canada, and includes the transportation of hazardous wastes.

The Transportation of Dangerous Goods Regulation sets out a system of product classification, documentation and labelling; placarding and marking of vehicles; hazard management; notification and reporting; and employee training. The transportation of hazardous and dangerous wastes requires that a prescribed “waste manifest” must be completed by the shipper, the carrier and the receiver.

2.0 MITIGATION PROGRAM

The preliminary draft Waste Management Plan establishes guidance for PNW LNG and the EPCC Contractor who generate, collect and manage waste or provide supervision of wastes generated and collected by others. It also provides the initial procedures for waste collection, temporary waste storage, waste transportation and disposal or recycling.

Project waste streams will include:

- Recyclable materials (e.g., cardboard, selected wood and glass, metals, selected paper, card and plastics, batteries, used and drained oil filters)
- Municipal-type solid waste (e.g., general refuse and food scraps)
- Municipal-type liquid waste (e.g., sanitary waste)
- Non-hazardous waste (e.g., tires, untreated timber, untreated wood and untreated sawdust and selected construction debris)

- Hazardous waste (e.g., empty aerosol cans, oil-based paints and containers, waste fuels, volatiles and paints in aerosol cans, glycol-based antifreeze, grease tubes, acid or caustic materials, fluorescent light bulbs, treated timber)
- Specific hazardous wastes (e.g., used or waste oils, petroleum-hydrocarbon-affected soils and water)
- Oily wastes (e.g., used absorbent pads and rags, used oil filters)
- Medical wastes from first aid stations (e.g., used dressings, expired medications and sharps).

2.1 GENERAL WASTE MANAGEMENT

The following general waste management and mitigation measures (Table 1) will be implemented, as appropriate.

Table 1: Waste and Hazardous Waste Management and Mitigation

Activity	Best Management Practices and Mitigation Measures
General	All site personnel will exercise good housekeeping to remove waste and ensure that all work areas, storage areas and yards are kept tidy and well-maintained.
	All reasonable preventive measures will be taken to avoid the release of waste or hazardous materials into the environment.
	Material Data Safety Sheets (MSDS) will be maintained on site.
	All incidents involving waste and hazardous material will be reported to the Environmental Monitor(s) and to the appropriate regulatory authorities, according to applicable regulations.
	Where a choice of hydrocarbons exists, the one least hazardous for the application will be selected.
	Waste will be recycled whenever possible.
	Hazardous and waste materials will, to the extent feasible, be disposed of or moved to a secure staging area, as required.
	Spoil piles and waste will be maintained at least 30 m from the marine environment (high water).
	Waste and spoil piles will be covered to prevent materials from being entrained during wet weather.
	Feeding and harassment of wildlife will be prohibited.
Spills	Review and adhere to the guidelines presented in the EEPRP, in regards to containment and clean-up of spills.
Collection	Construction debris and waste materials will be collected, transported and disposed of off-site.
	Waste containers must be provided around the facility site.
	Store waste and recycling materials on-site in wildlife-proof containers for permanent disposal at an approved facility.
	During construction, collect waste generated from the work site on a daily basis and dispose of at an approved facility to avoid the attraction of nuisance animals. Waste collection during operations will occur as needed depending on volumes of material.
	Periodic assessments of disposal manifests will be incorporated into environmental inspection activities.
	All containers will be kept closed with lids tightened except when adding or removing waste.

Activity	Best Management Practices and Mitigation Measures
Disposal	Transport and dispose of all wastes in accordance with applicable regulatory requirements.
	All waste disposal will be on land and in accordance with applicable legislation, guidelines and best management practices.
	Waste will not be deposited in the marine environment. If debris is accidently deposited, best efforts will be made to collect it, if it is safe to do so.
Waste Burning	Burning of waste is strictly prohibited unless appropriate regulatory approvals are in place and the environment lead has been consulted.
Medical	Medical waste from first aid posts will be managed in accordance with federal and legislative guidelines, including BC Health requirements.

2.2 HAZARDOUS WASTES

In addition to the general waste management practices outlined above, the following measures will be implemented to ensure the safe management of hazardous wastes. The EPCC Contractor will provide additional detail to this preliminary draft prior to construction start-up.

- All hazardous wastes will be securely stored in rigid-walled containers (e.g., rolloffs, skips or drums) that prevent spillage and the entry of rainwater or snow
- Containers storing hazardous wastes will be positioned on an impermeable surface with 100% containment of the largest container, or as required by legislation
- Waste storage will take into account chemical incompatibilities waste classes:
  - Explosives, gases, flammable liquids, flammable solids, oxidizing substances and organic peroxides, toxic and infections substances, radioactive materials, corrosives, and miscellaneous products, substances or organisms.
- Wastes that could react together will not be placed in the same container, and will be stored and labelled in accordance with waste regulations and Workplace Hazardous Materials Information Systems (WHMIS). Incompatible wastes will be separated from one another to prevent the possibility of accidental mixing
- If there is uncertainty concerning segregation of containers, the site PNW LNG Environmental Manager will be contacted for verbal and/or written guidance
- Ignitable and reactive wastes will be protected from open flames, smoking, welding, sparks, hot surfaces, etc.
- All containers of waste will be durably and clearly labelled so that labels may be read from a reasonable distance and the contents know without opening the container
- Labels will include, at a minimum:
  - “Hazardous Waste” or “Non-Hazardous/Domestic-type Waste”
  - Hazard Class (if applicable)
  - Contents
  - Generator Name
  - Generating Area or Area of Origin (within site).

2.3 LIQUID WASTES

- Waste liquid will be stored and transported in double walled tanks compliant with applicable standards and regulations
- Personnel will refer to the guidance regarding types of containers in Part 5 of the *Transportation of Dangerous Goods Regulations*
- Liquid waste will be transferred into containers using funnels, pumps, or other flow control devices to minimize spills and contamination of the exterior of the container
- Liquid wastes will be stored in designated, approved above-ground storage tanks appropriate for the type of waste being stored
- Any container that is leaking, bulging, etc. will transferred to a secure contained, as appropriate
- Liquid hazardous wastes will be segregated and not mixed
- Used lubricant oils, hydraulic fluids, and flammable liquids will be collected in segregated double-walled tanks or leak tight steel or plastic drums with tight fitting bungs and placed within an impermeable secondary containment system built or installed in a designated hazardous waste storage area
- Waste liquid coolant will be stored in steel or plastic barrels with secondary containment (as detailed above)
- Hydrotest water will be filtered and re-used to the extent possible; when it can no longer be re-used it will be either disposed of off-site by the waste management contractor, or disposed of at sea, in accordance with the applicable Disposal at Sea Regulations
- Spills will be cleaned up immediately and any contaminated material (i.e., soil absorbent or rags) will be covered, bagged and/or containerized in accordance with the procedures outlined in the EEPRP.

3.0 WASTE TRANSFER AND TRACKING

3.1 TRANSFER

Materials identified for re-use will be stored in a designated location until they are required. When needed, reusable materials will be transferred and distributed for reuse to the appropriate location on site. All other waste will be transferred offsite for recycling or disposal as determined by the EPCC Contractor(s) and PNW LNG. The solid waste disposal site will be identified in the Final EMP, in consultation with the EPCC Contractor, PNW LNG, and appropriate authorities.

The EPCC Contractor will schedule hazardous waste and non-hazardous waste recycling and disposal shipments with the appropriate, licensed waste management contractor, and will ensure that all waste manifest paperwork is signed and in order. The waste management contractor will be licensed in accordance with the applicable federal and provincial legislation.

All vehicles transporting liquid wastes will be equipped with appropriate spill kits. Where required, the Contractor will ensure that drivers transferring wastes have current Transportation of Dangerous Goods certification.

3.2 TRACKING

The project contractor (during construction) or PNW LNG (during operations) will implement a waste tracking system governing all hazardous waste transfers in accordance with the federal *Transportation of Dangerous Goods Regulation* and provincial regulations. The following measures will be implemented:

- Waste logs and manifests will be maintained and filed as appropriate
- The manifest will include the following, at a minimum:
  - Generator's name, location and contact number
  - Generator's unique identification number
  - Transporter's name and contact number
  - Destination name, location and contact number
  - Description of waste
  - Quantity of waste
  - Time and date of shipment
  - The receiver of the waste
  - Date of receipt
  - How the waste was handled
- All documentation will be provided to PNW LNG on a monthly basis
- The generator or consignor of the waste will remain the owner of the waste and will sign as the regulatory generator on all application documents, including waste manifests
- In accordance with the *Transportation of Dangerous Goods Regulations*, the generator or consignor is responsible for determining the classification of dangerous goods.

4.0 ENVIRONMENTAL COMPLIANCE MONITORING AND REPORTING

4.1 ENVIRONMENTAL COMPLIANCE MONITORING

Environmental Monitors will be on-site during construction activities to monitor the effectiveness of mitigation measures in achieving regulatory compliance. Environmental monitoring requirements specific to waste management are presented in the Environmental Monitoring Management Plan (see Appendix J.16 of the EIS/Addendum). Additional details on inspections and their frequency will be provided in the final Waste Management Plan, prior to construction.

4.2 ENVIRONMENTAL COMPLIANCE REPORTING

A monthly Waste Management Monitoring Report will be submitted by the Contractor to PNW LNG. This report will include:

- A monthly summary of the quantity of wastes stored, transported and disposed of (recorded by waste stream)
- A monthly summary of the quantity of wastes re-used, recovered or recycled

- The results of reconciliation of transport and disposal records of waste manifests, with any discrepancies identified
- Waste monitoring and inspection results and corrective measures implemented
- Training records.

Records of all inspection reports, training, waste inventories, shipments, disposals and off-site transfers will be kept on file for a specific time period (i.e., three years). These records will be kept on site by the Contractor. Material Data Safety Sheets of all hazardous wastes stored on site will be maintained.

Waste logs will be maintained by the Contractor and are anticipated to include:

- Volume of all wastes being stored, reused, recycled or disposed of on-site per waste type identified
- Volumes and types of all waste transported for recycling and off-site disposal
- Duty of care documentation
- Waste transfer paperwork
- Signed waste manifests, with reconciled transport and disposal copies
- Weekly inspection logs
- Waste Profile Sheets provided by the generators
- Waste management contractor's authorizations to transport waste
- Copy of each permit or other authorization pertaining to the operation of each treatment or disposal facility used
- Environmental incident reports, where applicable.

Appendix J.11
Blasting Management Plan

Appendix J

J.11 PRELIMINARY DRAFT BLASTING MANAGEMENT PLAN

1.0 INTRODUCTION

Pacific NorthWest LNG Limited Partnership (PNW LNG) has developed a preliminary draft Blasting Management Plan for the construction phase of the PNW LNG Project (the Project). This preliminary draft Blasting Management Plan outlines management practices and mitigation measures to address potentially harmful impacts to the environment from blasting during project construction, and to reduce adverse effects on the marine and terrestrial environments.

This preliminary draft plan presents a framework for managing potential adverse environmental effects based on the Environmental Impact Statement (EIS) for the Project and subsequent feedback from regulators, Aboriginal groups, stakeholders and the public. This plan will be updated and refined based on detailed Engineering Procurement Construction and Commissioning (EPCC) Contractor design and permitting requirements.

Roles and responsibilities related to environmental management are generally described in the Environmental Management Plan (EMP) Overview, Section 3.0. General information pertaining to compliance monitoring is provided in Section 2.2 of the EMP Overview.

1.1 REGULATORY CONTEXT

The Project is located on federal lands within waters under the jurisdiction of the Prince Rupert Port Authority (PRPA). Project construction and blasting activities will take place within the District of Port Edward, approximately 2 km from the town center.

Underwater blasting activities will be subject to several sections of the *Fisheries Act,* which includes provisions for the protection of fish, shellfish, crustaceans, marine mammals and their habitat. Underwater blasting will occur during Fisheries and Oceans Canada's (DFO) least-risk timing windows (November 30 to February 15, or other negotiated work window) to reduce potential mortality to fish during specific life cycle stages as defined in the *Fisheries Act*.

Fisheries and Oceans Canada has prepared a comprehensive document titled *Guidelines for the use of Explosives in or Near Canadian Waters* (Wright and Hopky, 1998) to provide information on the conservation and protection of fish, marine mammals and their habitat from the use of explosives near Canadian fisheries waters (Appendix 1). Important legislative directives of this document (including amendments up to November 25, 2013) about the use of confined or unconfined explosives include:

- *Fisheries Act* (2005, amended 2013):

  - Section 2(2): For the purposes of this Act, serious harm to fish is the death of fish or any permanent alteration to, or destruction of, fish habitat
  - Section 35(1): No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery
  - Section 36(3): Subject to subsection (4), no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water.
- *Marine Mammal Regulations*:
  - Section 7: No person shall disturb a marine mammal except when fishing for marine mammals under the authority of these regulations.

Blasting activities that occur above the water level do not need to be completed within DFO least-risk timing windows. All above water (terrestrial) blasting must meet the requirements of the District of Port Edward Noise Control Bylaw No. 520 (2011), which regulates and prohibits the making or causing of noise or nuisance sounds within the District of Port Edward. Members of the local community and aboriginal groups will be notified about blasting activities in advance.

Storage and disposal of explosives will comply with applicable regulatory requirements such as the *Canadian Explosives Act* (R.S.C., 1985, c. E-17).

2.0 MITIGATION PROGRAM

Blasting is required to remove or reduce bedrock associated with rocky shoreline and outcrops along Lelu Island and throughout Porpoise Channel to allow for construction of the project materials off-loading facility (MOF) and LNG storage areas. Studies (Wright, 1982) have shown that an overpressure in excess of 100 kPa may lead to various types of damage to fish, eggs, larvae and marine animals, the degree of which is related to type of explosive, size and pattern of the charge(s), method of detonation, distance from the point of detonation, water depth, and species, size and life stage of fish. Blasting mitigation measures are primarily focused around addressing these factors and the presence of “fish” as defined by the *Fisheries Act*.

Blasting activities will adhere to DFO *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters*, Part 21 of the Occupational Health and Safety Regulation, industry best management practices and site-specific mitigation measures. To reduce potentially harmful environmental impacts, mitigation measures outlined in Table 1 are required.

Table 1: Underwater and Terrestrial Blasting Mitigation Measures Summary

Project Construction Component	Best Management Practices and Mitigation Measures
Underwater Blasting	Conduct blasting during DFOs least-risk timing window of November 30 to February 15, or other work window(s) negotiated with DFO during the permitting phase of the Project.
	Implement a marine mammal observation (MMO) program during blasting activities (also see Environmental Monitoring Plan; J.16 of the EIS/Addendum and Appendix 1 of the Marine and Freshwater Resource Management Plan).
	Designated MMOs will have the authority to stop work activities that pose a hazard to marine mammals.
	Comply with District of Port Edward Noise Control Bylaw No. 520 (2011). Notify potentially affected public residents and Aboriginal groups 24 hours before blasting is conducted.
	Where appropriate, blasting will be confined to between 8:00 am and 7:00 pm. Nighttime construction activity will be limited to low noise activities (no impact type blasting activities).
	Blasting will be halted if a marine mammal is observed within the DFO mandated 500 metre protection zone.
	Implement a Dungeness crab salvage and relocation program within the work area prior to initiating blasting activities.
	Use of an air-induced bubble curtain around the immediate work area to reduce the likelihood of shockwave damage or fish coming into the blasting area.
	In areas of low to moderate currents ($\leq$1 knot), silt curtains will be installed around blasting activities if monitoring results indicate inferred total suspended solids levels will be higher than specified in permit conditions.
	Use the appropriate type and quantities of explosives to reduce excess disruption to the marine environment.
	Do not use ammonium nitrate-fuel oil based mixtures in or near marine or freshwater environments.
	Pre-determine blasting depths, patterns, alignment and detonation methods to reduce associated shockwaves in the marine environment (see Appendix 1).
	The blasting design will consider appropriate measures to reduce overpressure, through the optimum use of explosives for rock blasting. Where possible (i.e., if low tides occur during daytime hours), blasting will be timed with low tides to reduce the number of detonations that occur underwater.
	Sub-divide larger proposed detonations into smaller time-delayed discrete detonations wherever possible.
	Backfill blasting holes with suitable angular gravel wherever possible to confine the force of the explosion to the target fracture location (see Appendix 1).
	Monitor the location of fish in the vicinity of the blasting area using a qualified MMO and fish sounding equipment.
	Recover all detonation fuses and associated materials after completion of each blasting location. Storage and disposal of explosives must comply with applicable regulatory requirements such as the *Canadian Explosives Act* (R.S.C., 1985, c. E-17).

Project Construction Component	Best Management Practices and Mitigation Measures
Terrestrial Blasting	Comply with District of Port Edward Noise Control Bylaw No. 520 (2011). Notify potentially affected public residents and Aboriginal groups 24 hours before blasting is conducted.
	Where appropriate, blasting will be confined to between 8:00 am and 7:00 pm. Nighttime construction activity will be limited to low noise activities (no impact type blasting activities).
	Backfill blasting holes with suitable angular gravel wherever possible to confine the force of the explosion to the target fracture location (see Appendix 1).
	Avoid conducting terrestrial blasting activities during temperature inversions.
	Do not use ammonium nitrate-fuel oil based mixtures in or near marine or freshwater environments.
	Reduce flying debris by using rubber blast matting.
	Recover all detonation fuses and associated materials after completion of blasting at each location. Storage and disposal of explosives must comply with applicable regulatory requirements such as the *Canadian Explosives Act* (R.S.C., 1985, c. E-17)

3.0 ENVIRONMENTAL COMPLIANCE MONITORING AND REPORTING

Environmental Monitors will be on-site during marine construction activities to monitor the effectiveness of mitigation measures in achieving regulatory compliance. PNW LNG will provide contact information for people in the local community to issue noise complaints about the Project (refer also to Noise, Vibration and Ambient Light Management Plan; Appendix J.5 of the EIS/Addendum).

3.1 ENVIRONMENTAL COMPLIANCE MONITORING

Environmental monitoring will be conducted for terrestrial and underwater blasting activities according to District of Port Edward Noise Control Bylaw No. 520 (2011), *Guidelines for the use of Explosives in or Near Canadian Waters* (Appendix 1) and industry best management practices.

Environmental Monitors, including a designated MMO, will be on-site during blasting and marine construction activities to monitor the effectiveness of mitigation measures in achieving regulatory compliance. Environmental monitoring requirements specific to blasting operations are presented the Environmental Monitoring Management Plan (Appendix J.16 of the EIS/Addendum).

3.2 ENVIRONMENTAL COMPLIANCE REPORTING

The Environmental Monitor(s) will provide weekly reports to PNW LNG. These reports will include photographs, marine mammal observations (if any) and analytical data such as water quality readings. Details of mitigation measures applied, public noise complaints received, and the subsequent follow-up will also be reported.

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Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters

D.G. Wright and G.E. Hopky

Science Directorate
Central and Arctic Region
Department of Fisheries and Oceans
Winnipeg, Manitoba R3T 2N6

and

Habitat Management & Environmental Science Directorate
Department of Fisheries and Oceans
Ottawa, Ontario K1A 0E6

1998

Canadian Technical Report of Fisheries and Aquatic Sciences 2107

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GUIDELINES FOR THE USE OF EXPLOSIVES IN OR NEAR CANADIAN FISHERIES WATERS

by

D.G. Wright
Science Directorate
Central and Arctic Region
Department of Fisheries and Oceans
501 University Crescent
Winnipeg, Manitoba R3T 2N6
Canada

and

G.E. Hopky
Habitat Management and Environmental Science Directorate
Department of Fisheries and Oceans
200 Kent Street
Ottawa, Ontario K1A 0E6
Canada

Cat. No. Fs 98-6/2107E ISSN 0706-6457

Correct citation for this publication:

Wright, D.G., and G.E. Hopky. 1998. Guidelines for the use of explosives in or near Canadian fisheries waters. Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p.

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ABSTRACT

Wright, D.G., and G.E. Hopky. 1998. Guidelines for the use of explosives in or near Canadian fisheries waters. Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p.

The federal *Fisheries Act* includes provisions for the protection of fish, shellfish, crustaceans, marine mammals and their habitats. The detonation of explosives in or adjacent to fish habitat has been demonstrated to cause disturbance, injury and/or death to fish and marine mammals, and/or the harmful alteration, disruption or destruction of their habitats, sometimes at a considerable distance from the point of detonation.

Within the context of the guidelines and procedures outlined in this report, an explosive is defined as a chemical compound which, when detonated, creates a compressional wave having an almost instantaneous rise time to a very high peak pressure followed by a decay to below ambient pressure by either rapid oxidation or the breaking of high-energy chemical bonds.

The purpose of this report is to provide information to proponents who are proposing works or undertakings that involve the use of confined or unconfined explosives in or near Canadian fisheries waters, and to which the *Fisheries Act*, Sections 32 and 35 in particular, may apply. Guidelines are provided on methods and practices for the conservation and protection of fish, marine mammals, and fish habitat from impacts arising from the destructive forces of explosives. The report describes the suggested application and review procedures and processes for proponents whose use of explosives may result in the destruction of fish, or the harmful alteration, disruption or destruction of fish habitat.

RÉSUMÉ ANALYTIQUE

Wright, D.G. et G.E. Hopky. *Lignes directrices concernant l'utilisation d'explosifs à l'intérieur ou à proximité des eaux de pêche canadiennes,* rapport technique canadien des sciences halieutiques et aquatiques 2107, 1998, iv + 34 p.

La *Loi sur les pêches* fédérale renferme des dispositions relatives à la protection du poisson, des mollusques, des crustacés, des mammifères marins et de leur habitat. Il a été prouvé que la détonation d'explosifs dans l'habitat du poisson ou à proximité perturbe, blesse ou tue des poissons et des mammifères marins ou encore entraîne la détérioration, la destruction ou la perturbation de leur habitat. Il arrive parfois que les dommages se fassent sentir à une distance considérable du point de détonation.

Aux fins des lignes directrices et des procédures énoncées dans le présent rapport, on entend par explosif un composé chimique qui, lorsqu'il explose, crée une vague de compression entraînant presque instantanément un pic de pression extrêmement élevé suivi d'une décroissance sous la pression ambiante soit par oxydation rapide ou par la rupture des liaisons chimiques à haute énergie.

Le présent rapport a pour but de fournir de l'information aux promoteurs qui proposent des ouvrages ou des entreprises nécessitant l'utilisation d'explosifs confinés ou non confinés à l'intérieur ou à proximité des eaux de pêche canadiennes et auxquels la *Loi sur les pêches,* plus précisément les articles 32 et 35, pourraient s'appliquer. Il renferme des lignes directrices concernant les méthodes et pratiques de conservation et de protection du poisson, des mammifères marins et de leur habitat contre les effets découlant de la force destructrice des explosifs. On y décrit les procédures de présentation des demandes et d'examen pour les promoteurs qui prévoient l'utilisation d'explosifs de nature à entraîner la destruction du poisson ou la détérioration, la perturbation ou la destruction de son habitat.

SCOPE AND RATIONALE

The federal *Fisheries Act* includes provisions for the protection of fish, shellfish, crustaceans, marine mammals and their habitats. The detonation of explosives in or adjacent to fish habitat has been demonstrated to cause disturbance, injury and/or death to fish and marine mammals, and/or the harmful alteration, disruption or destruction of their habitats, sometimes at a considerable distance from the point of detonation. Therefore, the Department of Fisheries and Oceans (DFO) has prepared this document to provide information to proponents on the conservation and protection of fish, marine mammals, and their habitat from impacts arising from the use of confined or unconfined explosives in or near Canadian fisheries waters. The guidelines, and application and review procedures and processes outlined in this document apply in the context of the legislative and policy framework summarized below.

APPLICABLE LEGISLATION AND POLICY

Fisheries Act

A number of sections of the *Fisheries Act* and its attendant regulations are applicable to the conservation and protection of fish and fish habitat from the destructive forces of explosives.

- Section 2 defines “Canadian fisheries waters" as meaning all waters in the fishing zones of Canada, all waters in the territorial sea of Canada and all internal waters of Canada.

- Section 2 defines “fish" as including shellfish, crustaceans, marine animals and the eggs, sperm, spawn, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.

- Section 32 prohibits the destruction of fish by any means other than fishing, except as authorized by the Minister of Fisheries and Oceans or under regulations made by the Governor in Council under the *Fisheries Act*.

- Subsection 34(1) defines “fish habitat” as meaning spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes.

- Subsection 35(1) prohibits any person from carrying on any work or undertaking that results in the Harmful Alteration, Disruption or Destruction (HADD) of fish habitat.

- Subsection 35(2) provides for the alteration, disruption or destruction of fish habitat by any means or under any conditions authorized by the Minister of Fisheries and Oceans or under regulations made by the Governor in Council under the *Fisheries Act*.

- Subsection 36(3) prohibits the deposit of a deleterious substance into waters frequented by fish, unless otherwise permitted by regulation.

- Subsection 58(1) of the *Fishery (General) Regulations* provides for anyone proposing to carry on any work or undertaking likely to result in the HADD of fish habitat, to apply to have the means or conditions of that work or undertaking authorized by the Minister under Subsection 35(2) of the *Fisheries Act*, using the form set out in Schedule VI. Schedule VI includes a section for the applicant to provide details on the proposed use of explosives.

- Subsection 58(2) of the *Fishery (General) Regulations* provides the means for the Department of Fisheries and Oceans to issue Authorizations under Subsection 35(2) of the *Fisheries Act*, using the form set out in Schedule VII.

- Section 7 of the *Marine Mammal Regulations* prohibits disturbance of marine mammals except when fishing for them.

In addition, the Department of Fisheries and Oceans has developed a policy framework to assist in the interpretation and application of the applicable legislation. The most relevant documents are as follows:

- The **Policy for the Management of Fish Habitat** (1986) provides policy direction for interpreting the broad powers mandated in the *Fisheries Act* in a way that is consistent with the concept of sustainable development. To achieve the Policy's goal of fish habitat conservation when reviewing project proposals with the potential to affect fish habitat, DFO's habitat managers apply the No Net Loss (NNL) guiding principle. Under this principle, the Department strives to maintain the existing productive capacity of fish habitats, such that the fish habitat is able to sustain the production of fish suitable for fisheries purposes.

  In summary, in order to meet the NNL guiding principle, the habitat manager's first preference is to avoid or reduce the project's potential for a HADD of fish habitat through the application of appropriate mitigation measures. Avoidance measures, such as project relocation or redesign, can be effectively applied at the project design stage. Failing that, impacts may be further reduced by application of specific mitigation measures, such as use of timing windows during the construction phase. If a HADD is still expected to occur, unavoidable - i.e. residual - losses in habitat productive capacity may be compensated on a case-by-case basis if the manager concludes that compensation is acceptable and feasible.

- The **Directive on the Issuance of Subsection 35(2) Authorizations** (1995) clarifies the circumstances when an Authorization under Subsection 35(2) may be issued, and on providing proponents with letters of advice suggesting means of avoiding HADD of fish habitat.

- The **Habitat Conservation and Protection Guidelines** (1998) is a document for use by DFO's staff in administering the habitat provisions of the *Fisheries Act*. It outlines a standard approach to habitat conservation and protection through the application of the NNL guiding principle.

Canadian Environmental Assessment Act

A decision to issue an Authorization under Section 32 or Subsection 35(2) of the *Fisheries Act* triggers an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA).

IMPACTS

The use of explosives may result in a number of adverse impacts on fish and marine mammals, and their habitats.

Effects on Fish

The detonation of explosives in or near water produces post-detonation compressive shock waves characterized by a rapid rise to a high peak pressure followed by a rapid decay to below ambient hydrostatic pressure. The latter pressure deficit causes most impacts on fish.

The primary site of damage in finfish is the swimbladder, the gas-filled organ that permits most pelagic fish to maintain neutral buoyancy. The kidney, liver, spleen, and sinus venous also may rupture and haemorrhage. Fish eggs and larvae also may be killed or damaged (Wright 1982).

Studies (Wright 1982) show that an overpressure in excess of 100 kPa will result in these effects. The degree of damage is related to type of explosive, size and pattern of the charge(s), method of detonation, distance from the point of detonation, water depth, and species, size and life stage of fish.

Vibrations from the detonation of explosives may cause damage to incubating eggs (Wright 1982, Wright in prep.). Sublethal effects, such as changes in behaviour of fish, have been observed on several occasions as a result of noise produced by explosives. The effects may be intensified in the presence of ice and in areas of hard substrate (Wright 1982, Wright in prep.).

The detonation of explosives may be lethal to marine mammals and may cause auditory damage under certain conditions. The detonation of explosives in the proximity of marine mammals also has been demonstrated to induce changes in behaviour (Wright in prep.).

The number of shellfish and crustaceans killed by the detonation of explosives is believed to be negligible, however, few data are available. Sublethal effects of explosives on

shellfish and crustaceans including behavioural modifications are little known or understood (Wright 1982, Wright in prep.).

Effects on Fish Habitat

The use of explosives in and near fish habitat may also result in the physical and/or chemical alteration of that habitat. For example, sedimentation resulting from the use of explosives may cover spawning areas or may reduce or eliminate bottom-dwelling life forms that fish use for food. By-products from the detonation of explosives may include ammonia or similar compounds and may be toxic to fish and other aquatic biota (Wright in prep.).

GUIDELINES, AND APPLICATION AND REVIEW PROCESSES

The following sections have been prepared to guide proponents proposing works or undertakings that involve the use of confined or unconfined explosives in or near Canadian fisheries waters, and to which the *Fisheries Act*, Sections 32 and 35 in particular, may apply. Confined explosives are those that would be used within a substrate, including ice, while unconfined explosives are those that would be used in open water, or not within a substrate.

Note that the information and guidance provided in these sections pertains to the conservation and protection of fish and fish habitat in the context of the *Fisheries Act*, and to the CEAA requirements that may result. There is no intent to relieve the proponent of responsibilities under any other federal, provincial or municipal legislation. Proponents are encouraged to contact other appropriate regulatory agencies to ensure that the proposed work or undertaking is carried out according to their requirements.

GUIDELINES

This section provides guidelines on methods and practices which, if incorporated into a project proposal, are intended to prevent or avoid the destruction of fish, or any potentially harmful effects to fish habitat that could result from the use of explosives. Implementation of these measures, for this purpose, is at the discretion of the proponent. Use of these guidelines should not be taken to imply approval of the proposed project in accordance with the *Fisheries Act*. Note that should the proponent proceed with the project and the use of explosives results in the destruction of fish and/or the HADD of fish habitat as a result of a change in plans, or failure to implement the measures, contravention of Section 32 and/or Subsection 35(1) of the *Fisheries Act* could occur.

1. Proponents considering the use of explosives are encouraged to consult the appropriate DFO Regional/Area authorities (Appendix I) as early as possible in their planning process to identify possible alternatives to the use of explosives, the biological resources and their habitats at risk, and/or effective mitigation measures.

2. Where provincial or territorial resource management agencies, or aboriginal resource management boards undertake the administration of fisheries, the proponent is encouraged to consult with the relevant authorities.

3. The use of confined or, in particular, unconfined explosives in or near Canadian fisheries waters is discouraged, and proponents are encouraged to utilize other potentially less destructive methods wherever possible.

4. No use of ammonium nitrate-fuel oil mixtures occurs in or near water due to the production of toxic by-products (ammonia).

   Note:

   - The deposit of deleterious substances into waters frequented by fish is prohibited under Section 36(3) of the *Fisheries Act*, unless otherwise permitted by regulation. There is no regulation pursuant to the *Fisheries Act* that permits the deposit of by-products resulting from the use of ammonium nitrate-fuel oil mixtures.

5. After loading a charge in a hole, the hole is to be back-filled (stemmed) with angular gravel to the level of the substrate/water interface or the hole collapsed to confine the force of the explosion to the formation being fractured. The angular gravel is to have a particle size of approximately 1/12th the diameter of the borehole.

6. All “shock-tubes" and detonation wires are to be recovered and removed after each blast.

7. No explosive is to be knowingly detonated within 500 m of any marine mammal (or no visual contact from an observer using 7x35-power binocular).

   Note:

   - Upon review of a proposal, the DFO Regional/Area authority may impose a greater avoidance distance, depending on the size of the charge or other project specific or fishery resource conditions.

8. No explosive is to be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change (i.e., overpressure) greater than 100 kPa (14.5 psi) in the swimbladder of a fish.

   Notes:

   - For confined explosives, setback distances from the land-water interface (e.g., the shoreline), or burial depths from fish habitat (e.g., from under the riverbed) that will ensure that explosive charges meet the 100 kPa overpressure

guideline are shown in Table 1. Equations to derive these relationships have been adapted from Nicholls et al. (1971) and Anon (1980). The equations are described in Appendix II, and should be used for weights of explosives not covered in Table 1. Sample calculations and examples are illustrated in Appendix Ill.

- If a confined explosive is to be detonated close to the substrate-water interface (such as in trenching or demolition), the set-back distance closely approximates the theoretical lethal range within which 50% of the fish may be killed or injured. Consequently, the 100 kPa guideline is not likely to be met in those situations where, because of the design constraint's of the project, it is also likely not possible or practical to 'adjust' the setback distance as a means to meet the 100 kPa guideline. For example, preparation of a trench for a pipeline crossing typically requires no more than a below grade burial depth of about 2m. Therefore, the weight of explosive charge per delay will have to be adjusted in an effort to meet the 100 kPa guideline. A sample calculation to illustrate a trenching example is given in Appendix III.

- For unconfined explosives, proponents are encouraged to contact the appropriate DFO Regional/Area authorities (Appendix I) for further guidance.

9. No explosive is to be detonated that produces, or is likely to produce, a peak particle velocity greater than 13 $mm \cdot s^{-1}$ in a spawning bed during the period of egg incubation.

Note:

- For confined explosives, setback distances or burial depths from spawning beds that will ensure that explosive charges meet the 13 $mm \cdot s^{-1}$ guideline criteria are shown in Table 2. Equations to derive these relationships have been adapted from Nicholls et al. (1971) and Anon (1980) and are described in Appendix II. Sample calculations and examples are illustrated in Appendix III.

- For unconfined explosives, proponents are encouraged to contact the appropriate DFO Regional/Area authorities (Appendix I) for further guidance.

APPLICATION AND REVIEW PROCESSES

Proponents planning to use an explosive that is likely to destroy fish and/or cause a HADD of fish habitat are subject to certain legal obligations under the *Fisheries Act*, as identified in the preceding 'Applicable Legislation and Policy' section. This section discusses these obligations with respect to the proposed use of explosives, and suggests to proponents how to fulfil them.

Proponents should contact the DFO Regional/Area authorities (Appendix I) as early as possible in their planning process. The purpose is to find out whether the proposed use of

explosives is likely to affect a Canadian fisheries water and whether its use is likely to destroy fish and/or cause a HADD of fish habitat. Depending on the outcome, DFO may also discuss potential issues, specific information requirements, or the next steps and possible outcomes in a further review of the proposal. For example, as summarized in the subsequent 'Review and Decision-making Process' section, possible next steps could include a request for further information, or a recommendation that the proponent seek an authorization pursuant to Section 32 and/or Subsection 35(2). Possible outcomes may include the provision of written advice, the issuance of (an) authorization(s) subject to completion of a CEAA review, or, refusal to issue (an) authorization(s).

Proponents should contact DFO before irrevocable commitments (such as contracts for equipment/services) are made, in order to avoid any unnecessary delays in the application and review process. Note that DFO may become aware of your proposed project through its participation in co-operative arrangements with other governments, agencies, boards, etc.

The following 'Application Procedures' section provides information to assist the proponent in deciding if it should seek Authorization to destroy fish by means other than fishing, and/or Authorization to harmfully alter, disrupt or destroy fish habitat, through the use of explosives and, if so, provides information on procedures for filing, etc.

Note that application for Authorization under Section 32 and/or Subsection 35(2) is voluntary. Proponents are not prohibited from going ahead with their use of explosives without Authorization. But, if as a result of the use of explosives, fish are destroyed and/or there is a HADD of fish habitat, contravention of Section 32 and/or Subsection 35(1) of the *Fisheries Act* could occur and the proponent is liable to prosecution.

Application Procedures

1. Proponents unable to meet the overpressure or peak particle velocity guideline values identified, respectively, in measures 8 or 9 of the preceding 'Guidelines' section, should complete and submit an application for Authorization under Section 32 of the *Fisheries Act*, to destroy fish by means other than fishing. The recommended application form is shown in Appendix IV. However, the proponent should contact the appropriate DFO Regional/Area authority (Appendix I) to verify that this is the appropriate application form to use and/or to identify information requirements.

2. Proponents who wish to file for Authorization under Subsection 35(2) of the *Fisheries Act* should complete and submit a separate application in accordance with the form prescribed pursuant to Subsection 58(1) of the *Fishery (General) Regulations* (Appendix V). Assistance on filing the application form, and related procedures, may be obtained by contacting the appropriate DFO Regional/Area authorities (Appendix I).

3. Proponents seeking Authorization under both Section 32 and Subsection 35(2) should complete and submit both Section 32 (Appendix IV) and Subsection 35(2) (Appendix V) applications. However, to minimize duplication, the proponent may choose to cross-reference those sections that are the same in each application form, and is expected to only submit one set of the documents requested in the forms, unless otherwise requested by the DFO Regional/Area authority. Contact the appropriate DFO Regional/Area authorities (Appendix I) for further information and assistance.

4. In seeking Authorization, the proponent will be expected to provide the information requested in the application forms. Doing so will expedite the review process.

   In general, the proponent is expected to provide all plans, specifications, studies, procedures, samples or other information required to permit an assessment of the potential impact of the proposed use of explosives on fish and fish habitat, and the mitigation and/or compensation measures proposed to alleviate impacts and/or to compensate for any loss of productive capacity of habitat to produce fish. Typically, the fish and/or fish habitat information requirements include, but may not necessarily be limited to the items summarized below:

   a) A description of the project and the expected effects resulting from the use of explosives on the fisheries resources (including marine mammals) and/or fish habitat, including:

      i) A description of fish and marine mammal species and their habitats likely to be affected by the detonation;
      ii) A description of whether the fish, marine mammals and their habitats contribute, or have the potential to contribute, directly or indirectly, to a fishery - subsistence, commercial or recreational;
      iii) The timing of any seasonal migration of fish and marine mammals;
      iv) The theoretical lethal range (i.e., the range, or distance, over which the overpressure exceeds 100 kPa) of the explosives to be used (from equations provided in Appendix II);
      v) An assessment of potential impacts arising from the proposed use of explosives and a description of proposed mitigation and/or compensation measures; and
      vi) Other matters, such as the proposed contingency plan and monitoring and follow-up program.

   b) The proponent's mitigation plan should include discussion of the following measures that are particularly relevant to alleviating the potential impacts of explosives:

      i) The work or undertaking should be undertaken at the time of least biological activity or biological sensitivity. Proponents should consult with DFO Regional/Area authorities to determine the appropriate timing;

ii) If multiple charges are required, time-delay detonation initiators (blasting caps) should be used to reduce the overall detonation to a series of discrete explosions. Time delays for discrete explosions should be greater than 25 ms; and,
iii) If possible, large charges should be subdivided into a series of smaller discrete detonations or explosions using time-delay detonation initiators (a procedure known as decking) to reduce the overall detonation to a series of smaller discrete detonations or explosions.

In addition to these measures, the proponent should also consider additional mitigation measures including, but not limited to the following:

iv) Deployment of bubble curtains/air curtains to disrupt the shock wave;
v) Deployment of noise generating devices, such as an air compressor discharge line, to scare fish away from the site; or,
vi) Removal or exclusion of fish from the work area before the blast occurs.

5. Proponents should be aware that subsequent to filing the application, DFO may request additional information concerning fish and fish habitat, the mitigation and/or compensation plans, the contingency and monitoring and follow-up programs, and other matters as required to complete the *Fisheries Act* review. If the appropriate information is not already available, it is the proponent's responsibility to provide it and, also, to assure DFO that the proposed mitigation and/or compensation measures will be effective. Should it be necessary to conduct an environmental assessment of the project pursuant to the CEAA, then additional information will be required in order to meet the requirements of the CEAA.

6. The Department of Fisheries and Oceans will undertake to: respond to requests for review, or to referrals, of project proposals or activities; issue Authorizations or provide advice; and/or complete environmental assessments in a manner consistent with Departmental service standards. Generally, DFO will respond to requests for review or to referrals within 30 working days of notification. Timeframes required for the issuance of Authorizations or advice will be discussed with proponents. Proponents should be aware that the length of time required to complete a review can vary greatly, often depending on the type and complexity of project proposed, the fish and fish habitat issues involved, and whether or not an environmental assessment under the CEAA is required. Once again, proponents are encouraged to contact the appropriate DFO Regional/Area authorities (Appendix I) to discuss these issues.

7. If an unforeseen need to use explosives arises, Departmental service standards may be waived and a review completed as expeditiously as possible so as not to unduly delay a project. Further, Departmental service standards are waived in the event of an emergency where lives and/or property are threatened. In such cases, the amount of information required may be reduced due to the urgency of the

situation. Any verbal request for an emergency Authorization will be accepted only on the condition that it is followed by a written confirmation of the project details.

8. If applicable, proponents may be required by the Department of Fisheries and Oceans, Canadian Coast Guard, to issue a "Notice to Mariners" and/or a "Notice to Fishers". The appropriate DFO Area/Regional authorities (Appendix I) are prepared to assist the proponent with contacting the Canadian Coast Guard.

9. Resource management agencies of other governments, departments, or boards that have been established under some aboriginal land claim settlements, may have aquatic resource review requirements and service standards that are different than those described in this document. Proponents should contact those agencies to ensure compliance with any requirements they may have.

Review and Decision-making Process

This section summarizes the approach taken by the Department of Fisheries and Oceans in the review of referrals and of applications for Authorization. Included is a description of the key decisions possible from a review, and the criteria used in making decisions. There is also a brief summary of the linkage between Section 32 and/or Subsection 35(2) Authorizations and the responsibilities of the Department of Fisheries and Oceans to undertake environmental assessments pursuant to the *Canadian Environmental Assessment Act* (CEAA).

Fisheries Act

DFO will review the proponent's application in accordance with the *Fisheries Act* and its supporting policy framework, including this document. Upon receipt of information, notice, a referral, or application for Authorization concerning works or undertakings where the use of explosives is proposed, DFO will normally take the following steps in its review of the proposal:

1. Determine the adequacy of the information provided by the proponent.

2. Using the information provided, assess the extent of risk or potential damage to fish and marine mammals and/or fish habitat and the acceptability of this level of damage in context with the level of protection required.

3. Determine the probable success of proposed mitigation and/or compensation measures and, as appropriate the acceptability of any residual impacts.

4. Where relevant, consult with the appropriate provincial or territorial resource management agencies, and/or aboriginal resource management boards.

5. Note that prior to finalizing its review of the proposal DFO may, among other matters, advise the proponent of the need for more information, re-assess a revised project proposal, suggest that the proponent seek authorization, etc. The

review of a proposal is often an iterative process depending on a number of factors, such as the type of referral received by DFO, is completeness, its potential impacts on fish and/or fish habitat and the potential to mitigate and/or compensate for such impacts. Proponents should discuss this and related aspects of the review process with the relevant DFO/Regional area authority (Appendix I).

6. After examination of the proposal, DFO will make a decision regarding the proponent's application.

- **With respect to Section 32, DFO will either,**

  ⇒ upon determining that implementation of mitigation measures by the proponent is expected to prevent or avoid the destruction of fish, advise the proponent by letter that if such measures are incorporated into the project, Section 32 is not expected to be contravened. A letter of advice should not be taken to imply approval of the project pursuant to the habitat provisions of the *Fisheries Act*, or any other legislation. Note, if the destruction of fish occurs as a result of a change in the plans for the proposed project, or failure to implement the measures identified in the letter of advice, contravention of Section 32 of the *Fisheries Act* could occur.

  OR

  ⇒ upon determining that even with the implementation of mitigation measures the destruction of fish is still expected to occur **and**, because this mortality is acceptable within the context of the fisheries resource, issue a Section 32 Authorization using a letter format.

  OR

  ⇒ upon determining that even with the implementation of mitigation measures the destruction of fish is still expected to occur **but**, because this mortality is not acceptable within the context of the fisheries resource, reject the proposal, and notify the proponent that DFO will not issue a Section 32 Authorization and that a contravention of the *Fisheries Act* could occur should the proponent still choose to proceed as proposed.

- **With respect to Section 35, DFO will either,**

  ⇒ upon determining that implementation of mitigation measures by the proponent is expected to prevent or avoid a HADD of fish habitat, advise the proponent by letter that if such measures are incorporated into the project, Subsection 35(1) is not expected to be contravened. A letter of advice should not be taken to imply approval of the project pursuant to the habitat provisions of the *Fisheries Act*, or any other legislation. Note, if a

HADD of fish habitat occurs as a result of a change in the plans for the proposed project, or failure to implement the measures identified in the letter of advice, contravention of Subsection 35(1) of the *Fisheries Act* could occur.

OR

⇒ upon determining that even with the implementation of mitigation measures a HADD of fish habitat is still expected to occur **and**, because the proposed compensation for the unavoidable net loss of productive capacity of fish habitat is acceptable to DFO, issue a Subsection 35(2) authorization using the form provided in Schedule VII of Subsection 58(2) of the *Fishery (General) Regulations*.

OR

⇒ upon determining that even with the implementation of mitigation measures a HADD of fish habitat is still expected to occur **but**, because the proposed compensation for the unavoidable net loss of fish habitat productive capacity is not acceptable, reject the proposal, and notify the proponent that DFO will not issue a Subsection 35(2) Authorization and that a violation of the *Fisheries Act* could occur should the proponent still choose to proceed as proposed.

Notes:

- The Department of Fisheries and Oceans, in arriving at one of the above noted determinations, will also consider the following criteria:
    - Whether the use of explosives is the only technically feasible means by which to attain the desired objective; and
    - Whether the use of explosives is required to alleviate an emergency situation threatening human safety and/or property.
- Section 32 and/or Subsection 35(2) authorizations come with conditions attached, which among others may include:
    - The proponent may be required to develop, undertake and report on a monitoring program at its expense, typically, to monitor compliance and evaluate effectiveness of the mitigation and/or compensation measures.
    - If, during the course of the works or undertakings, the adverse effects of the explosives were significantly greater than anticipated, the proponent may be required to immediately cease all further use of explosives,

pending review of the situation with Department of Fisheries and Oceans personnel.

- Additional, site-specific terms and conditions as may be required in order to satisfy fishery resource and/or fish habitat protection requirements. For example, the conditions may be more stringent than the measures identified in the preceding 'Guidelines' section.

Canadian Environmental Assessment Act

Section 32 and Subsection 35(2) are included in the *Law List Regulation* of the *Canadian Environmental Assessment Act* (CEAA). Consequently, the Department of Fisheries and Oceans as the Responsible Authority must conduct an environmental assessment of the relevant proposed works or undertakings before an Authorization can be issued. If the result of the environmental assessment is that the work or undertaking will, after taking into account the appropriate measures, not likely result in significant impact that cannot be justified, then authorization(s) will normally be issued pursuant to Section 32 and/or Subsection 35(2) of the *Fisheries Act*. Procedures for coordinating the CEAA review with provincial and aboriginal government review processes vary. Proponents are strongly advised to contact the DFO Regional/Area authorities (Appendix I) to obtain additional information on environmental assessment procedures and requirements.

UPDATING

These guidelines will be reviewed and updated as necessary.

ACKNOWLEDGEMENTS

Many individuals and governmental and non-governmental organizations were consulted in the development of these guidelines. We gratefully acknowledge their interest and contributions. In particular, input from D. Haché, K. Fisher, K. Broughton and R. Drolet, from DFO, and L. Macanuf (Golder-VME) and R. Morin (Explotec Engineering Ltd) is appreciated.

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Table 1. Setback distance (m) from centre of detonation of a confined explosive to fish habitat to achieve 100 kPa guideline criteria for various substrates.

The data in this table is incorrect and should not be used.

Substrate Type	Weight of Explosive Charge (kg)							
	0.5	1	2	5	10	25	50	100
Rock	3.6	5.0	7.1	11.0	15.9	25.0	35.6	50.3
Frozen Soil	2.3	3.2	4.5	7.2	14.3	16	22.6	32
Ice	1.5	2.1	3.0	4.7	6.6	10.5	14.8	21
Saturated Soil	1.5	2.1	3.0	4.8	6.7	10.0	15.1	21.3
Unsaturated Soil	0.7	1.0	1.4	2.2	3.1	4.9	6.9	9.8

Erratum:

Wright, D.G., and G.E. Hopky. 1998. Guidelines for the use of explosives in or near Canadian fisheries waters. Can Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p.

Page 15: Table 1 should be replaced by the following Table:

Table 1. Setback distance (m) from centre of detonation of a confined explosive to fish habitat to achieve 100 kPa guideline criteria for various substrates.

Substrate Type	Weight of Explosive Charge (kg)							
	0.5	1	2	5	10	25	50	100
Rock	3.6	5.0	7.1	11.0	15.9	25.0	35.6	50.3
Frozen Soil	3.3	4.7	6.5	10.4	14.7	23.2	32.9	46.5
Ice	3.0	4.2	5.9	9.3	3.2	20.9	29.5	41.8
Saturated Soil	3.0	4.2	5.9	9.3	13.2	20.9	29.5	41.8
Unsaturated Soil	2.0	2.9	4.1	6.5	9.2	14.5	20.5	29.0

Table 2. Setback distance (m) from centre of detonation of a confined explosive to spawning habitat to achieve 13 mm•sec^{-1} guideline criteria for all types of substrate.

	Weight of Explosive Charge (kg)						
	0.5	1	5	10	25	50	100
Setback distance (m)	10.7	15.1	33.7	47.8	75.5	106.7	150.9

Appendix I
DFO Regional/Area Authorities

Newfoundland Region

Habitat Evaluation Engineer,
Habitat Management Division
Fisheries and Habitat Management Branch
PO Box 5667
St. John's, NF A1C 5X1
Voice: (709) 772-6157
Fax: (709) 772-4525

Maritime Region

New Brunswick and Prince Edward Island

Denis Haché, P. Eng.
Habitat Evaluation Engineer
PO Box 5030
Moncton, NB E1C 9B6
Voice: (506) 851-6252
Fax: (506) 851-6579

Nova Scotia

Brian Jollymore, P. Eng.
Habitat Evaluation Engineer
PO Box 550
Halifax, NS B3J 2S7
Voice: (902) 426-2549
Fax: (902) 426-1489

Laurentian Region

Manager, Fish Habitat
Fish Habitat and Environmental Science
Maurice-Lamontagne Institute
PO Box 1000
Mont-Joli, QC G5H 3Z4
Voice: (418) 775-0577
Fax: (418) 775-0658

Central and Arctic Region

Ontario

Area Manager, Ontario Area
Fisheries Management Branch
PO Box 5050, 867 Lakeshore Road
Burlington, ON L7R 4A6
Voice: (905) 336-4567
Fax: (905) 336-6437

Manitoba, Saskatchewan and Alberta

Manager, Habitat Management Division
Fisheries Science Branch
501 University Crescent
Winnipeg, MB R3T 2N6
Voice: (204) 983-5164
Fax: (204) 984-2402

Appendix I (concluded)
DFO Regional/Area Authorities

Central and Arctic Region (continued)

Nunavut

Area Manager, Nunavut Area
Fisheries Management Branch
PO Box 358
Iqaluit, NWT X0A 0H0
Voice: (867) 979-8002
Fax: (867) 979-8039

Western Arctic

Area Manager, NWT West Area
Fisheries Management Branch
PO Box 2310
Yellowknife, NWT X1A 2P7
Voice: (867) 920-6636
Fax: (867) 873-8871

Pacific Region

North Coast

Chief,
Habitat and Enhancement Branch
North Coast Division
South 417 - 2nd Ave. W.
Prince Rupert, BC V8J 1G8
Voice: (250) 627-3453
Fax: (250) 627-3480

Fraser River

Chief,
Habitat and Enhancement Branch
Fraser River Division
610 Derwent Way
Annacis Island
New Westminster, BC V3M 5P8
Voice: (604) 666-0315
Fax: (604) 666-6627

Northeastern and Southeastern B.C.

Chief, Major Projects Unit
Habitat and Enhancement Branch
327 – 555 Hastings Street
Vancouver, BC V6B 5G3
Voice: (604) 666-2057
Fax: (604) 666-7907

South Coast

Chief,
Habitat and Enhancement Branch
South Coast Division
3225 Stephenson Pt. Road
Nanaimo, BC V9T 1K3
Voice: (250) 756-7284
Fax: (250) 756-7162

Yukon

Chief,
Habitat and Enhancement Branch
Yukon Division
122 Industrial Road
Whitehorse, YT Y1A 2T9
Voice: (867) 393-6725
Fax: (867) 393-6738

Appendix II
General Equations to Determine Setback Distance for Confined Explosives to Meet Guideline Criteria of 100 kPa

Equation (A)

Equation (A) describes the transfer of shock pressure from the substrate to the water.

$$P_W = \frac{2(Z_W / Z_R)P_R}{1+(Z_W / Z_R)}$$

where:

P_W = pressure (kPa) in water
P_R = pressure (kPa) in substrate
Z_W = acoustic impedance of water
Z_R = acoustic impedance of substrate

Equation (B)

Equation (B) describes the relationship between acoustic impedance and the density and velocity of the medium through which the compressional wave travels.

$$Z_W/Z_R = \frac{D_W C_W}{D_R C_R}$$

where:

D_W = density of water = 1 g•cm^{-3}
D_R = density of the substrate in g•cm^{-3}
C_W = compressional wave velocity in water
= 146,300 cm•s^{-1}
C_R = compressional wave velocity in substrate in cm•s^{-1}

Appendix II (concluded)
General Equations to Determine Setback Distance for Confined Explosives to Meet Guideline Criteria of 100 kPa

Equation (B) (continued):

The following values are used for D_R and C_R for various substrates:

Substrate	D_R ($g \cdot cm^{-3}$)	C_R ($cm \cdot s^{-1}$)
Rock	2.64	457,200
Frozen Soil	1.92	304,800
Ice	0.98	304,800
Saturated soil	2.08	146,300
Unsaturated soil	1.92	45,700

Equation (C)

Equation (C) describes the relationship between the peak particle velocity (V_R) and the pressure, density and compressional wave velocity in the substrate.

$$V_R = \frac{2P_R}{D_R C_R}$$

Equation (D)

Equation (D) represents the scaled distance relationship and is used to equate the peak particle velocity to charge weight and distance.

$$V_R = 100\,(R/W^{.5})^{-1.6}$$

where:

V_R = peak particle velocity in $cm \cdot s^{-1}$
R = distance to the detonation point in m
W = charge weight per delay in kg

Appendix III
Sample Calculations and Examples for Confined Explosives

SAMPLE CALCULATIONS

Sample Calculation 1: Calculation of Setback Distance Required for a 100 kg Charge Set in Rock to Meet the 100 kPa Guideline.

1. From Equation (B):

$$Z_W/Z_R = \frac{D_W C_W}{D_R C_R}$$

$$= \frac{(1g \bullet cm^{-3})(146{,}300cm \bullet s^{-1})}{(2.64g \bullet cm^{-3})(457{,}200cm \bullet s^{-1})}$$

$$= 0.1212$$

2. From Equation (A):

$$P_W = \frac{2(Z_W / Z_R)P_R}{1+(Z_W / Z_R)}$$

$$P_W = \frac{2(0.1212)P_R}{1+(0.1212)}$$

$$P_W = 0.22\ P_R$$

3. To limit P_W to 100 kPa ($kg \bullet m \bullet s^{-2} \bullet m^{-2}$):

$$P_R = \frac{P_W}{0.22}$$

$$P_R = \frac{100\ kPa}{0.22}$$

$$P_R = 455\ kPa$$

$$P_R = 4.55 \times 10^2\ kPa$$

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

4. Convert kPa to dynes ($g \cdot cm \cdot s^{-2}$):

$$\text{dynes} = \text{kPa} \times 10^4$$

$$P_R = 4.55 \times 10^2 \times 10^4$$

$$P_R = 4.55 \times 10^6 \text{ dynes } (g \cdot cm \cdot s^{-2})$$

5. From Equation (C):

$$V_R = \frac{2P_R}{D_R C_R}$$

$$V_R = \frac{(2)\left(4.55 \bullet 10^6 \ g \bullet cm \bullet s^{-2}\right)}{\left(2.64 \ g \bullet cm^{-3}\right)\left(457{,}200 \ cm \bullet s^{-1}\right)}$$

$$V_R = 7.54 \ cm \bullet s^{-1}$$

6. From Equation (D):

$$V_R = 100(R/W^{.5})^{-1.6}$$
$$R = (W^{.5})(V_R/100)^{-0.625}$$
$$R = (100kg)^{.5}(7.54cm \bullet s^{-1}/100kg \bullet cm \bullet s^{-1} \bullet m)^{-0.625}$$
$$R = 50.3 \text{ m}$$

Therefore, a 100 kg charge of explosives detonated in rock requires a setback of 50.3 m from fish habitat in order to reduce the overpressure produced by the detonation to less than 100 kPa.

Now, the calculation of the set-back distance required for a 100 kg charge set in rock to meet the peak particle velocity guideline of 13 $mm \bullet sec^{-1}$ is as follows:

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

From Equation (D):

$$R = (W^{.5})(V_R/100)^{-0.625}$$

When

V_R = 13 mm•sec^{-1} = 1.3 cm•sec^{-1}

and W = 100 kg

$$R = (100^{.5})(1.3/100)^{-0.625}$$
$$R = 150.9 \text{ m}$$

Therefore, a 100 kg charge of explosives detonated in rock requires a setback of 150.9 m from a spawning area in order to reduce the peak particle velocity produced by the detonation to less than 13 mm•sec^{-1}.

Sample Calculation 2: Simplified Calculation of Setback Distance from Fish Habitat.

The calculations to determine the required setback distance to meet the 100 kPa guideline may be simplified. Since the weight of the charge and the distance from the charge to fish habitat are the only variables in the equations, a factor can be developed for substitution in Equation (D).

From Equation (D):

$$V_R = 100(R/W^{.5})^{-1.6}$$
$$R = (W.5)\ (V_R/100)^{-0.625}$$

Therefore:

$$R = W^{.5}(K)$$

By working through the equations of Appendix II and solving for V_R for each substrate

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

type, the following results are obtained:

SUBSTRATE TYPE	K
Rock	5.03
Frozen Soil	3.2
Ice	2.1
Saturated Soil	2.13
Unsaturated Soil	0.98

Therefore, to determine the setback distance required to meet the peak pressure guideline of 100 kPa, multiply the square root of the charge weight by the appropriate "K" factor.

Sample Calculation 3: Simplified Calculation of Setback Distance from Fish Spawning Habitat.

Similarly, to determine the set-back distance required to meet the peak particle velocity (V_R) guideline of 13 mm•sec^{-1}, a constant can be developed for substitution in Equation (D):

From Equation (D):

$$V_R = 100(R/W^{.5})^{-1.6}$$

$$R = (W^{.5})(V_R/100)^{-0.625}$$

where:

V_R = 13 mm•sec^{-1} = 1.3 cm•sec^{-1}

$$R = (W^{.5})(1.3/100)^{-0.625}$$

$$R = (W^{.5})(15.09)$$

Therefore, to determine the setback distance required to meet the peak particle velocity (V_R) guideline of 13 mm•sec^{-1}, multiply the square root of the charge weight by a factor of 15.09.

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

EXAMPLES

Example 1: On-shore Setback Distance from Fish Habitat.

A proponent wishes to use explosives to break rock in a quarry near a stream. What is the minimum setback distance from the stream required in order to limit the overpressure in the stream to less than 100 kPa?

Calculate the required set back distance for a 35 kg charges set in rock.

W		=	35 kg
$K_{(rock)}$	=	6.75	
R		=	$(W^{.5})(K)$
R		=	$(35^{.5})$ (5.03)
R		=	29.8 m

Note: It is assumed that the rock formation being quarried extends under the stream. Therefore the K factor for rock is used.

Therefore, the proponent would be required to maintain a set back distance of at least 29.8 m in order to meet the DFO guideline criteria of 100 kPa.

Example 2: Buried Charges for Geophysical Exploration.

A proponent wishes to conduct a geophysical survey beneath a shallow lake. Because of the shallow depth of the lake, it is not possible to use an air gun or other similar non-explosive energy source. To what depth must explosive charges (5 kg) be buried in order to limit the overpressure to less than 100 kPa?

W	=	5 kg
$K_{(sat.\ soil)}$	=	2.13
R	=	$(W^{.5})(K)$
R	=	$(5^{.5})$ (2.13)
R	=	4.8 m

Note: It is assumed that the charges are buried in un-consolidated sediments. Therefore the K factor for saturated soil is used.

Therefore the proponent would be required to bury the charges to a depth of at least 4.8 m below the substrate-water interface in order to limit the overpressure at the interface to less than 100 kPa.

Appendix III (continued)
Sample Calculations and Examples for Confined Explosives

Example 3: In-stream Trench Excavation.

A proponent wishes to use explosives to assist in the excavation of a trench for a pipeline across a trout stream. The right-of-way is located in a cobble bottom riffle area that is used as a feeding area. There is a potential spawning bed located 75 m upstream of the right-of-way. The explosives' parameters are as follows:

Weight of individual charges: 15 kg
# of holes detonated/delay: 5
Weight of charge/delay: 75 kg

Does the proposal meet the DFO guideline criteria for overpressure and peak particle velocity?

a) For the Overpressure Criteria:

$W = 75$ kg
$K_{(rock)} = 5.03$
$R = (W^{.5})(K)$
$R = (75^{.5})\ (5.03)$
$R = 43.6$ m

Note: Since explosives must be used to excavate the trench, it is assumed that the substrate consists of rock or strongly consolidated sediments. Therefore the K factor for rock is used.

Therefore the detonation of 75 kg of explosives could kill or injure fish within a radius of 43.6 m of the right-of-way.

b) For the Peak Particle Velocity Criteria:

To determine the setback distance required to meet the peak particle velocity (V_R) guideline of 13 mm•sec^{-1} in a spawning area, multiply the square root of the charge weight by a factor of 15.09.

$R = (W^{.5})(15.09)$
$R = (75^{.5})\ (15.09)$
$R = 130.7$ m

Therefore, the detonation of 75 kg of explosives would exceed the DFO Guideline for peak particle velocity of 13 mm•sec^{-1} in a spawning bed.

Appendix III (concluded)
Sample Calculations and Examples for Confined Explosives

Therefore, the application for an authorization to use explosives would be denied and major changes in the explosives program would be required in order for the project to be acceptable to DFO.

For example:

If the weight of explosive/delay were reduced to 5 kg by increasing the number of holes in the pattern and detonating each hole separately with 25 msec delays between each hole, the zone of overpressure exceeding 100 kPa would be:

$W = 5$ kg
$K_{(rock)} = 5.03$
$R = (W^{.5})(K)$
$R = (5^{.5})\ (5.03)$
$R = 11.2$ m

Similarly, the distance at which the peak particle velocity in the substrate would not exceed 13 mm•sec^{-1} would be:

$R = (W^{.5})(15.09)$
$R = (5^{.5})\ (15.09)$
$R = 33.7$ m

Therefore, if the weight of explosives per delay were reduced to 5 kg, the spawning area would be protected, as it is further than 33.7m from the detonation area. However, the detonation would still produce over-pressures exceeding 100 kPa to a distance of 11.2 m. Additional mitigation such as undertaking the project at a time of least fish activity or by removing/excluding fish from the area by either physical exclusion or scare tactics may be required.

Appendix IV
Application Form for Authorization to Destroy Fish by Means Other Than Fishing

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APPLICATION FOR AUTHORIZATION TO DESTROY FISH BY MEANS OTHER THAN FISHING

I, the undersigned, hereby request authorization to carry out the works or undertakings described on this application form. I understand that the approval of this application, if granted, is from the Department of Fisheries and Oceans standpoint only and does not release me from my obligation to obtain permission from other concerned regulatory agencies.

If an authorization is granted as a result of this application, I hereby agree to carry out all activities relating to the project within the designated time frames and conditions specified in the authorization.

Applicant's Name (Please Print) _____

Applicant's Business Address _____

_____

_____

_____

Applicant's Telephone Number _____

Applicant's Facsimile Number _____

Applicant's E-Mail Number _____

Date of Application _____

I solemnly declare that the information provided and facts set out in this application are true, complete and correct, and I make this solemn declaration conscientiously believing it to be true and knowing that it is of the same force and effect as if made under oath. This declaration applies to all material submitted as part of this application.

Applicant's Signature _____

Appendix IV (continued)
Application Form for Authorization to Destroy Fish by Means Other Than Fishing

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APPLICATION FOR AUTHORIZATION TO DESTROY FISH BY MEANS OTHER THAN FISHING (continued)

Location Details

Name of watercourse or waterbody (including co-ordinates)

_____

_____

Nearest Community _____

County _____

Province/Territory _____

Provide details of proposed activity including reasons as to why explosives must be used (attach additional information as required)

_____

_____

_____

_____

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_____

_____

Appendix IV (continued)
Application Form for Authorization to Destroy Fish by Means Other Than Fishing

¾ ¾

APPLICATION FOR AUTHORIZATION TO DESTROY FISH BY MEANS OTHER THAN FISHING (continued)

Schedule of Operations

Proposed starting date (D/M/Y) _____

Proposed completion date (D/M/Y) _____

The following documents will assist in assessing your application and help expedite its approval. Please check which documents you have attached.

Map indicating location of project	[ ]
Engineering specifications	[ ]
Dimensional drawings	[ ]
Assessment of fish and marine mammal resources	[ ]
Assessment of potential effects of project on fish and marine mammals	[ ]
Measures proposed to mitigate potential damage to fish and marine mammals	[ ]
Other	[ ]

Appendix IV (concluded)
Application Form for Authorization to Destroy Fish by Means Other Than Fishing

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APPLICATION FOR AUTHORIZATION TO DESTROY FISH BY MEANS OTHER THAN FISHING (concluded)

Explosives Contractor (If different from applicant)

Name _____

Address _____

_____

_____

Telephone number _____

Facsimile number _____

Details of Explosives

Type (including trade name) _____

Total weight of explosive to be used (kg) _____

Weight of individual shots/
Weight per delay _____

Shot pattern _____

Detonation depth _____

Delay period (msec) _____

Method of detonation _____

APPENDIX V
Application Form to Harmfully Alter, Disrupt or Destroy Fish Habitat

SCHEDULE VI/ANNEXE VI

(*Subsection 58(1)/paragraphe 58(1)*)

Fisheries and Oceans

Pêches et Océans

_____

Application No./N° de la demande

APPLICATION FOR AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT
DEMANDE D'AUTORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON

I, the undersigned, hereby request authorization to carry out the works or undertakings described on this application form. I understand that the approval of this application, if granted, is from the Minister of Fisheries and Oceans standpoint only and does not release me from my obligation to obtain permission from other concerned regulatory agencies.

Je soussigné, demande par les présentes l'autorisation d'exploiter les ouvrages ou entreprises décrits dans la formule. Je comprends que l'approbation de cette demande, le cas échéant, porte sur ce qui relève du ministre des Pêches et des Océans et ne me dispense pas d'obtenir la permission d'autres organismes réglementaires concernés.

If an authorization is granted as a result of this application, I hereby agree to carry out all activities relating to the project within the designated time frames and conditions specified in the authorization.

Si la demande est approuvée, je consens par les présentes à exécuter tous les travaux relatifs à ce projet selon les modalités et dans le laps de temps prescrits dans l'autorisation.

Applicant's Name (Please Print) _____ Nom du requérant (lettres moulées)

Applicant's Business Address _____ Adresse d'affaires du requérant

_____

_____

Applicant's Telephone No./ N° de téléphone du requérant _____ Date_____

I solemnly declare that the information provided and facts set out in this application are true, complete and correct, and I make this solemn declaration conscientiously believing it to be true and knowing that it is of the same force and effect as if made under oath. This declaration applies to all material submitted as part of this application.

Je déclare solennellement que les renseignements fournis et les faits énoncés dans cette demande sont véridiques, complets et exacts, et je fais cette déclaration solennelle, la croyant consciencieusement vraie et sachant qu'elle a la même force et le même effet que si elle était faite sous serment. Cette déclaration s'applique à tout document qui est présenté dans le cadre de cette demande.

_____ _____

Applicant's Signature (and corporate seal) Signature du requérant (et sceau de la société)

Name of watercourse or waterbody (give coordinates)
Cours d'eau ou plan d'eau (donner les coordonnées) _____

This watercourse is a tributary of (where applicable)
Cours d'eau tributaire de (le cas échéant)

_____

Nearest community Localité la plus proche	County Comté	Province Province
_____	_____	_____

APPENDIX V
Application Form to Harmfully Alter, Disrupt or Destroy Fish Habitat (continued)

SCHEDULE VI-Continued/ANNEXE VI (suite)

Fisheries and Oceans
Pêches et Océans

Application No./N° de la demande

APPLICATION FOR AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT
DEMANDE D'AUTORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON

Type of Activity/Genre d'activité

[ ] Bridge Pont	[ ] Stream Realignment Alignement de cours d'eau	[ ] Gravel Removal Enlèvement du gravier	[ ] Stream Traverse Traversée de cours d'eau
[ ] Culvert Ponceau	[ ] Channelization Canalisation	[ ] Obstruction Removal - Bypass Enlèvement ou contournement d'obstacle	[ ] Seismic Survey Levé sismique
[ ] Dam Barrage	[ ] Wharf - Break water Quai - Brise-lames	[ ] Stream Utilization - Recreation Utilisation récréative du cours d'eau	[ ] Agriculture
[ ] Stream Diversion Dérivation de cours d'eau	[ ] Dewatering Assèchement	[ ] Erosion Control Lutte contre l'érosion	[ ] Other (specify) Autres (préciser)
[ ] Mining Activité minière	[ ] Aquaculture	[ ] Flood Protection Protection contre les inondations	

List of Agencies (Federal, Provincial or Municipal) contacted or notified, or who have initiated contact with the applicant.
Liste des organismes (fédéraux, provinciaux ou municipaux) contactés ou qui ont pris contact avec le requérant.

PROVIDE DETAILS OF PROPOSED ACTIVITY INCLUDING REASONS FOR THE PROJECT AND TYPES OF EQUIPMENT TO BE USED
DONNER DES PRÉCISIONS SUR LES TRAVAUX PROJETÉS Y COMPRIS LA JUSTIFICATION DU PROJET ET LE TYPE D'ÉQUIPEMENT À UTILISER

APPENDIX V
Application Form to Harmfully Alter, Disrupt or Destroy Fish Habitat (continued)

SCHEDULE VI-Continued/ANNEXE VI (suite)

Fisheries and Oceans
Pêches et Océans

Application No./N° de la demande

APPLICATION FOR AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT
DEMANDE D'AUTORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON

SCHEDULE/CALENDRIER

	D/J	M/M	Y/A
Proposed Starting Date Date prévue du début des travaux	_____	_____	_____
Proposed Completion Date Date prévue de l'achèvement des travaux	_____	_____	_____

Approximate Timing of Work in shoreline, foreshore, tidal zone, or underwater areas.
Période approximative des travaux sur le rivage et les estrans ainsi que dans les zones àmarées et les zones sous-marines.

	D/J	M/M	Y/A		D/J	M/M	Y/A
From/De	_____	_____	_____	To/A	_____	_____	_____

The following documents will assist in assessing your application and help expedite its approval. Please check which documents you have attached.	**Les documents suivants faciliteront l'évaluation de votre demande et permettront d'accélérer son approbation. Veuillez cochez les documents vous avez joints àvotre demande.**
Map indicating location of project	[ ] Carte indiquant l'emplacement du projet
Engineering Specifications	[ ] Spécifications techniques
Scale Drawings	[ ] Dessins àl'échelle
Dimensional Drawings	[ ] Plans cotés
Assessment of Existing Fish Habitat Characteristics	[ ] Évaluation des caractéristiques existantes de l'habitat du poisson
Assessment of Potential Effects of Project on Fish Habitat	[ ] Évaluation des répercussions possibles sur l'habitat du poisson
Measures Proposed to Offset Potential Damage to Fish Habitat	[ ] Mesures proposées pour compenser les ventuels dommages àl'habitat du poisson
Other	[ ] Autres

ENVIRONMENTAL ASSESSMENT AND REVIEW PROCESS CONSIDERATIONS	**CONSIDIRATIONS CONCERNANT LE PROCESSUS D'IVALUATION ET D'EXAMEN EN MATIORE D'ENVIRONNEMENT**
NOTE: All applications pursuant to section 35 of the Fisheries Act will be assessed in accordance with applicable federal environmental assessment requirements.	REMARQUE : Toute demande en vertu l'article 35 de la Loi sur les pêches sera soumise aux exigences fédérales applicables àl'évaluation environnementale.

APPENDIX V
Application Form to Harmfully Alter, Disrupt or Destroy Fish Habitat (concluded)

SCHEDULE VI-Concluded/ANNEXE VI (fin)

Fisheries and Oceans
Pêches et Océans

Application No./N° de la demande _____

APPLICATION FOR AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT
DEMANDE D'AUTORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON

COMPLETE ONLY IF USE OF EXPLOSIVES IS INTENDED
A REMPLIR SEULEMENT EN CAS D'UTILISATION D'EXPLOSIFS

EXPLOSIVES CONTRACTOR (IF DIFFERENT FROM APPLICANT)/RESPONSABLE DES EXPLOSIFS (SI AUTRE QUE LE REQUIRANT)

Name/Nom : _____

Address/Adresse : _____

_____

Telephone No./N° de téléphone : _____

	D/J	M/M	Y/A		D/J	M/M	Y/Y
Anticipated Starting Date Date prévue du début des travaux	_____	_____	_____	Completion Date Date d'achèvement	_____	_____	_____

DETAILS OF EXPLOSIVES/PRÉCISIONS SUR LES EXPLOSIFS

Type (including trade name)
Genre (y compris la marque _____

_____

Weight and configuration (where applicable) _____
Poids et forme (le cas échéant)

_____

_____

Weight of individual shots and shot pattern where multiple charges are used
Poids des coups individuels et déploiement des coups, en cas de charges multiples

_____

_____

Detonation depth (in the rock; note also the depth of water, if applicable)
Profondeur de détonation (dans le roc; indiquer aussi, la profondeur de l'eau, s'il y a lieu)

_____

_____

Method of detonation
Méthode de détonation _____

_____

_____

Appendix J.12
Marine Pile Installation Management Plan

J.12 MARINE PILE INSTALLATION MANAGEMENT PLAN

1.0 INTRODUCTION

Pacific NorthWest LNG Limited Partnership (PNW LNG) has developed a Preliminary Draft Marine Pile Installation Management Plan to address potential environmental concerns during the construction phase of the Pacific NorthWest LNG Project (the Project). The purpose of the Preliminary Draft Marine Pile Installation Management Plan is to address potential adverse environmental effects resulting from marine pile installation and associated activities, such as drilling and concrete works. Project components that will require driving wooden or steel piles into the seabed include the marine terminal, the materials off-loading facility (MOF), the pioneer dock, the float camp and the bridge from Lelu Island to the mainland.

This preliminary draft plan presents a framework for managing potential adverse environmental effects based on the Environmental Impact Statement (EIS) for the Project and subsequent feedback from regulators, Aboriginal groups, stakeholders and the public. This plan will be updated and refined based on detailed Engineering Procurement Construction and Commissioning (EPCC) Contractor design and permitting requirements.

Roles and responsibilities related to environmental management are generally described in the Environmental Management Plan (EMP) Overview, Section 3.0. General information pertaining to compliance monitoring is provided in Section 2.2 of the EMP Overview.

1.1 REGULATORY CONTEXT

Protection of surface water quality, fish and fish habitat, as defined by Fisheries and Oceans Canada (DFO), are legislated within the *Fisheries Act*. Sections of the *Fisheries Act* (including amendments up to November 25, 2013) that are pertinent to the Project include:

- *Fisheries Act* (2005, amended 2013):
  - Section 2(2): For the purposes of this Act, serious harm to fish is considered to be the death of fish or any permanent alteration to, or destruction of, fish habitat
  - Section 35(1): No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery
  - Section 36(3): Subject to subsection (4), no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water.
- *Marine Mammal Regulations:*
  - Section 7: No person shall disturb a marine mammal except when fishing for marine mammals under the authority of these regulations.

As with underwater blasting (see Appendix J.11 of the EIS/Addendum) least-risk timing windows apply to marine pile driving for the lower Skeena Region (November 30 to February 15) to reduce potential mortality to fish during sensitive life stages for key marine species. Additional legislative requirements for marine pile driving activities are likely to include:

- Authorization from the Prince Rupert Port Authority (PRPA) which manages nautical traffic and related activities within its jurisdictional boundaries. Specifically, the PRPA reviews documentation and permits including, but not limited to, the Transport Canada Navigation Protection Program and the *Fisheries Act* Authorization issued by DFO, where applicable.
- *Navigation Protection Act* (NPA)—protects the public's right to navigate, and regulates the construction of works in navigable waters; this includes construction of wharves, docks, piers, dams, booms, bridges, overhead cables or pipelines.
- The District of Port Edward maintains Noise Control Bylaw No. 520 (2011), which regulates and prohibits the making or causing of noise or nuisance sounds within the District of Port Edward. Stakeholder and Aboriginal consultation and correspondence regarding pile driving timing will be required.

2.0 MITIGATION PROGRAM

Marine pile installation and drilling (pending Contractor specifics) is required after dredging to support project infrastructure and allow for construction of the project MOF and LNG carrier berths. Piles are expected to be composed of wood for temporary facilities (i.e., related to the pioneer dock) and steel for more permanent structures such as the MOF. Marine piles will be drilled or hammered (i.e., vibratory or impact) into sediment or bedrock and filled with concrete where applicable. Mitigation measures are focused on addressing the pile driving construction components in compliance with the regulatory context provided in Section 1.1.

Marine pile installation activities will consider the Best Management Practices for Pile Driving and Related Operations (Appendix 1) as general industry guidance while developing site-specific mitigation measures. Pile driving mitigation measures, outlined in Table 1 are recommended.

Table 1: Marine Pile Installation Mitigation Measures Summary

Project Construction Component	Best Management Practices and Mitigation Measures
Preparation	Maintain all equipment in good working condition and free of excess oil and grease to prevent leaking or spillage of any deleterious substances into the marine environment.
	Couplings, connectors, hydraulics and hoses are in good condition and inspected throughout each day whenever possible.
	Store fuel, lubricants and concrete constituents within approved containment units in compliance with safe operating procedures.
	Use biodegradable lubricants and hydraulic fluids where possible.
	Emergency spill equipment must be readily available and able to handle a "worst-case" spill scenario (see Appendix J.6 of the EIS/Addendum).
	Notify the appropriate authorities prior to initiating work (DFO, PRPA).
	Contractors will reduce damage to the marine environment wherever possible (i.e., use of anchors instead of spuds; avoid spudding/anchoring in sensitive locations such as eelgrass).
	Place bubble curtain, silt curtain and any other required mitigation measures prior to starting pile driving and drilling activities.
Underwater Drilling	Comply with District of Port Edward Noise Control Bylaw No. 520 (2011). Notify potentially affected Aboriginal groups and public residents 24 hours before underwater drilling is conducted.
	Where appropriate, nighttime construction activity will be limited to low noise activities (i.e. low impact drilling activities).
	Spot-checks will be conducted during equipment operation to confirm that couplings, connectors, hydraulics and hoses are not leaking.
	Conduct underwater drilling during DFOs recommended least-risk timing windows as per permit conditions.
	Place silt curtains and any other mitigation measures around underwater drilling activities if turbidity concentrations are above accepted thresholds (see Table 2).
	During pile drilling, visually monitor the effects on fish and marine mammals. If observable impacts occur during pile drilling activities, then effective means of reducing impacts must be implemented.
	Drill cuttings will be stored or returned to the seabed if turbidity concentrations remain within acceptable levels (see Table 2).
Driving Steel Piles	Low noise pile installation techniques (i.e., vibratory installation methods) will be used except during seating of some piles into bedrock.
	In instances when an impact pile driver is required (e.g., during pile seating), bubble curtains with bubble-containment casing will be used and the impact hammer will be constructed of sound absorbent material. To mitigate for behavioural effects, a bubble curtain will also be used during low noise pile installation.
	In instances when the use of bubble curtains is diminished by high currents, isolation casings that contain bubbles will be used in lieu of bubble curtains.

Project Construction Component	Best Management Practices and Mitigation Measures
	Bubble curtains will be used during pile installation (i.e., vibratory and impact) at the inner marine offloading facility. Bubble curtain type and/or casing used will be determined on a case by case basis, taking into consideration the type of activity (and predicted sound levels) and currents. In situ field validation of the effectiveness will be measured/monitored during the first seven days of each style of curtain/casing implemented to confirm underwater sound levels produced following implementation of this mitigation.
	Where appropriate, vibratory pile driving will be confined to between 8:00 am and 7:00 pm based on District of Port Edward Noise Control Bylaw No. 520 (2011) stipulations.
	Conduct pile driving during DFOs recommended least-risk timing windows as per permit conditions.
	Spot-checks will be conducted during equipment operation to confirm that couplings, connectors, hydraulics and hoses are not leaking.
	If an impact pile driving technique is required, a marine mammal observation (MMO) program will be required (with bubble curtain). An exclusion zone of 500 metres will be implemented according to DFO guidance and EIS commitments. See also Appendix 1 in the Marine and Freshwater Resource Management Plan (Marine Mammal Monitoring and Protection Plan).
	Place an air-induced bubble curtain around the wetted pile driving area, ensuring the bubbles create a perimeter around the entire wetted length of the pile.
	Where possible, use a vibratory hammer as opposed to an impact hammer.
	Implement a MMO program during pile driving activities (also see Environmental Monitoring Management Plan – Appendix J.16 of the EIS/Addendum)
	During impact hammer pile driving, if a marine mammal enters the safety perimeter, work will be stopped until the marine mammal leaves the safety perimeter. Impact pile driving should not resume until it is visually confirmed that the marine mammal is outside of the safety perimeter or a minimum of 15 minutes has elapsed since it was last sighted.
	The designated MMO has the authority to stop work activities that pose a hazard to marine mammals.
	Dispose of or recycle any waste products (i.e., pile cutoffs, welding materials etc.) at an approved designated facility. Debris or garbage is not to be disposed of in the marine or terrestrial environment.
Concrete Works	Spot-checks will be conducted during equipment operation to confirm that couplings, connectors, hydraulics and hoses are not leaking.
	Work involving the use of concrete, cement, Portland cement, mortars and other lime containing materials must be conducted so that sediments, concrete fines and concrete are not deposited into the marine environment.
	Where feasible, wash-down of concrete-laden equipment will be done off site. If not feasible to wash-down off site, wash-down must be conducted in a designated area, in a sealed container free of leaks away from the marine environment.
	Concrete equipment wash water will not be released into the marine environment. It will be disposed of following appropriate disposal methods and regulations.

Project Construction Component	Best Management Practices and Mitigation Measures
	Concrete forms are not to be filled beyond capacity.
	Isolate and hold water that comes into contact with uncured or partly cured concrete (e.g., wash water).
	In the event of a concrete or wash water release to the environment, stop work immediately and contain the release.
	Dispose of or recycle any waste products (e.g., forms) at an approved designated facility. Debris or garbage is not to be disposed of in the marine or terrestrial environment. (see Appendix J.10 of the EIS/Addendum).
	If the material is deemed toxic (i.e., high pH concrete), store the material in an approved containment unit and dispose of at an approved facility.

3.0 ENVIRONMENTAL COMPLIANCE MONITORING AND REPORTING

Monitoring for underwater marine pile installation activities will be conducted according to applicable regulatory guidance. Environmental monitoring of pile installation and associated activities will require a qualified MMO. Prior to initiating pile installation and associated activities, the PRPA will be notified to alert ship traffic in the area.

Public communication and the handling of complaints related to noise will be undertaken by PNW LNG to come to a mutually agreed upon resolution. Refer also to the Noise, Vibration and Ambient Light Management Plan (Appendix J.5 of the EIS/Addendum).

3.1 ENVIRONMENTAL COMPLIANCE MONITORING

Environmental Monitors will be on-site during marine construction activities to monitor the effectiveness of mitigation measures in achieving regulatory compliance. Environmental Monitors will be present to assist with compliance of the Marine Pile Installation Management Plan and all applicable permits, approvals and authorizations. Environmental monitoring requirements specific to marine pile installation are presented in the Environmental Monitoring Management Plan (Appendix J.16 of the EIS/Addendum).

3.2 ENVIRONMENTAL COMPLIANCE REPORTING

The Environmental Monitor(s) will provide weekly reports to PNW LNG. These reports will include photographs, marine mammal observations (if any) and analytical data such as water quality readings. Details of mitigation measures applied, public noise complaints received, and the subsequent follow-up will also be reported.

4.0 REFERENCES

Fisheries and Oceans Canada. (DFO). 1993. Land Development Guidelines for the Protection of Aquatic Habitat.

Fisheries and Oceans Canada. (DFO). May 2005. Skeena Region Reduced Risk In-stream Work Windows and Measures

Fisheries and Oceans Canada. (DFO). 2007. Operational Statement: Routine Maintenance Dredging for Navigation

Ministry of Water, Land and Air Protection. (MWLAP). March 2004. Standards and Best Practices for Instream Works

BC Marine and Pile Driving Contractors Association. March 2003. Best Management Practices for Pile Driving and Related Operations

Timing windows to conduct projects in or around waters (accessed September 24, 2014): http://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/index-eng.html

Best Management Practices for Pile Driving and Related Operations

BC Marine and Pile Driving Contractors Association

March 2003

The B.C. Marine and Pile Driving Contractors Association and Fisheries and Oceans Canada have developed a Best Management Practices Policy for pile driving operations and related activities when working on the water within the province of British Columbia.

The Pile Driving Industry utilizes many different construction methods, equipment and materials in order to complete the contractual obligations for its client. Hammers; including drop, diesel, air, vibratory and hydraulic, vibroflot, and rotary, air and churn drills are the primary instruments in a pile driving operation. These hammers and drills are supported by a wide variety of heavy equipment, including a range of conventional cranes (truck mounted, crawler and pedestal mounted), spud scows, support barges and other water borne equipment. The piling types include treated timber (primarily creosote), concrete and steel (pipe, h-beam and sheet). Construction projects have the potential to utilize a number of different combinations of equipment and materials. It is the purpose of this document to examine the characteristics of each potential combination and develop a Best Management Practices Policy that will meet the following criteria:

-Maximize environmental protection
-Adhere to the Fisheries and Oceans regulations
-Provide construction services economically

1)- Basic Rules of Operation

When in an aquatic environment, contractors will employ the following BASIC Best Management Practices:

- All equipment will be maintained in good proper running order to prevent leaking or spilling of potentially hazardous or toxic products. This includes hydraulic fluid, diesel, gasoline and other petroleum products.
- Storage of fuels and petroleum products will comply with safe operating procedures, including containment facilities in case of a spill.
- Pile cut offs, waste or any miscellaneous unused materials will be recovered for either disposal in a designated facility or placed in storage. Under no circumstances will materials be deliberately thrown overboard.
- Contractors will have emergency spill equipment available whenever working near or on the water.
- Contractors where possible will position their water borne equipment in a manner that will minimize damage to identified fish habitat (e.g. eel grass). Where possible, alternative methods will be employed (e.g. use of anchors instead of spuds). In the event that circumstances will not allow an alternative, contractors will minimize the damage and where required restore habitat to its original state at the completion of the project.

- Prior to the commencement any work that is longer than 5 working days in duration and falls under this agreement, the contractor will complete and forward the attached "Notice of Project" to the Department of Fisheries.
- Whenever Contractors are working in areas where spawning is present, the work will be temporarily suspended and the appropriate fisheries officer contacted.
- There will be no restriction of work during closure periods (with the only exception when spawning is present) provided the contractors employ an exclusion device around the work area to restrict fish access or when required an effective method of mitigating shock waves (bubble curtain).
- Whenever shock wave monitoring (hydro phone) is performed at a marine construction site and the findings are available to the contractor, the data will be forwarded to the B.C. Marine and Pile Driving Contractors Association. It is intended to build a data base of information so that work procedures will reflect the safest and most economical approach to protecting the fish and their habitat.

2)-Timber Piling (creosote):

When driving timber piling, the following Best Management Practices will be employed to ensure minimum impact to marine fish and their habitat:

- Where possible, new timber piles will comply with the best Management Practices for the use of treated wood in aquatic environments as developed by the Canadian Institute of Treated Wood and the Western Wood Preservers Institute.
- Where the above is not possible creosote piling will stand for a minimum of 45 days prior to installation.
- These requirements are for new piling only and will not restrict the use of re-used timber piling. Reused piling will not be subject to any additional treatments.
- Timber piling is normally driven using a drop hammer, a diesel/air impact hammer or a small vibratory hammer. Because of the relative small diameter of the timber pile, and its excellent energy absorbing quality, there is little threat to fish and their habitat when driving timber piles.
- No environmental monitoring is required.
- When demolition is required on timber pile structures, the contractor will remove the piling by mechanical means and avoid breaking the piling at the mud line or below. All demolition operations should be monitored in order to control and contain the construction debris.

3)-Concrete Piles

When driving concrete piles regardless of which hammer is being used, the following Best Management Practices will be employed to minimize the impact on fish habitat:

<u>Up to 24 inch diameter concrete piling</u>

- The physical design of 24 inch concrete pile dictates that one, the energy required must be controlled in order to prevent the pile from breaking and second the concrete construction of the pile will absorb the energy. These two factors result in low level shock waves (less than 30 kPa.) being emitted and are of no danger to fish and their habitat.
- No environmental monitoring is required.

Over 24 inch diameter concrete piling

- When driving concrete piles with a diameter greater than 24 inches using an impact or hydraulic hammer, the following Best Management Practice will be employed to minimize the impact on fish habitat:
- Visual monitoring of the impact on fish by the shock waves emitted will be required. If fish kill is evident then the contractor will introduce effective means of reducing the level of the shock waves. Appropriate mitigating measures would be the deployment of a bubble curtain over the full length of the wetted pile. This should defuse the shock waves to an acceptable level.
- If after the preventive measure is introduced, and further visual monitoring reveals unacceptable conditions (excessive fish kill), then the work will stop immediately and the system reviewed and corrected.

4)-Steel Pipe Piles (less than 24 inch in diameter):

When driving steel piles of less than 24 inches in diameter regardless of the type of hammer being used, the following Best Management Practices will be employed to minimize the impact on the fish habitat:

- Because of the small diameter of the pile it is an accepted principle that the energy required to drive the pile to final point of installation would not result in shock wave in excess of 30 kPa. , and therefore would not require protective measures from the possibility of shock waves.
- If due to the ground conditions, the pile installation is causing excessive fish kill work will cease and contractors will be responsible for introducing effective means of reducing the level of shock waves or introduce measures that will protect fish from entering the potentially harmful shock wave area. Appropriate mitigating measures would be the deployment a bubble curtain over the full length of the wetted pile that would defuse the shock waves to an acceptable level.
- If after preventive measures are introduced, and visual monitoring reveals unacceptable conditions (excessive fish kill), then the work will stop immediately and the system reviewed and corrected.

5)-Steel Pipe Piles (over 24 inches in diameter)

When driving steel pipe piles with a diameter greater than 24 inches using impact or hydraulic hammers, the following Best Management Practices will be employed to minimize the impact on fish habitat:

- Visual monitoring of the effects of the shock waves on fish habitat will be required. If fish kill is evident then the contractor will introduce effective means of reducing the level of the shock wave. Appropriate mitigating measures would be the deployment of a bubble curtain over the full length of the wetted pile. If after preventive measures are introduced, and further visual monitoring reveals unacceptable conditions (excessive fish kill), then the work will stop immediately and the system reviewed and corrected.

6)-Steel Sheet Piles and H-piles

When driving steel sheet piles and H-piles with a drop hammer, an impact hammer or a vibratory hammer the following Best Management Practices will be employed to minimize the impact on fish habitat:

- It is anticipated that the driving of these types of piles will not generate shock waves in excess of 30kPa., therefore the need for mitigating measures is not required.
- If due to ground conditions, the pile installation is causing excessive fish kill, work will cease and the contractor will be responsible for introducing an effective means of reducing the level of shock wave or introduce measures that will protect fish from entering the harmful shock wave area. Appropriate mitigating measures would be the deployment of a bubble curtain over the full length of the wetted pile that would defuse the shock waves to an acceptable level.
- If after preventive measures are introduced, and visual monitoring reveals unacceptable conditions (excessive fish kill), then the work will stop immediately and the system reviewed and corrected.

7)-Stone Column Construction

When installing stone column using a vibroflot the following Best Management practices will be employed to minimize the impact on fish habitat:

- The vibrating action and air flush associated with the operation of the probe results in a high degree of turbidity. When this level exceeds the criteria as outlined in the British Columbia Approved Water Quality Guidelines, the contractor will introduce containment method that are designed to isolate the contaminated area and to prevent
  fish from entering the contaminated area. Silt curtains and netting are two methods that can provide the necessary protection.
- When supplying the aggregate to the probe, the contractor will ensure that spillage is controlled thereby providing additional protection to the fish habitat.
- An independent environmental agency will be used to monitor the levels of turbidity.

8)-Underwater Drilling and Blasting

When performing underwater drilling and blasting the following Best Management Practices will be employed to minimize the impact on fish habitat:

<u>Underwater Drilling</u>

- Drilling underwater is a process that has very little impact on the fish habitat. The procedure does not generate shock waves.
- Contractors will ensure that all attachments (hydraulic connections and couplings) are in good operating order and inspected prior to the start of every day.
- Depending on soil conditions and the potential for turbidity, drill cuttings will be deposited adjacent to the operation, contained on the sea bed or deposited into containment skiffs or scows when it is determined that the drill cuttings are unsuitable for return to the environment.

Underwater Blasting

Contractors required to perform blasting underwater will provide the following protection:

- Because of the potential for a blasted shock wave, a protection shield will surround the immediate blast area. This would be in the form of an air-induced bubble curtain, which has the primary purpose of absorbing the shock wave and a secondary purpose of keeping fish from entering the blast area.
- In order to protect against flying rock, mats (rubber) will be placed over the blasting area. The placement of the mats will also provide protection for any fish caught in the immediate area.
- Monitoring of fish movement and concentrations will be performed to determine if fish herding or scaring techniques (seal bombs) can be utilized to reduce the presence of fish in the blast area.

9)-Cleaning out Pipe Piles:

When cleaning out pipe piles (i.e. air lifting) the following Best Management Practice will be employed to minimize the impact on fish habitat:

- If the material that is to be removed inside the pipe is non-toxic, then it shall be redistributed in a manner that will minimize damage to the surrounding fish habitat. This can be achieved by the following systems:
- The excavated material is pumped through a discharge tube and allowed to settle in the immediate area.
- The excavated material is pumped through a discharge tube and contained within an enclosure (silt curtain) in order to control the sediment.
- The excavated material is pumped through a discharge tube and additional flex hosing and redirected back to the base of the pile.
- If the material to be removed from the pipe is determined to be toxic, then it will be processed through an approved containment system and the unwanted material removed and disposed of accordingly.

10) Containment of Concrete Residue and Water Run Off

When placing concrete in form work over or in water, the following Best Management Practice will be employed to minimize the impact on fish habitat:

Pouring concrete

- Spills: When pouring concrete all spills of fresh concrete must be prevented. If concrete is discharged from the transit mixer directly to the form work or placed by wheelbarrow, proper sealed chutes must be constructed to avoid spillage. If the concrete is being placed with a concrete pump, all hose and pipe connections must be sealed and locked properly to ensure the lines will not leak or uncouple. Crews will ensure that concrete forms are not filled to overflowing.
- Sealing forms: All concrete forms will be constructed in a manner which will prevent fresh concrete or cement laden water from leaking into the surrounding water.

Curing concrete

- When fresh water is used to cure concrete, the run off must be monitored for acceptable pH levels. If the pH levels are outside the allowable limits then the run off water must be contained and neutralized.

Grinding concrete

- When grinding cured concrete the dust and fines entering the water must not exceed the allowable limits for suspended solids. When grinding green or not completely cured concrete and the dust or fines are entering the water, pH monitoring will be conducted to ensure allowable ranges are maintained. In the event that the levels are outside the acceptable ranges preventative measures will be introduced. This could include introducing silt curtains to contain the solids and prevent fish from entering a contaminated area or constructing a catch basins to recover the run off and neutralizing it prior to disposal.

Patching concrete

- Spills: When patching concrete all spills must be contained and prevented from falling into the water.

Washing down hand tools, pumps and transit mixer

- All tools, pumps, pipes, hoses and trucks used for finishing, placing or transporting fresh concrete must be washed off in such a way as to prevent the wash off water from entering the marine environment. The wash water will be contained and disposed of upland in an environmentally acceptable manner.

Whenever there is the possibility of contaminates entering habitat waters, the contractor will monitor pH levels to ensure acceptable levels.

APPENDIX

Fisheries and Oceans Canada

Contact List

Name	Telephone No.	Fax. No.

NOTICE OF PROJECT

To: Fisheries and Oceans Canada

Attention:

Fax. No.:

From: “Contractor”

Telephone No.:

Fax. No.:

Representative:

Please be advised of the following marine/pile driving project:

Project Name:

Project Location:

Project Manager/Superintendent:

Project Telephone No.:

Project Fax. No.:

Project commencement date:

Appendix J.13
Dredging Management Plan

J.13 PRELIMINARY DRAFT DREDGING MANAGEMENT PLAN

1.0 INTRODUCTION

Pacific NorthWest LNG Limited Partnership (PNW LNG) has developed a preliminary draft Dredging Management Plan for the construction phase of the Pacific NorthWest LNG Project (the Project). This preliminary draft Dredging Management Plan outlines regulatory requirements and commitments from the Environmental Impact Statement (EIS) for the Project and best management practices that will be implemented to reduce adverse environmental effects associated with marine dredging activities within the project area.

This preliminary draft plan presents a framework for managing potential adverse environmental effects based on the EIS/Application for the Project and subsequent feedback from regulators, Aboriginal groups, stakeholders and the public. This plan will be updated and refined based on detailed Engineering Procurement Construction and Commissioning (EPCC) Contractor design and permitting requirements.

Roles and responsibilities related to environmental management are generally described in the Environmental Management Plan (EMP) Overview, Section 3.0. General information pertaining to compliance monitoring is provided in Section 2.2 of the EMP Overview.

1.1 REGULATORY CONTEXT

The primary federal and provincial legislation protecting marine and freshwater resources within an industrial development context are:

- *Canadian Environmental Protection Act* (CEPA; 1999). Environment Canada (EC) administers CEPA under Part 7, Division 3. A permit under CEPA is required for the disposal at sea of clean dredged materials.
  - Section 127(1): The Minister may, on application, issue permits authorizing the loading for disposal and disposal of waste or other matter
  - Schedule 6 of CEPA provides several provisions for disposal at sea, including reduction and management of material to be disposed; information requirements for the material to be disposed, including chemical and physical characterization; disposal at sea site selection information requirements, and several other provisions required for including within a permit application for disposal at sea. Sediment quality is assessed against screening criteria for disposal at sea and Canadian Council of Ministers (CCME) for the Environment sediment and water quality guidelines for protection of marine life.

- *Fisheries Act* (2005, amended 2013):
  - Section 2(2): For the purposes of this Act, serious harm to fish is considered to be the death of fish or any permanent alteration to, or destruction of, fish habitat
  - Section 35(1): No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery
  - Section 36(3): Subject to subsection (4), no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water.
- *Marine Mammal Regulations* of the *Fisheries Act*
  - Section 7: No person shall disturb a marine mammal except when fishing for marine mammals under the authority of these regulations.

- *Species at Risk Act* (2002). :
  - Section 32(1): No person shall kill, harm, harass, capture or take an individual of a wildlife species that is listed as an extirpated species, an endangered species or a threatened species
  - Section 33: No person shall damage or destroy the residence of one or more individuals of a wildlife species that is listed as an endangered species or a threatened species, or that is listed as an extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada
  - Section 58(1): Subject to this section, no person shall destroy any part of the critical habitat of any listed endangered species or any listed threatened species – or of any listed extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada – if
    (a) the critical habitat is on federal land, in the exclusive economic zone of Canada or on the continental shelf of Canada.
    (b) the listed species is an aquatic species; or
    (c) the listed species is a species of migratory birds protected by the Migratory Bird Convention Act, 1994.

Potential permits relevant to dredging required to complete the Project as proposed include:

- Disposal at Sea permit under Section 127 of CEPA (as described above)
- *Fisheries Act* Authorization (Fisheries and Oceans Canada [DFO])
  - Required to authorize serious harm to fish (including destruction of fish habitat) for both the dredging and disposal components.

1.2 WORK STANDARDS, GUIDELINES AND BEST PRACTICES

The Province of British Columbia (BC) and the Federal Government have standards, guidelines or Best Practices for working in and around water and reducing project related impacts on marine and freshwater resources. These include*:*

- Measures to Avoid Causing Harm to Fish and Fish Habitat. DFO.
- Canadian Environmental Quality Guidelines. CCME.

2.0 MITIGATION PROGRAM

Construction of the materials off-loading facility (MOF) will require dredging of marine sediment. In order to reduce potential adverse environmental effects, mitigation measures outlined in Table 1 will be implemented.

Table 1: Dredging Mitigation Measures Summary

Project Construction Component	Best Management Practices and Mitigation Measures
Dredging	Salvage and relocate Dungeness Crabs wherever feasible prior to commencement of dredging activities; Dungeness Crabs will be relocated using proper handling techniques and strategies that limit stress.
	Material from the dredge area that is suitable for construction or habitat offsetting will be used rather than disposed of it at sea.
	Manage the risk posed by historical deposits of dioxins and furans in accordance with any site-specific permit conditions.
	Monitor dredge activity using a Global Positioning System (GPS) tracking device to maintain dredging within the approved area.
	Conduct dredging during DFO-specified least-risk timing window(s), if applicable (permit condition).
	Reduce the release of sediment to the water column during dredging using well maintained equipment suited for the task (i.e., clamshell bucket).
	Dredge operations will be conducted using methods that reduce sediment spill.
	Turbidity will be monitored in real time during in-water construction activities in accordance with any permit conditions and the rate of dredging will be adjusted, in the event that water quality guideline limits are exceeded.
	In areas of low to moderate currents (≤ 1 knot), silt curtains will be installed around dredging activities if monitoring indicates that inferred TSS levels are greater than predicted
	Dredging will occur at low tide, where possible.
	Dredged sediment will be disposed of at or near the center point of the Brown Passage disposal site, to minimize effects on water quality outside the site.
	Rock from the dredge area that is suitable for construction or habitat offsetting will be used rather than disposing of it at sea to reduce the amount of disposal material and associated potential TSS levels. Turbidity levels in accessible areas of the water column will be monitored during disposal.
	Daily consultation of current/forecasted meteorological and oceanographic information in order to assess the risk for sediment plume dispersion from dredging activities, and to identify potential risk of sediment spill from the vessel due to inclement weather.

Project Construction Component	Best Management Practices and Mitigation Measures
Fuelling, Fuel Storage and Equipment Maintenance	Dredging equipment and machinery (i.e., barge and crane) used on the project site should be maintained in good operating condition, clean (power washed), free of leaks, excess oil, and grease. Establish designated fueling and servicing areas to confine these activities.
	Construction machinery will use environmentally-sensitive hydraulic fluids that are non-toxic to aquatic life and that are readily or inherently biodegradable.
	The transportation, storage, and/or dispensing of fuel and other petroleum based products will comply with all federal and provincial regulations, and specifically the Field Guide to Fuel Handling, Transportation and Storage (MWLAP, 2002).
	Storage, handling, and transport of petroleum products including fuels, oils and lubricants, many of which are flammable, will comply with industry best practices, acts, regulations and guidelines as listed below: • The WorkSafeBC BC Occupational Health and Safety (OHS) Regulation including Part 5 • "Chemical and Biological Substances, Flammable and Combustible Substances" • Workplace Hazardous Materials Information System (WHMIS) • The BC Ministry of Transportation and Infrastructure "*Transport of Dangerous Goods*" (TDG) program, regulated under the BC *Transport of Dangerous Goods Act and Transport of Dangerous Goods Regulation* • CCME's "Environmental Code of Practice for Above Ground Storage Tank Systems Containing Petroleum Products" • The National Research Council (NRC)'s National Fire Code; and, • The *BC Fire Services Act*.
Spills	See Environmental Emergency Preparedness and Response Plan (Appendix J.6 of the EIS/Addendum) and Waste Management Plan (Appendix J.10 of the EIS/Addendum).

In addition to the above measures additional best management practices may be requested by EC. These are likely to include measures around dredge operator training, control of ascent rates, bucket capacity and sealing, and sedimentation control. Additional project and site-specific stipulations will be developed by EC as part of the anticipated disposal at sea permitting under CEPA.

3.0 ENVIRONMENTAL COMPLIANCE MONITORING AND REPORTING

3.1 ENVIRONMENTAL COMPLIANCE MONITORING

Environmental Monitors will be on-site during marine construction activities to monitor the effectiveness of mitigation measures in achieving regulatory compliance. Environmental monitoring requirements specific to dredging operations are presented in the Environmental Monitoring Management Plan (Appendix J.16 of the EIS/Addendum).

3.2 ENVIRONMENTAL COMPLIANCE REPORTING

Environmental monitoring reports will be filed by the Environmental Monitor(s) on a weekly basis to PNW LNG's Environmental Manager. These reports will include photographs and written description of the construction activities. Required reporting to regulators (BC Ministry of Environment, DFO), will be determined in consultation with those agencies.

4.0 REFERENCES

BC Ministry of Water, Land and Air Protection (MWLAP). A Field Guide to Fuel Handling, Transportation and Storage. Third Edition. 2002.

Fisheries and Oceans Canada. (DFO). 2007. Operational Statement: Routine Maintenance Dredging for Navigation

Timing windows to conduct projects in or around waters (accessed September 23, 2014): http://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/index-eng.html

Appendix J.14
Accommodation Management Plan

J.14 PRELIMINARY DRAFT ACCOMMODATION MANAGEMENT PLAN

1.0 INTRODUCTION

Pacific NorthWest LNG Limited Partnership (PNW LNG) has developed a preliminary draft Accommodation Management Plan that outlines the implementation of best management practices and mitigation measures to manage potential adverse effects of the Project on housing availability and affordability. It also provides a draft framework for managing PNW LNG's contracted workforce that is to be housed in the independently owned and operated accommodation camp. Since the accommodation camp will be owned and operated by an independent contractor PNW LNG will establish contractual obligations the contractor must adhere to regarding the management of workers, scope of facilities offered on-site and monitoring and reporting protocols. PNW LNG will also engage in a Joint Camp Management Committee comprised of workers, camp managers and owners that will meet regularly to discuss and develop strategies to adaptively manage camp policies and worker behaviour.

This plan presents a preliminary framework for managing potential adverse effects based on the Environmental Impact Statement (EIS) for the Project and subsequent feedback from regulators, Aboriginal groups, stakeholders and the public. This plan will be updated and refined based on detailed Engineering Procurement Construction and Commissioning (EPCC) Contractor design and permitting requirements, feedback from ongoing engagement, and collaborative planning with regulators, Aboriginal groups, and stakeholders.

1.1 OBJECTIVES

The final Accommodation Plan will include procedures to address all relevant commitments from the EIS Process. The objectives of the Accommodation Management Plan include:

- Require PMW LNG to engage in frequent communication with city and district planners in Port Edward and Prince Rupert as a means of responding to potential community grievances and changes in demand for housing infrastructure
- Outline camp management policies and practices – acknowledging that the accommodation camp is independently owned and operated
- Provide housing policies for non-local temporary workers of whom are not housed in the construction camp; policies will outline preferred accommodations and require workers to be housed in both Port Edward and Prince Rupert – when not housed in the construction camp – to lower the demand in a single community.

1.2 REGULATORY CONTEXT AND COMMITMENTS

1.2.1 Regulatory Context

The project EPCC Contractor(s) will be responsible for complying with applicable law, regulations and industrial standards for camp accommodations and housing including:

- The Industrial Camps Regulation made pursuant to British Columbia's (BC's) *Public Health Act*
- The Food Premises Regulation made pursuant to BC's *Public Health Act*
- The *Residential Tenancy Act*, as applicable
- The *Strata Property Act.*

The following plans may also be applicable:

- Ministry of Natural Gas Development and Minister Responsible for Housing Service Plan 2014/15 – 2016/17
- BC Housing Service Plan
- Prince Rupert's Quality of Life Official Community Plan 2007
- District of Port Edward Official Community Plan
- BC Construction Camp Rules and Regulations (2008-2014) - established between the British Columbia (BC) and Yukon Territory Building and Construction Trades Council and the Construction Labour Relations Association of BC.

1.2.2 Commitments

1.2.2.1 Health Risk Assessment

EPCC Contractor(s) have been instructed to undertake a Health Risk Assessment (HRA) that includes proposed mitigation measures to prevent or minimize health risks as identified in the HRA to a level "as low as reasonably practicable", or, where required by regulation to a level "as low as reasonably achievable". In addition:

- The HRA shall consider any recovery measures needed to mitigate acute and/or chronic health effects should control measures fail
- The HRA Include Provisions to ensure workers are medically fit for the job and healthy. Any medical diseases or disabilities which may adversely influence the employee's ability to perform his role in the work shall be reported prior to the commencement of duties
- The HRA will inform the scope of services and facilities offered on-site to address non-urgent health issues; communicable disease (e.g., viral outbreaks); sexually transmitted infections; mental health and additions.

1.2.2.2 On-site Recreational and Medical Facilities and Programs

The project EPCC Contractor(s) will also be responsible for meeting commitments made during the EIS process regarding the minimum scope of on-site recreational and medical facilities:

- Recreational Facilities - Recreational facilities will be provided on site at the construction camp to reduce potential demand on infrastructure and municipal services

- On-Site Medical Infrastructure and Services - EPCC contractors have been directed to provide the following:
  - Occupational Health and Medical Program
  - Disability management program to facilitate effective "stay at work" and "return to work" strategies
  - Occupation first aid and medical requirements for the worksite to ensure the prompt attention to injured workers and occupational health including:
    - On-site medical facility requirements
    - Off site medical facility requirements
    - First aid equipment, supplies, and location requirements
    - Anticipated demand and use of off-site supporting medical infrastructure and services (such as EMS and medical air evacuations)
    - Certified first aid attendant requirements
    - Certified medical professional requirements (e.g., nurse practitioner, registered professional nurse)
    - Transportation services including ambulatory services and air evacuation
    - Cascading medical services, for local, regional, provincial and inter-provincial.
  - Provisions of Nurse Practitioner and Advanced Care Paramedic within 3 months from the date of commencement of construction (site clearing) in addition to the required industrial first aid attendants. This is to ensure a proactive approach to providing medical and health care services is implemented in the early stages of the project to eliminate impact upon local medical/health care services.

1.2.2.3 Security and Emergency Management

EPCC Contractor(s) will provide for and ensure the safeguarding of personnel and property and emergency management is carried out in a legitimate manner that avoids or limits risks to the safety and security of local communities. EPCC Contractor(s) will adhere to, at a minimum:

1.2.2.3.1 Security Personnel

Retain direct or contracted workers to provide security to safeguard personnel and property. The EPCC Contractor(s) will make reasonable inquiries to ensure that those providing security are not implicated in past abuses and will train them adequately in the use of force, and appropriate conduct toward workers and local communities; and require them to act within the applicable law. The EPCC Contractor(s) will provide a grievance mechanism for local communities to express concerns about the security arrangements and acts of security personnel.

1.2.2.3.2 Emergency Preparedness and Response

Will, in accordance with PNW LNG's Environmental Emergency Preparedness and Response Plan (EEPRP) (see Appendix J.6 of the EIS/Addendum), assist and collaborate with local communities, government agencies, Aboriginal Groups and other relevant parties (identified in PNW LNG's EEPRP), in their preparations to respond effectively to emergency situations, especially when their participation and collaboration are necessary to respond to such emergency situations. If local government agencies have little or no capacity to respond effectively, the EPCC Contractor(s) will play an active role in preparing for and responding to emergencies associated with the Project. The EPCC Contractor(s) will document its emergency preparedness and response activities, resources, and responsibilities, and will disclose appropriate information to local communities, relevant government agencies, Aboriginal Groups and other relevant parties.

2.0 ENGAGEMENT STRATEGY

The results of consultation and engagement with stakeholders and regulatory agencies will be incorporated into the final Accommodation Management Plan. Table 1 outlines a preliminary list of key contacts and potential topics for discussion. This list will be further developed and refined as project planning and design proceeds.

Table 1: Preliminary Consultation and Engagement Outline

Stakeholder/Regulator	Potential Topics	Project-timeline
BC Ambulance Service	• Emergency preparedness and response – outbreaks and acute care; • Ongoing trends and issues; • Key performance indicators • Trauma coordination	• Pre-construction • Construction
BC Housing	• Waitlists and availability of assisted housing and non-market housing, • Funding opportunities for affordable housing initiatives, • Communication strategy for changes in the supply and demand placed on housing in local communities	• Pre-construction • Construction • Operations
City and District Planners , Housing Committee(s)	• Zoning bylaws for temporary housing and camp accommodations • Housing affordability initiatives and concerns of the local community • Location of temporary workers • Communication of worker turn-a-rounds and changes in workforce phasing - Part of PNW LNG's Communication Plan to engage in early and on-going communication with City and District planners, Aboriginal Groups and other stakeholders to allow for proactive planning for an influx of workers	• Pre-construction • Construction • Operations • Decommissioning
Health Agencies: Northern Health and the First Nations Health Authority	• Preventative health strategies and programs; • Emergency preparedness and response – outbreaks and acute care; • Ongoing trends and issues; • Key performance indicators	• Pre-construction • Construction
LSA Community Aboriginal Housing Coordinators	• Wait-lists, couch surfing, overcrowded accommodations • Increases in demand for band-owned housing • In-migration to aboriginal community from project related work opportunities	• Pre-construction • Construction • Operations
M'akola Housing Society/ Aboriginal Housing Management Association (AHMA)	• Homelessness and transitional housing opportunities/wait lists • Supply/demand of emergency housing • Procurement agreements with Aboriginal communities	• Pre-construction • Construction • Operations
Ministry of Community, Sport and Cultural Development	• Policy requirements for social management, follow-up and monitoring • Funding for infrastructure and housing as per of development placed on communities	• Pre-construction • Construction, • Operations • Decommissioning
Ministry of Natural Gas Development and Minister Responsible for Housing	• Policy requirements for social management, follow-up and monitoring • Funding for infrastructure and housing as per of industrial-related development placed on communities • Communication and housing need assessments/panel on housing in Northwest BC	• Pre-construction • Construction • Operations • Decommissioning
Temporary Accommodation managers/owners (e.g., motels, hotels, camps, RV parks)	• Potential effects of block booking • Community marketplace housing such as airbnb • Community events/tourism season • Emergency housing • Turn-around; shift rotation i.e., day(s)off	• Pre-construction • Construction

3.0 MITIGATION PROGRAM

The draft Accommodation Management Plan establishes guidance for PNW LNG and the EPCC Contractor to manage accommodation options for temporary workers during the construction and operations phases of the Project. The subsections below outline preliminary measures to manage the potential adverse effects of the construction camp, and on housing availability and affordability. The final management program will incorporate the results of the consultation and engagement as outlined in Table 1.

3.1 CAMP MANAGEMENT

While the accommodation camp will be owned and operated by an independent contractor, PNW LNG will establish contractual obligations the contractor must adhere to regarding the management of workers and scope of facilities offered on site.

The accommodation camp will be managed and operated in compliance with the applicable laws and regulations which include, but are not limited to:

- Industrial Camps Regulation, pursuant to the *Public Health Act*
- Food Premises Regulation, pursuant to the *Public Health Act.*

The accommodation camp will include security measures to manage access to and from the camp, and to protect workers and assets. Security measures will be designed to:

- Allow only authorized personnel to enter the camp premises
- Act as a check point for guests or camp staff to enforce the Code of Conduct and/or the Drug and Alcohol Policy as described below.

The accommodation camp will include the following amenities and features to operate as self-sufficiently as possible, and to be an attractive housing option for workers:

- Appropriate medical facilities, personnel, and related prevention health services. The EPCC Contractor(s) must ensure that their worker accommodation service provider has staffed the medical facilities at the accommodation camp with appropriate medical and health practitioners (e.g., nurse practitioners and advanced care paramedics with access to clinical oversight from a qualified physician(s)).
- Comfortable single room accommodations, preferably with en-suite or “jack and jill” style restrooms and the provision of women’s only facilities
- Wellness and recreation programs and facilities. Accommodation camp will include a fitness centre and/or other indoor or outdoor recreational opportunities with access to fitness and wellness programs to allow guests to maintain an active and healthy lifestyle while staying in the camp. The EPCC Contractor(s) will work with PNW LNG to incentivize approved use of municipal recreational facilities and programs.
- Entertainment options such as free wifi, televisions, or social spaces
- Restaurant-quality catering, including healthy food options, and options for special dietary needs and cultures

- The provision of alcoholic beverages at a licensed alcohol serving facility, in line with the Alcohol Management Plan described below.

Workers staying in the camp will be expected to comply with the accommodation camp "Code of Conduct" including policies regarding gender and cultural inclusion. In addition to compliance with PNW LNG's and the EPCC Contractor's general policies, this code will include policies and behavioural expectations around drugs and alcohol:

- Workers will be prohibited against the use of illegal drugs when in accommodation and at the work site, in compliance with PNW LNG's drug and alcohol policy
- Workers will be expected to comply with any alcohol management plan, which will prohibit consumption of alcohol in worker's rooms and limit the consumption of alcoholic beverages at the provided facilities.

Transportation to and from the camp will be in compliance with the Transportation Management Plan (see Appendix J.7 of the EIS/Addendum) and will be designed to reduce adverse interactions with the communities:

- Having workers drive their private vehicles to the camp will be discouraged. The camp will have limited parking options for private vehicles.
- Workers residing in nearby communities but staying at the camp for the duration of their shifts will be transported to and from the camp by bus or ride-share whenever feasible. This may be achieved by implementing a park-and-ride facility or designated pickup location in the communities, or by using a carpool-like pickup system.
- Fly-in-fly-out (FIFO) workers will be transported by bus or crew-cab truck between airports and the camp. These trips will be scheduled around flight schedules such that worker time between the airport and camp is minimized.

3.2 HOUSING STRATEGY

Potential adverse effects of worker housing on general housing availability and affordability is an issue of community concern. For this reason, PNW LNG will consult with the EPCC Contractor(s) service providers, the District of Port Edward, City of Prince Rupert and Aboriginal communities to identify measures to reduce, to the extent feasible, the effects of the influx of a large number of temporary workers on the community as early as possible (i.e., pre-construction). This collaborative effort will be required to identify potential issues early and allow time to manage project related effects with respect to project phasing and changing housing requirements. Table 1 also provides a list of key stakeholders/regulators and topics of consideration that may relate to the in-migration of workers as a result of the Project.

The following are examples of housing strategies which may be applicable to the Project. Final plans and strategies will be developed through engagement of housing-related stakeholders/regulators and will be implemented upon selection of the EPCC Contractor(s) and institution of applicable contract provisions. These strategies apply to the construction workforce not housed in the accommodation camp.

- Implement policies that require workers to be housed in more than one community, to lower the demand in a single community. In this case, temporary workers could be housed in both Port Edward and Prince Rupert.
- Purchase or lease an apartment or townhouse complex to rent out to temporary workers. This could come in the form of building a new complex, or renovating a vacant or formerly unsuitable structure. Either of these options would not affect the current housing availability.
- "Block-book" preferred hotel/motel accommodations to provide steady and predictable demand.
- Provide information to temporary workers about preferred accommodation options.

4.0 MONITORING AND REPORTING

Monitoring and reporting is required to ensure the effectiveness of the Accommodation Management Plan and mitigation measures, and to adapt the plan to changing conditions. The monitoring and reporting protocol of the Accommodation Management Plan will be established in conjunction with the Socio-Economic Effects Management Plan in consultation with the Ministry of Community, Sport and Cultural Development and the BC Environmental Assessment Office.

PNW LNG will additionally establish contractual provisions regarding monitoring and reporting protocols with the accommodation camp contractor. Monitoring and reporting protocols will also be developed with the city and district planners and other key stakeholders and regulators as required.

Appendix J.15
Archaeological and Heritage Resources Management Plan

J.15 PRELIMINARY DRAFT ARCHAEOLOGICAL RESOURCES AND HERITAGE MANAGEMENT PLAN

1.0 INTRODUCTION

Pacific NorthWest LNG Limited Partnership (PNW LNG) has developed a preliminary draft Archaeological Resources and Heritage Management Plan that outlines information and guidelines for the management of archaeological and heritage resources that may be encountered during any land altering, clearing and drilling activities for the Pacific Northwest LNG Project (the Project) on Lelu Island and associated private land within the District of Port Edward. Lelu Island is federally administrated land and after a positive Canadian Environmental Assessment (CEA) Agency decision will be leased to PNW LNG for 50 years. All PNW LNG and their contractor's personnel involved in planning and undertaking ground disturbing activities related to the Project should be aware of this plan and adhere to its procedures and practices.

This Plan:

1. Defines procedures and practices for the removal of archaeological materials (primarily culturally modified trees (CMTs)) where necessary
2. Describes the types of archaeological and heritage resources (above ground and sub-surface) that may be encountered during land altering activities
3. Outlines an archaeological and heritage resource Chance Find Procedure and "stop work" procedures required when an unrecorded archaeological site is encountered during land altering activities.

PNW LNG, its contractors and agents will fundamentally take their direction from the Prince Rupert Port Authority (PRPA) with respect to the management of archaeological and heritage resources on federal land. The PRPA, in consultation with Parks Canada and First Nations, has provided federal guidelines for the management of archaeological resources to PNW LNG. These guidelines are to be used by PNW LNG, their contractors and agents as best practices. Note: the *Heritage Conservation Act* will apply if any archaeological and heritage resources are identified on the mainland.

An accurate record of the condition and location of any archaeological and heritage resources is a goal of these best practices. The PRPA-Parks Canada guidelines state that archaeological resources are to be identified, assessed for heritage value, and protected where applicable. The clearing and construction of the liquefied natural gas (LNG) facility on Lelu Island will result in the removal of hundreds of culturally modified trees (CMTs) that are within the project development area (PDA) . Once removed CMTs will need to be respectfully managed in collaboration with appropriate Aboriginal groups.

In the event that unrecorded archaeological or heritage resources are encountered during construction of the LNG facility, PNW LNG's contractors and agents will stop all work in the immediate vicinity of the find and contact appropriate PNW LNG regulatory staff. PNW LNG will work directly with a professional archaeologist and representatives of appropriate Aboriginal groups so that the nature and integrity of the find can be accurately assessed. PNW LNG contractors and agents must report suspected artifacts, human remains or other heritage

objects, or collection of these items. Failure to do so without the express permission and knowledge of PNW LNG and the PRPA may result in penalties as defined in any contract with PNW LNG.

Although, generally, archaeological and heritage resources in British Columbia (BC) are protected under provincial legislation, the majority of the PDA, including all of Lelu Island, is within federal lands, which fall under the jurisdiction of the PRPA, and work carried out has been based on PRPA directive referencing the Treasury Board Policy on Management of Material. For the relatively small portion of the Project located on private or Provincial Crown land, heritage sites and objects that predate AD 1846 are protected under the *Heritage Conservation Act* , which is administered by the Archaeology Branch of the Ministry of Forests, Lands and Natural Resource Operations. Heritage resources specifically protected under the Act include provincial heritage sites, burial places with historic or archaeological value, aboriginal rock paintings or carvings, sites with evidence of human habitation or use before 1846, and heritage wrecks. The Provincial Archaeology Branch has established standards, policies, and guidelines for the conduct of archaeological assessment in BC.

Construction activities on Lelu Island will include (but are not limited to) the clearing of trees and vegetation, peat excavation and management, and the removal of existing soils and bedrock, thereby enabling the construction of the LNG facility. Several archaeological inventories on Lelu Island have been conducted by Millennia Research Ltd., Stantec Consulting Ltd., and Kleanza Consulting Ltd. These studies have created an inventory of the archaeological and heritage resources found on Lelu Island that will guide PNW LNG's contractors and agents and their consulting archaeologists in the appropriate management of these resources through the construction phase.

2.0 ARCHAEOLOGICAL RESOURCES ON LELU ISLAND

Inventories conducted to date have determined that CMTs are the primary archaeological resource present on Lelu Island. Over 600 CMTs have been recorded on the island to date, and it is likely that additional unrecorded CMTs are present. In addition, two stone artifacts have also been found on Lelu Island. One on the foreshore and one inland. Shell middens, burial sites, and other archaeological features have not been found to date, and are not anticipated. Abandoned dwellings, abandoned derelict boats, and box traps are present on the island or on the foreshore, but are not of archaeological significance.

Many CMTs within the PDA will be impacted during land altering activities. The management and mitigation recommendations for CMT removal can be found in the Management, Sampling, and Recording of Culturally Modified Trees section in this plan. It is anticipated that management decisions for inventoried CMTs that require removal will have been determined prior to commencing work.

3.0 GENERAL MITIGATION

Mitigation specific to the management of, or discovery of, archaeological and heritage resources include:

- Systematic Data Recovery (SDR) studies for CMT sites will be conducted by systematically recording a representative sample of CMT features, consisting of:
  - Detailed recording as outlined in the CMT Handbook (Archaeology Branch 2001)

  - Stem round collection
  - Monitoring of CMT removal by a crew comprised of a professional archaeologist and a local First Nations representative
  - Direct dating by stem-round sampling
  - Production of a comprehensive report.
- SDR studies will be conducted on affected heritage sites, consisting of:
  - Scientific excavation and/or surface collection studies
  - Collection and analysis of artifacts, faunal remains, botanical remains, and other archaeological remains
  - Collection and processing of carbon samples for dating
  - Completion of other appropriate specialized analytical processes (e.g., geochemical analysis of stone tools, blood residue analysis)
  - Analysis and interpretation of all recovered data
  - Cataloguing of all collected artifacts and their subsequent curation in an approved facility
  - Production of a comprehensive report
- Work affecting archaeological or heritage sites will cease until the site can be properly assessed by a professional archaeologist
- Archaeological or heritage resources of low significance may also be mitigated through a program of archaeological monitoring carried out during construction
- A chance find protocol document will be used during project construction in the event that unrecorded CMTs are encountered (see Section 24 and Appendix J.15 of the EIS/Addendum).

4.0 ARCHAEOLOGICAL AND HERITAGE RESOURCE CHANCE FIND PROCEDURE

PNW LNG's contractors and agents involved in construction activities will have some training and exposure to archaeological and heritage resources through a qualified archaeologist. Descriptions of archaeological resources that have or could be found on Lelu Island are listed in Appendix 1. If the construction personnel believe they have encountered a previously unidentified CMT, any other archaeological materials, features or human remains they must stop work within the immediate vicinity (e.g., within a 15 meter circumference (may vary as appropriate for site conditions) centered on the CMT or artifact) and follow the procedures outlined below:

1. The person(s) identifying the potential archaeological or heritage resources (e.g., a "find") must contact their foreman and/or senior site management personnel as soon as possible. PNW LNG contacts for archaeological and heritage resources should also be notified (see point 4 below). If a professional archaeologist is present and/or if any Aboriginal monitors are present at the worksite, then they should be contacted as well
2. The find should be "appropriately flagged". Accurately record the locations of the find. If a camera is available, take several photos of the find including an object as a reference of scale
3. Leave all potential archaeological and heritage resources as they have been found; do not move them
4. Contact PNW LNG. PNW LNG will review the information and, as necessary, secure the services of a professional archaeologist to conduct an initial assessment of the find. PNW LNG will also contact the appropriate Aboriginal groups to ensure they are aware of the find

5. A professional archaeologist will determine if the find is archaeological in nature and its importance in consultation with appropriate Aboriginal groups and their advisors
6. Work may resume at the location of the find as soon as practical, if it is determined that the find is not of cultural importance
7. If the find is of possible archaeological significance, instructions for modifying work practices at the location of the find will be provided. The objective is to protect the find from damage. A buffer zone centred on the find should be flagged with surveyor's tape to clearly demarcate a "no disturbance" an appropriate buffer zone around the find's location
8. Mitigation options will be developed by PNW LNG in collaboration with their prime contractor and any sub-contractors, professional archaeologists, PRPA and appropriate Aboriginal groups
9. In the unlikely event that possible human remains are found, work should immediately stop and all of the above steps in this procedure should be applied and personnel encountering the remains should elevate the seriousness of the issue to site and PNW LNG management. PNW LNG will work closely with PRPA and Aboriginal groups and consult with a professional archaeologist to determine if the remains are likely human. If it is considered possible that the remains are human in nature, PNW LNG will further notify the Royal Canadian Mounted Police (RCMP) and the local Coroner's Office
10. If the human remains are found to be of forensic concern, the Coroner and RCMP will initiate an investigation. PNW LNG and their prime contractor will cooperate fully in protecting the scene
11. If the professional archaeologists and the Coroner assesses the remains to be archaeological and not of forensic concern, PNW LNG, PRPA, Parks Canada and Aboriginal groups will collaborate to determine how best to manage the archaeological human remains. Options may include avoidance or respectful removal and reburial.

Table 1 Key Contacts

Pacific Northwest LNG (PNW LNG) Gerry Fraser t. 778-372-4703 c. 778-873-8794 e. gfraser@pnwlng.com Prime Contractor: Contacts TBD	First Nation Contacts TBD Prince Rupert Port Authority (PRPA) t. 250-627-8899 e. pcorp@rupertport.com

5.0 MANAGEMENT, SAMPLING, AND RECORDING OF CULTURALLY MODIFIED TREES

The following recommendations pertain to any CMT that must be removed from within the PDA.

1. The safety of the CMT falling team, including the faller, consulting professional archaeologist, and First Nation technicians, will be paramount in determining the most appropriate method of falling the CMT and any subsequent CMT sample collection.
2. If falling of the CMT can be avoided (e.g., it is on the edge of the project area or in the 30 meter wide no disturbance buffer zone circumnavigating Lelu Island), the instructions below should be followed in order to mitigate impacts.
    a. If a recorded CMT is not in direct conflict with the clearing of the PDA, but could be indirectly affected by activities near it (such as the unavoidable felling of a nearby tree that may fall onto the CMT) then archaeologically significant CMTs should be assessed and inventoried if this information is not already on the record.
3. Where CMTs require removal, the following procedures shall be followed in order to mitigate the removal of the CMT:
    a. A stem round (dating) sample should be selected by a professional archaeologist and marked prior to felling the CMT with tree paint, to indicate to the faller the correct position on the tree for collection of each sample. Where practical, the archaeologist or a First Nation technician should be present when the tree is felled to ensure datable samples are obtained
    b. The sample will not be limited to one scar or feature if multiple scars or features are present
    c. In the event that there is extensive rot associated with the feature (e.g., rotted face of bark strip) samples should be taken above the rot to access intact tree ring sections
    d. Samples from undercut or test-hole trees should be taken directly across the modified portion of the CMT (transverse cut)
    e. In all cases, a sample from each feature should be collected. As bark can slough off a barkstrip feature after the cultural event, samples should be taken from the cultural scar rather than wood exposed after stripping by bark sloughing off above or below the scar. If the latter is the only place available due to rot, then this must be noted
    f. If the CMT is dead, a supplementary sample should be taken from a live tree of the same species and equivalent size in close proximity, and also in the same apparent growing conditions for cross-dating purposes
    g. If a CMT is too large to collect a complete stem-round sample and appears rotten in the centre one or more wedge samples may be taken from the lobe
    h. Discs should be cut as thin as possible while still permitting transport without breakage. A tag or other means of identification must be firmly attached to each sample noting:

i. CMT number and feature number (if applicable) indicated on the tree with spray paint and/or surveyor's ribbon

ii. Tree condition (dead or alive)

iii. Collection date; time, crew and faller name

iv. Which side of the sample is the "top".

Individual pieces should all be marked with the same information, duplicated on each piece, or at a minimum the CMT number. If possible, draw a line across the sample to mark where the pieces fit together. A supply of large sample bags should be kept onsite, and broken sample pieces should be transported together in separate bags.

i. Sample Handling:

i. Samples should be transported immediately following collection, and should not be left exposed (e.g., left in full sunlight or exposed to the rain)

ii. Samples should be carefully transported to ensure minimal damage or breakage, and should be wrapped in packing material or tape in case the sample breaks during transport

iii. Following transport, any packing material should be immediately removed to allow the samples to 'breathe' and dry

iv. Samples should be stored carefully so as to maintain provenance, and to prevent breakage or damage (for example, avoid stacking heavy samples on top of lighter, more delicate ones).

5.12 DISTRIBUTION OF CMTS AND OR CMT SAMPLES

PNW LNG will collaborate with PRPA and Aboriginal groups on distribution of felled CMTs, portions of CMTs and/or CMT samples. Optimally, the final fate of a CMT or a portion of it will be addressed before trees are felled with documentation signed off by the appropriate parties to confirm distribution. PNW LNG will also work with Aboriginal groups to develop a plan to summary information gathered from the samples. This information will be shared with First Nations and relevant authorities.

6.0 ARCHAEOLOGICAL AND HISTORICAL RESOURCES ON PACIFIC NORTHWEST LNG PROJECT DEVELOPMENT AREA

6.12 CULTURALLY MODIFIED TREES (CMTS)

CMTs are the primary archaeological resource present on Lelu Island. A CMT is "a tree that has been altered by native people as part of their traditional use of the forest" (B.C. Archaeology Branch 2001). The majority of CMTs recorded in the region are Western red cedars or yellow cedars although other species such as western hemlock, Sitka spruce, and western yew have also been reported. CMTs, especially recently modified trees, may have visible tool marks on the scar from the tools used in cultural modification. (Refer to sample photos and descriptions on the following pages). Some trees exhibit multiple scars.

Tapered Bark-stripped Trees
Tapered bark-stripped trees are the most common type of CMT found in coastal BC. Red and yellow cedars are the most common species with evidence of bark stripping. Cedars were stripped to obtain the inner cedar bark which is used for numerous items including rope, baskets, mats, blankets, sacks, toweling and clothing. Where strips of bark have been removed, a long, tapered scar will be visible with healing lobes flanking the scar (**Error! Reference source not found.**).

Rectangular Bark-Stripped Trees
Rectangular bark-stripped trees have had large, rectangular slabs of bark removed (**Error! Reference source not found.**). This bark was used as roofing material and for quickly-made storage boxes.

Figure 1 Tapered bark stripped tree with pointed top

Figure 2 Rectangular bark stripped tree

Tested Trees

Tested trees are standing trees with one or more rectangular holes chopped into the trunk (**Error! Reference source not found.**). Typically, these holes were made in order to assess the quality of the heartwood of the tree. This would have been particularly important in selecting trees for canoes or planks.

Planked Trees

Planked trees are cedars from which large, rectangular planks have been removed (**Error! Reference source not found.**). This was accomplished by driving a series of wedges into the tree. The planks were gathered for use in the construction of longhouses and other structures.

Figure 3 Example of a tested tree test hole

Figure 4 Felled tree log with plank removal scar

Notched Trees

These are most frequently western red cedars that have one or more chopped notches (Figure 5 and Figure 6); they may be standing, felled or wind fallen.

Figure 5 Low angle notched tree

Figure 6 Deep notch on a large western red cedar

Felled Trees

Aboriginally felled trees are typically Western red cedars or yellow cedars which have been harvested using traditional techniques. Characteristics of a felled tree can be the presence of a stump and/or log that includes logging detritus and/or platform notch(es) on the stump.

Sectioned Trees

Sectioned trees are felled trees that have been cut into two or more sections (logs). Some sections may have been removed and the remaining sections may show no signs of further modifications. The log can be associated with an intentionally felled tree or a fallen tree with roots.

Undercut Trees

Undercut trees are standing trees with areas of missing wood and bark which were removed during the early stages of felling the tree (Figure 7 and Figure 8). These scars are similar to test holes, but are usually larger; tool marks are seen only on the top and bottom of the scar (not the sides).

Figure 7 Shallow undercut tree

Figure 8 Deep undercut tree

Kindling Trees

Kindling trees are most commonly found on the dry faces of western red cedars; the scars are usually in the form of chop marks indicating where small pieces of wood have been removed. Some of these show traditional tool marks; others are on older CMT features (Figure 9 and Figure 10).

Figure 9 Rectangular bark stripped tree with kindling removal and tool marks

Figure 10 Bark stripped tree with kindling removal and wedge tool marks

7.0 ARCHAEOLOGICAL RESOURCES

The following discussion describes archaeological and heritage resources that may be encountered during land altering activities. This is not an exhaustive list, but is intended to provide guidelines regarding other resources that may be encountered on Lelu Island. There are several common archaeological resources that may be encountered and include shell middens, artifacts, cultural depressions (houses or cache pits), and rock art.

Shell Middens

Shell middens are characterized by the presence of shells and commonly contain charcoal, ash and burnt sediments, and stone, bone, shell and antler artifacts. Shell midden deposits vary from small pockets to very large sites several hundred metres long and are usually but not always found along or near the shoreline. An example of shell midden sediments is shown in Figure 11.

Figure 11 An example of shell midden sediments

Human Remains

In the event that human remains are found on the Island, the coroner and a qualified archaeologist will determine if they are of archaeological or forensic concern. Respect is paramount when dealing with human remains or burial features. It must be remembered at all times that human remains are exactly that – human remains – and should be shown the proper respect and dignity due any human being, living or deceased. Potential archaeological burial features may include shell midden interments and cave or rock shelter interments.

Artifacts

Stone, bone and antler tools were used by aboriginal people prior to and after European contact. Two artifacts have been found on Lelu Island: a ground stone splitting adze, shown in Figure 12; and a chipped stone cobble tool, similar to the one shown in Figure 13.

Figure 12 Ground stone splitting adze found on Lelu Island

Figure 13 Example of a chipped stone cobble tool, similar to the one found on Lelu Island

Lithic (stone) Scatters

Lithic scatters are sites comprised of stone tools, tool fragments, and *debitage*—the flakes of stone that are produced during manufacturing. These stone artifacts may have been buried by natural processes since their original deposition. These sites vary from a single, isolated artifact (such as a stone adze using in logging) to extensive scatters of hundreds of tools, tool fragments and debitage.

Wet Site Deposits

Wet sites are typically associated within peat or water saturated silt areas. Wet sites preserve organic artifacts that typically degrade in non-wet sites. Artifacts that are typically found in wet sites include but are not limited to basketry, string and rope, wooden tools, weapons, sporting equipment, and cordage.

Petroglyphs and Pictographs

Petroglyphs (Figure 14) and pictographs (Figure 15) are prehistoric pictures or symbols that were carved or painted on rock surfaces.

Figure 14 Petroglyph in Prince Rupert harbour

Figure 15 Pictograph in Prince Rupert harbour

8.0 HISTORICAL HERITAGE RESOURCES ON LELU ISLAND

Historical structures representative of the more recent occupation and use of Lelu Island have also been found. The structures listed below are not of archaeological significance.

Box Traps

Box traps mounted in trees (Figure 16) are indicators of an historic trapline on the Island.

Abandoned Derelict Vessels

The fishing vessels abandoned on the mud flats (Figure 17) around the island have some (relatively low) heritage value and are of interest to maritime heritage experts. Damage to them should be avoided if possible.

Abandoned Dwellings

Abandoned dwellings found on Lelu Island consist of cabins (Figure 18) and raised wooden platforms. These structures can be identified by the presence of axe or chainsaw cut wood, milled lumber, nails or other metal fasteners, and household refuse.

Figure 16. Box trap mounted in a tree

Figure 17. Abandoned derelict vessel

Figure 18. Abandoned dwelling

Glossary

Term	Definition
Aboriginal group	Aboriginal groups as defined in Section 9.2 of the *Final Environmental Impact Statement Guidelines* issued by the Canadian Environmental Assessment Agency (CEA Agency) on June 7, 2013, and direction provided by the CEA Agency to the Proponent by letter on November 6, 2013, the Aboriginal groups considered in the assessment include: Metlakatla First Nation; Lax Kw'alaams First Nation; Gitxaala Nation; Kitselas First Nation; Kitsumkalum First Nation; and Gitga'at First Nation.
Archaeological site	An archaeological site is a location where there is physical evidence of past human activity. Archaeological sites can include things such as stone tools, remains of ancient houses and campsites, shell middens, and wet sites. Archaeological sites represent only one component of a range of heritage resources found throughout the province, including things like historic buildings, shipwrecks, heritage trails, etc.
Archaeological Resource	Archaeological resources encompass archaeological sites, and do not include traditional land-use sites.
Burial Site	A burial site is a mortuary feature which represents deliberate depositional events and can be identified by a number of different practices some of which include barrows/mounds, burial cairns, or interment within shell middens
Culturally Modified Tree (CMT)	A tree that has been altered by Aboriginal people as part of their traditional use of the forest.
Felled Trees (CMT Type)	These are trees of usually large diameter that were completely felled, using traditional felling techniques. Notched or planked trees are not recorded as felled trees. A felled tree is characterized by the presence of a stump and/or a log and may include platform notch(es) on stump, and logging detritus.
Heritage Resources	Heritage resource encompasses a wide range of sites which include archaeological sites and traditional land-use sites, like historic buildings, shipwrecks, heritage trails, etc.
Kindling Trees (CMT Type)	A tree that has exposed wood with chop marks and small areas in trees which wood has been removed. The removed wood probably was used as kindling.
Notched Trees (CMT Type)	These trees are either standing, windfallen, or felled in which one or more notches has been chopped. Notches represent the first stage of wood (usually plank) removal, though large notches could be the first stage in felling a tree. Notches are usually rectangular in shape and often occur in pairs. They either have a U-shaped or V-shaped cross section.
Petroglyph	Pictorial representations created on cliff faces and boulders. They are made by pecking, carving or incising in the rock surface. Petroglyphs often display anthropomorphic or zoomorphic figures, but may also depict abstract designs.
Pictograph	Pictorial representations created on prominent stable rock faces, such as cliff faces and large or even small boulders. They often display anthropomorphic or zoomorphic figures, but may also depict abstract designs
Planked Trees (CMT Type)	Planked trees are cedars from which large, rectangular planks have been removed by driving a series of wedges into the tree. The planks were gathered for use in construction of longhouses and other structures.

Term	Definition
Rectangular Bark-Stripped Trees (CMT type)	Rectangular bark-stripped trees have large, rectangular slabs of bark removed, usually for use as raw material for baskets and clothes and roofing materials for temporary shelters and over canoes under construction in the forest.
Shell Midden	Shell middens are typified by the presence of shellfish (clam, mussel, scallop, etc.) shells discarded after consumption, but they also commonly contain charcoal, ash and burnt sediments, fire-broken rocks, and stone, bone and antler artifacts
Sectioned Trees (CMT Type)	These are trees where the stem (log) has been cut into two or more sections.
Stone Artifacts (Lithics)	Stone that has been culturally modified by humans for a purpose, which may be utilitarian, ceremonial, or other. Stone artifacts are generally broken down by technique of manufacture, and are significant if the object is temporally distinct.
Tapered Bark-Stripped Trees (CMT type)	Tapered bark-stripped trees are the most common type of CMT found in coastal British Columbia. Red and yellow cedars are the most common species evidencing bark stripping. Cedars were stripped to obtain the inner cedar bark which is used for numerous items including rope, baskets, sacks, toweling and clothing such as cedar bark robes, aprons and hats.
Tested Tree (CMT type)	Standing trees with one or more rectangular holes chopped into its trunk. Typically these holes were made in order to assess the quality of the heartwood of the tree. This would have been particularly important in selecting trees for canoes or planks.
Undercut Tree (CMT Type)	A standing tree which has an area of missing wood and bark, removed as part of the initial stage of felling the tree.
Wet-site	An archaeological site that is situated in water-logged environment, and is composed of preserved organic materials such as baskets, cordage, wooden tools, wooden stakes, or rope in addition to lithic materials. Wet-sites are generally found within estuaries, bogs, floodplains, and other fluvial environments.

Appendix J.16
Environmental Monitoring Plan

J.16 PRELIMINARY DRAFT ENVIRONMENTAL MONITORING MANAGEMENT PLAN

1.0 INTRODUCTION

Pacific NorthWest LNG Limited Partnership (PNW LNG) has developed a preliminary draft Environmental Monitoring Management Plan (EMMP) to outline specific environmental compliance monitoring requirements related to the management of potential environmental concerns during construction and operations of the Pacific NorthWest LNG Project (the Project). This EMMP outlines an approach for monitoring:

- Water quality – marine, freshwater, treated discharge water, and liquid effluent
- Soils, with a particular emphasis on sedimentation, erosion and drainage to vegetated areas
- Vegetation, with an emphasis on marine riparian habitat, monitoring of sensitive and rare ecological communities, and invasive species management
- Emissions related to air quality, noise and ambient light
- Waste products and hazardous materials management monitoring
- Marine mammal observation and documentation within a one kilometre zone around marine pile installation and blasting activities
- Freshwater and marine habitat protection measures.

An external Environmental Monitor(s) will be present during project construction to mitigate potentially harmful environmental impacts and confirm regulatory compliance. PNW LNG will invite local First Nations to participate in environmental compliance monitoring programs, where appropriate. Monitoring will be conducted internally by PNW LNG during operations. This preliminary draft plan presents a framework for monitoring environmental conditions and mitigation measures used to manage potential adverse environmental effects. This plan is based on the Environmental Impact Statement (EIS) for the Project and subsequent feedback from regulators, Aboriginal groups, stakeholders and the public. This plan will be updated and refined based on detailed Engineering Procurement Construction and Commissioning (EPCC) Contractor design and permitting requirements.

2.0 PURPOSE

This EMMP provides high-level environmental compliance monitoring programs to support detailed environmental work plans to be developed by the EPCC Contractor. PNW LNG will update this preliminary draft EMMP once the EPCC Contractor is selected. This EMMP outlines site-specific environmental monitoring measures for project construction. Monitoring practices and procedures associated with project operations are provided as a preliminary overview pending finalized engineering design features.

2.1 ENVIRONMENTAL MONITORING COMPLIANCE REGULATIONS

Environmental regulatory requirements are provided in each of the component Environmental Management Plans (EMPs), outlining applicable environmental Acts and Regulations to be followed by EPCC Contractors. Environmental monitors will apply procedures and best management practices (BMPs) in compliance with the regulatory guidance outlined in the following EMPs:

- Preliminary Draft Air Quality and Greenhouse Gas Management Plan (Appendic J.4 of the EIS/Addendum)
- Preliminary Draft Noise, Vibration and Ambient Light Management Plan (Appendic J.5 of the EIS/Addendum)
- Preliminary Draft Environmental Emergency Preparedness and Response Plan (Appendic J.6 of the EIS/Addendum)
- Preliminary Draft Transportation Management Plan (Appendic J.7 of the EIS/Addendum)
- Preliminary Draft Marine and Freshwater Resource Management Plan (Appendic J.8 of the EIS/Addendum)
- Preliminary Draft Vegetation Management Plan (Appendic J.9 of the EIS/Addendum)
- Preliminary Draft Waste Management Plan (Appendic J.10 of the EIS/Addendum)
- Preliminary Draft Blasting Management Plan (Appendic J.11 of the EIS/Addendum)
- Preliminary Draft Marine Pile Installation Management Plan (Appendic J.12 of the EIS/Addendum)
- Preliminary Draft Dredging Management Plan (Appendic J.13 of the EIS/Addendum)
- Preliminary Draft Accomodation Management Plan (Appendic J.14 of the EIS/Addendum)
- Preliminary Draft Archaeological and Heritage Resources Management Plan (Appendic J.15 of the EIS/Addendum).

2.2 KEY FEDERAL AND PROVINCIAL LEGISLATION

Several provincial, federal and municipal Acts, Regulations, guidelines and bylaws are likely to apply to the Project during construction and operations. This regulatory context complies with commitments made in the EIS and is designed to protect valued components (e.g., fish, archaeological resources) of the Project. The key federal and provincial legislative context includes:

- *Canadian Environmental Protection Act*, Disposal at Sea Regulations
- *British Columbia Environmental Management Act (2003):*
- *British Columbia Water Act (1996):*

  - **Section 9(1):** The comptroller, a regional water manager or an engineer may grant an approval in writing authorizing on the conditions he or she considers advisable
    a. A person to make changes in and about a stream,
    b. A minister of the Crown, either in right of Canada or of British Columbia (BC), to make changes in and about a stream, or
    c. A municipality to make changes in and about a stream.

- *Transportation of Dangerous Goods Act*
- *Fisheries Act* (2005, amended 2013)
- BC Ambient Air Quality Objectives (BC MOE 2013)
- Canadian Ambient Air Quality Standards (Health Canada 2013)

- Canadian Council of Ministers of the Environment Canada (CCME)-wide standards (CCME 2000, CCME 1999))
- BC Ministry of Environment (BC MOE) Best Achievable Technology (BC MOE 2012)
- Flaring and Venting Reduction Guideline (BC OGC 2011)
- CCME Keeping Clean Areas Clean (CCME 2007).
- Marine Mammal Regulations enabled under the *Fisheries Act*
- Land Development Guidelines for the Protection of Aquatic Habitat
- Canadian Standards Association (CSA) Z731-03, Emergency Preparedness and Response
- *Environmental Management Act*, Hazardous Waste Regulation: provides requirements for authorized containment, storage/handling, disposal and transportation of substances identified as hazardous waste
- *Environmental Management Act*, Spill Reporting Regulation: identifies and outlines the reporting requirements when a spill occurs
- *Wildlife Act*
- *Species at Risk Act*(2002):
- *Migratory Birds Convention Act*
- Migratory Birds Regulations
- *BC Oil and Gas Activities Act*
- *Canada Marine Act*
- *Hazardous Products Act*
- *Weed Control Act*
- *Clean Energy Act*
- Greenhouse Gas Reduction Targets Act (Government of BC 2007)
- Greenhouse Gas Reduction (Cap and Trade) Act (Government of BC 2008b)
- *Navigation Protection Act*
- Waste Discharge Regulation
- Prince Rupert Port Authority (PRPA) Operations Regulations
- Canadian Aviation Regulations
- Vessel Pollution and Dangerous Chemicals Regulations
- Habitat Conservation and Protection Guidelines
- Canadian Council of Ministers of the Environment Guidelines
- International Convention for the Prevention of Pollution from Ships
- Policy for the Management of Fish Habitat
- Federal Policy on Wetland Conservation
- Fisheries Protection Policy Statement, 2013
- Provincial Archaeological Heritage Policy Framework
- BC Open Burning Smoke Control Regulation (Government of BC 2003b)
- Canadian Ambient Air Quality Standards (effective 2015)
- Sulphur in Diesel Fuel Regulations (EC 2002)
- Operational Statement for Mitigation of Seismic Sound in the Marine Environment.
- District of Port Edward Bylaws

3.0 ENVIRONMENTAL MONITORING SCOPE

This EMMP provides general and activity-specific monitoring requirements for the various phases of project construction and operations. Table 3-1 provides an overview of the current potential project construction and operations schedule.

Sample Construction Plan, Level 2 – September 30, 2014

ID	Task Name	2015				2016				2017				2018				2019				2020		
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
1	**Notice to Proceed**																							
2	**Onshore Geotech Investigation**																							
3	**Offshore Geotech Investigation**																							
4	**Pioneer Dock**																							
5	Roll On/Roll Off																							
6	**Site Clearing & Site Preparation**																							
7	Site Clearing / Tree Harvesting																							
8	Site Leveling and Preparation																							
9	Heavy Haul Road																							
10	**MOF**																							
11	Dredging/Blasting																							
12	Piling																							
13	Superstructure																							
14	**Access Bridge**																							
15	Temporary Access & Work																							
16	Substructure Construction (incl. piling)																							
17	Superstructure Construction																							
18	**Suspension Bridge, Trestle, Berths**																							
19	Bridge Superstructure																							
20	Topside Installation																							
21	Trestle & Berth																							
22	**LNG Trains**																							
23	Underground and Foundations																							
24	Train 1																							
25	Train 2																							
26	Utilities & Offsite																							
27	**LNG Tanks**																							
28	Tank 1																							
29	Tank 2																							
30	**Commissioning & Start of Operations**																							
31	Train 1																							
32	Train 2																							
33	Beginning of Train 1 Operations																							
34	Beginning of Train 2 Operations																							

Notes:

- Areas are sample “No Dredge” windows; TBD in permitting
- Schedule is prepared to illustrate sequence of activities
- Actual start date and duration are subject to CEAA EA approval and award of EPCC contract
- Beginning of operations and first cargo may be improved as construction execution proceeds

Modifications to the EMP Overview document or component sub-sections (Appendices J.1 – J.16 of the EIS/Addendum) may be required based on regulatory requirements and final project design features. The EMP and component activity-specific plans are intended to be a "living" document which can be updated and adapted as necessary to accommodate a changing regulatory environment.

3.1 GENERAL ENVIRONMENTAL MONITORING

During project construction, monitors will determine if appropriate environmental mitigation measures are followed and that regulatory requirements are met. General routine monitoring activities conducted at the Project site will comply with PNW LNG's corporate Health, Safety and Environment (HSE) Management System. The designated environmental monitor(s) will work with the PNW LNG Environmental Management Team and the EPCC Contractor(s) to reduce the likelihood of environmental impacts.

3.1.1 Construction

General compliance monitoring practices during project construction include:

- Designated Environmental Monitor(s) and/or Qualified Environmental Professionals will participate in daily environmental compliance meetings with the EPCC Contractor
- Inspect project equipment and vehicles for leaks, condition and maintenance practices
- Retain copies of required permits, project approvals, authorizations and applicable regulatory guidance at the site, on hand and accessible
- Maintain, in accessible locations, emergency environmental spill response supplies
- Direct EPCC Contractor construction activities related to environmental regulatory compliance and permitting requirements
- Provide recommendations to the EPCC Contractor to prevent or correct non-compliant construction activities
- Monitor and document water quality parameters (i.e., turbidity, pH etc.)
- Handling of Culturally Modified Trees

3.1.2 Operations

General compliance monitoring practices during project operations include:

- Designated Environmental Monitor(s) and/or Qualified Environmental Professionals will participate in environmental compliance meetings with project operations personnel
- Retain copies of required operating permits, regulatory approvals and applicable authorizations at the site
- Ensure that operational activities affecting component EMPs (i.e., liquid waste storage, spill response) comply with recommended preventative and mitigation measures using BMPs and standard operating procedures (SOPs)
- Direct project operations personnel as required during non-routine maintenance activities and/or other activities that may impact the environment
- Document and collect data according to operational EMPs (i.e., water quality, facility discharge points)
- The Environmental Monitor will maintain a log of findings for the Environmental Manager according to frequencies defined in this EMMP.

3.2 COMPONENT ENVIRONMENTAL MONITORING PLANS

Component monitoring programs (see Appendices J.4 to J.15 of the EIS/Addendum) will dictate mitigation measures and monitoring requirements for specific commitments made in the EIS. Additionally, environmental monitoring practices will maintain compliance with applicable regulations, permits and authorization conditions. Component environmental monitoring plans are summarized in Table 3-2.

Table 3-2: Component Environmental Monitoring Plan Summary

Project Component	Project Phase	Purpose
Air Quality	Construction Operations	The Preliminary Draft Air Quality and Greenhouse Gas Management Plan provides measures to reduce effects of air emissions, fugitive dust and greenhouse gas release from project activities
Noise, Vibration and Light	Construction Operations	The Preliminary Draft Noise, Vibration and Ambient Light Management Plan provides mitigation measures for terrestrial-based project construction activities (such as blasting, pile driving) and facility operations with potential to affect local communities and wildlife
Environmental Emergency Preparedness and Response	Construction Operations	The Preliminary Draft Environmental Emergency Preparedness and Response Plan outlines measures to prepare for and respond to any project related accidents, malfunctions or other environmental emergencies
Transportation	Construction Operations	The Preliminary Draft Transportation Management Plan provides measures to reduce the effects of project traffic on infrastructure; and procedures for the movement of dangerous goods and project personnel. Monitoring activities are discussed directly in the Transporation Management Plan.
Marine and Freshwater Resources	Construction	The Preliminary Draft Marine and Freshwater Resource Management Plan provides measures to avoid potentially harmful impacts to riparian areas, water quality, and fish habitat
Vegetation	Construction	The Preliminary Draft Vegetation Management Plan provides measures to minimize disturbance of native vegetation and soils, reduce the spread of invasive species, and protect ecological communities
Waste Management	Construction Operations	The Preliminary Draft Waste Management Plan outlines BMPs to manage hazardous and non-hazardous waste products
Blasting	Construction	The Preliminary Draft Blasting Management Plan outlines mitigation measures to reduce risk of mortality or injury to marine organisms
Marine Pile Installation	Construction	The Preliminary Draft Marine Pile Installation Management Plan provides measures to reduce effects of pile installation on marine organisms
Dredging	Construction	The Preliminary Draft Dredging Management Plan details guidelines for dredging and disposal of marine sediment
Accommodation Plan	Construction Operations	The Preliminary Draft Accommodation Plan will document practices and procedures on how PNW LNG and the EPCC contractor will interact with the communities and health and safety regulators.
Heritage Resources	Construction Operations	The Preliminary Draft Archaeological and Heritage Resources Management Plan describes methods to identify and preserve heritage resources
Environmental Monitoring	Construction Operations	The Preliminary Draft Environmental Monitoring Management Plan outlines comprehensive procedures and practices for monitoring effects on the environment. The Preliminary Draft Environmental Monitoring Management Plan is intended to summarize monitoring requirements for each component plan (Appendices J.4 to J.15 of the EIS/Addendum).

4.0 ROLES AND RESPONSIBILITIES

This EMMP is designed to provide a preliminary environmental monitoring outline for the Project and is based on commitments made in the EIS and on current regulatory requirements. Additional details and EMMP specifics may be added upon finalized project design, selection of EPCC Contractor, and permit conditions.

This EMMP provides the main roles and responsibilities for managing and maintaining regulatory compliance during project construction and operations.

4.1 CORPORATE PNW LNG ENVIRONMENTAL POLICY

PNW LNG's Health, Safety, and Environment Management System (HSE MS) has been developed to ensure PNW LNG complies with all health, safety and environmental requirements and to provide a safe and healthy workplace that minimizes impacts upon the environment.

PNW LNG will take measures to ensure that all employees, contractors and visitors on PNW LNG sites maintain a high level of awareness for health, safety and the environment. Participation in the HSE MS will be encouraged and recognized at all levels of the organization. It is essential to PNW LNG that all persons return home at the end of the day in equal health status as when they went to work, free from work induced health issues.

PNW LNG will (at a minimum):

- Provide project related guidance to consultants, contractors and regulatory liaisons
- Oversee project construction activities based on input from design engineers, permits and approvals
- Lead public communication and engagement practices
- Include the EMP in the EPCC Contractor's contract document and communicate all environmental issues to the EPCC Contractor(s)
- Require that the EPCC Contractor(s) uphold all commitments in the EMP
- Form an environmental management team, with a lead Environmental Coordinator, to provide oversight and support to the EPCC Contractor
- Appoint a HSE Coordinator to manage reported incidents and coordinate incident response and investigation, and to follow up on the f closure of action items stemming from incident investigations
- Notify stakeholders and concerned parties of construction activities and updates.

4.1.1 Environmental Management Team

The Environmental Management Team will be responsible for assessing and reporting on compliance with the terms and conditions of the EIS, as well as all regulatory permits, approvals, licenses and Proponent commitments and assurances related to pre-construction and construction. The team will consist of experienced, independent monitors/inspectors, including Qualified Environmental Professionals (i.e., professional Biologist, Agrologist, Forester, Geoscientist, Engineer, or Technologist) who are qualified to conduct biological, water quality, archaeological, erosion and sediment control, site restoration, and other project monitoring programs as required

during the construction and operations phase of the Project. Local First Nations will be invited to participate in the environmental compliance monitoring programs, where appropriate.

4.1.1.1 Environmental Monitor

The Environmental Monitor will be a qualified professional who is responsible for determining whether work activities are in compliance with environmental obligations (i.e., permits, standards and BMPs). A sufficient number of monitors and alternate monitors will be available to adequately cover the entire area under construction.

The Environmental Monitor(s) will:

- Report observations and mitigation measures taken that are related to permits and regulatory requirements
- Maintain a current version of the comprehensive EMP and be familiar with all aspects of the document
- Have the authority to modify or suspend site activities if environmental mitigation measures are not considered to be effective
- Attend project planning meetings, health and safety meetings and contractors tailgate meetings to communicate potential environmental concerns and requirements
- Monitor EPCC Contractor construction activity in the marine and terrestrial environments to verify compliance with the applicable activity-based EMPs, permits, approvals and authorizations
- Conduct field sampling of environmental media (i.e., water, soil etc.) as detailed in the monitoring program overview (Section 6.0) and this EMMP
- Submit routine environmental monitoring reports including relevant data, forms, photographs and documentation
- Address and closely monitor any non-compliance issues immediately
- Guide clean-up and restoration activities (i.e., after a spill) according to BMPs and SOPs.

4.1.1.2 Qualified Environmental Professional

Qualified Environmental Professionals will assist the Environmental Monitor with the implementation of specific monitoring programs detailed in each component EMP (i.e., marine mammal observation). Qualified Environmental Professionals will be qualified to implement, monitor and address specific components of construction and operations EMPs including archaeological surveys, soil erosion, sediment control, restoration, and other discipline-specific monitoring programs.

Qualified Environmental Professionals (QEPs) will implement mitigation measures presented in activity-based EMPs and help to ensure compliance with the project Proponent's environmental commitments. QEPs will be responsible for regulatory, permit and authorization field compliance within their area of expertise during third party environmental audits.

4.1.2 EPCC Contractor

The responsibilities of the EPCC Contractor will include (but are not limited to):

- Complete all works according to approved final project design
- Keep a current version of the project EMPs, schedule, applicable permits and documentation on site and accessible during all construction activities
- Uphold construction-related environmental commitments of the construction EMP, Proponent HSE plans, permits and approvals (both on behalf of PNW LNG and EPCC's)
- Communicate activities with the site Environmental Monitor or Qualified Environmental Professional
- Provide all project construction staff with orientation and adequate training on environmental mitigation measures
- Provide staff with adequate equipment and supplies to administer the EMP during construction
- Verify that project construction equipment is maintained and in good working condition
- Communicate regularly and effectively with the Proponent and adjust activities to stay in compliance with the requirements of the construction EMP and other project specific and regulatory environmental requirements
- Notify the HSE Coordinator and the Environmental Monitor of any incidents that have the potential to adversely affect the environment.

5.0 ENVIRONMENTAL COMPLIANCE MONITORING PLANS

Environmental monitors will be on the project site during terrestrial and marine construction and ongoing operations activities to monitor and report compliance with the EMP and all applicable regulatory permits, approvals and authorizations. Activity-specific work initiatives are likely to proceed concurrently; therefore, multiple monitors may be required to ensure adequate coverage throughout the project area.

Specific variables and processes requiring monitoring are outlined in the individual EMPs (e.g., Blasting Management Plan , Marine Pile Installation Management Plan , Waste Management Plan). Construction monitoring will focus on marine activities (e.g., bridge, docks, and materials off-loading facility (MOF), dredging and disposal) and where construction approaches within 30 metres of the marine zone. Monitoring will also focus on concrete production and use, pile installation, blasting, and activities with the potential for contaminant spills.

5.1 AIR QUALITY AND GREENHOUSE GAS EMISSIONS COMPLIANCE MONITORING

An air quality and greenhouse gas monitoring program will be developed for the Project. PNW LNG will:

- Develop and implement monitoring and follow-up programs according to regulatory permit or license requirements for the Project
- Conduct monitoring as outlined in the permits required for the Project and if necessary, revise mitigation measures to achieve conformance with approval conditions
- Develop an inspection process to evaluate the use and effectiveness of this plan and other component plans

Project activities and the implementation of the BMPs and mitigation measures in accordance with project EMP and facility permit conditions will be monitored on an ongoing basis by the PNW LNG Environmental Manager or delegate (i.e., Environmental Monitor). Monitoring requirements identified in the EIS or as part of the permitting will be incorporated in the final EMMP.

5.1.1 Air Quality Compliance Monitoring

Project air quality compliance monitoring parameters of interest include Criteria air contaminants (CACs), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), hydrogen sulphide (H_2S) and particulate matter (PM). These air quality parameters are selected based on expected preliminary project emissions, professional judgment obtained from previous project experience, and the ambient air quality objectives established by Canada and BC regulatory agencies.

Compliance monitoring frequency and reporting requirements for regulated air quality parameters of interest will be completed according to Table 5-1.

Table 5-1: Air Quality Compliance Monitoring Summary

Activity	Parameters	Monitoring Frequency	Reporting	Monitor
Construction Phase				
Site Preparation Wind Erosion	CACs and dustfall	Once per day	Monthly	Environmental Monitor or Air Quality QEP
Open Burning Waste Incineration	CACs	During burns	Monthly	Environmental Monitor or Air Quality QEP
Power Generation	CACs	Once per day	Monthly	Environmental Monitor or Air Quality QEP
Road Use	Dustfall	Once per day during dry periods	Monthly	Environmental Monitor or Air Quality QEP
Facility Installation	CACs and dustfall	Once per day	Monthly	Environmental Monitor or Air Quality QEP
Clean up and remediation	Dustfall	Once per day	Monthly	Environmental Monitor or Air Quality QEP
Operation Phase				
Project Operations	CACs	Once per day	Monthly	Environmental Monitor or Air Quality QEP
Facility maintenance and testing	CACs	Once per day	Monthly	Environmental Monitor or Air Quality QEP

5.1.2 Greenhouse Gas Compliance Monitoring

The primary greenhouse gas (GHG) parameters to be monitored include water vapour (H_2O), carbon dioxide (CO_2), methane (CH_4), ozone (O_3), and nitrous oxide (N_2O). GHG estimates usually incorporate emissions of CO_2, CH_4, and N_2O and are presented in units of carbon dioxide equivalent (CO_{2e}).

Compliance monitoring frequency and reporting requirements related to GHGs during the project operations phase will be completed according to Table 5-2.

Table 5-2: Greenhouse Gas Emissions Compliance Monitoring

Activity	Parameters	Monitoring Frequency	Reporting	Monitor
Operations Phase				
Project Operations	GHGs	Once per day	Monthly	Independent Environmental Monitor
Power Generation	GHGs	Once per day	Monthly	Independent Environmental Monitor
Road Use	GHGs	Once per day	Monthly	Independent Environmental Monitor

The independent Environmental Monitor will be retained by PNW LNG.

5.2 NOISE, VIBRATION AND AMBIENT LIGHT COMPLIANCE MONITORING

Compliance monitoring for noise, vibration and lighting emissions will be undertaken on a complaint-driven basis; procedures for each are outlined below. If a noise, vibration or light complaint is received, PNW LNG will address the complaint to come to a mutually agreeable resolution. This section pertains to the monitoring of land-based noise; in-water noise (management and monitoring) is addressed in:

- Preliminary Draft Marine and Freshwater Resource Management Plan (Appendix J.8 of the EIS/Addendum)
- Preliminary Draft Blasting Management Plan (Appendix J.11 of the EIS/Addendum)
- Preliminary Draft Marine Pile Installation Management Plan (Appendix J.12 of the EIS/Addendum)
- Preliminary Draft Dredging Management Plan (Appendix J.13 of the EIS/Addendum).

5.2.1 Noise and Vibration Compliance Monitoring

Noise and vibration monitoring and mitigation procedures will be complaint-driven. Monitoring and actions plans will be developed based on the site-specific nature of the complaint and take into consideration ambient conditions at that time.

5.2.2 Ambient Light Compliance Monitoring

Monitoring of ambient light levels will be complaint-driven so that specific light spill issues can be addressed. A photometer will be used by the EPCC Contractor and/or Environmental Monitor to measure spilled light during nighttime. Monitoring procedures and mitigation measures will take into account meteorological conditions, such as cloud cover and temperature, and assess any atypical environmental conditions such as temporary lighting.

5.3 ENVIRONMENTAL EMERGENCY PREPAREDNESS AND RESPONSE

5.3.1 Emergency Response Monitoring – Construction and Operations

Monitoring related to environmental emergencies will be specific to the incident and the environment affected. Monitoring related to environmental emergencies (i.e., clean-up and restoration) is presented in Sections 6.1.3, 6.2.2, and 6.3.2 of the Environmental Emergency Preparedness and Response Plan.

5.4 MARINE AND FRESHWATER RESOURCE COMPLIANCE MONITORING

5.4.1 Project Construction Phase

Construction environmental compliance monitoring will focus effort where construction is within 30 m of the marine environment (i.e., infringing into the planned riparian zone and at access points to the water), and where built structures are over or within the water (e.g., marine terminal, bridge, docks). Additionally, monitoring will focus on concrete production and use, pile driving, blasting, and activities with potential for spills of harmful materials. Any additional monitoring requirements will be determined through the project permitting phase with the appropriate regulatory authorities, and will be included in the final EMP prior to construction.

Table 5-6: Marine and Freshwater Resource Compliance Monitoring

	Best Management Practices and Mitigation Measures
Monitoring	Construction activities should be monitored full-time during start-up through to project completion for works including instream activities, sensitive activities (e.g., fish salvage) and any other construction activities.
	Use a qualified environmental monitor(s), who is a QEP and is provided with written authority to modify or halt any construction activity if it is deemed necessary to do so for the protection of fish and wildlife populations or their habitats.
	Marine Mammal Monitoring will be undertaken in accordance with the Marine Mammal Monitoring and Protection Plan (see Appendix 1 in Appendix J.8 of th EIS/Addendum).
	A pre-construction meeting will be held that includes the environmental monitors and persons undertaking work on-site to provide a common understanding of the best practices for the Project, safety, responsibility reporting, and emergency response.
	Collection of select marine country food species for laboratory analysis will monitor the quality of foods before and after dredging at the MOF during the construction phase.
	Complete and submit a Monitoring report if required, within 60 days of project completion to the authority requesting monitoring be conducted (e.g., DFO, BC MOE)

5.5 VEGETATION AND SOILS COMPLIANCE MONITORING

Procedures for monitoring the impact of project activities on vegetation, wetlands and soils are outlined below. Avoidance of, and limiting access to known locations of rare plant habitat, ecosystems of conservation concern and wetlands are the primary ways of reducing the impact of project activities on vegetation, during the construction and operational phases. The Environmental Monitor will monitor vegetation and follow up on any concerns reported by project personnel.

5.5.1 Species at Risk Monitoring

A Species at Risk Discovery Contingency Plan will be developed and followed to address any chance discoveries of plant species of conservation interest during the construction phase of the Project, and will be incorporated into the final Vegetation Management Plan.

5.5.2 Wetland Habitat Monitoring

Restoration and wetland habitat compensation will be monitored for effectiveness based on success measures and monitoring requirements outlined in the Wetland Compensation Plan (developed as part of the EIS). During the construction and operations phase of the Project, drainage and erosion will be monitored to help maintain the local surface and ground hydrology.

5.5.3 Soil Monitoring

5.5.3.1 Construction Soil Monitoring

Construction soil monitoring procedures are designed to mitigate erosion and destruction of surface soils during site preparation, clearing and grading on Lelu Island. Soil monitoring practices include:

- Monitoring sedimentation ditches, berms and ponds are adequate to contain rainfall and runoff.
- Inspecting vehicles, equipment and hydraulics for leaks before each work day and conducting spot-checks during construction activities.
- Monitoring erosion control measures such as rip-rap placement for effectiveness.

5.5.3.2 Operations Soil Monitoring

Operations soil monitoring procedures will be designed to reduce ongoing impacts to native soils on Lelu Island and subsequent sedimentation to the marine environment; during operations this will focus on storm water management facilities, erosion control measures such as rip-rap, and sedimentation berms on Lelu Island. Management of the marine riparian zone 30 metre buffer will be monitored for functionality and structure by a designated Environmental Monitor during ongoing project operations.

5.6 ENVIRONMENTAL COMPLIANCE MONITORING – WASTE

Environmental compliance monitoring related to waste management is primarily focused on inspections. Waste storage points at the LNG facility will be inspected regularly (i.e., weekly) for the following aspects:

- Damage, leaks, run-off, labelling, segregation
- Compromised integrity of containment bunds and impervious material under any contaminated soil stockpiles
- Protection from rain and snow
- Storage arrangement
- Safety equipment
- Appropriate spill response materials.

Additional details on inspections and their frequency will be provided in the final Waste Management Plan, prior to construction.

5.7 ENVIRONMENTAL COMPLIANCE MONITORING - BLASTING

Environmental Monitors will be on-site during marine construction activities to monitor the effectiveness of mitigation measures in achieving regulatory compliance.

Environmental monitoring will be conducted for terrestrial and underwater blasting activities according to District of Port Edward Noise Control Bylaw No. 520 (2011), *Guidelines for the use of Explosives in or Near Canadian Waters* and industry BMPs . Environmental monitoring for underwater blasting will require a qualified marine mammal observer (MMO) to monitor activities for compliance with the *Fisheries Act*. Prior to initiating blasting activities, the PRPA will be notified to ensure ship traffic within their jurisdiction is informed about construction activities.

PNW LNG will provide contact information for people in the local community to submit noise complaints regarding project activities (refer also to Preliminary Draft Noise, Vibration and Ambient Light Management Plan (Appendix J.5 of the EIS/Addendum)).

Table 5-8: Environmental Compliance Monitoring Summary – Blasting

Construction Monitoring Component	Monitoring Activity
Underwater Blasting	The Environmental Monitor will supervise and guide Dungeness crab salvage and relocation activities prior to blasting.
	Monitor underwater shock wave and sound levels using appropriate equipment (i.e., hydrophone) during underwater blasting activities. No explosive is to be detonated in or near fish habitat that procedures, or is likely to produce an instantaneous pressure change of 100 kPa (Wright and Hopky, 1998).
	The designated MMO will document marine mammal sightings and enforce the 500 metre DFO mandated exclusion safety zone. The MMO has the authority to stop blasting activities. Blasting may recommence after 30 minutes of observing a marine mammal within the 500 metre exclusion zone.
	The MMO will maintain daily records for all marine mammal monitoring activities detailing: • Species observed inside or outside the exclusion zone • Behavioural or activity changes • Any instances of marine mammals within the exclusion zone.
	The Environmental Monitor will supervise fish location and sounding activities to reduce blasting impacts on fish habitat.
	Fish mortality within a 500 m radius of the blast site (if applicable) will be monitored. If fish mortality occurs the following information will be recorded: • Date of observation • Time of day • Approximate number of individuals • Any noteworthy observations regarding the appearance or condition of the fish.
	Monitor compliance of blasting practices in relation to DFO mandated requirements.
Water Quality Monitoring	Collect and document water quality parameters (temperature, pH, conductivity, dissolved oxygen, and turbidity) at specific intervals using a YSI 556 water quality meter or similar.
Turbidity Monitoring	Record field turbidity measurements in Nephelometric Turbidity Units (NTU). Ensure turbidity concentrations do not exceed BC Ambient Water Quality Guideline (BCWQG) Criteria for Turbidity, Suspended and Benthic Sediments if turbidity concentrations change from background by 8 NTU at any one time for a duration of 24 h in all waters during clear flows or in clear waters.
	Implement corrective measures if turbidity measurements exceed 8 NTU above background in 24 hour period (i.e., conduct activities during high or slack tide).
Total Suspended Solids (TSS)	Relate turbidity values measured in the field during dredging to TSS values, which have been modelled for both dredging and disposal activities.
	Collect and submit TSS samples to a certified laboratory in the event turbidity levels indicate a potential exceedance during project blasting activities.
	Monitor and record noise levels during terrestrial blasting activities.
Terrestrial Blasting	Check equipment, hydraulics and vehicles for the presence of leaks.
	Collect water process and discharge quality parameters (temperature, pH, conductivity, dissolved oxygen, and turbidity) during blasting.
	The Environmental Monitor will document and ensure that any liquid runoff is addressed according to the Waste Management Plan (Appendix J.10 of the EIS/Addendum)
	The Environmental Monitor will monitor areas of potential erosion or blasting locations near sensitive habitat or species

5.8 ENVIRONMENTAL COMPLIANCE MONITORING – MARINE PILE INSTALLATION

Monitoring for underwater marine pile driving installation activities will be conducted according to applicable regulatory guidance. Environmental monitoring of pile installation and associated activities will require a qualified MMO. Prior to initiating pile driving and associated activities, the PRPA will be notified to alert ship traffic in the area.

Public communication and the handling of complaints related to noise will be undertaken by PNW LNG to come to a mutually agreeable resolution. Refer also to the Preliminary Draft Noise, Vibration and Ambient Light Management Plan.

Environmental Monitors will be on-site during marine construction activities to monitor the effectiveness of mitigation measures in achieving regulatory compliance. Environmental Monitors will be present to assist with compliance of the Marine Pile Installation Management Plan and all applicable permits, approvals and authorizations.

Table 5-9: Environmental Compliance Monitoring Summary – Marine Pile Installation

Construction Monitoring Component	Monitoring Activity
Marine Pile Driving and Drilling	Ensure that all pile installation equipment, couplings, connectors, hydraulics and hoses are in good condition and inspected each day prior to starting work.
	Perform spot checks on equipment during operations.
	The Environmental Monitor will document and ensure that any potentially harmful liquid runoff or hydrocarbon spill is addressed according to the Waste Management Plan or the Environmental Emergency Preparedness and Response Plan respectively.
	The Environmental Monitor or MMO will have the authority to stop pile installation activities if impacts to fish are observed. Impacts to fish include signs of damage to swim bladder such as loss of balance, inability to maintain buoyancy or deaths.
	The designated MMO will document marine mammal sightings and enforce the 500 metre DFO mandated exclusion safety perimeter.
	The MMO will maintain daily records for all marine mammal monitoring activities detailing: • Date of observation • Time of observation • Species observed inside or outside the exclusion zone, where possible • Approximate number of individuals • Behavioural or activity changes • Construction activity during observation.
	Fish mortality within a 500 m radius of the pile driving site (if applicable) shall be monitored and the following information shall be recorded: • Date of observation • Time of observation • Species • Approximate number of individuals • Any noteworthy observations regarding the appearance or condition of the fish.

5.9 ENVIRONMENTAL COMPLIANCE MONITORING – DREDGING

Environmental Monitors will be on-site during marine construction activities to monitor the effectiveness of mitigation measures in achieving regulatory compliance. Environmental monitoring requirements specific to dredging operations are presented in Table 5-10.

Table 5-10: Environmental Compliance Monitoring Summary - Dredging

Construction Monitoring Component	Monitoring Activity
Monitoring (General)	The Environmental Monitor will supervise and guide Dungeness crab salvage and relocation activities prior to dredging.
	Use a Qualified Professional with written authority to modify or halt any construction activity if it is deemed necessary to do so for the protection of fish and wildlife populations or their habitats.
Water Quality Monitoring (General)	Collect and document water quality parameters (temperature, pH, conductivity, dissolved oxygen, and turbidity) at specific intervals using a YSI 556 water quality meter or similar.
Turbidity Monitoring	Record field turbidity measurements in Nephelometric Turbidity Units (NTU) to compare with BC Ambient Water Quality Guideline (BCWQG) - Criteria for Turbidity, Suspended and Benthic Sediments.
	Implement corrective measures if turbidity measurements exceed 8 NTU above background in 24 hour period (i.e., conduct activities during high or slack tide).
Total Suspended Solids (TSS)	Relate turbidity values measured in the field during dredging to TSS values, which have been modelled for both dredging and disposal activities.
	Collect and submit TSS samples to a certified laboratory in the event turbidity levels indicate a potential exceedance during project dredging activities.
Spills	Conduct daily inspection of dredging equipment for leaks and/or potential malfunctions.

5.10 ACCOMMODATION PLAN

Monitoring and reporting is required to ensure the effectiveness of the Preliminary Draft Accommodation Plan and associated management plans and mitigation measures. The monitoring and reporting protocol of the Accommodation Plan will be established in consultation with the Ministry of Community, Sport and Cultural Development and the BC Environmental Assessment Office (EAO). Monitoring and reporting protocols for the Transportation Management Plan will also be established with the Ministry of Transportation and Infrastructure.

5.10.1 PNW LNG Monitoring Responsibilities

PNW LNG retains monitoring responsibilities but may delegate as appropriate monitoring functions to the EPCC Contractor. Results of the monitoring program will be compared to predicted effects presented in the EIS or as established in specific management plans to determine the effectiveness of mitigation. Adaptive management principles will be applied to improve the effectiveness of management plans and mitigations where required.

6.0 ENVIRONMENTAL COMPLIANCE REPORTING OVERVIEW

6.1 COMPONENT SPECIFIC REPORTING

Environmental monitoring reports will be filed by the Environmental Monitor(s) on a weekly basis. These reports will include a photographic timeline of construction activities, marine mammal observations (if any) and analytical data such as water quality readings. Details of mitigation measures applied, public noise complaints received and the subsequent follow-up. The Environmental Monitor(s) will submit the weekly monitoring reports to PNW's Environmental Manager. Template monitoring reports are presented in the Monitoring Forms.

Environmental monitoring reports for the quality of marine country foods will be filed to the Canadian Environmental Assessment Agency, which describes the quality of locally harvested marine food in Porpoise Harbour. These reports will be filed over three periods representing baseline, dredge completion and post-dredging completion phases.

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