Environmental Management Plan

Appendix E
Mitigation and Monitoring Plans

Appendix E.1 Guide to the Preparation of a Nest Removal Management and Compensation Plan
Appendix E.2 Water Quality Monitoring Plan
Appendix E.3 Red- and Blue-Listed Plants and Ecological Communities Survey and Mitigation Plan

E.1 APPENDIX E.1 GUIDE TO THE PREPARATION OF A NEST REMOVAL MANAGEMENT AND COMPENSATION PLAN

1
2

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 Scope 1

2.0 REGULATORY FRAMEWORK AND GUIDELINES FOR CONSERVATION 3

3.0 DEVELOPING A NEST REMOVAL MANAGEMENT AND COMPENSATION PLAN 5

3.1 Discovering Nests 5
3.1.1 Summary of Baseline Data 5
3.1.2 Construction Preparation Surveys 11
3.1.3 Wildlife Species of Concern Discovery Contingency Plan 11

4.0 BC WILDLIFE ACT PERMIT AUTHORIZATION 13

5.0 CONSULTATION 15

6.0 MANAGEMENT AND COMPENSATION CONSIDERATIONS 17

7.0 REFERENCES 19

LIST OF APPENDICES

Appendix A Guidance for Osprey Nest Relocation
Appendix B Osprey Nest Platform Design

LIST OF FIGURES

Figure 3-1: Raptor Nests Detected during Field Surveys 10

LIST OF TABLES

Table 3-1: Summary of Nests Found during Project-specific Field Surveys 6
Table 4-1: Recommended Timeline for Proposed Nest Platform Installation and Nest Removal 13

1.0 INTRODUCTION

The Coastal GasLink Pipeline Project (the Project) has the potential to interact with raptor (e.g., bald eagle, osprey, golden eagle, peregrine falcon) and great blue heron nests, which are protected year-round under the British Columbia (BC) *Wildlife Act*. Most raptors and herons use stick nests, although peregrine falcons use bare ledges. Raptor and heron nests are generally located in trees or on cliffs, but can also be found on the ground and on artificial structures. Nests of these species are often reused in consecutive years. Unlike raptors, most great blue herons nest in colonies, and comparatively fewer nest solitarily (Gebauer and Moul 2001; COSEWIC 2008). Colony nest sites are usually comprised of several nest trees clustered in a relatively small area.

1.1 SCOPE

The scope of this guide is to provide Coastal GasLink with information and instruction on how to prepare a Nest Removal Management and Compensation Plan that would be required as part of a BC *Wildlife Act* Permit Authorization if the removal of a raptor or heron nest protected year-round under the BC *Wildlife Act* is necessary. This guide has been developed to address a mitigation commitment made in Table 26-B-1 of Coastal GasLink's Application for an Environmental Assessment Certificate (EAC) (EAC Application) (Table 1-1).

Environmental Assessment Certificate Application Mitigation Commitment
EAC Table 26-B-1

Mitigation Commitment
If construction activities require the removal of a raptor nest that is protected year-round under the BC Wildlife Act (i.e., eagle, peregrine falcon, gyrfalcon, osprey and burrowing owl), a Nest Removal Management and Compensation Plan is required as part of a BC Wildlife Act Permit Authorization application submission to the Province to obtain permission to remove the nest. A BC Wildlife Act Permit Authorization application is not required for the removal of a raptor nest that is not protected under the BC Wildlife Act (e.g., red-tailed hawk nests).

Therefore, raptor and heron nests described in this guide refer to species identified under Section 34(b) of the BC *Wildlife Act*, and not to all raptor species with the potential to overlap with the Project (refer to Section 2.0).

2.0 REGULATORY FRAMEWORK AND GUIDELINES FOR CONSERVATION

Under Section 34 (b) of the BC *Wildlife Act*, the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron, or burrowing owl is protected year-round, whether it is active or not. Nests of great blue heron are also protected under the federal *Migratory Birds Convention Act*, 1994, and the coastal subspecies (*Ardea herodias fannini*) is listed as being of Special Concern under Schedule 1 of the *Species at Risk Act*.

Bald eagle, golden eagle, peregrine falcon, osprey, and great blue heron nesting areas are expected to overlap with the Project footprint. Coastal GasLink does not expect gyrfalcon or burrowing owl nesting areas to overlap with the Project. Guidance for the restoration and enhancement of raptor habitat is provided in *Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia* (BC Ministry of Environment and Climate Change Strategy [MECCS] 2013), and relevant information has been incorporated into this guide.

Additionally, guidance in A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia (BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development [MFLNRORD] 2014) will be reviewed if a nest removal permit application is required.

3.0 DEVELOPING A NEST REMOVAL MANAGEMENT AND COMPENSATION PLAN

A Nest Removal Management and Compensation Plan will be developed if a raptor or heron nest is discovered as described in Section 2.0, which must be removed because it cannot be avoided through practical Project construction planning. The following sections describe how a raptor or heron nest might be discovered, and the process for applying for the required regulatory authorization to remove that nest if required.

3.1 DISCOVERING NESTS

There are three ways in which a raptor or heron nest can be discovered: during baseline surveys, construction preparation surveys, or as an incidental observation during Project-related activities. Baseline surveys provide current information of known nest locations, and clearing preparation surveys will build on existing information and allow additional time for planning if any missed or newly created nests are identified as overlapping the Project footprint. Incidental nest detections will be documented and mitigated through the Wildlife Species of Concern Discovery Contingency Plan.

3.1.1 Summary of Baseline Data

Coastal GasLink conducted field surveys in 2013, 2014 and 2015 to identify the locations of raptor and heron nests with the potential to interact with the Project (Coastal GasLink 2014). During those field surveys, 23 nests (11 osprey and 12 bald eagle) were identified, none of which were found to occur within the Project footprint (i.e., the areas to be cleared for construction of the pipeline ROW, access roads, and ancillary sites; Figure 3-1). One osprey nest was found to be close to an existing road; however, Coastal GasLink does not anticipate having to remove it (Table 3-1; Figure 3-1). The distance from each known nest to the nearest Project feature ranges from 5 m to 8,000 m (Table 3-1).

Table 3-1: Summary of Nests Found during Project-specific Field Surveys

Species	Year Detected	Nest ID	Nearest KP	Distance to Project Feature (m)	Project Feature
Osprey	2013	W-002	67	1,318	Road
Osprey	2014	W-079	67	1,438	Road
Bald Eagle	2013	W-003	205	1,445	ROW
Bald Eagle	2013	W-016	205	1,401	ROW
Osprey	2013	W-041	215	5	Road
Osprey	2014	W-070	237	63	ROW
Osprey	2014	W-072	247	133	Road
Osprey	2014	W-071	248	323	Road
Osprey	2015	W-108	252	97	ROW
Bald Eagle	2015	W-110	288	132	ROW
Osprey	2015	W-109	289	196	Road
Bald Eagle	2013	W-015	296	754	ROW
Bald Eagle	2014	W-078	296	768	ROW
Bald Eagle	2014	W-073	298	1,054	Ancillary Site
Bald Eagle	2014	W-074	364	199	Ancillary Site
Bald Eagle	2014	W-075	364	136	Ancillary Site
Bald Eagle	2013	W-014	384	424	ROW
Bald Eagle	2014	W-076	308	308	ROW
Osprey	2013	W-004	393	197	ROW
Bald Eagle	2013	W-013	542	810	Road
Osprey	2014	W-104	586	295	ROW
Osprey	2013	W-012	586	515	ROW
Bald Eagle	2013	W-001	667	8,008	ROW

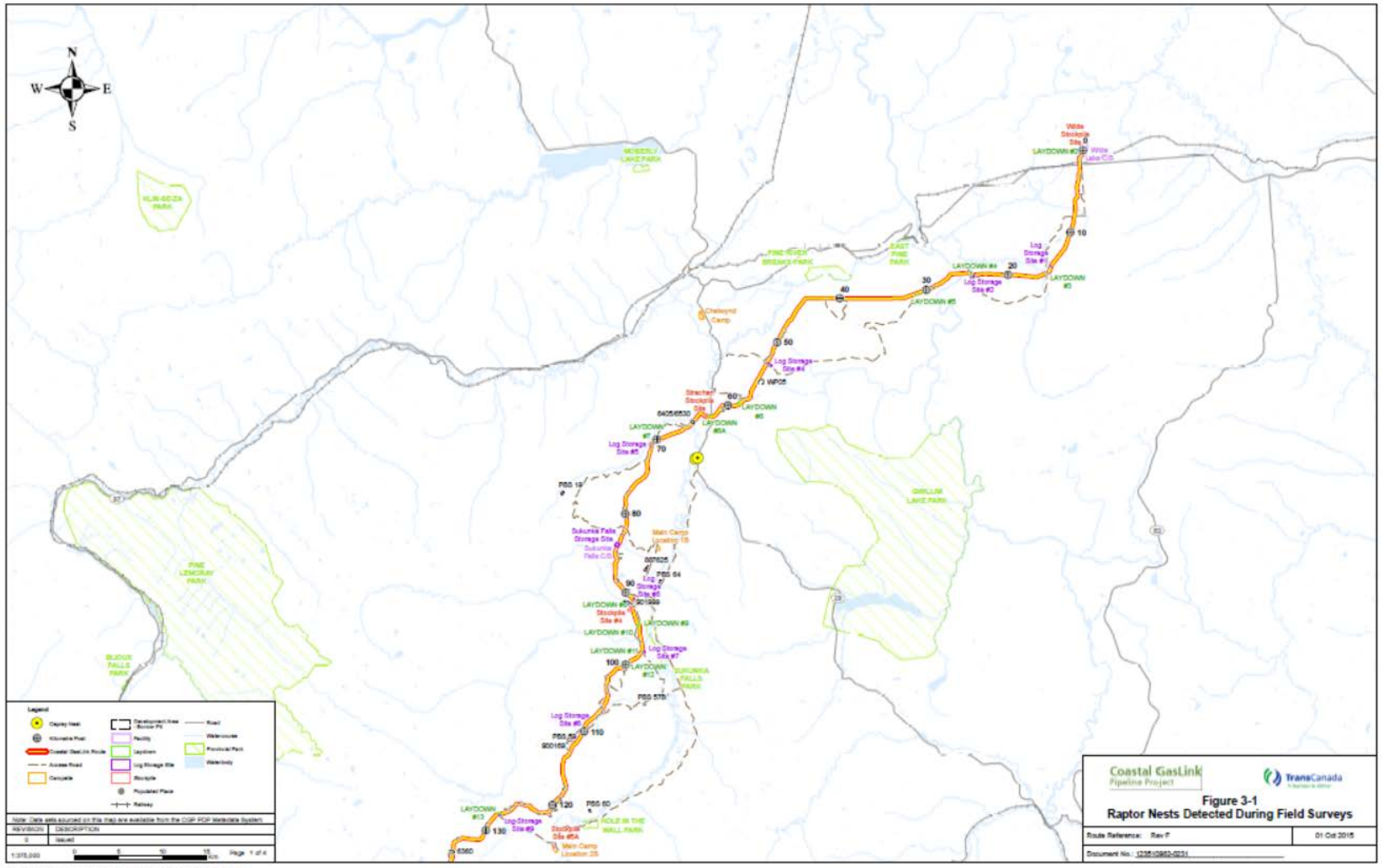
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Figure 3-1
Raptor Nests Detected During Field Surveys

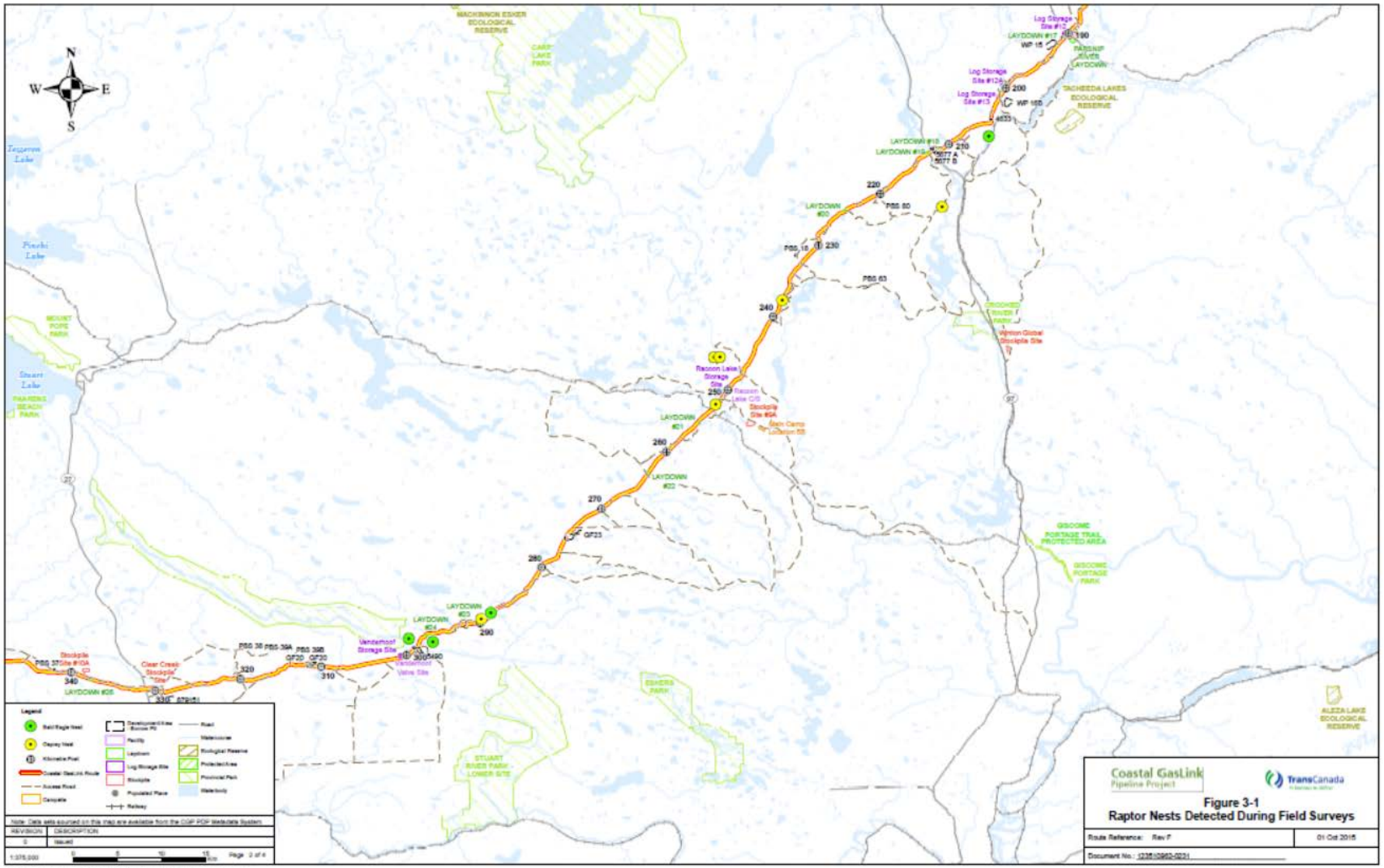
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Figure 3-1
Raptor Nests Detected During Field Surveys

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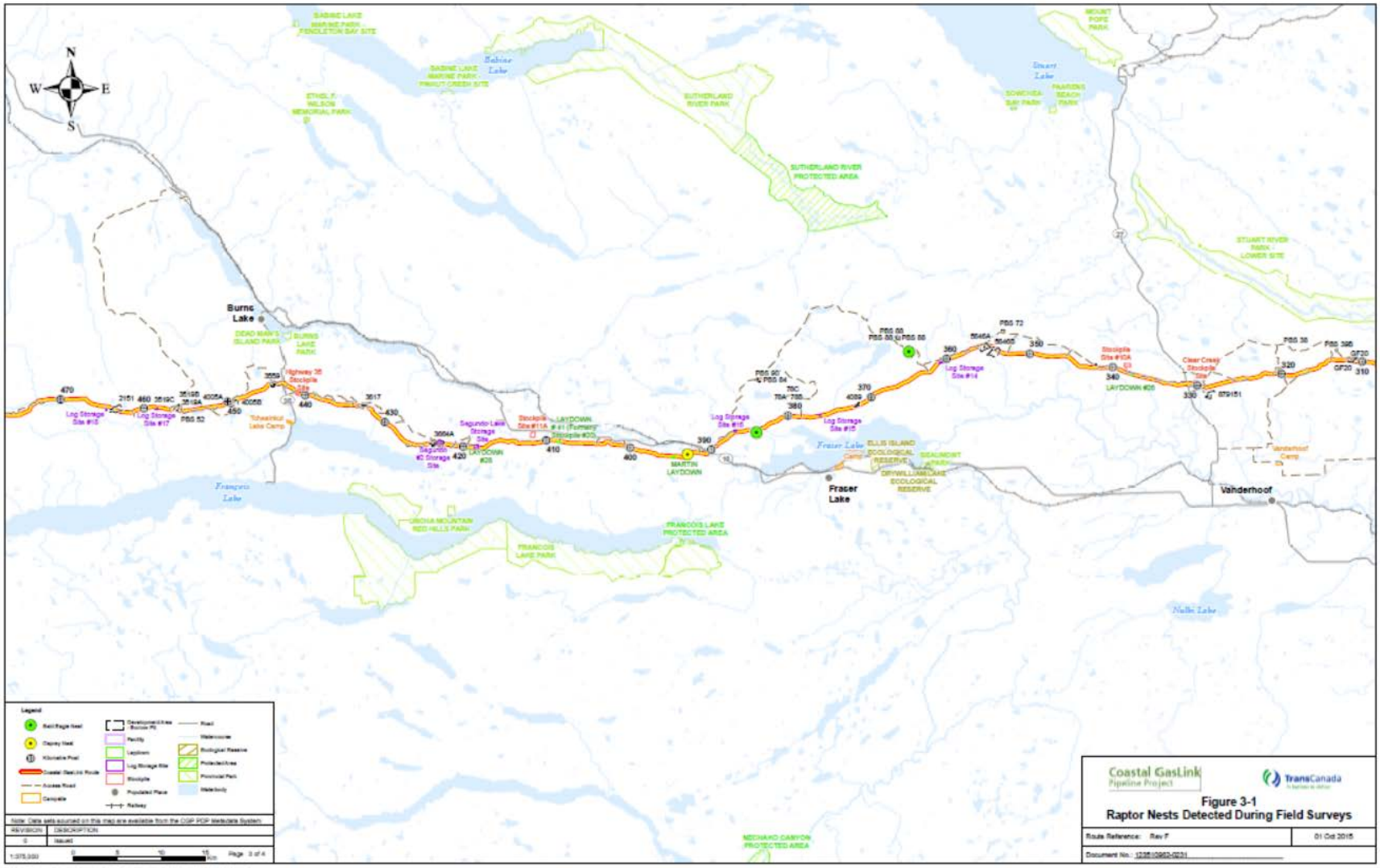
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Babine Lake
Stuart Lake
Francois Lake
Nulki Lake
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TransCanada
Figure 3-1
Raptor Nests Detected During Field Surveys
Route Reference: Rev F
01 Oct 2015

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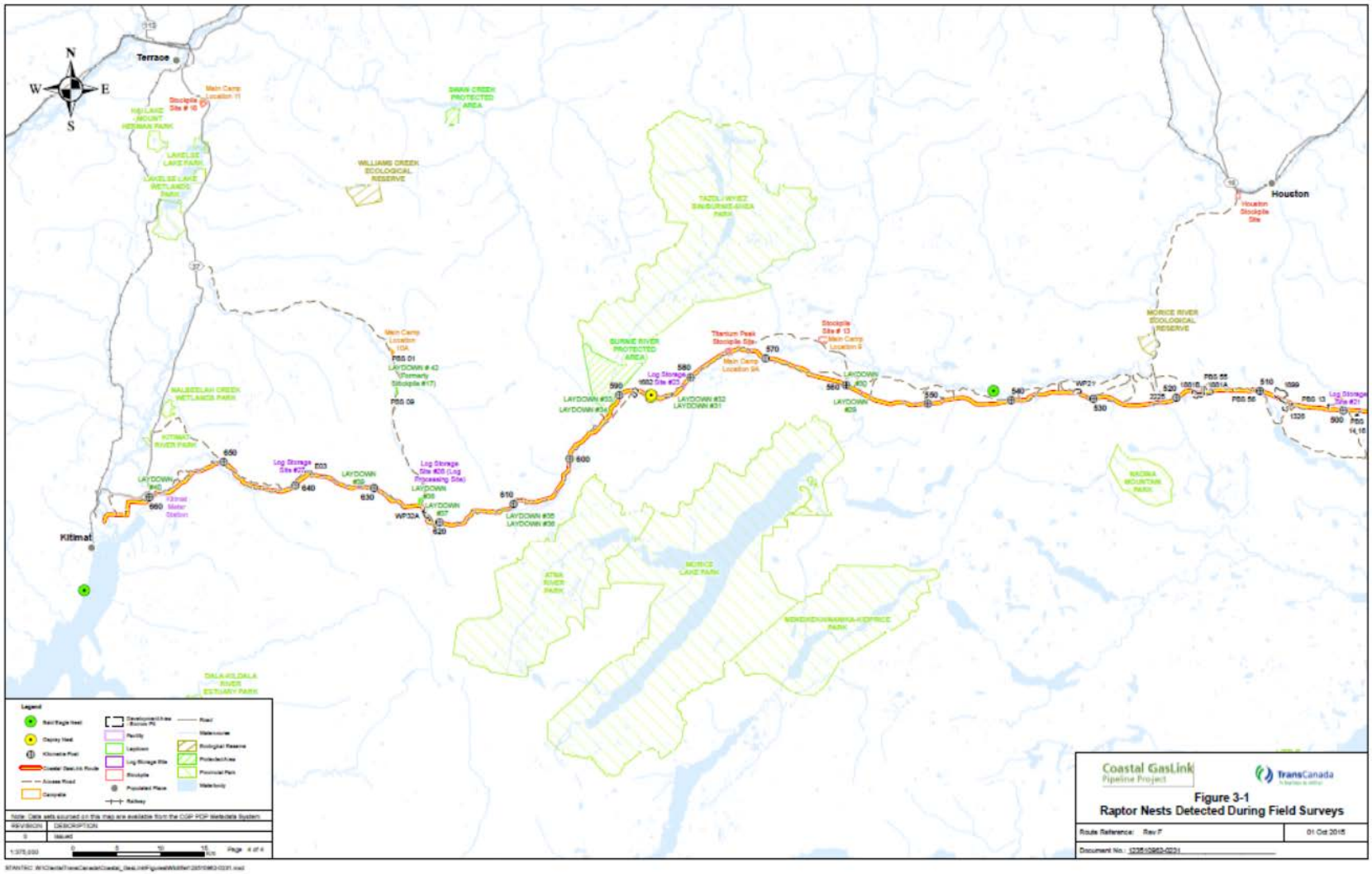

Figure 3-1: Raptor Nests Detected during Field Surveys

3.1.2 Construction Preparation Surveys

Construction preparation surveys along the route will target habitats with the potential to support raptor or heron nests. If a nest is detected in a location requiring clearing for the Project, a BC *Wildlife Act* permit authorization, including an accompanying Nest Removal Management Plan, will be developed (refer to Section 4.0) based on consultation with the relevant regulatory authority. If a nest is discovered as part of a construction preparation survey that is completed only a few days before construction is scheduled to begin, certain construction activities at that specific location may be delayed if the nest tree is located on the Project footprint. The length of the delay would depend on whether the nest is active and the time required to obtain a permit if nest tree removal is necessary.

If a nest is active, and Coastal GasLink cannot avoid the restricted activity window (i.e., the active nest period), Coastal GasLink will comply with applicable regulatory requirements and implement a minimum setback of 100 m consistent with the BC OGC permit conditions. If practical, Coastal GasLink will consider a larger setback consistent with BC MFLNRORD (2014) guidance, based on the construction activity and site conditions, if activity is planned for the restricted activity window.

If removal of a nest is required for construction, Coastal GasLink will proceed with a permit authorization application (refer to Section 4.0) and wait until the nest is not active before removing it.

3.1.3 Wildlife Species of Concern Discovery Contingency Plan

As part of its EAC Application, Coastal GasLink prepared a series of contingency plans to address unexpected circumstances. Appendix C.10 contains the Wildlife Species of Concern Discovery Contingency Plan, which describes measures to be taken for the discovery of a wildlife species of concern or their site-specific habitat. A raptor or heron nest is a site-specific habitat feature of a wildlife species of concern. Therefore, if a nest is discovered incidentally during construction, is identified as overlapping with the Project footprint, and is not avoidable, Coastal GasLink will implement the following steps in consideration of the contingency plan and the nest management removal and compensation plan:

- Immediately suspend work activities at the site.
- Notify the Environmental Inspector(s), who will notify the Construction Manager. Coastal GasLink will contact a wildlife resource specialist, if deemed necessary, for advice on the discovered nest and recommended interim mitigation.
    - If the nest is active (i.e., occupied by a raptor or heron), Coastal GasLink will comply with applicable regulatory requirements and implement a minimum setback of 100 m consistent with the BC OGC permit conditions, and if

practical, will consider a larger setback consistent with BC MFLNRORD (2014) guidance.

  - If the nest is not active (i.e., no signs of breeding activity), Coastal GasLink will maintain a 100 m undisturbed buffer around the nest tree where practical and will avoid cutting down the tree.

- Prepare a *BC Wildlife Act* permit authorization and accompanying Nest Removal Management and Compensation Plan (refer to Section 4.0).

4.0 BC WILDLIFE ACT PERMIT AUTHORIZATION

If a raptor or heron nest is identified as being in conflict with a Project activity, Coastal GasLink will consult with the relevant regulatory authority and, if required, a General Permit Application, type 3(1)(d)(i), (ii), or (iii), will be completed and submitted to the province of BC (BC MFLRNORD) through FrontCounter BC. Provision of a permit for the removal of a raptor or heron nest will be considered on a case by case basis. The permit application will include an accompanying Nest Removal Management and Compensation Plan, which will describe the following information:

- the location of the nest (UTM or legal description of the property)
- the species of bird occupying the nest to be removed
- the number of nests to be removed
- a detailed reasoning for nest removal, or an explanation of why the proposed activity is in the public interest
- the proposed timeline for nest removal and compensation (Table 4-1)
- a detailed description of the management and compensation to be implemented (refer to Section 5.0)
- submission of a project-completion report to the FrontCounter BC upon 30 days of nest removal

Table 4-1: Recommended Timeline for Proposed Nest Platform Installation and Nest Removal

Permit Phase	Time Frame	Task
Prepare and Submit Permit		
Permit application under the BC *Wildlife Act*	Anytime	Submit application to FrontCounter BC and negotiate permit commitments (between 30–90 days)
Permit Approved		
Artificial Nest Construction	Late September or October (prior to removal of the existing nest)	Install the artificial nesting pole(s) or platform(s)
Nest Removal	Late September to January (after the new nest platform(s) have been installed)	Commence activities, including removal of the old nest, and if appropriate, relocating the original nest to the new platform.
Post-nest Construction	Within 30 days of removing the existing nest	Electronically submit a project-completion report to FrontCounter BC.
	Subsequent breeding season (between February and August) and through Project construction	Monitor to determine whether new nest sites are active.

5.0 CONSULTATION

There is no requirement under the BC *Wildlife Act* to consult on the development of a Nest Removal Management and Compensation Plan, however, Coastal GasLink expects to consult with a relevant regulatory authority (i.e., BC MFLNRORD, or BC MECCS) if a raptor or heron nest requires removal. If a great blue heron nest must be removed, Coastal GasLink will also consult with Environment and Climate Change Canada (ECCC).

6.0 MANAGEMENT AND COMPENSATION CONSIDERATIONS

The recommended time frame for the removal and potential relocation of a raptor or heron nest is September 16 to January 14 (BC MECCS 2014a, b; BC MFLNRORD 2014)[1]. However, permit authorization may still be granted in the event that a nest is found outside of this timing window. The recommended timeline for activities associated with nest removal and relocation is provided in Table 2.

Dependent on permit authorization, Coastal GasLink will:

- Obtain a qualified biologist to guide management or compensation for the nest to be removed or relocated (BC MECCS 2013). Options may include:
    - Selectively pruning mature trees in a nearby suitable habitat (outside of the breeding season and under the guidance of a qualified biologist) to make the trees more attractive to raptors for perching and nesting.
    - Compensating for a removed raptor nest by replacing it with an artificial platform at a 1:1 ratio. The artificial nest platform will be placed in suitable nearby habitat during the least-risk timing window to encourage nesting in an alternate location (refer to Appendix A and B). This approach has primarily been successful for osprey, but could be applied for bald eagle nests (Bortolotti et al. 1988). Site selection for osprey should avoid proximity to nesting bald eagle.
- Coastal GasLink will apply adaptive management which may include the evaluation of practical corrective measures in consultation with a resource specialist if, within 5 years post-construction, a relocated or artificial nest is not used, or if a new natural nest has not been established within 1,000 m of the location where the nest was removed. Coastal GasLink will engage with the relevant regulatory authority to determine the most appropriate approach.

The ability for osprey to nest on a human-made structure is considered high (BC MECCS 2013), but is generally less so for bald eagle, and is non-existent for great blue heron, in British Columbia. Artificial nest platforms used by bald eagle in North America include power poles and communication towers (Bortolotti et al. 1988; Marion 1992), which are used when nest sites are limited or unavailable (Wildlife Habitat Council 2001). However, as nesting trees are generally not lacking in the Project area, selectively pruning mature trees to encourage the relocation of a nesting pair of bald eagles may be a reasonable option for the Project (BC MECCS 2013). There is a limited likelihood of a Project interaction with a golden eagle or peregrine falcon nest due to the lack of cliffs within the Project footprint.

[1] This date range reflects new information that was made available after filing the EAC Application, and supersedes the date range provided in Table 26-B-1 of Coastal GasLink's EAC Application.

Nest platforms for great blue heron have been constructed in Texas and Michigan, USA in areas where nesting vegetation was lacking (National Audubon Society 2009; Newstead et al. 2010). The construction of nest platforms in Michigan obtained positive results with the use of a series of tripod poles in areas once used by great blue heron (National Audubon Society 2009). However, for great blue heron nests in colonies, relocation would likely involve more than one nest and require careful planning based on input from a qualified biologist. Little information exists on the success of great blue heron nest relocation to an artificial nest structure, particularly in areas where heron are unhabituated to disturbance.

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Appendices – Contents

Appendix A Guidance for Osprey Nest Relocation
Appendix B Osprey Nest Platform Design

Appendix A

Guidance for Osprey Nest Relocation

1

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Osprey have been found to relocate to new nesting platforms when they are provided in suitable habitat near the existing nest (Poole et al. 2002; Virginia Department of Game and Inland Fisheries 2010). The availability of human-made nesting platforms has been a significant factor in the recovery of osprey populations in some areas (Watts and Paxton 2007), and is expected to minimize Project impacts on osprey breeding success. Appendix B provides additional information on nest platform design.

The following guidance will be considered prior to the installation of new nest platforms (Land Owner Resource Centre 1999; BC MOECCS 2013; and BC MOECCS 2014a):

- Nest platforms should be constructed no more than 50 m from fish-bearing waterbodies (including wetlands, streams, and lakes). The sites should be at least 100 m from human activity and away from power lines and other potential sources of electrocution risk.
- Nest platforms should be in an open area without tree cover over the nest. This provides a preferred vantage point, sufficient space for flight, and the ability to detect predators.
- The platform should be set higher than the original nest location.
- The support should consist of a single pole (e.g., hydro or utility pole).
- The nest platform support should be strong enough to support a 90 kilogram nest (e.g., a 1.2 m x 1.2 m skid or pallet, a circular or oval convex, or a polygonal shape with more than three sides but with a minimum horizontal width of 1 m).
- The base of nest platform poles or trees should have aluminum flashing at least 1 m high to deter predators.
- If possible, the original nest should be relocated, intact, onto the new platform. If not feasible, sticks from the nest should be roughly arranged on the platform in the shape of a nest to attract further nest-building behavior.
- The original nest support or substrate should be modified or removed to discourage ospreys from rebuilding a nest at the same site (e.g., covered in chicken wire).

Appendix B

Osprey Nest Platform Design

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The following is obtained from Land Owner Resource Centre (1999).

Single-poled platforms are better suited for use on land. This structure can be adapted for use in areas with deep soil as well as areas without soil. Old hydro poles are ideal for supporting nesting platforms.

Equipment:

- One pole, six to nine meters in length
- 1.2 m x 1.2 m skid or pallet with 10-inch high retaining fence
- Four wood or metal braces
- Power auger (for deep soil sites)
- Rock drill and mounting set (for rocky sites)
- Six-inch spikes
- Two-inch roofing nails
- Steel guy wire
- Four eye bolts (minimum two-inch thread)
- Cement
- Pliers, claw hammer and sledge hammer
- One piece of one-meter square sheet metal

The following steps are recommended for installation in deep soil:

1. Attach the nesting platform (skid or pallet) to the pole. Wire a few "starter" nest sticks to the platform.

2. Use the power auger to drill a hole one to two meters deep.

3. Place the pole in the hole and secure it with cement, sand or rock.

4. If necessary, attach guy wires to add extra support.

5. Wrap the predator guards (sheet metal) around the base of the pole. Nail them in place with roofing nails, ensuring that they are pounded in flush so as to not provide toe-holds for predators.

The following steps are recommended for installation with no soil (e.g., rock):

Equipment: rock drill and mounting sets (as used by utility companies).

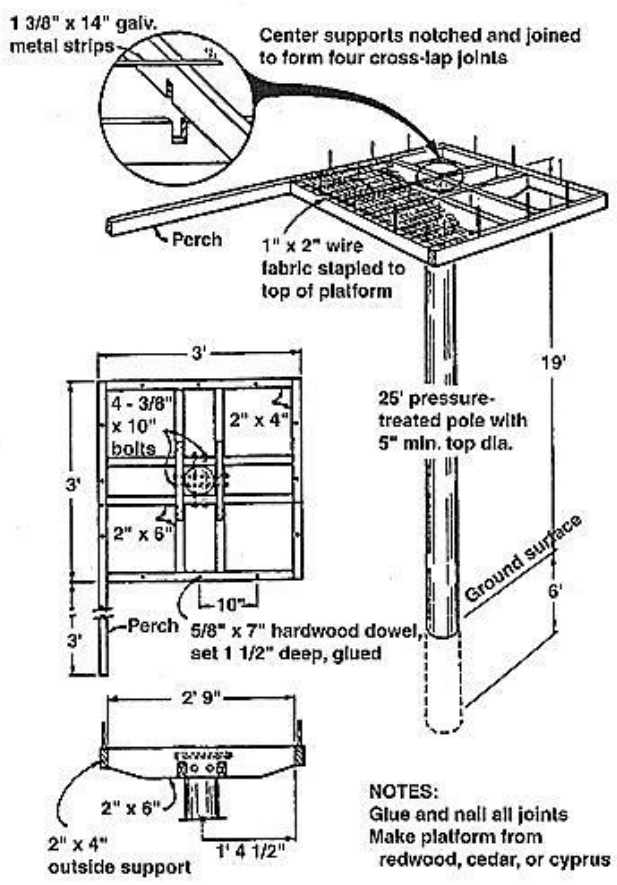
1. Attach the nesting platform (skid or pallet) to the pole. Wire a few starter sticks to the platform.

2. Use the rock drill to make the holes to accommodate the mounting set.

3. Set the bracket inside the holes. Pour in cement for additional support.

4. Raise and anchor the pole in place using the mounting set.

5. If necessary, attach guy wires prior to raising the pole to add extra support.



6. Wrap the predator guards (sheet metal) around the pole. Nail them in place with roofing nails, ensuring that they are pounded in flush and can't provide toe-holds for predators.

An additional 1 m-length of wood can be mounted as a perch.

E.2 APPENDIX E.2 WATER QUALITY MONITORING PLAN

QUALIFIED PROFESSIONAL STATEMENT

The Water Quality Monitoring Plan (WQMP) has been prepared to guide the collection, analysis and reporting of water quality data in association with the Coastal GasLink Pipeline Project (the Project), and to satisfy Condition #4 of the Environmental Assessment Certificate (EAC) and the British Columbia (BC) Oil and Gas Commission (BC OGC) permit conditions.

Coastal GasLink Pipeline Ltd. (Coastal GasLink) has the right to reproduce, use and rely on the WQMP for its intended purposes in planning, construction and operation of the Project in the Province of BC, including the right to submit this document to relevant regulatory authorities.

The WQMP has been prepared for the exclusive use of Coastal GasLink in association with the Project. It may not be used by any other person or entity, other than for its intended purposes, without the consent of Triton Environmental Consultants Ltd. (Triton) and Coastal GasLink.

The information contained in this document has been collected in accordance with current guidelines and laws as practised in the Province of BC at the time the work was completed. Information obtained from secondary sources has been assumed to be correct. Triton accepts no responsibility for damages or liability that may arise from use of the material from this document. The recommendations contained in this document may change if new information becomes available or if information Triton has relied on is altered. If circumstances become apparent that deviate from Triton's understanding of conditions presented in this document, it is requested that Triton be notified and permitted to reassess the information provided.

The majority of this report was prepared by a Registered Professional Biologist, with minor content completed by others, which was reviewed and approved by a Registered Professional Biologist before inclusion in the WQMP.

This report should be considered as a whole; relying on only portions of the report may create a misleading view of Triton's opinions.

The Authorship and Review table documents the credentials of those Qualified Professionals responsible for developing the WQMP.

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TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 MONITORING LOCATIONS AND SCHEDULE 5

2.1 Implementation Zone 5
2.2 Data Collection Locations 5
2.3 Data Collection Period 7

3.0 WATER QUALITY PARAMETERS AND THRESHOLDS 8

3.1 Turbidity, Total Suspended SOLIDS and Benthic Sediments 8
3.2 Physiochemical Parameters 9
3.3 Hydrostatic Test Water 10
3.4 Watershed-Specific Water Quality Objectives 11

4.0 METHODS 12

4.1 Turbidity and TSS 12
4.2 Benthic Sediments 12
4.2.1 Shallow Watercourses 13
4.2.2 Deep Watercourses 13
4.3 Hydrostatic Test Water 14

5.0 REPORTING 15

6.0 RESPONSE TO EXCEEDANCES 16

7.0 ROLES AND RESPONSIBILITIES 17

8.0 SAFETY 20

9.0 QUALITY CONTROL AND QUALITY ASSURANCE 21

10.0 REFERENCES 23

LIST OF TABLES

Table 1-1: EAC Condition #4 and BC OGC Section 25 Permit Conditions 1
Table 2-1: Stream Classifications 5
Table 3-1: Guidelines for Turbidity, Suspended and Benthic Sediments 8
Table 3-2: Guidelines for Physiochemical Parameters 9
Table 3-3: Guidelines for Hydrostatic Test Water Parameters 11

1.0 INTRODUCTION

The Water Quality Monitoring Plan (WQMP) has been developed to satisfy Condition #4 of the Environmental Assessment Certificate (EAC) Table of Conditions. The content is also applicable to water quality monitoring undertaken to satisfy the British Columbia Oil and Gas Commission (BC OGC) section 25 permit conditions for the Coastal GasLink Pipeline Project (the Project) (Table 1-1).

Table 1-1: EAC Condition #4 and BC OGC Section 25 Permit Conditions

Condition Number	Condition
4	The Holder must develop and implement a Water Quality Monitoring Plan, in consultation with OGC, to address onsite water quality monitoring associated with the Construction phase of the Project where works are planned for in-stream works within the Riparian Reserve Zone of an S1, S2, S3, or within 20m of an S4 stream, as identified by the *OGAA*, unless otherwise authorized by OGC or DFO. The Water Quality Monitoring Plan must be consistent with the following as they apply to aquatic life: • the *BC Ambient Water Quality Guidelines (Criteria) for Turbidity, Suspended and Benthic Sediments*; • the BC Ambient Water Quality Criteria for pH or, if applicable; • the BC Water Quality Objectives established by MOE as of the date of this EAC with respect to turbidity, total suspended solids, benthic sediments, and pH. A Qualified Professional must develop and supervise the implementation of the Water Quality Monitoring Plan. The Plan must include monitoring at upstream locations and downstream of the location of disturbance to develop baseline information. The Plan must include measures to identify and report to OGC any exceedances of the above Water Quality Guidelines or Objectives. For exceedances of the above Water Quality Guidelines or Objectives that are caused by, or contributed to by Construction activities, the Holder must undertake measures to remedy the factors producing the exceedance, in consultation with OGC. In order to allow for 30 days review and comment, the Holder must provide the Plan to EAO no less than 60 days prior to the Holder's planned date to commence Construction. Once the Plan is complete, the Plan must be submitted to OGC. The Holder must maintain records of the data collected during the implementation of Water Quality Monitoring Plan throughout the Construction phase of the Project and provide those records to OGC and EAO upon request.

Condition Number	Condition
Varies by construction section permit	Except with leave of the Commission, prior to construction activities in a stream classified as S1, S2, S3 or S4; or the Riparian Reserve Zone (RRZ) of a stream classified as S1, S2, S3, or a S4 stream, the permit holder must develop a Water Quality Monitoring Program to the satisfaction of the Commission. The Water Quality Monitoring Program must: a. be developed, implemented and supervised by a qualified professional; b. be consistent with the Ministry of Environment's approved water quality guidelines; c. include environmental water quality monitoring, including field monitoring of turbidity, pH and total suspended solids for potential exceedance of BC Water Quality Guidelines for the protection of aquatic life or, where they exist, the Water Quality Objectives for a specific watercourse, as they may be amended from time to time; d. require pre and post construction monitoring upstream (baseline) and downstream of the location of potential disturbance from construction activities; e. require sampling that is representative of water quality variation across the stream; and f. require documentation of pre and post construction monitoring completed under e.
Varies by construction section permit	Except with leave of the Commission, prior to construction activities in a wetland, the permit holder must develop a Wetland Water Quality Monitoring Program to the satisfaction of the Commission. The Wetland Water Quality Monitoring Program must: a. be developed, implemented and supervised by a qualified professional; b. be consistent with the Ministry of Environment's approved water quality guidelines; c. include environmental water quality monitoring for potential exceedance of the BC Water Quality Guidelines for the protection of aquatic life or, where they exist, the Water Quality Objectives for a specific wetland, as they may be amended from time to time; d. where appropriate, require pre and post construction monitoring proximal to the location of potential disturbance from construction activities; and e. require documentation of pre and post construction monitoring completed under d.
Varies by construction section permit	The permit holder must implement the Water Quality Monitoring Programs developed as per conditions X and Y (number dependent on construction section permit) and do each of the following: a. provide records of documentation of all pre and post construction monitoring to the Commission; b. immediately report to the Commission any exceedance of the BC Water Quality Guidelines for aquatic life or, where they exist, the Water Quality Objectives for a specific watercourse or wetland that persist for a period of 24 hours or greater, relative to the baseline; and c. immediately take steps to address the factors producing any exceedance of the BC Water Quality Guidelines for aquatic life, relative to the baseline, should any exceedance persist for a period of 24 hours or greater, and where such steps do not result in addressing the turbidity exceedance, promptly suspend construction operations at the site of activities causing the exceedance until effective solutions, satisfactory to the Commission, have been developed and implemented.

The WQMP identifies the water quality parameters to be monitored, the schedule and locations where monitoring will occur, the personnel responsible for implementing the WQMP and the proposed method for reporting the results.

The WQMP is designed to monitor for effects related to the introduction of sediment into fish-bearing waters that may be caused by construction activities. Physical and chemical parameters that may be affected by the introduction of sediments will be monitored. Specifically, the monitored parameters will include: turbidity, pH, conductivity, dissolved oxygen (DO) and temperature. The WQMP does not include monitoring of groundwater or domestic water wells.

In accordance with EAC Condition #4, the WQMP was developed by qualified professionals as detailed in the Qualified Professional Statement.

2.0 MONITORING LOCATIONS AND SCHEDULE

2.1 IMPLEMENTATION ZONE

Water quality monitoring will be conducted during the construction phase of the Project where construction activities are planned for in-stream works within the riparian reserve zone (RRZ) of an S1, S2 or S3, or within 20 m of an S4 stream, and at all fish-bearing surface waters, such as ponds and wetlands.

The riparian management area (RMA) is made up of the riparian management zone (RMZ) and, immediately adjacent to fish-bearing streams of >1.5 m channel width, the RRZ (BC Ministry of Forests and BC Environment, 1995). Table 2-1 provides definitions of stream classifications identified in the BC EAO and BC OGC conditions (BC OGC 2015).

Table 2-1: Stream Classifications

	S1A [a]	S1B	S2	S3	S4	S5 [b]	S6 [b]
Stream width (metres)	>100[c]	20-100	5-20	1.5-5	<1.5	>3	<3
Riparian reserve zone width (RRZ)	50	50	30	20	0	0	0
Riparian management zone width (RMZ)	50	20	20	20	30	30	20
Riparian management area width (RMA)	100	70	50	40	30	30	20

[a] S1 large rivers may have a RRZ if designated by the Ministry of Environment and Climate Change Strategy (MECCS)
[b] S5 and S6 streams are non-fish bearing
[c] includes active floodplain area

2.2 DATA COLLECTION LOCATIONS

At all water crossings where the WQMP is implemented, parameters should be monitored upstream or at a distance away from the disturbance area to provide a reference baseline. The baseline is used to determine whether changes in the measured parameters can be attributed to construction activities or if changes are the result of prevailing environmental conditions (the control site). Precise control site locations will be at the discretion of the Environmental Inspector(s) in consultation with the Qualified Professional and water quality monitoring team, but should be located in an area that can be accessed safely without disturbing the waterbody and located far enough upstream or away from the works that no construction-related

effects would be expected; usually at least 25 m upstream on streams <5 m wide, and at least 50 m upstream on larger watercourses. The control site should be located downstream of any significant tributaries, existing road crossings, beaver activity or other features that may affect water quality parameters. In locations where complex or dynamic hydrology exists, additional upstream control sites may be established, in consultation with the Qualified Professional and at the discretion of the Environmental Inspector. When recording data from upstream sites, they should be clearly marked as "control" sites.

The locations of sample sites associated with potential effects from construction are at the discretion of the Environmental Inspector in consultation with the Qualified Professional and water quality monitoring team, but in general will be located immediately downstream of water discharge locations, instream works or work occurring adjacent to fish-bearing waters. An additional site or series of sites should be located downstream from the affected area. The number and spatial distribution of downstream collection points is site-specific, and is intended to determine the severity and extent of any exceedance of water quality parameters. Preferably, these sites will encompass a zone-of-influence (ZOI) that represents the area in which 90% of the suspended particles introduced from construction activities are expected to fall out of suspension (CAPP, CEPA, and CGI 2012). Where very fine-grained sediments (clays) or high-velocity flows are present, the ZOI may extend a considerable distance downstream, and sampling the entire ZOI may not be practical. It is impractical to systematically sample each stream crossing location to determine the ZOI, which depends on many factors (particle size, stream morphology, discharge volume and water velocity, etc.). The Environmental Inspector, in consultation with the Qualified Professional or water quality monitoring team, will be responsible for estimating the ZOI, although it is expected that measurements could occur at least 300 m downstream from the crossing at streams <5 m wide, and potentially >1 km downstream on larger watercourses with swift water velocity. The estimated ZOI should be conservative to avoid having to establish additional water quality monitoring stations downstream after the start of construction; however, the Environmental Inspector should not hesitate to add them if deemed necessary to capture the ZOI.

All data collection sites must be georeferenced by recording the location with a GPS, and marked up photographs can be used to describe sample collection locations. A brief description of the site should also be recorded so the water quality monitoring team and personnel who are not familiar with the construction site can locate the water quality sampling locations. If sample collection occurs over an extended period or multiple personnel are expected to conduct water quality readings or collect samples, the collection points should be marked in the field.

2.3 DATA COLLECTION PERIOD

Collection of baseline water quality data should occur before any significant site preparation work occurs within the implementation zone, including vegetation clearing at the water crossing in preparation for earthworks. Minor vegetation clearing associated with preliminary survey work can proceed without triggering the WQMP, unless instream disturbance is expected. Where practical, it would be beneficial to collect several readings over a period of days to capture the local variation associated with the range of climatic and hydrologic conditions expected during the construction period, especially where construction within the implementation zone will be extended over a week or more (e.g., HDD crossings and large diversion channels).

Readings will be collected at various times throughout the construction period, but should occur at least three times daily while work is occurring in the implementation zone (before the start of activities each morning, midday and immediately following construction activities for the day). Sampling frequency will increase during activities with elevated risk of generating sediments or altering water chemistry (e.g., during active instream works, concrete and grouting works, during water diversions and when bore paths are under waterbodies), or immediately following any incident which may affect water quality.

3.0 WATER QUALITY PARAMETERS AND THRESHOLDS

3.1 TURBIDITY, TOTAL SUSPENDED SOLIDS AND BENTHIC SEDIMENTS

Consistent with EAC Condition #4, thresholds for turbidity, Total Suspended Solids (TSS), and benthic sediments were derived from the British Columbia *Ambient Water Quality Guidelines (Criteria) for Turbidity, Suspended and Benthic Sediments* (Singleton 2001) and are shown in Table 3-1. These thresholds are similar to guidelines provided by the Canadian Council of Ministers of the Environment (CCME) (2002); any differences are noted below. The guidelines for streambed substrate composition are designed to protect incubating eggs and alevin of salmonid fishes, and to protect areas suitable for salmonid spawning from being degraded. Therefore, the guidelines are static and do not allow for proportional changes from background levels. Existing streambed substrates in the vicinity of many crossings will not meet the guidelines. If baseline streambed substrate conditions do not meet the guidelines and habitat in the ZOI has been assessed to have only moderate or lower potential spawning habitat, streambed substrate composition will not be monitored, however turbidity and TSS monitoring will take place.

Table 3-1: Guidelines for Turbidity, Suspended and Benthic Sediments

Parameter	Guideline	
	Clear Flow	**High Flow or Turbid Water**
TSS	Change from background of 25 mg/L at any one time for a duration of 24 h	Change from background of 10 mg/L at any time when background is 25 – 100 mg/L*
	Change from background of 5 mg/L at any one time for a duration of 30 d	Change from background of 10% when background is >100 mg/L
Turbidity	Change from background of 8 NTU at any one time for a duration of 24 h	Change from background of 5 NTU at any time when background is 8 – 50 NTU**
	Change from background of 2 NTU at any one time for a duration of 30 d	Change from background of 10% when background is >50 NTU
Streambed Substrate Composition	% fines not to exceed (at potential salmonid spawning sites): • 10% <2 mm • 19% <3 mm • 28% <6.35 mm***	
	Geometric mean diameter not less than 12 mm	
	Fredle number not less than 5 mm	

Notes:
* CCME guidelines are less stringent, and indicate a maximum change of 25 mg/L is acceptable when background levels are between 25 mg/L and 250 mg/L
** CCME guidelines are less stringent, and indicate a maximum change of 8 NTU is acceptable when background levels are between 8 and 80 NTU
*** CCME guidelines are more stringent and specify 25% <6.35 mm

3.2 PHYSIOCHEMICAL PARAMETERS

Thresholds for physiochemical parameters were derived from the British Columbia Ambient Water Quality Guidelines (Criteria) reports (MECCS, 1997; Oliver and Fidler 2001; McKean and Nagpal 1991), but in some cases the CCME guidelines were selected as thresholds for the Project. Guidelines provided by the MECCS and the CCME differ for all parameters except pH, thus both are reported in Table 3-2; Project thresholds are indicated by bold print.

Table 3-2: Guidelines for Physiochemical Parameters

Parameter	Guideline			
pH	**6.5 – 9.0**			
DO	CCME*	Warm water ecosystems		6.0 mg/L
		Cold water ecosystems		**9.5 mg/L**
		Systems where DO is naturally <110% of guidelines		**>90% of the background**
	BC Ambient Water Quality Criteria**	General		5 mg/L
		Buried embryos and alevin present		9 mg/L
		Interstitial flow		6 mg/L
Temperature	CCME	Thermal additions to receiving waters should be such that thermal stratification and subsequent turnover dates are not altered from those existing prior to the addition of heat from artificial origins. Thermal additions to receiving waters should be such that the maximum weekly average temperature is not exceeded. Thermal additions to receiving waters should be such that the short-term exposures to maximum temperatures are not exceeded. Exposures should not be so lengthy or frequent as to adversely affect the important species.		
	BC Ambient Water Quality Criteria	Fish presence unknown		MWMT*** of 18°C; max daily temp. of 19°C; max of 12°C for incubation period in Spring and Fall; **hourly rate of change not to exceed ±1°C****
		Dolly Varden or Bull Trout present		Max. daily temp. of 15°C; spawning and incubation (fall-winter) temperature range of 2°C-10°C.
		Other fish species		see Table 6 in Oliver and Fidler (2001)
Conductivity	**No Guidelines**			

Notes:

*CCME guidelines differentiate between “early life stages” and “other life stages”. Only values for early life stages are included, as they are more stringent.

**BC Ambient Water Quality Guidelines also provide 30-day mean values to be calculated from at least 5 samples over a 30-day period. Since construction will not last 30 days at most locations, these values are not included.

*** MWMT: Mean Weekly Maximum Temperature

****Project guidelines are slightly modified from this guideline, refer to text below.

Guidelines for pH are static (i.e., they do not specify an allowable change from background, and instead report a range suitable to protect most aquatic organisms). Background pH measurements at some crossings may be outside of the guidelines; at these crossings no further change to the background pH away from the guideline values will be permitted. Changes towards, and within, the acceptable range will not be deemed to exceed thresholds.

The British Columbia guidelines for DO depend on the species and life stages of fish potentially present (MELP 1997), whereas the CCME guidelines provide minimum values for aquatic life in "warm water" and "cold water" ecosystems (CCME 1999). The ecosystems are not defined by the CCME; however, "cold-water" ecosystems include those inhabited by salmonid species (US Environmental Protection Agency 1986), therefore the cold water guideline for early life stages of fish (9.5 mg/L) will be used for the Project (the CCME guideline is slightly more stringent than the British Columbia guideline of 9.0 mg/L to protect salmonid embryos and alevin). Where the background DO at a crossing is less than 9.5 mg/L, the CCME guideline of maintaining downstream DO within 90% of the background value will be used.

CCME guidelines for temperature are largely qualitative and are based on the physical state of the receiving or affected environment, and British Columbia guidelines are based on mean weekly maximum temperatures (MWMT), and on the species and life stages present. Construction activities are not expected to significantly alter water temperatures, and the fish species composition at each stream crossed by the Project differs, often both spatially and temporally.

There are no British Columbia or CCME guidelines for electrical conductivity (EC) for the protection of aquatic life and no thresholds have been set for the Project. EC is easily measured and so will be recorded as part of the WQMP.

3.3 HYDROSTATIC TEST WATER

Water used to perform hydrostatic pressure tests of the pipeline will be sampled for the parameters listed in Table 3-3 (as specified in the *Oil and Gas Waste Regulation* under the British Columbia *Environmental Management Act*) before being discharged to land. On-site testing is not necessary if the water is hauled off-site to be disposed of at an approved facility.

Table 3-3: Guidelines for Hydrostatic Test Water Parameters

Parameter	Value
Chlorides (as CL)	500 mg/L
Hydrocarbons	No visible sheen
Electrical Conductivity	2 dS/cm (2000 µS/cm)
pH	Between 6.5 and 8.5
If methanol, ethylene glycol, or other additives have been used: EC(50) 15 (measured by Microtox® assay)	75% or greater

3.4 WATERSHED-SPECIFIC WATER QUALITY OBJECTIVES

There are provincial water quality objectives for the Bulkley River, Fraser River (Moose Lake to Hope section), Nechako River, Peace River mainstem, and Pine River (MECCS 2013). There are crossings within these watersheds, however there are no crossings of the mainstems of these rivers, and therefore they are not considered in this WQMP. The Lower Kitimat River and Arm has water quality objectives for the lower 10 km of the river, and a crossing is planned for this section of the river. Water quality objectives for the parameters included in the WQMP are identical to British Columbia Ambient Water Quality Guidelines for pH, and for turbidity and TSS with the following minor exception: the maximum increase above background remains as 5 NTU (turbidity) or 10 mg/L (TSS), even if background levels are below 8 NTU or 25 mg/L (British Columbia Ambient Water Quality Guidelines allow an 8 NTU or 25 mg/L increase when background is below these thresholds).

Broad water quality objectives have been identified in Land and Resource Management Plans (LRMPs) that are applicable to the Project. Implementation of these objectives is largely achieved through regulation and requirements from relevant regulatory authorities. These objectives generally do not provide measureable water quality guideline targets that can be incorporated into this WQMP. However, the WQMP is considered to be in alignment with these objectives.

4.0 METHODS

As described in EAC Condition #4 and BC OGC permit conditions, water quality monitoring will focus on turbidity, TSS and benthic sediments. Physiochemical parameters that are related to the introduction of sediments will be measured and monitored with portable instruments. These parameters include water temperature, turbidity, pH, EC and DO.

4.1 TURBIDITY AND TSS

Turbidity can be used as a proxy for TSS if the relationship between these parameters is established before construction (Marquis 2010; CCME 2002). Establishing the relationship requires the collection of grab samples for TSS analysis at various concentrations, and simultaneously recording the turbidity. The least squares method of linear regression analysis is used to define the relationship between turbidity and TSS, and the relationship can be used to predict the TSS given a turbidity reading. The relationship is site specific, and therefore a relationship cannot be easily developed for use across the entire Project area. Because this method requires laboratory analysis of several samples, it is impractical to develop a TSS/turbidity curve for all crossings. TSS/turbidity curves could be developed for large watercourse crossings (S2 and larger), and smaller watercourse crossings where non-standard crossing techniques are proposed (i.e., those that do not comply with existing provincial BMP's).

Water quality grab samples will be collected from crossing locations before the start of any construction activities. Additional samples will be collected if and when turbidity values exceed thresholds (refer to Table 3-1) from control sites upstream and from the affected waters where the turbidity exceedance occurred. Grab samples will be collected according to the guidelines in the *Ambient Freshwater and Effluent Sampling Manual* (Part E of WLAP 2003). These samples will be submitted for laboratory analysis to determine the actual TSS readings. If no turbidity exceedances occur, then the baseline sample collected prior to construction will be deemed unnecessary and will be discarded. Bottles that have been opened and used to store water intended for TSS analysis will not be used to send samples of any other parameter.

4.2 BENTHIC SEDIMENTS

Benthic sediment composition will be monitored using sediment traps in shallow watercourses, and by grab samples at deep watercourses as described in the following subsections.

4.2.1 Shallow Watercourses

Sediment traps could be used to monitor sediment deposition on any watercourse, of wadeable depth (typically <0.8 m deep), that provides actual or potential salmonid spawning sites within the ZOI. Gravel buckets are installed along transects, at equally spaced intervals across wetted width of channel, before construction activities both above and below crossing locations. The number and location of sampling transects downstream of crossing location will be dictated by the anticipated ZOI. Transects should be located in areas with similar water depths and velocities to reduce variability.

Sealed 4 L buckets filled with washed angular gravel are dug into the substrate, ensuring that the cover of the bucket is flush with the stream bed. Once any further upstream bucket placement is completed and sediments have settled out, lids are removed working from farthest upstream site first before construction activities begin.

Buckets should be retrieved immediately after construction to assess construction-related sediment deposition relative to upstream controls. Actively sampling (open) buckets should always be approached from downstream. Bucket lids are replaced and buckets are removed from the stream bed. Reference gravel is removed from site with a coarse screen and remaining sediment is sent to a laboratory to determine the quantity and particle size distribution of fine sediments. A detailed sampling protocol can be found in the *Guidelines for Monitoring Fine Sediment Deposition in Streams* (WLAP 2002).

4.2.2 Deep Watercourses

At crossings where it is not practical to install sediment traps due to high flows or deep water depth, sediment samples can be collected using a grab sampler (e.g. Ekman or Ponar Grab). Sample collection may occur from accessible infrastructure such as a bridge, through ice cover in the winter, or from a boat. Collection of grab samples will follow protocols in the *Lake and Stream Bottom Sediment Sampling Manual* (Resources Inventory Committee 1997). Multiple grab samples will be collected from a pre-determined number of sites above and below crossing locations, before and after construction activities. Sampling trips will start at the most downstream site and work upstream so as to not disturb sediments before the deployment of the sampling device.

Samples collected where the jaws of the grab sampler were not fully closed will be discarded and additional grabs will be completed until a sample has been successfully collected. Samples will be transferred from the grab sampler to an appropriately sized container and shipped to a laboratory for mechanical (particle size) analysis.

4.3 HYDROSTATIC TEST WATER

Water used for hydrostatic pressure testing of the pipeline may be discharged to land, following the requirements under section 7(2)(e) of the *Oil and Gas Waste Regulation*:

- Water must not be discharged directly to any natural surface waters or discharged in a location where it could reasonably enter surface waters.
- The effluent must be discharged on a stable slope and not cause erosion, at a rate that does not cause it to accumulate on the ground surface.
- Water quality parameters must not exceed the values presented in Table 3-3.

If hydrostatic test water is to be discharged to land, it will be sampled for pH and electrical conductivity using portable instruments, visually assessed for hydrocarbon sheen, and chlorides will be tested with a titration kit or specialized instrument. Where additives have been used, samples must be sent to a Canadian Association for Laboratory Accreditation (CALA) accredited laboratory for analysis of toxicity using a Microtox® Photobacteria bioassay, consistent with the *Oil and Gas Waste Regulation*. If the bioassay is necessary, it is recommended that the other parameters are laboratory-tested as well. No sampling of hydrostatic test water is necessary if it is taken off-site to an approved facility for disposal.

5.0 REPORTING

Reports will note any exceedances of parameters (including the time, duration, and severity of the exceedance), actions taken to bring water quality back to within threshold parameters, and comments about the effectiveness of the actions taken. If applicable, reports should include recommendations to prevent a similar exceedance from occurring at other crossing locations, and any improvements that could make the response more effective. It is preferable to display the results of the WQMP graphically upon the completion of works at each crossing location for inclusion in a monitoring summary report, but this may not be necessary at small stream crossings where construction is of short duration or where no significant deviations from baseline measurements occurred.

The results of the WQMP should be catalogued and presented in a consistent way between all crossings, such that the data may be used to conduct additional analyses post-construction (in particular, it should enable pooling water quality data for analysis at different watershed scales). Summaries of the WQMP will be included as a component of the larger environmental reports that will be made available to the BC OGC and other relevant regulatory agencies upon request.

Where the WQMP indicates that exceedances occurred and negative effects on fish and fish habitat may have occurred (e.g., prolonged elevated levels of TSS, fine sediment deposition on potential fish spawning habitat, changes to pH level outside of thresholds), incident reports will be prepared and the proposed remedial action will be discussed with the BC OGC. The BC OGC will be notified of any exceedance that persists for a period of 24 hours or more.

6.0 RESPONSE TO EXCEEDANCES

If water quality parameters reach or exceed threshold values, the Environmental Inspector and Qualified Professional will be notified. The Environmental Inspector or Qualified Professional will alert the Construction Manager and work with the construction management team to develop corrective actions. If the Environmental Inspector or Qualified Professional is not immediately available, the Construction Manager will be notified. Corrective actions will be site-specific, but could include:

- The installation of additional erosion and sediment control measures to limit sediment-laden runoff from entering watercourses.
- Temporarily stopping activities that are contributing to the water quality exceedance until parameters return to near-background levels.
- Consideration of re-scheduling works until conditions are more favourable (e.g., avoiding work during heavy precipitation or working in the early morning when the ground is frozen during freeze-thaw activity).

Corrective actions will be documented within 24 hours of implementation. An adaptive management approach will be used to implement corrective actions and monitor their effectiveness. If unsuccessful, alternative corrective actions will be developed and implemented in a timely manner (this may include ceasing on-site construction activities). Where an exceedance persists for more than 24 hours and corrective actions are unsuccessful in addressing the exceedance, construction activities will be suspended at the crossing location until effective solutions have been developed and implemented. In such situations, the Construction Manager has the decision-making authority after considering input and recommendations from the Environmental Inspector or the Qualified Professional.

7.0 ROLES AND RESPONSIBILITIES

The roles and responsibilities for implementing the Environmental Management Plan (EMP) are described in Section 4, Environmental Compliance, of the EMP. The Environmental Inspector is primarily responsible for implementing the WQMP, aided by the direction or advice of the Qualified Professional and other resource assistance, as required. The roles and responsibilities for implementing the WQMP are described below.

Construction Manager

- Accountable for compliance with Project requirements.
- Leads the construction management team and is responsible for construction-related decisions.

Environmental Inspector

- Responsible for implementing the EMP and the WQMP, as advised by the Qualified Professional.
- Advises the Construction Manager and the construction management team on construction-related decisions.
- Initiates the WQMP concurrently with the start of construction activities.
- Performs or directs the designated individuals carrying out water quality monitoring tasks, such as water sample location identification and marking (in consultation with the Qualified Professional), water sample collection and on-site water sample analysis.
- Ensures that baseline water quality has been collected before any disturbance.
- Ensure that water quality data is appropriately collected, which may include collecting grab samples and using field-portable meters.
- Ensures that all sampling equipment is properly calibrated and functioning correctly.
- Reports the results of water quality sampling in daily reports and in summary reports, as required.
- Ensures that grab samples are collected and shipped according to the laboratory's specifications.
- Ensures that measurements collected during water quality sampling are documented, including the severity, duration, and spatial and temporal extent of any exceedance.
- Identifies the need for assistance in collecting water quality data and coordinates the activities of the water quality monitoring team.

- Alerts the construction management team and the Qualified Professional of water quality parameter exceedance.
- Determines appropriate corrective actions in response to exceedance of water quality parameters, in consultation with the Qualified Professional and the construction management team.
- Ensures implementation of corrective actions.
- Identifies suitable areas for the discharge of hydrostatic test water consistent with the requirements of the Oil and Gas Waste Regulations, and ensures that water quality meets guidelines before discharge.

Qualified Professional

- Responsible for overseeing implementation of the WQMP.
- Advises the Environmental Inspector and water quality monitoring team on the implementation and execution of the WQMP.
- Advises the Environmental Inspector or construction management team in response to exceedance of water quality parameters.

Water Quality Monitoring Team

- Performs water quality monitoring tasks, such as water sample location identification and marking (in consultation with the Environmental Inspector and the Qualified Professional), water sample collection and on-site water sample analysis.
- Identifies water quality sampling locations, including upstream control sites that are not prone to project effects or anomalous results, sampling locations associated with construction activities and determining the downstream ZOI for locating downstream sampling locations (in consultation with the Environmental Inspector and the Qualified Professional).
- Flags or otherwise demarcates the Water Quality Implementation Zone.
- Identifies site-specific features sensitive to water quality changes, such as acidophilic plant communities, incubating fish eggs and water intakes.
- Assists the Environmental Inspector with the collection and analysis of water quality data, as directed by the Environmental Inspector.
- Collects water quality data, which may include collecting grab samples, using field-portable meters and, in the case of chloride testing, performing field titrations.
- Ensures that all sampling equipment is properly calibrated and functioning correctly.
- Develops TSS/Turbidity curves on a site-specific basis, where required, including collecting grab samples of varying TSS concentration for laboratory analysis.

- Ensures that grab samples are collected and shipped according to the laboratory's specifications.
- Alerts the Environmental Inspector, construction management team (if Environmental Inspector is not readily available) and the Qualified Professional of water quality parameter exceedance.
- Documents measurements collected during water quality sampling, and the severity, duration, and spatial and temporal extent of any exceedance.
- Reports the results of water quality sampling in daily reports and in summary reports, as required.

Site Inspector

- Oversees contractor watercourse and wetland crossing activities.
- Collects water quality data, which may include collecting grab samples and using field-portable meters.
- Ensures that all sampling equipment is properly calibrated and functioning correctly.
- Reports the results of water quality sampling in daily reports and in summary reports, as required.
- Alerts the Environmental Inspector, Qualified Professional or the construction management team (if Environmental Inspector is not readily available) of water quality parameter exceedance.
- Documents measurements collected during water quality sampling, and the severity, duration, and spatial and temporal extent of any exceedance.

The Environmental Inspector will facilitate the distribution of information and reports to contacts beyond the worksite as necessary, which may include identified Coastal GasLink personnel, primary contacts for contractors and relevant regulatory agencies. The Environmental Inspector is also responsible for assisting in developing corrective actions and ensuring that the recommendations are consistent with the plans, applicable legislation and TransCanada's policies and procedures, under the advice of the Qualified Professional.

The construction contractor and site inspector may be responsible for assisting with developing corrective actions for exceedances, as well as implementing them. The contractor is also responsible for keeping the construction management team, including the Environmental Inspector, up to date regarding construction schedules and activities so that they can ensure the WQMP is implemented.

8.0 SAFETY

The implementation of the WQMP should be overseen by a Qualified Professional (as defined in the EMP) with experience in measuring and interpreting water quality data. At minimum, personnel must be trained to use the portable equipment used to measure the water quality parameters, including calibrating them, and must be familiar with protocols for collection of grab samples per the *Ambient Freshwater and Effluent Sampling Manual* (Part E of WLAP 2003). Personnel should be trained in Workplace Hazardous Materials Information System (WHMIS) and transportation of dangerous goods (TDG) regulations. Appropriate labels and material safety data sheets (MSDS's) for required chemicals (e.g., calibration solutions, analyte preservatives, etc.) must be kept on-site in accordance with regulations.

Personnel must have the required safety training and certifications to work in and around water and construction sites. Such training may include Swiftwater Rescue, Ice Safety, Boat Safety, and any contractor-specific or Coastal GasLink-specific training. Where sampling of swift, turbulent, or deep waters is necessary, sampling should be conducted by a two-person team.

9.0 QUALITY CONTROL AND QUALITY ASSURANCE

To ensure that the results obtained during the WQMP can be used to accurately describe any potential effects related to the construction of the Project, data must be collected diligently and accurately to ensure confidence in the results. In addition to following the methods and protocols described in this WQMP, quality control measures will include:

- Persons responsible for implementing the WQMP should have experience in collecting and analyzing water quality data and be familiar with the operation and calibration of each piece of equipment required.
- The same measurement instrument should be used for all measurements at a given site where practical. A single portable instrument can be used to take readings at multiple sites.
- Instruments should be calibrated daily. The date, time and results of the calibrations should be recorded.
- Where practical, measurements should be collected by the same personnel at a construction site, or by as few persons as practical. Each new person collecting measurements increases the potential that slight differences in sampling procedure may influence the results.
- Sampling site locations must be carefully chosen by the Environmental Inspector (as advised by the Qualified Professional or water quality monitoring team) to be representative of the stream and habitats of concern. Replicate locations should have similar depth, velocity, and other hydrological characteristics. If practical, these characteristics should be recorded before sampling.
- Sampling should occur from the most-downstream location first, to avoid stirring up sediment or otherwise affecting downstream samples.
- Collection of grab samples must adhere to the procedures outlined in the *Ambient Freshwater and Effluent Sampling Manual* (WLAP 2003). The receiving laboratory should be contacted ahead of time to ensure that the quantity, storage, transport, and labelling of samples is consistent with their standards.
- Benthic sediment samples should be collected following the procedures in the WQMP and the *Guidelines for Monitoring Fine Sediment Deposition in Streams* (WLAP 2002)
- Grab samples should be sent to a CALA-accredited laboratory for analysis.
- Protocols should be developed for field staff to identify areas for improvement such that improvements can be implemented simultaneously and consistently Project-wide; keeping in mind that data must be collected in a manner so as to be comparable.
- Analysis of water quality data should be ongoing and not conducted at the termination of the program.

- Other anthropogenic activities or natural features that are observed, which may impact water quality, should be noted so that alternative explanations for anomalous readings can be investigated, if necessary.

Quality assurance measures will include:

- Periodic audits of the personnel implementing the WQMP should be conducted by persons with expertise in designing and implementing water quality monitoring programs.
- Data must be diligently recorded and stored. It is recommended that a database or spreadsheet be developed to store the data collected during the WQMP where data is frequently entered, rather than infrequently entered in bulk (ideally, data can be entered directly into the database in the field). The database or spreadsheet program should include data validation formulas to check for anomalous entries (e.g., values that are orders of magnitude different from adjacent data; unrealistic values) and highlight exceedances that may not have been immediately noted by the Environmental Inspector or Qualified Professional.
- Replicate samples will be included for 10% of all sampled submitted for laboratory analysis. It is recommended that instruments used to collect data in the field be tested against one another to determine any variances. This may be conducted when several instruments are located together for calibration.

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E.3 APPENDIX E.3 RED- AND BLUE-LISTED PLANTS AND ECOLOGICAL COMMUNITIES SURVEY AND MITIGATION PLAN

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 Definitions 2
1.2 Regulatory Context 2
1.2.1 Land and Resource Management Plans 2
1.2.2 *Oil and Gas Activities Act* 3
1.2.3 *Forest and Range Practices Act* 3
1.2.4 *Species at Risk Act* 3
1.2.5 Federal Policy on Wetland Conservation 3
1.3 Consultation 4
1.4 Potential Effects Mechanisms 4
1.5 Summary Of Occurrences 4

2.0 SITE HABITAT ASSESSMENT SURVEYS 5

2.1 Red- And Blue-Listed Plant Species 5
2.2 Red- And Blue-Listed Ecological Communities 10

3.0 MITIGATION 17

3.1 Red- And Blue-Listed Plant Species Mitigation 18
3.2 Red- And Blue-Listed Ecological Communities Mitigation 19

4.0 SCHEDULE 21

5.0 REPORTING 23

6.0 REFERENCES 25

LIST OF APPENDICES

Appendix A BC Conservation Data Centre Field Survey Form
Appendix B Site Visit Inspection Form (FS1333)

LIST OF TABLES

Table 2-1: Red- and Blue-Listed Plants in the Certified Pipeline Corridor..... 6
Table 2-2: Red- and Blue-listed Ecological Communities in the Certified Pipeline Corridor..... 11

1.0 INTRODUCTION

The purpose of the Red- and Blue-Listed Plants and Ecological Communities Survey and Mitigation Plan (the Plan) is to satisfy Condition #17 of the Coastal GasLink Environmental Assessment Certificate (EAC) issued by the British Columbia (BC) Environmental Assessment Office (BC EAO) (2014), which states:

> The Holder must, prior to Construction, for any red- and blue-listed plants and ecological communities identified by the BC Conservation Data Centre, conduct site habitat assessment surveys for all locations within the Certified Pipeline Corridor, and propose mitigation to address adverse effects to those plants and ecological communities. The Holder must consult with EC, FLNR and OGC in the development of surveys and mitigation.
>
> The Holder must include the survey results and mitigation in relevant permit applications where available at the time of application or as soon as practicable thereafter.

The objectives of this Plan are to:

- summarize existing information about known occurrences of red- and blue-listed plants and ecological communities within the Certified Pipeline Corridor (CPC) and within new access roads
- describe methods for conducting construction preparation surveys to confirm the spatial extent and attributes of each occurrence
- provide guidelines for determining suitable mitigation from among the options presented in Coastal GasLink's EAC Application and the Environmental Management Plan (EMP)
- describe the reporting structure

As part of Coastal GasLink's EAC Application, Appendix 2-A includes an EMP presenting mitigation that will be implemented during construction. Project-specific mitigation is included in the EMP, including mitigation to be implemented to reduce or avoid adverse effects on Ecological Communities of Concern. The Red- and Blue-Listed Plant and Ecological Communities Survey and Mitigation Plan supplements the information found in the EMP and provides more detail regarding construction preparation surveys and identification of suitable mitigation specific to each finding.

Construction preparation surveys will be conducted in the CPC. The CPC is defined as the certified pipeline corridor set out in Appendix A of the Certified Project Description for an EAC for the Project. This area includes the pipeline route and temporary workspaces, but does not include access roads.

1.1 DEFINITIONS

Plants and plant communities in British Columbia (BC) are designated as being of conservation concern by the BC Conservation Data Centre (BC CDC). The BC CDC ranks the abundance and status of all ecological communities and plant species from S1 (most rare) to S5 (least rare) and lists them on Red, Blue and Yellow lists (Red being the most rare and Yellow being not at risk). This Plan focuses on those listed as red or blue.

The federal *Species at Risk Act* (SARA) tracks plant species at risk, but does not track ecological communities at risk. The only SARA-listed plant species observed during field surveys for the Project was whitebark pine (*Pinus albicaulis*). Refer to Section 7 of the EMP for information regarding mitigation for potential adverse effects on whitebark pine for the Project.

1.2 REGULATORY CONTEXT

1.2.1 Land and Resource Management Plans

The CPC crosses six Land and Resource Management Plan (LRMP) areas, including the Dawson Creek, Prince George, Vanderhoof, Lakes District, Morice and Kalum LRMPs. The LRMPs are produced as guidance for land and resource activities in each region. Three of the six LRMPs contain guidance specific to red- or blue-listed plants or ecological communities, and one contains more general guidance pertaining to rare plant species and plant associations. This guidance is summarized below.

The Dawson Creek LRMP contains a strategy to conserve biodiversity through mapping rare plant communities, rare ecosystems and rare habitat types. This information is intended to be incorporated into the landscape unit and operational plans within the region (Government of BC 1999).

The Morice LRMP contains a goal to avoid development of infrastructure, including roads, in red- and blue-listed ecosystems. It recommends ecological enhancement where ecosystem losses occur as a result of development (Government of BC 2007).

The Kalum LRMP contains a goal to maintain naturally occurring wildlife and vegetation species while protecting red- and blue-listed species. It notes that implementation of conservation measures may occur to protect listed species and communities (Government of BC 2002).

The Vanderhoof LRMP includes management direction pertaining to biodiversity to maintain or enhance rare plant species and plant associations by identifying them and developing appropriate management plans (Government of British Columbia 1997).

1.2.2 *Oil and Gas Activities Act*

The *Oil and Gas Activities Act* (OGAA) came into force on October 4, 2010. The BC Oil and Gas Commission (BC OGC) is the regulatory agency that oversees oil and gas operations in BC and administers the OGAA Environmental Protection and Management Regulation (EPMR). The BC OGC has published a guide (BC OGC 2018) that outlines strategies for the permit holder to utilize to comply with the regulations. The guide provides direction in the following areas, which are pertinent to vegetation and wetlands:

- waterbody classification with associated setbacks
- riparian management areas with associated best management practices
- wetland crossings
- old growth management areas
- natural range barriers
- integrated management of invasive plants

1.2.3 *Forest and Range Practices Act*

The *Forest and Range Practices Act* (FRPA) (2010) and regulations govern the activities of forest and range licensees in BC. The statute sets the requirements for forest land users related to planning, road building activities, logging, reforestation and old growth management areas. As a result, the identification and mapping of wetlands, riparian areas, old forest, plant species and ecosystems at risk are required.

1.2.4 *Species at Risk Act*

The *Species at Risk Act* (SARA) is a federal law that seeks to prevent endangered or threatened species from becoming extinct and secures the necessary actions for their recovery, and manages species of special concern to help prevent them from becoming endangered or threatened. The status of species is assessed and designated by the Committee on the Status of Endangered Wildlife Species in Canada (COSEWIC), which then recommends a designation for legal protection through listing under SARA. Both plant and animal species can be listed under SARA.

1.2.5 Federal Policy on Wetland Conservation

The Federal Policy on Wetland Conservation is described in detail and applied to red- and blue-listed ecological communities (and other wetland categories) within the Wetlands Management Plan for the Project.

1.3 CONSULTATION

This Plan has been developed in consultation with the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD), Environment and Climate Change Canada (ECCC) and the BC OGC. Aboriginal groups potentially affected by the Project were invited to comment on the Plan, and comments were considered in the development of the Plan.

1.4 POTENTIAL EFFECTS MECHANISMS

Effects on red- and blue-listed plants and ecological communities may occur as a result of construction, operations, and decommissioning and abandonment phases of the Project. The potential effects mechanisms include the alteration or loss of occurrences of red- or blue-listed plant species or communities in land areas that will be directly affected by Project construction activities, including associated physical works and activities. Pipeline and facility construction, operations, and decommissioning and abandonment have the potential to directly and indirectly affect vegetation along the route through the following three primary mechanisms:

- clearing and maintenance of an earlier seral stage
- introduction or spread of invasive plants
- introduction or spread of forest pests in forested communities

1.5 SUMMARY OF OCCURRENCES

Coastal GasLink's EAC Application indicated that two red-listed and 15 blue-listed plant species had the potential to be disturbed because of construction activities. Since the EAC Application was submitted, the conservation status of one plant species (dwarf clubrush; *Trichophorum pumilum*) has changed from blue-listed to yellow-listed. Subsequent fieldwork on footprint refinements within the CPC indicates that an additional two blue-listed plant species are present within the CPC.

Ecological communities were derived from the Terrestrial Ecosystem Mapping (TEM) product developed for the EAC Application. According to the EAC Application, 10 occurrences of red-listed ecological communities (15.1 ha) and 222 occurrences of blue-listed ecological communities (448.3 ha) have the potential to be disturbed because of construction activities (CGL 2014).

Before conducting field surveys, this summary of occurrences will be revised using the most up-to-date construction footprint to determine the number, location and spatial extent of occurrences of red- and blue-listed communities.

2.0 SITE HABITAT ASSESSMENT SURVEYS

Site habitat assessment surveys will be completed for each occurrence of red- and blue listed plants and communities within the CPC.

2.1 RED- AND BLUE-LISTED PLANT SPECIES

The objectives of the site habitat assessment surveys for red- and blue-listed plant species are to:

- confirm and delineate each occurrence of a red- or blue-listed plant species
- provide details on the plant population attributes of each occurrence (e.g., density, cover, phenology)
- select and recommend site-specific mitigation for each occurrence

Table 2-1 shows the red- and blue-listed plant species found in plots within the CPC during previous field surveys. This table includes details about habitat preferences, growth forms, propagation methods, state and global ranks, number of occurrences and the kilometre post (KP) for each occurrence. These data will assist Qualified Professionals in determining which mitigation may be appropriate for a given plant species.

Table 2-1: Red- and Blue-Listed Plants in the Certified Pipeline Corridor

Scientific Name	Common Name	Growth Form	Life History [1]	Habitat Type [2]	Propagation [3]	Provincial Status [4]	State/Global Conservation Rank [4, 5]	Number and Location of Occurrences (KP)
Red-Listed Plant Species								
Carex adusta	lesser brown sedge	graminoid	Perennial	dry coniferous forest	seed	Red	S1/G5	1 (251)
Sphagnum annulatum	sphagnum	moss	Perennial	Wetlands	spores	Red	S1S2/GNR	1 (279)
Blue-Listed Plant Species								
Anemone canadensis	Canada anemone	forb	Perennial	swamp, riparian herbaceous, riparian shrub	rhizomes; seeds	Blue	S2S3/G5	1 (489)
Carex crawei	Crawe's sedge	graminoid	Perennial	fen, meadow	rhizomes; seeds	Blue	S2S3/G5	1 (139)
Carex tenera	tender sedge	graminoid	Perennial	meadow, mesic coniferous forest	seeds	Blue	S2S3/G5	1 (282)
Draba glabella	smooth draba	forb	Perennial	stream, river, cliff, rock, sparsely vegetated rock, talus	seeds	Blue	S2S3/G5T5	1 (139)
Epilobium hornemannii ssp. *behringianum*	Hornemann's willowherb	forb	Perennial	bog, fen, swamp, marsh, riparian shrub, alpine/subalpine meadows	stolons; seeds	Blue	S2S3/G5T4	1 (81)
Epilobium oregonense	Oregon willowherb	forb	Perennial	bog, fen, marsh, swamp, riparian forest, riparian shrub	stolons; seeds	Blue	S2S3/G5	1 (570)

Table 2-1: Red- and Blue-Listed Plants in the Certified Pipeline Corridor (cont'd)

Scientific Name	Common Name	Growth Form	Life History [1]	Habitat Type [2]	Propagation [3]	Provincial Status [4]	State/Global Conservation Rank [4, 5]	Number and Location of Occurrences (KP)
Festuca minutiflora	little fescue	graminoid	Perennial	cliff, rock, sparsely vegetated rock	seeds	Blue	S2S3/G5	1 (139)
Galium labradoricum	northern bog bedstraw	forb	Perennial	fen, marsh, meadow, moist coniferous forest, wet coniferous forest	rhizome; seeds	Blue	S3/G5	1 (140) 2 (182) 2 (185) 2 (200)
Juncus stygius	bog rush	graminoid	Perennial	pond margins, peat bogs (e-flora)	seeds	Blue	S2S3/G5T5	1 (644) 1 (645)
Malaxis paludosa	bog adder's-mouth orchid	forb	Perennial	bog, swamp, moist coniferous forest, wet coniferous forest	corms; seeds	Blue	S2S3/G4	1 (645)
Meesia longiseta		moss	Perennial		spores	Blue	S3/G5	1 (357)
Melica spectabilis	purple oniongrass	graminoid	Perennial	meadow, alpine/subalpine meadow	rhizomes; bulbs; seeds	Blue	S2S3/G5	1 (536)
Pedicularis parviflora ssp. *parviflora*	small-flowered lousewort	forb	annual/biennial	bog, fen, swamp, marsh	seeds	Blue	S3/G4T4	1 (623)
Pinus albicaulis	whitebark pine	coniferous tree	Perennial	cliff, rock, sparsely vegetated rock, mesic coniferous forest, dry coniferous forest	seeds	Blue	S2S3/G3G4	*not discussed in this Plan
Scorpidium cossonii	intermediate hook-moss	moss	Perennial		spores	Blue	S2S4/GU	1 (81)

Table 2-1: Red- and Blue-Listed Plants in the Certified Pipeline Corridor (cont'd)

Scientific Name	Common Name	Growth Form	Life History [1]	Habitat Type [2]	Propagation [3]	Provincial Status [4]	State/Global Conservation Rank [4, 5]	Number and Location of Occurrences (KP)
Tomentypnum falcifolium		moss	Perennial		spores	Blue	S3/G3G5	1 (448) 2 (453) 1 (494) 1 (495) 1 (544)

Notes:

[1] E-flora. Available at http://ibis.geog.ubc.ca/biodiversity/eflora/. Accessed December 2018.

[2] BC CDC Species and Ecosystems Explorer. Available at http://www.env.gov.bc.ca/atrisk/toolintro.html. Accessed December 2018.

[3] Douglas et al. 1998-2002. Illustrated Flora of BC, Volumes 1 – 8. B.C. Min. Environ., Lands and Parks, and B.C. Min. For., Victoria, B.C.

[4] Provincial Status (SRank):

Provincial Status applies to a species' or ecological community's conservation status in British Columbia. The status ranks have the following meaning:

1 = critically imperiled

2 = imperiled

3 = special concern, vulnerable to extirpation or extinction

4 = apparently secure

[5] State/Global Conservation Rank (GRank):

A Global Rank applies to a species/ecological community across its entire range. The ranks have the following meaning:

3 = vulnerable to extirpation or extinction

4 = apparently secure

5 = demonstrably widespread, abundant, and secure.

U = unrankable

Survey Methods

Before starting construction preparation surveys, a rare plant field guide containing each targeted species will be developed to aid in species identification and survey timing based on suitable habitat.

Surveys will be conducted by qualified vegetation ecologists or botanists (refer to Section 4.0 for the schedule).

Field crews will navigate to the known location of each occurrence of red- or blue-listed plant species using up to date base maps and GPS units. Field crews will search the extent of contiguous suitable habitats along the route for target plant species using a meandering transect method (Stantec 2010, ANPC 2012, Penny and Klinkenberg 2010). Information contained in the BC CDC Field Survey Form (Appendix A) will be collected for each occurrence, including:

- plant species
- date
- GPS location
- habitat description
- slope
- elevation
- aspect
- soil moisture regime
- soil nutrient regime
- phenological development phase
- spatial extent of the population and/or density
- rank considerations
- landscape context
- photos
- any notes or comments

To determine if more than one population is present, the area around the known occurrence will be surveyed. This area will depend on the extent of continuous suitable habitat and connectivity of dispersal vectors (e.g., riparian corridors). The extent of suitable habitat will be informed by desktop mapping and Coastal GasLink's Terrestrial Ecosystem Mapping (TEM) product.

A voucher specimen will be collected for each species in accordance with ANPC (2006) collection guidelines for verification.

A handheld GPS will be used to delineate the spatial extent of each occurrence within the CPC to aid in mitigation planning. An updated spatial data file (e.g., shapefile) will be produced for each occurrence.

Appropriate mitigation will be selected and recommended for each occurrence in the field based on:

- the location of the occurrence relative to the CPC boundaries
- its population attributes
- the conservation ranking

Mitigation identified in the EAC Application and EMP will be provided to each crew and any site-specific mitigation opportunities for each site will be noted in the field.

Section 5.0 in this Plan describes how these survey results will be documented and incorporated into permit applications and appropriate construction documents (i.e., environmental worksheets). In addition, Coastal GasLink is required to conduct construction preparation surveys for SARA-listed and provincially –listed vascular and non-vascular plants, and submit the survey results and site-specific mitigation plans to the BC OGC before clearing (BC OGC 2015).

2.2 RED- AND BLUE-LISTED ECOLOGICAL COMMUNITIES

The objectives of the site habitat assessment surveys for red- and blue-listed ecological communities are to:

- confirm the presence and classification of red- or blue-listed ecological communities within the CPC
- delineate and record the confirmed boundary of red- or blue-listed ecological communities
- select and recommend mitigation that is appropriate for each site and occurrence

Table 2-2 shows the ecological communities identified as present in the CPC and their current conservation status.

Table 2-2: Red- and Blue-listed Ecological Communities in the Certified Pipeline Corridor

Name	Category	Global/State Rank [1]	Provincial Listing
amabilis fir - Sitka spruce/devil's club	Upland forest	S3/GNR	Blue
amabilis fir - western redcedar/oak fern	Upland forest	S3/GNR	Blue
(balsam poplar, black cottonwood) - spruces/red-osier dogwood	Floodplain: mid-bench	GNR	Red
balsam poplar - white spruce/mountain alder - red-osier dogwood	Floodplain: mid-bench	S3/GNR	Blue
Bebb's willow/bluejoint reedgrass	Wetland; swamp	GNR	Blue
black cottonwood - subalpine fir/devil's club	Floodplain: mid-bench	S2S3/GNR	Blue
black spruce/common horsetail/peat moss	Wetland; bog	GNR	Blue
black spruce/creeping-snowberry/sphagnum	Wetland; bog	GNR	Blue
black spruce/lingonberry/peat moss	Wetland; bog	GNR	Blue
Douglas-fir - hybrid white spruce/knight's plume	Upland forest	S3/G3	Blue
Douglas-fir - hybrid white spruce/thimbleberry	Upland forest	S3/GNR	Blue
Douglas-fir - lodgepole pine/cladonia	Upland forest	S3/GNR	Blue
Douglas-fir/soopolallie/feathermoss	Upland forest	GNR	Blue
Drummond's willow/bluejoint reedgrass	Floodplain: low-bench	S2S3/G3	Blue
hybrid white spruce/horsetails/leafy moss	Wetland; swamp	GNR	Blue
hybrid white spruce/pink spirea - prickly rose	Upland forest	S3/GNR	Blue
hybrid white spruce/pink spirea/oak fern	Upland forest	S3/GNR	Blue
Labrador tea/western bog-laurel/peat moss	Wetland; bog	GNR	Blue
lodgepole pine - black spruce/feathermoss	Upland forest	S3/G3	Blue
lodgepole pine/common juniper/rough-leaved ricegrass	Upland forest	S3/GNR	Blue
lodgepole pine/huckleberry - velvet-leaved blueberry	Upland forest	S3/GNR	Blue
lodgepole pine/huckleberry/cladonia	Upland forest	GNR	Blue
MacCalla's willow/beaked sedge	Wetland; swamp	GNR	Blue
mountain alder/common horsetail	Floodplain: low-bench	S3/G3	Blue
mountain alder/red-osier dogwood/lady fern	Floodplain: low-bench	S3/G3G4	Blue
narrow-leaved cotton-grass/shore sedge	Wetland; fen	GNR	Blue
Sandberg's bluegrass - slender wheatgrass	Grassland	GNR	Red
Saskatoon/slender wheatgrass	Grassland	S2/G2	Red
scheuchzeria/peat moss	Wetland; bog	GNR	Blue

Name	Category	Global/State Rank [1]	Provincial Listing
scrub birch/water sedge	Wetland; fen	GNR	Blue

Table 2-2: Red- and Blue-listed Ecological Communities in the Certified Pipeline Corridor (cont'd)

Name	Category	Global/State Rank [1]	Provincial Listing
shore sedge - buckbean/hook-moss	Wetland; bog	GNR	Blue
Sitka sedge/peat moss	Wetland; fen	S2/G2	Red
Sitka spruce/salmonberry Very Wet Maritime	Floodplain	S2/G3	Red
Sitka spruce/salmonberry Wet Submaritime 2	Floodplain: high-bench	S3/G3	Blue
Sitka willow/Sitka sedge	Wetland; swamp	GNR	Blue
spruce - subalpine fir/skunk cabbage	Wetland; swamp	GNR	Blue
subalpine fir - mountain hemlock/cladonia	Upland forest	GNR	Blue
subalpine fir/alders/horsetails	Upland forest	GNR	Blue
sweet gale/Sitka sedge	Wetland; fen	S2/G3	Red
tamarack/water sedge/golden fuzzy fen moss	Wetland; fen	GNR	Blue
tufted clubrush/golden star-moss	Wetland; fen	GNR	Blue
western hemlock - amabilis fir/deer fern	Upland forest	GNR	Blue
western hemlock - western redcedar/salal Very Wet Maritime	Upland forest	GNR	Blue
western redcedar - Sitka spruce/skunk cabbage	Wetland; swamp	GNR	Blue
white spruce - lodgepole pine/soopolallie/showy aster	Upland forest	GNR	Blue
white spruce - subalpine fir/black huckleberry/red-stemmed feathermoss	Upland forest	GNR	Blue
white spruce/oak fern - sarsaparilla	Upland forest	GNR	Blue
white spruce/red swamp currant/horsetails	Upland forest	GNR	Blue
whitebark pine/cladonia lichens - curly heron's-bill	Upland forest	GNR	Blue

Notes:

[1] Global/State Conservation Rank

Global Rank (GRank) applies to a species/ecological community across its entire range. The ranks have the following meaning:

2 = imperiled

3 = vulnerable to extirpation or extinction

GNR = Global Rank not yet released

State (provincial) rank (SRank) applies to a species' or ecological community's conservation status in BC. The status ranks have the following meaning:

2 = imperiled

3 = special concern, vulnerable to extirpation or extinction

4 = apparently secure

Survey Methods

Each occurrence of a red- or blue-listed ecological community within the CPC will be visited during construction preparation surveys. Red- or blue-listed wetlands within the footprint will be surveyed in the course of the field program for the Wetlands Management Plan.

Before fieldwork, vegetation ecologists will review indicator species and community descriptions for the ecological communities present along the CPC and prepare a field guide and updated base maps with current community information from TEM to aid in community identification and delineation in the field.

Surveys will be conducted by qualified vegetation ecologists or botanists.

Field crews will navigate to the location of each occurrence of a red- or blue-listed community (according to the Project's TEM) using updated base maps and GPS units. Once field crews have arrived at the location of the red- or blue-listed community, a ground inspection site visit will be completed according to BC MFLNRORD and BC Ministry of Environment and Climate Change Strategy (MECCS) (2010), if there was not already one established during the baseline studies for the Project's Technical Data Report. Refer to Appendices A and B for an example of data forms that will be adapted to the Project's purposes. Information collected at each occurrence will include:

- date
- GPS location
- site series
- structural stage
- slope
- elevation
- aspect
- moisture regime
- spatial extent
- location
- rank considerations
- landscape context
- photos
- stand age

- successional status
- plant species assemblage
- any notes or comments

The purpose of the site identification and classification plot is to confirm the ecological community or site series and structural stage of each occurrence.

A handheld GPS will be used to delineate the spatial extent of each occurrence along the CPC to aid in mitigation planning. An updated spatial data file (i.e., shapefile) will be produced for each occurrence.

Appropriate mitigation will be selected and recommended for each occurrence in the field and office and will be based on the extent and location of the occurrence, relative to the CPC, and its conservation rank. Mitigation identified in the EAC Application and EMP will be provided to each crew and any site-specific mitigation opportunities for each site will be noted in the field.

Section 5.0 in this Plan describes how these survey results will be documented and incorporated into permit applications and guidance documents for construction (i.e., environmental worksheets).

3.0 MITIGATION

The list of mitigation presented in the EAC Application, EMP, and Ecological Community and Species of Concern Discovery Contingency Plan are presented below. General mitigation that is applicable to both listed plant species and listed communities is summarized in Section 3.0. Mitigation specific to listed plant species are presented in Section 3.1, while those specific to listed ecological communities are presented in Section 3.2.

Site-specific mitigation opportunities based on the options listed in the EAC Application and EMP will be identified and noted while crews are in the field.

Mitigation common to listed plant species, as well as listed communities, are presented below:

- Avoid the site by refining the construction footprint, relocating workspace, or adjusting the equipment layout or location of the footprint. If none of these options is practical, construction methods should be altered to provide the greatest protection to the community or population. Options for altering construction methods are described in Coastal GasLink's Ecological Community and Species of Concern Discovery Contingency Plan (Appendix C.9).
- Ensure a buffer of 20 m between timber decking sites and ecological communities of concern or plant populations of concern, wherever practical.
- For Species at Risk listed under Schedule I of SARA, confirm whether a permit pursuant to Section 73 of SARA is required before conducting any activity.
- Coastal GasLink will determine site-specific and appropriate mitigation according to the Ecological Communities and Species of Concern Discovery Contingency Plan (Appendix C.9 of the EMP), which lists the sensitivity criteria considered and presents a suite of mitigation options (i.e., staged mitigation).
- Mitigation of sensitive resources should be reviewed with contractor personnel before construction, to ensure personnel understand the procedures involved.
- Extend road or watercourse bores and provide alternative measures for equipment to travel past the area of concern (e.g., protection matting, or snow during the winter; drive around).
- Narrow the ROW or workspace, or re-orient the area of disturbance and clearly mark and protect the site using fencing and signage.
- Restrict access at the site and clearly mark with flagging and signage to inform all users of the restrictions.

- Propagate specific components of ecological communities or plants of concern on-site (e.g., harvest seed from the ROW or adjacent area and sow onto ROW following cleanup), or by other means (e.g., collect seed or cuttings, grow in greenhouse and plant onto ROW following cleanup).
- Temporarily cover the site (e.g., geotextile pads, flex net, snow, rig/swamp mats, plywood) to reduce physical disturbance of the vegetation and soil surface during construction.
- Create a raised ramp (e.g., bridge, rig) for traffic to travel on, to reduce compaction of the vegetation or soil surface.
- Carefully re-contour the site to match pre-disturbance site conditions so that drainage is not altered.
- Construct in winter when the ground is frozen and there is full snow cover, if practical.
- Reduce impact from compaction by allowing the ground surface to freeze before vehicle access.
- During construction, fence or flag community components or populations that are adjacent to the footprint to prevent incidental damage.
- Limit the size of the work area through alpine and subalpine areas by reducing workspace and extra workspace in these areas, where practical.
- Retain the natural range of alpine and subalpine plant community types and structure by implementing mitigation such as retaining diverse micro-habitats (i.e. “leave patches”).
- Manage the alpine and subalpine habitats as invasive plant-free zones with strict guidelines on vehicle and equipment access as outlined in the EMP.
- If previously unidentified ecological communities of concern or plant species of concern are found on the construction footprint before construction, implement the Ecological Community and Species of Concern Discovery Contingency Plan.
- At locations where the Ecological Community and Species of Concern Discovery Contingency Plan is implemented, conduct post-construction monitoring to assess mitigation success (e.g., for three years starting in the first full growing season following cleanup).
- Implement alternative mitigation deemed appropriate by the Environmental Inspector(s) in consultation with the vegetation resource specialist.

3.1 RED- AND BLUE-LISTED PLANT SPECIES MITIGATION

Species of concern will be flagged in the field before construction.

The list of mitigation specifically for red- or blue-listed plant species (excluding whitebark pine) includes:

- The Environmental Worksheets will include appropriate site-specific mitigation to be implemented at each site where a species of concern occurs within the CPC.
- Use natural recovery in areas of species of concern unless invasive species or noxious weeds are a concern, or unless otherwise specified by Coastal GasLink.
- Leave gaps in the spoil pile to avoid listed plants or listed plant populations.
- Salvage and transplant individual plants (or seed or other propagules), portions of sod containing the plants of risk and the surrounding vegetation, or the feature that houses the plants (e.g., log or rock) to an appropriate off ROW location.
- In alpine and subalpine areas, move select, floristically rich (i.e., moss, lichen and small herbs) rocks out of the work area and return to the work area following construction, where practical.
- The Environmental Worksheets will include appropriate site-specific mitigation to be implemented at each site where a listed plant species occurs within the Project footprint.

3.2 RED- AND BLUE-LISTED ECOLOGICAL COMMUNITIES MITIGATION

The list of mitigation specifically for red- and blue-listed ecological communities includes:

- The Environmental Worksheets will include appropriate site-specific mitigation to be implemented at each site where an ecological community of concern occurs within the Project footprint.
- Near ecological communities of concern and plant populations of concern, grading should be prohibited except where required to safely install pipe.
- Use natural recovery in areas of ecological communities of concern unless invasive species or noxious weeds are a concern, or unless otherwise specified by Coastal GasLink.
- Conduct careful duff layer and topsoil or surficial soil salvage at the site, storing topsoil or surficial soil separately and ensuring it is returned to the location from where it was stripped.
- Implement all applicable mitigation outlined in the EMP under the headings of: clearing, maintenance, invasive plants and forest pests.
- In the identified red-listed ecological community areas along the route, retain a forested or shrub buffer between the red-listed ecological community at risk and adjacent early seral plant communities by reducing the extra workspace, where

practical, when the Project footprint enters and exits the feature. The buffer will reduce the potential adverse effect of windthrow, help preserve the natural environmental conditions of the community, and limit the movement of invasive plant seed and plant parts along the open corridor. Flag the area for potential narrowing in the field before clearing.

- Before clearing, assess forests along the route for the presence of forest pests that could be moved or worsened by Project activities. In alpine and subalpine areas, white-pine blister rust and mountain pine beetle are of particular concern. The assessment will be conducted by a Qualified Professional. Implement the Forest Pest Management Plan, as needed.
- Seed grasslands immediately after final cleanup, or in areas of winter construction, after machine cleanup. Re-seed with an appropriate and Certified No. 1 native seed mix. Where the grassland occurs in an area with invasive plants or in areas where sediment and erosion control is a concern, seed an aggressive short-lived cover crop that will provide a quick cover.
- Reclaim micro-topography features to the extent practical, specific to grasslands immediately after construction.

4.0 SCHEDULE

The schedule of field surveys described in this Plan is subject to ecological and access constraints. Portions of the CPC are at high elevations and latitudes subject to late snowpack. Most listed plant species and communities can only be identified during the growing season, often with either flowers or fruits present. Portions of the CPC do not have road access.

Given the ecological and access constraints, surveys for red- and blue-listed plants should take place in mid to late June and August, depending on the species. Ecological community surveys should take place in mid to late July through the end of August.

5.0 REPORTING

A final report documenting the findings and mitigation for each occurrence of a red- or blue-listed plant or ecological community will be completed at the end of the field program.

The report will consist of a document outlining key findings during fieldwork accompanied by a map book detailing the location of each occurrence using the field-verified and collected spatial data. The report will include the population- or community-level details, location and mitigation for each occurrence.

Together with the mitigation, these results will inform Project Environmental Worksheets for construction and will support the information requirements for permit applications to regulatory agencies, such as the BC OGC or BC MFLNRORD.

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Appendices – Contents

Appendix A BC Conservation Data Centre Field Survey Form (Plants)
Appendix B Site Visit Inspection Form (FS1333)

Appendix A

BC Conservation Data Centre Field Survey Form (Plants)

1

1

B.C. Conservation Data Centre
FIELD SURVEY FORM (PLANTS)
Note: Complete only for Red- or Blue-Listed species. Please fill out as many fields as you can, but precise locality and population data are especially important pieces of information.

Project name: _____
New/Update
Update EO #___

Species: _____
Name of surveyor/Address/ phone #/Email:
_____
_____
Survey Date: (*Month/Day/year*): ____ ____ _____ **1st visit or repeat visit to this site:** _____
Revisit needed? ___yes ___no Why?: _____
Specimen Collection # & Herbarium: (*Please make a collection; in most cases, a collection is necessary to verify identification*) _____ **Was a photo taken?** _____

Location/Directions: (*Please be as precise as possible; include photocopies of 1:20,000 trim or 1:50,000 topographic maps (if possible, but any maps are welcome*)
_____
_____
_____
_____
_____
_____

Position:
UTM grid reference: (*from blue grid on 1:50,000 NTS map*): **MAP SHEET#** _____
(*North American Datum (NAD) designation is found below the contour interval scale on NTS map, 27 or 83; a GPS unit can be set to either NAD designation; We use NAD 83 data*).
ZONE ____ **EASTING** __ __ __ __ __ __ **NORTHING** __ __ __ __ __ __ __ **NAD** ____
LATITUDE ____ ____ ____ **LONGITUDE**____ ____ _____
Did you use a GPS unit to determine this value? Y / N Precision of point (+/- metres) ____

Habitat: *(Please include dominant plants and identify plant communities, a general description of area including land forms/use)*
_____
_____
_____
_____
_____
_____
_____

Topographic features: **Elevation:** _____ metres feet (*circle one*) **Slope:** _____ **Aspect:** _____
(Please note if elevation was derived from GPS unit)

Light:
___ open
___ partial
___ filtered
___ shade

Slope Position:
___ crest
___ upper slope
___ mid slope
___ lower slope
___ bottom

Moisture:
___ inundated
___ saturated (wet-mesic)
___ moist (mesic)
___ dry-mesic
___ dry (xeric)

Population Data:
Number of individuals: (estimate or exact count, if feasible; if plants are spreading vegetatively, indicate number of aerial stems): _____
Number of sub-populations & separation distances (if applicable):_____

Area and units covered by population: _____ ____ Length: _____ ____ Width:_____ ___
(Please also indicate direction for length & width and reference to any landscape features, shape of areas & how areas relates to any UTM's provided, ie the centrum): _____

_____

_____

Confidence Extent: ____Full extent of population known ___Full extent not known ___Uncertain full extent known

Phenology: (Indicate the number observed in each category (or check if numbers are unknown):
___ in leaf ___ in bud ___in flower ___immature fruit ___mature fruit ___seed dispersing
___dormant ___seedlings

Area for sketch:

_____

Rank Considerations:

Condition: *An integrated measure of the quality of biotic and abiotic factors, structures and processes* ***within the habitat the population occupies****, and how they reflect on how well this species is doing at this site.*

Please consider:

1) *reproduction and health*
2) *ecological processes*
3) *species composition and biological structure*
4) *habitat degradation, presence of exotic species and disturbance*
5) *physical/chemical factors that affect the element's ability to persist at the site.*

_____
_____
_____
_____
_____
_____

Landscape context: *Factors, structures and processes at work* ***over the landscape surrounding*** *the population.*

Please consider:

1) *the degree of fragmentation and connectivity of suitable habitat for this species*
2) *species composition*
3) *biological structure*
4) *ecological processes*
5) *abiotic factors*

_____
_____
_____
_____
_____

Notes: (*Land ownership, development plans, management activities, if any, or other comments*):

_____
_____A

private land owner **may request** that the exact location **not** be released to the public. The CDC will only release the location in response to an FOI request. Does the landowner want the exact location withheld from the public? YES ____ NO ___
Was the landowner contacted about the release of the exact location? YES ____ NO ___

LANDOWNER'S NAME:_____ PHONE: _____ E-MAIL:_____

Please return to: CDC, Ministry of Environment, Ecosystems Branch, P.O. Box 9358 Station Provincial Government, Victoria BC V8W 9M2 (fax: 250-387-2733) cdcdata@gov.bc.ca THANK YOU!

CONSERVATION EVALUATION FORM

PROJECT IDENTIFICATION	**DATE:**
PROJECT ID:	**PLOT #:**
POLY #:	**SEI CLASS:SUBCLASS:**
ECOLOGICAL COMMUNITY	

CONSERVATION INFORMATION

OWNER/JURISDICTION:	
DISTURBANCE:	**KNOWN THREATS:**
ADJACENT LAND USE:	**OTHER FACTORS:**
ALIEN SPP.:	

SUCCESS. STATUS:		**EST. SIZE COMM:**	**(ha)**

FRAGMENTATION OF ECOLOGICAL COMMUNITY

❒ < 5% FRAGMENTED ❒ 5 - 25 % FRAGMENTED ❒ > 25% FRAGMENTED

EVALUATION SUMMARY

LANDSCAPE CONTEXT:	EXCELLENT ❒ GOOD ❒ FAIR ❒ POOR ❒
ECOLOGICAL INTEGRITY:	EXCELLENT ❒ GOOD ❒ FAIR ❒ POOR ❒
CONDITION:	EXCELLENT ❒ GOOD ❒ FAIR ❒ POOR ❒

NOTES(AT-RISK SPECIES, WILDLIFE OBSV., ACCURACY INFO, ETC)

OBSERVER	NAME:
ADDRESS:	
EMAIL:	PHONE/FAX:

SUBMIT DATA

CDC, Ministry of Environment, Ecosystems Branch, P.O. Box 9358 Station Provincial Government, Victoria BC V8W 9M2 (fax: 250-387-2733) THANK YOU!

Include: FS882 or GIF or VENUS file ❒ air photos with polygon marked ❒ map product(s) ❒ ground photos ❒

COMPLETING THE CONSERVATION EVALUATION FORM

This form is intended for ecologists familiar with the RISC[1] Standards For Describing Terrestrial Ecosystems In The Field (DTEIF[2]). Submit a ground inspection (GIF) or ecosystem field (FS882) form with copies of air photos and/or maps. This information is necessary to identify and assess the conservation status of at-risk ecological communities.

PROJECT IDENTIFICATION:

Enter the date and GIF or FS882 plot number. If this form is completed as part of an inventory project provide the project name, related polygon number and sensitive ecosystem category, if applicable.

ECOLOLOGICAL COMMUNITY

Enter the name of the ecological community as on the CDC tracking list

CONSERVATION INFORMATION

OWNER/JURISDICTION: Enter the land owner or land management jusridiction (i.e. Provincial park, TFL #, regional government)

ADJACENT LAND USE: Provide details of land use adjacent to the community (i.e. housing, logging, recreation, etc)

DISTURBANCE: Enter DTEIF site disturbance codes and comments.

KNOWN THREATS: Record any known threats to the ecological community such as fire suppression, invasiveness of alien species, etc.

OTHER FACTORS: Record any other information known about the site

ALIEN SPP.: Note the type and abundance of alien species associated with the ecological community or in the vicinity.

SUCCESS. STATUS: Enter DTEIF succesional status codes

EST.SIZE COMM: Enter the estimated size of the community in hectares.

FRAGMENTATION: Indicate the degree of fragmentation within the community

EVALUATION SUMMARY:

Complete this section only if familiar with these terms as defined by CDC. Refer to CDC website - element occurrence ranking factors

NOTES

Record any other information or comments.

OBSERVER

Enter your name and contact information. A CDC ecologist may contact you if additional information or clarity is required.

1. Resource Information Standards Committee
2. Field Manual For Describing Terrestrial Ecosystems, Land Management Handbook 25. 1998. Prov. Of BC., Victoria, BC.

Appendix B

Site Visit Inspection Form (FS1333)

BRITISH COLUMBIA
The Best Place on Earth

Ministry of Forests and Range

SITE VISIT FORM

PROJECT ID

Plot No.	Plot Type ☐ Grnd ☐ Visual ☐ Note ☐ Other	Date YY - MM - DD
Surveyors	Map Polygon No.	Plot Photo

Plot Location

FS Region/ District	East	North	UTM Zone
NTS Map.	Lat.	Long.	Accur. (+/- m)

Plot Representing

BGC	SS	SMR	SNR	Map Label

Site Features	Elevation	Slope %	Aspect	Surface Shape ☐ ST ☐ CC ☐ CV

Crest ☐ Upper ☐ Mid ☐ Lower ☐ Toe ☐ Level ☐ Dep. ☐ Gully ☐ Flood Plain? ☐

Expose. Type ☐ insolation ☐ wind ☐ snow ☐ water spray ☐ misc.
☐ n/a ☐ frost ☐ cold air ☐ salt spray ☐ air toxicity _____

Site Disturb. ☐ fire ☐ site prep. ☐ terrain ☐ soil dist. _____
☐ n/a ☐ harvest ☐ planted ☐ biotic ☐ other _____

Stand Attributes	Stand Age _____ Est. ☐ Mea. ☐	Stand Ht. _____ Est. ☐ Mea. ☐	Canopy Composition

Struct. Stage 1a ☐ 1b ☐ 2a ☐ 2b ☐ 2c ☐ 2d ☐ 3a ☐ 3b ☐ 4 ☐ 5 ☐ 6 ☐ 7a ☐ 7b ☐

Success Status NV ☐ PS ☐ YS ☐ MS ☐ OS ☐ YC ☐ MC ☐ OC ☐ DC ☐

Terrain	Texture	Surficial Material	S. Expression	Geo. Process	Rock Types
1					1
2					2

Rooting Zone Drainage ☐ X ☐ R ☐ W ☐ M ☐ I ☐ P ☐ V

Humus/Organic Form ☐ Mor ☐ Moder ☐ Mull ☐ Fibric ☐ Mesic ☐ Humic

Humus Thickness _____ cm	Ah? ☐ Ae? ☐ _____ cm	Estimated Soil Depth _____ cm
R.Z. Soil Texture _____	R.Z.Coarse Fragrament % _____	Estimated Rooting Depth _____ cm
Gleying or Mottling ☐ n/a _____ cm	Seepage ☐ n/a _____ cm	Restrict.Layer ☐ n/a _____ cm

Restrict. Type ☐ **C**ement ☐ **P**an ☐ **K**ompact ☐ **L**ithic ☐ **W**ater ☐ **X** Chem. ☐ **Z** Permafrost

SPP. LIST COMP. ☐ PART. ☐

% COVER BY LAYER TREE (A) ☐ SHRUB (B) ☐ HERB (C) ☐ MOSS / LICHEN (D) ☐

Associated Full Cruise Card ? ☐ No ☐ Yes

COL.	TREES & SHRUBS	A1	A2	A3	A	B1	B2	B

COL.	HERB LAYER (C)	%

COL.	MOSS / LICHEN / SEEDLING (D)	%

Notes/Diagram

Tree Mensuration

SPP.	dbh	Ht.	BH Age	Path. Y/N	Notes