TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

1.0 INTRODUCTION

The Wetlands Management Plan (WMP or the Plan) has been developed to satisfy Condition #6 of Schedule B to the Environmental Assessment Certificate (EAC) for the Coastal GasLink Pipeline Project (Project), issued by the British Columbia (BC) Environmental Assessment Office (BC EAO) (2014). This Plan includes the following elements:

- A review of recent regulatory guidance on the Federal Policy on Wetland Conservation (the Policy) and application to this Project and Plan
- Summary of existing information about known occurrences of wetlands within the Project footprint, hereafter called the study area for the purposes of this Plan
- Methods for construction preparation surveys and post-construction monitoring
- Guidelines for applying the mitigation hierarchy and an adaptive management approach
- A proposed approach to determine the requirement for wetland compensation measures if necessary
- Potential options for wetland compensation measures

1.1 ENVIRONMENTAL ASSESSMENT

The main purpose of the WMP is to satisfy Condition #6 of Schedule B to the Coastal GasLink EAC which states:

> The Holder must develop and implement a Wetlands Management Plan in consultation with EC, FLNR and OGC. The Wetlands Management Plan must meet the objective of no net loss in wetland function, in a manner consistent with the *Federal Policy on Wetland Conservation*. In addition, the Plan must contain:
> - description of surveys for wetlands that must be undertaken prior to Construction to collect site-specific information on wetland location, type, area, and function;
> - five years of post-Construction wetland monitoring to confirm whether residual loss of wetland area and function occurs as a result of Project Construction and Operations; and
> - mitigation and compensation measures to address any loss of wetland area and function, and a description of the manner and extent to which the measures are consistent with *Federal Policy on Wetland Conservation*.
>
> If, following five years of post-Construction monitoring, loss of wetland area and function is confirmed, the Holder must compensate for the loss in accordance with the *Federal Policy on Wetland Conservation*.
>
> 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 Holder must also provide the Plan to EC, FLNR and OGC.

1.2 DEFINITIONS

Wetlands are defined as "land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation and various kinds of biological activity which are adapted to a wet environment" (NWWG 1988).

Wetland classes are defined by both the Canadian Wetland Classification System (NWWG 1997) and Wetlands of British Columbia: a Guide to Identification (MacKenzie and Moran 2004). Five wetland classes are recognized in Canada: bogs, fens, marshes, swamps and shallow open water wetlands.

Wetland functions are natural processes that are independent of the benefits that humans may garner from them (Hanson et al. 2008). Wetland functions included in this Plan include hydrological functions, biogeochemical functions and habitat functions (Smith et al 1995; Hanson et al 2008).

Hydrologic functions include:

- water flow moderation (storage, peak flow attenuation)
- groundwater recharge and baseflow augmentation
- dissipation of energy (reduced flow velocity)

Biogeochemical functions include:

- water quality improvement (nutrient transformation or removal)
- nutrient and organic export
- carbon sequestration and storage (which in turn contributes to maintenance of global carbon balance and climate)

Habitat functions include:

- provision of life-history requisites (e.g., for nesting, denning, rearing) for various wetland-dependent faunal groups (mammals, birds, herptiles and fish), particularly migratory birds, species at risk and fish
- suitable soils and hydrology to support wetland-associated vegetation resources, such as ecological communities and plant species of concern
- habitat for species of interest

During field studies, Indigenous participants identified key wetland functions and values of importance to them. These functions include:

- water filtration
- habitat for wildlife (specifically moose, fish, birds)
- habitat for rare plant species and medicinal plant species

1.3 REGULATORY CONTEXT

The Condition 6 of Schedule B to the EAC states that this Plan must be developed to meet the objective of no net loss in wetland function, in a manner consistent with the Federal Policy on Wetland Conservation, and if a loss of wetland area and function is confirmed through monitoring, Coastal GasLink must compensate for the loss in accordance with the Federal Policy on Wetland Conservation.

Federal Policy on Wetland Conservation

The Government of Canada adopted The Federal Policy on Wetland Conservation (the Policy) in 1991 as a commitment to promote wetland conservation within all federal decisions and responsibilities. Although it is not a regulatory document Cabinet-level direction has been to apply the Policy to all federal policies, plans, programs, projects and activities (Lynch-Stewart et al. 1996). The Canadian Wildlife Service (CWS) branch of Environment and Climate Change Canada (ECCC) is responsible for implementing the Policy whenever federal corporations, agents or authorities are making decisions that may affect wetlands, such as granting permits, constructing facilities, leasing Crown land or conducting land use planning.

The Policy was considered during preparation of the EAC Application. Wetlands were identified as a valued component within the EAC Application and wetland functions have been assessed in accordance with guidance contained in the Canadian Wildlife Service Wetlands Environmental Assessment Guideline (Milko 1998), The Federal Policy on Wetland Conservation Implementation Guide for Federal Land Managers (Lynch-Stewart et al. 1996) and Wetland Ecological Functions Assessment: An Overview of Approaches (Hanson et al. 2008).

The objective of the Policy is to "promote the conservation of Canada's wetlands to sustain their ecological and socio-economic functions, now and in the future" (Government of Canada 1991). The Policy includes seven goals in support of this objective. Among these goals, the most relevant to the Project is: "recognition of wetland functions in resource planning, management and economic decision-making with regard to all federal programs, policies and activities" (Government of Canada 1991).

The Policy also includes seven strategies to guide the use and management of wetlands. Strategy 2 (Managing Wetlands on Federal Lands and Waters and Other Federal Programs) commits all federal departments to the goal of no net loss of wetland functions when any of the following three conditions apply:

- Wetlands on federal lands and waters
- In areas affected by the implementation of federal programs where the continuing loss or degradation of wetlands has reached critical levels
- Where federal activities affect wetlands designated as ecologically or socio-economically important to a region (Government of Canada 1991)

ECCC provided Project-specific guidance on the application of the Policy in their comments to the BC Environmental Assessment Office (BC Environmental Assessment Office (EAO) 2014; ECCC 2014a and 2014b). According to this guidance, only the third condition listed above applies to this Project, since the Project does not intersect with wetlands on federal lands or waters, or wetlands within areas where the continuing loss or degradation of wetlands has reached critical levels (ECCC 2014a).

ECCC guidance indicates that wetlands designated as ecologically-important to a region include:

- areas of regional or continental significance to waterfowl within the Joint Venture planning boundaries of BC
- estuaries identified by the Pacific Estuary Conservation Program
- eelgrass (Zostera spp.) beds
- red- and blue-listed wetland communities (ECCC 2014a)

ECCC's guidance indicates that there are areas of regional or continental significance to waterfowl within the study area that include portions of the Canadian Intermountain and Prairie Habitat Joint Ventures service areas, critical waterfowl habitat areas and important bird areas (ECCC 2014b). Wetlands known to support important life history requisites for known occurrences of species listed on Schedule 1 of the Species at Risk Act (SARA) are also considered ecologically important to a region.

No estuaries or eelgrass beds were delineated in the study area.

Red- and blue-listed wetland communities are present in the study area and were identified by the Terrestrial Ecosystem Mapping (TEM) during baseline studies for the Project.

Several wetlands were noted as being important to Indigenous groups along the route. Table 1-1 shows wetlands where Indigenous groups had concerns or requests for specific mitigation based on the Project at the time of the EAC Application. Where these wetlands may be affected by the Project (i.e., the route has not changed to completely avoid them), these wetlands will be included in the list of survey locations.

The Gosnell Creek wetland complex was identified in the Morice Land and Resource Management Plan as an area of importance. If there is a net loss of wetland function in this wetland complex, a compensation plan may be required to offset the losses (Government of British Columbia 2007).

Table 1-1: Identified Issues and Concerns Related to Wetlands

Location – Rev 1	Description	Issue or Concern
Entire Project	Wetlands and wildlife habitat	Potential impacts to wetlands, wetland habitat and wetland vegetation
33.1 m south of KP 23.5_R3	Wetland	Protection of wetland with swamp mats
237.9 m east of KP 81.2	Wetland	Requested monitoring of sensitive wetland
226 m southeast of KP 200.4	Wetland	Avoid if fish are present
5.1 m northwest of KP 237.5	Wetland	Adjust construction timing to reduce the effects to a sensitive wetland area
551.4 m northeast of KP 429.2	Wetland; moose and fish habitat	Avoid wetland moose habitat because a decline in moose habitat in the region has increased the importance of this site; also noted to be a good location for fish because there is a continuous supply of water
201.9 m north of KP 438.9	Wetland	Avoid wetlands and instead use previously disturbed areas
2.2 m northeast of KP 507.1	Wetland	Groundwater flow connected to this wetland may be affected in the event of a spill
174.3 m southwest of KP 507.0	Wetland	Avoid wetland because this is an ideal location for rare plants, medicines and wildlife
385 m southwest of KP 607.1_R1	Wetland	Avoid wetland because this is an ideal location for rare plants, medicines and wildlife
19.9 m southeast of KP 515.9_R1	Wetland	Implement best construction practices to reduce length of time required to reclaim muskeg

Wetlands designated as ecologically-important to a region according to ECCC guidance and identified as being of interest to Indigenous groups will be referred to as, ‘ecologically and socio-economically important wetlands’ in this Plan (Table 1-1). The ‘no net loss’ goal of the Policy applies to these wetlands and, therefore, the functions of these wetlands will be surveyed and monitored in implementation of this Plan. Mitigation identified in the EAC Application and the EMP applies to all wetlands within the Project footprint.

Oil and Gas Activities Act

The *Oil and Gas Activities Act*, (OGAA), Environmental Protection and Management Regulation (EPMR) and BC Oil and Gas Commission (BC OGC) Environmental Protection and Management Guide (EPMG), together provide requirements and recommendations, which are pertinent to wetlands:

- waterbody (including wetlands) classification with associated riparian management areas
- Best Management Practices within riparian management areas
- guidance for wetland crossings, when this activity is unavoidable
- integrated management of invasive plants
- soil conservation practices to minimize erosion and maintain natural drainage patterns
- guidelines for restoration and reclamation/revegetation

In support of the Coastal GasLink permit application to the BC OGC, all wetlands within the Project footprint have been classified according to riparian classes in accordance with Section 23 of the EPMR, and their respective riparian management areas (RMA), riparian reserve zones (RRZ) and riparian management zones (RMZ) have been applied and incorporated into construction plans. Construction activities will not be located within wetlands classified as W2 without leave from the BC OGC in accordance with Section 5(iii) of the EPMR and permit conditions issued by the BC OGC (BC OGC 2018). Where construction activities within wetlands classified as W2 are unavoidable, a justification has been provided to the BC OGC to support the exception to Section 5(iii) in the context of Section 25 of OGAA pipeline permit applications (OGA 2015). Unavoidable crossings of all wetlands will be constructed in accordance with Sections 11, 12 and 13 of the EPMR and best practices described in the EPMG.

1.4 ENGAGEMENT

The WMP has been informed by engagement with ECCC, BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD), the BC OGC and affected Indigenous groups.

Coastal GasLink recognizes the importance of traditional knowledge and has included available TEK and TLU information into the planning and design phases of the Project.

1.5 POTENTIAL EFFECTS MECHANISMS

The Wetlands Management Plan is intended to promote natural recovery of wetlands by using recommended methods of soil handling, surface and ground water management, and salvage of roots, propagules and seeds in the native soils; however, the mechanisms that could potentially lead to a residual loss of wetland functions along the pipeline include:

- clearing and continued maintenance that removes or limits the tall shrub and treed component of wetlands, thereby reducing wetland functions associated with woodlands and forests (e.g., nesting or denning for migratory birds or species at risk, altering the structure and composition of provincially-listed forested ecological communities)
- unexpected disruption of surface and ground water flows resulting in wetlands either drying or excessively flooding, thereby changing species composition, hydrological functions, biogeochemical functions and associated habitat functions
- unintended effects because of improper soils handling (i.e., loss or burial of native soils containing organics, vegetation, seeds, microbial life and propagules)
- introduction or spread of invasive plants, thereby changing the wetland plant species composition and habitat function

Many of these potential effects can be mitigated by proper application of construction mitigation and subsequent adaptive management measures.

1.6 SUMMARY OF WETLANDS IN PROJECT FOOTPRINT

The EAC Application indicated that 228 wetlands (234 ha) had potential to be disturbed because of construction activities . This includes 110 ha of swamp, 68 ha of fen, 49 ha of bog, 6 ha of marsh and <1 ha of shallow open water.

2.0 MONITORING PLAN

To satisfy Condition 6 of Schedule B to the EAC, construction preparation surveys must be undertaken to establish the existing condition of ecologically and socio-economically important wetlands that may be affected by the Project. This approach is consistent with guidance provided by ECCC and the implementation of the Policy as discussed in Section 1.2.

2.1 OBJECTIVES

The overall management objective of this Plan is to achieve no net loss of wetland area or function within ecologically and socio-economically important wetlands as a result of this Project.

The monitoring objectives of this Plan include:

- establishing the construction preparation location, type, area and function of ecologically and socio-economically important wetlands in the study area
- detecting threats to wetland functions in years 1 through 4 (post-construction), which will guide remedial measures to mitigate the potential loss of functions by Year 5 of the post-construction monitoring period
- determining whether there has been a loss of wetland area in Year 5 of the post-construction monitoring period
- determining if there has been a net-loss of wetland functions in Year 5 of the post-construction monitoring period
- providing a means for determining if compensation (quantity and type) is required

2.2 METHODS

Construction preparation survey procedures will provide the spatial and attribute information to characterize the existing condition of wetlands within the study area with sufficient accuracy and precision to apply mitigation, develop environmental worksheets and compare with results from repeated methods in the 5-year post-construction monitoring period.

Comparison of results from the construction preparation and post-construction periods will be used as a basis for determining whether the overall management objective has been achieved and whether compensation measures are required to meet the stated management objective. Qualified vegetation/wetland ecologists and wildlife ecologists will complete monitoring site visits, as required.

2.2.1 Construction Preparation Surveys

Wetland Delineation and Classification

Before fieldwork, wetlands within the study area will be mapped at a relatively large scale (e.g., 1:5,000 scale) using a combination of aerial imagery interpretation and field surveying. This mapping procedure will provide an updated and detailed delineation of wetland area before construction, which will provide a basis for comparison with Year 5 post-construction, at which time comparable mapping methods would be repeated to assess whether a loss of wetland area occurred within the study area.

The minimum mapping unit for classifying an occurrence of a red- or blue-listed wetland would be approximately 1,000 m^2 (0.10 ha) at 1:5000, whereas the minimum mapping unit for wetland classification based on criteria in the BC OGC EPMR (size and biogeoclimatic subzone) is 2,500 m^2 ¬¬ (0.25 ha).

Observable inlets and outlets will be marked on these base maps and visited in the field, where practical, to aid in confirming wetland functions (see below).

Wetland complexes (i.e., areas composed of more than one wetland association within a single polygon) will be considered one wetland assessment unit for the purpose of function assessments and BC OGC EPMR classification. For singular discrete wetlands (not in a complex), functions assessments and BC OGC EPMR classification will be evaluated based on observations of the wetland's full extent, rather than a standard 400 m^2 ground inspection plot (see below).

Before fieldwork, vegetation ecologists will review indicator species and community descriptions for the wetlands present along the study area. This preparation will make delineation/confirmation of wetland boundaries in the field more efficient.

Field crews (vegetation/wetland ecologists and Indigenous participants) will complete fieldwork using base maps showing polygons of each wetland occurrence to aid the functional assessment and in determining mitigation.

A minimum of one standard 400 m^2 ground inspection plot per unique wetland association (i.e., ecological community), nested within a representative area of the discrete wetland, or larger wetland complex, will be completed to confirm the classification of each wetland association within the study area to confirm whether each occurrence is provincially red- or blue-listed.

A project-specific version of the site visit form (SIVI, FS1333) will be completed according to methods in BC MFLNRORD and BC MECCS (2010). Information collected at each occurrence will include:

- date
- GPS location
- slope
- elevation
- aspect
- landscape context
- spatial extent
- photos
- plant species assemblage
- structural stage
- stand age (where appropriate)
- successional status
- soil drainage
- hydric soil indicators
- depth of organic soil
- soil moisture regime/hydrodynamic index
- hydrogeomorphic unit
- site series
- conservation rank
- presence of forest pests
- any notes or comments

A handheld GPS will be used to delineate the portion of the wetland boundary located within the study area as a means of confirming or refining the large-scale wetland mapping described above, if necessary. An updated spatial data file will be produced for each ecologically or socio-economically important wetland for the purposes of mitigation planning, construction plans and re-assessment in Year 5 of the post-construction monitoring period.

Wetland Functions Assessment

Methods for completing wetland functions assessments have been synthesized and adapted to this region and Project context from several existing rapid assessment methods, including Null et al. (2000), Wisconsin Department of Natural Resources (2014), Hruby et al. 1999, Hanson et al. (2008) and Adamus (2011).

Ecologically and socio-economically important wetlands will be surveyed for habitat, biogeochemical and hydrological functions. They will be surveyed using a standardized datasheet created for the Project.

1) Habitat Function

Habitat functions will be assessed for three main groups of animals: amphibians (particularly western toad, SARA Schedule 1 special concern), mammals and birds (including the following guilds: wetland-associated species of waterfowl, shorebirds, and songbirds); plus fish, where relevant, and vegetation.

Before the start of fieldwork, wildlife data and habitat suitability models from the Project's baseline report will be reviewed to identify areas of known locations of animals of interest (e.g., wetland-dependent migratory birds, SARA listed species, and wildlife of interest to Indigenous groups). A gap analysis will be conducted and the survey plan will aim to fill these gaps within ecologically or socio-economically important wetlands.

Wildlife species can be elusive and require surveying at specific times of the year to confirm presence and particular activity (e.g., breeding, denning, nesting, foraging); therefore, attributes of wetlands that indicate the potential for a wetland to support habitat for particular faunal groups will be observed and noted (Table 2-1). This is a commonly-accepted approach with established rapid assessment methods developed in other jurisdictions (Null et al. (2000); Wisconsin Department of Natural Resources (2014); Adamus (2011); and Hruby et al. 1999). The applicability of the indicators in Table 2-1 to some particular species or guilds is subject to the limitations of range boundaries for certain species or guilds. For example, indicators of potential heron habitat are only relevant to the fannini subspecies of great blue heron in wetlands within the coastal range of this subspecies.

Field crews will augment rapid assessment methods with provincial survey methods (i.e., based on methods in RIC standards) for particular faunal groups, if necessary, where baseline data or data collected to satisfy other EAC conditions is not sufficient, and will also record any incidental observations of wildlife or wildlife signs while completing rapid assessment methods.

Table 2-1: Wetland Indicators: Habitat Functions

Habitat Function	Indicator	Rationale
Wildlife – Amphibians	Permanent or seasonal open water coinciding with the breeding period	Amphibians require water to lay eggs and during larval development
	Emergent vegetation	Required for attaching eggs
	Woody debris along the shoreline and forest cover within the wetland buffer	Provide foraging, cover and dispersal habitat
Wildlife – Birds	Exposed mudflats	Provide feeding areas for shorebirds
	Multiple strata of vegetation	Provides habitat for various birds, including songbirds, raptors and herons
	Percent open water, evidence of gradual drawdown, and presence of aquatic or emergent vegetation	Various waterfowl species require these attributes for feeding. Optimum timing, water depth and vegetation preference varies according to particular species
Wildlife – Mammals	Presence of shrubby or submerged aquatic vegetation	Important for moose and/or beaver forage
	Presence of deciduous trees such as birch, cottonwood and aspen	Provides food and dam/lodge building material for beaver/muskrat
Wildlife – All	Degree and proximity to disturbance	If there is evidence of high levels of disturbance, wildlife use of a wetland will be much lower or non-existent
Fisheries	Wetland has surface water connectivity with an adjacent fish-bearing stream or lake	Wetlands provide foraging and overwintering habitat for juvenile fish
Vegetation	Percent cover and structural stage of dominant plant species	Wetlands are characterized by a dominance of wetland indicator plant species; ecological communities at risk are defined by their species composition and structural stage
	Presence of federally- or provincially-listed, wetland-dependent plant species at risk	The presence of listed plant species indicate the wetland's ability to support and maintain habitat functions for species at risk
	Percent cover of non-native invasive plant species	The presence of non-native invasive plant species indicates the condition of the wetland plant community and could have implications for wildlife species habitat functions as well

Habitat function for amphibians will be surveyed by determining whether key features are present. These features include downed logs or woody debris near the edge of the wetland and emergent vegetation growing near the margin of the wetland (Null et al. 2000). Field crews will also take note of any egg masses, tadpoles, juveniles or adults of any amphibian species. The presence of juvenile toads in the areas around wetlands is an indicator of breeding in those wetlands (COSEWIC 2012).

Habitat function for mammals will focus on beaver, muskrat and moose. Features that indicate suitable habitat for these species include food sources (deciduous trees and shrubs such as red-osier dogwood) and a mix of vegetation and open water (Null et al. 2000). Signs of beaver and muskrat include dams, dens, lodges, trails/tracks and browsed-trees or shrubs. Signs of moose include browse and game trails.

Key habitat features for waterfowl species include 30-50% open water and 50-70% emergent vegetation in the main body of the wetland. Snags and trees provide roosting or nesting potential while mudflats provide foraging habitat for shorebirds (Null et al. 2000). Signs of bird habitat use include nests, tracks in mud and observations of birds.

Wildlife habitat suitability ratings will be conducted at each wetland for amphibians (particularly western toad, SARA Schedule 1 special concern), mammals, and birds (including the following guilds: wetland-associated species of waterfowl, shorebirds and songbirds). Wildlife habitat assessment ratings will range from 1-4, where 1 is the highest habitat suitability for that species and 4 is nil (i.e., the species would not be present in that habitat). These surveys will be based on RISC standards (RIC 1999a).

Along with these indicators of habitat function, pond-breeding amphibian surveys may be undertaken based on RISC standards, if the gap analysis shows that there are wetlands with potential to support western toad that have not been surveyed (RIC 1998). If amphibian surveys are required to support another management plan or EAC condition, data from those surveys will be used instead of completing duplicate surveys.

Data from aerial waterfowl surveys conducted for the baseline assessment will be used to determine the number of birds breeding in each wetland. These have been conducted according to RISC standards (RIC 1999b).

Red- and blue-listed plant species and ecological communities will be surveyed according to comparable methods described in the Project's Red- and Blue-Listed Plants and Ecological Communities Survey and Mitigation Plan.

2) Biogeochemical Functions

Biogeochemical functions will be assessed using rapid assessment methods.

Observable inlets and outlets will be marked on maps during the large-scale pre-field mapping. These locations will be observed in the field as indicators of biogeochemical functions.

Biogeochemical functions will be assessed in the field by looking at the hydrogeomorphic unit and hydrodynamic index of the wetland (i.e., the landform of the wetland plus the depth, duration, source and movement of water), and amount of vegetation present. For example, linked-palustrine-basins with herbaceous or woody vegetation and constricted outlets tend to reduce water velocity and thereby remove sediments as a result of settling and associated nutrients because of adsorption (Null et al. 2000; Hruby et al. 1999; Adamus 2011). Table 2-2: Wetland Indicators: Biogeochemical Functions provides indicators of the potential to provide biogeochemical functions that will be assessed in the field.

Table 2-2: Wetland Indicators: Biogeochemical Functions

Biogeochemical Function	Indicator	Rationale
Removal of sediment and excess nutrients	Hydrogeomorphic unit and hydrodynamic index	Hydrogeomorphic systems and subsystems are characterized by their landforms, which in-turn affect the depth, duration, source and movement of water transporting sediment
	Presence of an outlet and/or a constricted-outlet	Wetlands without outlets would have no opportunity to improve downstream water quality by retaining sediment, whereas wetlands with constricted outlets indicate attenuation of flows, which promotes settling of sediment
	Presence and density of emergent vegetation	Dense emergent vegetation in flow-through systems reduces water velocity and aids in removal of sediments
Nutrient cycling/transformation	Hydroperiod; evidence of seasonal drawdown	Wetlands with alternating periods of inundation and drying have the potential to create alternating oxic and anoxic soils that contribute to denitrification
	Total vegetation cover	Cover is used as a surrogate for measures of biomass and productivity. Soluble nutrients can be absorbed and converted into biomass.
Carbon sequestration	Presence of woody vegetation, *Sphagnum* mosses or sedge peat	Peatlands containing *Sphagnum* mosses or sedge peat and other wetlands containing high volumes of woody debris have high potential to sequester carbon

3) Hydrological Functions

Hydrological functions will be assessed using rapid assessment methods:

- water flow moderation (storage, peak flow attenuation)
- groundwater recharge and baseflow augmentation
- dissipation of energy (reduced flow velocity)

Before fieldwork, the location of each wetland within its respective watershed will be determined. The size and position of the wetland relative to the surrounding watershed influences the potential of the wetland to provide hydrological functions.

Hydrological functions will be assessed in the field by looking at the hydrogeomorphic unit and hydrodynamic index of the wetland, wetland hydrology indicators, and the landscape context and vegetation structure.

The potential for a wetland to affect flows is a function of the hydrogeomorphic unit and hydrodynamic index of the wetland and its landscape setting. To evaluate this function, field crews will determine the relative size and location of the wetland within its contributing watershed. During field surveys, crews will look for indicators of wetland hydrology, such as watermarks, drift lines, sediment deposits and drainage patterns, within wetlands. Table 2-3 provides indicators for hydrological functions that will be assessed in the field.

The potential for a wetland to provide erosion control and shoreline stabilization depends on whether the wetland experiences regular flooding or waves such as along shorelines of lakes or within active floodplain areas. Herbaceous vegetation can dampen the effect of waves and reduce erosion to shorelines or river banks (Null et al. 2000). As described in the context of biogeochemical functions, the hydrogeomorphic system/sub-system and vegetation within a wetland determine the potential of the wetland to reduce surface water velocity and associated erosive force.

Table 2-3: Wetland Indicators: Hydrological Functions

Hydrological Function	Indicator	Rationale
Water flow moderation	Hydrogeomorphic unit, location and size relative to the contributing watershed	Wetlands higher in the watershed that are large relative to their watershed area, have a higher potential to perform this function than those at the bottom of the watershed or that are small relative to the contributing watershed
	Presence and elevation of hydrology indicators such as: watermarks, drift lines, sediment deposits and drainage patterns	The elevation of these indicators relative to the observed water level and/or wetland outlet (if present) provide an indication of the minimal level of inundation during a flood event (the highest levels are typically much higher)

Table 2-3: Wetland Indicators: Hydrological Functions (cont'd)

Hydrological Function	Indicator	Rationale
Groundwater recharge or baseflow augmentation	Wetland class, association and location in the watershed	Wetlands higher in the watershed tend to contribute to recharge or discharge to ground or surface waters
	Located in active floodplain or riparian area	Wetlands located in this position are likely to contribute to baseflows
	Coarse textured soils sandy or gravely	Coarse-textured substrates are generally more permeable, although some wetlands with organic soils can certainly contribute to recharge
Dissipation of energy	Presence of herbaceous vegetation	Herbaceous vegetation slows down the speed of water flow, protecting shores or stream banks
	Hydrogeomorphic unit and landscape setting	Wetlands along shorelines or lakes have a higher potential to perform this function

Once field crews have delineated and classified the wetlands within the study area and conducted the functions assessment, appropriate mitigation will be selected and recommended for each occurrence in the field. Mitigation will be based on the extent and location of the wetland occurrence relative to the Project footprint, as well as its conservation rank or functions. Mitigation identified in the EAC Application and the EMP will be provided to each crew and any site-specific mitigation opportunities for each site will be noted in the field.

2.2.2 Post-Construction Surveys

During the 5-year post-construction monitoring period, three methods will be used to meet the monitoring objectives stated in Section 2.1: rapid reconnaissance surveys (years 1-4), wetland functions assessments (years 1, 3, 5) and delineation and classification of wetland area (Year 5).

Rapid Reconnaissance Surveys

It is anticipated that mitigation applied during design and construction will minimize or avoid a loss of wetland functions in most instances; however, early detection of potential threats to wetland functions would facilitate remedial actions that could address an inadvertent loss of functions at a more efficient cost than compensation in Year 5 of the post-construction monitoring period. Early detection would also minimize the temporal-loss of functions associated with alternative management strategies (i.e., compensation).

Rapid reconnaissance surveys will occur annually in years 1 through 4 during the post-construction period. These surveys will provide early warning detection of threats to wetland function within these four years. The objectives of this method are to observe and record obvious signs of issues, such as gross changes in surface

hydrology or vegetation cover triggering a need for further site-specific investigation to determine a cause of the change.

For those wetlands that were avoided, field crews will observe and note the condition of the appropriate riparian management area buffer indicated for each wetland classification from the BC OGC EMPR.

Field crews will record observed threats to wetland functions and provide adaptive management options, should they be required. Potential threats to wetlands along the Coastal GasLink route include those in Table 2-4.

Table 2-4: Wetland Indicators: Threats

Threat	Indicator	Rationale
Sources of disturbance and/or destruction	All-terrain vehicle (ATV) tracks through wetland; or new adjacent development or land use	Human recreation such as ATVing has the potential to remove vegetation and change hydrology (tracks); noise or changes to adjacent land cover could influence habitat functions
Hydrologic changes	Obvious flooding or dewatering (drying) of surface hydrology relative to construction preparation condition	Wetland hydrology may change because of improperly placed or sized culverts, alterations to surface grading or beaver dams
Absence or removal of vegetation	Persistent bare ground; observable increases in bare ground evidence of plant mortality	Indicators could be associated with changes in wetland hydrology, soils handling, erosion or lack of propagules
Increase of non-native vegetation	Presence of non-native invasive species	These species can out-compete native species and change community structure
Runoff and erosion	Evidence of deposition and/or erosion	Inadequate surface water management or ground cover could promote rapid loss of soil or excess soil deposition within wetlands in the study area

These surveys will be completed quickly and efficiently, simply recording the location, presence of indicators from Table 2-4 and comments regarding potential remedial measures that could be applied. The rapid reconnaissance surveys could be completed efficiently using either helicopter or ATV. These surveys could possibly be coupled with waterfowl surveys during odd years (1, 3 and 5) or integrated into the post-construction monitoring plan or routine monitoring of pipeline integrity.

Wetland Function Assessment

The wetland function assessment will occur in years 1, 3 and 5 post-construction for any given construction spread. Methods from Section 2.2.1 will be repeated within the same locations as in the construction preparation surveys. Repeating the same function assessment three times after construction will help determine if changes to functions have occurred and may illustrate trends.

Delineation of Wetland Area

The area of wetlands will be delineated and classification determined again in Year 5 of the post-construction period. This will allow for a comparison of the area before and after construction. If there is a net loss of wetland area, compensation will be required. The final wetland delineation will use comparable methods as described in Section 2.2.1.

2.3 SCHEDULE

Construction preparation surveys will occur under snow-free conditions before starting construction. Construction will be executed in eight different construction sections, with total construction times slightly different for each section. Post-construction surveys will occur the field season immediately after the end of construction, and will occur at approximately the same time each year and in accordance with provincial standards (where RISC standards are applied). Depending on the length of time for each construction section, there may be up to four years between the construction preparation survey and initiation of post-construction survey period.

2.3.1 Ecological Constraints

The route crosses a wide variety of environments, including subalpine and alpine areas, coastal forest, interior plateau forest and boreal forest. Surveys will be completed during the growing season. The elevational range of the Project necessitates that some areas need to be surveyed later in the year (July or August) rather than earlier (May or June). Pond-breeding amphibian surveys need to occur in early spring (May or June), and ideally should take place twice throughout the breeding season. Aerial surveys for migrating waterfowl should occur in late April and late May, to provide a comparison with baseline results.

2.3.2 Access Constraints

Portions of the Coastal GasLink route cross remote terrain that can be difficult to access. Two methods of site access are access via helicopter or access via vehicle.

3.0 MITIGATION

Mitigation was provided in Section 9.5 of the EAC Application and in the EMP. Mitigation from these two sources that pertain to wetlands is provided below:

- Where required by permit condition, reduce activity within the riparian management area (RMA) of a wetland unless leave is available and granted by BC OGC.
- Install berms, cross ditches or silt fences between wetlands (non-peat) and disturbed areas when deemed necessary by the Environmental Inspector(s).
- Reduce the area of disturbance when crossing a wetland, to the extent practical.
- Reduce grading within wetland boundaries to the extent practical, Do not use temporary workspace within the boundaries of wetlands, unless necessary for site-specific purposes. Temporary workspace within the boundary of a wetland must be approved by the Environmental Inspector(s).
- In the event that beaver dams or lodges are encountered in wetlands, implement appropriate mitigation as detailed in the EMP, as applicable.
- Where watercourse crossings occur in wetlands, implement appropriate mitigation for watercourse crossings as detailed in the EMP, as applicable.
- Install protection, such as corduroy or ramps, wherever there is regular traffic through permanently wet, low-lying areas of mineral and organic soil.
- Carefully salvage, separate and store organic and mineral trench subsoil.
- Where the open trench has the potential to dewater a wetland, undertake trenching in a manner that prevents the flow of water along the trench.
- Replace trench material as soon as practical and re-establish construction preparation contours within the wetland boundary to maintain cross ROW drainage.
- Replace trench spoil in the same manner as it was excavated, avoiding admixing of soils and uneven contour.
- Re-establish wetland water connectivity across the ROW by constructing channels through the trench crown unless a Qualified Professional has determined that it is not necessary or technically feasible.
- Where construction occurs during frozen conditions, delay final cleanup (i.e., soil feathering, grade touch-ups, final contouring and surface soil/surface material replacement) until the area is in a non-frozen condition consistent with the Wet Soils Contingency Plan.
- Special measures, such as limiting construction traffic or installing swamp mats or matting may be warranted in areas with poorly-drained and organic soils (refer to the Wet Soils Contingency Plan in Appendix C.4 of the EMP).

- Limit heavy equipment travel to machinery and vehicles equipped with low-ground-pressure tires or wide tracks to reduce compaction and rutting if wet or thawed soil conditions are present. Where rutting of wet or thawed soils occurs, the Wet Soils Contingency Plan (Appendix C.4 of the EMP) may be implemented.
- If wet or thawed soil conditions occur, implement the Wet Soils Contingency Plan (Appendix C.4 of the EMP).
- Stabilize exposed surface material and subsoil where the potential for erosion exists. Refer to the Soil Erosion Contingency Plan (Appendix C.7 of the EMP) for additional information.
- Where practical, protect wetlands, shallow water areas, emergent vegetation and surrounding terrestrial vegetation that support amphibian breeding habitat by implementing appropriate buffers (150 m buffer on undeveloped land, 100 m buffer on rural lands and 30 m buffer on urban lands) (BC MECCS 2012).
- All equipment must arrive at the Project site clean and free of soil or vegetative debris. Equipment will be inspected by the Environmental Inspector(s) or designate and, if deemed to be in appropriate condition, will be identified with a suitable marker or tag. Any equipment that arrives in a dirty condition will not be allowed on the ROW until it has been cleaned.
- If species of concern are identified during construction of the Project, implement the Wildlife Species of Concern Discovery Contingency Plan (Appendix C.10 of the EMP) or Ecological Community of Concern and Species of Concern Discovery Contingency Plan (Appendix C.9 of the EMP).
- In wetlands, implement appropriate mitigation for wildlife (e.g., mitigation for migratory birds, amphibian breeding habitat, ungulate winter range, raptor nests) as detailed in the EMP , as applicable.
- 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 that could contravene SARA.
- If wetlands contain fish habitat, implement appropriate mitigation to protect fish habitat as detailed in the EMP.
- Reduce the removal of vegetation in wetlands to the extent practical.
- Lay geotextile material, matting or log corduroy over sensitive soil and wetland areas to reduce soil and surface vegetation effects, or construct only in frozen conditions in these areas to reduce rutting.
- Conduct clearing near watercourses or wetlands as described in Sections 7.1 and 8.4 of the EMP.

- Reduce the width of grubbing near watercourses, wetlands and through other wet areas to facilitate the restoration of shrub communities and to avoid creating bog holes.
- Conduct ground level cutting/mowing/mulching of wetland vegetation instead of grubbing, to the extent practical. The method of removing wetland vegetation is subject to approval by Coastal GasLink.
- During clearing, fell trees toward the ROW, wherever practical. Recover trees that inadvertently fall into adjacent undisturbed vegetation.
- In accordance with permit conditions, fall any tree that is harvested within its tree length of a stream or wetland away from the stream or wetland, and immediately remove any debris or soil deposited below the high-water mark. When altering a tree that is located on the bank of a waterbody, where practical, ensure that the root structure and stability are maintained to help bind the soil and encourage rapid colonization of low-growing plant species.
- Use natural recovery in peatland and non-peatland wetlands.
- Natural recovery is the preferred method of reclamation (i.e., do not seed wetland areas unless invasive species or Noxious weeds are a concern), unless otherwise specified by Coastal GasLink.
- Install erosion and sediment control at all watercourses and waterbodies and on approach slopes to watercourses and waterbodies as directed by the Environmental Inspector(s).
- Use inert, non-toxic bentonitic clay-based materials as drilling mud for horizontal directional drill watercourse crossings. Implement the Directional Drilling Procedures and Instream Drilling Mud Release Contingency Plan.
- Implement all applicable mitigation outlined in the EMP under the headings of: clearing, maintenance, invasive plants and forest pests.
- In the few Red-listed ecological communities that comprise wetlands along the proposed 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 (ideally by 10-15 m), 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 to narrow in the field before clearing.
- If ecological communities and species of concern are identified before construction, implement the following:
    - If previously unidentified ecological communities of concern or plant species of concern are found on the ROW before construction, implement the

Ecological Community and Species of Concern Discovery Contingency Plan (Appendix C.9 of the EMP).

  - Clearly mark identified ecological communities of concern and plant species of concern before the start of ROW preparation and construction.
  - Ensure a buffer of 20 m between timber decking sites and ecological communities of concern or plant populations of concern.
  - Mitigation of sensitive resources should be reviewed with contractor personnel before construction, to ensure personnel understand the procedures involved.
- Obtain required approvals for changes in and about a stream under the *Water Sustainability Act* from the BC OGC. Where required, obtain authorization or notification under the *Fisheries Act*.
- Reduce the removal of vegetation in wetlands, to the extent practical, and do not mow/brush vegetation within wetland riparian (fringe) areas during operation.
- Avoid temporary workspace within the boundaries of wetlands, unless necessary for site-specific purposes. Temporary workspace within the boundary of a wetland will be determined with input from the Environmental Inspector(s) and the appropriate resource specialist or Qualified Professional.
- Prevent ground disturbance by using a protective layer, such as frost packing, snow, ice or matting, or biodegradable geotextile and clay ramps, between the wetland root bed and seed bed and construction equipment. When wetlands are being crossed, limit the use of extra temporary workspace, limit grubbing to the ditchline, build a log corduroy or implement other measures alongside the wetlands to reduce potential adverse effects from heavy machinery traffic, keep soil salvage of peat and mineral soils separate in shallow peat wetlands, and replace mineral soils before replacing peat and wetland substrate.
- Install structures, such as berms, cross ditches or silt fences, between wetlands (non-peat) and disturbed areas, when deemed necessary by the Environmental Inspector(s).
- Use natural recovery in wetland areas unless invasive species or noxious/restricted weeds are a concern, unless otherwise specified by the relevant regulatory authority.
- Reduce the width of grubbing near watercourses, wetlands and through other wet areas to facilitate the reclamation of shrub communities and to avoid creating bog holes.
- Reclaim borrow pits according to regulatory specifications, and in a manner that avoids creating unsuitable amphibian breeding habitat or traps. Recontour pit edges with gentle slopes to allow amphibian movement. Replace salvaged surface

soils and allow natural regeneration. Seed and plant with native wetland species, where warranted, to re-establish natural vegetation.

- Compensation would only be considered where additional mitigation to restore habitat or function was considered to not be an appropriate course of action and following consultation with relevant regulatory authorities.

A mitigation checklist will be provided to vegetation ecologists in the field so that site-specific mitigation can be identified for each ecologically or socio-economically important wetland.

3.1 OIL AND GAS COMMISSION SECTION 25 PERMIT CONDITIONS

The BC OGC Section 25 permits include the following conditions pertaining to wetlands within the Project (BC OGC 2015):

- The pipeline permits issued for each section of the Project by the BC OGC identify a number of specific conditions to mitigate effects on wetlands.
- Clearing and site preparation, inclusive of work space, must be confined to the construction corridor and must not, without leave of the Commission, occur within a riparian management area (RMA), except to facilitate a stream or wetland crossing, or where it does not involve new clearing, a wetland classified as W2, except those identified in the construction plans referenced in BC OGC Permissions, or to facilitate crossing of that wetland.
- Any trees harvested within the RMA of a stream or wetland must be felled away from the stream or wetland, and any trees, debris or soil deposited below the high-water mark must be removed immediately.
- Except with leave of the BC OGC, the permit holder must not undertake any construction activities within a wetland when an active waterfowl nest is present within 200 metres of the pipeline right-of-way and workspaces in that wetland (BC OGC 2015).
- Subject to sections 11 and 12 of the EPMR, crossings of non-fish bearing streams and wetlands must be constructed in accordance with the methods and any mitigations that specified in each construction section's supplemental stream crossings submission that has been submitted to the satisfaction of the Commission.
- Subject to sections 11 and 12 of the EPMR, crossings of fish bearing streams and wetlands must be constructed in accordance with the timing, methods and any mitigation that are specified in each construction section's supplemental stream crossings submission that has been submitted to the satisfaction of the BC OGC. Any contingency method specified in each construction section's supplemental stream crossings submission may only be utilized with leave of the Commission.

- Open cut crossings of wetlands must be planned and conducted in accordance with the relevant detail in each construction section's supplemental stream crossings submission that has been submitted to the satisfaction of the BC OGC, and the following requirements:
  - where the wetland substrate consists of rocks, pebbles or coarse gravel overlaying finer material, this material must be removed and stockpiled separately above the high-water mark of the stream for replacement during restoration
  - excavated materials must be contained using appropriate techniques, so that that sediment-laden water and spoil do not re-enter the wetland; and
  - any sediment-laden trench water must be pumped onto stable surfaces in a manner that does not cause erosion of soils or release of suspended sediments to watercourses
- Construction or maintenance activities within a fish bearing stream or wetland must occur:
  - during the applicable reduced risk work windows as specified in the Regional Timing Windows (BC MECCS 2015))
  - in accordance with alternative timing and associated mitigation recommended by a Qualified Professional and accepted by the Commission
  - in accordance with an authorization or letter of advice from Fisheries and Oceans Canada that is provided to the Commission
- Equipment to be used in or adjacent to a stream, lake or wetland must be clean or otherwise free of external grease, oil or other fluids, excessive muds, soil and vegetation, prior to entering the waterbody.
- Within the riparian management area, generators and other stationary equipment that require refuelling must be situated in secondary containment capable of containing the fuel capacity of the generators.
- 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:
  - be developed, implemented and supervised by a Qualified Professional
  - be consistent with the BC Ministry of Environment and Climate Change Strategy's (BC MECCS) approved water quality guidelines
  - 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

- where appropriate, require pre and post-construction monitoring proximal to the location of potential disturbance from construction activities
- require documentation of pre and post-construction monitoring completed under previous bullet

- The permit holder must implement the Water Quality Monitoring Programs developed as per conditions 37 and 38 and do each of the following:
  - provide records of documentation of all pre and post construction monitoring to the Commission;
  - 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
  - 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.
- As part of the post-construction monitoring program, the permit holder must, for all watercourse and wetland crossings:
  - inspect and provide a report to the Commission that includes assessment of:
    - RMA stability
    - erosion risk to the watercourse
    - vegetation re-establishment within the RMA, including species composition, percent establishment and presence of invasive plant species
    - identify where contingency measures may be required to address the three items above
  - Where contingency measures are required, the permit holder must develop and implement an appropriate plan to the satisfaction of the Commission.

Adherence to these conditions further supports satisfying the stated objective of Condition 6 of Schedule B to the EAC to achieve no net loss in wetland function in a manner consistent with the Federal Policy on Wetland Conservation.

4.0 ADAPTIVE MANAGEMENT

If reconnaissance level surveys indicate that mitigation implemented during construction is not achieving the predicted outcomes during years 1 through 5 post-construction, Coastal GasLink will implement adaptive management.

If excess flooding or dewatering of wetlands is noted, a site-specific investigation will occur and corrective measures, such as culvert placement (i.e., installation of different sizes/locations or removal) or re-grading, may occur. Other corrective actions include re planting if there was a loss of topsoil or if monitoring reveals that vegetation is not re-establishing (refer to the Reclamation Program, Section 11.4); and weed management if invasive species are found (refer to the Invasive Plant Management Plan, Section 5.0).

5.0 WETLAND COMPENSATION

There are three mitigation strategies for consideration to achieve no net loss of wetland function. Avoidance of impacts is preferred (typically achieved through project design), followed by minimizing impacts (typically achieved through project design and construction), and compensation for unavoidable impacts.

Avoidance

As construction planning and site-specific mitigation advances, avoidance of disturbance to wetlands will continue to be considered.

Minimization

Mitigation will be applied throughout the construction phase to minimize the potential loss of wetland functions. This mitigation is outlined in Section 3.0 and includes minimizing the additional temporary workspace through wetland areas.

Compensation

If there is a net loss of wetland function after avoidance and minimization, compensation may be required. The following sections provide detail about wetland compensation, if it is required.

5.1 WETLAND COMPENSATION QUANTITY

A net-loss in the area or functions of ecologically and socio-economically important wetlands will be evaluated using the following approaches:

The area of wetlands will be delineated during construction preparation to produce a spatial extent to compare to after Year 5 post-construction. Once the second delineation has occurred in Year 5 post-construction, the area before and post-construction will be compared to inform a determination of whether there has been a net-loss of area.

Determining whether a net-loss of functions has occurred will require a comparison of the area and condition of wetlands with the potential to provide each given function before construction and at Year 5 post-construction. If there is a net loss in the area of wetlands providing a specific function, compensation may be required. The end determination of net-loss and the appropriate compensation, including activities and monitoring, will be subject to review and consultation with ECCC, BC OGC and BC MFLNRORD.

Typically wetland compensation occurs at a 2:1 ratio (ECCC 2014a), where 2 ha of wetland compensation would be required for every 1 ha of wetland function lost. The compensation ratio is greater than 1:1 because compensation programs are not always effective, and to account for temporal loss of functions.

5.2 WETLAND COMPENSATION TYPE

If a loss of function is detected during the post-construction monitoring period, then Coastal GasLink will implement practical corrective measures to restore wetland functions on-site, within the construction footprint. Examples of activities that may be required include: re grading and re-contouring to re-create or restore wetland landforms, placing topsoil (if required to support plant), active revegetation (i.e., seeding or planting targeted species to enhance attributes) or enhancement of wildlife habitat features within wetlands (i.e., placement of snags and downed woody debris). Wetland reclamation methods are summarized in the Reclamation Program, Section 11.4 and will be detailed in the Reclamation Plans.

Wetland compensation may entail wetland restoration, enhancement or creation. Wetland restoration is the preferred method of compensating for loss of wetland functions. Restoration returns the composition, structure and function of a formerly degraded wetland to pre-disturbance conditions. Enhancement increases one or more functions of an existing wetland. Finally, creation involves converting uplands to create a wetland (Interagency Workgroup on Wetland Restoration 2003).

Wetlands compensation will likely entail actively restoring, enhancing or creating wetlands off-site to restore functions within the same watershed or otherwise biologically meaningful spatial boundary (e.g., within the range of the same population unit of target wildlife species).

5.3 WETLAND COMPENSATION DELIVERY OPTIONS

Coastal GasLink may carry out wetland compensation projects, or may use a number of other options. Compensation through a partnership with an environmental non-governmental organization (ENGO) involves the proponent providing funding to a wetland restoration agency (e.g., Ducks Unlimited) for delivering wetland compensation. The wetland restoration agency assumes responsibility for delivery and performance of the compensation measures. The final compensation plan will reviewed with relevant regulatory authorities.

6.0 REPORTING

6.1 ANNUAL REPORTS

Construction Preparation Report

The construction preparation report will include three parts. The first part of the report will be a document outlining the results of the wetland functions assessment. It will include the total number of wetlands sampled, document construction preparation conditions, and provide mitigation or any site-specific concerns before the start of construction.

The second component of the construction preparation report will consist of a geodatabase containing wetlands delineated through the large-scale mapping, plus any updates that may occur through field delineation, if necessary. This geodatabase will also include the BC OGC EPMR wetland classification and indication of riparian management areas.

Finally, a map book showing the locations of ecologically or socio-economically important wetlands and proposed mitigation will be produced.

Annual Monitoring Reports

A report will be submitted to the relevant regulatory authority and shared with Indigenous groups on request after each field season, providing results of each successive year of monitoring.

The annual report from years 1 through 4 of the post-construction monitoring period will include two parts. The first part will include a report on the results of the rapid reconnaissance survey. If any threats to wetland function were recorded during surveys, these will be reported on here, along with any potential adaptive management measures identified during fieldwork. The second part of the report will include an assessment of the functions of ecologically or socio-economically important wetlands that were surveyed in that year. The results of post-construction monitoring will be compared to construction preparation results. For those wetlands that were completely avoided during construction (but were still within the study area), a brief description of any changes will be included.

The annual report from years 2 and 4 post-construction will contain the results of the rapid reconnaissance surveys only. If any threats to wetland function were recorded during surveys, these will be reported here, along with any potential adaptive management measures identified during fieldwork.

6.2 FINAL REPORT

After completing the final year of post-construction monitoring, a report summarizing changes over the entire Project will be submitted to the relevant regulatory authority documenting net changes in area or functions of wetlands where changes occurred and which function the loss is related to proposed compensation for any loss of functions recommendations for compensation quantity, type and form of delivery

A second component of the final post-construction report is a geodatabase containing wetlands delineated through the large scale mapping and field delineation. Any differences in the area of wetlands will be shown.

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Appendices – Contents

Appendix A Example Data Sheets

CGL Wetlands Management Plan

Date:	Plot Number:
Surveyors:	
Nearest KP:	

HYDROLOGICAL FUNCTIONS	
Indicator Present (Y/N)	**Wetland Function Indicator**
WATER FLOW MODERATION	
	hydrogeomorphic unit (from Field Manual for Describing Terrestrial Ecosystems, 2010; Tables 2.11 and 2.12): System = _____ Element group = _____ …has potential to moderate flows?
	wetland occurs in the upper portion of its contributing watershed (contributing watershed boundary is relative to outlet of wetland)
	presence of dense woody or herbaceous emergent vegetation
	outlet is constricted
	located adjacent to watercourse (note if lacustrine or fluvial within hydrogeomorphic unit above)
	relatively large compared to the contributing watershed
	evidence of watermarks, drift lines, sediment deposits at elevations indicating fluctuating water levels
Relative potential to provide water flow moderation and dissipate energy - high, medium, low, nil– Provide rationale based on observed indicators.	
GROUNDWATER RECHARGE / BASEFLOW AUGMENTATION	
	located at headwaters or watershed divide
	located in an active floodplain or riparian area
	coarse textured soils are sandy or gravely
Relative potential to provide groundwater recharge or baseflow augmentation - high, medium, low, nil– Provide rationale based on observed indicators.	
Additional Comments:	

CGL Wetlands Management Plan

Date:	Plot Number:
Surveyors:	
Nearest KP:	

HABITAT FUNCTIONS	
WILDLIFE - AMPHIBIANS	
Indicator Present (Y/N)	**Wetland Function Indicator**
	permanent or seasonal open water coinciding with the breeding season (late spring – early summer)
	emergent vegetation or floating aquatic vegetation present within areas of permanent or seasonal standing water
	woody debris present within wetland and/or along the shoreline and forest cover within the wetland buffer
	other wetlands or streams within 1km of wetland
	40% or more of the surrounding land use (within 1km) are undeveloped (including urbanization, agriculture, but not forestry)
	wetland habitat is not fragmented
	more than one wetland class and/or association is present

Estimate percent of wetland functions assessment unit that is located within the Project footprint_____

Relative potential to support amphibian habitat (breeding, foraging and/or dispersal) - high, medium, low, nil–
Provide rationale based on observed indicators, direct observations, or signs, and note which life-history stages each rating applies to if more than one applies

WILDLIFE - BIRDS

Indicator Present (Y/N)	Wetland Function Indicator
	exposed sandbars or mudflats present
	multiple strata of vegetation are present
	large percent (>30-50%) shallow open water present and/or floating aquatic vegetation present within wetland
	emergent vegetation present
	forested or shrub-vegetation present within the wetland and/or buffer
	snags present in the wetland and/or buffer
	wetland supports invertebrates, amphibians, and/or fish as prey species
	wetland habitat is not fragmented
	more than one wetland class and/or association is present

Estimate percent of wetland functions assessment unit that is located within the Project footprint_____

Relative potential to support habitat for wetland-associated birds. - high, medium, low, nil–
Indicate type (waterfowl, shorebirds, or songbirds.) and which life requisites could potentially be supported (breeding, foraging and/or dispersal) along with rating below for each guild.

Provide rationale based on observed indicators, direct observations, or signs.

CGL Wetlands Management Plan

Date:	Plot Number:
Surveyors:	
Nearest KP:	

WILDLIFE – MAMMALS

Indicator Present (Y/N)	Wetland Function Indicator
	presence of shrubby or submerged aquatic vegetation
	presence of deciduous trees such as birch, cottonwood, or aspen
	presence of permanent open water
	presence of emergent vegetation
	high degree of interspersion among different zones of vegetation associated with different depths or duration of inundation (i.e., more highly-featured edge habitats from plan view)
	high degree of interspersion among areas of open water and vegetated portions of wetland (i.e., more highly-featured edge habitats from plan view)
	presence of banks suitable for denning
	evidence of wildlife use (dens or browse)
	wetland habitat is not fragmented
	more than one wetland class and/or association is present

Estimate percent of wetland functions assessment unit that is located within the Project footprint_____

Relative potential to support habitat for wetland-associated mammals. - high, medium, low, nil–
Indicate type (e.g, beaver/mink/otter, moose, and grizzly bear) and which life requisites could potentially be supported (breeding, foraging and/or dispersal).
Provide rationale based on observed indicators, direct observations, or signs.

FISHERIES

Indicator Present (Y/N)	Wetland Function Indicator
	surface water connectivity with an adjacent fish-bearing stream or lake present

Relative potential to support habitat for fish - high, medium, low, nil–
Provide rationale based on observed indicators, direct observations, or signs.

VEGETATION

Indicator Present (Y/N)	Wetland Function Indicator
	50% or more of existing vegetation cover are wetland indicator plant species
	wetland supports a provincially-listed plant species at risk
	plant species assemblage and structural stage that define a red- or blue-listed community occurrence are present
	non-native invasive plant species are absent

Estimate percent of wetland functions assessment unit that is located within the Project footprint_____

Overall relative potential to support wetland flora, and diversity of plant species (or communities) –high, med, low, nil-
Provide rationale

CGL Wetlands Management Plan

Date:	Plot Number:
Surveyors:	
Nearest KP:	

Species	Count	Life Stage	Detection Type
Additional Comments or Observations:			

CGL Wetlands Management Plan

Date:	Plot Number:
Surveyors:	
Nearest KP:	

BIOGEOCHEMICAL FUNCTIONS	
REMOVAL OF SEDIMENT AND EXCESS NUTRIENTS	
Indicator Present (Y/N)	**Wetland Function Indicator**
	hydrogeomorphic unit (from Field Manual for Describing Terrestrial Ecosystems, 2010; Tables 2.11 and 2.12): System = _____ Element group = _____ …has potential to remove sediments and/or nutrients
	hydrodynamic index (from MacKenzie and Moran, 2004) hydrodynamic index = _____ …has potential to remove sediments and/or nutrients
	wetland has a constricted outlet
	evidence of seasonal drawdown
	evidence of sediment deposits during fluctuating flows
	high percent cover of perennial herbaceous emergent wetland vegetation
	soils are organic, or high % clay content texture
Relative potential to remove sediment or excess nutrients - high, medium, low, nil– Provide rationale based on observed indicators.	
PRIMARY PRODUCTIVITY AND EXPORT OF ORGANIC MATTER	
Indicator Present (Y/N)	**Wetland Function Indicator**
	wetland has an outlet from which organic matter is flushed
	high percent cover of perennial herbaceous wetland vegetation
	deciduous trees or shrubs are dominant
	wetland is seasonally inundated
Relative potential to produce and export organic matter - high, medium, low, nil– Provide rationale based on observed indicators.	
CARBON SEQUESTRATION AND STORAGE	
Indicator Present (Y/N)	**Wetland Function Indicator**
	presence of coarse woody vegetation in a treed-swamp, or fen
	soils are sphagnum or sedge peat
Relative potential to sequester and store carbon - high, medium, low, nil– Provide rationale based on observed indicators.	
Additional Comments:	

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