Appendix I

Wetlands Baseline Study

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Wetland Baseline Study

Kami Iron Ore Mine and Rail Infrastructure Project, Labrador

Prepared for

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EXECUTIVE SUMMARY

In 2011, Stassinu Stantec Consulting Ltd. was contracted by Alderon Iron Ore Corp (Alderon) to prepare a Wetland Baseline Study for an area encompassing the Kamistiatusset (Kami) Iron Ore Mine and Rail Infrastructure (the "Project"), in western Labrador. The purpose of this Wetland Baseline Study is to provide environmental baseline information on wetlands to be used in the environmental assessment of the Project, as well as ongoing Project planning and design work. Specific objectives of the study were to identify the number and area of wetlands, classify the wetlands, and provide an assessment of key wetland functions and an estimate of the contributing area based on wetland classification.

The identification and assessment of wetlands was conducted in an area of approximately 161 km^2 for which detailed air photos were available (i.e., the Study Area). Within this area, the identification and assessment of wetlands was completed using a combination of field surveys and desktop analyses. Field surveys were used to identify and classify wetlands according to the Canadian Wetland Classification System, as well as assess their character and potential functions using the NovaWET approach. This information was supplemented with data collected as part of the Ecological Land Classification for the Project, and used in conjunction with high-resolution aerial photos and topographical data to delineate and classify the wetlands within the Study Area. A number of hydrogeomorphic descriptors were also identified for each wetland polygon to convey information on its landscape position, landform, and water flow path. A landscape-level approach, which relied heavily on wetland classification data and hydrogeomorphic descriptors, was applied to the wetlands of the Study Area to evaluate their potential to provide a suite of functions: surface water detention; sediment and other particulate retention; streamflow maintenance; groundwater recharge; carbon sequestration and storage; shoreline stabilization; habitat for wildlife (including fish, waterfowl and other waterbirds, and species of conservation concern); and socio-economic value. The evaluation also incorporated information collected during field surveys and obtained from other baseline reports being prepared for the Project. Correlations between wetland characteristics and potential functions are based on relationships identified in the literature and were tailored to better represent the unique conditions of the Study Area.

A total of 265 wetlands were identified within the Study Area, accounting for an area of 1,763 ha (11 percent of the Study Area). These belonged to two wetland classes (fen and marsh) and five primary wetland forms. Whereas fens occupy the large majority of wetland habitat, marshes are more limited in abundance, being restricted to the shorelines of certain waterbodies and watercourses. The wetlands likely contribute to all of the examined functions, except for groundwater recharge, but estimates of contributing area vary. An atlas of delineated wetlands polygons within the Study Area, in addition to data on their classification and other characteristics, are provided in the Appendices of this report.

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ABBREVIATIONS

ACCDC	Atlantic Canada Conservation Data Centre
Alderon	Alderon Iron Ore Corp
ATV	All-terrain vehicle
CEAA	*Canadian Environment Assessment Act*
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWCS	Canadian Wetland Classification System
EA	Environmental Assessment
EIS	Environmental Impact Statement
ELC	Ecological Land Classification
GIS	Geographic Information System
G-Rank	Global rarity ranking for a species
Kami	Kamistiatusset
DOECDOEC	Newfoundland and Labrador Department of Environment and Conservation
NLEPA	*Newfoundland and Labrador Environmental Protection Act*
NLESA	*Newfoundland and Labrador Endangered Species Act*
NovaWET	Nova Scotia Wetland Evaluation Technique
N-Rank	National rarity ranking for a species
NSE	Nova Scotia Environment
QMS	Quality Management System
S Rank	Sub-national (provincial) rarity ranking for a species
SARA	*Species at Risk Act*
Study Area	Wetland Study Area
TMF	Tailings management facility

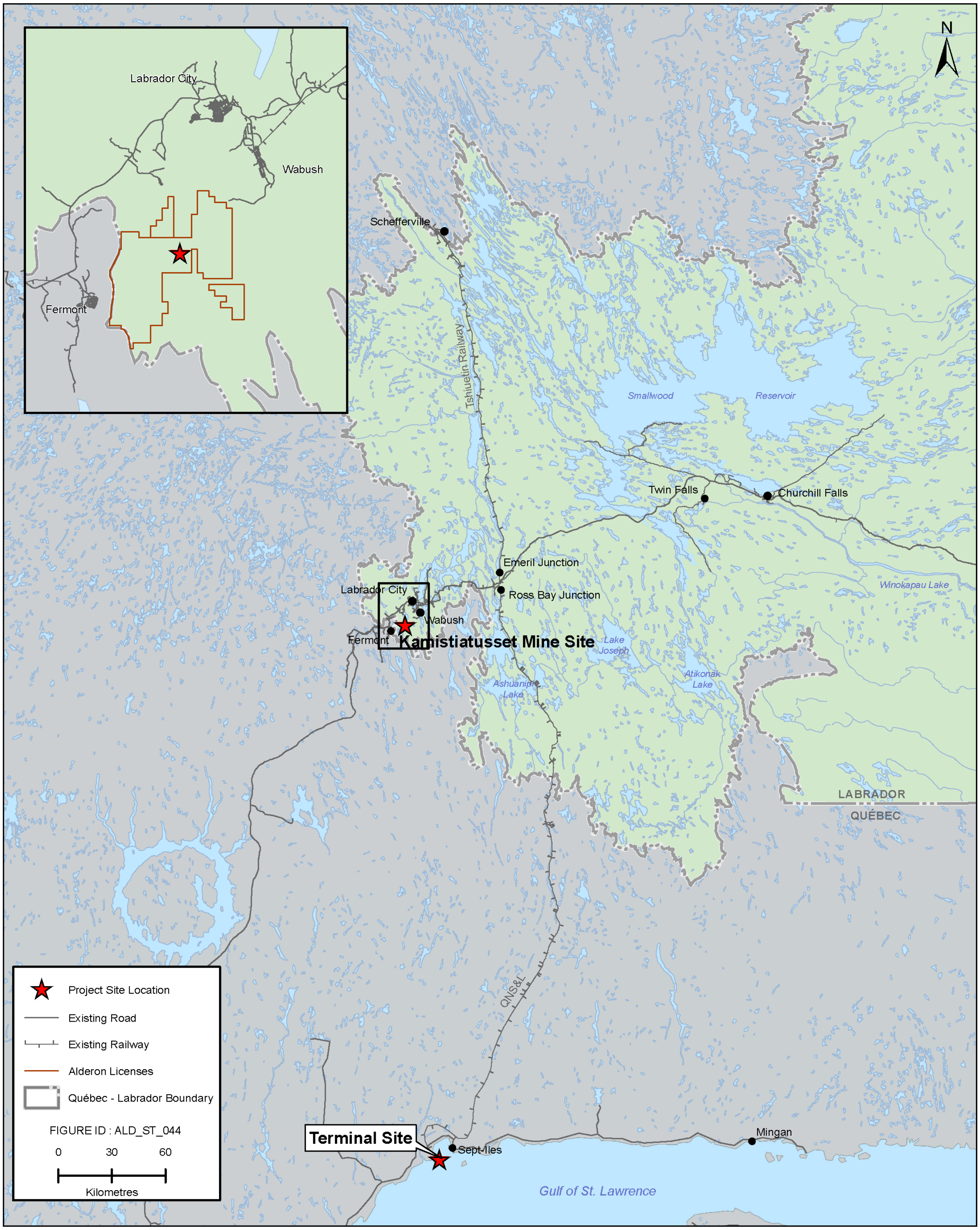
1.0 INTRODUCTION

Alderon Iron Ore Corp. (Alderon) is proposing to develop an iron ore mine in western Labrador, and build associated infrastructure at the Pointe-Noire Terminal in the Port of Sept-Îles, Québec. The mine Property is located south of the towns of Wabush and Labrador City in Newfoundland and Labrador and east of Fermont, Québec (Figure 1.1). The Kami Iron Ore Mine and Rail Infrastructure (the "Project") is located entirely within Labrador, and includes construction, operation, and rehabilitation and closure of an open pit, waste rock disposal areas, processing infrastructure, a tailings management facility (TMF), ancillary infrastructure to support the mine and process plant, and a rail transportation component. The mine will have a nominal capacity of 16 million metric tonnes of iron ore concentrate per year. Concentrate will be transported by existing rail to the Pointe-Noire Terminal at the Port of Sept-Îles, where Project-related components will be located on land within the jurisdiction of the Port Authority of Sept-Îles.

The Labrador Project components will require approvals from the Government of Newfoundland and Labrador and are subject to environmental assessment (EA) under the *Environmental Protection Act* (NLEPA) and associated *Environmental Assessment Regulations*. Federal approvals will also be required, which trigger the requirement for a federal EA under the *Canadian Environment Assessment Act* (CEAA), at the comprehensive study level. The Project was registered in accordance with the NLEPA and CEAA in October 2011.

The Newfoundland and Labrador Minister of Environment and Conservation has required an Environmental Impact Statement (EIS), for which Guidelines are being developed by the Ministerial appointed EA Committee. This Baseline Study Report is being submitted in support of the EIS and federal EA.

Figure 1.1 Project Location for the Kamistiatusset (Kami) Iron Ore Mine Project



1.1 Kami Iron Ore Project Overview

The Kami Iron Ore Project in Labrador includes construction, operation, and closure / decommissioning of the following primary components (Figure 1.2):

- Open pit (Rose Pit);
- Waste rock disposal areas (Rose North and Rose South);
- Processing infrastructure includes crushing, grinding, spiral concentration, magnetic separation, and tailings thickening areas;
- Tailings management facility (TMF);
- Effluent treatment facility;
- Ancillary infrastructure to support the mine and process plant (gate and guardhouse, reclaim water pumphouse, truck wash bay and shop, electrical substation, explosives magazine storage, administration / office buildings, maintenance offices, warehouse area and employee facilities, conveyors, load-out silo, stockpiles, sewage and water treatment units, mobile equipment, access road and transmission lines);
- A rail transportation component to connect the mine site to the Québec North Shore & Labrador (QNS&L) Railway; and
- Electrical transmission line from terminal to be located by Nalcor Energy to the mine site.

1.2 Wetland Functions, Values, and Regulatory Context

Wetlands may be 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" (Government of Canada 1991). Classes of wetlands that are generally recognized in Canada include bog, fen, marsh, swamp, and shallow water types (National Wetlands Working Group 1997). Wetlands are an integral component of the boreal ecosystems that stretch across northern Canada, and they are abundant throughout Labrador.

In many regions of North America and elsewhere, wetlands have been increasingly subject to conversion to anthropogenic land-use types for the purposes of agriculture, urbanization, industrial development, and recreation. They have traditionally been regarded as unexploited wastelands and obstacles to development and production, and their perceived value has depended primarily on their potential for conversion to more "productive" uses. However, knowledge of wetland functions and values has grown considerably in the last two decades. In addition to their obvious value to biological diversity, wetlands are now credited with supporting coastal and estuarine fishery resources, protecting shorelines from erosive wave action and watersheds from flood surges, and contributing to improved water quality in watersheds, among other functions. Further benefits of functional wetlands include their utility as outdoor educational exhibits and laboratories, value for recreational pursuits, and harvesting potential for items such as berries, wild game and peat (i.e., peat moss and fuel peat).

"Wetland function" may be defined as "the natural processes and derivation of benefits and values associated with wetland ecosystems, including economic production (e.g., peat, agricultural crops, wild rice, peatland forest production), fish and wildlife habitat, organic carbon storage, water supply and purification (groundwater recharge, flood control, maintenance of flow regimes, shoreline erosion buffering), and soil and water conservation, as well as tourism, heritage, recreational, educational, scientific, and aesthetic opportunities" (Government of Canada 1991). This definition does not distinguish between the processes that wetlands perform and the value that society places on them for ecological, economic, and social reasons. However, such a distinction is often made by others, with wetland "functions" being the natural physical, biological, and chemical processes that occur in the development and maintenance of wetlands, and "values" being the benefits that these functions provide to people or the environment (Smith et al. 1995; Novitzi et al. 1997; Kusler 2004).

As an indication of the increasing attention on wetlands, their conservation is federally promoted by the Federal Policy on Wetland Conservation (Government of Canada 1991). This policy has been adopted in order to help meet the objectives of wetland conservation as outlined in the North American Waterfowl Management Plan, Ramsar Convention on Wetlands (Ramsar Convention Secretariat 2006), and the Canadian Biodiversity Strategy (Government of Canada 1995). The objective of this policy is to "promote the conservation of Canada's wetlands to sustain their ecological and socio-economic function, now and in the future". This federal government framework strives for the goal of "no net loss" of wetland function, and recommends that the hierarchical sequence of mitigation alternatives (avoidance, minimization and, as a last resort, compensation) be followed. The Federal Wetland Conservation Policy (Government of Canada 1991) generally applies to projects on federal lands, projects receiving federal funding, or projects subject to federal approvals. Additionally, wetlands may be under federal protection under the *Species at Risk Act* (SARA) if they contain critical habitat for species at risk, the *Migratory Birds Convention Act* if they contain nests of migratory birds, and/or the *Fisheries Act*, if the wetland contributes to an existing or potential fish habitat. The minimum information pertaining to wetlands required to support a CEAA-level assessment and to maintain consistency with the Federal Wetland Conservation Policy include:

- Documentation of the number, area, and classification of wetlands affected by the Project.
- Identification of the functions provided by these wetlands.
- An assessment of the effects of the loss of these functions in the watershed.

Under the provincial Policy for Development in Wetlands, development activities in and affecting wetlands require a permit under Section 48 of the *Water Resources Act* (Government of Newfoundland and Labrador 2002). The objective of the policy is to permit developments in wetlands that do not adversely affect the water quantity, water quality, hydrologic characteristics or functions, and terrestrial and aquatic habitats of the wetlands (Government of Newfoundland and Labrador 2011a). Under this policy, all uses and developments of wetlands that result in potentially adverse changes to water quantity or water quality or hydrologic characteristics or functions of the wetlands, require the implementation of mitigative measures to be specified in the terms and conditions for the environmental approval. Additionally, the terms and conditions of the environmental approval will specify the restoration measures to be implemented upon cessation of activities or abandonment of facilities on wetland areas (Government of Newfoundland and Labrador 2011a).

There are also provincial initiatives which aim to prevent loss of key wetland functions. For example, Newfoundland and Labrador's wetland habitat stewardship program "works within the context of the Eastern Habitat Joint Venture to secure, enhance and restore important fresh and saltwater wetlands for waterfowl and other wildlife species" (Government of Newfoundland and Labrador 2011b). This program arranges wetland stewardship agreements with municipalities that manage important wildlife habitat within their planning boundaries and where development pressure is often greatest. Under such agreements, municipalities commit to procuring designated wetlands within their planning boundaries and to implementing "wise use" principles, as outlined within a conservation plan (Government of Newfoundland and Labrador 2011b).

1.3 Study Team

The Wetland Baseline Study was conducted by Stassinu Stantec Limited Partnership (Stassinu Stantec). The Study Team included a Study Manager, Study and Field Lead, Senior Reviewer, Scientific Authority, Field Observers, and Information Management / Geographic Information System (GIS) Specialists (Table 1.1). All team members have in-depth knowledge and experience in their fields of expertise and a broad general knowledge of the work conducted by other experts in related fields. Brief biographical statements, highlighting project roles and responsibilities and relevant education and employment experience, are provided below.

Table 1.1 Study Team – Wetland Baseline Study

Role	Personnel
Study Manager and Field Lead	Sean Bennett
Senior Review	E. Doyle Wells
Field Team	Sean Bennett (Wetland classification and functional assessment, soils and vegetation)
	Rich LaPaix (Wetland classification and functional assessment, vegetation)
Data Analysis and Report Preparation	Sean Bennett
	Rich LaPaix
Scientific Authority	Sue Meades (Vegetation)
Information Management/GIS	Chris Shupe (GIS Team Lead), Heather Ward

Sean Bennett, B.Sc., P.Biol., R.P.F., is a Professional Biologist (ASPB) and Professional Forester (CAPF) in Stantec's St. John's, Newfoundland and Labrador, office, with over 14 years of experience in the area of environmental consulting. A technical professional with focus on the assessment and characterization of terrestrial ecosystems, Mr. Bennett has provided expertise and coordinated projects throughout Canada in accordance with applicable federal and provincial (Yukon, North West Territories, Nunavut, British Columbia, Alberta, Saskatchewan, and Newfoundland and Labrador) regulatory requirements. Proficient in botanical / vegetation inventories (including taxonomy and species identification), soil classification (Canadian System of Soil Classification), and the application of Ecological Land Classification (ELC) principles, he has conducted baseline environmental studies evaluating a variety of habitats to identify site-specific constraints (i.e., environmentally sensitive areas) and developing appropriate mitigative measures for proposed developments. Mr. Bennett served in the capacity of Study Manager.

Doyle Wells, Ph.D., is an associate of Stantec. Dr. Wells has researched and published phytosociological, morphological and ecological classifications for wetlands in Atlantic Canada and was a member of the national group responsible for developing the Canadian Wetlands Classification System. He is a former Forest Science Director responsible for the development, operation and management of the Forest Science Program of the Canadian Forest Service (Atlantic) in Newfoundland and Labrador. His recent work includes the development and delivery of Identification and Interpretation of Wetlands in Newfoundland and Labrador to various groups and agencies. Mr. Wells was the lead author and responsible for the delineation and interpretation of the wetlands for baseline components of Nalcor Energy's Labrador-Island Transmission Link project. Mr. Wells served in the capacity of Senior Reviewer for the Project.

Rich LaPaix, M.Sc., is a terrestrial ecologist for Stantec's office in Dartmouth, Nova Scotia, and has over five years professional experience in the field. His terrestrial ecological skills are primarily used in the context of environmental assessment and monitoring initiatives which address the effects of various anthropogenic activities on rare or sensitive species and habitats. Mr. LaPaix is experienced in wetland delineation, classification, and functional assessment, having been involved in a number of wetland studies within Atlantic Canada. He is an experienced botanist and vegetation ecologist, and also has expertise as a wildlife ecologist, particularly in performing surveys of songbirds within Atlantic Canada. Mr. LaPaix was a field researcher for this Project and the principle author of the report.

Susan J. Meades, M.Sc., is a field botanist with over 30 years' experience. She has a B.A. (Botany) from Rutgers University-NCAS and a M.Sc. (Botany) from Eastern Illinois University. Ms. Meades was an adjunct professor in the Biology Department of Algoma University College (1997-2008), where she taught Principles of Ecology, Diversity of Vascular Plants, Plant Identification Techniques, and Plant Systematics. She lived in Newfoundland and Labrador for 17 years, where she worked as a consultant and was instrumental in the establishment of Burnt Cape Ecological Reserve. She is the senior author of the *Annotated Checklist of the Vascular Plants of Newfoundland and Labrador* and the author of *Natural Regions of Newfoundland and Labrador (1990)*. Ms. Meades is also the botanical illustrator for the *Forest Site Classification Manual: A Field Guide to the Damman Forest Types of Newfoundland and Indicator Plant Species in Canadian Forests*. She is currently working on an illustrated guide to the wildflowers of Newfoundland and Labrador, a checklist of the Vascular and Non-Vascular Plants of northern Ontario and is the project leader of the Northern Ontario Plant Database project. Ms. Meades was responsible for verifying the identity of potentially rare or unconfirmed vascular plant species collected from the Project Study Area.

Chris Shupe, Ad. Dip Remote Sensing, Dip. Cartography, is Team Leader for GIS / Information Management Services in Nova Scotia and Newfoundland and Labrador, is responsible for preparation, interpretation and analysis of satellite and air photo data to support various disciplines in preparing environmental assessments. He performs land cover identification and land use and disturbance classification to identify the effect of disturbances on the landscape. Before coming to Dartmouth in 2007, Mr. Shupe held the role of senior analyst within Calgary's Geomatics department. As such, he has played a key role in the project planning, spatial analysis and mapping on key projects including Imperial Oil's Mackenzie Gas pipeline, Cold Lake and Kearl Lake SAGD projects and Altalink’s Heartland 500 kV transmission line project. With over six years of experience working in Alberta's Oil and Gas sector and with his strong background and education in both cartography and remote sensing, Mr. Shupe has also played an important role in the development and implementation of the company’s cartographic / graphic and quality control standard.

Heather Ward, MSc. Candidate, is a GIS Analyst with the Information Management team in Stantec’s St. John’s office. Mrs. Ward started working with Stantec in January 2012. She is currently an MSc candidate completing her Master in Geography with a focus in Remote Sensing at Memorial University. Her experience comes from a combination of private sector work in Remote Sensing and GIS and work related to her Master of Science program. Mrs. Ward has considerable experience with remote sensing, geo-statistical and spatial analysis as well as cartography. Mrs. Ward also teaches GIS sciences at Memorial University.

2.0 RATIONALE AND OBJECTIVES

This Wetland Baseline Study forms one aspect of Alderon's environmental study program for the Project. The purpose of this and other such baseline studies has been to gather and present information on key aspects of the environment, and thus, provide an appropriate understanding of the existing environmental conditions within and near the Study Area for use in the EIS. The purpose of this study is to provide environmental baseline information on wetland habitat within the Study Area, to be used in the EA of the Project, as well as ongoing Project planning and design work. Specific objectives of the study are to:

- Identify the number and area of wetlands in the Study Area.
- Classify wetlands within the Study Area.
- Provide an assessment of key wetland functions and an estimate of the contributing area based on wetland classification.

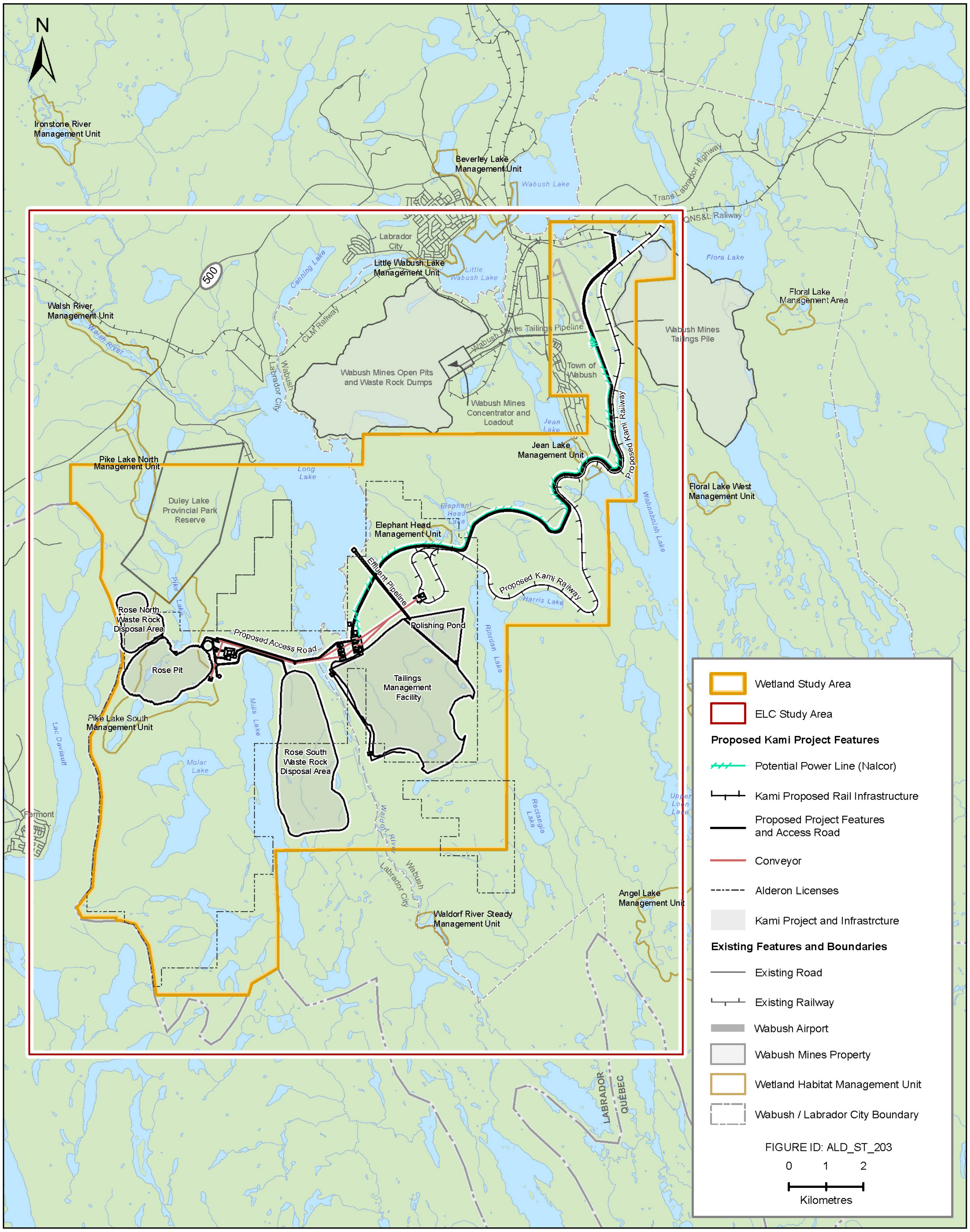
Information presented herein will provide valuable information about the distribution of wetlands and is intended to support and/or supplement that contained in associated baseline studies prepared for the Project. These baseline studies will be used collectively to guide ongoing Project planning, as well as to support and inform the EA for the Project.

3.0 STUDY AREA

The area covered by the Wetland Baseline Study (i.e., the Study Area) encompasses those portions of the ELC Study Area for which detailed air photos were available (Figure 3.1). The boundaries of the ELC Study Area have been used for other environmental studies relating to the Project and were selected to encompass all existing and proposed developments associated with the Kami mine site; habitat of key wildlife species that could potentially interact with the proposed Project; the routes and habitat for major migratory species within Habitat Stewardship Protection Areas within and in the vicinity of the Kami mine site; and key areas used for resource harvesting, recreation and cultural activities. The Study Area is largely constrained to where high resolution ortho-corrected air photos (captured during the summer of 2011) were available, because these were needed to generate information on the distribution and character of wetlands. However, information on the distribution and character of wetlands within the entire area associated with the Project is provided, where available.

The boundaries of the Study Area encompass an area of approximately 161 km^2 whereas the greater ELC Study Area comprises an area of 396 km^2. The Study Area generally corresponds to the Kami Project mineral licenses in Labrador, although a licensed portion in the southern end is not fully encompassed (Figure 3.1). However, the Study Area fully encompasses the proposed mine site, access road, and rail transportation components, and therefore the zone which is proposed to be directly affected by the construction and operation of the mine.

Figure 3.1 Kami Project ELC and Wetland Study Areas



4.0 METHODS

4.1 Pre-Survey Planning

Project planning and initial data compilation included defining the objectives and the purpose of the work; conducting a literature review of information pertaining to the distribution and character of wetlands within the region as well as functional assessment methodologies; and developing a field sampling plan and appropriate survey intensity. Additional details are provided in Sections 4.2 and 4.3.

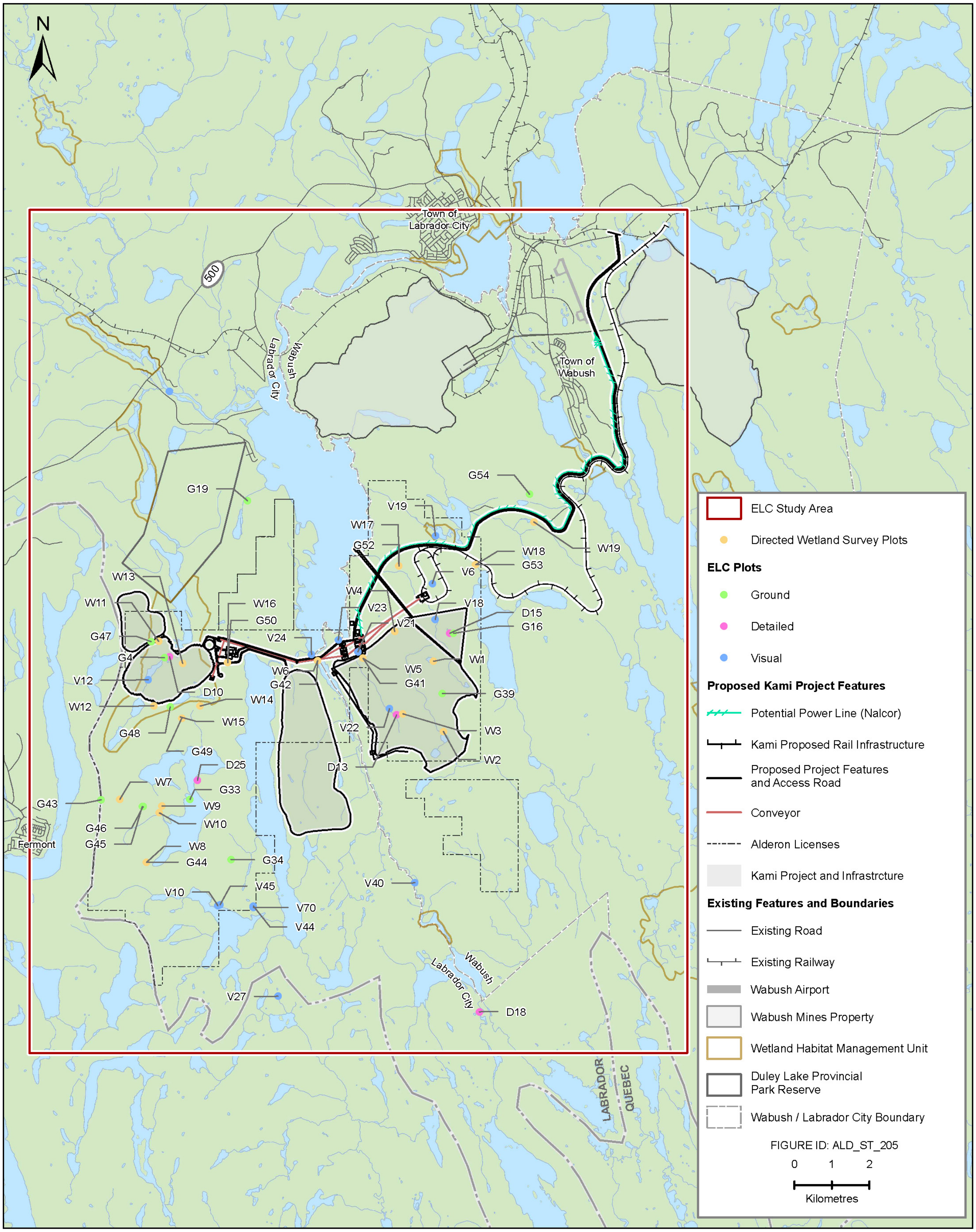
4.2 Wetland Identification and Classification

Wetlands within the Study Area were identified and classified using a combination of field surveys and desktop analyses. Field surveys were conducted September 28 to 30, 2011, and were used to identify and classify wetlands according to the Canadian Wetland Classification System (CWCS). Results from these surveys were used to help identify and classify additional wetland habitat within the Study Area with the use of air photos and topographical data. Additional wetland surveys conducted as part of the overall ELC field program during July 2011 were also used to confirm wetland habitat. A total of 19 sites were surveyed during directed wetland surveys, with another 49 ELC plots being used for the purposes of wetland identification (Figure 4.1). Further information used to confirm wetland habitats and associated functions was collected during surveys conducted July 22 to 27, 2012. The technical approach used for wetland identification during the surveys was based on principles prescribed in the US Army Corps of Engineers Wetlands Delineation Manual (1987) using vegetation, soil, and hydrology as wetland indicators.

The CWCS is a hierarchical system used to classify wetlands into classes, forms, and types (National Wetlands Working Group 1997). Each of the classes of wetlands (e.g., bogs, fens, marshes, shallow water wetlands, and swamps) is distinguished on the basis of a number of ecological features, including their origin (e.g., hydrological regime) and character (e.g., dominant vegetation type). They may be subdivided into wetland forms on the basis of surface morphology of the wetland (e.g., slope, raised, flat), position in the landscape (e.g., valley, delta, basin), surface features (e.g., ridges, nets, ribs, mounds), and proximity to waterbodies and tidal effects (e.g., lacustrine, riverine). This information, when combined with that for the general physiognomy of vegetation cover (e.g., forb, graminoid, shrub, treed), constitute the wetland types (e.g., shrub slope fen, graminoid lacustrine marsh). Due to the hierarchical nature of this system, wetlands may be classified at multiple levels and can be identified to be comprised of multiple wetland types, forms, or classes.

A desktop study was used to provide regional context for the occurrence and distribution of wetlands in the Study Area. Using spatially-referenced field data as a guide, high-resolution ortho-rectified aerial images and topographical mapping were used to delineate and classify wetlands within the Study Area. Contiguous wetland areas were mapped, with the percentage, class, form, and physiognomic vegetation being recorded for all dominant (i.e., >10 percent by area) wetland types. However, when a contiguous wetland was composed of multiple wetland classes (e.g., fen and marsh), separate polygons were typically used (a descriptor was added to these polygons to indicate that they were part of the same wetland).

Figure 4.1 ELC and Wetland Sample Plot Locations



4.3 Wetland Functional Assessment

A functional assessment of wetlands within the Study Area was conducted using a multi-tiered approach that incorporated both field surveys and data collected during desktop analyses. Data were used to evaluate the importance of wetlands for providing a suite of key hydrogeomorphological and wildlife-related functions, including surface water detention, sediment and other particulate retention, streamflow maintenance, groundwater recharge, carbon sequestration and storage, shoreline stabilization, habitat for wildlife (including fish, waterfowl and other waterbirds, and species of conservation concern), and socio-economic values. The functional categories provide a structure for assessing the value of wetlands and for identifying potential environmental effects and/or changes resulting from interactions with the proposed Project.

The identification and evaluation of these key functions follows guidelines outlined in *Correlating Enhanced National Wetlands Inventory Data with Wetland Functions or Watershed Assessments: A Rationale for Northeastern U.S.* (Tiner 2003), as summarized in NovaWET (Tiner 2009; NSE 2011), but has been modified and supplemented with additional information so as to better suit the conditions of the Study Area. Functions have been selected for evaluation based on information on the location and character of the Project area (e.g., coastal surge protection was not evaluated as a possible function to be performed by wetlands in the Study Area due to the distance to the ocean's coast). Information used for the functional assessment included: data on wetland types following the CWCS; information on wetland landscape position, landform, and water flow pathways (as defined by Tiner 2005a); the results of other field programs (ELC, fish and fish habitat, waterfowl, forest songbird, rare plant, and land and resource use) conducted for the Project, data from detailed functional assessments performed following the NovaWET field methodology (Tiner 2009; NSE 2011), and other information obtained on the character of wetlands.

4.3.1 Desktop Component

The desktop component of the functional assessment involved the collection of classification data for each of the delineated wetland polygons within the Study Area and a review of baseline studies being prepared for the Project. Classification data obtained for each of the wetland polygons include: information on wetland class, form, and type following guidelines of the CWCS (National Wetlands Working Group 1997); wetland landscape position, landform, and water flow pathways, as identified by Tiner (2005a); and data on the proximity of wetlands to watercourses and other waterbodies.

A number of hydrogeomorphic descriptors were assigned to each wetland polygon following guidelines outlined by Tiner (2005a) to describe their landscape position, landform, and water flow path. Landscape position represents the relationship between wetlands and waterbodies / watercourses, and includes the following designations: terrene; marine; estuarine; lentic; and lotic. Where relevant, additional descriptors were added to identify whether a wetland was associated with a stream or river, with streams identified as single mapped lines and rivers as features where both banks are delineated on topographical mapping sources. Landform is the physical form of a wetland or the predominant land mass upon which it occurs. A number of landform designations have been identified for use by model-based approaches to functional assessments, and are slope, fringe, basin, floodplain, interfluve, and flat. Water flow paths reflect hydrological relationships among wetlands as well as watercourses and/or waterbodies and are based on surface water connections, because these are more readily identified than groundwater linkages. Recognized water flow paths include isolated, inflow, outflow, throughflow, bidirectional-tidal, and bidirectional-nontidal. Wetlands were typically assigned their dominant condition, but multiple designations were maintained for those comprised of more than one major landscape position, landform, and/or water flow path. Furthermore, because polygons were typically used to distinguish different classes (e.g., fen and marsh) within the same contiguous wetland, separate designations for landscape position, landform, and/or water flow path were sometimes assigned to minor wetland components. Information on whether a wetland was located along a lake (i.e., including those which were not classified as having a lentic landscape position) or intersected with a perennial stream, as well as the order of the stream, was also collected. Designations for landscape position, landform, water flow path, as well as additional information on proximity to water features, was made with reference to both aerial images and topographical mapping (i.e., mapped watercourses).

Further information of relevance to the functional assessment was obtained through a review of environmental baseline reports being prepared for the Project. In particular, data on the occurrence of wildlife were obtained through a review of survey results associated with the ELC, fish and fish habitat, waterfowl, forest songbird, rare plant, and land and resource use studies conducted by Stassinu Stantec. Species of waterfowl and other waterbirds that are associated with wetlands of the Study Area were identified by performing a spatial overlay of delineated wetland boundaries and observations made during aerial waterfowl surveys conducted in spring, summer, and fall of 2011. Observations that were within 50 m of the wetland boundaries were considered, for the purposes of the functional assessment, to be associated with wetland habitats. Additional data on the occurrence of important waterfowl and other avifauna habitats within the Study Area were obtained through a review of the Habitat Conservation Plans for the Town of Labrador City (2010) and Wabush (2009).

4.3.2 Field Component

Directed field surveys, conducted during September 28 to 30, 2011, collected information on wetland functional characteristics within the Study Area. Functional assessments were based on the NovaWET field methodology (Tiner 2009; NSE 2011) and conducted by a team of terrestrial ecologists. NovaWET is a functional assessment method designed to assess the condition and functions of wetlands, the surrounding landscape, and the contributing watershed. The most recent field-based methods of this approach (NSE 2011) have been adapted from rapid assessment methods from various US states (including Wisconsin (Wisconsin Department of Natural Resources 2001), Minnesota (Minnesota Board of Water and Soil Resources 2009, 2010), North Carolina (North Carolina Wetland Functional Assessment Team 2008), Oregon (Adamus et al. 2009), California (Collins et al. 2008)), from method reviews (Fennessy et al. 2004; Hanson et al. 2008), and from earlier versions of NovaWET (Tiner 2009). The NovaWET field methodology survey was applied to a representative suite of 19 sites, wetland types that occurred within the Study Area. Results of these surveys were used to inform desktop assessments of potential wetland functions within the Study Area.

4.3.3 Interpretation and Calculation of Wetland Functions

The interpretation of wetland functions is primarily based on guidelines outlined in *Correlating Enhanced National Wetlands Inventory Data with Wetland Functions or Watershed Assessments: A Rationale for Northeastern U.S.* (Tiner 2003), as summarized in NovaWET (Tiner 2009; NSE 2011), but has been tailored to reflect the unique wetland characteristics of the Study Area. The aforementioned guidance documents provide a methodology for predicting a number of key wetland functions based primarily on a wetland's classification, landscape position, landform, and water flow path. Correlations between wetland characteristics and potential wetland functions are based on expert opinion and supported by the published literature (Tiner 2005b) and have been developed and used by the US Fish and Wildlife Service for conducting landscape level assessments in the northeast United States. Although the correlations have been developed for wetlands in more southern regions, they are generally considered to be relevant for a wide geographic area (Tiner 2003). The reader is referred to Tiner (2003) for a more complete review of the approach, including a discussion of its limitations. Additional information obtained during both field surveys and desktop assessments were used to modify interpretation, where applicable, and to provide specific context for the functional assessment. For each of the wetland functions examined, an estimate of the contributing area within the Study Area was calculated by summing the wetland polygons that were considered to contribute to that function. These summations are based on polygons that are often comprised of wetlands with multiple forms and types (wetland classes were typically delineated separately however) and do not necessarily take into account considerations related to variation within a wetland. Because estimates of contributing area to specific functions are typically based on the entire size of delineated wetland polygons although only portions of them may be important for supporting that function, they are likely overrepresentations. More detailed discussion on the considerations used for assigning particular function to wetlands is provided in Section 5.5.

4.4 Quality Assurance / Quality Control Procedures

To ensure consistent delivery of high quality products and services, Stassinu Stantec has developed and implemented a Quality Management System (QMS) within its operations. The QMS is registered to International Organization for Standardization 9001:2000 (QMS - Requirements) by QMI Management Systems, Registration (CERT-0011312:026332).

A quality assurance / quality control review of the mapping was performed by comparing all ground-truthed sampling locations with that of pre-typed (mapped) polygons. Each polygon was also checked after mapping to ensure all attributes met conditions for the classification hierarchy.

5.0 STUDY OUTPUTS

5.1 Regional Context

The Study Area is located within the Atlantic Boreal wetland region, which is characterized as having a Maritime climate with cold winters, cool summers, frequent fog, and precipitation that ranges from 950 to 1,500 mm annually (Wells and Hirvonen 1988). The Interior Atlantic Boreal wetland subregion encompasses the Study Area, as well as the majority of insular Labrador and adjacent Québec. String fens and string bogs have been noted as being abundant within this subregion; basin bogs and slope fens are considered common; and alder swamps and riparian marshes may occur along smaller streams and rivers (Wells and Hirvonen 1988). The reader is referred to Wells (1981, 1996), Wells and Hirvonen (1988), Wells and Pollett (1983), and Wells and Zoltai (1985) for a more comprehensive documentation of wetlands within Labrador.

5.2 Distribution and Description of Wetland Forms and Complexes

A total of 287 wetland polygons were delineated during the functional assessment (Appendix A), accounting for an area of 1,673 ha, or 11 percent of the Study Area (16,092 ha) (Figure 5.1; Table 5.1). Because multiple polygons were used to delineate wetlands with multiple classes (e.g., fen and marsh), the number of individual wetlands within the Study Area is less than that of the delineated polygons (265). The size of individual wetlands varied considerably within the Study Area, and ranged from less than 0.05 ha to greater than 500 ha (average of approximately 5.5 ha). Two wetland classes were identified within the Study Area: fen and marsh. Fens occupy the large majority of wetland habitat whereas marshes are found in limited abundance, being restricted to the shorelines of certain waterbodies and watercourses.

Figure 5.1 Distribution of Wetlands within Study Area

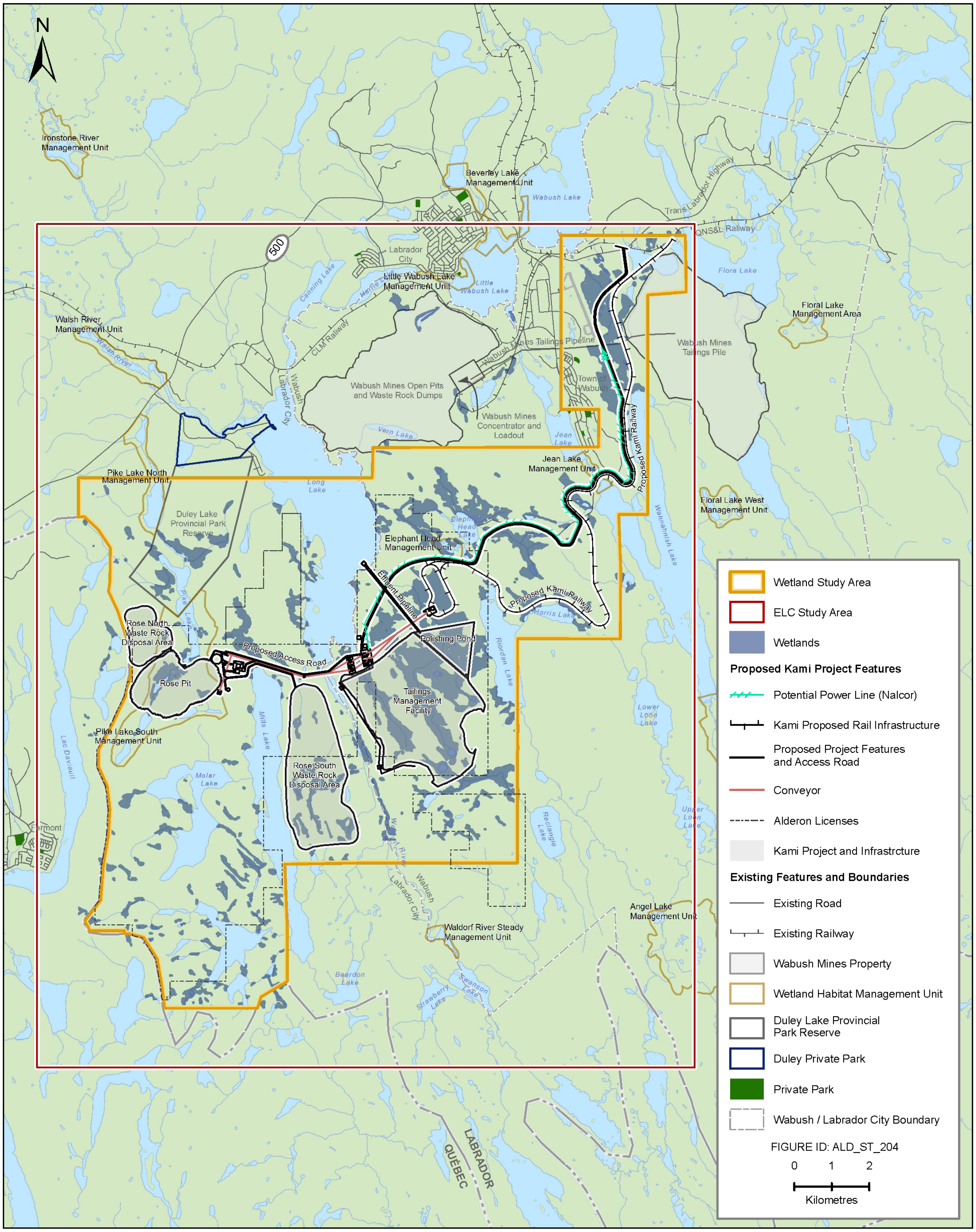


Table 5.1 Number of Occurrences and Areas of Wetland Forms within the Study Area

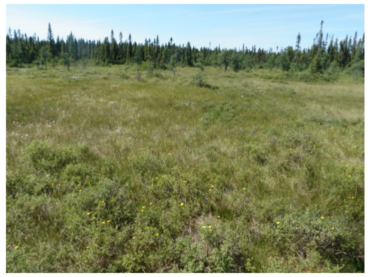
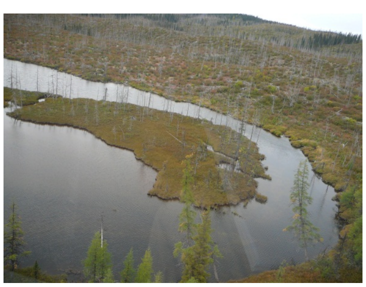
Class	Form	Number of Occurrences[1]		Area (ha)		Percent of Total Wetland Area
		#	Percent in Complexes	Area (ha)	Percent in Complexes	
Fen	Slope	242	25.2	1285.5	78.2	72.9
	Atlantic Ribbed	29	82.8	317.5	97.3	18.0
	Stream	41	58.5	139.8	91.8	7.9
	Shore	14	35.7	5.5	43.8	0.3
Marsh (Fen)	Lacustrine (Shore)	24	75.0	15.0	86.8	0.8
All wetlands		265	21.9	1763.3	82.7	100.0

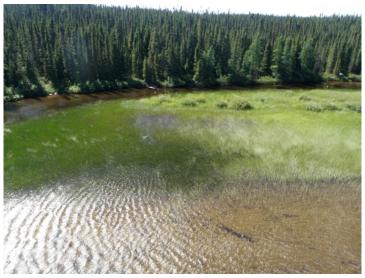
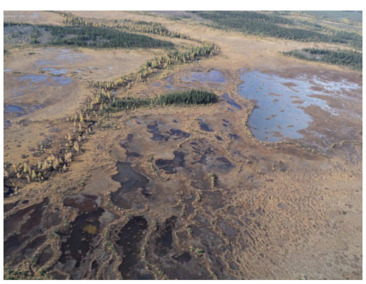
[1] The number of occurrences for wetland forms conveys their representation within delineated wetland polygons independent of whether they occur more than once within particular polygons.

Fens are minerotrophic peatlands with fluctuating water levels (National Wetland Working Group 1997). Ground and surface water movement is common within fens, with surficial flow often being observable in the form of channels or pools. The vegetation of fens is strongly influenced by water depth and chemistry and they may be dominated by graminoids, bryophytes, shrubs, and/or trees. Fens were common throughout the Study Area and often formed complexes comprised of multiple forms. Specific forms identified in the Study Area include string, shore, slope, and stream fens. These forms are distinguished based on differences in their surface pattern, surface relief, proximity to water bodies, and topography (National Wetland Working Group 1997), as is summarized Table 5.2.

Marshes are typically mineral wetlands and are periodically inundated by standing or slow-flowing water whose levels generally fluctuate seasonally. Their surface waters are typically rich in nutrients and declining water levels may expose areas of matted vegetation or mud flats during dry periods. Although their substrate is usually mineral material, well-decomposed peat may occasionally be present. Marshes typically display zones or surface patterns consisting of pools or channels interspersed with patches of emergent vegetation (National Wetland Working Group 1997). Marshes were limited in distribution and abundance within the Study Area, being restricted to the margins of fens found in association with certain waterbodies and watercourses. Both lacustrine and riparian marsh forms were identified in the Study Area, with key features for these being presented in Table 5.2. Due to their association and degree of interspersion, it was often not practical to separate “marsh” from “fen” and they are therefore presented here as being a combination of these two vegetation types.

Table 5.2 Wetland Forms and Complexes Identified Within the Assessment Area

Wetland Form	Features
Slope Fens  	Found on slopes and have a relatively uniform surface pattern (i.e., lack pattern of peat ridges and pools). Often dissected by small streams. The presence of *Dasiphora fruticosa* (yellow flowering shrub in right photo) is a very good indicator of moderate-strongly-minerotrophic, nutrient-rich fens.
Atlantic Ribbed Fens  	Found on slopes and are characterized by ridges of peat that enclose pools of open water (flarks) that are oriented perpendicular to the downslope gradient.
Stream Fens  	Located in main channel or along the banks of permanent or semi-permanent watercourses and is influenced by periodic flooding or high water table, and more nutrient enriched conditions.
Shore Fens  	Located adjacent to lakes or ponds and influenced by their water levels.

Wetland Form	Features
Lacustrine Marsh (Shore Fen)  	Occur along the margins of permanent waterbodies.
Riparian Marsh (Stream Fen)  	Located within riparian zones of streams or rivers in association with riparian thickets and on recently deposited alluvial sediments.
Wetland Complexes  	Wetland complexes consist of three or more wetland forms that exist adjacent to and contiguous with each other. Although these wetland forms occur adjacent to one another, they maintain the hydrological, ecological, and floristic features that normally characterize each ecosystem as if it were a separate entity on the landscape.

5.2.1 Slope Fens

Slope fens are common in regions that receive high amounts of precipitation and are found on sloping surfaces. Although they may encompass variously-shaped water features, they do not have a regular pattern of peat ridges and pools. Although often associated with slopes of 5° to 30° (National Wetland Working Group 1997), those within the Study Area were more commonly associated with shallow slopes (i.e., less than 5°) and many were observed on nearly level topography (i.e., less than 2°). Additionally, this wetland form was assigned to small fens confined to basins, because the “basin fen” form identified by the CWCS is not generally recognized as being present in Eastern Canada, being a feature of more western landscapes (Doyle, pers. comm.). Dominant vegetation was typically comprised of shrubs and graminoids towards the core of the slope fens, and of trees towards the margins, but large areas of tree-dominated slope fen are present within the Study Area. Their peat is typically well to moderately-decomposed and reaches depths of 1 to 2 m (National Wetland Working Group

1997). Slope fens were the most abundant wetland form identified during the survey and comprise an area of approximately 1,286 ha, or 73 percent of the total wetland area identified.

5.2.2 Atlantic Ribbed

String fens are known to be abundant in western Labrador, develop on sloping areas, and are characterized by ridges of peat (i.e., ribs / strings) that enclose pools of open water (i.e., flarks) that are oriented perpendicular to the downslope gradient (National Wetland Working Group 1997). The ribs / strings act as small dams, which impede water flow, and their configuration and spacing is dependent on the slope of the terrain, being more closely spaced and defined on steeper slopes. Those within the Study Area are Atlantic ribbed subform, which are known to be abundant in western Labrador (Wells and Hirvonen 1988, National Wetland Working Group 1997). Although the Atlantic ribbed fen subform is known to be associated with steep slopes (i.e., 5 to 30 degrees), those encountered within the Study Area were more typically found on low to moderate gradients of less than 5 degrees. The peat ridges of the Atlantic ribbed fens were typically dominated by graminoids and shrubs. Vegetation within the pools varied depending on their depth, with graminoids providing moderate cover within shallow pools and floating leaved forbs being scattered within the deeper pools. String fens within the Study Area were typically parts of larger wetland complexes, being particularly associated with slope fens. They were estimated to occupy of approximately 318 ha, or 18 percent of the wetland area identified within the Study Area.

5.2.3 Stream Fens

Stream fens are located in the main channel or along the banks of permanent or semi-permanent watercourses (National Wetland Working Group 1997). Such watercourses typically have low gradients and the slow flow of these features allows peat to develop along their edges. Although their water levels are influenced by that of the adjacent watercourse, they are not necessarily subject to flooding. Stream fens were common within the Study Area, and were most abundant as part of larger wetland complexes. Within this context, they often comprised a band of treed vegetation that dissected more open peatland habitat or were present within peripheral drainage-ways. However, stream fens were also found to be dominated by graminoids and shrubs, and to exist independently of other wetland forms. Overall, stream fen was estimated to comprise an area of approximately 140 ha, or 8 percent of the wetland habitat within the Study Area. Peat depths within stream fens are variable but often in excess of 3 m, and may include some mineral soil deposits as a result of flood events (National Wetland Working Group 1997).

5.2.4 Shore Fens

Shore fens are located immediately adjacent to lakes or ponds and although their water table is influenced by the adjacent waterbody, they are not typically subject to flooding. Peat depths are usually in excess of 2 m and have been documented to contain moderately to well-decomposed sedge, moss, or aquatic vascular plant material (National Wetland Working Group 1997). Although a large proportion of the fens within the Study Area were located adjacent to waterbodies, few were classified as shore fens because their hydrology was not evidently influenced by these features. As such, shore fens were relatively uncommon within the Study Area, comprising an area of almost 6 ha, or less than 1 percent of the total wetland area. Vegetation within the shore fens was comprised of varying amounts of graminoids and shrubs. A band of marsh vegetation was commonly associated with this wetland form, being found in the transition zone between fen and open water.

5.2.5 Lacustrine Marsh (Shore Fen)

Lacustrine marshes occur along the margins of permanent waterbodies. Their water levels are directly linked to the hydrology of the adjacent lakes and they are typically inundated for extended periods. The distribution of lacustrine marshes within the Study Area is closely associated with that of shore fens, with marsh typically occupying a band of varying width between the fen and open water habitats, or being interspersed amongst each another. Pockets of marsh within the Study Area are best characterized as belonging to the lacustrine shore marsh subtype because they are located on the shores of lakes that grade into deep water (National Wetland Working Group 1997). However, an area within a semi-closed basin that was protected from direct wave action of the adjacent lake was also identified, and is best characterized as a lacustrine lagoon marsh (National Wetland Working Group 1997). The lacustrine marsh wetland form is characteristically dominated by sedges (*Carex* spp.), but a patch of forb-dominated marsh was also identified during field surveys. Furthermore, both shrubs and graminoids are prominent within the fen components, to which pockets of marsh are closely associated. Lacustrine marsh (shore fen) wetlands were limited in distribution and abundance within the Study Area, being restricted to certain sheltered waterbodies, particularly in association with their inflows and outflows. They were estimated to encompass 15 ha within the Study Area, accounting for close to 1 percent of the total wetland area identified.

5.2.6 Riparian Marsh (Stream Fen)

Riparian marshes (stream fens) are located within the riparian zones of streams or rivers (National Wetland Working Group 1997). Their hydrology is primarily influenced by water levels within the adjacent watercourses, but they may also receive inputs from other sources, including surface runoff and groundwater discharge. Within the ELC Study Area, they were observed to be present as low-lying pockets interspersed amongst riparian shrub thickets. Although no occurrences of riparian marsh were identified during the desktop classification exercise, the patchy character and small size of this wetland form results in it being difficult to identify using air photo analyses and it would represent a very minor component of the wetlands within the Study Area. Furthermore, the lacustrine marsh (shore fen) form (see Section 5.2.7) was typically present at the inflow or outflow of waterbodies and therefore encompasses components of the riparian marsh form.

5.2.7 Wetland Complexes

Wetland complexes were identified for the purposes of this survey as areas comprised of three or more wetland forms that are contiguous with each other, but which maintain the hydrological, ecological and floristic features that normally characterize each form as if it were a separate entity on the landscape. Using this definition, wetlands comprised of minor elements of more than one form were not classified as complexes if these forms simply represented different sections of the same hydrological, ecological, or floristic feature (e.g., a small stream fen with a section of sloped fen leading down to it would not be classified as a complex). Much of the wetland habitat within the Study Area is connected and extensive areas of wetland complex are present. Overall, approximately 83 percent of the wetland area identified was considered to belong to a wetland complex. Wetlands not considered complexes were typically small and formed by slope fen form, with a number of stream fens also occurring independently.

5.3 Wetland Conditions

5.3.1 Hydrology

Wetlands within the Study Area were generally observed to have natural water sources and hydrological conditions and to be subject to minor amounts of anthropogenic stress. The majority of wetlands within the Study Area are contained within topographical / hydrological systems that are removed from urban influences, and are not affected by flooding or sources of pollution from outside sources. However, those located in close proximity to the infrastructure of Labrador City and Wabush have greater potential to receive anthropogenic nutrient or sediment loads. Evidence of anthropogenic sediment delivery and periodic flooding were observed within several wetlands adjacent to existing mining developments. Additionally, some runoff from activities associated with exploratory drilling was observed to enter wetlands during field surveys, although amounts were small in comparison to wetland size. Furthermore, evidence of recreational usage (i.e., snowmobile and all-terrain vehicle (ATV) tracks) and explorative mining initiatives (including vegetation clearing, ATV usage, and pipe installation) were observed within the wetlands. Although the effects of these activities were generally limited in spatial extent, those associated with explorative mining initiatives were observed to have important localized influences. For example, uncapped mining exploration wells were observed to alter surficial hydrology in at least one wetland. With regards to natural sources of hydrological alteration, recent beaver activity was observed to result in the partial creation of at least one shore fen / marsh system during field studies, and likely serves as an ongoing factor in the creation of similar communities within the Study Area.

Fens are usually characterized by water table at, or close to the surface. Lateral flow represents the dominant form of water movement through fens, and is based on the pathway the water takes, either through sheet flow across the fen surface; surface flow in narrow channels along fen margins; surface flow in channels in strings; or subsurface flow through near-surface layers of peat. Many of the fens within the Study Area represent the source of streams or are located along headwater streams (i.e., perennial stream order 1 or 2). Channels formed by perennial watercourses within fens were continuous and typically had steep-sided banks composed of peat. However, those within shore fen and marsh habitats varied in character from continuous to meandering and were somewhat disconnected. The presence of disconnected channels indicates that although channelized flow is present, some sheet flow is also occurring within these wetland types. Wetlands within the Study Area are typically connected to other wetlands and water features by channelized inlets, outlets, drainage-ways, or by being located immediately adjacently to waterbodies.

Standing water was present within both fens and marshes of the Study Area. Fens commonly contained small pools of open water (i.e., flarks), with average depths varying from approximately 10 to 50 cm. Larger ponds were present within some of the peatlands and observed to have depths greater than 1 m. Such features comprised relatively low cover within many of the fens but accounted for as much as 50 percent of the area of others. Marshes were consistently associated with high levels of inundation (i.e., greater than 60 percent) and were typically comprised of emergent plants that were growing out of the shallow water of adjacent lakes.

The large majority of wetland within the Study Area may be characterized as having a permanently saturated water regime, indicating the year-round presence of a high water table - a feature that promotes the development of peat. Although streams are common features within many of the fens, most fens are not expected to be inundated, even during high flow events (i.e., as evidenced by the depth of their channels, the steepness of their banks, and the vegetative character of adjacent habitat). Some stream fen forms that would be periodically inundated by watercourses were present in the Study Area, but they were uncommon and small in size. However, the hydrology of watercourses that flow though fen habitats does have an ongoing influence on the adjacent habitat, as evidenced by the band of treed vegetation that was typically associated with streams that dissected open peatland systems. Marshes within the Study Area occupy positions that are inundated for most of the growing season but draw down in late summer or early autumn in most years. As such, they are considered to be semi-permanently flooded. In addition to being permanently saturated, shore fens that are associated with lacustrine marsh habitats are likely inundated for brief to extended periods of time, especially early in the growing season (i.e., temporarily flooded).

5.3.2 Vegetation

Plant communities within the Study Area are generally undisturbed and subject to little anthropogenic modification. Furthermore, no non-native or invasive species were encountered within the wetlands during field surveys. Wetlands provide habitat for several rare or potentially uncommon plants and are primarily surrounded by naturally-occurring communities. As such, wetland plant communities within the Study Area may be considered to have a high level of integrity. However, recreational activities (i.e., snowmobile and ATV tracks) and those associated with explorative mining initiatives were observed to cause noticeable disturbance to wetland vegetation. Furthermore, wetland vegetation in close proximity to the infrastructure associated with towns of Labrador City and Wabush have a higher potential to be influenced by anthropogenic disturbances and other stressors.

Vegetated buffers around wetlands provide multiple benefits, including wildlife habitat, erosion protection, and reduced surface water runoff. The Study Area has generally been subject to low amounts of human activities, and as a result, the landscape is dominated by naturally regenerating vegetation. As such, wetlands within the Study Area typically have vegetated buffers greater than 100 m, which were comprised of native species typical of the natural ecotypes present in the region. Although some roads and disturbances from drilling activities were present within 100 m of the wetland edges, these affected a low percentage of the buffer area (i.e., less than 5 percent) and were infrequently encountered. Because lands adjacent to surveyed wetlands are subject to minimal amounts of anthropogenic disturbance and other influences, they may be considered to have high integrity and likely serve as important buffer areas for the promotion of wetland water quality and wildlife habitat functions.

Three dominant physiognomic vegetation types, as identified by the CWCS (National Wetland Working Group 1997), are present within the Study Area: shrub; graminoid; and treed. These general vegetation types encompass the “Non-Patterned Shrub Fen”, “Patterned Shrub Fen”, “Graminoid Fen”, “Riparian Marsh (Fen)”, “Tamarack / Black Spruce-Feathermoss”, and “Black Spruce / Tamarack-Sphagnum Woodland” ecotypes identified during the ELC of the Study Area. In addition, a non-vegetated shallow water (i.e., “Shallow Water with Vegetation” ecosystem unit physiognomic group may also occur. The composition and structure of these vegetative communities within the Study Area varies depending on the topographical position of wetland features and their soil moisture and nutrient regimes. Summary descriptions for the wetland vegetation types are provided in the following sections; more detailed information on their character and extent within the Study Area is provided in the ELC report as prepared for the Project.

5.3.2.1 Shrub Vegetation Types

The majority of open peatland habitat in the Study Area may be characterized as belonging to the “shrub fen” physiognomic type. This vegetation type encompasses both the Non-Patterned Shrub Fen and Patterned Shrub Fen ecotypes identified by the ELC for the Study Area. Although these ecotypes are floristically very similar, they have previously been separated by their morphological features; with patterned fens exhibiting a “ribbed” pattern as a result of alternating peat ridges (ribs / strings) and narrow hollows and shallow pools (flarks), and non-patterned fens lacking this pattern. With regards this survey, the patterned shrub fen ecotype is directly associated with the string fen wetland form (Atlantic ribbed fen subform) as identified by the CWCS (National Wetland Working Group 1997) and the vegetative character of the non-patterned ecotype applies to the remaining majority of open peatland habitat. The vegetative character of patterned fens exhibits considerable variation in relation to their micro-topography, both patterned (i.e., string fens) and non-patterned fens (i.e., slope fens) have similar species composition. Patterned fens are almost always on “obvious” slopes. Although they occur on organic substrates that are typically deep enough to restrict plant roots from contact with available nutrients, the low subsurface permeability of these deposits facilitates contact with slow-moving groundwater that is sufficiently mineral-rich to maintain a circumneutral pH.

The shrub fen vegetation described here may be considered to be the most characteristic wetland habitat within the Study Area and corresponds with the *Potentillo-Campylietum stellati* association identified by Wells (1996). This association has been documented to occur in association with nutrient-rich string and slope fens in western Labrador, and also throughout Newfoundland. However, it is characterized by two sub-associations, with the more northern

Drepanocladetosum sub-association occurring in northern Newfoundland and western Labrador. This sub-association may, in turn, be divided into two variants that within western Labrador contain a number of differential species common within fens of the Study Area. Compared to other peatland plant associations within Atlantic Canada, the *Potentillo-Campylietum stellati* association is known to have high species richness. Furthermore, occurrences of this association in western Labrador have been found to have higher iron and nitrogen concentrations in their peat than other plant associations in Atlantic Canada and also have relatively high calcium magnesium ratios. However, the association has been documented to contain only 3.5 mg/g of calcium, a level that is near that which is generally considered to represent the boundary of ombrotrophic and minerotrophic systems (i.e., 3.0 mg/g) (Wells 1996). Relationships between this plant association and the pH of organic soils indicates that the fens within the Study Area are generally strongly minerotrophic, with an average pH of 4.71 for the western Labrador region (Wells 1996).

This vegetation type typically has a pronounced shrub layer that is less than 1 m high and dominated by shrubby cinquefoil (*Dasiphora fruticosa*) and sweet gale (*Myrica gale*), with lesser amounts of other species, such as Newfoundland dwarf birch (*Betula michauxii*), also being common. A prominent herbaceous layer is comprised of both graminoids and forbs, and a prevalent moss carpet is dominated by brown mosses. Deergrass (*Trichophorum cespitosum*) and coastal sedge (*Carex exilis*) provided the majority of graminoid cover and Canada burnet (*Sanguisorba canadensis*) was the most abundant forb. Other common graminoids in these open peatlands include alpine cotton-grass (*Trichophorum alpinum*), mud sedge (*Carex limosa*), green-keeled cotton-grass (*Eriophorum viridicarinatum*), and sheathed sedge (*Carex vaginata*). Other notable species in the moderately well-developed and relatively species-rich herb layer include rough-leaved aster (*Eurybia radula*), three-leaf false Solomon's-seal (*Maianthemum trifolium*), common butterwort (*Pinguicula vulgaris*), Mistassini primrose (*Primula mistassinica*), hooded ladies'-tresses (*Spiranthes romanzoffiana*), low spike-moss (*Selaginella selaginoides*), slender bog arrowgrass (*Triglochin palustris*), and Labrador Indian-paintbrush (*Castilleja septentrionalis*). Mosses with the greatest cover include star campylium moss (*Campylium stellatum*), tomenthypnum moss (*Tomenthypnum nitens*), *Drepanocladus* spp., and various species of *Sphagnum*.

While the dominant plant species within these open peatlands are adapted to growing in areas with high water tables and circumneutral conditions, plant associations growing on raised hummocks are present and resemble bog habitats. In particular, they often have a continuous carpet of sphagnum mosses, and abundance of low ericaceous shrubs, and widely scattered or clumped, stunted tamarack and black spruce trees. Common shrub species occupying slightly elevated sphagnum hummocks include: bog rosemary (*Andromeda polifolia*), leatherleaf (*Chamaedaphne calyculata*), Labrador tea (*Rhododendron groenlandicum*), bog laurel (*Kalmia polifolia*), and small cranberry (*Vaccinium oxycoccos*). Such hummocks were common components of the raised peat ribs / strings, but also occur as isolated hummocks in non-patterned systems. Those found as strings reflect the *Chamaedaphno-Sphagnetum angustifolii* association, and are known to mainly occur in association with weakly minerotrophic ribbed fens in Labrador (Doyle 1996).

Flarks, the level areas, hollows, or pools within the open peatlands, were dominated by sedges, mosses, and aquatic forbs. Mud sedge was particularly prominent within the shallower flarks, with other forbs such as livid sedge (*Carex livida*), water sedge (*Carex aquatilis*), coastal sedge, and spoon-leaf sundew (*Drosera intermedia*) also being present. The high water table associated with these sites often provided proper conditions for aquatic plants, including bog buckbean (*Menyanthes trifoliata*), cow lily (*Nuphar variegata*), and flat-leaved bladderwort (*Utricularia intermedia*). *Drepanocladus* spp. and *Cladopodiella fluitans* are abundant within these flarks and give their bottom a dark, blackish color.

5.3.2.2 Graminoid Vegetation Types

Within the Study Area, the graminoid physiognomic vegetation types occur in association with two general ecological contexts: low-lying flat areas within open peatlands; and marsh / fen systems associated with waterbodies and watercourses. Although both systems are dominated by graminoids, the vegetative composition of these systems is distinct. As such, they are described separately here and in accordance with their representative Graminoid Fen and Riparian Marsh (Fen) ELC ecotypes.

Graminoid-dominated fens (i.e., the Graminoid Fen ELC ecotype) typically occur at the wetted centre of larger wetland mosaics, as small isolated basins, and on flat surfaces that slope gently in the direction of surface and groundwater flow. These sites are generally confined to actively forming, deep organic soils or floating organic mats that have separated as a result of freeze-thaw processes, in settings typically low in nutrients, but where concentrations of mineral rich groundwater are high enough to promote the establishment of graminoid-dominated communities. Water sedge is dominant along with a number of other graminoids, including coastal sedge, bottle sedge (*Carex rostrata*), slender sedge (*Carex lasiocarpa*), mud sedge, deer grass, alpine cotton-grass, and tall cotton-grass (*Eriophorum angustifolium* subsp. *angustifolium*). Characteristic herbs include Canada burnet, three-leaf false Solomon's-seal, buckbean, bog goldenrod (*Solidago uliginosa*), and hooded ladies'-tresses. Other less common and often inconspicuous herbs found in rich graminoid fens include round-leaved sundew (*Drosera rotundifolia*), Mistassini primrose, leafy white orchid (*Platanthera dilatata* var. *dilatata*), and sticky tofieldia (*Triantha glutinosa*). Low shrubs may be present, but collectively they cover less than 25 percent of sites. Characteristic shrubs, where present, include sweet gale, shrubby cinquefoil, bog willow (*Salix pedicellaris*), and mountain fly-honeysuckle (*Lonicera villosa*). Characteristic non-vascular species include the mosses star campylium moss and limprichita moss (*Drepanocladus revolvens*). This vegetation type typically grades into the shrub physiognomic grouping along its edges.

Graminoid-dominated communities associated with riparian marsh and fen systems (i.e., the Riparian Marsh (Fen) ELC ecotype) primarily occur in association with the shoreline of relatively large floodplains. These areas are characterized by organic substrates and dominated by sedges, particularly bottle sedge and slender sedge, with limprichita moss and star campylium moss forming a prominent ground cover. Open water habitats adjacent to this ecotype typically supported submergent and floating aquatic macrophytes, including four-leaf mare's-tail (*Hippuris tetraphylla*); flat leaf bladderwort, and greater bladderwort (*Utricularia macrorhiza*).

A number of additional forbs are present in association with this vegetation type, including water horsetail (*Equisetum fluviatile*), bog buck-bean, marsh cinquefoil (*Comarum palustre*), and three-leaf false Solomon's-seal.

5.3.2.3 Treed Vegetation Types

Two dominant treed vegetative communities were present in association with wetlands of the Study Area and corresponded with the Tamarack / Black Spruce-Feathermoss and Black Spruce / Tamarack-Sphagnum Woodland ELC ecotypes. Both vegetation types are well represented in association with a variety of fen forms.

Vegetation associated with the Tamarack / Black Spruce-Feathermoss ecotype comprised the majority of tree-dominated vegetation within wetlands of the Study Area. Tree cover within this community type is often patchy and interspersed, comprising a sparse canopy of tamarack and black spruce or occasionally a pure canopy of tamarack. The shrub layer has variable cover and is dominated by tall-shrubs, including stunted tamarack and black spruce, dwarf birch, sweet gale, bog willow, and pussy willow (*Salix discolor*). Shrubby cinquefoil and ericaceous species, especially Labrador tea, bog rosemary, blueberry (*Vaccinium* spp.), and creeping snowberry (*Gaultheria hispidula*), dominate the low-shrub layer. Forb / herb cover is also variable, and may include Canada burnet, woodland horsetail (*Equisetum sylvaticum*), bog goldenrod, and three-leaf false Solomon's-seal. Graminoids are sparse, yet diverse, comprised of various fine-leaved graminoids, typically including deergrass, alpine cotton-grass, sheathed sedge, lesser panicled sedge (*Carex diandra*), and ticklegrass (*Agrostis hyemalis*). The moss layer is prominent and characterized mainly by sphagnum mosses, interspersed by the microtopographical hummock-forming tomenthypnum moss, along with ribbed bog moss (*Aulacomnium palustre*), and feathermosses including Schreber's moss and stair-step moss (*Hylocomium splendens*). Water-filled hollows were occupied primarily by star campylium moss.

Vegetation associated with the Black Spruce / Tamarack-Sphagnum Woodland ecotype represents an ecotone between fen communities and upland forests. As such, it typically forms around the margins of open peatlands and is considered here to be a transitional habitat. Vegetation is composed primarily of species adapted to nutrient-poor conditions and it is characterized by a sparse tree cover comprised of black spruce and scattered tamarack. Ground vegetation is dominated by ericaceous shrubs and a sphagnum moss (*Sphagnum* spp.) carpet, with micro-hummocks punctuated by fine-leaved graminoids (e.g., *Carex* spp.). The shrub layer is well developed and dominated by scrub black spruce, common Labrador tea, leather-leaf, creeping snowberry, and small bog cranberry. Forb / herb cover is limited, but may include Canada burnet, cloudberry (*Rubus chamaemorus*), and three-leaf false Solomon's-seal. Common fine-leaved graminoids include sheathed sedge, three-seeded sedge (*Carex trisperma*), and few-seeded sedge (*Carex oligosperma*). The moss layer is prominent, consisting of a *Sphagnum* moss carpet with moderately high micro-hummocks, usually occurring where tree cover has established. Screber's moss is often abundant on micro-hummocks in drier areas where it is interspersed with *Dicranum* species.

5.3.3 Soils

Wetlands within the Study Area are characterized as having organic soils derived from wetland vegetation in the form of peat. Peat depths were observed to vary from 0.7 to 2.8 m; with an average depth of 1.8 m. Depths were found to be highest within slope fens, with an average of 2.1 m (1.4 to 2.8 m). Predominant upland soils within the wetland's immediate drainage area were typically comprised of sand to sandy-loams. Soils were generally found to be undisturbed, with some alterations being associated with recreational ATV use and exploratory mining activities (i.e., surface rutting).

Organic soils associated with the shrub- and graminoid-dominated peatlands of the Study Area are primarily comprised mainly of Mesisols, dominated by organic layers in a moderate stage of decomposition (Om horizons). Organic soils may grade into mineral Gleysols at the edges of these wetlands. Drainage is usually poor to very poor, but is imperfect on transitional sites. Potential rooting depth is usually shallow due to high water levels. Humus forms are dominated by Fibrimors and Mesimors on wet sites, and by Hemimors and Humimors on imperfectly drained sites. The water table is usually at or near the surface, particularly in hollows / pools between peat ridges. This ecotype is generally nutrient-poor to -medium, with a hygric to hydric soil moisture regime. Site productivity is typically poor.

Soils associated with the Tamarack / Black Spruce-Feathermoss ecotype that comprised the majority of tress fen habitat are mainly organic Fibrisols and Mesisols, dominated by organic layers in early to moderate stages of decomposition (Of and Om horizons). Organic soils may grade into mineral Gleysols at the edges of these sites. Humo-Ferric and Ferro-Humic Podzols, along with Gleyed subgroups are also possible. In many cases, soils also have surface O-horizons derived from sphagnum moss. These sites usually have very high surface stoniness that reflects their deposition history, but that may also be promoted by loss of finer material over time. Mineral soil texture is medium to coarse (silt loam to sand) and drainage is imperfect to poor on most sites. Potential rooting depth is variable, but is typically 30 cm or less because of high water and/or stone content. Humus forms are dominated by Hemimors and Humimors on imperfectly drained sites, and by Fibrimors and Mesimors on poorly drained sites. The water table is usually at or near the surface, particularly in hollows between micro-hummocks, but can vary by landform. The ecotype is nutrient-medium to -rich, with subhygric to subhydric soil moisture regimes. Drainage is very poor to poor and potential rooting depth is shallow due to high water levels. Site productivity is typically high in relation to the surrounding landscapes.

Soils associated within the transitional Black Spruce / Tamarack-Sphagnum Woodland habitats include Fibrisols, Mesisols, Orthic Gleysols, and Fera Gleysols. They are typically deep organics; depth of organics can be less in areas of scoured bedrock. Gleyed Podzols are also found where these sites grade into dryer ecotypes. Surface horizons are usually dominated by poorly decomposed sphagnum mosses regardless of soil type. Mineral soil textures can vary between silt loam and sand. Drainage is usually poor to very poor, but is imperfect on transitional sites. Potential rooting depth is usually shallow due to high water levels and in some cases, near-surface bedrock. Humus forms are dominated by Fibrimors and Mesimors on wet sites, and by Humimors on imperfectly drained sites. The water table is usually at or near the surface, particularly in hollows between micro-hummocks, but can vary by landform. This ecotype is generally nutrient-poor, with a subhygric to subhydric soil moisture regime. Site productivity is typically poor.

Soils associated with lacustrine marshes / shore fen wetland forms vary from fibrous peat to silts with high humic content, depending on parent material type and site conditions. When fluvial or lacustrine deposits are the dominant parent material, Orthic Regosols, Gleyed Regosols, and Gleyed Humic Regosols are the main soil types. When the dominant parent material is glacial till or glaciofluvial, Gleysols or Gleyed Podzols may be found. Mineral soil textures vary from fine silts and silt loams to coarse sands, depending on parent material type and/or deposition event. Drainage is generally imperfect to poor, but can be moderately well on sites further away from the associated floodplain. Potential rooting depth is usually less than 0.3 m, but can be deeper in moderately well-drained sites. Humus forms are dominated by Mulls. Moder humus forms are also possible on sites with intermittent flooding. The ecotype is generally nutrient-medium to -rich, with a subhydric to hydric soil moisture regime. Site productivity is typically medium-rich. At these sites the substrates are derived solely from fluvial or lacustrine deposits, either in areas where sediments have been deposited on bends in the river, at confluences of the river and its tributaries, or in areas where the wave action of fresh-water lakes and ponds has resulted in the accumulation of sediments along the margins of these landforms. Areas with marked water fluctuations during the growing season experience periodic aerobic conditions, which limit organic matter accumulation, thus promoting the development of soils that support this riparian marsh vegetation.

Further information on their character may be obtained with reference to soil descriptions prepared for the Non-patterned Shrub Fen, Patterned Shrub Fen, Graminoid Fen, Riparian Marsh (Fen), Tamarack / Black Spruce-Feathermoss, and Black Spruce / Tamarack-Sphagnum Woodland ecotypes identified during the ELC of the Study Area.

5.3.4 Management Status

Through an agreement with the Province, the towns of Labrador City and Wabush have committed to the management of wetlands within specified Stewardship Zones encompassed by each respective municipality. With the assistance of the Eastern Habitat Joint Venture, a Habitat Conservation Plan has been developed by both municipalities that are intended to guide and govern activities with the potential to negatively affect wetlands and waterfowl within areas designated for conservation (Wabush 2009, Labrador City 2010). Within each Stewardship Zone (municipal boundary), there exists a number of specific Management Units intended to represent “significant” areas of wetlands that have been deemed of importance to waterfowl during nesting, brood-rearing, feeding and/or staging.

The Study Area overlaps with the respective Stewardship Zones for Labrador City and Wabush, as well as several of the specific Management Units that they encompass. Management Units occurring within the municipal boundaries of Labrador City that overlap the wetland Study Area include Pike Lake North and Pike Lake South. Similarly, Management Units for the Town of Wabush which overlap with the Study Area include Jean Lake Rapids and Elephant Head.

Other Management Units that fall within the greater ELC Study Area include Little Wabush Lake, Wabush Narrows, Walsh River, Angel Lake, and Waldorf River Steady. Data on the occurrence of wetlands (Table 5.3) indicate that over 50 ha of wetland habitat is represented within the portions of the Management Units that overlap with the Study Area.

Additionally, a large portion of Duley Lake Provincial Park Reserve is located within the Wetland Study Area. Park reserves have been set aside to protect areas with important natural features and landscapes as part of a provincial initiative to protect representative portions of the different ecoregions within the province (Government of Newfoundland and Labrador 2011c). Duley Lake Provincial Park Reserve provides protection to open lichen woodland, which is considered representative of the Ecoregion (Government of Newfoundland and Labrador 2011c) but also encompasses over 70 ha of wetland habitat (Table 5.3). Although there is no day use or camping facilities within Provincial Park Reserves, such services are provided in the adjacent Duley Park Private.

Table 5.3 Area and Wetland Types Present within Municipal Management Units and Duley Lake Provincial Park

Management Unit		Area (ha) of Management Unit	Wetland Area (ha)	Rationale for Conservation Status
Municipal Management Units	Angel Lake	406.8	n/a	Habitat for staging, nesting, and breeding waterfowl
	Elephant Head	30.5	10.0	Encompasses a lake and some surrounding wetlands, which are important habitat for nesting waterfowl and provide feeding opportunities for Canada Goose
	Jean Lake Rapids	34.0	0.4	Harlequin duck is regularly observed in the rapids of this area
	Little Wabush Lake	38.6	n/a	Habitat for migratory waterfowl and shorebirds
	Wabush Narrows	n/a	n/a	Staging area during spring migration
	Pike Lake North	128.4	n/a	Habitat for nesting, breeding, and staging waterfowl
	Pike Lake South	609.6	41.1	Waterfowl habitat
	Waldorf River Steady	25.8	n/a	Provides good feeding opportunities for waterfowl
	Walsh River	116.7	n/a	Habitat for nesting and breeding waterfowl and other birds
	Total	**1,390.4**	**> 51.5**	Habitat for waterfowl and other birds
Duley Lake Provincial Park Reserve		762.9	72.8	Protection of open lichen woodland, which is representative of the Ecoregion
Duley Park Private		197.6	n/a	Campground portion of the Long (Duley) Lake Provincial Park Reserve

5.4 Landscape Position, Landform, and Water Flow Path

5.4.1 Landscape Position

Seven landscape positions were identified for wetlands within the Study Area and correspond to three major designations types (lentic, lotic, and terrene) and combinations thereof (Table 5.4; Appendix C). Wetlands located along permanent waterbodies are considered to have a lentic landscape position, whereas those that are periodically flooded by watercourses are lotic systems. Terrene wetlands are either isolated or headwater wetlands or wetlands that are on broad, flat terrain cut through by stream but where overbank flooding does not occur (i.e., hydrologically decoupled from streams) (Tiner 2005a). Many of the fens within the Study Area have streams that flow through them, but because they are not inundated by these features; they have been classified as having terrene landscape positions. Similarly, although many of the fens within the Study Area were located adjacent to waterbodies, few were classified as lentic systems because their hydrology was not evidently influenced by these features. Several descriptors were also applied to the landscape position designations in order to further characterize the hydrological character of the wetlands: terrene systems that contained ponds were classified as “terrene pond”, whereas lotic wetlands were classified as being associated with either “stream” of “river” systems.

The majority of wetland habitat within the Study Area was identified as having a terrene or terrene pond landscape position, with much lesser amounts of lentic, lotic (river), lentic / lotic (stream), lotic (stream), and lentic / lotic (river) designations being present (Table 5.4; Appendix C). Due to similarities in the criteria used to identify wetland forms and landscape position designations, there is a high degree of association among them. Wetlands whose hydrology is not strongly influenced by the presence of adjacent waterbodies, including slope and string fen forms, generally have a terrene landscape position. Although stream fens are defined as those systems whose hydrology is influenced by the watercourses that run through them, many were not classified as lotic systems here because they are not subject to overbank flooding. Conversely, shore fens, lacustrine marshes, and certain stream fens were classified as lotic and/or lentic systems. However, because designations were assigned to wetland polygons with multiple forms, they are not necessarily indicative of all the individual forms they encompass (i.e., they were assigned based on the dominant wetland condition).

Table 5.4 Area, Number and Percent of Wetland Polygons within the Study Area According to Landscape Position, Landform, and Water Flow Path Designations

Designation	Area (ha)	% of Area	Number	% of Number
Landscape Position				
Lentic	11.0	0.6	21	7.3
Lentic / Lotic (river)	0.6	0.0	2	0.7
Lentic / Lotic (stream)	8.6	0.5	13	4.5
Lotic (river)	15.6	0.9	4	1.4

Designation	Area (ha)	% of Area	Number	% of Number
Lotic (stream)	4.5	0.3	5	1.7
Terrene	848.3	48.1	205	71.4
Terrene Pond	874.8	49.6	37	12.9
Landform				
Basin	27.9	1.6	45	15.7
Flat	30.8	1.7	34	11.8
Flat / Slope	1146.1	65.0	33	11.5
Fringe	30.9	1.8	27	9.4
Island	0.9	0.0	6	2.1
Slope	464.3	26.3	121	42.2
Slope / Basin	62.3	3.5	21	7.3
Water Flow Path				
Bidirectional Nontidal	8.9	0.5	17	5.9
Inflow	3.3	0.2	3	1.0
Isolate	4.4	0.3	12	4.2
Outflow	361.0	20.5	33	11.5
Outflow (undefined)	344.3	19.5	142	49.5
Throughflow	1033.3	58.6	67	23.3
Throughflow / Bidirectional Nontidal	8.0	0.5	13	4.5

5.4.2 Landform

Wetland landforms recognized within the Study Area include slope, basin, flat, fringe, island, and combinations thereof. Wetlands that occur on slopes of greater than 2 percent are considered to have a “slope” landform (Tiner 2005a). The basin landform designation is given to those wetlands that occur on more gentle slopes and that are in distinct depressions that are primarily formed by the surrounding upland habitat. Conversely, the “flat” landform designation has been assigned to wetlands that are on very gentle slopes and which are not located in distinct depressions. Wetlands with a “fringe” landform are restricted to the edges of waterbodies or watercourses, whereas “island” represents a wetland that is completely surrounded by water. The majority of wetlands within the Study Area were identified as having a flat / slope, or slope landform position, with lesser amounts of slope / basin, fringe, flat, basin, and island forms being present (Table 5.4; Appendix C).

5.4.3 Water Flow Path

Water flow paths identified within the Study Area include isolate, outflow, inflow, throughflow, bidirectional non-tidal, and combinations thereof (Table 5.4). Wetlands with a “throughflow” system have surface water that flows through them, as may be promoted by the presence of a watercourse (Tiner 2005a). An “outflow” water flow path represents wetlands that had a stream outflow but no apparent inflow. An “undefined outflow” designation was assigned when there was an apparent lack of channelized outflow, but the wetland was not isolated from down-gradient water features, as evidenced by the presence of drainage features or proximity to waterbodies. Conversely, those with an “inflow” designation had a channelized inlet but no apparent outflow. Wetlands assigned an “isolate” water flow path were typically surrounded by uplands habitats, received precipitation and runoff from adjacent area, but had no apparent outflow. Water levels within wetlands assigned “bidirectional non-tidal” water flow paths fluctuate according to the rise and fall of lake wetlands and are only assigned to those with lentic landscape positions. Such wetlands were sometimes also assigned a “throughflow” water flow path if they had streams that flowed through them that originated from outside of the lake. The majority of wetland within the Study Area was assigned throughflow, undefined outflow, or outflow water flow paths (Table 5.4; Appendix C). The prominence of the throughflow water flow path is reflective of the large wetland complexes with the Study Area being dissected by streams.

5.5 Wetland Functions and Values

Key information used to identify and assign wetland functions and values within the Study Area, as well as estimates of the contributing number and area of wetlands to these functions and values, are provided in Table 5.5. More detailed discussion on the considerations used for assigning particular function to wetlands is provided in their respective sections (i.e., Sections 5.5.1 to 5.5.5). Because functions were assigned at the level of wetland polygons, they do not necessarily reflect the range of conditions that are represented therein (i.e., wetland complexes may encompass multiple forms and these may differ in their functional characteristics). As such, estimated contributing areas are likely to be an overrepresentation where functions have been assigned based on the presence of select wetland forms or other features (i.e., entire wetland polygons have been identified as contributing to specific wetland functions although only small portions of them may directly contribute to the function in an important way). For example, entire wetland polygons were identified as contributing to the function of shoreline stabilization when they bordered waterbodies although only a small proportion of their area would have comprised the shoreline itself. Due to inherent difficulties in assessing wetland functions, results are best considered qualitative in nature. A complete presentation of the probable functions as per Table 5.5 performed by individual wetlands in the Study Area is provided in Appendix D.

Table 5.5 Key Criteria used to Identify and Assign Wetland Functions and Values within the Study Area and Estimated Number of Contributing Wetland Polygons and Area

Function / Value	Key Criteria used for the Identification of Wetland Functions and Values within the Study Area	Estimated # of Contributing Wetland Polygons	Estimated Contributing Wetland Area
Surface Water Detention	All marshes; fens containing ribbed forms or have a terrene pond landscape position (i.e., wetlands with surface water features)	84	1309.3
Sediment and Other Particulate Retention	Lentic and lotic marshes	24	16.1

Function / Value	Key Criteria used for the Identification of Wetland Functions and Values within the Study Area	Estimated # of Contributing Wetland Polygons	Estimated Contributing Wetland Area
Streamflow Maintenance	Headwater wetlands (those along streams of perennial order 1), as well as those with a lentic landscape position	92	1244.1
Groundwater Recharge	Wetlands within the Study Area are not expected to perform this function	0	0.0
Carbon Sequestration	All fens and seasonally or semi-permanently flooded marshes	287	1763.3
Shoreline Stabilization	Wetlands with a lotic or lentic landscape position, excluding those with an islands landform; or that otherwise bordered the banks of a waterbody or watercourse	164	1502.0
Fish Habitat	Lentic and lotic marshes	24	16.1
Fish Habitat (stream shading)	Wetlands containing stream fen forms dominated by trees or shrubs	35	890.4
Waterfowl and Waterbird Habitat	All marshes; fens having a lentic, lotic (river), or terrene pond landscape position; fens having a ribbed form	101	1318.1
Species of Conservation Concern	Wetlands containing ecotypes which are known to be associated with Species of Conservation Concern	287	1763.3
Socio-economic Value	NA - socio-economic value not related to wetland classification data and no estimates are provided	n/a	n/a

5.5.1 Water Quality and Quantity

Wetlands may help maintain the quality and quantity of water through a number of physical, chemical, and metabolic processes. The following sections provide a discussion of the potential for wetlands within the Study Area to contribute to a number of water quality functions: surface water detention; the retention of sediments and other particulate matter; streamflow maintenance; and groundwater recharge. However, the review does not necessarily account for the opportunity that wetlands have to provide particular functions (such as may result from certain land use practices up- or down-gradient) and does not integrate information on the character of the watershed. However, the role that wetlands play in the landscape with respect to maintaining water quality and quantity is dependent on the character and condition of particular watersheds. For example, the density of wetlands in a watershed will determine the benefit that individual wetlands provide downstream - wetlands are considered to reduce flood peaks by as much as 75 percent compared to rolling topography when they occupy only 20 percent of the total basin area (NSE 2011 and references therein). When wetland densities in the watershed exceed 20 percent total cover, the flood storage benefits of additional wetlands rapidly decrease. Furthermore, wetlands within watersheds that are subject to greater degrees of anthropogenic development and use have greater potential to be subject to the delivery of runoff and sediments and are the less likely to have the opportunity to minimize downstream flooding. For example, studies have shown that watersheds with more than 10 percent cover of impervious surfaces have degraded water quality, as evidenced by a decline in benthic macroinvertebrate diversity (e.g., Schueler 1994; Arnold and Gibbons 1996). Other studies have demonstrated a deterioration of stream habitat and biological integrity of approximately 5 to 10 percent (e.g., Horner et al. 1996; May et al. 1997; Wang and Lyons 2003) or 8 to 12 percent (Wang et al. 2001; Stepenuck et al. 2002). The effect of impervious surfaces on water quality is considered to be most pronounced at the tertiary watershed level (Caraco et al. 1998).

5.5.1.1 Surface Water Detention

Surface water detention refers to the storage of water at the surface. Wetlands with substantial amounts of open water retained at the surface during the growing season, and wetland types that are known to have a high capacity to retard flows, are generally associated with this function. As such, the identification of this function for particular wetlands has been based both on the presence and character of surface water features, as well as information on their classification. Marshes are typically associated with streams and riparian areas and may therefore play an active role in water flow regimes by ameliorating peak flows and dry periods. As such, lentic and lotic marshes are generally considered to provide a high level of performance for the function of surface water detention (Tiner 2003; NSE 2011) and have been treated here as such. Although fens are generally considered to have moderate capabilities to provide surface water detention functions (Tiner 2003; NSE 2011), their capability to do so depends on a number of features, such as their slope, size of their associated basins, and the degree to which they receive surface water inputs. Although sloped wetlands are generally not considered to contribute to the function of surface water detention to any substantial degree (Tiner 2003, 2005), wetlands attributed a “slope fen” form within the Study Area were typically found on low gradients and often contained standing water in the form of small pools or larger ponds. As such, the identification of fens that were considered to contribute to the function of surface water detention was primarily based on the presence of surface water features - those that contained string fen forms or were associated with a terrene pond landscape position were considered to contribute to this function. Based on these criteria, 84 of the wetland polygons, accounting for 1,309 ha of wetland area, were considered to contribute to the function of surface water detention (Table 5.5). However, all fens within the Study Area would be contribute to the more general function of “water detention” (i.e., the storage of water throughout the wetland, not just as surface water) because their peat has high water retention capabilities and their water tables are at or near the surface.

The function of surface water detention is related to a number of ecological services, including wetland capacity to contribute to stormwater management. Additionally, the ability of wetlands to provide stormwater management functions is related to whether it has a fluctuating water table, contains basin or floodplain forms, and whether it is fed by surface water sources, particularly artificial surface water conveyance features (e.g., drainage ditches). Wetlands with such features may collect and store surface water during storms and high-water events, alleviate flooding, and may prevent environmental and property damage associated with high-energy flows. However, due to the majority of the Study Area being relatively undeveloped, most of the wetlands within the Study Area would not currently contribute to this service. Additionally, fens of the Study Area are primarily fed by groundwater and therefore have low potential to detain surface water from upstream sources. However, several wetlands that were adjacent to existing infrastructure associated with Labrador City, Wabush, and Cliffs Resources Wabush Mine were observed to receive runoff from these developments. In addition to providing capacity for stormwater management, the function of water storage is also related to the general value of water retained on the surface for a variety of functions relating to wildlife, raising local groundwater tables, local climate moderation, aesthetics, and supporting chemical processes.

5.5.1.2 Sediment and Other Particulate Retention

Some wetlands are quite effective at removing sediments and other particulate matter from surface water. The ability of a wetland to provide this function is dependent on various factors, including the degree of flow channelization through the wetland. In general, seasonally flooded wetlands that are located on the banks of waterbodies or watercourses are considered to have high value for the retention of sediments and other particulate matter, whereas those that are only temporarily flooded are regarded as having moderate value (Tiner 2003; NSE 2011). As such, lotic and lentic marshes are generally considered be have high importance for contributing to this function (Tiner 2003; NSE 2011) and have been treated as such for the purposes of this review. Although fens have sufficient vegetative density to decrease water energy and allow suspended materials to settle, they have a low realization of this function as a result of not being regularly subject to inundation. As such, those within the Study Area have not been identified as contributing to this function to an important degree (some shore fens may be temporally flooded however). Based on these considerations, 24 of the wetland polygons within the Study Area, accounting for 16 ha, was considered to have potential to contribute to the function of sediment and other particulate retention (Table 5.5).

The potential for wetlands to be subject to sediment delivery also reflects adjacent land uses, as well as other factors such as ground slope and the erodibility characteristics of the surrounding soils (NSE 2011). Due to majority of the Study Area being subject to minimal amounts of anthropogenic development, there is generally a low potential for surrounding land uses to deliver important amounts of nutrients and/or sediment loads to wetlands. Many of the wetlands are contained within topographical / hydrological systems away from urban influences, and are not affected by sources of pollution from outside sources. Thus, their potential to capture excess nutrients from suspended sediments or to be subject to eutrophication from manures, fertilizers, septic tanks, and sewage is low. Although some amounts of runoff from activities associated with exploratory drilling exercises were observed to enter wetland habitats, amounts were small in comparison to the size of the wetlands. However, evidence for the discharge of anthropogenic sources of water were observed within several wetlands adjacent to infrastructure associated with Labrador City, Wabush, and existing mine developments. Such wetlands are likely subject to elevated levels of sediment delivery and would therefore be likely to currently perform functions related to the retention of sediments and other particulate matter. Although fens within the Study Area are generally not subject to inundation under natural hydrological conditions, adjacent developments may result in their flooding. As such, the capacity of wetlands to retain sediments and other particular matter may change in conjunction with surrounding development activities.

Although wetlands currently have low capacity to receive nutrient and sediments loads from surrounding lands, they are likely to be increasingly exposed to such material with time as a result of planned mining developments within their vicinities. By retaining sediments and other materials, they have capacity to provide important ecological functions, but their integrity may become jeopardized in doing so. For example, excessive nutrient loading to a wetland can promote algal blooms and low-diversity communities comprised of invasive or weedy species.

5.5.1.3 Streamflow Maintenance

Wetlands have potential for contributing to the function of streamflow maintenance by absorbing water during high precipitation or run-off events and slowly release water stores during drier periods. Wetlands that are in headwater positions are particularly important for providing this function because they represent the source of streams (Tiner 2003; NSE 2011). Additionally, because lakes may also be important regulators of streamflow, lentic wetlands that are associated with throughflow lakes are generally attributed this function (Tiner 2003; NSE 2011). By maintaining flow to down-gradient waterbodies in dry conditions, wetlands that contribute to the function of streamflow maintenance have value for supporting wildlife habitat and water resources for human use.

Following rationale outlined by others (Tiner 2003; NSE 2011), wetlands within the Study Area that represent the source of streams or are along perennial first-order streams were considered to be of high value for contributing to the function of streamflow maintenance. Although wetlands along second-order streams may also be classified as headwater streams in mountainous landscapes (Tiner 2003), they have not been treated as such here due to the more moderate nature of the area's topography. Additionally, wetlands that had a lentic landscape position were also attributed this function, since lakes within the Study Area were typically throughflow systems (i.e., they have outflows). Based on these criteria, 105 of the wetland polygons within the Study area, accounting for 1,238 ha of wetland area, were considered to contribute to this function (Table 5.5). However, other wetlands that serve as groundwater discharge sites and are hydrologically connected to down-gradient water feature are also likely to help maintain base stream flows and moderate peak flows and flooding.

5.5.1.4 Groundwater Recharge

Depending on landscape position, substrate distribution, and morphology, wetlands may have the potential to capture surface flow and precipitation and discharge all or a portion to the groundwater table. Wetlands that provide this function are considered recharge sites, whereas those that primarily receive their hydrology from groundwater inputs are considered discharge sites (NSE 2011). Due to implications relating to water quality and quantity, wetlands which act as groundwater recharge are generally regarded as proving important ecological functions. Although this function cannot be determined directly without long-term monitoring programs, detailed information on the character of wetlands and surrounding landscape indicate that the majority of wetland habitat within the Study Area are functioning as groundwater discharge sites and do not contribute to groundwater recharge. Such information includes:

- Extensive peat development in the fens due to limitations in the oxidation of organic matter indicates relatively consistent saturation, as is typically associated with discharge sites (NSE 2011).
- An undeveloped upland watershed with little residential development or impervious surfaces is likely to promote upland recharge and subsequent discharge to nearby wetlands. However, wetlands in closer proximity to developments in the northern section of the Study Area would have greater potential to serve as recharge sites because the presence of paved surfaces, topographic disruptions, and wells act to lower potentiometric contours and increase downward water flow. That is, land that is primarily developed to high-density residential, commercial, industrial and /or road land uses (equivalent to lots 0.10 hectare or smaller), and which has a high amount of impervious surfaces, result in more runoff to wetlands and lowered water tables creating a gradient for recharge under wetlands (NSE 2011).
- The surrounding upland soils are primarily comprised of well-drained sand to sandy loams, which allow more infiltration of precipitation than soils comprised of finer material. The infiltrated water will percolate downward vertically and/or flow laterally, becoming groundwater discharge where wetlands intersect the water table.
- Perennial outlet channels (and lack of inlet channels within some fens) suggest an internal source of groundwater (e.g., springs or seeps). Wetlands with permanent stream inlets but no permanent outlets are more likely to recharge groundwater than those with outlets as a result of: a higher hydraulic gradient likely being present in the area lacking the outlet; water being more likely to percolate through substrate due to its residence time in the wetland; wetlands without outlets generally experience more water level fluctuations that result in the inundation of unsaturated soils; and a lack of an outlet suggests that water is being lost either through recharge or evapotranspiration.
- Surrounding lands typically slope down towards the wetlands. Because water tables usually run parallel to the land surface topography, a hydraulic gradient favorable for groundwater discharge results.

Based on the above considerations, none of the wetlands within the Study Area have been identified to provide the function of groundwater recharge (Table 5.5). However, as noted previously, there is greater potential for wetlands located in close proximity to the infrastructure of Labrador City, Wabush and existing mine developments to perform this function.

5.5.2 Carbon Sequestration and Storage

Wetlands can act as both sinks and sources for greenhouse gases. Wetlands may contribute to the mitigation of global climate change if the fixation of atmospheric carbon (carbon dioxide) through photosynthesis exceeds the release of carbon to the atmosphere through the decomposition of organic material (carbon dioxide, methane), on a long term basis (greater than one year). Although individual wetlands can vary widely in their annual net carbon balances, those with peat formation and woody vegetation are typically attributed this function, as these features represent long-term storage of sequestered carbon.

The accumulation of biomass within wetlands occurs when net primary productivity exceeds losses of organic matter due to decomposition, disturbances (e.g., fires), and dissolved organic carbon export. The rate of peat production within wetlands is directly linked to that of carbon sequestration. In fens and bogs, microbial activity and ensuing decomposition rates are adversely affected by cold soil temperatures, low nutrient availability, and a water table at or near the surface of the wetland for most of the year. As such, bogs and fens can be important carbon sinks by storing large volumes of organic matter. However, because nutrients are more available and pH is higher in fens (especially rich fens) than bogs, microbial activity and rates of decomposition are also greater. As such, fens have a much slower rate of peat accumulation, are often less than 1 m in depth, although those within the Study Area were found to have peat depths varying from 1.4 to 2.8 m. Marshes may also be important for sequestering carbon, although their ability to do so depends on the hydrological regime (Tiner 2003; NSE 2011). In particular, wetlands that are saturated throughout the year tend to accumulate peat and act as carbon sinks. In contrast, wetlands with large seasonal water level fluctuations are typically poor at sequestering carbon, since exposure of the substrate to air during drawdown periods promotes rapid decomposition of organic matter deposited in the sediment. The rate of plant decomposition in marshes is often equal to or greater than the rate of plant biological productivity, resulting in minimal to no peat accumulation. Additionally, although carbon is stored in marshes in the form of living plant biomass, the amount of carbon stored over several seasons is likely to remain the same.

The large majority of wetland within the Study Area is comprised of fen with extensive peat development. Because marshes within the Study Area are likely be at least seasonally flooded (i.e., as opposed to temporarily flooded), and were typically associated with shore fen wetland components, they are also considered here to contribute to the function of carbon sequestration and storage. As such, all wetlands within the Study Area are considered to contribute to these functions, accounting for an area of 1,763 ha (Table 5.5).

5.5.3 Shoreline Stabilization

Vegetated riparian wetlands have the potential to slow the flow of surface water, stabilize soil, and disperse energy in a way that reduces the erosive forces of surface water. In doing so, they may provide effective protection from shoreline erosion by absorbing energy from waves, tides, and flowing water without resulting in extensive damage to vegetation or wetland substrates. Wetlands that are located along the shores of waterbodies (including rivers, streams, and lakes) are generally considered to have high potential to provide shoreline stabilization functions, excluding those that form islands in the waterbodies (Tiner 2003; NSE 2011), and were treated here as such. Based on these criteria, 164 of the wetlands within the Study Area, accounting for 1,502 ha of wetland area, was considered to contribute to this function (Table 5.5). However, because this estimate has been based on the total size of wetland polygons, it may be considered an overestimation of the actual contributing area (i.e., the portions of wetlands that bordered water bodies is typically a small fragment of their overall area). For example, although greater than 55 ha in size, less than 500 m of Wetland Polygon 143 borders Mills Lake itself and is therefore directly associated with the function of shoreline stabilization.

The degree to which wetlands may help stabilize shorelines is dependent on the character of their vegetation. Greater shoreline protection is provided by high-density vegetation, and wetlands with wide stands are more likely to stabilize sediments than narrower ones. For example, Knutson et al. (1981) found that wetlands wider than 10 m reduced wave energy by 88 percent, while emergent wetlands less than 2 m wide were relatively ineffective in wave buffering. Although fens that were located immediately adjacent to waterbodies in the Study Area did not typically have vegetation rooted within the shallow water zone (i.e., the boundary between the peatland and lake was abrupt), marshes typically had high (greater than 50 percent) macrophyte cover in this zone. Furthermore, where marsh habitat occupied a narrow fringe around the periphery of waterbodies, its width was often approximately 10 m. In addition, vegetation within the shallow water zone of lacustrine marsh systems was predominantly comprised of species with moderately strong stems (e.g., beaked sedge [*Carex rostrata*]), in addition to some scattered shrubs.

The degree to which wetlands serve to stabilize shorelines is also dependent on a number of factors related to the erosive potential of a site. Wetlands located in areas with strong currents and wave action have the greatest potential for protecting shorelines, and sandy or erodible soils will benefit the most from shoreline wetland protection. Marshes within the Study Area are typically associated with sheltered waterbodies (less than 1,000 m wide and subject to minimal boat traffic) and are therefore not likely to be subject to high amounts of wave activity that could cause shoreline erosion. The potential for erosion and/or slope failure of shoreline or streambank areas is also dependent on the land use and condition on the slope above the water level and on top of the bank. Bare soils or those with shallow-rooted grasses that are manicured on a regular basis provide less protection than deep-rooted and naturally-regenerated grasses. Due to relatively low amounts of anthropogenic developments and disturbances within the Study Area, the up-slope shoreline vegetation conditions are typically comprised of unmanicured grasses, forbs, shrubs, and trees, and would therefore have a high capacity to protect the bank from erosion or slope failure.

5.5.4 Fish, Waterfowl and Waterbird and Species of Conservation Concern Habitat

5.5.4.1 Fish Habitat

The value of wetlands for providing fish habitat is generally related to their connectivity with deep-water habitats. As such, wetlands are considered to have high value for fish if they provide spawning / nursery habitat or refuge for native fish species in adjacent estuaries, lakes, rivers, or streams (NSE 2011). Additionally, wetlands may intermittently support populations of certain fish species as a result of colonization during flood events, and some isolated but permanently flooded wetlands can support native populations of species such as minnows. Wetlands that are isolated and are not permanently flooded do not generally support fish populations. However, those that do not directly support fish may still be important for maintaining their habitat by improving the quality of downstream water (e.g., by providing shade to maintain water temperature in adjacent waterbodies or watercourses).

The value of wetlands for providing fish habitat was evaluated by the degree to which they were contiguous with a permanent waterbody or watercourse that was either known or expected to be capable of supporting native fish species. Marshes located in association with waterbodies or watercourses are generally considered to have high value with regards to fish habitat (Tiner 2003; NSE 2011), and were treated here as such. Although fens often encompassed streams known to support fish and/or were located immediately adjacent to larger waterbodies, the majority of those within the Study Area are not likely to be inundated by these features or support fish populations. However, some shore fens are likely inundated for brief to extended periods of time, especially early in the growing season (i.e., temporarily flooded), and may therefore also provide fish habitat. Wetlands that contain tree and shrub-dominated stream fen forms were considered to contribute to the function of “stream shading” following guidelines outlined by others (Tiner 2003, 2005). Based on these criteria, 16 ha of wetland within the Study Area were considered to contribute to the fish habitat directly, and an additional 890 ha were identified as contributing to the function of stream shading (Table 5.5). However, because only a portion of many of these wetlands were actually comprised of stream fen forms, the area values presented here would be an overestimation of the actual area that directly contributed to this function. For example, approximately 20 percent of Wetland 209 (which has a total area within Study Area of 517 ha) is actually comprised of treed stream fen and would therefore directly contribute to this function.

Fish species which have been recorded in the Project Study Area and have potential to benefit from the presence of wetland habitats include brook trout (*Salvelinus fontinalis*), slimy sculpin (*Cottus cognatus*), lake chub (*Couesius plumbeus*), burbot (*Lota lota*), lake whitefish (*Coregonus clupeaformis*), longnose sucker, (*Catostomus catostomus*), northern pike (*Esox lucius*), lake trout (*Salvelinus namaycush*), white sucker (*Catostomus commersonii*), longnose dace (*Rhinichthys cataractae*), pearl dace (*Margariscus margarita*), and round whitefish (*Prosopium cylindraceum*) (Bruce et al. 1978. Whereas brook trout and slimy sculpin were most prevalent in streams, lake chub, brook trout, slimy sculpin, and burbot were generally found in ponds, although their species composition depended on size and location. Larger waterbodies, such as Long and Wahnahnish Lakes, are known to support lake whitefish, longnose sucker, northern pike, lake trout, and white sucker (Bruce et al. 1979).

Wetlands within the Study Area may also contribute to the value of fish habitat by helping to maintain water quality in downstream resources. In particular, wetlands help disperse the physical, chemical, and biological effects of pollution in downstream waters. Sensitive water resources located within 1 km downstream of wetlands that contribute to this function will realize the greatest benefit to water quality from the wetland (NSE 2011). As discharges from the wetland move farther downstream, the benefits to water quality provided by the wetland will continue to diminish. As such, wetlands that contribute to water quality and are within 1 km upstream of one or more fish or water supply resources may be considered to have value for contributing to the water quality of downstream fish habitat (NSE 2011).

5.5.4.2 Waterfowl and Waterbird Habitat

The ability of wetlands to provide habitat for waterfowl and other waterbirds varies according to their position relative to waterbodies and watercourses, the presence and character of open water, and the availability of appropriate vegetation for foraging and nesting opportunities. However, because of relationships to certain habitat features, some wetland types (e.g., salt marshes, lentic marshes, lotic river marshes) are generally associated with providing important waterfowl and other waterbird habitat, whereas others have little or no capacity to provide this function (Tiner 2003; NSE 2011).

Species of waterfowl and other waterbirds that were recorded in the vicinity of wetlands (i.e., within 50 m of their boundaries, as identified by an overlay) during spring staging, breeding and fall staging waterfowl surveys conducted for the Project include (in order of decreasing abundance): Common Goldeneye (*Bucephala clangula*), Common Loon (*Gavia immer*), Common Merganser (*Mergus merganser*), Ring-necked Duck (*Aythya collaris*), Sandpiper (*Actitis* sp.), Greater Yellowlegs (*Tringa melanoleuca*), Merganser (*Mergus* sp.), Greater Scaup (*Aythya marila*), Canada Goose (*Branta canadensis*), Spotted Sandpiper (*Actitis macularius*), American Black Duck (*Anas rubripes*), Surf Scoter (*Melanitta perspicillata*), and American Green-winged Teal (*Anas crecca*). Such species are likely to use wetland habitats within the Study Area for a variety of purposes, including staging, feeding, nesting, breeding, and brood rearing. Other species of waterbirds that were recorded in proximity to wetlands, such as Common Tern (*Sterna hirundo*) and Herring Gull (*Larus argentatus*), are not likely to use wetlands to any substantive degree, being more associated with large open waterbodies and their coastlines within the Study Area.

Marshes found alongside lakes or rivers are generally considered to have high potential to provide waterfowl and waterbird habitat (Tiner 2003; NSE 2011), but the degree to which they may perform this function is dependent on a number of factors. For example, wetlands with vegetation that is interspersed with open water are more likely to support a higher diversity and/or abundance of waterfowl than those with very dense vegetation and no channels or open water areas (NSE 2011). Although marshes within the Study Area typically had high amounts of emergent vegetation, the degree to which this vegetation was interspersed with open water varied considerably. Nevertheless, all marsh (fen) polygons within the Study Area were considered for the purposes of this review as contributing to the function of waterfowl and waterbird habitat.

Many of the fens within the Study Area also provide habitat for waterfowl and/or other waterbirds during various stages of their life history. For example, Canada Goose use fens for both foraging and breeding in Labrador, and often make use of small islands within such wetlands for nesting (Minaskuat 2007). Waterfowl surveys conducted for the Project found breeding evidence for Canada Goose within fens of the Study Area, as well as other species, including American Black Duck and American Green-winged Teal. Furthermore, Greater Yellowlegs were frequently sighted on string fens during spring surveys and Spotted Sandpiper was abundant around ponds. As such, fens with a terrene pond, lentic, or lotic (river) landscape position were considered to contribute to this function, in addition to wetlands with string fen forms. Based on the criteria outline above, 101 wetlands, accounting for an area of approximately 1,318 ha, were considered to contribute to the function of waterfowl and waterbird habitat (Table 5.5).

Whereas the use of wetland habitats within the Study Area by waterfowl and other waterbirds varies depending on seasonality, a number of locations within the Study Area have been formally recognized because of their importance to avifauna. That is, the municipalities of Labrador City and Wabush have prepared Habitat Conservation Plans, with assistance of the Eastern Habitat Joint Venture and in partnership with the province, for a number of specific Management Units that have been identified for their importance as waterfowl habitat. Management Units located within the boundaries of the Project Study Area include Little Wabush Lake, Wabush Narrows, Walsh River, Pike Lake North, Pike Lake South, Jean Lake Rapids, Elephant Head, Angel Lake, and Waldorf River Steady (Figure 5.1).

5.5.4.3 Species of Conservation Concern Habitat

Information on the presence of species at risk and other species of conservation concern were obtained with reference to environmental baseline studies being prepared for the Project, including the ELC, fish and fish habitat, waterfowl, forest songbird, rare plant, and land and resource use surveys). Although no mammal, fish, or herpetile species of conservation concern are likely to depend on wetland habitats within the Study Area, two federally and provincially protected birds and 18 plant species of conservation concern were identified to have wetland associations.

Rusty Blackbird (*Euphagus carolinus*) is considered to be of special concern at the federal level Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2006) and is listed as vulnerable within the province (NLESA 2007). This species is associated with a variety of habitats within the boreal forest, including a typical association with wet forests and wetland habitats, including fens, bogs, beaver ponds, and swamps (COSEWIC 2006). A single Rusty Blackbird was detected in association with an open fen during ELC surveys for the Project, and it has potential to occupy a variety of wetland habitats with the Study Area.

The Olive-sided Flycatcher (*Contopus cooperi*) is listed both federally and provincially as threatened (COSEWIC 2007; NLESA 2007). This species is primarily associated with natural and altered forest edges that contain tall trees or snags for perching, with suitable habitat within the boreal forest region being most likely to occur in or near wetlands (COSEWIC 2007). A single Olive-sided Flycatcher was observed during the forest songbird survey and this species has potential to use wetland habitats throughout the Study Area, particularly the edges of open peatlands and adjacent forested habitats.

All species of vascular plant encountered during surveys for the Project were identified and their population status in Newfoundland and Labrador determined through a review of the rankings provided by DOEC (DOEC 2010), Atlantic Canada Conservation Data Centre (ACCDC 2010), COSEWIC (2010), and those listed under the SARA and the NLESA. Although no federally or provincial designated plant species at risk were identified in the Study Area, a total of 22 other rare vascular plant species were found to be associated with wetland habitats during field surveys (ELC and Rare Plants) for the Project. All ELC vegetation types that are associated with wetland habitats were found to provide habitat for rare plants (Table 5.6). More detailed information on the occurrence of these species within the Study Area may be obtained with reference to the Rare Plant Survey and ELC reports which have been prepared for the Project.

All wetland habitats within the Study Area have potential to provide habitat for variety of rare vascular plants. As such, all wetlands within the Study Area are considered to contribute to this function, representing an area of 1,763 ha (Table 5.6).

Table 5.6 Wetland-related Rare Vascular Plants Identified within the Study Area and their Occurrence with ELC Wetland Vegetation Types

Common Name	Scientific Name	G-Rank	N-Rank	S-Rank	General Status	ELC Wetland Vegetation Types					
						Patterned Shrub Fen	Non-patterned Shrub Fen	Graminoid Fen	Riparian Marsh (Fen)	Tamarack / Black Spruce-Feathermoss	Black spruce / Tamarack-Sphagnum Woodland
green false hellebore	*Veratrum viride* var. *viride*	G5TNR	NNR	S1	May be at risk		✓			✓	✓
northern valerian	*Valeriana dioica* subsp. *sylvatica*	G5T4T5	N4N5	S1	-					✓	
tall northern green orchid	*Platanthera aquilonis*	G5	NNR	S2S3	May be at risk	✓	✓			✓	
chestnut sedge	*Carex castanea*	G5	N5	S1S2	May be at risk					✓	
inland sedge	*Carex interior*	G5	N5	S2S4	Undetermined		✓			✓	
lesser panicled sedge	*Carex diandra*	G5	NNR	S2S4	Undetermined				✓	✓	
spike muhly	*Muhlenbergia glomerata*	G5	N5		-		✓				
yellow sedge	*Carex flava*	G5	N5	SNA	Undetermined				✓	✓	
Buxbaum's sedge	*Carex buxbaumii*	G5	NNR	S2S4	Undetermined				✓		
hyssop-leaf fleabane	*Erigeron hyssopifolius*	G5	N5		-					✓	
swamp thistle	*Cirsium muticum*	G5	NNR	S2S4	Undetermined	✓	✓				
Lapland buttercup	*Coptidium lapponicum*	G5	NNR	S2S3	Sensitive			✓		✓	
variegated scouring rush	*Equisetum variegatum* var. *variegatum*	G5T5	NNR	S3	Sensitive		✓				
beautiful cottongrass	*Eriophorum callitrix*	G5	NNR	S2S4	Undetermined		✓				
toad rush	*Juncus bufonius* var. *bufonius*	G5T5	NNR	S2S4	Undetermined	✓					
American moor rush	*Juncus stygius* var. *americanus*	G5	NNR	S2S4	Undetermined			✓			
golden groundsel	*Packera aurea*	G5	NNR	S2S4	Undetermined					✓	

Common Name	Scientific Name	G-Rank	N-Rank	S-Rank	General Status	ELC Wetland Vegetation Types					
						Patterned Shrub Fen	Non-patterned Shrub Fen	Graminoid Fen	Riparian Marsh (Fen)	Tamarack / Black Spruce-Feathermoss	Black spruce / Tamarack-Sphagnum Woodland
Mistassini primrose	*Primula mistassinica*	G5	NNR	S2	Sensitive	✓	✓	✓		✓	
pink pyrola	*Pyrola asarifolia*	G5	NNR	S2S4	Undetermined					✓	
bog willow	*Salix pedicellaris*	G5	NNR	S2S4	Sensitive	✓	✓	✓	✓	✓	✓
purple false melic	*Schizachne purpurascens*	G5	NNR	S2S4	Undetermined				✓	✓	✓
red-tinged bulrush	*Scirpus microcarpus*	G5	NNR	S2S4	Undetermined	✓					
horned dandelion	*Taraxacum ceratophorum*	G5T5	N5	S3	Sensitive					✓	
Kotzebue's grass-of-parnassus	*Parnassia kotzebuei*	G5	N5	S3S4	Sensitive					✓	
sticky tofieldia	*Triantha glutinosa*	G4G5	NNR	S1S3	Undetermined	✓	✓	✓			

5.5.5 Socio-economic Value

Wetlands can provide a variety of social benefits, including those relating to educational, scientific, recreational, and economic opportunities. Information obtained from the land and resource use study prepared for the Project indicate that the region is used by aboriginal and non-aboriginal groups for a variety of purposes, including hunting, fishing, trapping, boating / water navigation, snowmobile and ATV use, skiing, wood harvesting (for firewood and saw-logs), berry picking, cabin use, outfitting, birding, and geo-caching. Evidence of human use of wetlands within the Study Area indicates that they are used for a variety of recreational purposes, but they may also currently serve other socio-economic interests. Wetlands close to human habitation are likely be accessed and used relatively more frequently than those that are remote. As a result of their remoteness, many of the wetlands within the Study Area may be considered to currently have low socio-economic value.

Evidence of human use of wetlands within the Study Area indicates that they are used for recreational purposes, including hunting, fishing, and ATV and snowmobile travel. Much of the wetland habitat within the Study Area has potential to be used for hunting purposes. Larger areas of lacustrine marsh or shore fen habitats are likely to be frequented most often, due to their greater capacity to provide habitat for waterfowl and the relative ease with which they may be accessed. Hunting activity at such sites was confirmed during field surveys by the presence of spent shotgun shells. Fen habitats that are not located next to waterbodies are likely to be only infrequently visited for such purposes, although those that contain large ponds would have greater capacity to support waterfowl. Wetlands located immediately adjacent to waterbodies or watercourses are also likely frequented for recreational fishing purposes. Evidence of recreation use, in the form of snowmobile and ATV trails, were present within wetlands throughout the Study Area, but were most prominent in locations next to human developments. Additionally, many areas around Wabush and Labrador City are known to be used for recreational purposes, including canoeing, kayaking, and hiking (Wabush 2009, Labrador City 2010) and wetland habitats within the Study Area have potential to contribute to these opportunities.

Much of the Study Area is within the Labrador City and Wabush Stewardship Zones and a number of specific municipal management areas, including Little Wabush Lake, Walsh River, Pike Lake North, Pike Lake South, Jean Lake Rapids, Elephant Head, Angel Lake, and Waldorf River Steady Management Units, are found within the boundaries of the Study Area (Figure 5.1). Wetlands habitats within these Management Units have been considered to provide valuable opportunities to raise awareness and educate visitors and residents about waterfowl within the community and the importance of wetlands (Wabush 2009, Labrador City 2010). Additionally, Duley Lake Provincial Park and Duley Park Private are located within the northwestern quadrant of the Study Area, and wetlands within their boundaries are likely to be used for a variety of recreational and educational purposes.

All wetlands within the Study Area have potential socio-economic value but no estimates of the likely contributing area of wetland habitat to this value have been made because of difficulties in basing such determinations on the types of classification data that have been collected. However, none of these aforementioned uses are considered unique or irreplaceable, and some are harmful to the integrity of other wetland functions. In particular, recreational usage has potential to physically disturb plant species of conservation concern and to effect wildlife usage through both sensory disturbance and direct mortality.

5.6 Summary

Wetlands within the Study Area were classified according to the criteria outlined in the Canadian Wetland Classification System (CWCS). The CWCS is a hierarchical system that incorporates three general levels of wetland features – class, form, and type (Warner and Rubec 1997). Wetland classes are based on the properties of the wetland that reflect their origin and the nature of the wetland environment. This level may be used to group wetlands at their most general scale, and include bog, fen, swamp, marsh, and shallow water designations. Wetland forms and subforms are subdivisions of each wetland class and are based on their morphology, surface pattern, water type, and the morphological characteristics of the underlying soil. Many wetland forms apply to more than one wetland class whereas others are more specific. Wetland types are further subdivisions of their forms and subforms and are based on the physiognomic characteristics of their vegetation communities (Warner and Rubec 1997).

A total of 265 wetlands were identified within the Study Area, accounting for an area of 1,763 ha or 9 percent its area. Two wetland classes (fen and marsh) and six wetland forms were identified within the Study Area. Whereas fens occupy the large majority of wetland habitat, marshes are limited in abundance, being restricted to the shorelines of certain waterbodies and watercourses. Wetland complexes (identified as wetlands which are comprised of three or more forms) are common. An atlas of delineated wetlands polygons within the Study Area, in addition to data on their classification and other characteristics, are provided in the Appendices of this report.

Fens are minerotrophic peat lands with fluctuating water levels (Warner and Rubec 1997). Surface water movement is common within fens and may be observed in channels or pools. Their vegetation is strongly influenced by water depth and chemistry and they may be dominated by graminoids, bryophytes, shrubs, and/or trees. Fens identified within the Study Area were primarily classified as slope and string (Atlantic Ribbed) fens, with shore and stream fens also present. Slope and string fens are characterized by many of the same species, with minerotrophic indicators being Newfoundland dwarf birch, mountain fly-honeysuckle, livid sedge, sweet gale, and rough-leaved aster common. Strongly minerotrophic wetland indicators were also prevalent, including shrubby cinquefoil, Canada burnet, star campylium moss, and limprichita moss. Mistassini primrose, low spike-moss, yellow cowlily, leafy white orchid, Scotch false asphodel, and sticky tofieldia occur sporadically in strongly-minerotrophic peatlands, and are rarely found in other peatlands.

Marshes are relatively uncommon within the Study Area, occurring most often along the shorelines of certain waterbodies and watercourses. These are typically mineral wetlands and are periodically inundated by standing or slow flowing water whose levels generally fluctuate seasonally. During drier periods declining water levels may expose areas of matted vegetation or mud flats. The surface waters are typically rich in nutrients. Although their substrate is usually mineral material, well-decomposed peat may occasionally be present. Marshes typically display zones or surface patterns consisting of pools or channels interspersed with patches of emergent vegetation, bordering wet meadows and peripheral bands of shrubs or trees (National Wetland Working Group 1997). Both lacustrine and riparian marsh forms were identified in the Study Area.

Wetlands play an important role in hydrological, ecological, and socioeconomic systems. For example, they have potential to support fishery resources, protect shorelines from erosion, improve water quality within watersheds, and to be used for resource harvesting of berries, waterfowl and other game, peat moss, and fuel peat. A landscape-level approach was taken to complete a functional assessment of wetlands within the Study Area, and involved the characterization of physical and structural wetland features which served as indicators of their potential functions and services. Wetland classification data and hydrogeomorphic descriptors were relied heavily on to evaluate wetland potential to provide a suite of functions: surface water detention, sediment and other particulate retention, streamflow maintenance, groundwater recharge, carbon sequestration and storage, shoreline stabilization, habitat for wildlife (including fish, waterfowl and other waterbirds, and species of conservation concern), and socio-economic value. The evaluation also incorporated information collected during field surveys and obtained from other environmental studies conducted for the Project. The approach was based largely on the methods of others (e.g., Tiner 2009; NSE 2011) but was tailored to the specific wetland types and probable functions performed by wetlands occurring within the Study Area.

6.0 INFORMATION SOURCES

6.1 Personal Communications

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APPENDIX A

Wetland Mapping of the Study Area

Figure A-1 Kami Wetlands Map Index

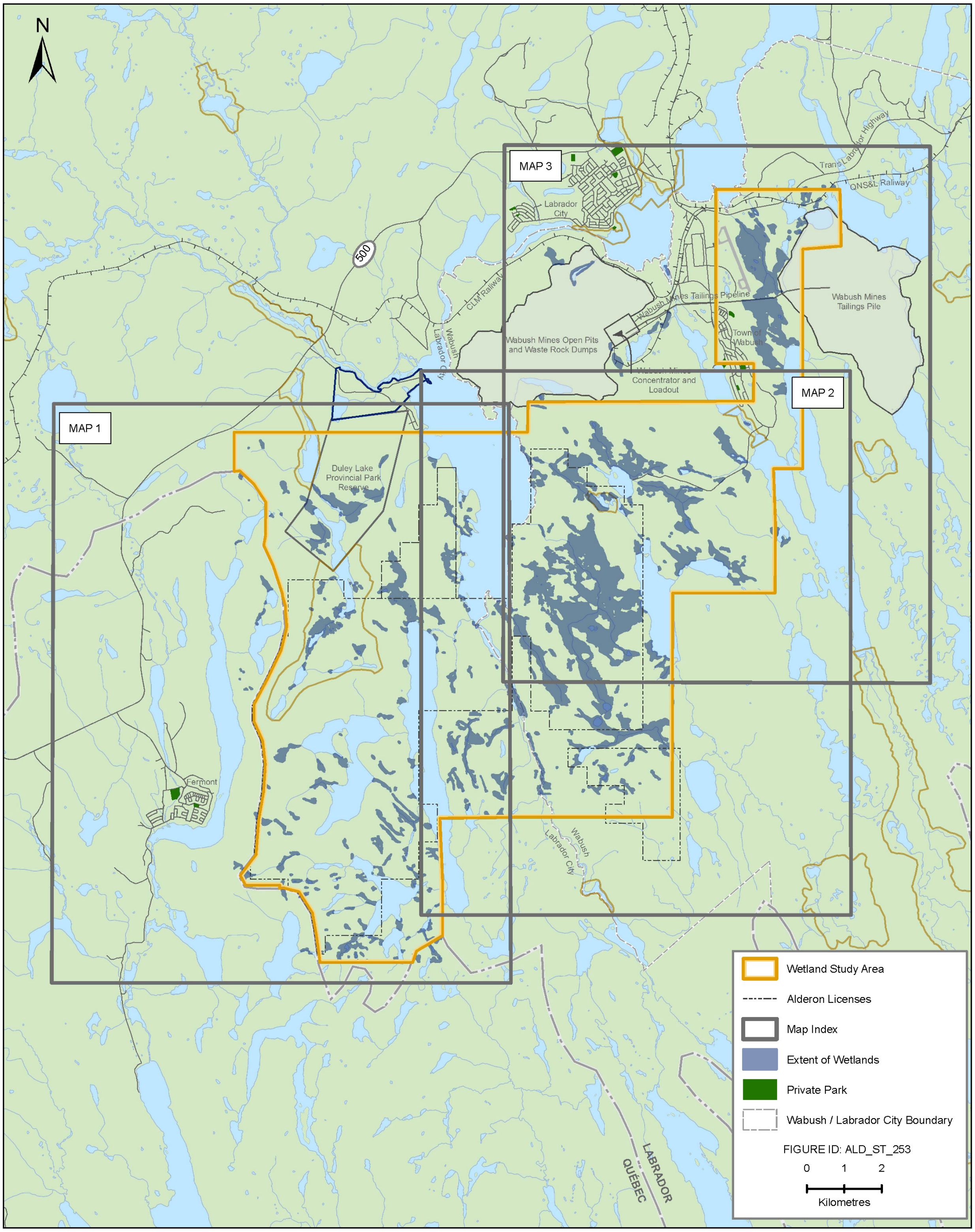


Figure A-2 Kami Wetlands Map #1

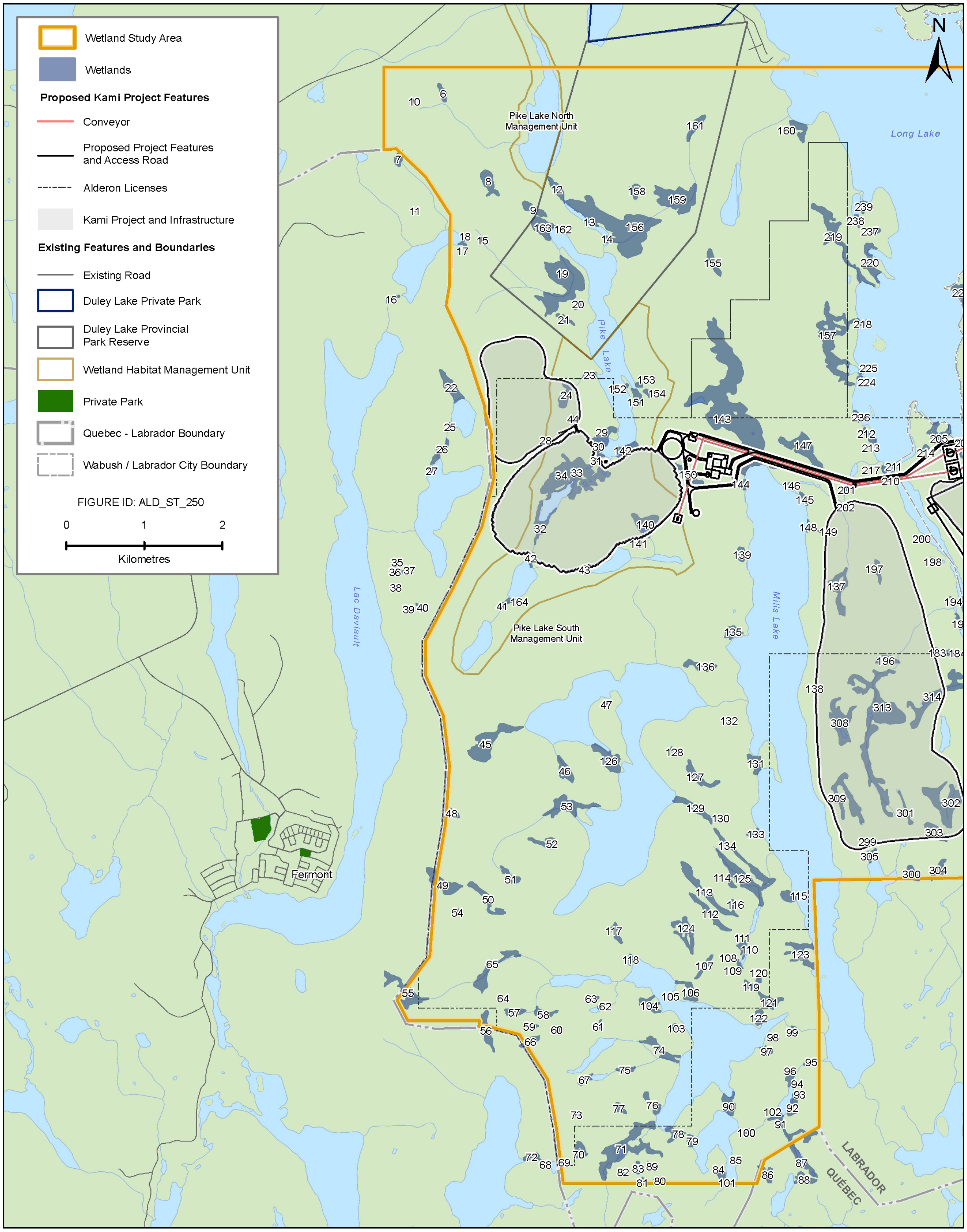


Figure A-3 Kami Wetlands Map #2

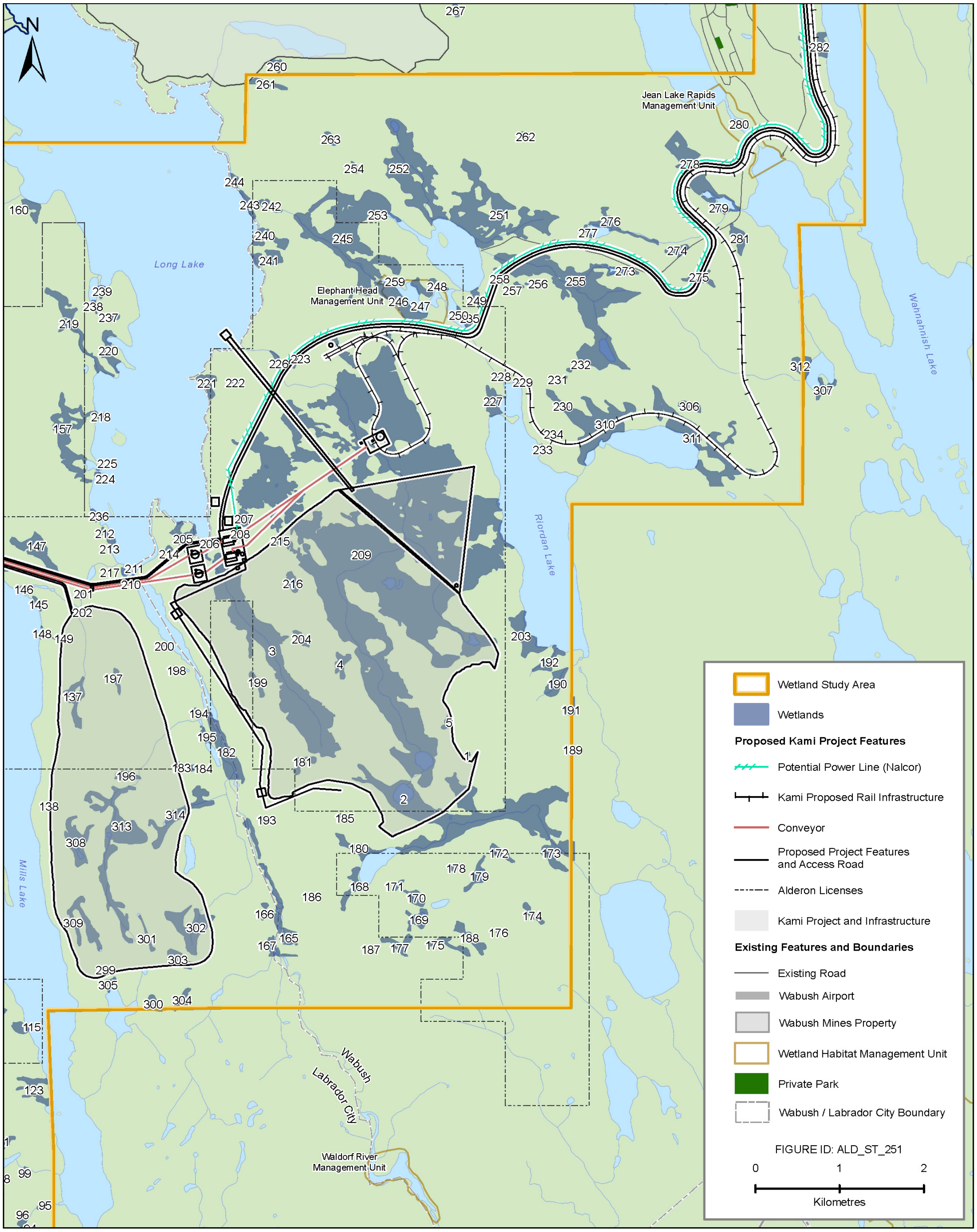
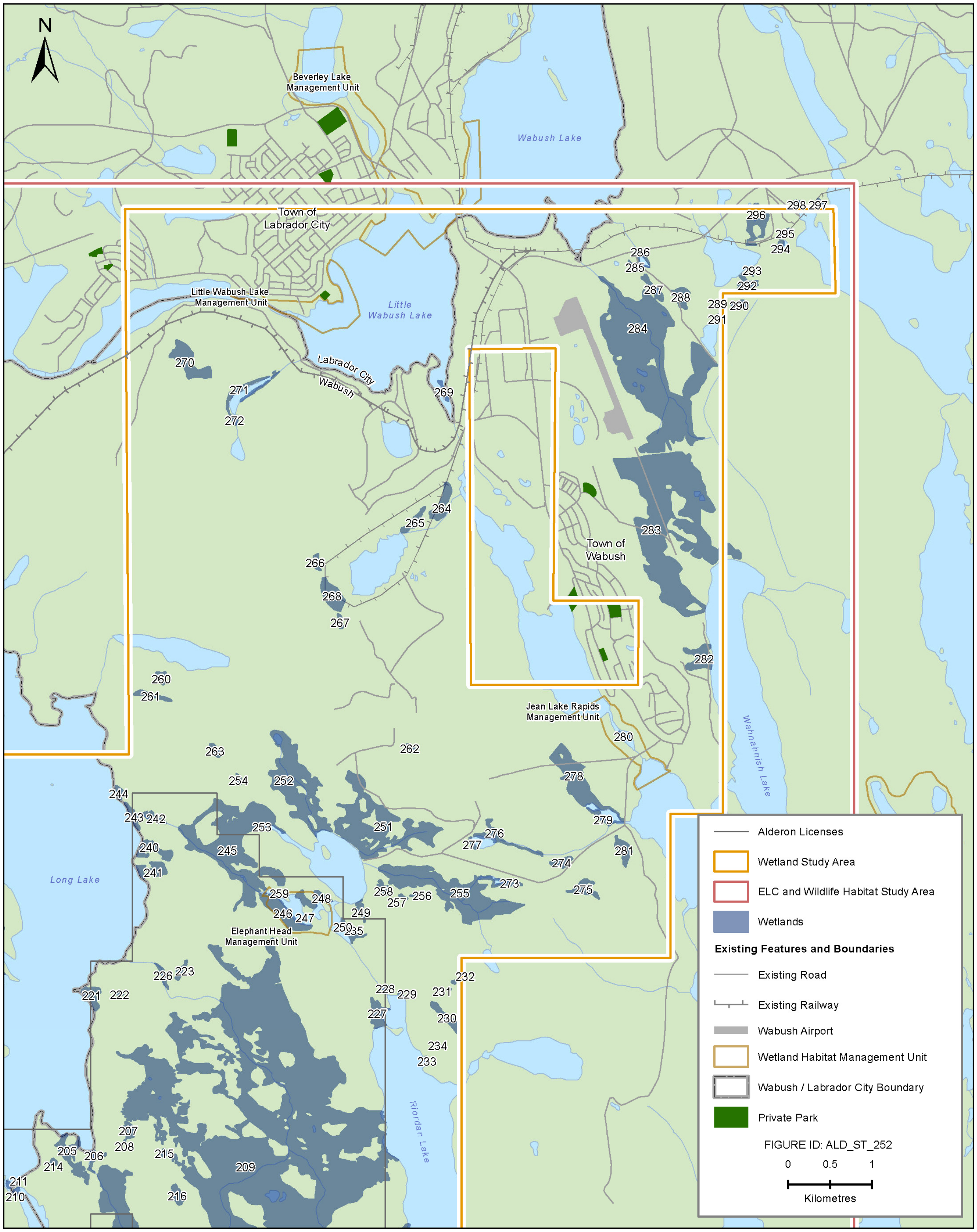


Figure A-4 Kami Wetlands Map #3



APPENDIX B

Area and Classification of Wetland Polygons within the Study Area

Table B1. Area and Classification of Each of the Delineated Wetland Polygons within the Study Area[1] Following the Canadian Wetland Classification System

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
1	100	Slope Fen	Shrub / Graminoid													0.19
2	30	Atlantic Ribbed Fen	Graminoid / Shrub	20	Slope Fen	Treed	10	Stream Fen	Treed	30	Slope Fen	Shrub / Graminoid	10	Slope Fen	Open Water	68.96
3	30	Stream Fen	Treed	60	Slope Fen	Graminoid / Shrub	10	Slope Fen	Treed							72.15
4	30	Slope Fen	Shrub / Graminoid	70	Slope Fen	Treed										2.51
5	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.75
6	80	Atlantic Ribbed Fen	Graminoid / Shrub	20	Atlantic Ribbed Fen	Treed										1.14
7	70	Slope Fen	Treed	10	Slope Fen	Shrub / Graminoid	20	Slope Fen	Open Water							1.23
8	90	Slope Fen	Graminoid / Shrub	10	Slope Fen	Treed										3.27
9	100	Atlantic Ribbed Fen	Treed													2.10
10	100	Slope Fen	Shrub / Graminoid													0.05
12	100	Stream Fen	Treed													2.02
13	100	Lacustrine Marsh (Shore Fen)	Graminoid													0.45
14	100	Shore Fen	Shrub / Graminoid													0.19
15	100	Slope Fen	Graminoid / Shrub													0.20
17	100	Slope Fen	Graminoid / Shrub													0.07
18	100	Slope Fen	Shrub / Graminoid													0.18

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
19	20	Lacustrine Marsh (Shore Fen)	Graminoid / Shrub	40	Slope Fen	Treed	30	Slope Fen	Shrub / Graminoid	10	Strea m Fen	Treed				18.68
20	20	Slope Fen	Graminoid	80	Slope Fen	Treed										0.61
21	20	Slope Fen	Graminoid / Shrub	80	Slope Fen	Treed										0.99
23	100	Stream Fen	Shrub / Graminoid													0.37
24	60	Slope Fen	Graminoid / Shrub	40	Slope Fen	Treed										2.87
28	100	Slope Fen	Shrub / Graminoid													0.33
29	100	Lacustrine Marsh (Shore Fen)	Graminoid													1.09
30	90	Slope Fen	Shrub / Graminoid	10	Slope Fen	Treed										2.90
31	50	Shore Fen	Graminoid / Shrub	50	Stream Fen	Shrub										0.38
32	60	Shore Fen	Graminoid	20	Stream Fen	Shrub	20	Slope Fen	Treed							2.82
33	50	Lacustrine Marsh (Shore Fen)	Graminoid	50	Stream Fen	Graminoid										2.14
34	50	Slope Fen	Shrub / Graminoid	30	Slope Fen	Treed	20	Slope Fen	Graminoid / Shrub							17.13
41	50	Stream Fen	Treed	50	Slope Fen	Treed										0.47
42	80	Stream Fen	Shrub	20	Stream Fen	Treed										0.61
43	100	Lacustrine Marsh (Shore Fen)	Shrub / Graminoid													0.18
44	100	Slope Fen	Shrub / Graminoid													0.12
45	30	Slope Fen	Graminoid / Shrub	40	Slope Fen	Treed	30	Slope Fen	Treed							9.89

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
46	60	Slope Fen	Shrub / Graminoid	40	Slope Fen	Treed										3.09
47	40	Slope Fen	Graminoid / Shrub	60	Slope Fen	Treed										0.13
48	50	Slope Fen	Graminoid / Shrub	50	Slope Fen	Treed										0.91
49	60	Slope Fen	Graminoid / Shrub	40	Slope Fen	Treed										5.53
50	40	Slope Fen	Graminoid / Shrub	60	Slope Fen	Treed										3.00
51	70	Slope Fen	Graminoid / Shrub	30	Slope Fen	Treed										1.56
52	50	Slope Fen	Graminoid / Shrub	50	Slope Fen	Treed										1.79
53	60	Slope Fen	Treed	30	Slope Fen	Shrub / Graminoid	10	Stream Fen	Treed							6.18
54	40	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed										0.24
55	10	Slope Fen	Graminoid	20	Atlantic Ribbed Fen	Graminoid / Shrub	40	Slope Fen	Treed	30	Slope Fen	Shrub / Graminoid				5.97
56	70	Slope Fen	Shrub / Graminoid	30	Slope Fen	Treed										2.96
57	80	Slope Fen	Graminoid	10	Slope Fen	Treed	10	Slope Fen	Open Water							1.53
58	40	Slope Fen	Graminoid	30	Slope Fen	Treed	30	Slope Fen	Open Water							1.61
59	100	Slope Fen	Graminoid / Shrub													0.17
60	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.44
61	40	Slope Fen	Graminoid	60	Slope Fen	Treed										0.49
62	100	Stream Fen	Treed													0.21
63	50	Slope Fen	Graminoid / Shrub	50	Slope Fen	Treed										0.59
64	100	Slope Fen	Shrub / Graminoid													0.15
65	30	Slope Fen	Shrub / Graminoid	40	Slope Fen	Treed	30	Stream Fen	Shrub							4.88
66	40	Slope Fen	Graminoid	30	Slope Fen	Treed	30	Slope Fen	Open Water							1.33

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
67	20	Lacustrine Marsh (Shore Fen)	Graminoid	70	Slope Fen	Treed	10	Stream Fen	Treed							0.86
69	40	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed										0.23
70	100	Slope Fen	Treed													1.37
71	20	Slope Fen	Graminoid	50	Slope Fen	Treed	20	Slope Fen	Shrub / Graminoid	10	Slope Fen	Open Water				13.17
73	100	Slope Fen	Treed													0.15
74	90	Slope Fen	Treed	10	Slope Fen	Shrub / Graminoid										2.86
75	60	Slope Fen	Graminoid / Shrub	40	Slope Fen	Treed										0.79
76	100	Slope Fen	Treed													1.49
77	100	Slope Fen	Treed													0.94
78	40	Slope Fen	Graminoid / Shrub	60	Slope Fen	Treed										1.62
79	100	Slope Fen	Treed													0.69
80	70	Slope Fen	Graminoid / Shrub	30	Slope Fen	Treed										0.52
81	60	Slope Fen	Graminoid / Shrub	40	Slope Fen	Treed										0.27
82	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.07
83	30	Slope Fen	Graminoid / Shrub	70	Slope Fen	Open Water										0.74
84	100	Slope Fen	Treed													0.96
85	100	Slope Fen	Treed													0.28
86	60	Slope Fen	Graminoid / Shrub	40	Slope Fen	Treed										1.39
87	40	Slope Fen	Graminoid	20	Slope Fen	Shrub / Graminoid	40	Slope Fen	Treed							5.08
89	100	Slope Fen	Treed													0.33
90	40	Atlantic Ribbed Fen	Graminoid / Shrub	60	Slope Fen	Treed										2.68
91	50	Slope Fen	Shrub / Graminoid	50	Stream Fen	Treed										1.03
92	100	Slope Fen	Treed													1.15

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
93	100	Lacustrine Marsh (Shore Fen)	Graminoid													0.22
94	100	Lacustrine Marsh (Shore Fen)	Graminoid / Shrub													0.18
95	80	Slope Fen	Treed	20	Slope Fen	Shrub / Graminoid										0.53
96	90	Slope Fen	Treed	10	Stream Fen	Treed										0.82
97	80	Slope Fen	Graminoid / Shrub	20	Slope Fen	Treed										1.05
98	70	Slope Fen	Graminoid / Shrub	30	Slope Fen	Treed										0.38
99	100	Slope Fen	Treed													0.50
100	100	Slope Fen	Treed													0.27
101	100	Lacustrine Marsh (Shore Fen)	Graminoid / Shrub													0.05
102	100	Lacustrine Marsh (Shore Fen)	Graminoid													0.11
103	30	Slope Fen	Shrub / Graminoid	70	Slope Fen	Treed										0.55
104	40	Slope Fen	Graminoid / Shrub	40	Slope Fen	Treed	20	Slope Fen	Treed							1.91
105	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.05
106	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										2.14
107	100	Slope Fen	Treed													1.17
108	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.31
109	100	Lacustrine Marsh (Shore Fen)	Graminoid													0.06

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
110	100	Lacustrine Marsh (Shore Fen)	Graminoid													0.13
111	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.80
112	100	Slope Fen	Treed													2.83
113	20	Atlantic Ribbed Fen	Graminoid / Shrub	80	Slope Fen	Treed										5.54
114	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.53
115	20	Slope Fen	Shrub / Graminoid	80	Slope Fen	Treed										1.73
116	30	Slope Fen	Shrub / Graminoid	70	Slope Fen	Treed										0.42
117	60	Slope Fen	Shrub / Graminoid	40	Slope Fen	Treed										1.15
118	100	Slope Fen	Treed													0.42
119	40	Slope Fen	Graminoid	30	Slope Fen	Treed	30	Slope Fen	Open Water							0.84
120	100	Slope Fen	Treed													0.32
121	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										1.99
122	20	Slope Fen	Shrub / Graminoid	80	Slope Fen	Treed										1.45
123	100	Slope Fen	Treed													4.02
124	100	Slope Fen	Treed													3.86
125	10	Atlantic Ribbed Fen	Graminoid / Shrub	40	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed							10.59
126	60	Atlantic Ribbed Fen	Graminoid / Shrub	20	Slope Fen	Shrub / Graminoid	20	Slope Fen	Treed							5.20
127	50	Atlantic Ribbed Fen	Graminoid / Shrub	50	Slope Fen	Treed										2.83
128	100	Slope Fen	Shrub / Graminoid													0.44
129	30	Slope Fen	Graminoid / Shrub	70	Slope Fen	Treed										2.91

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
130	50	Slope Fen	Graminoid	50	Slope Fen	Treed										0.32
131	20	Slope Fen	Shrub / Graminoid	80	Slope Fen	Treed										2.02
132	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.17
133	100	Slope Fen	Treed													1.14
134	100	Stream Fen	Treed													1.32
135	40	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed										1.98
136	40	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed										2.36
137	100	Slope Fen	Treed													4.24
138	100	Slope Fen	Graminoid / Shrub													0.22
139	30	Slope Fen	Shrub / Graminoid	70	Slope Fen	Treed										1.39
140	20	Slope Fen	Treed	80	Atlantic Ribbed Fen	Graminoid / Shrub										5.08
141	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.28
142	40	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed										2.10
143	10	Atlantic Ribbed Fen	Graminoid / Shrub	30	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed	10	Slope Fen	Graminoid				55.47
144	40	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed										1.41
145	70	Slope Fen	Graminoid / Shrub	30	Slope Fen	Treed										0.57
146	100	Slope Fen	Treed													0.40
147	100	Slope Fen	Treed													8.08
148	100	Slope Fen	Treed													0.32
149	100	Slope Fen	Treed													0.16
150	30	Atlantic Ribbed Fen	Graminoid / Shrub	20	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed							2.04
151	100	Slope Fen	Shrub / Graminoid													1.27

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
152	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.08
153	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.31
154	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.49
155	70	Slope Fen	Graminoid / Shrub	30	Slope Fen	Treed										1.87
156	20	Atlantic Ribbed Fen	Graminoid / Shrub	50	Slope Fen	Shrub / Graminoid	30	Slope Fen	Treed							29.37
157	100	Slope Fen	Treed													13.89
158	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										1.85
159	10	Atlantic Ribbed Fen	Graminoid / Shrub	30	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed							11.41
160	50	Slope Fen	Graminoid / Shrub	50	Slope Fen	Treed										2.24
161	40	Slope Fen	Graminoid / Shrub	60	Slope Fen	Treed										2.12
162	100	Lacustrine Marsh (Shore Fen)	Graminoid / Shrub													0.17
163	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										4.28
164	100	Shore Fen	Shrub / Graminoid													0.31
165	30	Stream Fen	Graminoid	20	Slope Fen	Shrub / Graminoid	50	Riparian Thicket	Shrub							7.14
166	40	Slope Fen	Open Water	20	Slope Fen	Treed	40	Slope Fen	Shrub							0.64
167	30	Stream Fen	Graminoid	70	Riparian Thicket	Shrub										1.79
168	40	Slope Fen	Graminoid / Shrub	60	Slope Fen	Treed										3.34
169	30	Slope Fen	Treed	20	Slope Fen	Graminoid / Shrub	50	Slope Fen	Open Water							3.03
170	60	Slope Fen	Graminoid / Shrub	20	Slope Fen	Treed	20	Slope Fen	Open Water							2.41

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
171	60	Slope Fen	Graminoid / Shrub	40	Slope Fen	Open Water										0.52
172	70	Slope Fen	Treed	30	Slope Fen	Shrub / Graminoid										2.03
173	40	Slope Fen	Shrub / Graminoid	10	Stream Fen	Treed	50	Slope Fen	Treed							7.38
174	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										1.25
175	100	Slope Fen	Treed													1.97
176	100	Slope Fen	Shrub / Graminoid													0.06
177	60	Slope Fen	Graminoid / Shrub	40	Stream Fen	Treed										2.60
178	70	Slope Fen	Shrub / Graminoid	30	Slope Fen	Treed										0.69
179	60	Slope Fen	Treed	40	Slope Fen	Open Water										2.85
180	40	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed										3.84
181	80	Slope Fen	Shrub / Graminoid	20	Slope Fen	Treed										1.57
182	40	Slope Fen	Shrub / Graminoid	30	Stream Fen	Graminoid / Shrub	20	Stream Fen	Treed	10	Slope Fen	Treed				11.19
183	40	Slope Fen	Graminoid / Shrub	60	Slope Fen	Treed										0.46
184	100	Slope Fen	Treed													0.21
185	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.40
186	100	Slope Fen	Graminoid / Shrub													0.11
187	100	Slope Fen	Shrub / Graminoid													0.25
188	70	Slope Fen	Treed	30	Slope Fen	Shrub / Graminoid										2.92
189	100	Slope Fen	Shrub / Graminoid													0.32
190	40	Slope Fen	Treed	40	Slope Fen	Shrub / Graminoid	20	Stream Fen	Treed							4.42
191	40	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed										1.23
192	60	Slope Fen	Treed	40	Slope Fen	Shrub / Graminoid										2.60

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
193	40	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed										0.57
194	100	Shore Fen	Graminoid													0.28
195	100	Shore Fen	Graminoid													0.54
196	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										1.70
197	100	Slope Fen	Shrub / Graminoid													1.00
198	40	Slope Fen	Graminoid	60	Slope Fen	Open Water										0.26
199	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										1.28
200	100	Slope Fen	Shrub / Graminoid													0.04
201	50	Stream Fen	Treed	50	Stream Fen	Shrub / Graminoid										0.05
202	100	Slope Fen	Treed													0.07
203	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										7.71
204	60	Slope Fen	Graminoid / Shrub	40	Slope Fen	Treed										1.25
205	10	Atlantic Ribbed Fen	Graminoid / Shrub	30	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed							6.36
206	20	Slope Fen	Treed	30	Stream Fen	Treed	50	Stream Fen	Shrub							1.39
207	60	Slope Fen	Shrub / Graminoid	40	Slope Fen	Treed										1.68
208	100	Slope Fen	Shrub / Graminoid													0.09
209	30	Slope Fen	Graminoid	20	Atlantic Ribbed Fen	Graminoid / Shrub	10	Stream Fen	Treed	20	Slope Fen	Treed	20	Slope Fen	Shrub / Grami noid	517.3 6
210	100	Lacustrine Marsh (Shore Fen)	Graminoid													0.36
211	100	Lacustrine Marsh (Shore Fen)	Forb													0.19

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
212	100	Slope Fen	Graminoid													0.44
213	100	Slope Fen	Treed													0.40
214	100	Slope Fen	Treed													0.49
215	100	Slope Fen	Treed													0.44
216	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										2.06
217	100	Shore Fen	Shrub / Graminoid													0.06
218	100	Shore Fen	Shrub / Graminoid													0.28
219	60	Slope Fen	Treed	30	Stream Fen	Treed	10	Slope Fen	Shrub / Graminoid							7.32
220	30	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed	10	Stream Fen	Shrub / Graminoid							3.22
221	10	Stream Fen	Treed	40	Slope Fen	Graminoid / Shrub	30	Slope Fen	Treed	20	Slope Fen	Shrub / Graminoid				2.88
222	100	Stream Fen	Treed													0.16
223	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.88
224	90	Shore Fen	Shrub / Graminoid	10	Lacustrine Marsh (Shore Fen)	Graminoid										0.12
225	100	Shore Fen	Shrub / Graminoid													0.07
226	100	Stream Fen	Treed													0.94
227	60	Slope Fen	Shrub / Graminoid	40	Slope Fen	Treed										4.10
228	30	Stream Fen	Graminoid	60	Slope Fen	Treed	10	Stream fen	Forb							0.40
229	100	Slope Fen	Graminoid / Shrub													0.12
231	100	Slope Fen	Shrub / Graminoid													0.06
232	100	Slope Fen	Shrub / Graminoid													0.15
233	30	Slope Fen	Shrub / Graminoid	70	Slope Fen	Treed										0.40

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
234	40	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed										0.18
235	20	Lacustrine Marsh (Shore Fen)	Shrub / Graminoid	80	Slope Fen	Treed										2.08
236	100	Slope Fen	Treed													0.77
237	100	Slope Fen	Treed													0.59
238	20	Slope Fen	Graminoid / Shrub	80	Slope Fen	Treed										0.26
239	50	Slope Fen	Graminoid	20	Slope Fen	Shrub / Graminoid	30	Slope Fen	Treed							0.55
240	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										3.97
241	50	Atlantic Ribbed Fen	Graminoid / Shrub	50	Slope Fen	Treed										3.37
242	50	Stream Fen	Treed	50	Slope Fen	Shrub / Graminoid										1.58
243	20	Stream Fen	Treed	80	Slope Fen	Treed										1.60
244	100	Slope Fen	Treed													0.87
245	20	Stream Fen	Treed	30	Atlantic Ribbed Fen	Graminoid / Shrub	30	Slope Fen	Shrub / Graminoid	20	Slope Fen	Treed				51.55
246	30	Atlantic Ribbed Fen	Graminoid / Shrub	30	Slope Fen	Shrub / Graminoid	40	Slope Fen	Treed							8.08
247	100	Lacustrine Marsh (Shore Fen)	Graminoid													0.12
248	40	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed										3.71
249	30	Slope Fen	Open Water	70	Slope Fen	Treed										1.04
250	100	Lacustrine Marsh (Shore Fen)	Graminoid													0.13

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
251	10	Atlantic Ribbed Fen	Graminoid / Shrub	10	Slope Fen	Shrub / Graminoid	80	Slope Fen	Treed							38.52
252	30	Atlantic Ribbed Fen	Graminoid / Shrub	20	Stream Fen	Treed	20	Slope Fen	Shrub / Graminoid	20	Slope Fen	Treed	10	Slope Fen	Grami noid	32.58
253	100	Lacustrine Marsh (Shore Fen)	Graminoid													0.67
254	100	Slope Fen	Treed													0.51
255	30	Atlantic Ribbed Fen	Graminoid / Shrub	20	Stream Fen	Treed	20	Slope Fen	Shrub / Graminoid	30	Slope Fen	Treed				57.52
256	50	Slope Fen	Shrub / Graminoid	50	Slope Fen	Treed										0.14
257	30	Slope Fen	Shrub / Graminoid	70	Slope Fen	Treed										0.26
258	100	Slope Fen	Treed													1.25
259	100	Shore Fen	Treed													0.13
261	10	Slope Fen	Open Water	20	Slope Fen	Shrub / Graminoid	70	Stream Fen	Treed							1.62
262	100	Slope Fen	Treed													0.64
263	100	Slope Fen	Shrub / Graminoid													1.00
273	100	Lacustrine Marsh (Shore Fen)	Shrub / Graminoid													1.32
274	30	Slope Fen	Shrub / Graminoid	70	Slope Fen	Treed										1.55
275	50	Slope Fen	Graminoid / Shrub	50	Slope Fen	Treed										2.68
276	20	Stream Fen	Treed	40	Slope Fen	Shrub / Graminoid	40	Slope Fen	Treed							3.37
277	100	Lacustrine Marsh (Shore Fen)	Shrub / Graminoid													0.50

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
278	10	Atlantic Ribbed Fen	Graminoid / Shrub	10	Slope Fen	Shrub / Graminoid	80	Slope Fen	Treed							14.74
279	100	Lacustrine Marsh (Shore Fen)	Graminoid / Shrub													2.73
280	60	Stream Fen	Graminoid / Shrub	10	Stream Fen	Treed	30	Riparian thicket	Shrub							0.37
281	50	Slope Fen	Graminoid / Shrub	50	Slope Fen	Treed										3.18
282	30	Slope Fen	Shrub / Graminoid	70	Slope Fen	Treed										6.11
283	40	Atlantic Ribbed Fen	Graminoid / Shrub	20	Slope Fen	Shrub / Graminoid	40	Slope Fen	Treed							107.9 4
284	50	Atlantic Ribbed Fen	Graminoid / Shrub	30	Slope Fen	Treed	20	Slope Fen	Shrub / Graminoid							114.1 4
285	20	Slope Fen	Open Water	80	Slope Fen	Shrub / Graminoid										0.92
286	100	Shore Fen	Treed													0.74
287	40	Atlantic Ribbed Fen	Graminoid / Shrub	20	Slope Fen	Open Water	10	Shore Fen	Graminoid	30	Slope Fen	Treed				2.19
288	100	Slope Fen	Treed													3.03
289	30	Slope Fen	Open Water	70	Slope Fen	Shrub										0.40
290	20	Slope Fen	Open Water	80	Slope Fen	Treed										1.18
291	40	Slope Fen	Shrub / Graminoid	60	Slope Fen	Treed										0.61
292	10	Slope Fen	Open Water	90	Slope Fen	Treed										2.40
293	100	Slope Fen	Treed													0.08
294	100	Shore Fen	Treed													0.71
295	50	Slope Fen	Treed	50	Slope Fen	Shrub										0.80
296	30	Atlantic Ribbed Fen	Graminoid / Shrub	10	Atlantic Ribbed Fen	Open Water	20	Slope Fen	Shrub / Graminoid	40	Slope Fen	Treed				5.35
297	100	Slope Fen	Treed													1.04
298	100	Slope Fen	Treed													0.67

Wetland Polygon ID	Wetland Type 1			Wetland Type 2			Wetland Type 3			Wetland Type 4			Wetland Type 5			Area (ha)
	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	%	Form	Type	
299	100	Slope Fen	Shrub / Graminoid													0.48
300	100	Slope Fen	Shrub / Graminoid													1.40
301	100	Stream Fen	Treed													0.63
302	100	Slope Fen	Treed													11.40
303	100	Slope Fen	Treed													3.11
304	100	Slope Fen	Treed													1.76
305	100	Lacustrine Marsh (Shore Fen)	Graminoid / Shrub													0.87
306	100	Slope Fen	Treed													1.46
308	60	Slope Fen	Shrub / Graminoid	30	Slope Fen	Treed	10	Slope Fen	Open Water							7.84
309	50	Atlantic Ribbed Fen	Graminoid / Shrub	50	Slope Fen	Treed										6.25
310	20	Slope Fen	Graminoid	70	Slope Fen	Treed	10	Slope Fen	Open Water							25.67
311	30	Slope Fen	Treed	20	Atlantic Ribbed Fen	Graminoid / Shrub	50	Slope Fen	Shrub / Graminoid							24.89
312	100	Slope Fen	Treed													3.55
313	70	Slope Fen	Treed	20	Slope Fen	Shrub / Graminoid	10	Slope Fen	Open Water							24.08
314	80	Slope Fen	Treed	20	Slope Fen	Shrub / Graminoid										8.85

[1]Some additional wetlands were delineated and characterized outside of the Study Area but are not presented here

APPENDIX C

Hydrogeomorphic Descriptors and Information on Proximity to Water Features for Wetland Polygons within the Study Area

Table C1. Hydrogeomorphic Descriptors and Information on Proximity to Water Features for Wetland Polygons within the Study Area[1]

Wetland Polygon ID	Complex?	Complex Number	Landscape Position	Landform	Water Flow Path	Stream Order	Borders Lake?	Comments
1	No		Terrene	Slope	Outflow (undefined)	n/a	No	
2	Yes		Terrene Pond	Flat / Slope	Outflow (channel)	1	No	contains pond
3	Yes		Terrene	Slope	Throughflow	1	No	
4	No		Terrene	Slope	Outflow (undefined)	n/a	No	
5	No		Terrene	Slope	Outflow (undefined)	n/a	No	
6	No		Terrene Pond	Slope	Outflow (undefined)	n/a	No	
7	No		Terrene Pond	Slope / Basin	Outflow (channel)	1	No	
8	No		Terrene	Slope	Outflow (undefined)	n/a	No	
9	No		Terrene	Slope	Outflow (undefined)	n/a	No	
10	No		Terrene	Basin	Isolate	n/a	No	
12	No		Lotic (stream)	Flat	Throughflow	3	Yes	
13	Yes	7	Lentic	Fringe	Bidirectional Nontidal	n/a	Yes	
14	No		Lentic and Lotic (river)	Island	Throughflow	3	Yes	Waldorf River
15	No		Terrene	Basin	Outflow (channel)	1	No	
17	No		Terrene Pond	Basin	Isolate	n/a	Yes	
18	No		Terrene	Basin	Outflow (undefined)	n/a	Yes	
19	Yes		Terrene	Flat / Slope	Throughflow	2	No	
20	No		Terrene	Slope / Basin	Outflow (undefined)	n/a	No	
21	No		Terrene	Slope	Outflow (undefined)	n/a	No	
23	No		Lentic and Lotic (stream)	Fringe	Throughflow	1	Yes	
24	No		Terrene	Slope	Outflow (channel)	1	No	
28	No		Terrene	Basin	Outflow (undefined)	n/a	No	
29	Yes	9	Lentic	Fringe	Throughflow and Bidirectional Nontidal	2	Yes	

Wetland Polygon ID	Complex?	Complex Number	Landscape Position	Landform	Water Flow Path	Stream Order	Borders Lake?	Comments
30	Yes	9	Terrene	Slope	Outflow (channel)	2	Yes	
31	No		Lentic and Lotic (stream)	Fringe	Throughflow and Bidirectional Nontidal	2	Yes	
32	Yes		Lentic and Lotic (stream)	Fringe	Throughflow and Bidirectional Nontidal	2	Yes	
33	Yes	10	Lentic and Lotic (stream)	Fringe	Throughflow and Bidirectional Nontidal	2	Yes	
34	Yes	10	Terrene	Flat / Slope	Outflow (channel)	2	Yes	
41	Yes	11	Terrene	Slope	Throughflow	1	No	
42	No		Lentic and Lotic (stream)	Fringe	Throughflow	2	Yes	
43	No		Lentic and Lotic (stream)	Fringe	Throughflow and Bidirectional Nontidal	1	Yes	
44	No		Terrene	Basin	Outflow (undefined)	n/a	No	
45	No		Terrene	Slope	Outflow (undefined)	n/a	No	
46	No		Terrene	Basin	Outflow (channel)	1	No	
47	No		Terrene	Basin	Outflow (undefined)	n/a	No	
48	No		Terrene	Slope	Isolate	n/a	No	
49	No		Terrene	Slope	Outflow (undefined)	n/a	No	
50	Yes		Terrene Pond	Slope / Basin	Throughflow	n/a	No	
51	No		Terrene	Basin	Outflow (channel)	1	No	
52	No		Terrene	Basin	Outflow (undefined)	n/a	No	
53	Yes		Terrene	Slope	Throughflow	1	No	outflow to lake
54	No		Terrene	Basin	Isolate	n/a	No	
55	Yes		Terrene	Slope / Basin	Outflow (channel)	1	No	
56	No		Terrene	Slope	Outflow (undefined)	n/a	No	
57	No		Terrene Pond	Basin	Outflow (channel)	1	No	
58	No		Terrene Pond	Basin	Outflow (channel)	1	No	
59	No		Terrene	Basin	Outflow (undefined)	n/a	No	
60	No		Terrene	Slope	Throughflow	n/a	No	

Wetland Polygon ID	Complex?	Complex Number	Landscape Position	Landform	Water Flow Path	Stream Order	Borders Lake?	Comments
61	No		Terrene	Basin	Outflow (undefined)	n/a	No	
62	No		Terrene	Slope	Throughflow	1	Yes	
63	No		Terrene	Basin	Outflow (undefined)	n/a	No	
64	No		Terrene	Basin	Outflow (undefined)	n/a	No	
65	Yes		Terrene	Slope	Throughflow	1	No	
66	No		Terrene Pond	Basin	Outflow (undefined)	n/a	No	
67	Yes		Lentic and Lotic (stream)	Slope / Basin	Throughflow	1	Yes	Stream not visible on map
69	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
70	No		Terrene	Slope	Outflow (undefined)	n/a	No	
71	Yes		Terrene Pond	Slope / Basin	Throughflow	1	No	
73	No		Terrene	Basin	Isolate	n/a	No	
74	No		Terrene	Slope	Throughflow	1	No	
75	Yes		Terrene Pond	Slope / Basin	Throughflow	1	No	
76	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
77	No		Terrene	Slope	Outflow (undefined)	n/a	No	
78	Yes		Terrene	Slope / Basin	Isolate	n/a	Yes	
79	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
80	No		Terrene Pond	Basin	Outflow (undefined)	n/a	No	
81	No		Terrene	Slope	Outflow (undefined)	n/a	No	
82	No		Terrene	Basin	Isolate	n/a	No	
83	No		Terrene Pond	Basin	Outflow (undefined)	n/a	No	
84	Yes	2	Terrene	Slope	Outflow (channel)	1	Yes	
85	No		Terrene	Slope	Throughflow	n/a	No	
86	No		Terrene	Slope	Outflow (undefined)	n/a	No	
87	Yes		Terrene	Slope / Basin	Outflow (channel)	1	No	
89	No		Terrene	Slope	Outflow (undefined)	n/a	No	

Wetland Polygon ID	Complex?	Complex Number	Landscape Position	Landform	Water Flow Path	Stream Order	Borders Lake?	Comments
90	Yes		Terrene	Slope	Outflow (undefined)	n/a	Yes	
91	Yes	3	Terrene	Flat / Slope	Throughflow	1	No	
92	Yes	4	Terrene	Slope	Outflow (undefined)	n/a	No	
93	Yes	4	Lentic	Fringe	Bidirectional Nontidal	n/a	Yes	
94	Yes	1	Lentic and Lotic (stream)	Fringe	Throughflow and Bidirectional Nontidal	2	Yes	
95	No		Terrene	Flat	Throughflow	2	Yes	
96	Yes	1	Terrene	Slope	Throughflow	2	Yes	
97	No		Terrene	Flat	Outflow (undefined)	n/a	Yes	
98	No		Terrene	Slope	Outflow (undefined)	n/a	No	
99	No		Terrene	Slope	Throughflow	3	No	
100	No		Terrene	Slope	Throughflow	1	No	
101	Yes	2	Lentic and Lotic (stream)	Fringe	Throughflow and Bidirectional Nontidal	1	Yes	
102	Yes	3	Lentic	Fringe	Throughflow and Bidirectional Nontidal	1	Yes	
103	No		Terrene	Slope	Outflow (undefined)	n/a	No	
104	Yes		Terrene	Slope / Basin	Outflow (undefined)	n/a	No	
105	No		Terrene	Flat	Outflow (undefined)	n/a	Yes	
106	No		Terrene	Flat	Outflow (undefined)	n/a	Yes	
107	No		Terrene	Slope	Throughflow	n/a	No	
108	Yes	5	Terrene	Flat	Outflow (channel)	1	Yes	
109	Yes	5	Lentic and Lotic (stream)	Fringe	Throughflow and Bidirectional Nontidal	1	Yes	
110	Yes	6	Lentic and Lotic (stream)	Fringe	Throughflow and Bidirectional Nontidal	1	Yes	
111	Yes	6	Terrene	Slope	Outflow (channel)	1	Yes	
112	No		Terrene	Slope	Outflow (undefined)	n/a	No	
113	Yes		Terrene	Slope	Outflow (undefined)	n/a	No	
114	No		Terrene	Slope	Outflow (undefined)	n/a	No	

Wetland Polygon ID	Complex?	Complex Number	Landscape Position	Landform	Water Flow Path	Stream Order	Borders Lake?	Comments
115	No		Terrene	Flat	Outflow (undefined)	n/a	Yes	
116	No		Terrene	Slope	Outflow (undefined)	n/a	No	
117	No		Terrene	Flat	Outflow (undefined)	n/a	No	
118	No		Terrene	Flat	Outflow (undefined)	n/a	Yes	
119	No		Terrene Pond	Basin	Outflow (undefined)	n/a	No	
120	No		Terrene	Flat	Outflow (undefined)	n/a	No	
121	No		Terrene	Flat	Outflow (undefined)	n/a	No	
122	No		Terrene	Flat	Outflow (undefined)	n/a	Yes	
123	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
124	No		Terrene	Slope	Outflow (undefined)	n/a	No	
125	Yes		Terrene	Slope	Throughflow	1	No	
126	Yes		Terrene	Flat / Slope	Outflow (undefined)	n/a	Yes	
127	Yes		Terrene	Flat / Slope	Outflow (undefined)	n/a	No	
128	No		Terrene	Slope	Isolate	n/a	No	
129	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
130	No		Terrene	Basin	Outflow (undefined)	n/a	No	
131	No		Terrene	Flat	Outflow (undefined)	n/a	Yes	
132	No		Terrene	Flat	Isolate	n/a	No	
133	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
134	No		Terrene	Flat	Outflow (channel)	2	No	
135	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
136	No		Terrene	Flat / Slope	Outflow (undefined)	n/a	No	
137	No		Terrene	Slope	Outflow (channel)	1	No	
138	No		Terrene Pond	Basin	Outflow (undefined)	n/a	No	
139	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
140	Yes		Terrene Pond	Slope / Basin	Outflow (channel)	1	No	

Wetland Polygon ID	Complex?	Complex Number	Landscape Position	Landform	Water Flow Path	Stream Order	Borders Lake?	Comments
141	No		Terrene	Basin	Outflow (undefined)	n/a	No	
142	No		Terrene Pond	Flat	Outflow (undefined)	n/a	Yes	
143	Yes		Terrene Pond	Flat / Slope	Outflow (undefined)	n/a	Yes	
144	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
145	No		Terrene Pond	Basin	Outflow (undefined)	n/a	Yes	
146	No		Terrene	Flat	Throughflow	3	Yes	
147	No		Terrene	Slope	Outflow (undefined)	n/a	No	
148	No		Terrene	Flat	Outflow (undefined)	n/a	Yes	
149	No		Terrene	Slope	Outflow (undefined)	n/a	No	
150	Yes		Terrene	Slope	Outflow (undefined)	n/a	No	
151	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
152	No		Terrene	Flat	Outflow (undefined)	n/a	Yes	
153	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
154	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
155	No		Terrene	Slope	Outflow (undefined)	n/a	No	
156	Yes	7	Terrene	Slope	Throughflow	1	Yes	
157	No		Terrene	Slope	Outflow (channel)	1	Yes	Stream not visible on map
158	No		Terrene	Slope	Outflow (undefined)	n/a	No	
159	Yes		Terrene	Slope	Throughflow	1	No	
160	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
161	No		Terrene	Slope	Outflow (channel)	1	No	
162	Yes	8	Lentic	Fringe	Throughflow and Bidirectional Nontidal	1	Yes	Stream not visible on map
163	Yes	8	Terrene	Slope	Throughflow	1	Yes	Stream not visible on map
164	Yes	11	Lentic and Lotic (stream)	Fringe	Throughflow and Bidirectional Nontidal	1	Yes	
165	Yes		Lotic (river)	Fringe	Throughflow	3+	No	Waldorf River

Wetland Polygon ID	Complex?	Complex Number	Landscape Position	Landform	Water Flow Path	Stream Order	Borders Lake?	Comments
166	No		Terrene Pond	Slope / Basin	Outflow (undefined)	n/a	No	
167	No		Lotic (river)	Fringe	Throughflow	3+	No	Waldorf River
168	No		Terrene	Flat / Slope	Outflow (undefined)	n/a	Yes	
169	No		Terrene Pond	Slope / Basin	Throughflow	1	Yes	Stream not visible on map
170	No		Terrene Pond	Slope / Basin	Outflow (undefined)	n/a	No	
171	No		Terrene Pond	Basin	Outflow (undefined)	n/a	Yes	
172	No		Terrene	Slope	Throughflow	n/a	No	
173	Yes		Terrene	Slope	Throughflow	1	No	
174	No		Terrene	Slope	Outflow (undefined)	n/a	No	
175	No		Terrene	Slope	Outflow (undefined)	n/a	No	
176	No		Terrene	Slope	Outflow (undefined)	n/a	No	
177	Yes		Terrene	Slope	Throughflow	n/a	No	
178	No		Terrene	Slope	Outflow (undefined)	n/a	No	
179	No		Terrene Pond	Slope / Basin	Outflow (channel)	1	No	Stream not visible on map
180	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
181	No		Terrene	Slope	Outflow (undefined)	n/a	No	
182	Yes		Lotic (river)	Fringe	Throughflow	3+	No	Waldorf River
183	No		Terrene	Basin	Outflow (undefined)	n/a	No	
184	No		Terrene	Slope	Throughflow	n/a	No	
185	No		Terrene	Slope	Outflow (undefined)	n/a	No	
186	No		Terrene Pond	Basin	Outflow (undefined)	n/a	No	
187	No		Terrene	Slope	Throughflow	n/a	No	
188	No		Terrene	Slope	Outflow (undefined)	n/a	No	
189	No		Terrene	Slope	Outflow (undefined)	n/a	No	
190	No		Terrene	Slope	Throughflow	1	No	
191	No		Terrene	Slope	Throughflow	1	No	

Wetland Polygon ID	Complex?	Complex Number	Landscape Position	Landform	Water Flow Path	Stream Order	Borders Lake?	Comments
192	No		Terrene	Slope	Throughflow	1	Yes	
193	No		Terrene	Slope	Throughflow	n/a	No	
194	No		Lentic	Basin	Bidirectional Nontidal	n/a	Yes	
195	No		Lentic and Lotic (stream)	Fringe	Throughflow	1	No	
196	No		Terrene	Slope	Throughflow	1	No	
197	No		Terrene	Basin	Throughflow	n/a	No	
198	No		Terrene Pond	Basin	Isolate	n/a	No	
199	No		Terrene	Slope	Outflow (undefined)	n/a	No	
200	No		Terrene	Basin	Outflow (undefined)	n/a	Yes	
201	No		Lotic (stream)	Island	Throughflow	3	No	
202	No		Terrene	Flat	Outflow (undefined)	n/a	Yes	
203	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
204	No		Terrene	Slope	Outflow (undefined)	n/a	No	
205	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
206	No		Lotic (stream)	Flat	Throughflow	1	Yes	
207	No		Terrene	Slope	Outflow (undefined)	n/a	No	
208	No		Terrene	Slope	Throughflow	n/a	No	
209	Yes	13	Terrene Pond	Flat / Slope	Throughflow	1 and 2	No	
210	No		Lentic and Lotic (river)	Fringe	Throughflow and Bidirectional Nontidal	3	Yes	Waldorf River
211	Yes	12	Lentic	Island	Bidirectional Nontidal	n/a	Yes	
212	No		Terrene	Basin	Outflow (undefined)	n/a	Yes	
213	No		Terrene	Flat	Outflow (undefined)	n/a	Yes	
214	No		Terrene	Slope	Outflow (undefined)	n/a	No	
215	Yes	13	Terrene	Flat	Outflow (undefined)	n/a	No	
216	Yes	13	Terrene	Flat	Outflow (undefined)	n/a	No	
217	Yes	12	Lentic	Island	Bidirectional Nontidal	3	Yes	

Wetland Polygon ID	Complex?	Complex Number	Landscape Position	Landform	Water Flow Path	Stream Order	Borders Lake?	Comments
218	No		Lentic	Flat	Bidirectional Nontidal	n/a	Yes	
219	Yes		Terrene	Slope / Basin	Outflow (channel)	1	Yes	
220	Yes		Terrene	Flat	Outflow (undefined)	n/a	Yes	
221	Yes		Terrene	Flat / Slope	Throughflow	1	Yes	Stream not visible on map
222	No		Terrene	Slope	Throughflow	1	No	Stream not visible on map
223	No		Terrene	Slope	Outflow (undefined)	n/a	No	
224	No		Lentic	Flat	Bidirectional Nontidal	n/a	Yes	
225	No		Lentic	Flat	Bidirectional Nontidal	n/a	Yes	
226	No		Terrene	Slope	Throughflow	2	No	
227	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
228	Yes		Lotic (stream)	Flat / Slope	Throughflow	3+	No	
229	No		Terrene	Flat	Throughflow	1	Yes	Stream not visible on map
231	No		Terrene	Basin	Isolate	n/a	No	
232	No		Terrene	Basin	Throughflow	n/a	No	
233	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
234	No		Terrene	Slope	Outflow (undefined)	n/a	No	
235	No		Terrene	Flat / Slope	Throughflow	3+	Yes	
236	No		Terrene	Flat	Outflow (undefined)	n/a	Yes	
237	No		Terrene	Slope	Outflow (undefined)	n/a	No	
238	No		Terrene	Basin	Outflow (undefined)	n/a	Yes	
239	No		Terrene	Basin	Outflow (undefined)	n/a	Yes	
240	No		Terrene	Flat / Slope	Outflow (undefined)	n/a	Yes	
241	No		Terrene Pond	Flat / Slope	Outflow (undefined)	n/a	Yes	
242	No		Terrene	Slope	Throughflow	3+	No	
243	No		Terrene	Flat / Slope	Throughflow	3+	Yes	
244	No		Terrene	Flat / Slope	Outflow (undefined)	n/a	Yes	

Wetland Polygon ID	Complex?	Complex Number	Landscape Position	Landform	Water Flow Path	Stream Order	Borders Lake?	Comments
245	Yes	14	Terrene	Flat / Slope	Throughflow	3+	No	
246	Yes	14	Terrene	Flat / Slope	Outflow (undefined)	n/a	Yes	
247	Yes	14	Lentic	Fringe	Bidirectional Nontidal	n/a	Yes	
248	Yes		Terrene	Flat / Slope	Outflow (undefined)	n/a	Yes	
249	No		Terrene Pond	Slope / Basin	Outflow (undefined)	n/a	Yes	
250	No		Lentic	Fringe	Bidirectional Nontidal	n/a	Yes	
251	Yes		Terrene	Slope	Outflow (channel)	1	Yes	
252	Yes		Terrene Pond	Flat / Slope	Outflow (channel)	1	Yes	
253	Yes	14	Lentic	Fringe	Bidirectional Nontidal	n/a	Yes	
254	No		Terrene	Slope	Outflow (undefined)	n/a	No	
255	Yes	16	Terrene	Flat / Slope	Throughflow	1 and 2	No	includes small pond
256	No		Terrene	Slope	Outflow (undefined)	n/a	No	
257	No		Terrene	Slope	Throughflow	n/a	No	
258	No		Terrene	Slope	Outflow (channel)	1	No	Stream not visible on map
259	Yes	14	Lentic	Island	Bidirectional Nontidal	n/a	Yes	
261	No		Terrene	Slope / Basin	Inflow	n/a	No	
262	No		Terrene	Slope	Outflow (undefined)	n/a	No	
263	No		Terrene	Slope	Outflow (undefined)	n/a	No	
273	Yes	16	Lentic	Fringe	Bidirectional Nontidal	n/a	Yes	
274	No		Terrene	Slope	Outflow (undefined)	n/a	No	
275	No		Terrene	Flat / Slope	Throughflow	n/a	No	
276	Yes	17	Terrene	Slope	Throughflow	1	Yes	
277	Yes	17	Lentic	Fringe	Bidirectional Nontidal	n/a	Yes	
278	Yes	18	Terrene	Slope	Outflow (channel)	1	Yes	
279	Yes	18	Lentic	Fringe	Bidirectional Nontidal	n/a	Yes	
280	No		Lotic (river)	Island	Throughflow	3+	No	

Wetland Polygon ID	Complex?	Complex Number	Landscape Position	Landform	Water Flow Path	Stream Order	Borders Lake?	Comments
281	No		Terrene	Flat / Slope	Outflow (channel)	1	No	Stream not visible on map
282	No		Terrene	Slope	Outflow (undefined)	n/a	No	
283	Yes	19	Terrene	Flat / Slope	Outflow (channel)	1	Yes	Stream not visible on map
284	Yes	19	Terrene Pond	Flat / Slope	Throughflow	1 and 2	No	
285	No		Terrene Pond	Basin	Inflow	n/a	No	
286	No		Lentic	Basin	Outflow (channel)	1	Yes	contains pond
287	Yes		Terrene Pond	Slope / Basin	Outflow (channel)	1	No	Stream not visible on map
288	No		Terrene	Slope	Outflow (channel)	1	No	Stream not visible on map
289	No		Terrene Pond	Basin	Isolate	n/a	No	
290	No		Terrene Pond	Basin	Outflow (undefined)	n/a	No	
291	No		Terrene	Flat	Outflow (undefined)	n/a	Yes	
292	No		Terrene Pond	Basin	Outflow (undefined)	n/a	No	
293	No		Terrene	Flat	Outflow (undefined)	n/a	No	
294	No		Lentic	Flat	Bidirectional Nontidal	n/a	Yes	
295	No		Terrene	Basin	Inflow	n/a	No	
296	Yes		Terrene Pond	Flat / Slope	Outflow (channel)	1	No	Stream not visible on map
297	No		Terrene	Slope	Outflow (undefined)	n/a	No	
298	No		Terrene	Slope	Outflow (undefined)	n/a	No	
299	No		Terrene	Slope / Basin	Outflow (channel)	1	No	Stream not visible on map
300	No		Terrene	Slope / Basin	Outflow (undefined)	n/a	No	
301	No		Lotic (stream)	Slope	Outflow (undefined)	n/a	No	
302	No		Terrene	Slope	Throughflow	1	No	
303	No		Terrene	Flat/Slope	Outflow (undefined)	n/a	No	
304	No		Terrene	Flat/Slope	Outflow (undefined)	n/a	No	
305	No		Lentic	Flat	Bidirectional Nontidal	n/a	Yes	

Wetland Polygon ID	Complex?	Complex Number	Landscape Position	Landform	Water Flow Path	Stream Order	Borders Lake?	Comments
306	No		Terrene	Slope	Outflow (undefined)	n/a	No	
308	Yes	22	Terrene	Flat/Slope	Outflow (undefined)	n/a	Yes	
309	No		Terrene	Flat/Slope	Outflow (undefined)	n/a	No	
310	Yes		Terrene Pond	Slope	Outflow (undefined)	n/a	Yes	
311	Yes		Terrene	Slope	Outflow (undefined)	n/a	Yes	
312	No		Terrene	Slope	Outflow (undefined)	n/a	Yes	
313	Yes	21	Terrene	Flat/Slope	Throughflow	1	No	
314	No		Terrene	Flat/Slope	Throughflow	n/a	No	

[1]Some additional wetlands were delineated and characterized outside of the Study Area but are not presented here

APPENDIX D

Probable Functions for Wetland Polygons within the Study Area

Table D1. Probable Functions for Wetland Polygons within the Study Area[1]

Wetland Polygon ID	Surface Water Detention	Sediment and Other Particulate Retention	Streamflow Maintenance	Carbon Sequestration	Shoreline Stabilization	Fish Habitat	Stream Shading	Waterfowl and Waterbird Habitat	Species of Conservation Concern Habitat
1				Yes					Yes
2	Yes		Yes	Yes	Yes		Yes	Yes	Yes
3			Yes	Yes	Yes		Yes		Yes
4				Yes					Yes
5				Yes					Yes
6	Yes			Yes				Yes	Yes
7	Yes		Yes	Yes	Yes			Yes	Yes
8				Yes					Yes
9	Yes			Yes				Yes	Yes
10				Yes					Yes
12				Yes	Yes		Yes		Yes
13	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
14			Yes	Yes	Yes			Yes	Yes
15			Yes	Yes	Yes				Yes
17	Yes			Yes	Yes			Yes	Yes
18				Yes	Yes				Yes
19	Yes (shore fen / marsh component)	Yes (shore fen / marsh component)		Yes	Yes	Yes (shore fen / marsh component)	Yes	Yes (shore fen / marsh component)	Yes
20				Yes					Yes
21				Yes					Yes
23			Yes	Yes	Yes			Yes	Yes
24			Yes	Yes	Yes				Yes
28				Yes					Yes

Wetland Polygon ID	Surface Water Detention	Sediment and Other Particulate Retention	Streamflow Maintenance	Carbon Sequestration	Shoreline Stabilization	Fish Habitat	Stream Shading	Waterfowl and Waterbird Habitat	Species of Conservation Concern Habitat
29	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
30				Yes	Yes				Yes
31			Yes	Yes	Yes		Yes	Yes	Yes
32			Yes	Yes	Yes		Yes	Yes	Yes
33	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
34				Yes	Yes				Yes
41			Yes	Yes	Yes		Yes		Yes
42			Yes	Yes	Yes		Yes	Yes	Yes
43	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
44				Yes					Yes
45				Yes					Yes
46			Yes	Yes	Yes				Yes
47				Yes					Yes
48				Yes					Yes
49				Yes					Yes
50	Yes			Yes				Yes	Yes
51			Yes	Yes	Yes				Yes
52				Yes					Yes
53			Yes	Yes	Yes		Yes		Yes
54				Yes					Yes
55	Yes		Yes	Yes	Yes			Yes	Yes
56				Yes					Yes
57	Yes		Yes	Yes	Yes			Yes	Yes
58	Yes		Yes	Yes	Yes			Yes	Yes
59				Yes					Yes

Wetland Polygon ID	Surface Water Detention	Sediment and Other Particulate Retention	Streamflow Maintenance	Carbon Sequestration	Shoreline Stabilization	Fish Habitat	Stream Shading	Waterfowl and Waterbird Habitat	Species of Conservation Concern Habitat
60				Yes					Yes
61				Yes					Yes
62			Yes	Yes	Yes		Yes		Yes
63				Yes					Yes
64				Yes					Yes
65			Yes	Yes	Yes		Yes		Yes
66	Yes			Yes				Yes	Yes
67	Yes (shore fen / marsh component)	Yes (shore fen / marsh component)	Yes	Yes	Yes	Yes (shore fen / marsh component)	Yes	Yes (shore fen / marsh component)	Yes
69				Yes	Yes				Yes
70				Yes					Yes
71	Yes		Yes	Yes	Yes			Yes	Yes
73				Yes					Yes
74			Yes	Yes	Yes				Yes
75	Yes		Yes	Yes	Yes			Yes	Yes
76				Yes	Yes				Yes
77				Yes					Yes
78				Yes	Yes				Yes
79				Yes	Yes				Yes
80	Yes			Yes				Yes	Yes
81				Yes					Yes
82				Yes					Yes
83	Yes			Yes				Yes	Yes
84			Yes	Yes	Yes				Yes
85				Yes					Yes

Wetland Polygon ID	Surface Water Detention	Sediment and Other Particulate Retention	Streamflow Maintenance	Carbon Sequestration	Shoreline Stabilization	Fish Habitat	Stream Shading	Waterfowl and Waterbird Habitat	Species of Conservation Concern Habitat
86				Yes					Yes
87			Yes	Yes	Yes				Yes
89				Yes					Yes
90	Yes			Yes	Yes			Yes	Yes
91			Yes	Yes	Yes		Yes		Yes
92				Yes					Yes
93	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
94	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
95				Yes	Yes				Yes
96				Yes	Yes		Yes		Yes
97				Yes	Yes				Yes
98				Yes					Yes
99				Yes	Yes				Yes
100			Yes	Yes	Yes				Yes
101	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
102	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
103				Yes					Yes
104				Yes					Yes
105				Yes	Yes				Yes
106				Yes	Yes				Yes
107				Yes					Yes
108			Yes	Yes	Yes				Yes
109	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
110	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
111			Yes	Yes	Yes				Yes

Wetland Polygon ID	Surface Water Detention	Sediment and Other Particulate Retention	Streamflow Maintenance	Carbon Sequestration	Shoreline Stabilization	Fish Habitat	Stream Shading	Waterfowl and Waterbird Habitat	Species of Conservation Concern Habitat
112				Yes					Yes
113	Yes			Yes				Yes	Yes
114				Yes					Yes
115				Yes	Yes				Yes
116				Yes					Yes
117				Yes					Yes
118				Yes	Yes				Yes
119	Yes			Yes				Yes	Yes
120				Yes					Yes
121				Yes					Yes
122				Yes	Yes				Yes
123				Yes	Yes				Yes
124				Yes					Yes
125	Yes		Yes	Yes	Yes			Yes	Yes
126	Yes			Yes	Yes			Yes	Yes
127	Yes			Yes				Yes	Yes
128				Yes					Yes
129				Yes	Yes				Yes
130				Yes					Yes
131				Yes	Yes				Yes
132				Yes					Yes
133				Yes	Yes				Yes
134				Yes	Yes		Yes		Yes
135				Yes	Yes				Yes
136				Yes					Yes

Wetland Polygon ID	Surface Water Detention	Sediment and Other Particulate Retention	Streamflow Maintenance	Carbon Sequestration	Shoreline Stabilization	Fish Habitat	Stream Shading	Waterfowl and Waterbird Habitat	Species of Conservation Concern Habitat
137			Yes	Yes	Yes				Yes
138	Yes			Yes				Yes	Yes
139				Yes	Yes				Yes
140	Yes		Yes	Yes	Yes			Yes	Yes
141				Yes					Yes
142	Yes			Yes	Yes			Yes	Yes
143	Yes			Yes	Yes			Yes	Yes
144				Yes	Yes				Yes
145	Yes			Yes	Yes			Yes	Yes
146				Yes	Yes				Yes
147				Yes					Yes
148				Yes	Yes				Yes
149				Yes					Yes
150	Yes			Yes				Yes	Yes
151				Yes	Yes				Yes
152				Yes	Yes				Yes
153				Yes	Yes				Yes
154				Yes	Yes				Yes
155				Yes					Yes
156	Yes		Yes	Yes	Yes			Yes	Yes
157			Yes	Yes	Yes				Yes
158				Yes					Yes
159	Yes		Yes	Yes	Yes			Yes	Yes
160				Yes	Yes				Yes
161			Yes	Yes	Yes				Yes

Wetland Polygon ID	Surface Water Detention	Sediment and Other Particulate Retention	Streamflow Maintenance	Carbon Sequestration	Shoreline Stabilization	Fish Habitat	Stream Shading	Waterfowl and Waterbird Habitat	Species of Conservation Concern Habitat
162	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
163			Yes	Yes	Yes				Yes
164			Yes	Yes	Yes			Yes	Yes
165				Yes	Yes			Yes	Yes
166	Yes			Yes				Yes	Yes
167				Yes	Yes			Yes	Yes
168				Yes	Yes				Yes
169	Yes		Yes	Yes	Yes			Yes	Yes
170	Yes			Yes				Yes	Yes
171	Yes			Yes	Yes			Yes	Yes
172				Yes					Yes
173			Yes	Yes	Yes		Yes		Yes
174				Yes					Yes
175				Yes					Yes
176				Yes					Yes
177				Yes			Yes		Yes
178				Yes					Yes
179	Yes		Yes	Yes	Yes			Yes	Yes
180				Yes	Yes				Yes
181				Yes					Yes
182				Yes	Yes		Yes	Yes	Yes
183				Yes					Yes
184				Yes					Yes
185				Yes					Yes
186	Yes			Yes				Yes	Yes

Wetland Polygon ID	Surface Water Detention	Sediment and Other Particulate Retention	Streamflow Maintenance	Carbon Sequestration	Shoreline Stabilization	Fish Habitat	Stream Shading	Waterfowl and Waterbird Habitat	Species of Conservation Concern Habitat
187				Yes					Yes
188				Yes					Yes
189				Yes					Yes
190			Yes	Yes	Yes		Yes		Yes
191			Yes	Yes	Yes				Yes
192			Yes	Yes	Yes				Yes
193				Yes					Yes
194			Yes	Yes	Yes			Yes	Yes
195			Yes	Yes	Yes			Yes	Yes
196			Yes	Yes	Yes				Yes
197				Yes					Yes
198	Yes			Yes				Yes	Yes
199				Yes					Yes
200				Yes	Yes				Yes
201				Yes	Yes		Yes		Yes
202				Yes	Yes				Yes
203				Yes	Yes				Yes
204				Yes					Yes
205	Yes			Yes	Yes			Yes	Yes
206			Yes	Yes	Yes		Yes		Yes
207				Yes					Yes
208				Yes					Yes
209	Yes		Yes	Yes	Yes		Yes	Yes	Yes
210	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
211	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes

Wetland Polygon ID	Surface Water Detention	Sediment and Other Particulate Retention	Streamflow Maintenance	Carbon Sequestration	Shoreline Stabilization	Fish Habitat	Stream Shading	Waterfowl and Waterbird Habitat	Species of Conservation Concern Habitat
212				Yes	Yes				Yes
213				Yes	Yes				Yes
214				Yes					Yes
215				Yes					Yes
216				Yes					Yes
217			Yes	Yes	Yes			Yes	Yes
218			Yes	Yes	Yes			Yes	Yes
219			Yes	Yes	Yes		Yes		Yes
220				Yes	Yes		Yes		Yes
221			Yes	Yes	Yes		Yes		Yes
222			Yes	Yes	Yes		Yes		Yes
223				Yes					Yes
224	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
225			Yes	Yes	Yes			Yes	Yes
226				Yes	Yes		Yes		Yes
227				Yes	Yes				Yes
228				Yes	Yes				Yes
229			Yes	Yes	Yes				Yes
231				Yes					Yes
232				Yes					Yes
233				Yes	Yes				Yes
234				Yes					Yes
235	Yes (shore fen / marsh component)	Yes (shore fen / marsh component)		Yes	Yes	Yes (shore fen / marsh component)		Yes (shore fen / marsh component)	Yes
236				Yes	Yes				Yes

Wetland Polygon ID	Surface Water Detention	Sediment and Other Particulate Retention	Streamflow Maintenance	Carbon Sequestration	Shoreline Stabilization	Fish Habitat	Stream Shading	Waterfowl and Waterbird Habitat	Species of Conservation Concern Habitat
237				Yes					Yes
238				Yes	Yes				Yes
239				Yes	Yes				Yes
240				Yes	Yes				Yes
241	Yes			Yes	Yes			Yes	Yes
242				Yes	Yes		Yes		Yes
243				Yes	Yes		Yes		Yes
244				Yes	Yes				Yes
245	Yes			Yes	Yes		Yes	Yes	Yes
246	Yes			Yes	Yes			Yes	Yes
247	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
248				Yes	Yes				Yes
249	Yes			Yes	Yes			Yes	Yes
250	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
251	Yes		Yes	Yes	Yes			Yes	Yes
252	Yes		Yes	Yes	Yes		Yes	Yes	Yes
253	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
254				Yes					Yes
255	Yes		Yes	Yes	Yes		Yes	Yes	Yes
256				Yes					Yes
257				Yes					Yes
258			Yes	Yes	Yes				Yes
259			Yes	Yes	Yes			Yes	Yes
261				Yes			Yes		Yes
262				Yes					Yes

Wetland Polygon ID	Surface Water Detention	Sediment and Other Particulate Retention	Streamflow Maintenance	Carbon Sequestration	Shoreline Stabilization	Fish Habitat	Stream Shading	Waterfowl and Waterbird Habitat	Species of Conservation Concern Habitat
263				Yes					Yes
273	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
274				Yes					Yes
275				Yes					Yes
276			Yes	Yes	Yes		Yes		Yes
277	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
278	Yes		Yes	Yes	Yes			Yes	Yes
279	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
280				Yes	Yes		Yes	Yes	Yes
281			Yes	Yes	Yes				Yes
282				Yes					Yes
283	Yes		Yes	Yes	Yes			Yes	Yes
284	Yes		Yes	Yes	Yes			Yes	Yes
285	Yes			Yes				Yes	Yes
286			Yes	Yes	Yes			Yes	Yes
287	Yes		Yes	Yes	Yes			Yes	Yes
288			Yes	Yes	Yes				Yes
289	Yes			Yes				Yes	Yes
290	Yes			Yes				Yes	Yes
291				Yes	Yes				Yes
292	Yes			Yes				Yes	Yes
293				Yes					Yes
294			Yes	Yes	Yes			Yes	Yes
295				Yes					Yes
296	Yes		Yes	Yes	Yes			Yes	Yes

Wetland Polygon ID	Surface Water Detention	Sediment and Other Particulate Retention	Streamflow Maintenance	Carbon Sequestration	Shoreline Stabilization	Fish Habitat	Stream Shading	Waterfowl and Waterbird Habitat	Species of Conservation Concern Habitat
297				Yes					Yes
298				Yes					Yes
299	Yes			Yes					Yes
300	Yes			Yes				Yes	Yes
301				Yes					Yes
302	Yes		Yes	Yes					Yes
303				Yes					Yes
304				Yes					Yes
305		Yes		Yes	Yes	Yes		Yes	Yes
306	No			Yes					Yes
308				Yes				Yes	Yes
309	Yes			Yes				Yes	Yes
310	Yes			Yes				Yes	Yes
311	Yes			Yes				Yes	Yes
312	Yes			Yes				Yes	Yes
313				Yes					Yes
314	Yes			Yes					Yes

[1]Some additional wetlands were delineated and characterized outside of the Study Area but are not presented here