Wetlands Inventory and Classification Study

Proposed Bay d'Espoir to Western Avalon Transmission Line (TL 267)

FINAL REPORT

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IMPORTANT NOTICE

EXECUTIVE SUMMARY

Newfoundland and Labrador Hydro (Hydro) is proposing to develop a transmission line (TL 267) across southeastern Newfoundland, from Bay d'Espoir to the Western Avalon Peninsula (the Project). The purpose of this *Wetlands Inventory and Classification Study* is to identify, delineate and where possible categorize all wetlands located within the proposed transmission line right of way (40 m wide) and surrounding (1 km wide) Study Area. This "desk-top" wetlands analysis has utilized existing and high quality spatial imagery for the Project Area, and was completed in conjunction with a larger Ecological Land Classification (ELC) Study.

The wetlands analysis and mapping exercise described in this report identified approximately 3,807 ha of wetland within the Study Area along the proposed TL 267 as far east as where the proposed transmission line meets the existing TL 203 near Come By Chance. This included the following wetland classes: 1) bog, 2) fen, 3) swamp, 4) marsh, and 5) shallow water, as well as a number of associated forms and sub-forms within these classes, as per the Canadian Wetland Classification System, and wetland complexes comprised of multiple types. Wetlands constitute approximately 27 percent of the total land area classified in the overall 1 km wide Study Area through the ELC. Comparatively, approximately 144 ha of wetland habitat was identified within the proposed 40 m wide transmission line right of way itself, which represents 26 percent of the total habitat within the Study Area as identified and classified through the ELC.

The remaining segment of the TL 267 right of way, between Come By Chance and the Western Avalon Terminal Station near Chapel Arm, was the focus of a similar wetlands study completed several years ago (Stantec 2010). That study identified approximately 10.40 ha of wetland within that segment of the proposed TL 267 right of way and 227.44 ha within the 1 km wide Study Area, all of which were classified as "bog".

Potential wetland functions provided by the identified wetland classes will vary depending on the actual type of wetland, its location and other characteristics, as well as a variety of other natural and anthropogenic factors. Bogs typically provide ground water recharge potential and are important in carbon sequestration and storm water retention. Fens often provide higher habitat functions than bogs and also contribute to carbon sequestration. Swamps are typically important in sediment and surface water retention, as well as providing a source of food for various wildlife species. Shallow water wetlands provide food sources for wildlife such as moose as well as habitat for waterfowl. Marshes provide important nursery habitat for fish as well as wildlife nesting and foraging habitat. The proposed TL 267 will, like the existing transmission lines in the area, cross through a portion of the Come By Chance Habitat Management Unit.

The information provided through this *Wetlands Inventory and Classification Study* is intended to support the Project's Environmental Assessment (EA) registration and review, and will be used in on-going Project planning and design as well as in the eventual permitting and construction / mitigation planning for the Project.

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1.0 INTRODUCTION

Newfoundland Labrador Hydro (Hydro) owns and operates an extensive electrical generation and transmission system on the Island of Newfoundland, which includes a 613 megawatt (MW) hydroelectric generation station at Bay d’Espoir in the south-central portion of the Island, as well as several transmission lines that extend between it and other electrical infrastructure and load centres across the Island. This includes two existing transmission lines that run from that facility to Sunnyside which were constructed in the late 1960s, as well as a transmission system that extends between Sunnyside and Chapel Arm.

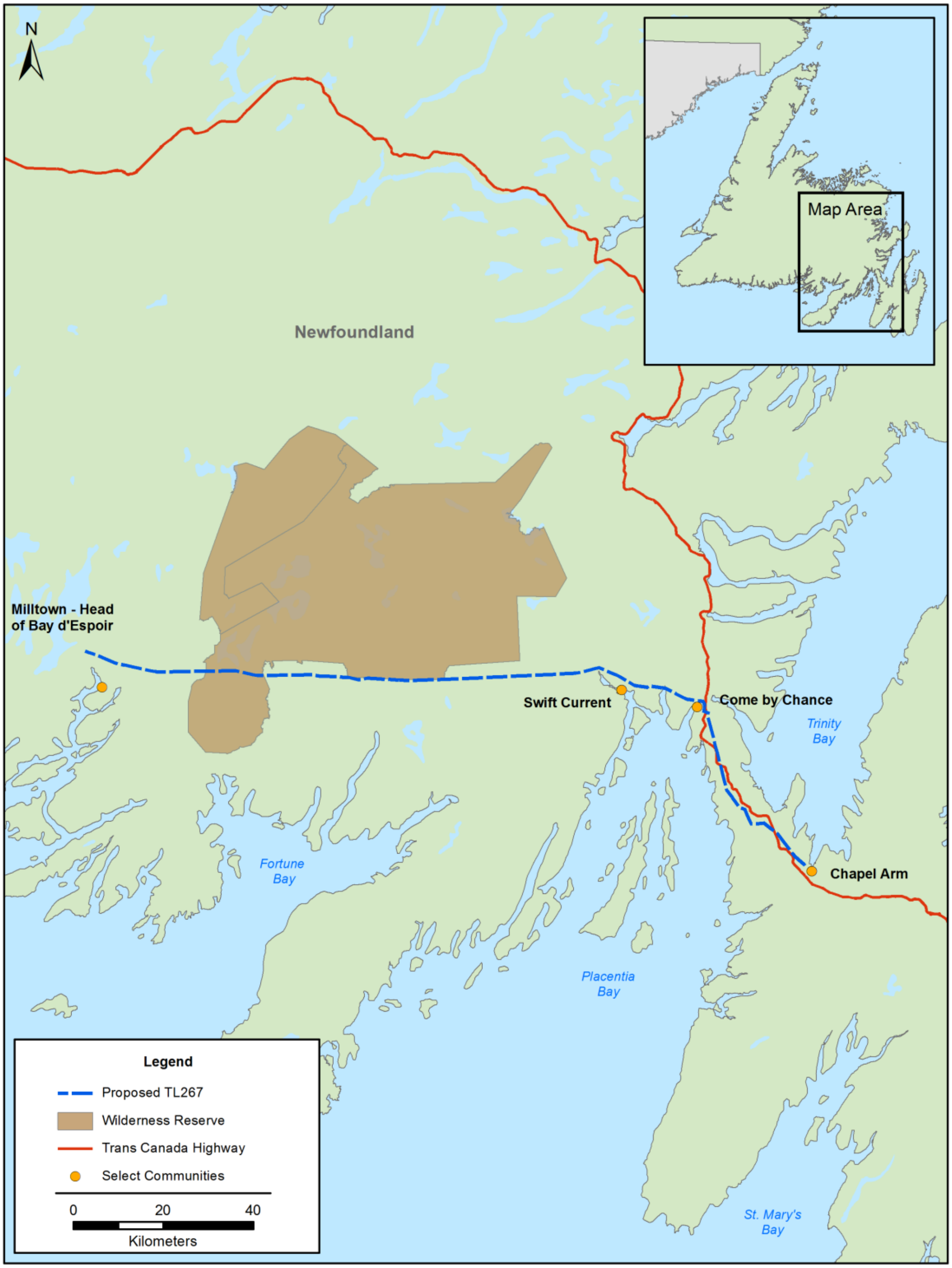
The proposed development project that is the subject of this study includes the construction and operation of a new 230 kilovolt (kV) transmission line that will be approximately 188 km long and connect the existing Bay d’Espoir and Western Avalon Terminal Stations (hereinafter also referred to as the “Project” or “TL 267”). The proposed TL 267 will parallel existing transmission line infrastructure from Bay d’Espoir to Come By Chance (TL 202 and TL 206) and further parallels TL 203 from Come By Chance to the Western Avalon substation in Chapel Arm (Figure 1). Upgrades to existing infrastructure at the Bay d’Espoir and Western Avalon terminal stations will also be completed as part of this Project. The existing transmission lines (TL 202, 203 and 206) were cleared and constructed within the boundaries of the easement granted to Hydro by Government at the time of their development, as will the proposed TL 267.

Given that this new transmission line and associated infrastructure will follow entirely along existing transmission lines and other infrastructure in the region, the Project is expected to have few if any environmental issues associated with it. Hydro is, however, committed to ensuring that Project construction and operations are conducted in an environmentally responsible and acceptable manner, in full compliance with associated environmental regulations and permits, as well as the company’s own environmental policies, plans and standards.

The Proponent has therefore planned and completed an environmental study program in relation to the proposed Project, in order to obtain and compile information on key aspects of the existing biophysical and socioeconomic environments within and near the Project area. The information provided through this study program is intended to support the Project’s Environmental Assessment (EA) registration and review, and will be used in on-going Project planning and design, as well as in the eventual permitting and construction / mitigation planning for the Project.

This *Wetlands Inventory and Classification Study* comprises one component of that environmental study program.

Figure 1 - The Proposed Bay d'Espoir to Western Avalon Transmission Line (TL 267)



1.1 Study Rationale and Purpose

Wetlands are generally widespread across much of south-central and eastern Newfoundland and throughout the province as a whole, and are often particularly important and valued because of their hydrologic, ecological and anthropogenic functions. This includes their role in the natural purification and storage of freshwater, in runoff and flood control, and as habitat for fish and wildlife resources. The protection of wetlands is also the subject of various federal, provincial and municipal agreements, legislation and policies.

Transmission line design, including tower placement and the specific siting of other Project infrastructure and activities, will play a key role in addressing any potential effects on wetlands. This will involve identifying and attempting to avoid certain areas such as wetlands and any other particularly important or sensitive habitats, for both practical and environmental reasons. Given the overall number and extent of wetland areas throughout this region of Newfoundland, however, it is inevitable that the Project will result in some degree of interaction with wetlands.

The purpose of this Wetlands Inventory and Classification Study has therefore been to identify, delineate and where possible characterize all wetlands located within and near the proposed TL 267. This "desk-top" analysis has been based on, and completed in conjunction with, a larger Ecological Land Classification (ELC) Study (Amec Foster Wheeler 2015), and presents information on wetland distribution and type as a stand-alone mapping product for use in on-going Project planning and design.

1.2 Wetlands Definitions and Associated Regulatory Considerations

Wetlands often represent one of the most productive ecosystems in the natural environment. Several definitions of "wetland" exist in the literature, a number of illustrative examples of which are provided below:

> A wetland means land that has the water table at, near or above the land surface and includes bogs, fens, marshes, swamps and other shallow open water areas (NL Water Resources Act 2002).
>
> A wetland is any land that is covered with water for a part of the day or year. Wetland boundaries are usually established in the spring when water levels are highest (Canadian Wildlife Service 2002).
>
> A wetland is 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 (Environment Canada 1991).
>
> Wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters (Ramsar Convention on Wetlands 1971).

Although each definition is somewhat different, the key elements that define a wetland are generally understood to include:

- Land that is saturated or covered by water for some time during the growing season;
- Poorly drained soils; and
- Predominantly water-adapted vegetation.

Wetlands are environmentally significant for a number of reasons, including flood control, water storage (groundwater recharge), water filtration, shoreline erosion buffering, carbon absorption and their use as fish and/or wildlife habitat. With their often unique properties, wetlands may also serve a range of socioeconomic functions, including natural heritage, recreation (hunting and fishing) and be a valued aesthetic resource (Environment Canada 1991). Loss or alteration of wetlands by way of drainage, infilling, or channelization can have adverse effects on downstream water quality and quantity, as well as having an effect on terrestrial and aquatic habitat and associated flora and fauna. Further potential consequences of wetland loss can include structural damage to infrastructure due to increased water flows, river bed erosion causing siltation, effects on fish resources and adverse implications for the recreational use of water bodies and associated resources (NL DEC 2014a).

Wetland conservation is a shared federal, provincial, municipal and international responsibility. Strategies for wetland conservation in Canada encompass the protection, enhancement and use of wetland resources according to principles that will assure their long-term social, economic and ecological benefits (Environment Canada 2015).

1.2.1 Federal Policy on Wetland Conservation

The Federal Policy on Wetland Conservation (Environment Canada 1991) directs all federal government departments to conserve or sustain wetland functions during the delivery of their programs and services. It also provides direction and support to individual decision-makers to ensure that opportunities for the sustained wise use of wetlands are realized, and to avoid or resolve wetland-related conflicts (Lynch-Stewart et al. 1996). One of the main considerations in developing the Policy was Canada's membership in the Ramsar Convention on Wetlands (1971), which was signed by Canada in 1981. The Ramsar Convention is a global conservation treaty specifically dealing with wetland loss and sustainable use.

The Federal Policy on Wetland Conservation promotes wetland conservation through the full range of federal decisions and responsibilities. Its key goals include:

- No net loss of wetland functions on all federal lands and waters; and
- The enhancement and rehabilitation of wetlands in areas where the continuing loss or degradation of wetlands or their functions have reached critical levels.

Processes and measures for the implementation of the Federal Policy on Wetland Conservation are outlined in the Implementation for Federal Land Managers Guide (Lynch-Stewart et al. 1996) and other sources, which outline various strategies for achieving no net loss of wetland function through a series of associated mitigation measures.

The general sequence of possible wetland mitigation measures are as follows:

1) *Avoidance*: refers to the elimination of potential adverse effects on wetlands and their functions by way of project design;

2) *Minimization*: refers to the control (reduction and minimization) of adverse effects to wetland functions through project modifications and/or other measures; and

3) *Compensation*: refers to the potential replacement of unavoidably lost wetlands areas and functions, through enhancement or rehabilitation of existing wetlands or the creation of new wetland areas.

The Guide emphasizes the importance of incorporating wetland conservation considerations into planning and decision-making process, including as part of the EA review of proposed development projects.

1.2.2 Newfoundland and Labrador Policy for Development in Wetlands

Under the Newfoundland and Labrador *Water Resources Act* (2002), the provincial Policy for Development in Wetlands establishes various guidelines and criteria related to the potential issuance of provincial permits for proposed development activities that occur within and/or will affect wetlands (NL DEC 2014a). The objective of the Policy is to permit and guide developments in wetlands so that they do not adversely affect the water quantity, water quality, hydrologic characteristics or functions, and terrestrial and aquatic habitats of these wetlands. It also outlines a number of scenarios where development in or affecting wetland areas may not be permitted, including:

- Infilling, drainage, dredging, channelization, removal of vegetation cover or removal of soil or organic cover of wetlands which could aggravate flooding problems or have unmitigable adverse water quality or water quantity or hydrologic effects;

- Development in wetlands that are located within the recharge zones of domestic, municipal or private groundwater wells; and

- Placing, depositing or discharging any raw sewage, refuse, municipal and industrial wastes, fuel or fuel containers, pesticides, herbicides or other chemicals or their containers, or any other material which impairs or has the potential to impair the water quality of wetlands.

The Policy also specifies various associated development activities that require permitting, including:

- Removal of the surface vegetation cover of wetlands for extraction of peat, or for preparing the area for agricultural or forestry activities;

- Construction of ditches, tile fields and other types of flow conveyances to drain wetlands for extraction of peat, or for preparing the area for agricultural or forestry operations;

- Removal of the top soil or organic cover of wetlands for use as horticultural or fuel peat, or for preparing the area for agricultural or forestry activities;

- Infilling, dredging, or any other disturbance of wetlands for the construction of permanent or temporary roads, bridges, culverts, trails, power and telecommunication transmission lines, pipelines, etc., through wetlands which would necessitate only minor disturbances to the vegetation and organic cover, the flow drainage pattern of the area and ground slope;

- Infilling, dredging or other disturbance of wetlands for the construction of residential, commercial, industrial and institutional facilities or extension and upgrading of existing buildings and facilities within wetland areas;

- Development related to recreational activities including the setting up of campgrounds, permanent and semi-permanent facilities, etc, on wetland areas; and the

- Construction of flow control structures to alter the normal water level fluctuations of wetlands for the purposes of enhancing the quality or quantity of fish and other wildlife habitat.

Throughout the environmental permitting process for proposed developments that will occur in, and affect, wetland areas, mitigative measures to avoid or reduce potentially adverse changes to wetlands and their hydrologic characteristics or functions are identified and implemented.

2.0 APPROACH AND METHODS

The protection of wetlands in Newfoundland and Labrador is the subject of various federal, provincial and municipal agreements, legislation and policies, as outlined previously. Work involving the potential alteration or loss of wetland habitat typically requires environmental permits or other approvals prior to undertaking a proposed project. Given the importance of, and current emphasis upon, wetland conservation, it is important that wetland habitat be identified and considered in the early planning stages of any development project in the province, and throughout its design and eventual implementation phases.

The key objective of this Wetlands Inventory and Classification Study was therefore to provide information on the presence, locations, distribution, sizes and types of wetlands that occur within and near the proposed TL 267 right of way. This objective was achieved through the following activities and outcomes:

- Utilize and build upon the larger ELC Study (Amec Foster Wheeler 2015) and associated spatial imagery to identify and delineate all wetlands in the area;
- Categorize and describe wetlands according to the Canadian Wetland Classification System (NWWG 1997); and
- Report preparation including detailed maps with wetland boundaries and types defined.

The following sections describe the general approach used in the completion of the Study, including the Study Area, data sources and the overall methods used to compile and present the resulting environmental information.

2.1 Study Areas and Regional Ecological Context

The proposed Project will include construction and operation of a new electrical transmission system along existing transmission lines and roadways in south-central and eastern Newfoundland for a total distance of approximately 188 km. In completing this Wetlands Inventory and Classification Study, the associated analysis has focused upon a number of geographic scales, including:

Project Area or *Transmission Line Right of Way*: A specific routing has been selected for the transmission line, which will involve a cleared right of way approximately 40 m wide.

Study Area: The larger (1 km wide) Study Area extends 500 m on either side of the centre line of the identified right of way for the proposed TL 267, as described above. This surrounding area is considered in order to provide relevant, regional context for the analysis, as well as address the potential for Project-related activities to occur outside the 40 m wide transmission line routing itself.

The associated wetlands mapping presented in this Report illustrates and considers the currently identified transmission line routing (approximately 40 m wide right of way) in order to help identify particular locations where the proposed Project would interact directly with wetland areas, as well as all wetlands within the larger (1 km wide) surrounding Study Area. A detailed illustration of the wetland habitat occurring within the right of way and larger Study Area is presented in the Map Atlas included as Appendix A.

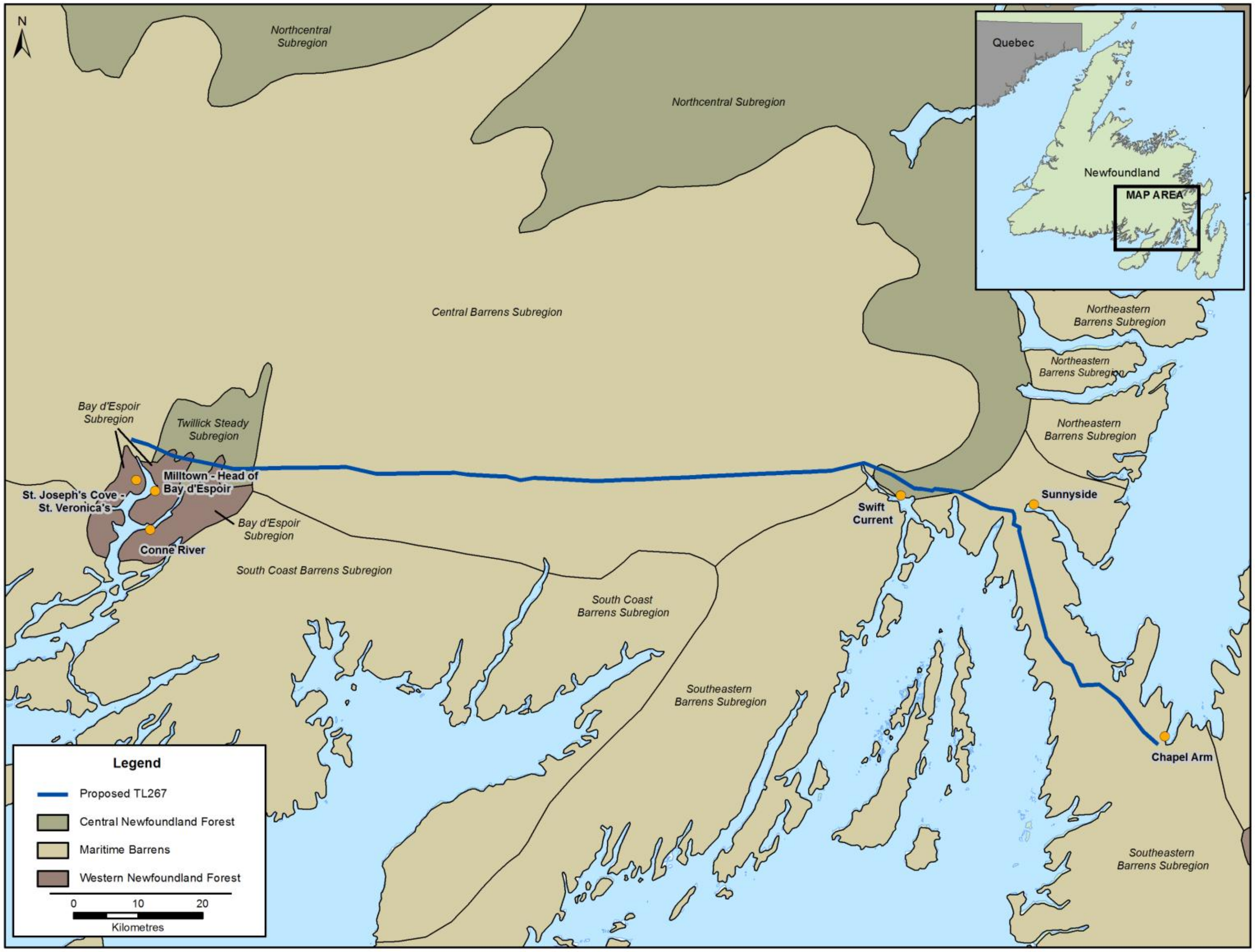
This study focuses primarily on wetlands along the proposed TL 267 as far east as where the proposed transmission line meets the existing TL 203, near Come By Chance. The remaining section of the TL 267 right of way, between Come By Chance and the Western Avalon Terminal Station near Chapel Arm, was the focus of a similar wetlands assessment several years ago (Stantec 2010). For completeness and reference, the wetland habitats and associated areas identified within that section of the Study Area are summarized in Chapter 3 of this report and the associated Appendices. That previous study (Stantec 2010) should be consulted for further details on its associated methodologies and findings.

The proposed transmission line extends through south-central and eastern portions of the Island of Newfoundland, and in doing so, will cross through a portion of the Boreal Shield Ecozone of Canada (Wiken 1986). The Boreal Shield Ecozone consists of a base of ancient bedrock covered by gravel, sand and other glacial deposits. Regional topography is comprised of broadly rolling uplands that form poorly drained depressions covered by lakes, ponds and wetlands. The climate of the Ecozone is generally continental in nature, with long cold winters, short warm summers and abundant precipitation. Cool temperatures and a short growing season along with acidic soils influence the resultant vegetation community composition, distribution and abundance. The landscape configuration consists primarily of forested cover dominated by coniferous species intermixed with hardwoods. Bogs, marshes and other wetlands comprise the remaining landscape matrix of vegetation communities.

At the provincial scale, the proposed transmission line will also pass through three of the Ecoregions that have been identified on the Island of Newfoundland (Damman 1983), including (primarily) the large Maritime Barrens Ecoregion (79 percent of the transmission line's linear distance), along with smaller portions of the Central Newfoundland Forest Ecoregion (18 percent) and Western Newfoundland Forest Ecoregion (three percent) at its ends (Figure 2). Within the Maritime Barrens Ecoregion, the proposed right of way occurs primarily within the Central Barrens Subregion with a smaller portion on the Avalon Peninsula falling within the Southeastern Subregion. The section of the transmission line within the Central Newfoundland Ecoregion crosses two Subregions, Twillick Steady near Bay d'Espoir and Northcentral near the Isthmus of the Avalon Peninsula.

The Maritime Barrens Ecoregion is characterized by cool summers with frequent fog and strong winds. Winters are relatively mild with intermittent snow cover. Consequently, this ecoregion is dominated by open heathland and peat bog interspersed with patches of stunted balsam fir (*Abies balsamea*), black spruce (*Picea mariana*) and eastern larch (*Larix laricina*). Heath plants are primarily *Kalmia angustifolia* on protected slopes and *Empetrum nigrum* or *E. easmesii* on windswept ridges and headlands (Meades 1990).

Figure 2 - Ecoregions and Subregions in Newfoundland Crossed by the Proposed Project



The Central Newfoundland Ecoregion has a more continental climate than the Maritime Barrens area, with cooler winter and higher summer temperatures. Forest fires have historically been more frequent in this ecoregion and have led to a replacement of balsam fir-*hyloconium* forest types over many areas. However, upland areas within the Twillick Steady Subregion remain dominated by balsam fir forest. Ground cover in the Northcentral Subregion is primarily dwarf shrub heath (*K. angustifolia*) with interspersed stands of balsam fir and black spruce. Topography in both subregions is less than 300 m above sea level and the topography is rugged and undulating (Meades 1990).

The Western Newfoundland Forest Ecoregion (Bay d'Espoir Subregion) is characterized by a humid climate with a relatively longer frost-free period. Higher humidity reduces the prevalence of fire as a disturbance mechanism and favours the growth of *dryopteris*-balsam fir forest rather than black spruce as the dominant tree. Rich soils also support the growth of yellow birch (*Betula alleghaniensis*) in sheltered valleys of this subregion.

The proposed Project will also cross through a portion of the existing boundaries of the Bay du Nord Wilderness Reserve (2,895 km^2), which encompasses a vast landscape of ponds, rivers, barrens, bogs and fens, forests, and thickets in south-central Newfoundland.

2.2 Spatial Imagery and Ortho-photography

High resolution colour imagery acquired by Hydro was used as the basis for the ELC and associated wetlands analysis and mapping. This imagery (flown by a fixed wing aircraft with an attached high resolution camera) consists of 3,504 individual images covering the Project Area extending from Bay d'Espoir to Sunnyside at a resolution of 15 cm per pixel. This imagery and its IMU (Inertial Measurement Unit) was utilized and incorporated within a developed geographic information system (GIS) workflow. In addition, a LiDAR (Light Detection and Ranging) dataset that was captured concurrently with the imagery was also acquired and used in the analysis. These LiDAR data were provided in LAS format and were then classified and processed into a compatible format to be utilized for feature extraction by the interpreters see below). The Study Team produced several surface models to assist in feature identification and validation, including surface models containing ground elevation data, vegetation classification based on height as well as classified slope, aspect and hillshade rasters. Processed LiDAR datasets have been analyzed for the full extent of the Study Area and the 40 m wide transmission line right of way at a raster resolution of not less than 1 m per pixel.

These two data sources were combined in a GIS for analysis and eventual mapping. Data delineation, capture and analysis was performed within an RDBMS (Relational Database Management System) and SQL (Structured Query Language) Server utilizing Stereo Analyst (digital stereo viewing software) product extensions to enable the visualization and capture of true stereo features while enhancing feature integrity during both the capture and data cleaning process. This enabled interpreters to accurately assess ground and/or cover type over the extent of the Study Area. Factors such as topographical slope and vegetation height are readily apparent when using stereo mapping methods such as those described above.

2.3 Vegetation Typing and Mapping

Experienced digital aerial photography interpreters used the ArcGIS and Stereo Analyst combination to classify all ELC polygons within the previously mentioned spatial extents. Each individual polygon was visually assessed to determine its characteristics. Similar vegetation, wetland and anthropogenic features were grouped together while areas exhibiting characteristics significantly different were separated as necessary and classed appropriately. The environment in which interpreters delineated and classified allowed for multi-interpreter classification, through which the data were continuously evaluated and validated for data integrity using spatial databases. Geodatabases were developed using domain and coded value tables which enable the interpreters to classify the data based on pre-defined variables, eliminating user error based on feature types within the database. This also allows for further refinement, classification and additions to the geodatabase. Each domain also contains coded value tables which further break down each domain value. For example, the Form – Bog domain contains 9 possible bog types found within the Canadian Wetland Classification Manual. Each coded value table includes every feature type found within the Canadian Wetland Classification Manual for the entire extent of the Study Area.

The ELC and associated wetland mapping was completed using polygons delineated during softcopy air photo interpretation. Delineation and classification both generally occurred at a scale of between 1:2,000 and 1:5,000. While efforts were made maintain a scale close to 1:5,000 for the analysis, finer scales were necessary at times to ensure proper classification and/or feature extraction. The mapping was supported by the interpretation of LiDAR datasets to provide detailed slope, aspect and elevation models. ELC mapping completed for the entire Study Area followed 1 hectare minimum standards.

3.0 RESULTS

Through this study, all wetlands that are crossed by the proposed transmission line right of way (40 m wide) and within the larger surrounding Study Area (1 km wide) were identified and categorized based on the Canadian Wetland Classification System (NWWG 1997).

3.1 Identified Wetland Classes

The wetlands analysis and associated mapping exercise identified and delineated five wetland classes within the Study Area:

1) *Bogs* are characterized by an accumulation of sphagnum moss or "peat". These areas are typically topographically confined, receiving water from precipitation (rain, fog and snow melt) only. In most bogs the water table is at or near the surface. Organic decomposition is very slow due to low temperatures and low pH and as such, accumulation of organic matter is high. Productivity is relatively low in bogs where woody vegetation and stunted trees typically dominate. The majority of bogs within the Study Area are dominated by low shrubs. Herbaceous dominated bogs are present to a lesser extent and are characterized by various species of cottongrass and rush species.

   Bogs constitute the majority of wetland habitat in the region, representing 72 percent of all wetland areas identified within the Study Area and nearly 20 percent of its total land area. A number of forms and sub-forms of bogs were identified within the Study Area, of which flat bogs cover the largest area. Flat bogs occur on flat terrain and are topographically unconfined occurring in broad, poorly defined lowland areas. Peat accumulation in these areas tends to be uniform across the entire area. Other bog types identified in the region include basin bog, blanket bog, domed bog, plateau bog, riparian bog, slope bog and string bog, and sub-forms of several of these.

2) *Fens* are also characterized by the accumulation of peat but differ from bogs hydrologically in that they are also characterized by the movement of mineral rich surface water via pools, channels and open water. This higher nutrient influence allows fens to be relatively more productive than bogs with a higher diversity of species. This higher nutrient level also increases microbial activity leading to typically lower accumulations of organic matter due to a higher rate of decomposition. Fens are typically dominated by a combination of sedges, forbs and low shrubs such as dwarf birch and willow.

   Stream fens (a sub-form of riparian fen) are the most common fen type within the Study Area. As suggested in the name, these typically occur within the main channel or adjacent to streams and rivers. Low water velocities in these areas typically allow the accumulation of peat along the stream edges which constitutes the majority of the bank substrate. Other identified fen types included basin, channel, feather, horizontal, other types of riparian fen, slope, spring and string fens (various sub-forms).

3) *Swamps* are defined as wetlands that are influenced by minerotrophic ground water and dominated by trees and tall shrubs. Soils can be organic or mineral. These areas may be seasonally or permanently flooded and the water table is typically at or near the surface. Swamps are somewhat common within the Study Area and are typically dominated by black spruce, eastern larch and/or alder.

   Riverine swamp (a sub-form of riparian swamp) is the most common type of swamp occurring in the Study Area. These wetlands are subject to extreme water level fluctuations in response to water levels in the immediately adjacent river or stream. Several other forms and sub-forms of swamps were also identified.

4) *Marsh Wetlands* are characterized by the presence of standing or slow moving surface water that is typically nutrient rich. These areas are generally dominated by emergent vegetation (such as cattails and Iris), forbs (such as goldenrods and asters), shrubs (including alders and willows) and graminoides (grasses and sedges). This wetland type can occur in isolation but in many cases occur along lakes and rivers (riparian marsh sub-form) and can also exist as part of a wetland complex.

5) *Shallow Water Wetlands* have standing or flowing water that is less than 2 meters deep during mid-summer. Water levels are seasonally stable and vegetation tends to be dominated by aquatic vegetation such as pond lily and pondweed.

A number of wetland complexes were also identified which display characteristics typical of a combination of two or more of the above listed wetland classes.

3.1.1 Wetland Classes and Sub-forms by Area

Approximately 3,800 ha of wetland habitat was identified within the 1 km wide Study Area along the proposed transmission line from Bay d'Espoir to where the proposed transmission line meets the existing TL 203 near Come By Chance. This represents approximately 27 percent of the total area classified through the 2015 ELC Study. Table 3.1 provides a summary of the area (ha) covered by each wetland class, form and sub-form identified within the 1 km wide Study Area, and the relative proportions of each.

Comparatively, approximately 144 ha of wetland habitat was identified within the proposed 40 m wide transmission line right of way itself, which represents about 26 percent of the total area of same. Most of the wetland types, forms and sub-forms that were identified in the larger 1 km wide Study Area were also identified within the 40 m right of way, with the exception of the marsh and shallow water classes, as well as several sub-forms of fens and swamp.

Table 1 - Summary of Wetlands in the 1 km Wide Study Area (Areas / Proportions) – 2015 Study

Wetland Class	Wetland Form	Wetland Sub-Form	Area (ha)	% Total Wetland Area	% Total Land Area
Bog	Basin Bog		48.03	1.3%	0.3%
	Blanket Bog		179.67	4.7%	1.3%
	Domed Bog		11.52	0.3%	0.1%
	Flat Bog		1164.39	30.6%	8.3%
	Plateau Bog	Northern Plateau Bog	7.58	0.2%	0.1%
	Riparian Bog	Floating Bog	15.15	0.4%	0.1%
		Shore Bog	229.38	6.0%	1.6%
	Slope Bog		467.12	12.3%	3.3%
	String Bog		623.54	16.4%	4.4%
Sub Total			*2746.38*	*72.1%*	*19.5%*
Fen	Basin Fen		10.05	0.3%	0.07%
	Channel Fen		1.19	0.0%	0.01%
	Feather Fen		5.84	0.2%	0.04%
	Horizontal Fen		6.66	0.2%	0.05%
	Riparian Fen	Shore Fen	38.86	1.0%	0.28%
		Stream Fen	133.31	3.5%	0.95%
	Slope Fen		30.65	0.8%	0.22%
	Spring Fen		5.18	0.1%	0.04%
	String Fen	Atlantic Ribbed Fen	31.29	0.8%	0.22%
		Ladder Fen	13.24	0.3%	0.09%
		Net Fen	4.79	0.1%	0.03%
		Northern Ribbed Fen	20.59	0.5%	0.15%
Sub Total			*301.65*	*7.9%*	*2.1%*
Swamp	Discharge Swamp	Seepage Swamp	11.83	0.3%	0.1%
	Flat Swamp	Unconfined Flat Swamp	13.95	0.4%	0.1%
	Riparian Swamp	Channel Swamp	2.46	0.1%	0.0%
		Lacustrine Swamp	3.31	0.1%	0.0%
		Riverine Swamp	100.71	2.6%	0.7%

Wetland Class	Wetland Form	Wetland Sub-Form	Area (ha)	% Total Wetland Area	% Total Land Area
	Slope Swamp	Drainageway Swamp	10.76	0.3%	0.1%
		Peat Margin Swamp	7.28	0.2%	0.1%
		Unconfined Slope Swamp	2.31	0.1%	0.0%
Sub Total			*152.61*	*4.0%*	*1.1%*
Marsh	Riparian		1.55	0.0%	0.0%
Sub Total			*1.55*	*0.0%*	*0.0%*
Shallow Water	Basin		1.04	0.0%	0.0%
Sub Total			*1.04*	*0.0%*	*0.0%*
Complex [1]			603.77	15.9%	4.3%
Sub Total			*603.77*	*15.9%*	*4.3%*
WETLAND TOTAL			**3807.00**	**100.0%**	**27.1%**

[1] Complex wetlands are a combination of two wetland classes above within any one polygon.

Table 2 - Summary of Wetlands in the 40 m Wide Right of Way (Areas / Proportions) - 2015 Study

Wetland Class	Wetland Form	Wetland Sub-Form	Area (ha)	% Total Wetland Area	% Total Land Area
Bog	Basin Bog		2.46	1.7%	0.4%
	Blanket Bog		9.89	6.9%	1.8%
	Domed Bog		0.14	0.1%	0.0%
	Flat Bog		43.69	30.4%	7.8%
	Plateau Bog	Northern Plateau Bog	0.69	0.5%	0.1%
	Riparian Bog	Floating Bog	0.65	0.5%	0.1%
		Shore Bog	6.76	4.7%	1.2%
	Slope Bog		17.13	11.9%	3.1%
	String Bog		18.89	13.1%	3.4%
Sub Total			*100.30*	*69.8%*	*17.9%*
Fen	Basin Fen		1.22	0.8%	0.2%
	Channel Fen		0.17	0.1%	0.0%
	Riparian Fen	Shore Fen	2.04	1.4%	0.4%

Wetland Class	Wetland Form	Wetland Sub-Form	Area (ha)	% Total Wetland Area	% Total Land Area
		Stream Fen	7.34	5.1%	1.3%
	Slope Fen		1.26	0.9%	0.2%
	Spring Fen		0.20	0.1%	0.0%
	String Fen	Atlantic Ribbed Fen	1.79	1.2%	0.3%
		Ladder Fen	0.78	0.5%	0.1%
		Northern Ribbed Fen	1.72	1.2%	0.3%
Sub Total			*16.52*	*11.5%*	*2.9%*
Swamp	Riparian Swamp	Channel Swamp	0.22	0.2%	0.0%
		Riverine Swamp	4.07	2.8%	0.7%
	Slope Swamp	Peat Margin Swamp	0.41	0.3%	0.1%
Sub Total			*4.70*	*3.3%*	*0.8%*
Marsh	Riparian		0.00	0.0%	0.0%
Sub Total			*0.00*	*0.0%*	*0.0%*
Shallow Water	Basin		0.00	0.0%	0.0%
Sub Total			*0.00*	*0.0%*	*0.0%*
Complex [1]			22.26	15.5%	4.0%
Sub Total			*22.26*	*15.5%*	*4.0%*
WETLAND TOTAL			**143.78**	**100.0%**	**25.6%**

[1] Complex wetlands are a combination of two wetland classes above within any one polygon.

As noted previously, this study has focused primarily on identifying and classifying wetlands along the proposed TL 267 as far east as where the proposed transmission line meets the existing TL 203 near Come By Chance. The remaining segment of the TL 267 right of way, between Come By Chance and the Western Avalon Terminal Station near Chapel Arm, was the focus of a similar wetlands study completed several years ago (Stantec 2010). That study identified approximately 10.40 ha of wetland within that segment of the proposed TL 267 right of way, and 227.44 ha within the 1 km wide Study Area, all of which were classified as "bog".

The Map Atlas in Appendix A presents the detailed results of the wetlands inventory and classification and associated mapping at the 1:15,000 scale. The associated GIS system contains this information at a scale of 1:5,000, and can be analyzed and queried in detail as required.

3.1.2 Possible Functional Roles for Wetlands in the Study Area

Environment Canada and the US Army Corps of Engineers both define wetland ecological function as the natural processes (physical, chemical, biological) that a wetland provides that is independent from the benefits these processes provide to humans (USACE 1999; Hanson et al. 2008). This is differentiated from wetland values which reflect the ecosystem services wetlands provide to humans and the associated societal value. These “values” are a product of the ecological function that a wetland may provide, but may change depending on individual or community preference (Hanson et al. 2008).

A variety of approaches and methods have been developed and implemented to assess the various functions that wetlands do or can provide. The common functional criteria amongst most methodologies include some level of assessment of whether and how the wetland interacts with the hydrological and hydrogeological aspects of the landscape (stream flow regulation, ground water recharge, flood prevention), habitat functions (such as the presence of rare flora or fauna, food source or nesting habitat for wildlife, fish habitat), biochemical functions (nutrient cycling, carbon sequestration, sediment retention), and socioeconomic functions (aesthetic, educational, recreational, commercial resources).

The five wetland classes that have been identified within the Study Area do or can provide a number of these functions in various combinations and to varying degrees. The functions that any individual wetland provide depends on a number of factors such as the actual wetland type, location, wetland size, proximity to human populations and hydrological regime.

Although detailed functional assessments of individual wetlands that may interact with this Project cannot be completed through a solely desk-top analysis of spatial imagery (such as that completed here), a number of general statements can be made regarding each of the wetland classes that have been identified within the Study Area.

Bog

The main source of water for a typical bog is precipitation, snow melt or fog. As discussed above, this water is generally low in nutrients and pH and thus restricts microbial activity that would otherwise break down organic matter releasing nutrients into the substrate. This leads to a relatively high accumulation of organic material (high carbon sequestration), but it also lowers productivity in terms of vegetation growth. This lack of productivity lowers the relative habitat function of bogs in terms of being a high quality food source for wildlife. Bogs can, however, provide nesting habitat, transportation corridors and serve open space functions.

Where bogs are typically isolated from surface water, hydrological functions such as storm water retention and flood control are low, although in high precipitation events some bogs can provide this function. Although bogs do not typically receive ground water discharge, they may provide a source of ground water recharge where water contained in the peat may slowly move downward providing a continuous source to aquifers below.

The majority of the Study Area is located in a remote part of insular Newfoundland, and as such, human uses and societal values such as berry picking, landscape aesthetics, education and others may not apply as these areas are not easily accessible from communities. Bogs occurring in closer proximity to the inhabited areas at either end of the proposed Project Area may, however, provide one or more of these functions.

Fen

Fens are typically more ecologically productive than bogs as the source of water is typically nutrient rich surface water and ground water. As a result, fens typically offer a greater habitat function and food source for wildlife. Fens typically have higher species diversity than bogs, and as such, may have a higher potential to contain rare flora. Open water within fens may also provide habitat for waterfowl, amphibians, fish and reptiles.

Fens associated with streams and rivers have the opportunity to provide storm water retention and flood control functions, as well as receive pollutants and run off from any adjacent developed areas. As stated above, the majority of the proposed Project Area is located in a somewhat remote area, and the potential filtering of pollutants would be more likely near communities or other developed area. Fens are characterized by the accumulation of peat, and therefore do contribute to sequestration of carbon.

Similar to bogs, fens that are accessible to people may provide greater opportunities for human use and value, such as recreational, aesthetic and educational opportunities.

Swamp

Swamps are typically dominated by trees and shrubs and can be flooded for a portion or all of the growing season. This vegetation can provide a high roughness coefficient which allows swamps to provide high sediment retention and storm water retention functions. These areas provide nesting habitat for wildlife as well as an important food source for various wildlife species through seed and berry production.

Marsh

Marshes often provide important habitat for fish and wildlife species such as waterfowl. These areas provide nursery habitat for a variety of fish and other aquatic species as well as nesting and foraging habitat for some bird species and mammals. Riparian and estuarine marshes can also provide bank stabilization functions as well as sediment retention during storm events.

Shallow Water

Shallow water wetlands often provide a food source for wildlife who feed on aquatic vegetation, such as moose. They can also provide habitat for waterfowl, amphibians and reptiles as well as various mammal species that spend a portion of their time in or near water (such as beavers). These areas may also provide recreational and aesthetic values to society in areas accessible by the public.

3.2 Habitat Management Units

At the municipal level, Newfoundland and Labrador's Wetland Habitat Stewardship Program works within the context of the Eastern Habitat Joint Venture to secure, enhance and restore important wetland areas for waterfowl and other wildlife species. Under this program, Wetland Stewardship Agreements are developed and signed with municipalities that manage important habitats within their planning boundaries. Through these Agreements, the participating communities formally commit to securing designated wetlands within their municipal planning boundaries, and to implementing "wise use" principles as outlined within a conservation plan. Through this partnership the resources of the Eastern Habitat Joint Venture are made available to develop a conservation plan for the wetlands, to assist in the restoration of degraded wetlands, to provide for educational opportunities, and to promote the participation of the local residents in the use and protection of their resource (NL DEC 2014b).

There are a number of designated wetland areas (Habitat Management Units) in Newfoundland and Labrador that have been selected and designated for conservation purposes. The proposed TL 267 will, like the existing transmission lines in the area, cross through a portion of the Come By Chance Habitat Management Unit (Appendix A).

4.0 SUMMARY AND CONCLUSION

The purpose of this Wetlands Inventory and Classification Study has been to identify, delineate and where possible categorize all wetlands located within the proposed transmission line right of way and surrounding Study Area, for use in on-going Project planning and design and in support of the Project's EA Registration. This "desk-top" wetlands analysis has utilized existing and high quality spatial imagery for the Project area, and was completed in conjunction with a larger ELC Study (Amec Foster Wheeler 2015).

The wetlands analysis and mapping exercise described in this report identified approximately 3,807 ha of wetland within the Study Area along the proposed TL 267 as far east as where the proposed transmission line meets the existing TL 203 near Come By Chance. This included the following wetland classes: 1) bog, 2) fen, 3) swamp, 4) marsh, and 5) shallow water, as well as a number of associated forms and sub-forms within these classes, as per the Canadian Wetland Classification System, and wetland complexes comprised of multiple types. Wetlands constitute approximately 27 percent of the total land area classified in the overall 1 km wide Study Area through the ELC. Comparatively, approximately 144 ha of wetland habitat was identified within the proposed 40 m wide transmission line right of way itself, which represents 26 percent of the total habitat within the Study Area as identified and classified through the ELC.

The remaining segment of the TL 267 right of way, between Come By Chance and the Western Avalon Terminal Station near Chapel Arm, was the focus of a similar wetlands study completed several years ago (Stantec 2010). That study identified approximately 10.40 ha of wetland within that segment of the proposed TL 267 right of way and 227.44 ha within the 1 km wide Study Area, all of which were classified as "bog".

The information provided through this *Wetlands Inventory and Classification Study* is intended to support the Project's EA registration and review, and will be used in on-going Project planning and design as well as in the eventual permitting and construction / mitigation planning for the Project.

5.0 REFERENCES

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Appendix A

Wetlands Map Atlas

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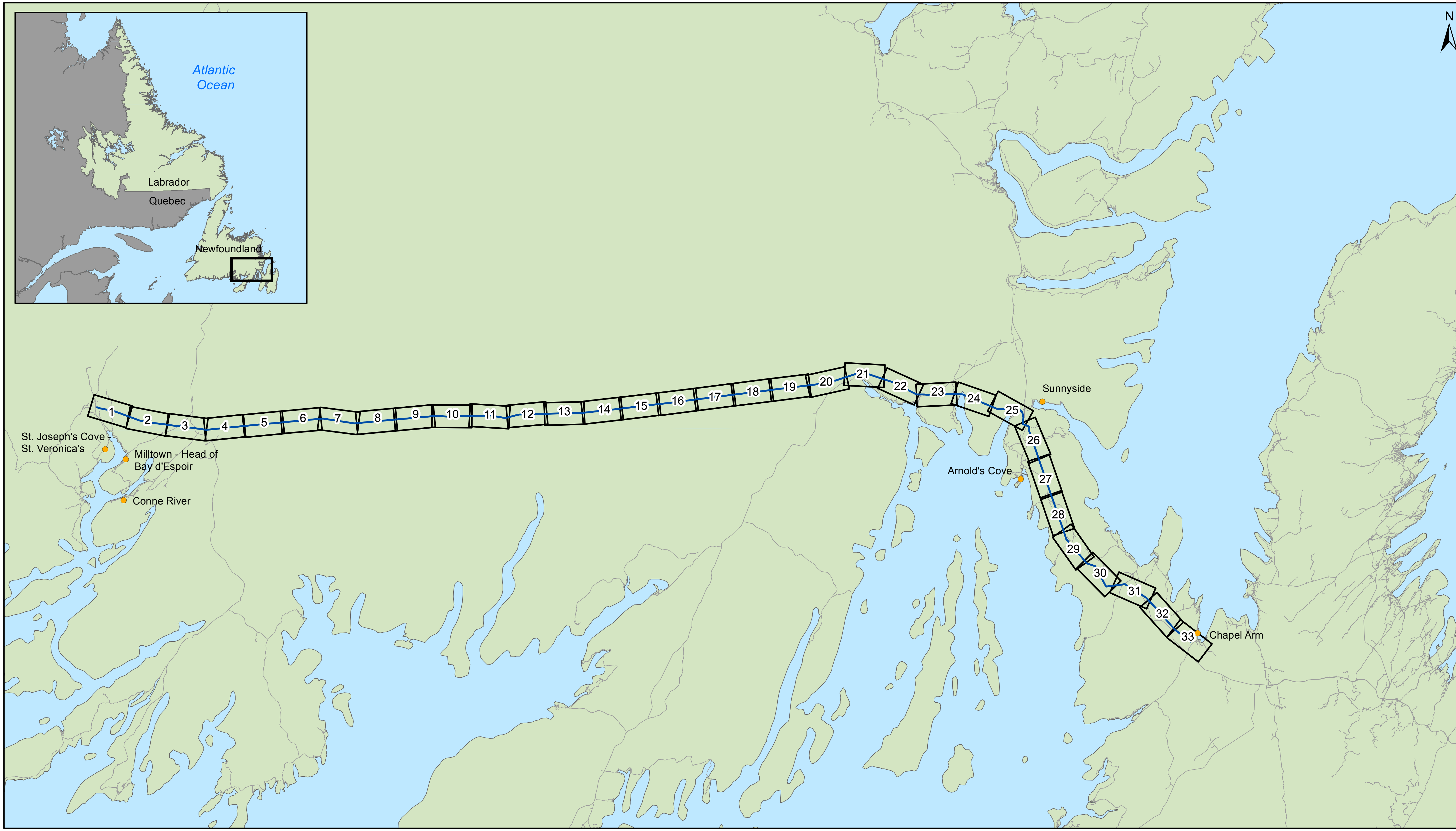

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MAP INDEX

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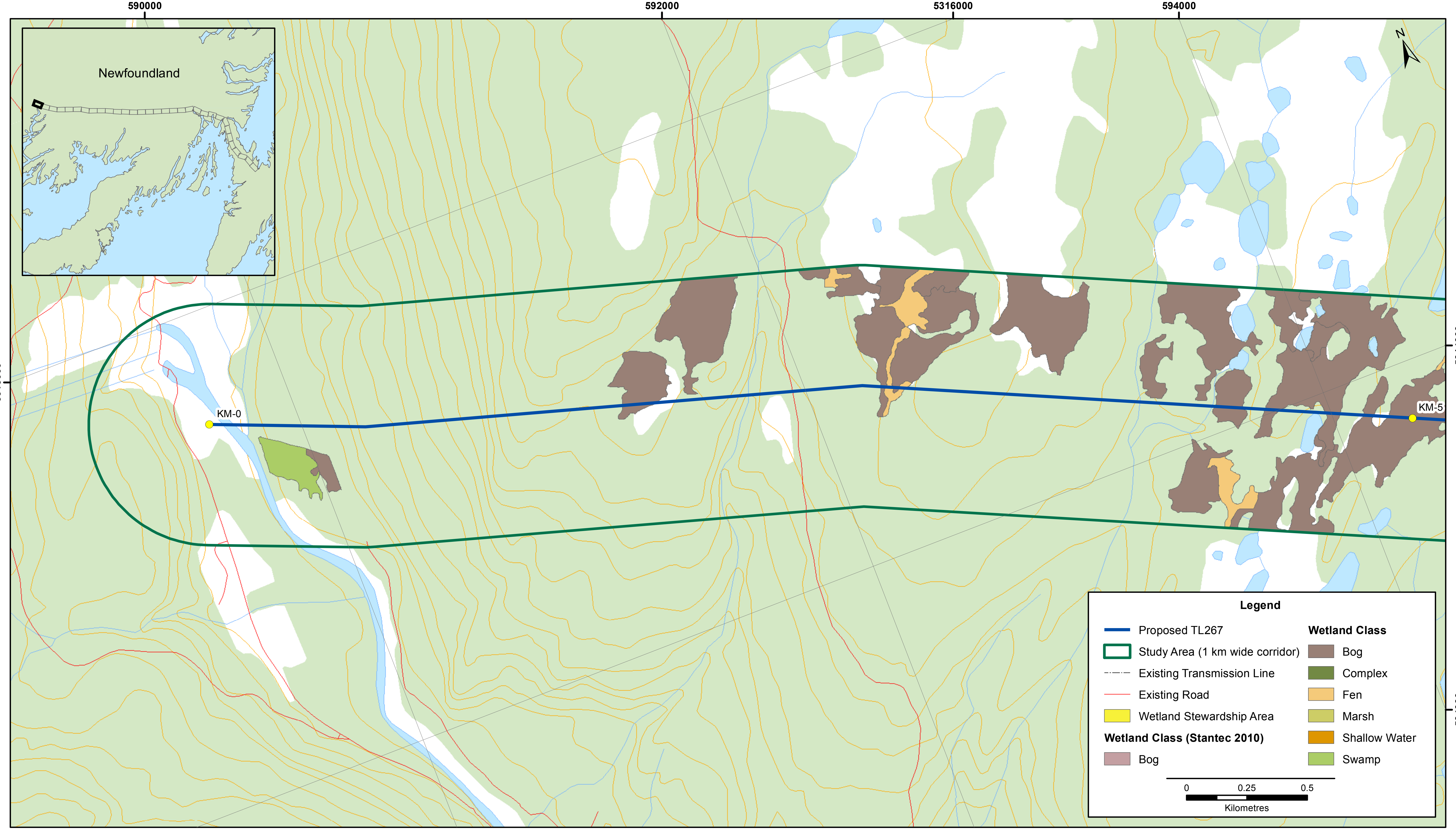

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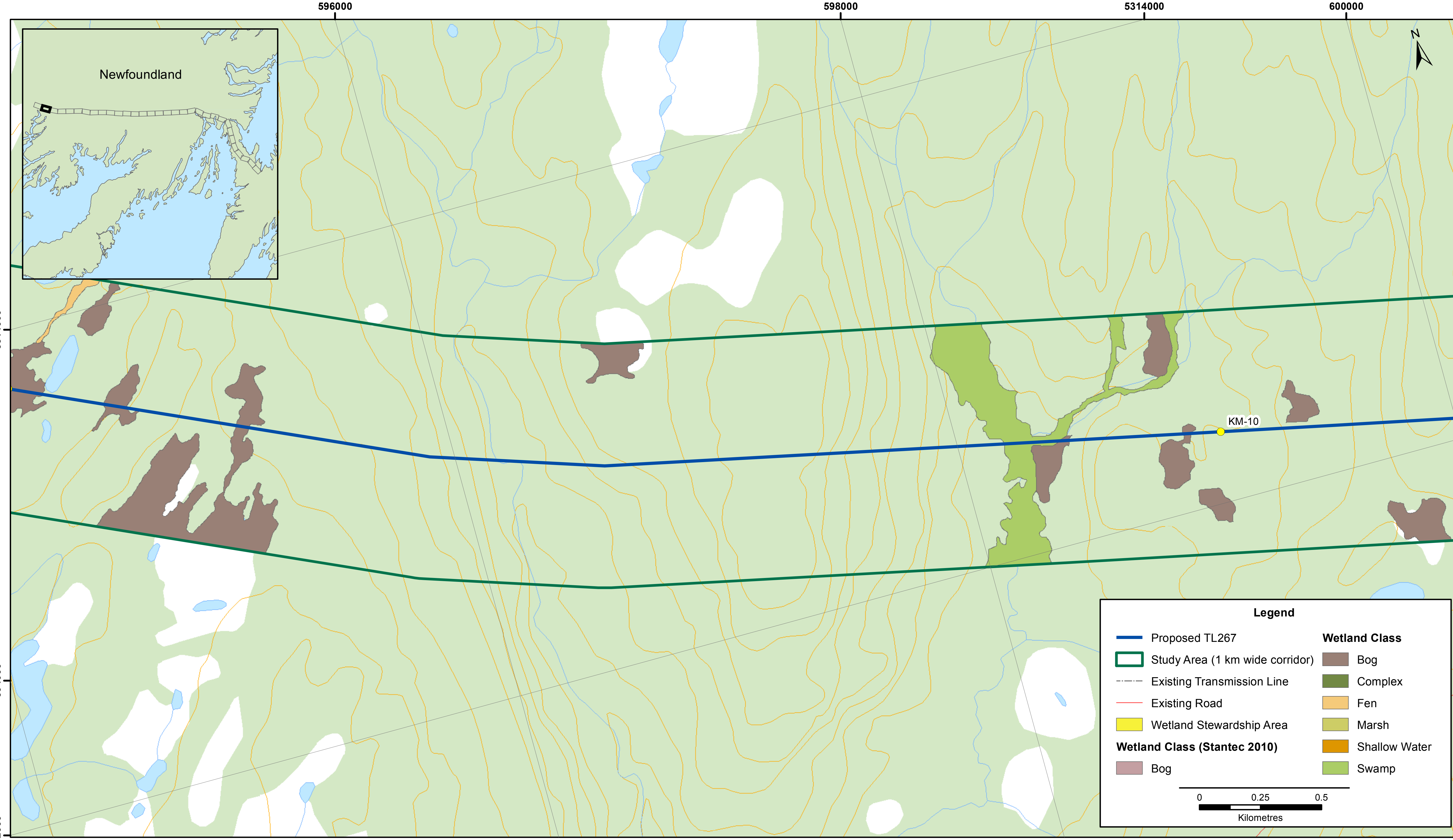

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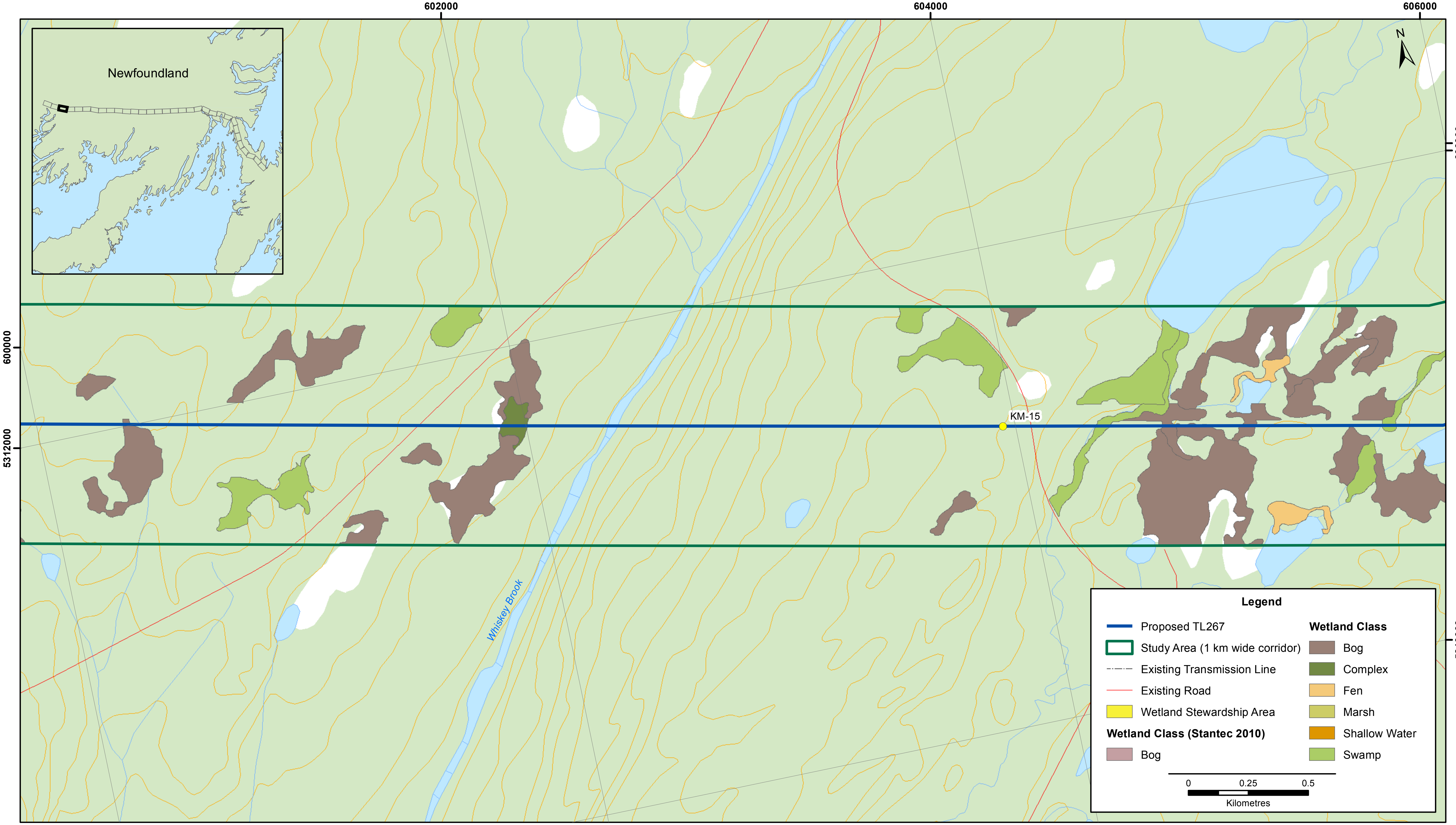

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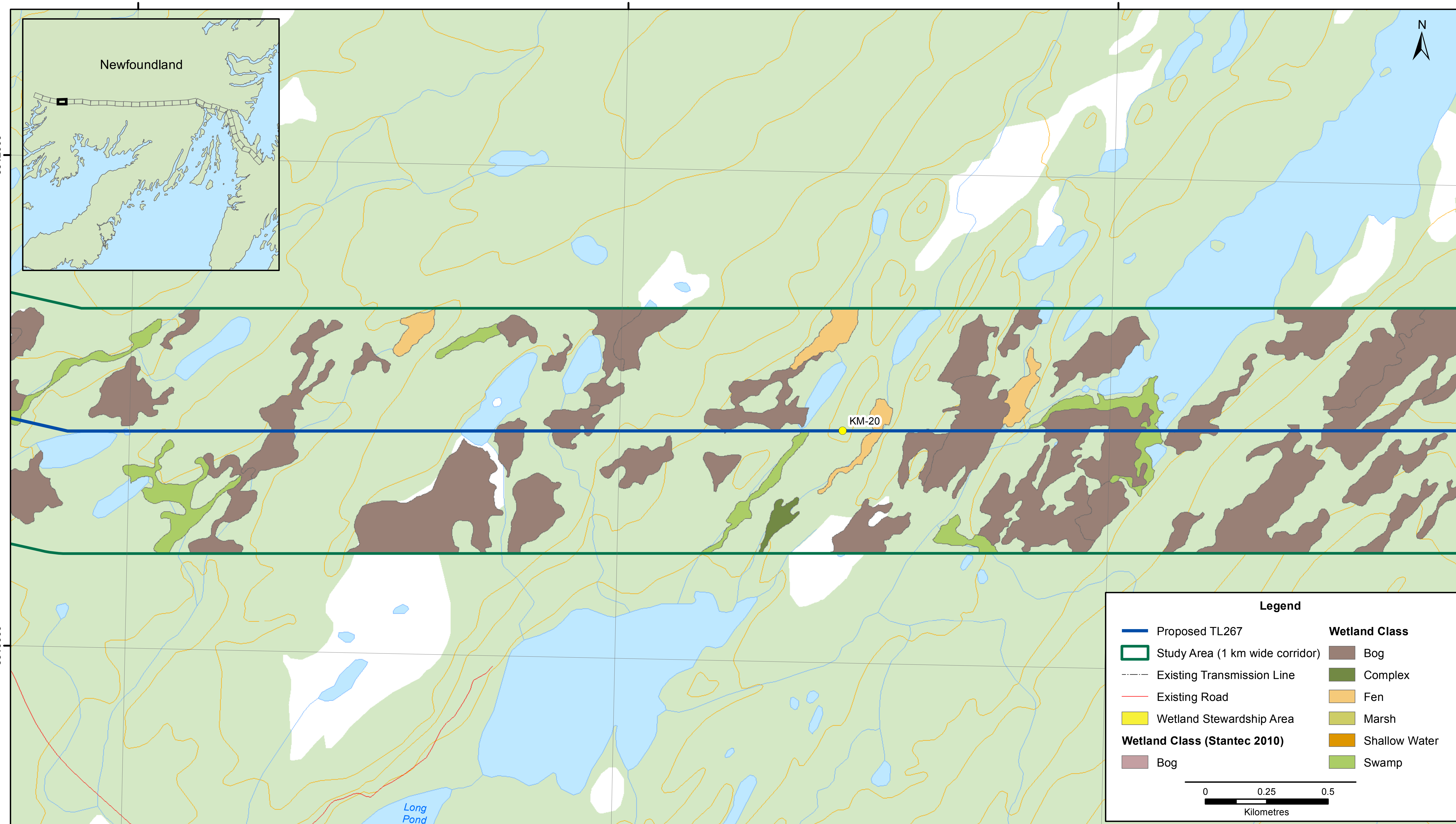

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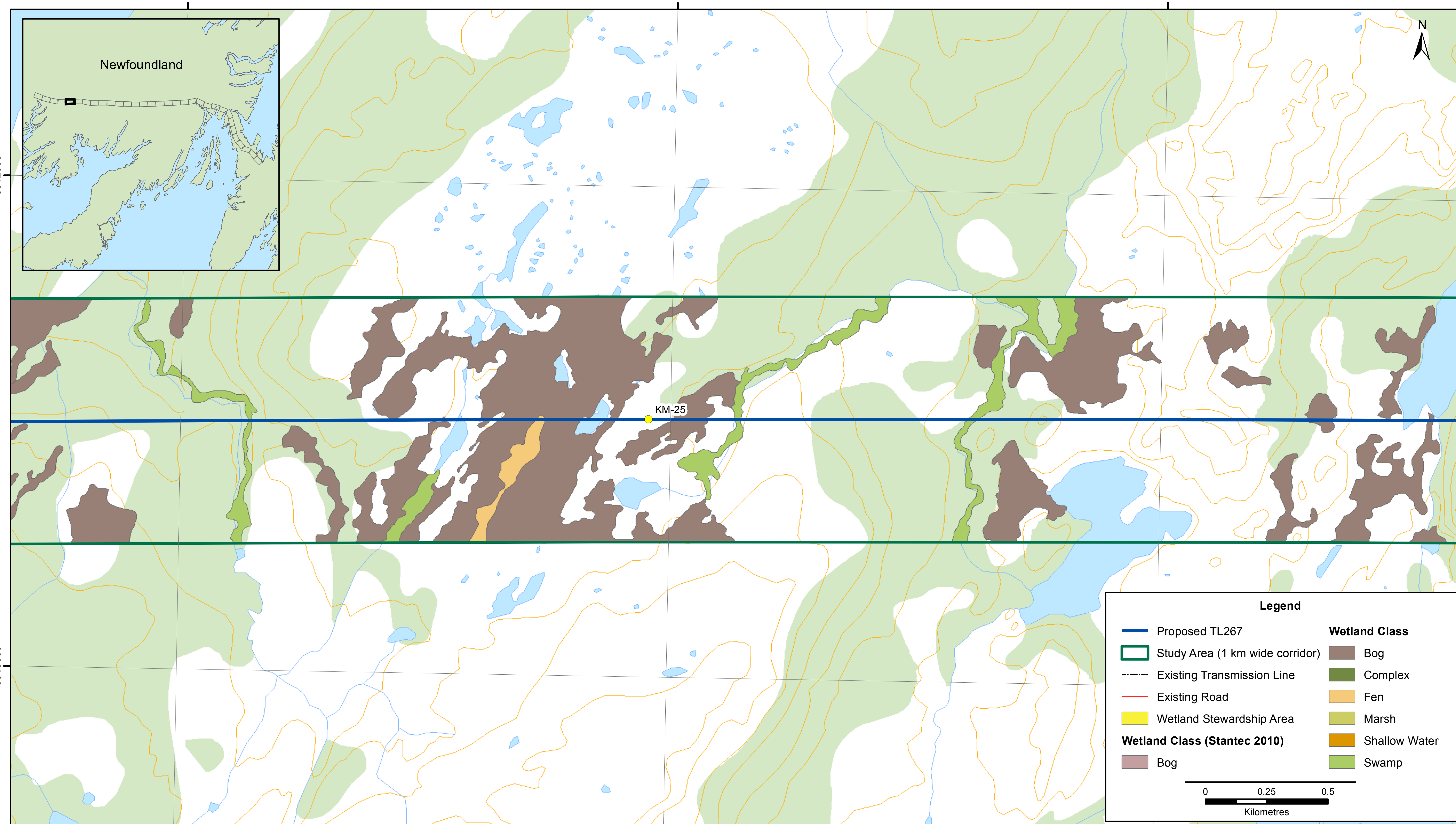

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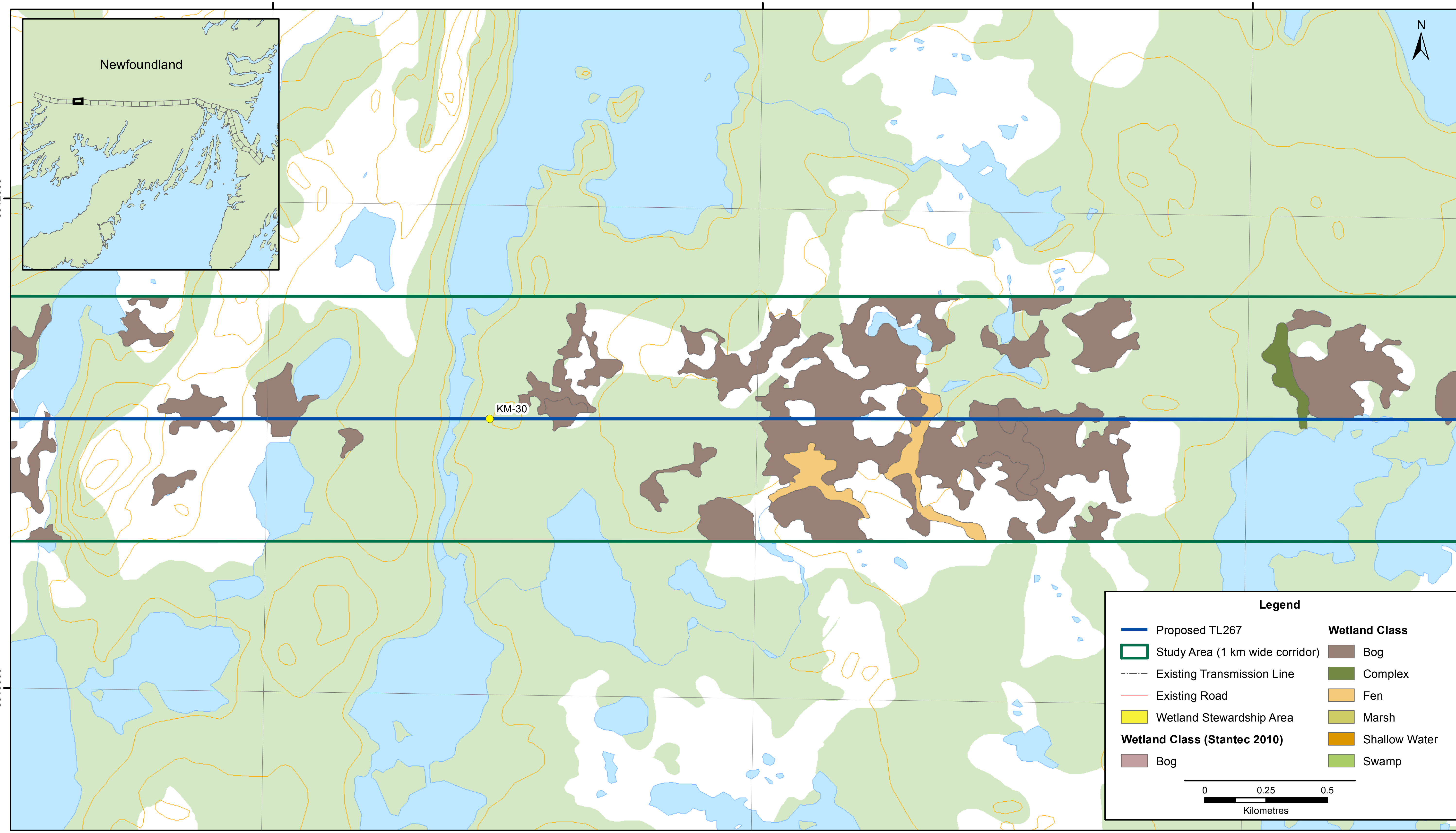

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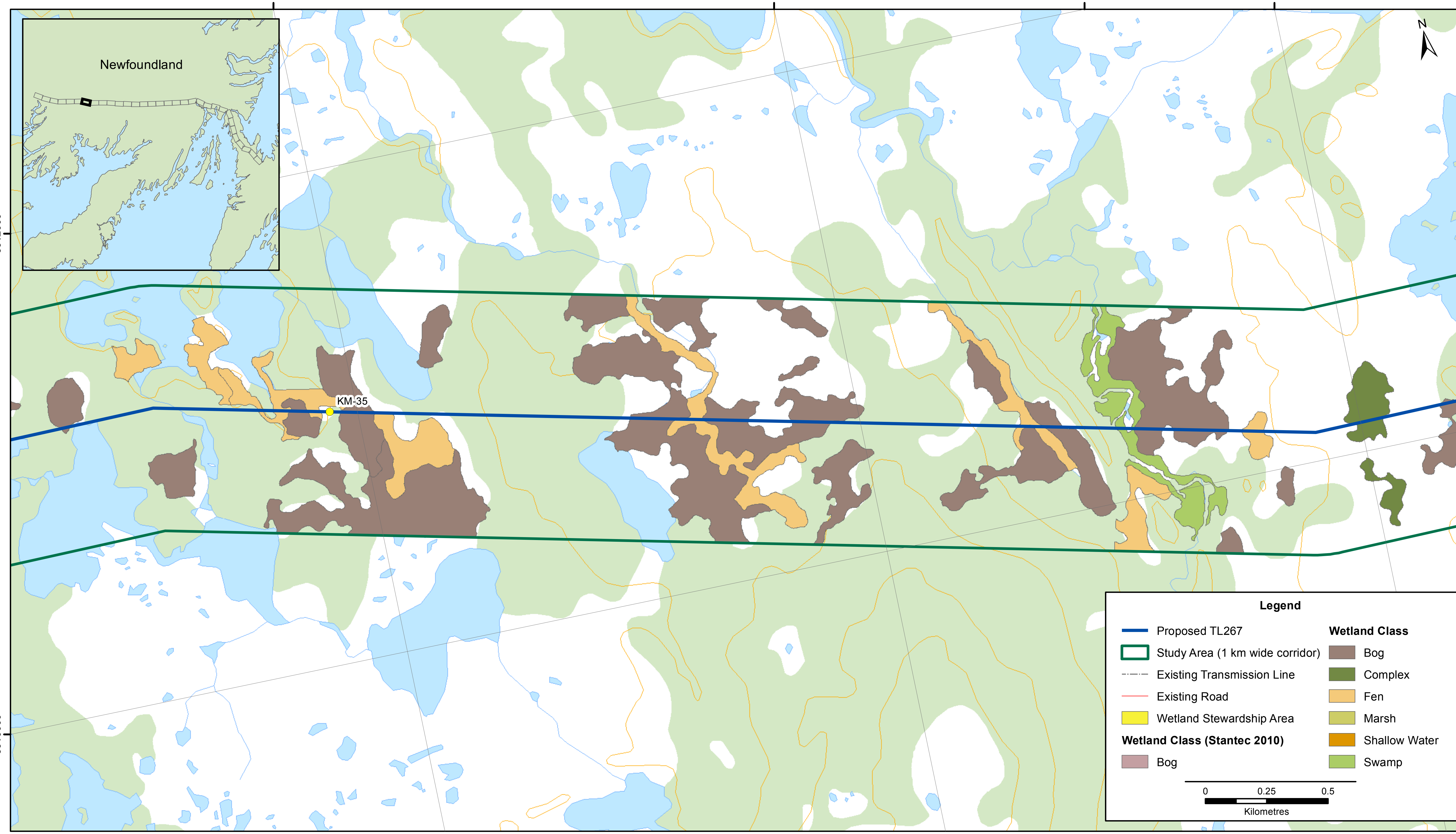

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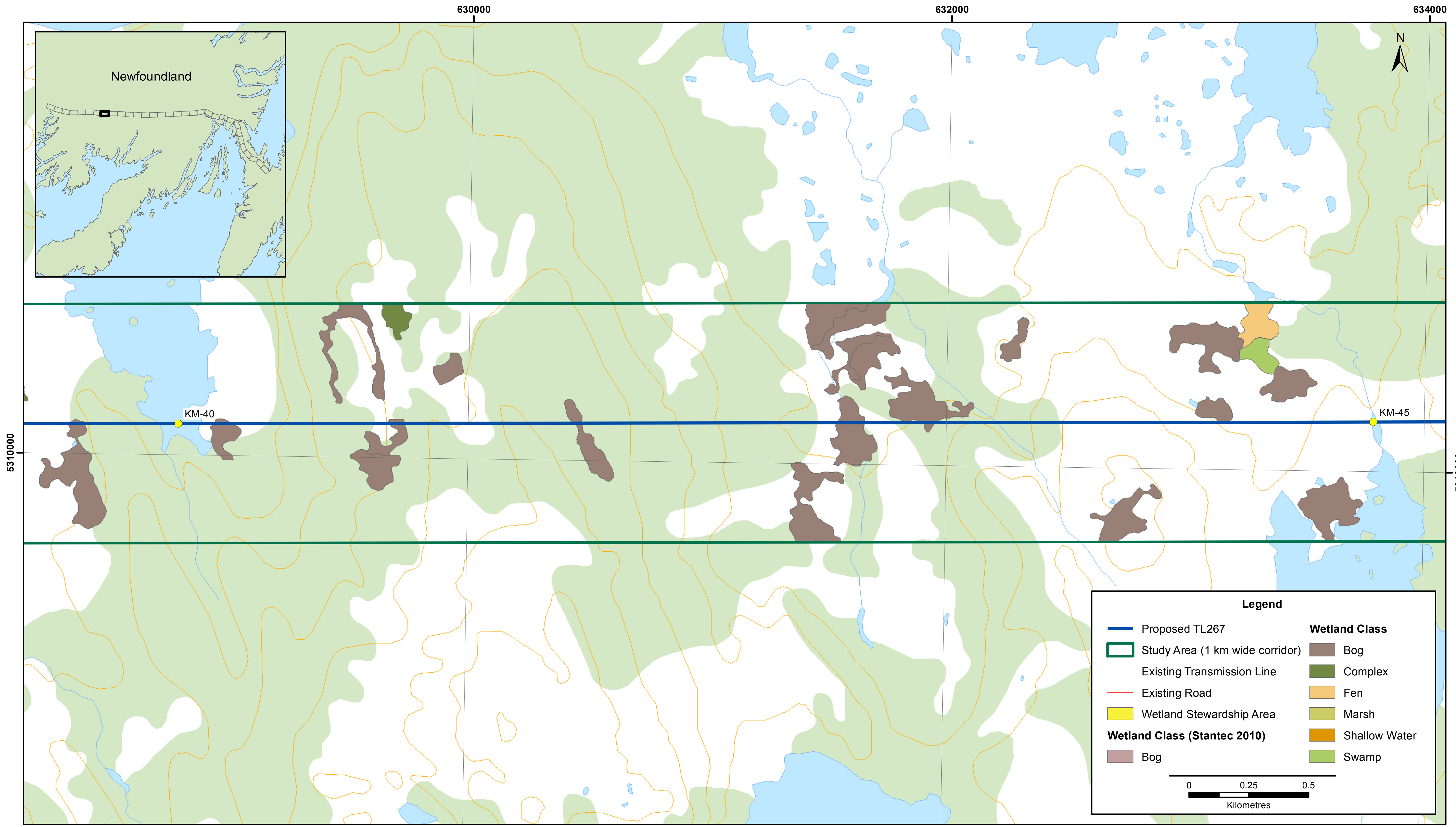

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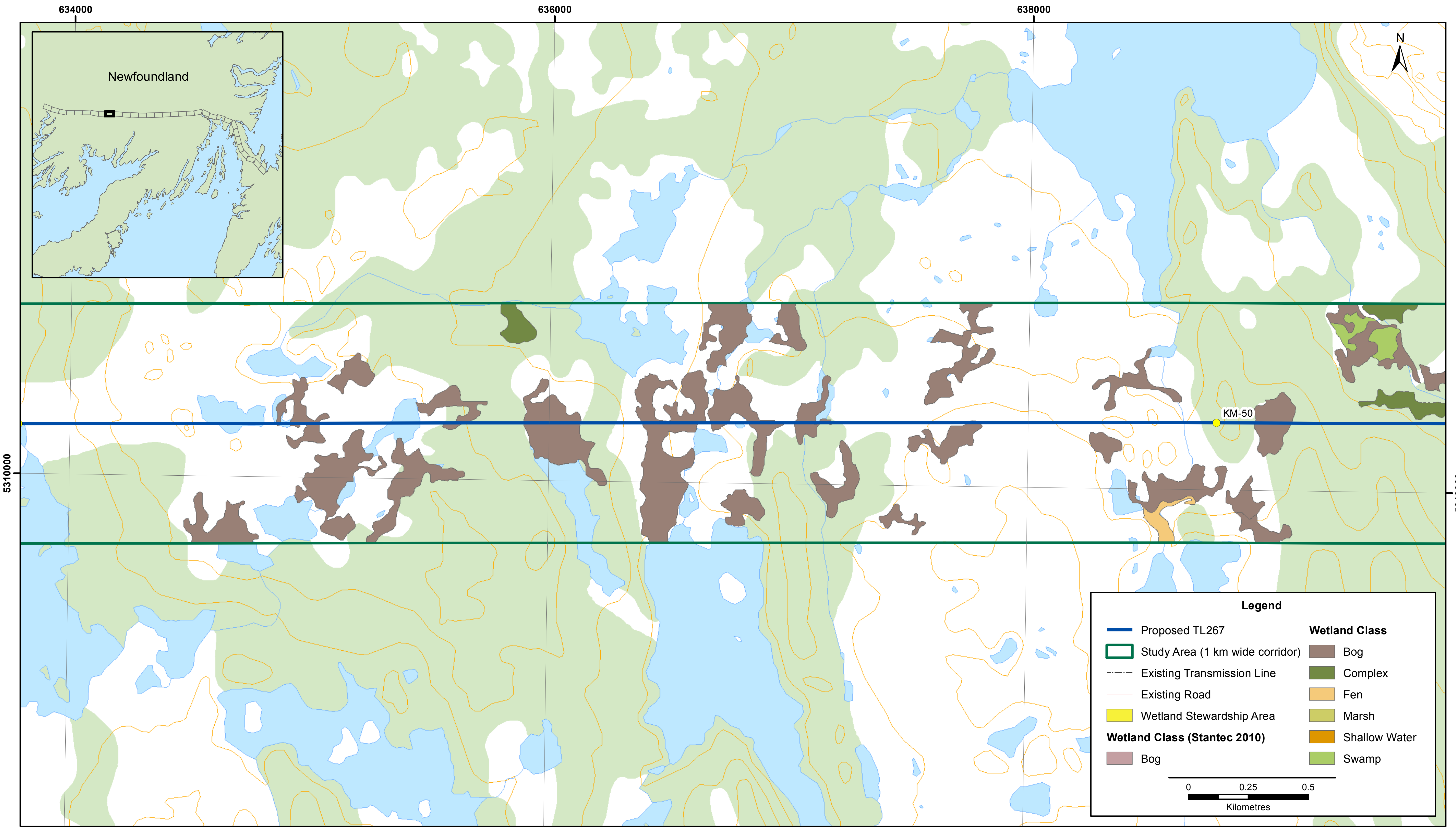

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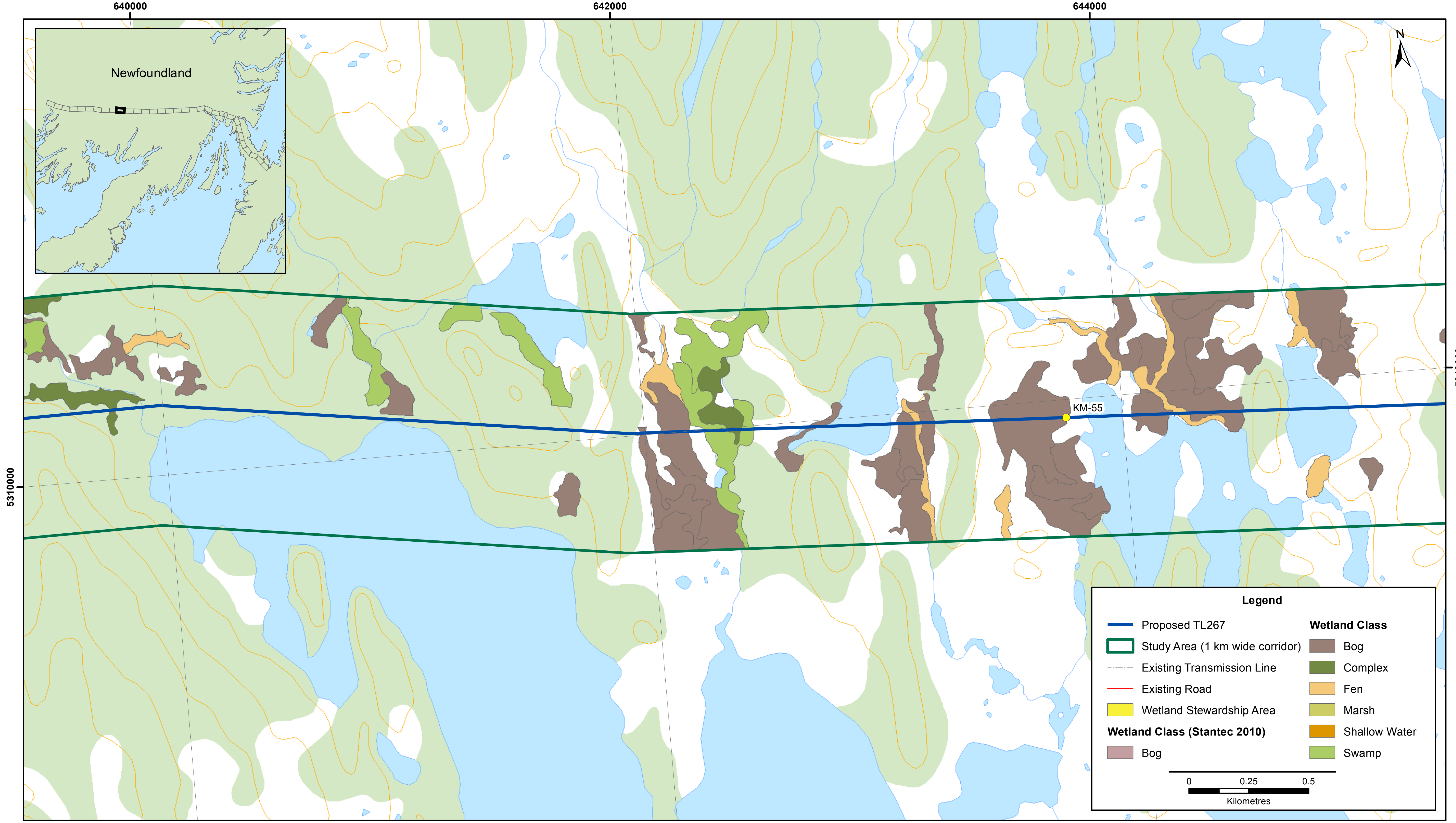

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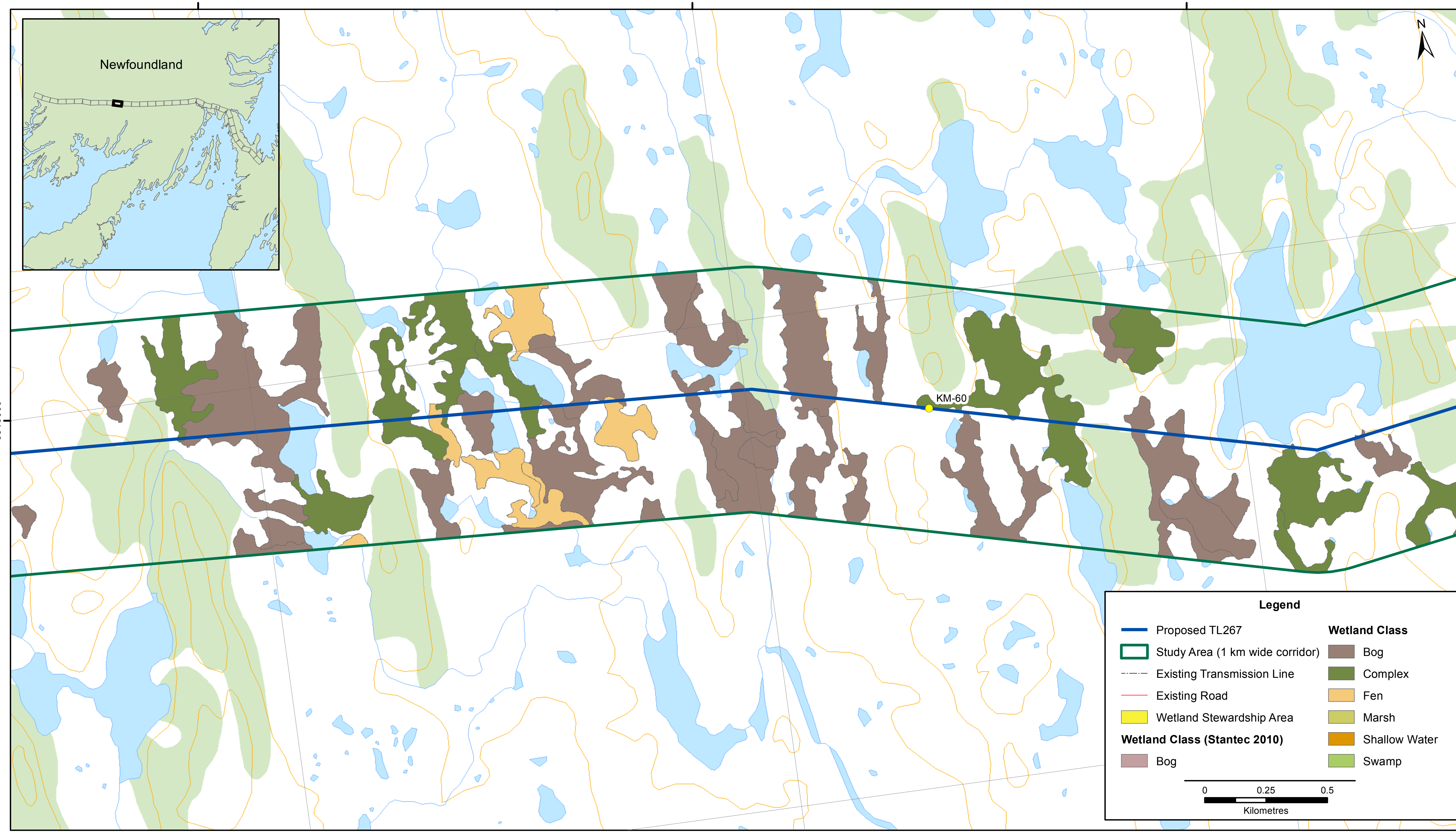

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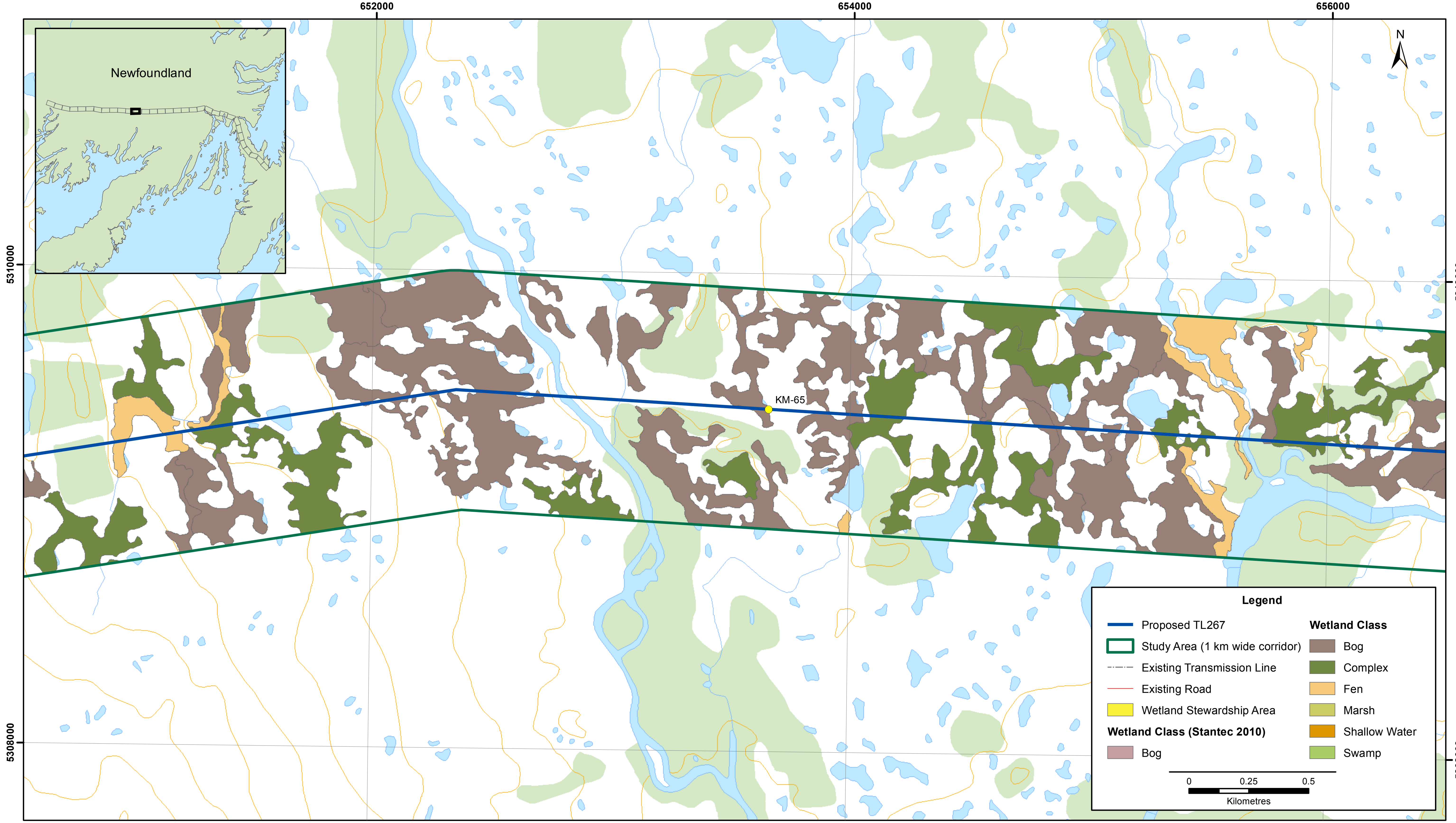

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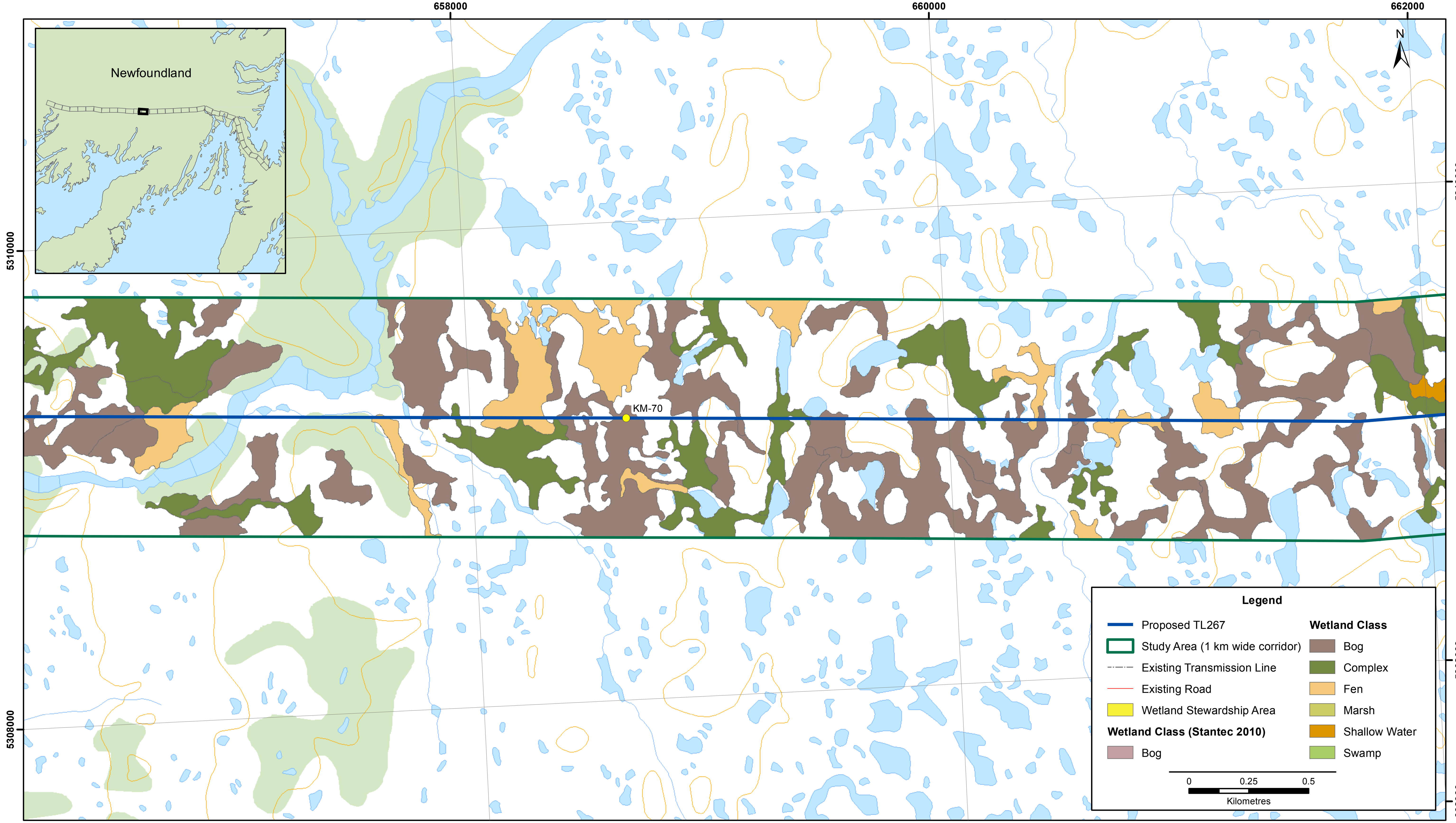

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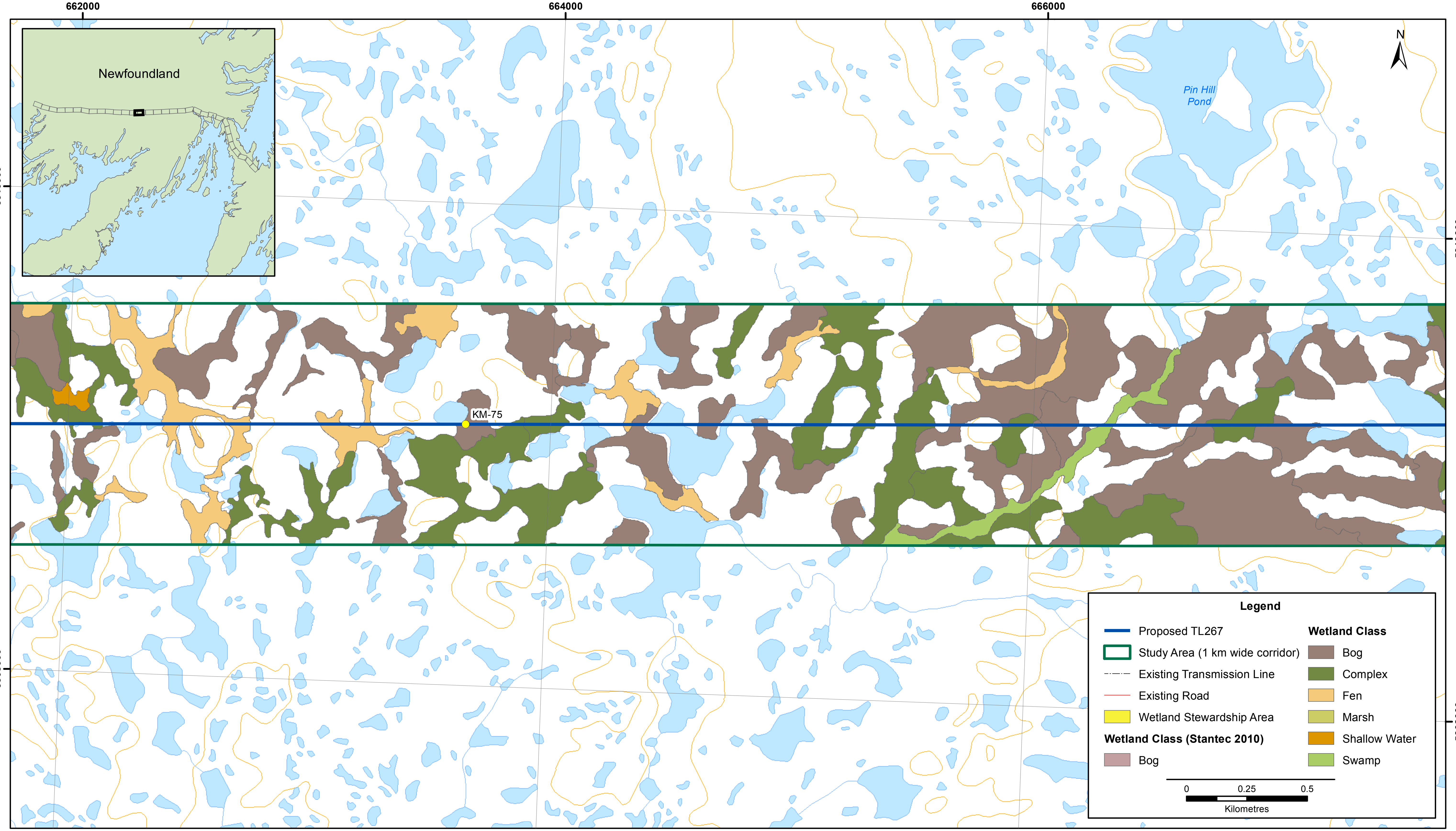

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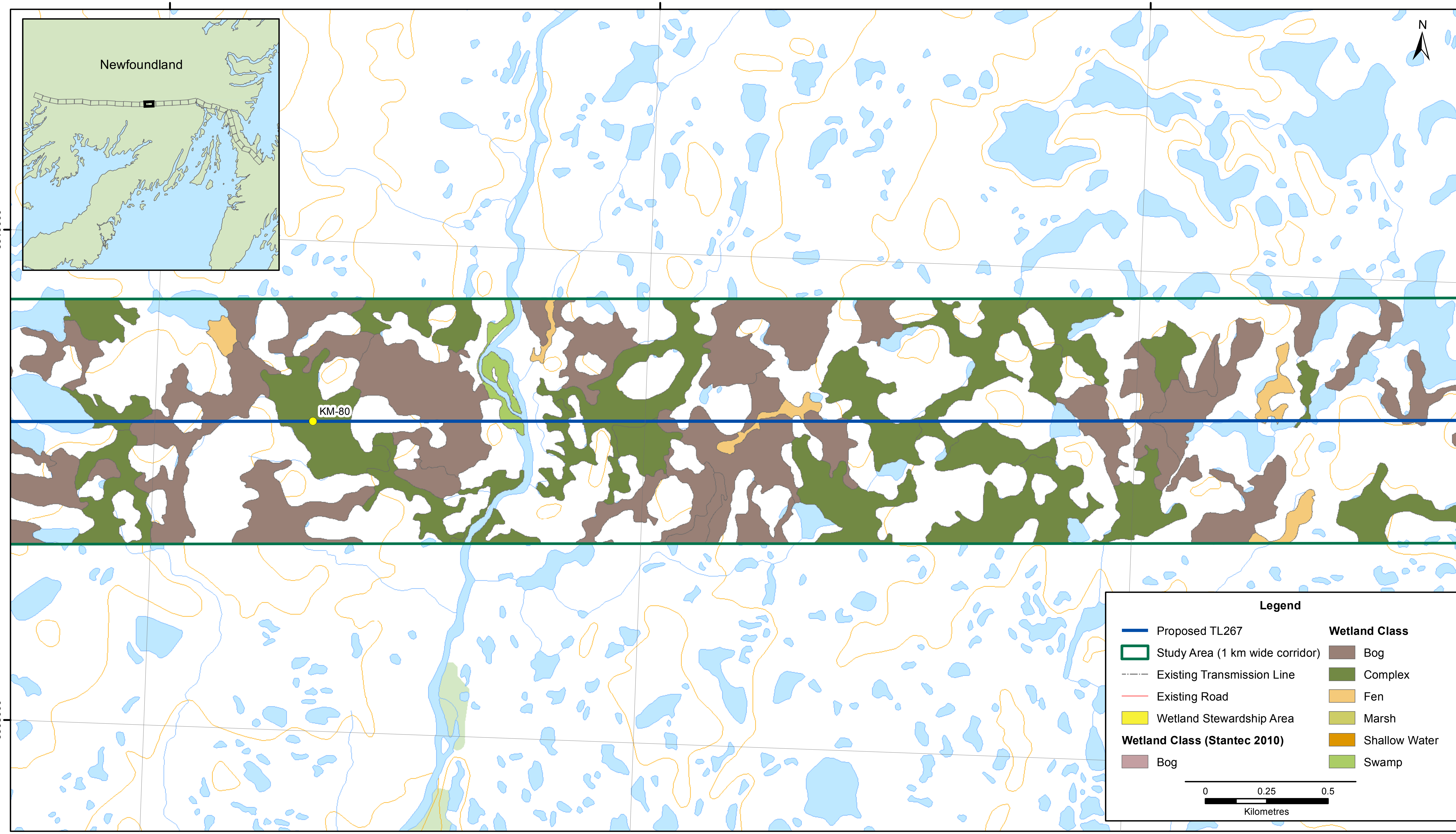

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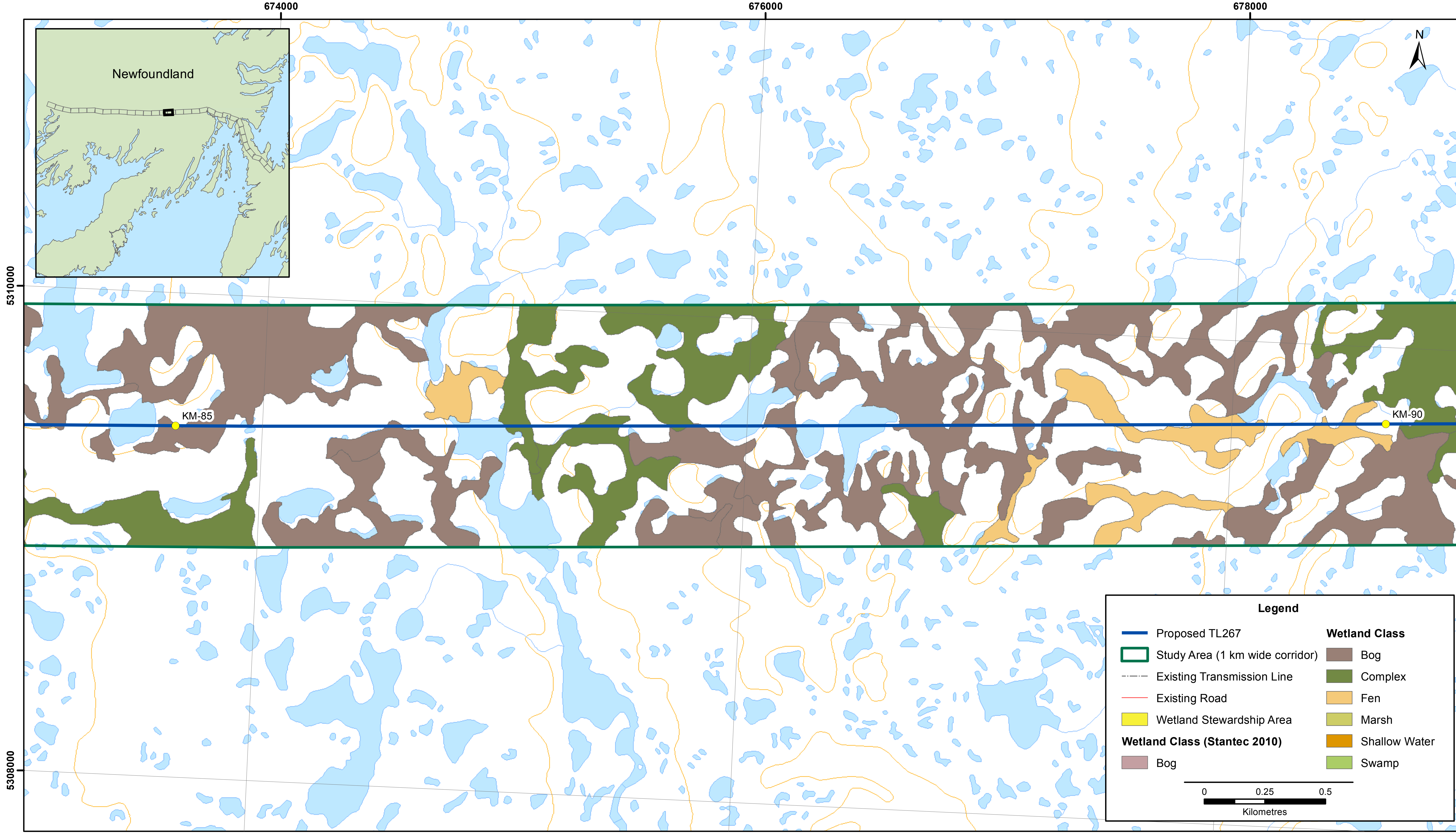

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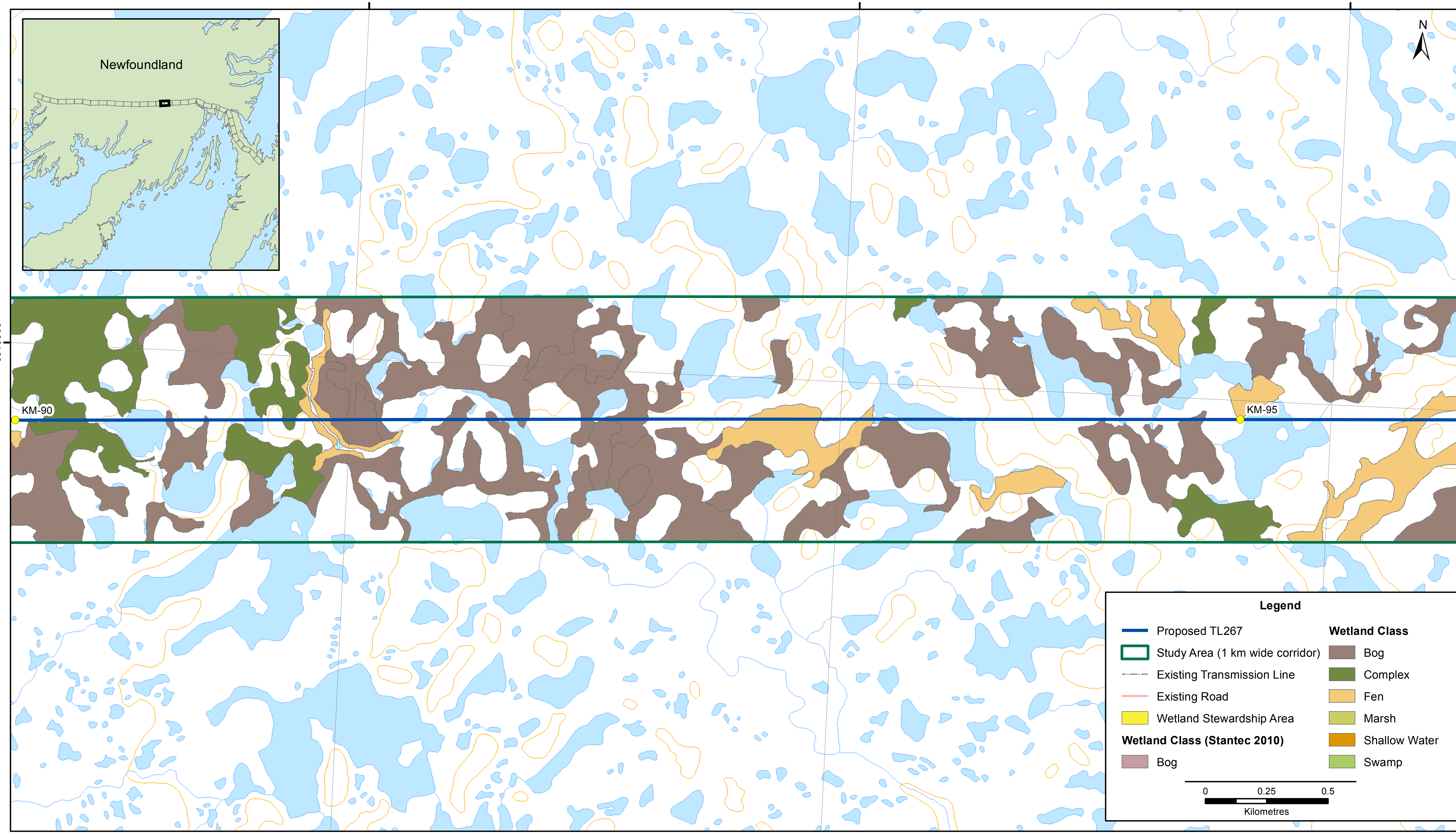

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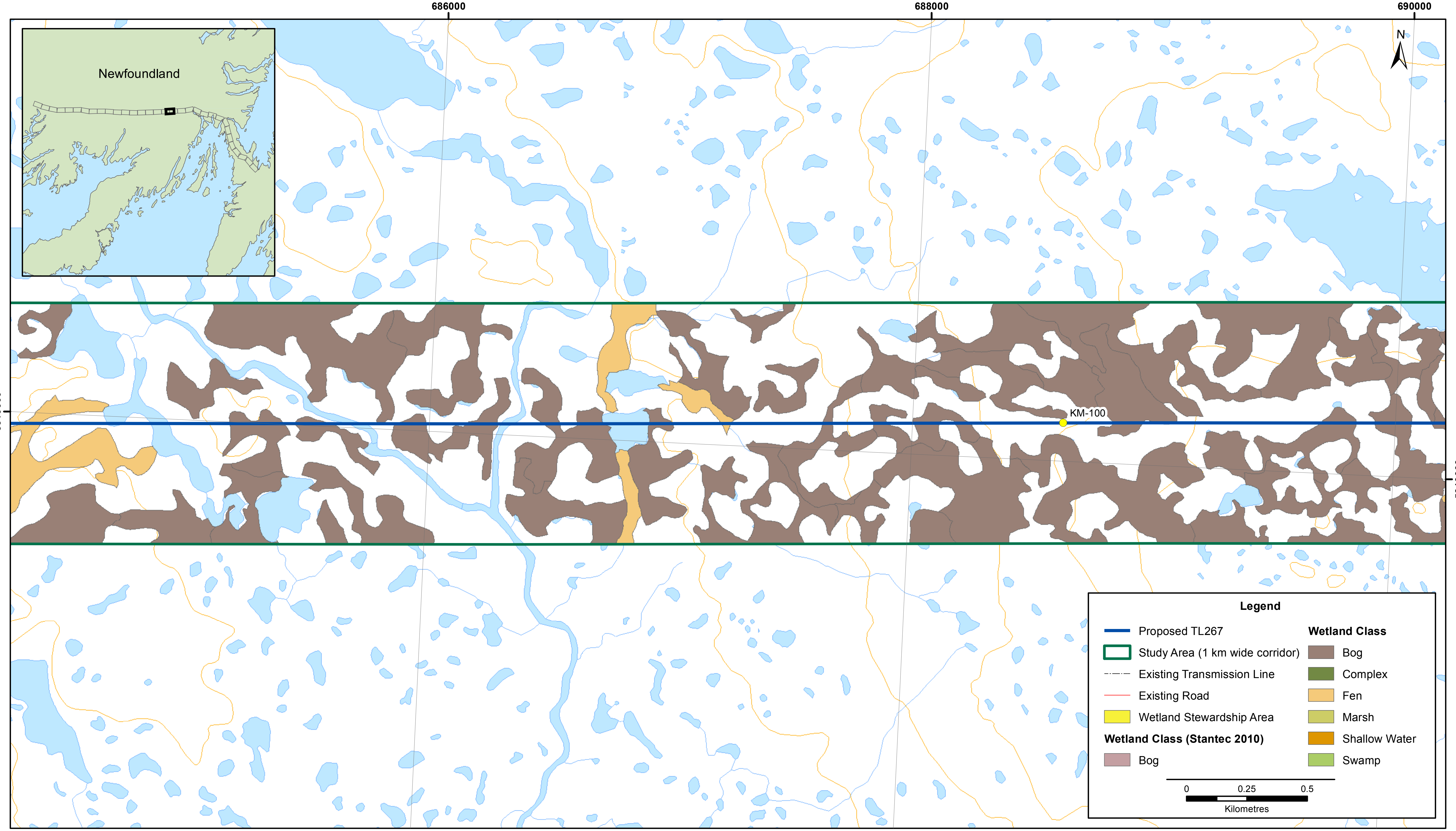

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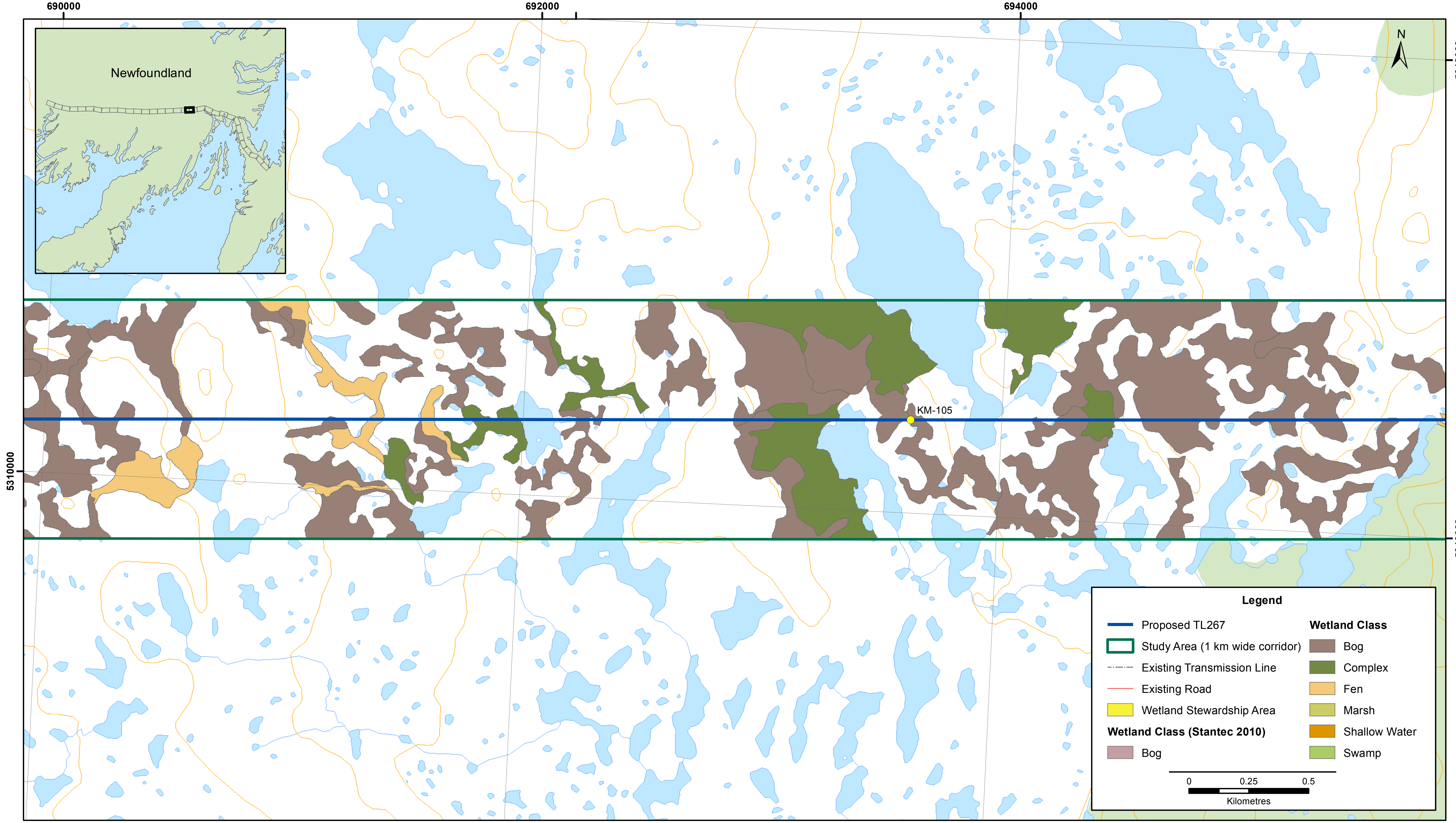

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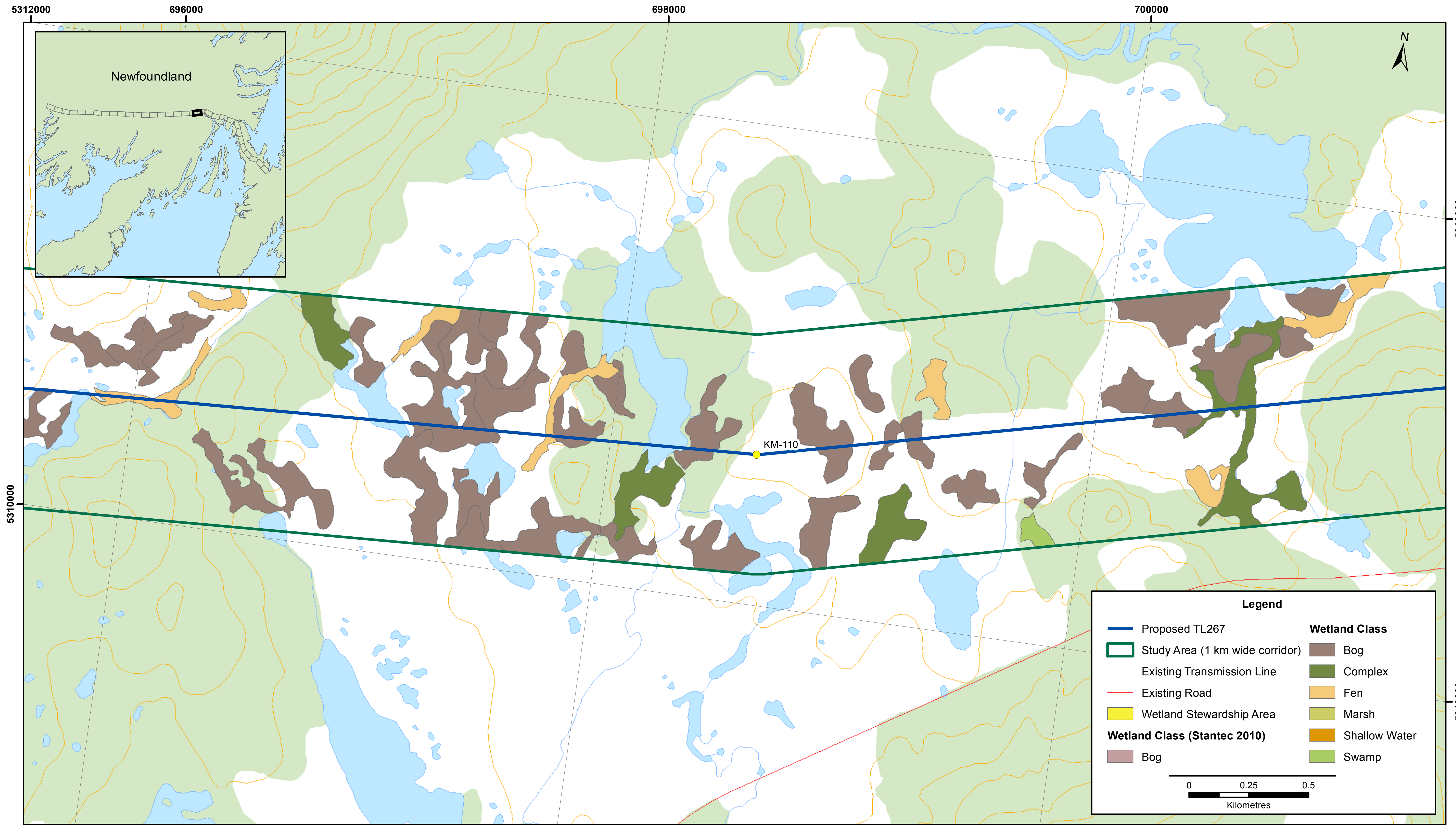

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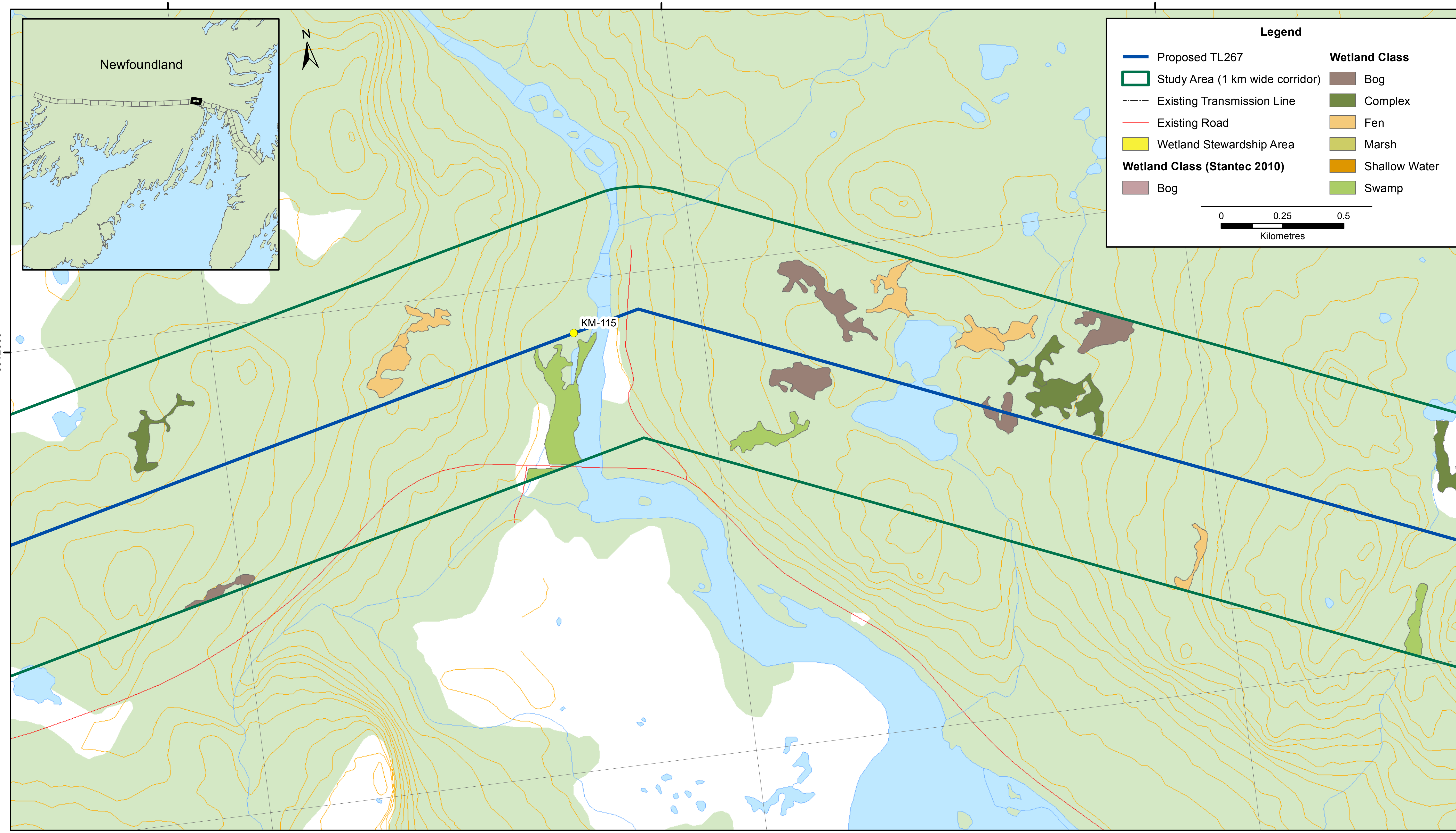

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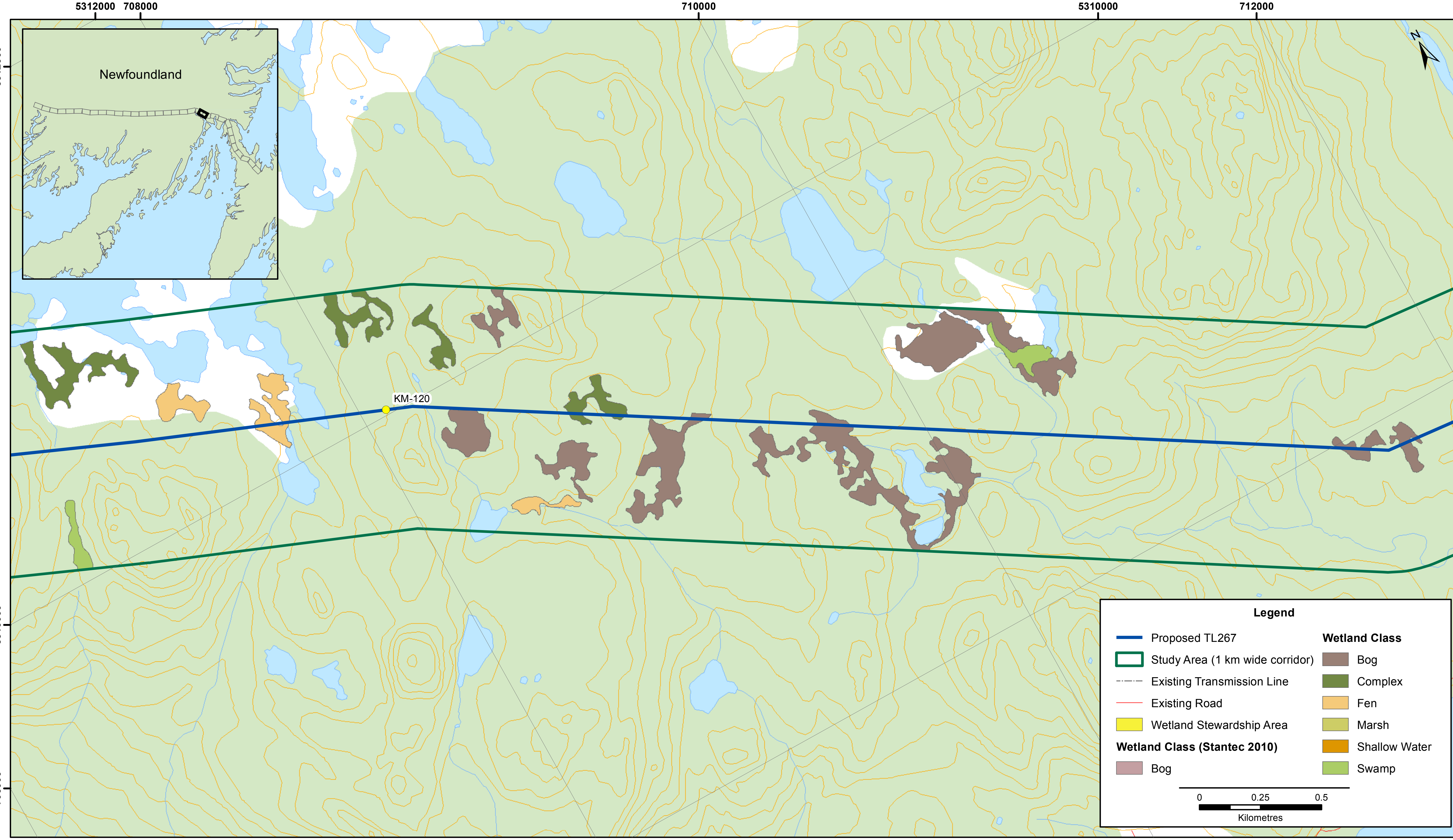

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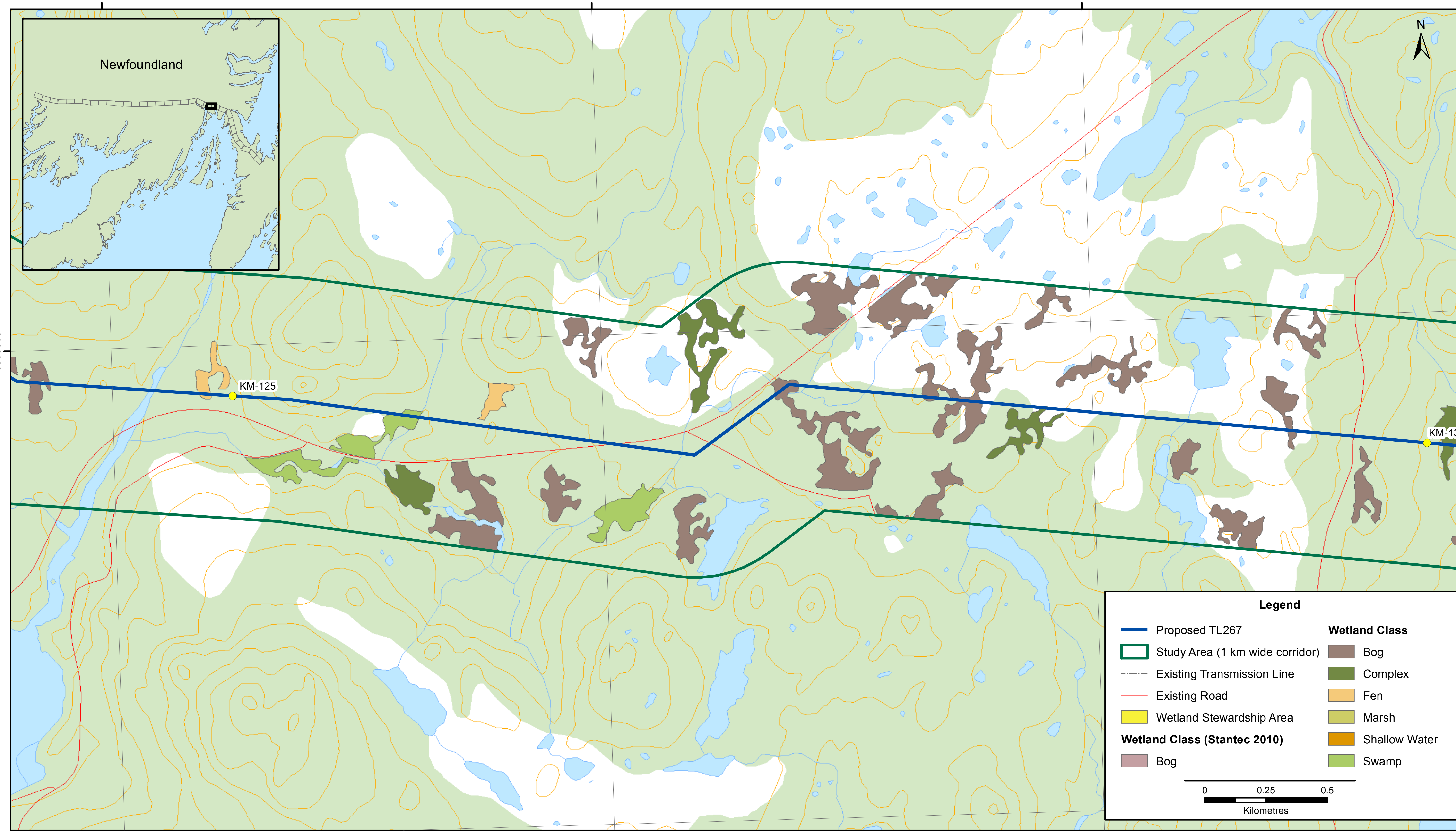

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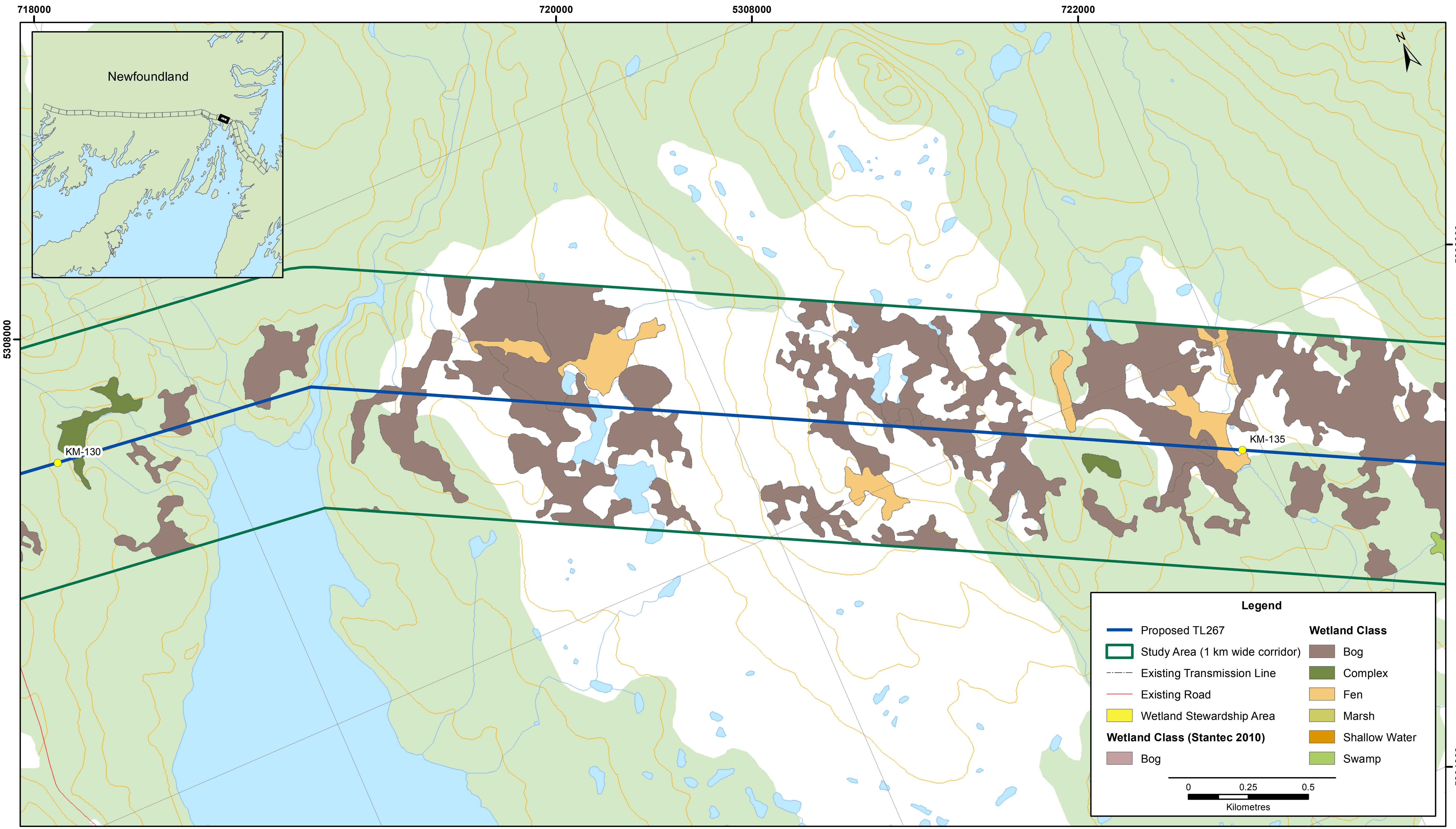

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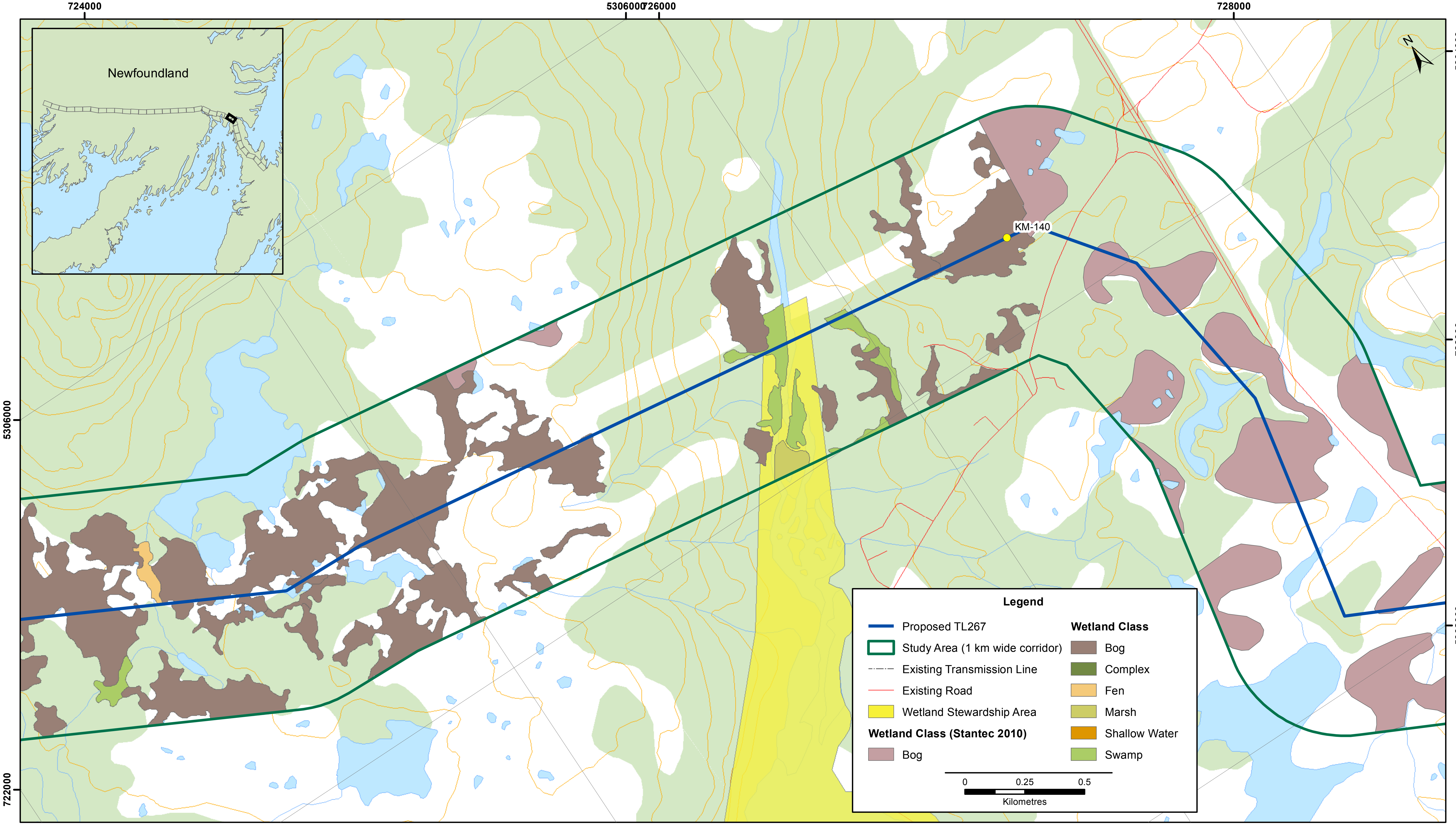

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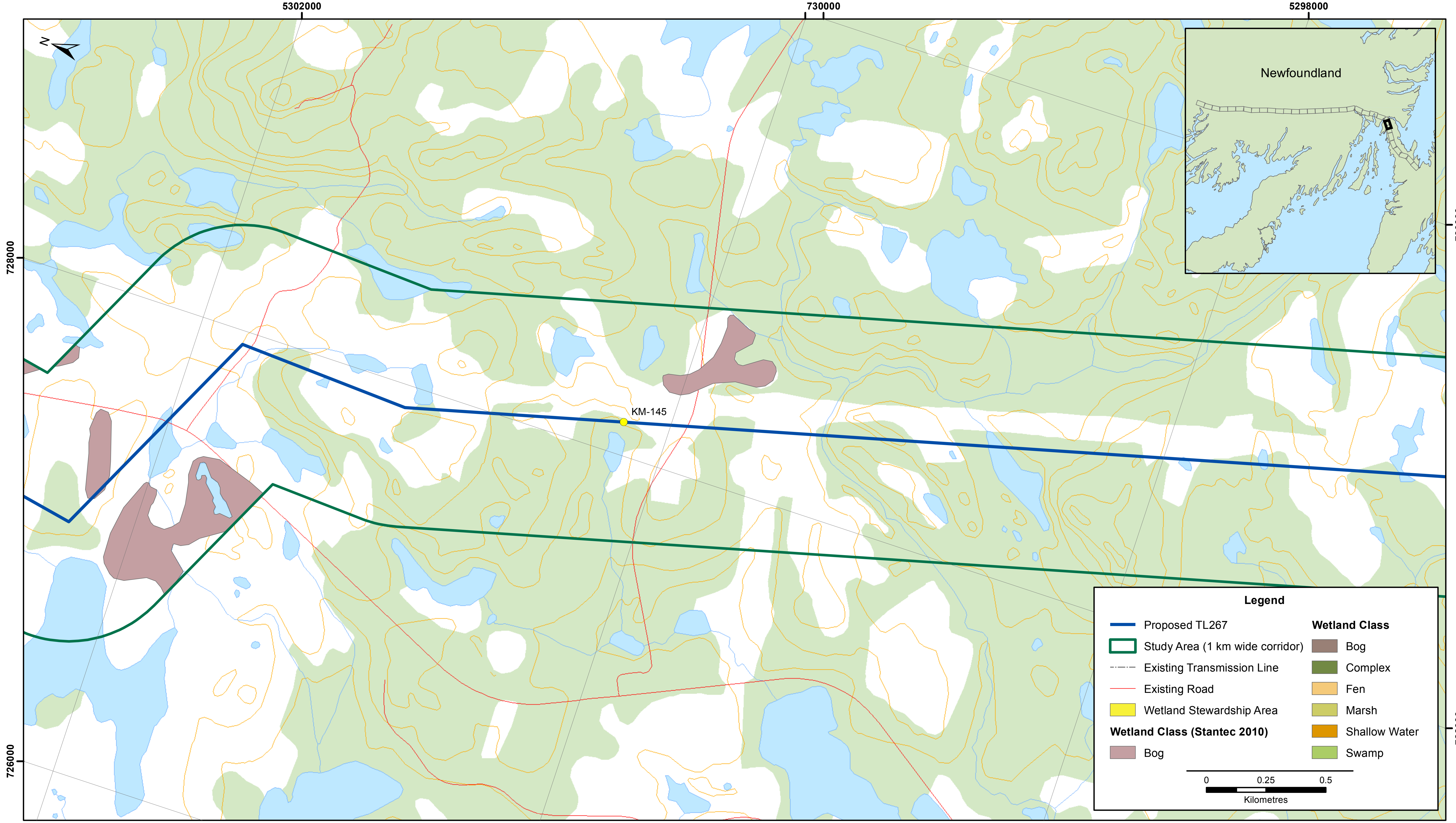

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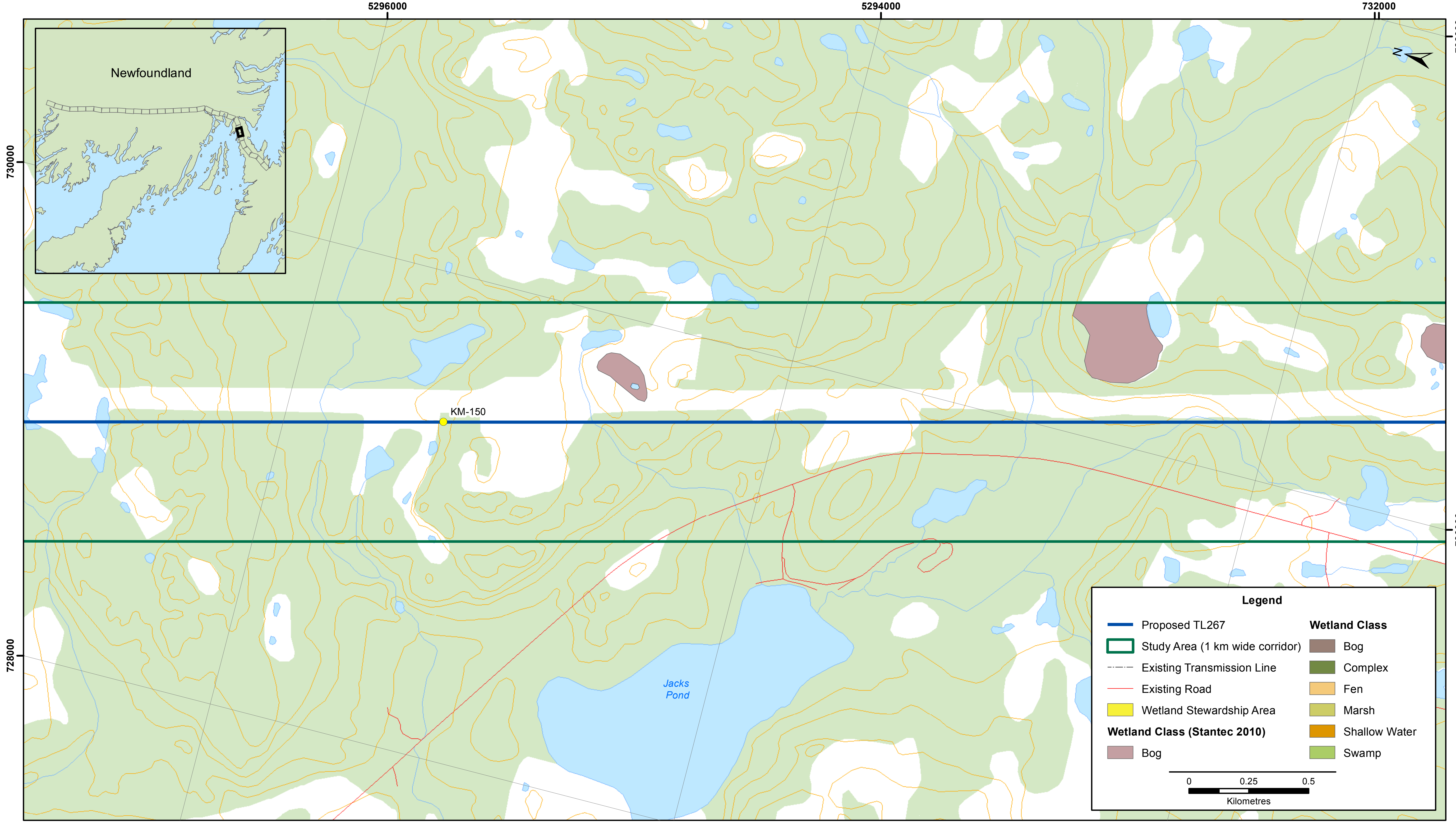

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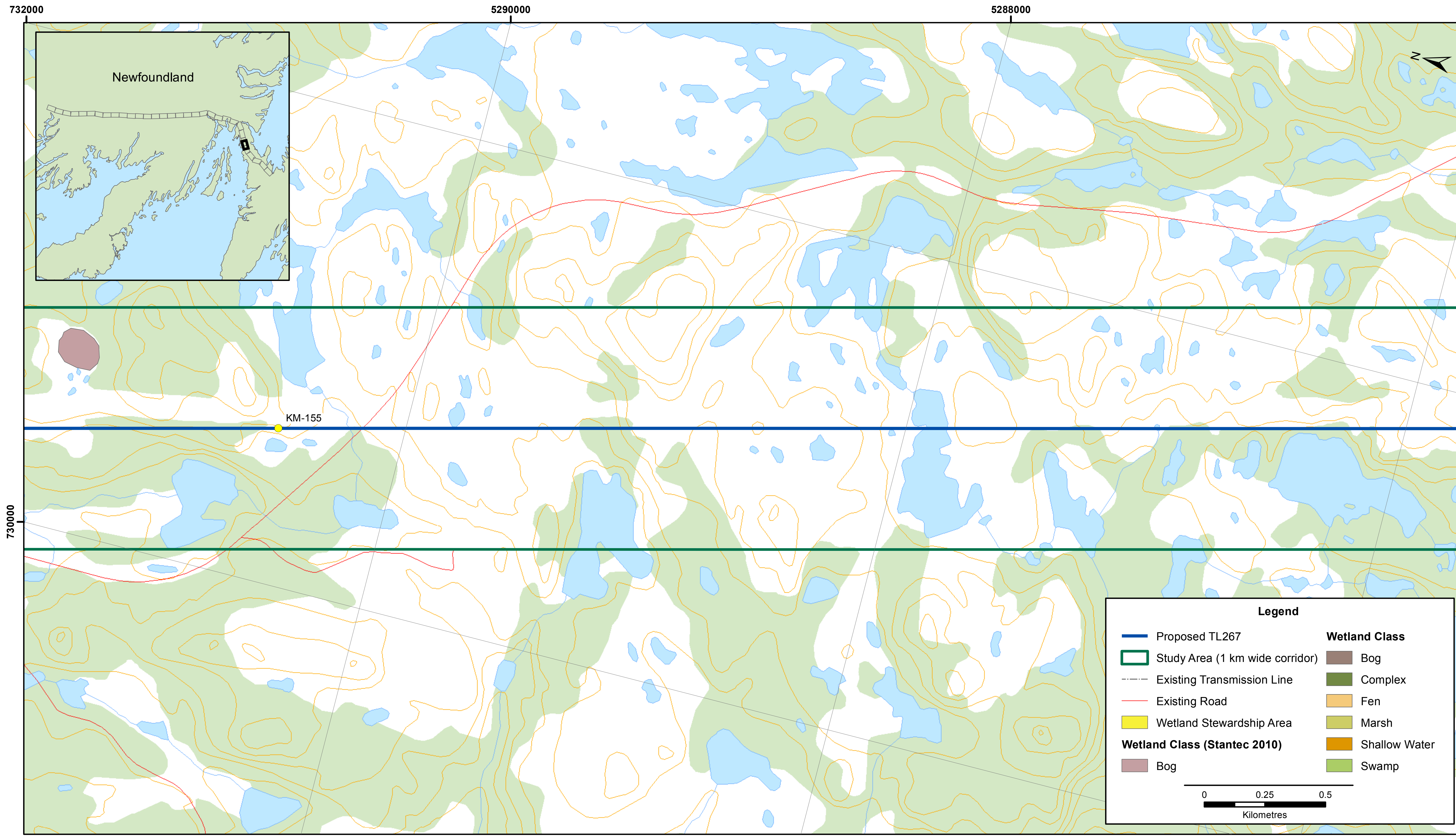

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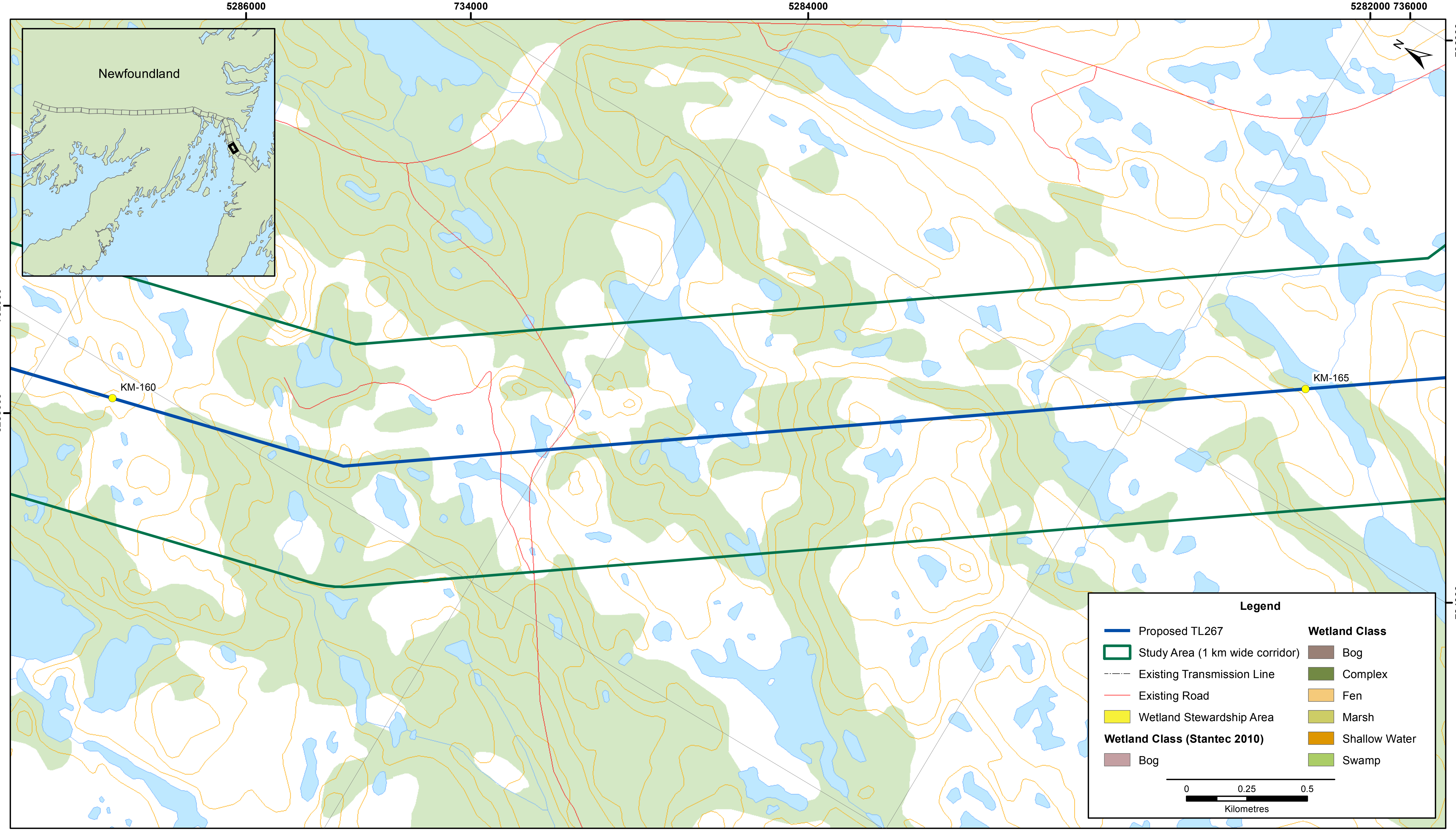
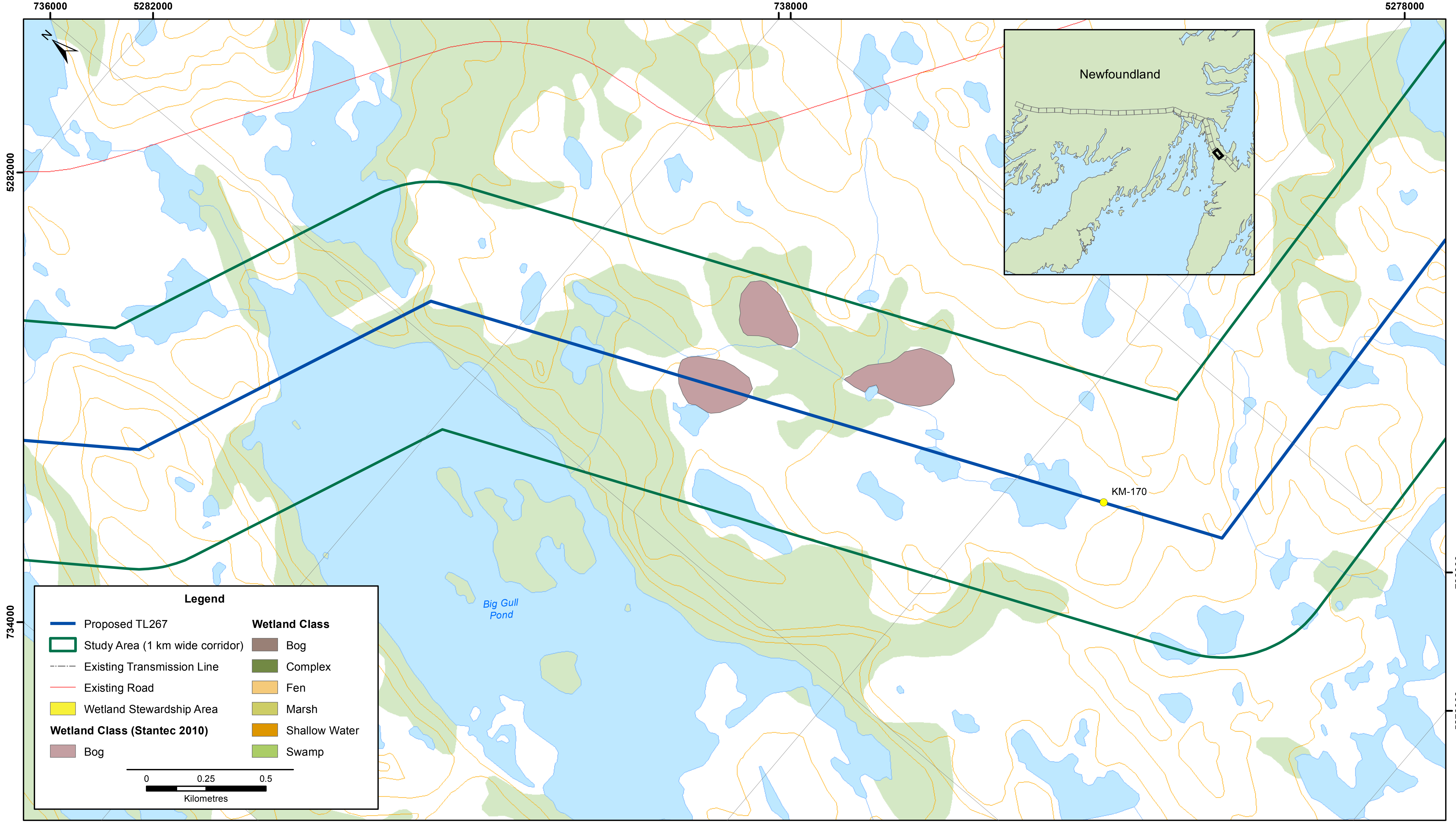


PROPOSED BAY D'ESPOIR TO WESTERN AVALON TRANSMISSION LINE (TL 267) – WETLANDS

newfoundland labrador hydro
a nalcor energy company

amec foster wheeler



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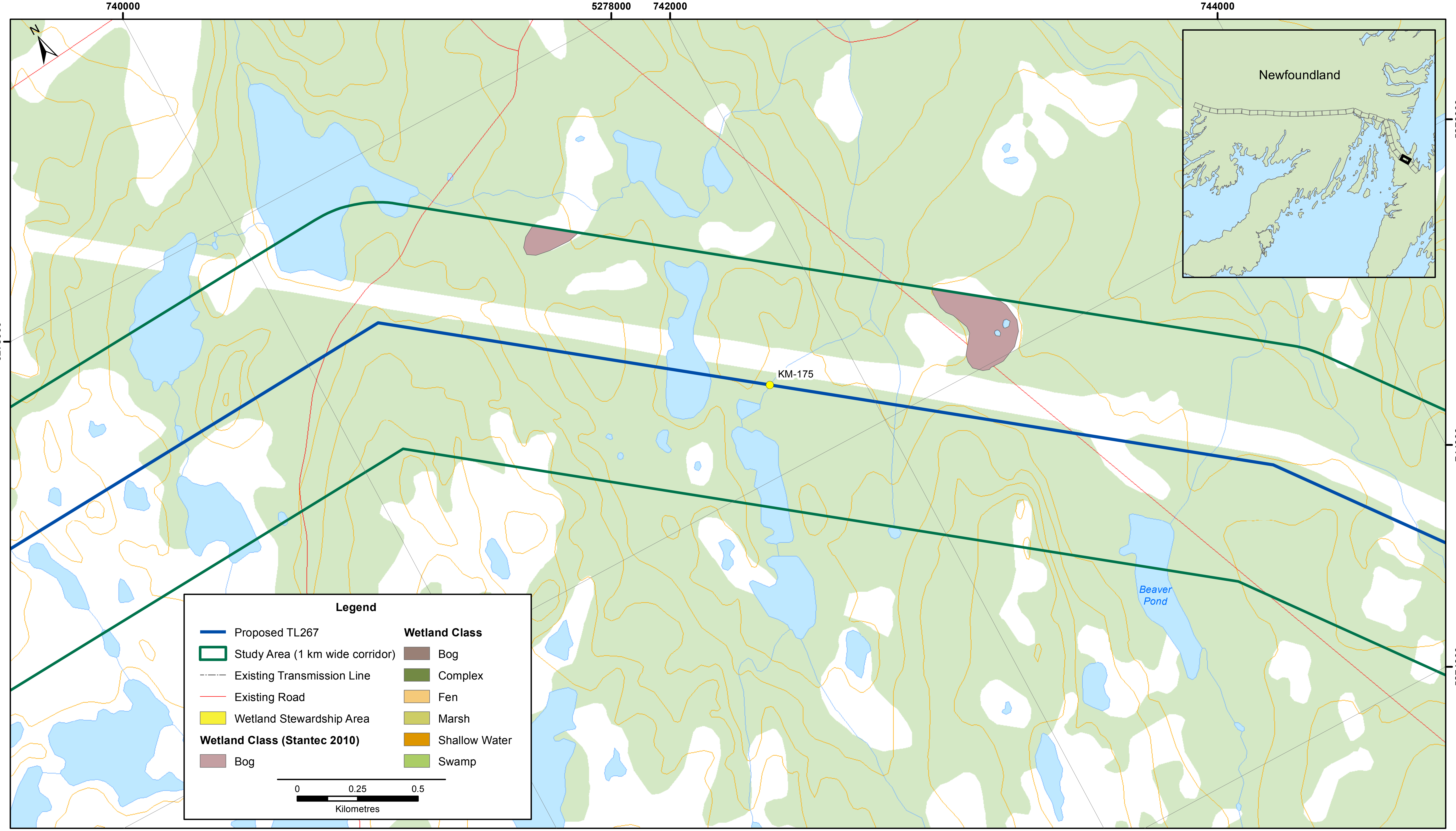

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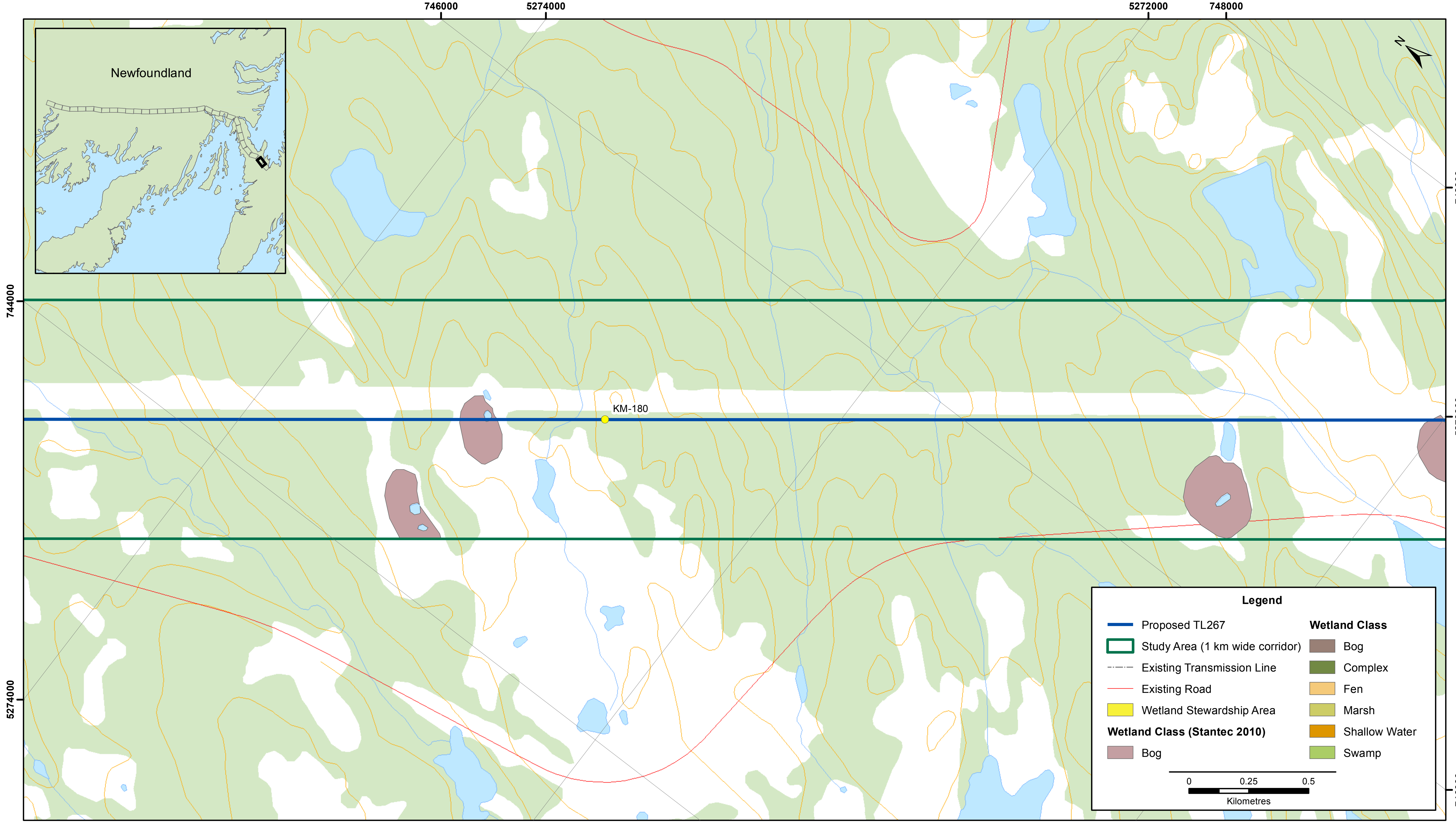

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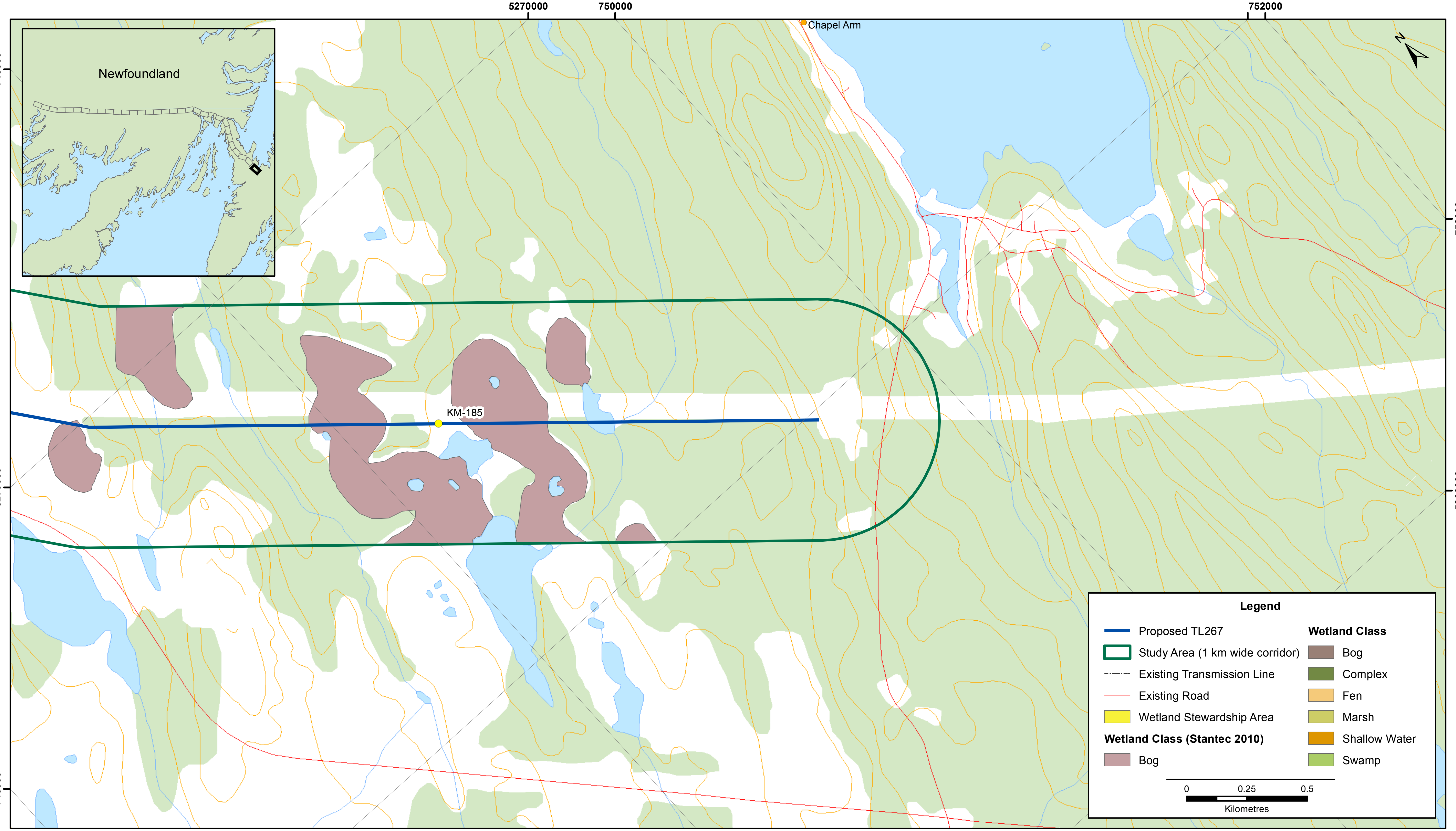

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