KGS GROUP
CONSULTING ENGINEERS

RED RIVER BASIN COMMISSION

NETLEY-LIBAU MARSH RESTORATION PILOT PROJECT
MANITOBA ENVIRONMENT ACT PROPOSAL

FINAL

KGS Group 18-3471-001
March 2019

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March 21, 2019 File No. 18-3471-001

Environmental Approvals Branch
Manitoba Sustainable Development
Suite 160, 123 Main Street
Winnipeg, Manitoba
R3C 1A5

ATTENTION: Ms. Tracey Braun
Director

RE: Environment Act Proposal
Netley-Libau Marsh Restoration Pilot Project

Dear Ms. Braun:

On behalf of the Red River Basin Commission and the Netley-Libau Marsh Restoration Pilot Project Steering Committee, KGS Group is pleased to submit four (4) paper copies and one (1) electronic copy of the final Environment Act Proposal to obtain a licence for the Netley-Libau Marsh Restoration Pilot Project. Over the past few decades, the structure of Netley-Libau Marsh has been significantly altered and deteriorated to the point where it is no longer a healthy functional wetland. The restoration work being proposed is a pilot project to examine the feasibility of restoring the function of the marsh using material dredged from the Red River.

Communication with Manitoba Sustainable Development indicated that an Environment Act Licence is required for a Class 2 Development under Manitoba Regulation (164/88) in the class of Water Development and Control for "Alterations to stream channels which affect fish mobility and fish habitat". As part of the licensing process, a Manitoba Sustainable Development Environment Act Proposal Form with the $7,500.00 application fee has been included with the Environmental Assessment report.

Please do not hesitate to contact the undersigned if you have any questions or require additional information.

Yours truly,

Shaun Moffatt, M.Sc.
Senior Environmental Scientist

SM/jr
Enclosure

cc: Steve Strang, Red River Basin Commission

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EXECUTIVE SUMMARY

Kontzamanis Graumann Smith MacMillan Inc. (KGS Group) was retained by the Red River Basin Commission on behalf of its partners, the Netley-Libau Marsh Restoration Pilot Project Steering Committee, to prepare an Environment Act Proposal (EAP) for the Red River Dredging and Marsh Restoration Pilot Project (the Project). The Netley-Libau Marsh (NLM) complex consists of Netley Marsh, the portion west of the Red River and Libau Marsh, the portion east of the Red River.

Over the past few decades, the structure of NLM has been substantially altered through drainage, dredging and water management, such that it has deteriorated to the point where it is no longer a healthy functional wetland. NLM has experienced a measureable loss of plant communities, wildlife and fish habitat; a gradual loss of aquatic vegetation and wetland areas; the erosion of channels; an amalgamation of water bodies and declining water bird populations.

The restoration work being proposed is a pilot project to examine the feasibility of restoring the function of the marsh using material suction dredged from the Red River, using an Amphibex. The slurry material dredged from the river will be pumped through a hose to be discharged into a contained area within Hardman Lake, and potentially Netley Lake if budget and schedule allow. The slurry material will settle and consolidate into shallow-water habitat, referred to as mudflats, which are appropriate for the growth of emergent wetland vegetation. The proposed pilot project is considered a Class 2 Development under Manitoba Regulation (164/88) in the class of Water Development and Control for “Alterations to stream channels which affect fish mobility and fish habitat”.

As part of the pilot project several methods, such as turbidity curtains, straw bales and geo-tubes, will be tested to determine the most effective and affordable method of containing the dredged slurry material. The size of the containment area was selected to provide sufficient room for suspended sediments to settle and to allow for any fish located within the containment area to move freely away from the slurry discharge points. Additionally, the slurry materials will be pumped so that as material settles and consolidates, the crest elevation of the mudflat will be maintained at least 0.1 m below the Lake Winnipeg Ordinary High Water Mark (OHWM). The performance of dredging activities and the development of mudflats will be monitored during construction to determine the rate of sediment accumulation, and the effectiveness of the various types of containment options, in terms of supporting mudflat construction and preventing escape of turbid, sediment-laden water from the project area and into adjacent waterbodies.

Vegetative colonization of the mudflats will likely occur naturally from seeds within the dredged materials, and from adjacent emergent marsh vegetation. Different seeding mixes and methods as well as vegetative plantings may be evaluated as part of the pilot project, to stabilize the mudflats following dredging operations. The type of substrate (e.g. clay or sand) and the average depth of water will be considered when determining the most appropriate vegetative species. Plants such as cattail that will grow from rhizomes (i.e. root masses), will be sourced and transplanted from similar nearby habitat.

A follow-up monitoring program will be developed to evaluate the benefits to the marsh from this pilot project of dredging and mudflat construction. The monitoring program will consider components such as vegetation establishment, and benefits to fish, wildlife, birds, water quality, mudflat sustainability, and silt accumulation within dredge sites. The monitoring programs will be

designed such that sampling locations, frequencies and parameters assessed will be comparable to previous baseline data to quantify any measurable changes.

The RRBC held four open houses in October and November, 2018 and met with the Peguis First Nation in February 2019. Individuals and local organizations that have an interest in NLM or Lake Winnipeg have typically expressed support for proceeding with the proposed project. In particular the Peguis First Nation provided a letter of support as they have a keen interest in restoring NLM. The NLM was traditionally used by their people for hunting and gathering, and borders their Treaty Land Entitlement "initial selection" area. Members of the Netley Marsh Waterfowl Foundation and Manitoba Association of Cottage Owners, individuals who live on the shores of Lake Winnipeg and NLM, and several commercial fishermen have also spoken in favour of restoring the marsh.

Because the dredging will occur during the open water season and the Red River and Lake Winnipeg are on the list of scheduled waterways under the *Navigation Protection Act*, the Project will need to include provisions for navigation to be maintained so that the work will not cause substantial interference with navigation. A Notice of Works form must be completed and submitted to the Transport Canada Navigation Protection Program to review the likely interference with navigation and determine if further authorization or protective measures are required.

In-water work has the potential for fish habitat degradation or loss (including serious harm), which can occur as a result of infilling or conversion of wetlands. As such a Request for Review will be submitted to Fisheries and Oceans Canada to determine if Authorization is required under the *Fisheries Act*. The proposed mudflats in Hardman Lake, and potentially Netley Lake, will have a crest elevation below the OHWM and therefore is not considered infilling fish habitat. While the fish habitat will be altered, the area being altered is relatively small, and the Project will provide an overall benefit to fish habitat with an increase in vegetated shoreline. While the Mapleleaf mussel is known to inhabit the Red River and is listed as Endangered on Schedule 1 of the *Species At Risk Act*, they will not be present at the project site because the area that will be dredged is not suitable habitat as the substrate is erosion and depositional materials that freeze during winter.

Inquiries with various government agencies have indicated that there are no major environmental constraints such as rare species or heritage resources at the site. The objective of improving emergent vegetation growth on the constructed mudflats is to benefit the species of concern, including western grebe and yellow rail,that may be present in the Project area, and to improve the flushing or flow of water through the marsh, specifically at the mouth of the Red River. Based on the available information on the project and the environment, the assessment of environmental effects outlined in this environmental assessment report, and the application of proposed mitigation measures and with the required follow-up activities, the proposed pilot project will not likely result in any significant residual adverse environmental effects.

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1.0 INTRODUCTION

Kontzamanis Graumann Smith MacMillan Inc. (KGS Group) was retained by the Red River Basin Commission (RRBC [‡]) on behalf of its partners, the Netley-Libau Marsh Restoration Pilot Project Steering Committee, to prepare an Environment Act Proposal (EAP) for the Red River Dredging and Marsh Restoration Pilot Project (the Project). Netley Marsh, the portion of the marsh complex lying west of the Red River (Figure 1), is surrounded by cottages and cropland. Libau Marsh, the portion of the marsh east of the Red River (Figure 1), includes part of the Patricia Beach Provincial Park and part of the Brokenhead Ojibway Nation reserve and is surrounded primarily by haylands and cattle pasture [(1)]. This report will use the hyphenated name Netley-Libau Marsh (NLM) [(2)] to refer to the entire complex.

Over the past few decades, the structure of NLM has been substantially altered and deteriorated to the point where it is no longer a healthy functional wetland. Drainage, dredging and other water management schemes occurring since the early part of the twentieth century have substantially altered the natural flow of the Red River through the marsh. Since the 1970s, Lake Winnipeg water levels have also been managed by Manitoba Hydro for hydroelectric production. As a result of numerous factors, NLM has experienced a measureable loss of plant communities, wildlife and fish habitat; a gradual loss of aquatic vegetation and wetland areas; the erosion of channels; an amalgamation of water bodies and declining water bird populations [(3)].

The RRBC and its partners are proposing to undertake a restoration pilot project in NLM to examine the feasibility of restoring the function of the marsh. Specific sections of the Red River will be suction-dredged using the Amphibex equipment currently utilized for spring ice-breaking on the Red River. The material dredged from the river will be pumped into Hardman Lake to construct shallow-water habitat appropriate for the growth of emergent wetland vegetation, referred to as mudflats (Figure 2). If the mudflat construction in Hardman Lake proceeds

[‡] The Red River Basin Commission is a co-operative, non-profit organization with a 25-member board representing basin cities, counties, municipalities, watershed boards, water resource districts, power boards, First Nations and other local interests. The RRBC's first priority is to evaluate projects addressing human health and safety. The commission has nine inventory teams that collect information in the basin on water law, water institutions, hydrology, water supply, water quality, drainage, flood damage reduction, recreation.

according to plan and there is sufficient time and budget in the construction schedule, the process of using dredged material to construct a mudflat will be tested at a second location, on a slightly smaller scale, in Netley Lake (Figure 3). The Project, while experimental in nature, could have multiple benefits such as a healthier marsh, help mitigate ice induced flooding and improve river navigation.

Based on KGS Group's discussion with the Manitoba Sustainable Development Environmental Approvals Branch, the Project is considered a Class 2 development under the Classes of Development Regulation (164/88) in the class of Water Development and Control for "Alterations to stream channels which affect fish mobility and fish habitat."

Key Objectives

Key objectives of the project are as follows;

- Enhance nutrient sequestration in the NLM and demonstrate its capacity to reduce phosphorus in Lake Winnipeg.
- Enhance the NLM function in providing feeding and spawning habitat for fish, furbearers, and water birds.
- Enhance the function of NLM for traditional Indigenous uses including hunting, trapping, fishing, and ceremonial uses for their holistic well-being.
- Assess the technology for reestablishment of emergent vegetation to provide ecological goods and services, including nutrient sequestration within NLM, while also potentially providing biofuel benefits from harvestable macrophyte biomass.
- Demonstrate innovative, dredging related solutions that could be applied throughout the Lake Winnipeg Watershed, the Red River Basin and elsewhere across Canada.
- Reestablish the mouth of the Red River as the primary conduit of water to Lake Winnipeg and potentially reducing flooding upstream caused by ice jamming.

Project Background

Wetlands provide numerous environmental benefits including reduction of erosion, enhanced flood control, recharge of groundwater, sequestration of nutrients, reduction of toxic materials, support for economically important animals (hunting, fishing, etc.), supply of agricultural and aqua cultural products, and provision of recreational opportunities. For Indigenous communities, the water and land in marshlands are an important part of their culture and are used for traditional practices.

NLM is the largest coastal freshwater wetland in North America and is in a seriously deteriorating condition [(4)]. The marsh can no longer provide its primary function: to clean and filter the water going into Lake Winnipeg from the Red River watershed. It has become less productive and is no longer behaving like a healthy, functional marsh. Over the past three decades, substantial loss of emergent plants has been documented as a result of: altered hydrology; a prolonged climactic wet cycle; minimization of low-water periods needed for plant colonization; a redirection (versus flow through) of Red River flows into the marsh due to siltation of the mouth of the Red River and a cessation of dredging; increases in ice breaking which mitigates ice jamming and conveys flows more readily to the NLM; invasive species; and the negative effects of increasing contaminant loading from the river. Several studies have suggested that resuming dredging in the project area may assist with water level redirection and sediment management, which could potentially help restore NLM and reduce river bank erosion which is currently occurring at a very rapid rate.

The RRBC and its partners are initiating this three-year feasibility study to examine the potential benefits that dredging could have on the reestablishment of vegetation in the marsh, hydrology, flooding, sediment accumulation, fisheries and wildlife. This study will examine the potential of using sediment dredged from the Red River to construct mudflats within Hardman Lake and Netley Lake to provide substrate for vegetation growth as a method of marsh restoration. The Project proposes to use equipment that has the capacity to perform suction-dredging and the ability to move dredged material over long distances. This will allow for targeted dredging and the strategic placement of dredged sediments.

The goal of this experimental pilot project is to apply existing technology to create mudflats as substrate for emergent plant habitat, monitor the resulting improvement in phosphorus retention by the marsh, and, to demonstrate what can be achieved for establishment of emergent vegetation in NLM. The Project will determine if dredging of the Red River can help reestablish the NLM as an ecological asset that, once restored, can improve water quality for Lake Winnipeg by sequestering nutrients that would otherwise be discharged into the lake.

2.0 PROJECT DESCRIPTION

The following sections have been structured to address the Description of Development requirements as outlined in the EAP Form.

2.1 STATUS OF TITLE

KGS Group has not retrieved Certificates of Title for the lands where the project will be constructed, however the owner(s) and legal description of the lands are as follows:

St. Andrews							
OBJECT ID [1]	**Roll [2]**	**Survey**	**Civic**	**Street**	**Full Address**	**Primary Owner**	**Secondary Owner**
7085	0	<Null>	<Null>	1	<Null>	<Null>	<Null>
7087	0	<Null>	<Null>	1	<Null>	<Null>	<Null>
7091	0	<Null>	<Null>	1	<Null>	<Null>	<Null>
7093	0	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
7094	0	<Null>	<Null>	1	<Null>	<Null>	<Null>
13306	574900	*NW27-15-5E	<Null>	<Null>	<Null>	HMQ [3]	<Null>
13315	577300	*NW34-15-5E	<Null>	<Null>	<Null>	HMQ [3]	<Null>
13316	577350	*NW-15-5E	<Null>	<Null>	<Null>	HMQ [3]	REDACTED
13317	577700	*SW34-15-5E	<Null>	<Null>	<Null>	HMQ [3]	<Null>
13319	577900	*SW3-16-5E	<Null>	<Null>	<Null>	HMQ [3]	<Null>
13320	578100	SW3-16-5E	<Null>	<Null>	<Null>	HMQ [3]	<Null>
St. Clements							
OBJECT ID	**Roll**	**Survey**	**Civic**	**Street**	**Full Address**	**Primary Owner**	**Secondary Owner**
12894	508500	*SW26-16-5E	<Null>	<Null>	<Null>	REDACTED	<Null>
12896	508600	*NE27-16-5E	<Null>	<Null>	<Null>	HMQM [4]	<Null>
12897	508700	*NE27-16-5E	<Null>	<Null>	<Null>	HMQM [4]	<Null>
12898	508800	SE27-16-5E	<Null>	<Null>	<Null>	HMQM [4]	<Null>

Notes:

1. Object ID corresponds to property references on the map in Appendix A
2. Data shown as provided
3. HMQ – Her Majesty the Queen
4. HMQM – Her Majesty the Queen Manitoba

2.2 MINERAL RIGHTS

The owner of mineral rights beneath the lands proposed for development is assumed to be the primary land owner.

2.3 EXISTING AND ADJACENT LAND USE

In 1986, NLM was comprised of 90.1% Crown land, 8.3% private land, 1.1% Indian Reserve and 0.5% municipal land [(5)]. Land use in the project area may change as a result of the Project. If the Project is successful in creating mudflats where emergent vegetation can grow, an industry may be created from the harvestable macrophyte biomass, if used as biofuel [(6)].

The land use adjacent the project site is as follows:

- West – NLM followed by agricultural fields and cottages.
- North – Lake Winnipeg.
- East – NLM followed Patricia Beach Provincial Park and Brokenhead Ojibway Nation reserve.
- South – NLM and the Red River followed by agricultural fields.

2.4 LAND USE DESIGNATION AND ZONING

The Red River is the dividing line between the Rural Municipality (RM) of St. Andrews on the west side of the river and the RM of St. Clements on the east side. Where the Red River splits into three channels, the municipal division follows the western channel to Lake Winnipeg and then west along the southern shore of the lake. The Hardman Lake project area falls within the RM of St. Clements while the Netley Lake project area falls within the RM of St. Andrews (Appendix A).

Most of the lands within NLM are zoned as Hazard Lands (HL). This includes lands within a horizontal distance of 107 m (350 ft) of the normal high water mark of the Red River or Lake Winnipeg and their tributaries; that are subject to subsidence or are low-lying, marshy or unstable, or are otherwise unsuitable or hazardous for a proposed purpose by virtue of its soil or topography. A small amount of land located at the northwest portion of the map shown in Appendix A is zoned Seasonal Residential (SR), a definition that was established to provide

land use guidelines for those areas having existing large lot seasonal residential development, including rural residential. A small portion of land in the southeast is an area zoned Agricultural General (A80) and provides for a broad range of agricultural uses, including livestock operations while restricting the potential for land fragmentation [(7)].

2.5 PREVIOUS STUDIES AND ACTIVITIES

While there is a substantial amount of relevant background information that was used in preparation of this EAP, one previous study that is particularly relevant to the proposed Project is the Bathymetry of Lakes in the Netley-Libau Marsh produced in 2011 by Aquatics Environmental Services Inc. in St. Andrews, Manitoba. Maps from the report are provided in Appendix B and include elevations shown in metres (m) above Mean Sea Level and geo-referenced on the World Geodetic System Grid (1984) and Universal Transverse Mercator North Zone 14. Bathymetric survey data was collected in August through September 2010. Satellite real-time kinematic (RTK) positing and base stations were used to enhance the precision of the position data. The report includes an index of lakes in NLM and bathymetry maps of all lakes in the complex. Lake volumes were calculated from the bathymetric data. All results shown on the maps are based on a water elevation of 217.4 m. The total volume of all lakes in the complex is calculated to be 58,360,826 m^3 and Netley Lake was found to account for 57.6% of the total water volume [(8)].

Additionally, a substrate assessment is on-going to facilitate planning, design and construction of the mudflats, which is described in Section 2.6.1. Samples were collected in January and February from the proposed dredging locations and where the mudflats would be constructed. Where possible a 1.2 m (4 ft) depth core or sample of substrate material was collected. Substrate samples are being analyzed for particle size distribution, sediment quality and seed bank viability. It is assumed that the sediment quality will be similar between the dredging areas and where the mudflats will be created as the sediment source is primarily from flows along the Red River. Regardless sediment quality is being assessed to identify if there are any parameters of concern that need to be considered during the Project. The particle size analysis will be used to verify the estimated pumping rates, slurry volumes and consolidation of the placed material. The substrate composition and seed bank viability will be used to develop the vegetation planting requirements.

2.6 PROPOSED DEVELOPMENT

2.6.1 Construction

The methods of dredging and mudflat construction will closely follow those employed for mudflat creation projects conducted at the Audubon Paul J. Rainey Wildlife Sanctuary in Vermilion Parish, southwest Louisiana (the Audubon Louisiana Project) [(9)]. The boat launch area on Netley Creek known as End of Main will be used as the construction staging area and any boats or equipment will be launched from this location. The Amphibex will be returned to shore for refueling.

Dredging

One of the dredging methods tested at the Audubon Louisiana Project was use of an Amphibex 400, (Amphibex). This is the same as the unit owned by the Province of Manitoba which is proposed for use on this Project. The Amphibex is 3.5 m wide, 10.9 m long, and 3.0 m high, and it draws about 0.6 m of water. The Amphibex has a climate-controlled, enclosed cabin for one operator and two pivoting spuds and stabilizer pods that allow it to walk across shallow areas, land, or self-load to a flatbed. The Amphibex also has several environmentally friendly features as follows;

- It is built with an Acert C9 Caterpillar engine that is known to emit few pollutants.
- The engine is located within a well that is designed to capture any engine contaminants.
- The propulsion system is conceived to have maximum power with minimal disturbance to marine vegetation sediment layers at the bottom of waterbodies.
- The hydraulic system is environmentally safe as it runs on vegetable oil [(10)].

The maximum working depth of the Amphibex is 4.9 m due to the length of the spuds and stabilizing pods. The Amphibex has an extendable boom with interchangeable tools for a variety of uses (cutter bucket, excavator bucket, rake, sprayer, etc.), can dig to a depth of 6.0 m, and has self-propulsion to 8 knots when on water. The excavator arm rotates side-to-side, reaches out roughly 6.0 m, and uses the cutter blades to break up the substrate so that twin hydraulic slurry pumps can push the material into the discharge hose. The arm is extended and is slowly

drawn down and back to remove a strip of material, then is rotated and reaches out for the next strip. The spuds not only raise and lower, but tilt, so that they also "walk" backwards as they remove material. The 0.25 m diameter discharge hose can be outfitted with hose-floats and can discharge over a distance of 1,000 m without a booster pump.

Material for mudflat construction will be dredged from the Red River from Site A and possibly Sites B and C, as shown in Figure 2 and Figure 3. These areas were selected based on interpretation of material type from previous bathymetry and dredging studies and approximate estimates of materials required and may be refined as required during the construction activities. For the Hardman Lake area a maximum volume of 45,000 m^3 of solids will be moved by the Amphibex, with an average dredged depth of 2 m. The actual pumped slurry volume (ie. solids plus water) will be greater than this, and will depend on many factors, including the compressibility of the soil as well as the depth of cut of the hydraulic dredge head during each strip of sediment removal, that will in turn impact the resultant slurry density.

Site A will be the primary area to obtain material for construction of the mudflat on Hardman Lake. Preliminary visual assessment of the soil cores from Site A has shown that the sediment water content is extremely high, and the material appears to contain a high quantity of sand in addition to silts and clay. This higher sand content will be good to construct the base of the Hardman Lake mudflat. Site B has been identified as an additional dredging location where the substrate will likely contain more organic material as it is in an area with slower moving water allowing finer clay and silt material to accumulate. Dredging Site B will only be used if the substrate from Site A is too high in sand content and additional silt and clay material is required to provide a better growing substrate for vegetation. In this scenario, the conceptual design plan is to place a 0.15 m layer of organic substrate on top of the base layer, if required.

Dredging at Site C will be conducted to obtain material for construction of the mudflat on Netley Lake (Figure 3). Construction on Netley Lake will only proceed if there is sufficient budget and time, as previously noted. The work would be on a smaller scale than Hardman Lake and would be a repeat of what was tested in Hardman Lake.

Mudflat Creation

A mudflat will be constructed in the northeast corner of Hardman Lake within the containment area shown in Figure 2 and if there is sufficient budget and time a mudflat will also be constructed in Netley Lake north of the Netley Cut as shown in Figure 3. To avoid in-filling fish habitat, per Fisheries and Oceans Canada (DFO) regulations, the design crest elevation for the mudflats after the material has settled will be a minimum of 0.1 m below the Ordinary High Water Mark (OHWM) for Lake Winnipeg. Lake Winnipeg is considered a reservoir for Manitoba Hydro generation operations and in the case of reservoirs, DFO considers the OHWM to be the normal high operating levels (Full Supply Level). Manitoba Hydro maintains water levels in Lake Winnipeg between 216.7 m asl and 217.9 m asl, so the design crest elevation for the mudflats, after the material has settled, will be no higher than 217.8 m asl.

The OHWM will be surveyed in and delineated on stakes throughout the mudflat construction area. The dredged material from the Amphibex will be more or less uniformly distributed throughout the area up to the OHWM. Since there is a high water content within the silt and clay slurry that has been redistributed and mobilized by the dredge, the material will consolidate over time (ie. compress to a lower elevation than as measured immediately following slurry placement), thereby ensuring that final crest elevation is kept below the OHWM. The amount of consolidation will be monitored throughout this pilot project to refine the design of any future projects. By constructing the mudflats to an elevation near the normal high operating levels maintained by Manitoba Hydro for Lake Winnipeg, it is anticipated that emergent marsh plants will be able to establish as the mudflats will experience periods when they are drier and periods when they are wet, but the water levels will not be so deep that emergent plants cannot establish and survive.

Containing dredged material within the project area for the mudflats to stabilize, particularly fine-grained and fluid material, may require containment. Pumping slurry into a contained area will allow excess water, which must naturally drain from the slurry, to escape as the material settles, consolidates, and dewaters [(9)]. Containment is important, not only for retaining fill material, but also to protect from erosional forces. Wind-generated waves, boat-generated waves, or any other disturbance can keep fine sediment particles in suspension or cause later erosion of settled material [(9)]. The proposed containment area has been selected to provide abundant

room for suspended sediments to settle and to allow any fish located within the containment area to move away from the slurry outfall area. As such fish salvage is not currently planned as part of the Project.

The Audubon Louisiana Project notes that containment can be natural: using existing landscape features that prevent movement of material, such as marsh islands and shorelines, or constructed: using material brought in and placed or rearranged to obstruct the flow of water and fill. The type of containment employed depends partly upon the type of dredged substrate and the depth of the receiving basin. For receiving basins less than 0.3 m, containment can include turbidity curtains, hay bales or mesh bags of hay pinned in place by sticks, posts or 2 x 4s. These types of containment designs slow slurry movement allowing the heavier sediment to fall out and they act to filter and hold larger particles in place while allowing water and smaller particles to escape. When using organic containment, sediment accumulates within the stems of the baled hay to become more solid and can support vegetative plantings that will act as containment and buffers as the original material degrades. For receiving basins up to 1.0 m in depth or exposed to wind-generated waves, plywood walls screwed to 2 x 4 posts and inserted into the bottom work well; however, this method obstructs natural spreading of vegetation. Earthen levees can be used as containment for almost any depth, but because they require additional dredging of the receiving basin, they may not be warranted or cost-effective. A number of commercially available containment options also exist and are appropriate for deeper sites. Examples of commercial containment options include textile walls supported by floats and anchored by various types of tethers, geotubes and aquadams. Containment for the Amphibex project area at the Audubon Louisiana Project was constructed from hay-filled mesh tubes pinned between 2 x 4 posts [(9)].

As part of this pilot project it is anticipated that three containment methods will be tested (specifically straw bales, Aqua Dams/Tiger Tubes, and GeoTubes) to determine the most effective and affordable method of containing the dredged slurry material during construction, and to resist erosion due to wave action. Photographs and schematic drawings showing examples of these containment types are provided in Appendix C. The success of mudflat construction and establishment within the contained area will also be compared to an area where the slurry will be deposited with no containment, immediately adjacent the contained area, to test whether containment is necessary. It is proposed that the length of containment

extending from shoreline to shoreline will be divided into three sections where the different containment methods will be tested. The section of containment testing the Aqua Dams/Tiger Tubes, which are impermeable, will have established breaks along the containment length where straw bales will be placed to allow the water to exit while filtering the suspended, fine soil materials.

Response by Wildlife

Documentation from the Audubon Louisiana Project indicated that during dredging operations wading birds were immediately attracted to the flowing water and new mud at the outfall site. The new mud was too soft to support their weight, but the birds sat on or near the discharge floats or any solid support to feed on the broken clams, small crabs, worms or shrimp that had been moved in the slurry. As the substrate became more firm, birds were able to walk on the mudflats and after two months the mud developed a layer of algae and by the end of three months many types of shore and water birds could all be found at the site. As vegetation started to colonize the mudflat small and medium mammal tracks were noted and some were seen at night on trail cameras that were installed [(9)].

Construction Monitoring

The performance of dredging activities and the development of mudflats will be monitored during construction to determine the rate of sediment accumulation, effectiveness of the various types of containment options in terms of supporting mudflat construction and preventing escape of turbid, sediment-laden water from the project area and into adjacent waterbodies. Boats will be used to access the mudflat areas to monitor the progress of dredging and mudflat creation.

As part of the Project, several different containment options will be tested and evaluated and adaptive management will be employed to ensure that the Project does not have potential adverse effects on the aquatic environment surrounding the project area. Throughout construction there will be visual assessment of sediment plume extent and movement using unmanned aerial vehicles. Additional measures such as turbidity curtains will be employed to mitigate potential adverse effects if turbidity levels that exceed background natural conditions are being released from the project area into adjacent waterbodies.

Bathymetric measurements will be taken following dredging of the source material and compared to the existing bathymetry data to provide insight into how much material was moved and to document the excavation geometry. Periodic measurements thereafter will help demonstrate whether the excavated material source area is a sediment trap, and if the source area can be reused in the future to source additional construction materials. This can be done simply with a GPS-linked depth finder system that produces 3D maps. Periodic elevation surveys of the target area can provide information on how much material was retained during dredging, how much dewatering and consolidation took place, and how natural forces rework the material. Because depth of fill affects resulting surface features, bathymetric survey pre- and post-dredging would provide a baseline to understand some of the processes underlying the changes. Aerial imagery of the site prior to and at scheduled monitoring points following construction can be compared to yield important information on the trends of fill movement, vegetation growth and topographic changes [(9)].

Three independent site visits are proposed as part of the monitoring activities to be conducted at the beginning, midway point, and end of construction. Each site visit will be carried out by qualified staff at KGS Group who will observe site conditions and ongoing construction activities, including the overall shape and performance of the mudflats. Results of the site visits will be documented with field notes and photos. Information collected by KGS Group will be supplemented by additional photos and notes documenting construction activities and site conditions collected by the RRBC and its partners on a regular basis between and after KGS Group site visits. Results of the monitoring and site visits will be documented in a report.

Vegetative Plantings

Vegetative colonization of the mudflats will likely occur naturally from seeds within the dredged materials and from adjacent emergent marsh vegetation. While some areas will be left to see how they naturally regenerate, different seeding mixes and methods as well as vegetative plantings will be evaluated as part of the pilot project to help stabilize the mudflats following dredging operations. Plant roots hold the substrate together and plant stems diffuse wind and water energy. The type of substrate (e.g. clay or sand) and the average depth of water will be considered when determining the most appropriate vegetative species although it is anticipated that cattail (*Typha* spp.) will be the predominant species. Cattail will easily establish and grow

from rhizomes (i.e. root masses) that can be sourced and transplanted from similar nearby habitat. Boats will be used to access the mudflat areas to plant seeds or install vegetation. Vegetation growth, either from natural regeneration of areas vegetated will be monitored throughout the remainder of 2019 and into the next full growing season during 2020.

2.6.2 Operation and Maintenance

Follow-up Monitoring

As part of the experiment a follow-up monitoring program will be developed to evaluate the benefits to the marsh from dredging and mudflat construction. The monitoring program will consider components such as vegetation establishment, and benefits to fish, wildlife, birds, water quality, mudflat sustainability and silt accumulation within dredge sites. In particular the aerial extent, biomass (per unit area), and phosphorus sequestration (e.g. P per unit biomass) of plants will be monitored over the duration of the first (2019) and second (2020) year of the pilot project.

The monitoring programs will be designed such that sampling locations, frequencies and parameters assessed will be comparable to previous baseline data to quantify any measurable changes. To more accurately assess the benefits of the Project it is anticipated that monitoring data will need to be collected beyond the currently scheduled one year post-construction (2020), but this will depend on additional funding.

For the Audubon Louisiana Project, an assessment of site characteristics was accomplished, in part, by photographic documentation of conditions from three positions on the ground and by a drone. Two motion-activated cameras were set up at either end of the pond to monitor wildlife movement, environmental conditions, water level changes, and storm events, helping to interpret and illustrate what was occurring with the soft mud fill. At the Audubon Louisiana Project, the proponent also monitored bathymetric changes of the Amphibex borrow site every six months by a GPS-linked fathometer system. This system provided information on the refill rate of the borrow site and established a timeline for possible reuse. Borrow site refill rates depend on site-specific hydrologic and sedimentation patterns. Similar methods may be employed as part of the proposed Project.

A summary report will be prepared describing the results of monitoring activities undertaken. The report will include details of the construction methodology, as described in this report, an overview of monitoring activities undertaken, photos and notes of actual construction activities and observed site conditions, and a discussion of the performance of the dredging and mudflat construction methods, including recommendations, as appropriate.

2.6.3 Schedule

Assuming the necessary approvals are received, the dredging and mudflat construction would be conducted between July 1 and September 14, 2019 to coincide with fisheries timing windows for in-water work in southern Manitoba [(11)]. It is anticipated that there will be no requirement for tree and shrub clearing. If it is determined that clearing is required, however, in accordance with the *Migratory Bird Convention Act*, a nest survey would be conducted just prior to clearing activities if scheduled during critical nesting and rearing periods of mid-April to late-August. Follow-up monitoring to assess the success of the Project would continue through the summer of 2020.

2.6.4 Funding

Funding for this project is being provided in the form of cash contributions and in-kind contributions (i.e. provision of support services, equipment, materials, etc.) as listed below. In particular, several of the in-kind contributors (as noted by an *) are contributing to the Project on an on-going basis as part of the Advisory and Steering Committees.

In-kind Contributors:

- City of Winnipeg
- Ducks Unlimited Canada*
- Environment Canada and Climate Change *
- International Institute for Sustainable Development*
- Lake Winnipeg Foundation*
- Manitoba Hydro*
- Native Plant Solutions
- Province of Manitoba*
- Red River Basin Commission*
- Red River College
- South Basin Mayors and Reeves*

- Southern Chiefs Organization*
- University of Manitoba*

Cash Contributors:

- City of Winnipeg
- Community Spirit Fund (South Beach Casino)
- EcoAction Fund
- Federation of Canadian Municipalities
- Lake Friendly
- Lake Winnipeg Basin Program
- Manitoba Fisheries and Wildlife Enhancement Fund – Wildlife
- Selkirk and District Foundation
- Winnipeg Foundation

2.7 STORAGE OF GASOLINE AND ASSOCIATED PRODUCTS

Amphibex and boat operators will comply with Manitoba Regulation 188/2001 respecting "Storage and Handling of Petroleum Products and Allied Products" and transportation of petroleum will be in accordance with the *Dangerous Goods Handling and Transportation Act*. Fuel will be transported in approved containers and all employees involved in the handling and storage of fuels will have Workplace Hazardous Materials Information System (WHMIS) and spill-response training. All petroleum product storage sites and mobile transportation units will be equipped with appropriate fire suppression products.

A spill control plan including typical cleanup procedures, communication requirements and subsequent reporting will be established prior to construction activities. This spill-response plan will require spills to be immediately contained and cleaned up so there is no potential run-off of contaminants. The spill-response plan will be developed in accordance with applicable contract specifications, environmental legislation, permits and authorizations. Information to be available on-site at all times includes an updated list of key contacts and telephone numbers for reporting spills and problems and WHMIS documents for all hazardous materials at the work area.

In the event of an accidental leak or spill of a hazardous substance, the responsible party will abide by the spill control plan. Any documentation will be maintained in the work area at all times during construction. All spills or accidental releases of petroleum products or other hazardous substances to a watercourse, to federal lands, and/or as specified by the Manitoba

Regulation 439/87 respecting Environmental Accident Reporting shall be immediately reported to Manitoba Sustainable Development and the Contract Administrator. All spills or releases of petroleum and other products shall be contained, treated and disposed of in accordance with the Manitoba Regulation 188/2001 respecting the Storage and Handling of Petroleum Products and Allied Products Regulation or any future amendment thereof and any other applicable requirement.

In the event of a spill on the ground the entire affected area will be cleaned up and all soil with contaminant levels exceeding the applicable criteria will be appropriately disposed of at a licenced soil recycling facility. If affected soil is to be stored on-site for any time a designated storage area will be identified and prepared to prevent further effects to other soil in the area. Soil will be remediated to Canadian Council of Ministers of the Environment's guidelines. Spill sites may also require an environmental site assessment and/or a remedial action plan.

2.8 OTHER APPROVALS

Additional approvals from Transport Canada and DFO may be required for the Project.

2.8.1 NAVIGATION PROTECTION ACT

Under the *Navigation Protection Act* (NPA) work in a waterway on the list of scheduled waterways requires Ministerial review with works determined likely to substantially interfere with navigation requiring approval whereas works determined not likely to substantially interfere with navigation are permitted. While Hardman Lake and Netley Lake are not on the list of scheduled water bodies, the Red River and Lake Winnipeg are, and the proposed dredging may be considered a works under Transport Canada regulations. Because the dredging will occur during the open water season, the Project will need to include provisions for navigation to be maintained so that the work will not cause substantial interference with navigation. A Notice of Works form must be completed and submitted to the Transport Canada Navigation Protection Program to review the likely interference with navigation and determine the required approvals and whether further protection measures are required.

2.8.2 FISHERIES ACT / SPECIES AT RISK ACT

The *Fisheries Act* provides protection of aquatic species and the habitats upon which they depend and requires that projects avoid causing serious harm to fish. This applies to work being conducted in or near waterbodies that support fish that are part of or that support a commercial, recreational or Aboriginal fisheries, including projects that have the potential to affect the passage of fish or modify the flow of watercourses. In-water work has the potential for fish habitat alteration or loss (serious harm), which may occur as a result of infilling or conversion of wetlands. The proposed mudflats in Hardman Lake, and potentially Netley Lake, will have a crest elevation below the OHWM and therefore is not considered infilling fish habitat. While the fish habitat will be altered the area is relatively small and the Project will provide an overall benefit to fish habitat with an increase in vegetated shoreline.

The *Species at Risk Act* (SARA) prohibits the killing, harming, harassment, possession, capturing or taking of a species listed as extirpated, endangered or threatened; the damage or destruction of a residence or the destruction of any part of the critical habitat of such a listed species. The Mapleleaf mussel is known to inhabit the Red River and is listed as Endangered on Schedule 1 of SARA. DFO has recently been re-evaluating how they determine impacts on the mussel and its habitat and has broadened the spectrum of suitable habitat such that only rock, moving sediments and areas that freeze are excluded as potential habitat. Based on the substrate sampling completed, the area that will be affected by the Project is not suitable habitat as the substrate is erosion and depositional materials that freeze during winter.

Because of the potential to affect fish habitat and the presence of Mapleleaf mussel in the Red River a Request for Review will be prepared and submitted to DFO. As stated, it is expected that the Project will not cause serious harm and the substrate is not suitable for Mapleleaf mussel and therefore it is anticipated that authorization under the *Fisheries Act* will not be required.

3.0 PUBLIC CONSULTATIONS

The RRBC hosts a Marsh Day each year to introduce and educate stakeholders and interested public members about the history and importance of the NLM. The Marsh Day includes a boat tour through the NLM to get personal exposure to the conditions. The proposed pilot project was introduced on storyboards presented during the 2017 Marsh Day with an update on the project progress provided during the 2018 Marsh Day (Appendix D).

The RRBC also held four open houses during the planning process in fall 2018 where additional details and presentations were provided and feedback was requested. Examples of the communication materials used, such as advertisements, storyboards, information pamphlet and feedback form are provided in Appendix D. The four open houses were as follows;

- October 15, 2018 in St. Andrews; 102 attendees
- November 21, 2018 in St. Clements; 14 attendees
- November 22, 2018 in Winnipeg; 52 attendees
- November 29, 2018 in Selkirk; 48 attendees

In general, individuals and local organizations that have an interest in NLM or Lake Winnipeg are in favour of proceeding with the proposed project. There were no negative comments or opposition expressed towards the project at the open houses. Questions raised at the open houses were to understand details of the project (e.g. how many mudflats, how much dredging, how will seeding be done), how people can support the project and how to make the pilot project a full time annual project. Members of the Netley Marsh Waterfowl Foundation and Manitoba Association of Cottage Owners, individuals who live on the shores of Lake Winnipeg and NLM, and several commercial fishermen spoke in favour of restoring the marsh [(12)].

In addition to the public consultation the Southern Chiefs Organization is part of the Steering Committee and has provided Indigenous insight into the Project. A meeting was also held with the Peguis First Nation Chief and Council on February 6, 2019 to present and discuss the Project. The Peguis First Nation has a keen interest in restoring NLM as it was traditionally used by their people for hunting and gathering, and borders their Treaty Land Entitlement “initial

selection" area. Chief Glenn Hudson submitted a letter following the meeting stating "On behalf of Peguis First Nation and our councilors we fully support this vital initiative to restore the Nelty-Libau Marshes and would like to partner with the RRBC whenever possible to ensure the success of this Project" (Appendix D).

4.0 PHYSICAL ENVIRONMENT

4.1 LOCATION, PHYSIOGRAPHIC SETTING AND CLIMATE

The NLM is located within the RM of St. Andrews and RM of St. Clements, approximately 10 kilometres (km) north of Selkirk and 57 km northeast of Winnipeg, Manitoba [13] (Figure 1). The project area is located within the Gimli Ecodistrict of the Interlake Plain Ecoregion and Boreal Plain Ecozone. The project site lies along the southern shore of the south basin of Lake Winnipeg in an area characterized by short, warm summers and cold winters. The Interlake Plain Ecoregion is underlain by low relief, flat-lying Palaeozoic limestone rock. The surface of the plain has an elevation ranging from 218 m asl at Lake Winnipeg to 410 m asl near the Manitoba Escarpment at its northwestern end [14].

Average annual precipitation at the Gimli weather station (Station No. 5031038, Latitude 50° 37.800' N Longitude 97° 1.200' W) is 533 millimetres (mm) with 94 mm falling as rain in June. Precipitation varies greatly from year to year and is highest from late spring through summer. The warmest month is July, with an average temperature of 19.2°C while the lowest average temperature is -18.2°C in January [15].

The marsh is sometimes referred to as the mouth or the delta of the Red River as the river flows through the marsh before it enters the lake. Wave action on Lake Winnipeg, particularly due to strong wind-assisted tides known as seiches, has produced a small beach ridge at the south end of the lake which acts as a barrier separating parts of the marsh from the lake [1].

4.2 GEOLOGY AND HYDROGEOLOGY

The north and south basins of Lake Winnipeg were formed following the retreat of glacial Lake Aggasiz. The basins remained separate entities until they were connected hydrologically approximately 2,900 years ago by back-flooding of the northern basin caused by uplift due to isostatic rebound (uplifting of the earth surface after the removal of the weight of glacial ice). Physical processes such as wind and wave action in the south basin of Lake Winnipeg and its associated inflows have led to the development of the various barrier ridges, open water areas and channels that define NLM [16].

There are no drilling records within the extents of NLM, but areas to the south, east and west have water well records and test hole information. In 1986, the province of Manitoba compiled geology and hydrogeology data for most of southern Manitoba [17]. The overburden in the region consists of Lake Agassiz silty clay above glacial till. Typically, the glacio-lacustrine clays vary from about 6 m to 15 m thick [18]. The underlying glacial till is typically around 10 m thick, but ranges from less than one metre to almost 20 m thick. At most locations, the till overlies limestone bedrock, but occasionally the till blanket is missing and the glacio-lacustrine clays are in contact with the bedrock.

The local bedrock consists of Red River Formation limestone overlying Winnipeg Formation sandstone. Below the Winnipeg Formation is Precambrian basement bedrock. Both the Red River and Winnipeg formations dip gently to the west. The Red River Formation is approximately 35 m thick on the east side of NLM and 60 m thick on the west side. The underlying Winnipeg Formation is typically between 30 m and 35 m thick.

The Red River Formation is host to a major aquifer referred to as the Carbonate Aquifer. The Carbonate Aquifer is a very large regional aquifer that provides potable water to many rural communities in southeastern Manitoba. The aquifer generally consists of sub-horizontal water bearing fractures. In places, there are very large open fractures which can provide very large volumes of water. The water quality in the Carbonate aquifer varies significantly, with areas west of the Red River typically having higher total dissolved solids (TDS) and salinity compared to areas east of the Red River. In the area around NLM, the TDS ranges from 430 ppm to 700 ppm, which, although elevated, does not preclude this water being used as a potable source [17].

The Winnipeg Formation also hosts a major aquifer, but the water quality from the sandstone aquifer has very high TDS; ranging from 850 ppm east of NLM to greater than 10,000 ppm on the west side, making the groundwater unsuitable as a potable source. Virtually all water wells in the vicinity of NLM are completed in the Carbonate Aquifer [17].

4.3 SURFACE WATER

4.3.1 Netley-Libau Marsh

NLM is designated as a Manitoba Heritage Marsh [(1)] and it is the largest coastal wetland in Manitoba [(4)]. The marsh represents about 16% of all riverine wetlands around Lake Winnipeg (22,200 hectares, excluding uplands) [(19)] with open water accounting for 8,567 hectares [(5)]. Situated behind a 25 km barrier ridge along the south lakeshore of Lake Winnipeg, the marsh consists of a complex of shallow lakes, lagoons, and channels [(19)] interlaced with fingers of grassland, trees and shrubs [(1)] through which the Red River flows on its way to Lake Winnipeg. There are several openings in the barrier ridge separating NLM from Lake Winnipeg, although these are constantly changing due to wind action and southward migration of the lake due to a faster rate of isostatic rebound at the north end of the lake. It has been reported by members of the project team that total suspended sediment levels in Hardman Lake are quite a bit lower than in the Red River.

4.3.2 The Red River

The Red River begins at a point near the North Dakota, South Dakota and Minnesota borders. It flows due north to enter Lake Winnipeg on its southern-most shore. The Red River watershed includes both the 130,000 square kilometre (km^2) Red River basin and the 162,000 km^2 Assiniboine River watershed, which extends west of Moose Jaw in southwestern Saskatchewan and south to Minot in North Dakota [(20)]. The elevation at Wahpeton, North Dakota, the source of the Red River, is 287 m asl while at Lake Winnipeg, the elevation is 218 m asl. The difference is only 71 m over a distance of 872-river km for a slope of less than 0.1 m/km [(21)].

The river is an important hydraulic feature of NLM as it passes through the centre of the marsh and exists as a single channel until it breaks into three smaller channels at a site known as The Forks. The meandering, slow-moving river typically carries a substantial load of suspended sediment and this material is typically deposited and re-suspended depending on the rate of river flow. All three channels have been used at different times for ship traffic but around 1911, federal engineers dredged a channel at the mouth of the centre channel, on a northwest orientation in hopes of reducing sedimentation of the channel mouth [(19)].

In 1913, the federal government dredged a channel south of the Forks, referred to as the Netley Cut connecting the Red River with the south end of Netley Lake, near the river's confluence with Netley Creek. Initially, Netley Cut was less than 24 m wide but widening of the channel by erosion began almost immediately. By 2003 Netley Cut had grown to 400 m and in 2009 it was 450 m [19]. In 2009, based on 6 days of field measurements over a range of flow conditions it was determined that an average of 37% of the flow in the Red River upstream of the cut enters Netley Lake, while the remainder continues down the Red River.

At the downstream junction the Red River flow splits nearly evenly between the east and centre channels, whereas the flowrate in the west channel is relatively insignificant [22]. In 1999, the federal government discontinued dredging at the mouth of the Red River and local boaters report that since then siltation has occurred to the extent that navigation is being impaired [19].

4.3.3 Lake Winnipeg

Covering approximately 24,500 km^2, Lake Winnipeg is the 10th largest body of freshwater in the world and is Canada's sixth-largest freshwater lake. From NLM at the south end of the lake to Limestone Bay at the north end, the lake is 436 km long [23]. Lake Winnipeg is composed of a large, deeper north basin with an average depth of 13 m and a smaller, shallower south basin with an average depth of 9 m [24]. Uplifting in the north basin due to isostatic rebound is occurring more rapidly than in the south basin and is affecting shoreline change on Lake Winnipeg. Lake Winnipeg water levels fluctuate due to long-term hydrologic cycles (wet and dry years), seasonally due to spring runoff and almost daily because of wind set-up. Since 1975, Lake Winnipeg water levels have been regulated and it became the world's third-largest hydroelectric reservoir with water flowing out of the north end of the lake used for power generation along the Nelson River. Manitoba Hydro maintains water levels in the lake between 216.7 m asl and 217.9 m asl. Regulation of lake levels also regulates the water levels in NLM because of its connection with the lake [25].

4.3.4 Water Quality

In natural aquatic systems, Phosphorus enters freshwater systems slowly and in low concentrations through erosion of soil, deposition from animal waste and plant decomposition.

Most nitrogen available for plants comes mainly from decaying organic matter, fecal matter, or bacteria that can “fix” the atmosphere’s nitrogen into a form plants can utilize. Human impacts have significantly accelerated the rate at which phosphorus and nitrogen enters aquatic systems through drainage, wetland loss, fertilizer application, livestock, and urban and rural wastewater. Although nutrients in water are essential to biological life, too high of a nutrient concentration causes eutrophication and a rapid increase in plant and algae growth [(26)].

At 953,240 km^2, Lake Winnipeg's drainage basin is the largest drainage basin of all lakes in Canada, covering four provinces and four U.S. states. The shallow waters and large volume of water flowing in from the rivers draining into the lake are major influences on water quality [(24)]. Intensive agriculture represents a major land use within the Red River watershed and chemical fertilizers and pesticides transported from agricultural fields and municipal and industrial wastewaters have resulted in increased concentrations of nutrients such as phosphorus and nitrogen in the Red River which is the major contributor of nutrients to Lake Winnipeg [(16)]. While providing only 11% of annual water flows into Lake Winnipeg, the Red River watershed contributes over 60% of annual phosphorus loads and 30% of annual nitrogen loads to the lake [(3)]. The highest levels of phosphorus and nitrogen are typically found in the south basin near the inflow from the Red River, with nutrient levels declining as the water flows north. The excess amount of phosphorus and nitrogen flowing into Lake Winnipeg contributes to increasingly large, frequent, and potentially toxic, algal blooms, which can kill animals that use the water and affect human health [(24)].

Water quality samples were collected from NLM in August 2009 as part of a research study to measure the current state of nutrients in NLM and to evaluate potential phosphorus storage with NLM restoration efforts. Water samples were analyzed for a suite of water quality parameters, including: total reactive phosphorus (TRP) for fresh samples, turbidity, total phosphorus, ammonia, pH, alkalinity, dissolved inorganic carbon (DIC), and phytoplankton and compared to the Manitoba Water Quality Standards, Objectives and Guidelines (MWQSOG) [(27)]. A summary of the study findings in terms of nutrients in NLM is provided below; however, the authors of the study note that the samples collected from NLM in August 2009 provide a snapshot of the water quality parameters during that time, and do not necessarily reflect overall water quality issues of the marsh and adjoining Lake Winnipeg [(26)].

Phosphorus

Total phosphorus (TP) is the total amount of inorganic and organic P that is found in the water. The MWQSOG states that TP should not exceed 0.025 mg/L in water bodies. TP concentration in NLM during August 2009 ranged between 0.39 and 3.53 mg/L, with and average of 1.69 mg/L and one sample that measured 9.56 mg/L, all substantially above the MWQSOG [(26)].

Ammonia-Nitrogen

Ammonia-N is the concentration of nitrogen in the water that is found in the form of ammonia. This form of nitrogen is a waste product of aquatic life and in higher concentrations is toxic to living organisms. Ammonia toxicity varies depending on water pH and temperature. The MWQSOG states that at 20°C and pH of 9, ammonia levels should be <0.3 mg/L. Ammonia levels were undetectable for most sample sites, and were well below the guidelines with an average 0.04 mg/L. Several sites along the Red River had ammonia levels from 0.03 to 0.18 mg/L, suggesting higher ammonia inputs closer to the Red River [(26)].

pH

The level of pH is a measure of the number of hydrogen ions (H+) found in solution. It is very important in driving chemical reactions. The suggested pH range for aquatic life is between 6.5 and 9.0. Water with pH of <7 is considered acidic with an excess of H+, while water with pH of >7.0 is considered basic and has more chemicals able to accept H+ than the concentration of H+ itself. The average pH of water in NLM was 7.82 and ranged between 7.29 and 8.38, well within the guideline [(26)].

Alkalinity

Alkalinity measures the buffering capacity of water, and refers to the concentration of dissolved chemicals (solutes) in water able to neutralize acids without the pH being changed. In natural systems the most common buffering solutes are bicarbonate and carbonate. The mean alkalinity of NLM in August 2009 was 302 mg/L, and ranged from 208 to 568 mg/L [(26)].

Chlorophyll a

Total chlorophyll analysis includes chlorophyll a pigments from both living and dead plant cells. Chlorophyll a is a green pigment found in all plants and often used as a measure of algal production in aquatic systems. High levels of algal production are undesirable because they can release toxins that cause health effects, and reduced oxygen concentrations and fish kills in water from decaying algae. Desirable limits of chlorophyll a are variable depending on natural levels in a given area. Water bodies with chlorophyll a concentrations between 56 and 155 µg/L are considered hyper eutrophic (i.e., high in nutrients) and characterized by dense algae and macrophytic growth. Average total chlorophyll a values in NLM were low, at 31.3 µg/L, and ranged from 1.4 to 86.7 µg/L [(26)].

Total Inorganic Carbon

The total inorganic carbon or dissolved inorganic carbon is the sum of inorganic carbon species in a solution. The inorganic carbon species include carbon dioxide, carbonic acid, bicarbonate anion, and carbonate. Average dissolved inorganic carbon levels in NLM were 76.7 mg/L, and ranged between 51 and 141 mg/L [(26)].

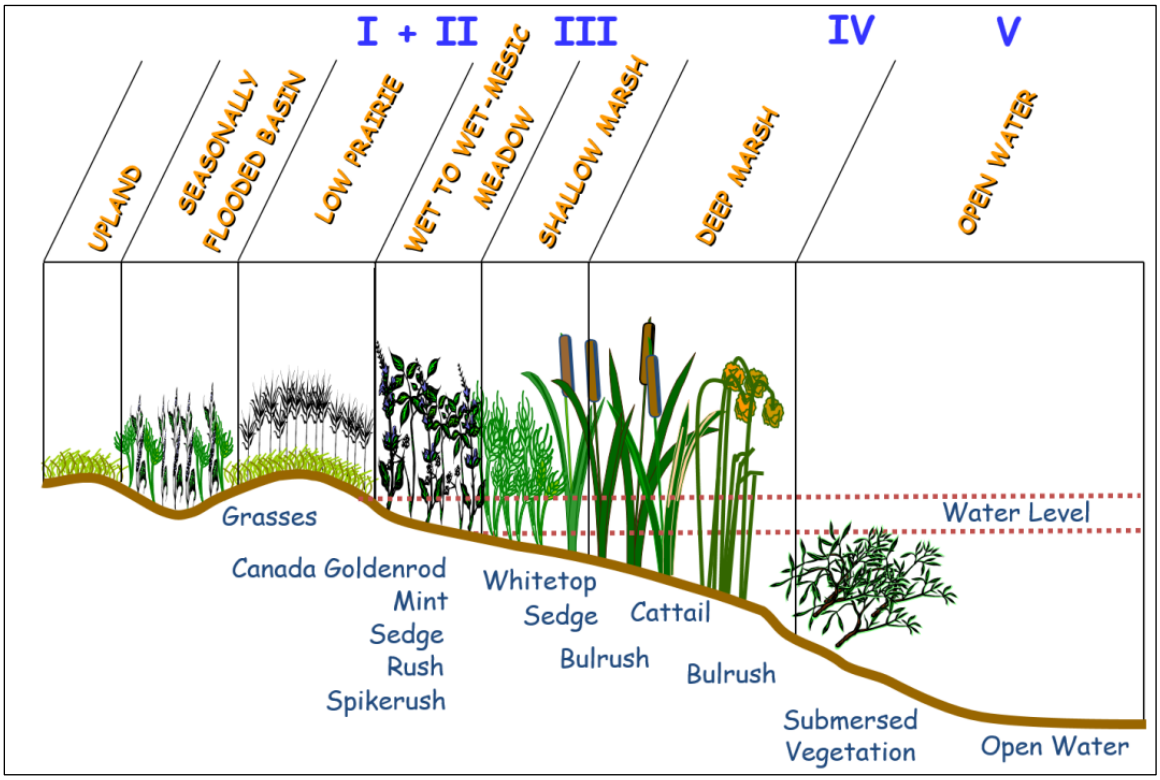
4.4 VEGETATION

In marshes, vegetation zones develop along wetland water depth gradients (Figure 4) depending on three main hydrological drivers:

- How often the marsh is flooded (i.e., every year, alternate years, etc.)
- Water levels during flooding
- How long flooding lasts (i.e., 1-2 months, 3-4 months, all summer)

Vegetation zones identified in NLM include open water; emergent (shallow and deep marsh); wet meadow; and low prairie [(16)].

FIGURE 4
WETLAND PLANT ZONATION [16]



Vegetation changes are characteristic of all freshwater marshes as these systems are susceptible to varying climatic conditions such as years of drought and flood. NLM has experienced a loss of emergent vegetation, in the shallow and deep marsh zones, over the past number of years which has resulted in the decline of many of the marsh's ecological functions such as those related to habitat provision, wave energy dissipation, sediment stabilization, and water quality improvements [16].

Although the quality and quantity of vegetation in the marsh has changed over the years, the dominant emergent species at present include cattail, giant reed grass, awned sedge, reed canary grass, willow and bulrush. These six dominant species and their associated understory flora form distinct zonation patterns depending on water depth [25].

4.5 WILDLIFE

4.5.1 Mammals

Common furbearers found in NLM include muskrat, fox, coyote, mink, beaver, river otter, weasel, raccoon, and skunk. Of these, only the muskrat has been well studied within the NLM due to its significance to the Manitoba fur economy. Low muskrat numbers have been experienced in NLM since Lake Winnipeg water-level regulation. This is attributed to the loss of emergent vegetation caused by persistent high water levels in combination with a stabilization of water levels in the lake. The timing of Lake Winnipeg draw-down has also been suggested as contributing to the decline of NLM muskrats. Muskrats build their houses before the freeze up of the marsh; however, Manitoba Hydro lowers Lake Winnipeg waters in the winter to create more freeboard for spring inflow. This typically occurs after muskrats have built their houses and the lowered lake/marsh water levels can prevent muskrats from accessing their burrows forcing them to abandon their houses and die [16].

4.5.2 Amphibians and Reptiles

Manitoba has 14 species of amphibians and 8 species reptiles [28]. Coastal freshwater marshes such as NLM provide good amphibian habitat where, depending upon their life stage, the amphibians can act as both predator and prey in wetland food webs. Grazing by tadpoles can reduce algal populations while the feeding behaviour of adult frogs can impact invertebrate communities. Amphibians also provide a food source for wetland fauna such as fish and waterfowl [16].

4.5.3 Birds

NLM is well-known for its concentrations of southward-migrating birds and during fall migration the number of geese and ducks can exceed 100,000 [1]. The NLM is a globally significant Important Bird Area (IBA) and waterfowl use the marsh for staging, molting and nesting. Species meeting IBA criteria include Forster’s tern, Franklin's gulls, black-crowned night-herons, yellow-headed and red-winged blackbirds, swallows and waterfowl. The numbers of sandhill cranes, Canada geese and western grebes come very close to meeting IBA

population thresholds. Surveys conducted in the 1980s identified 114 bird species. Gulls, terns and western grebes are the most common nesting species while American white pelicans and double-crested cormorants are common non-nesters on the marsh. Mallards and male wood ducks are the most common molting species with estimates reported as high as 25,000 birds [(5)].

The marsh around Hardman Lake is known as the Netley Marsh Game Bird Refuge. Created on Crown Land in 1966, the 1,072 hectare refuge was established to provide a refuge area for migratory game birds, thus encouraging them to remain in the area longer in the fall [(5)] although use of the marsh by waterfowl has declined sharply over the years as the habitat has been degraded [(5)].

According to the Manitoba Breeding Bird Atlas (MBBA) the Hardman Lake project area is within MBBA square 14PA58 of Region 3: Red River Valley, and the Netley Lake project area is within MBBA square 14PA57. A total of 57 bird species have been recorded within square 14PA58 and 64 bird species have been recorded in square 14PA57 (Appendix E).

4.5.4 Species of Conservation Concern

Within the Interlake Plain Ecoregion several species of conservation concern are identified. Most of the listed species are globally secure and abundant, but in Manitoba some are rare and may be vulnerable to extirpation (Appendix F). The Manitoba Conservation Data Centre (CDC), Biodiversity Information Manager completed a search of the CDC rare species database and indicates that the western grebe is known to be found within the proposed works area on Netley Lake [(29)] (Appendix G). Of those species identified in the MBBA species summaries for square 14PA57 and square 14PA58, four are classified by the federal SARA as Schedule 1 species, including the barn swallow, bank swallow, bobolink and western grebe, described as follows:

- Bank swallow is provincially widespread (S5B) but is listed as Threatened under SARA. It is insectivorous and breeds in a wide variety of natural and artificial sites with vertical banks, including riverbanks, lake and ocean bluffs, aggregate pits, road cuts, and stock piles of soil. Breeding sites tend to be somewhat ephemeral due to the dynamic nature of bank erosion. Breeding sites are often situated near open terrestrial habitat used for aerial foraging such as grasslands, meadows, pastures, and agricultural cropland [(30)].

- Barn swallow is provincially widespread (S4B) but is listed as Threatened under SARA. Nesting habitats are on artificial structures, including barns and other outbuildings, garages, houses, bridges, and road culverts [31].

- Bobolink is provincially widespread (S4B) and listed as Threatened by COSEWIC. Since the conversion of the prairie to cropland and the clearing of the eastern forests, the bobolink has nested in forage crops (e.g., hayfields and pastures dominated by a variety of species, such as clover, timothy, kentucky bluegrass, and broadleaved plants) [32].

- Western grebe is provincially widespread (S4B) and listed as Special Concern under SARA. The preferred nesting area consists of marshes and lakes with stands of emergent vegetation, stable water levels, large areas of open water, and ample populations of prey fish [33].

The CDC also identified the presence of yellow rail within a two kilometre radius of the proposed Netley Lake work. The records for the yellow rail however, have low locational accuracy and it was not identified in the MBBA. Yellow rail is provincially uncommon (S3B) and listed as Special Concern under SARA. Relatively little is known about this small, secretive rail. It is primarily restricted to shallow, dense, grassy marshes and wet meadows. Most of its breeding range (about 90%) is in Canada. It is relatively uncommon in most areas. Yellow rails nest in wet marshy areas of short, grass-like vegetation, usually sedge, that have an overlying dry mat of dead vegetation that they use to roof their nests [34].

4.6 FISH AND AQUATIC HABITAT

The fisheries ecology of NLM is typical of shallow water zones associated with both a river and a lake. Seasonal river flows and seasonally fluctuating lake water levels from wind induced seiches help to prevent stagnation and enhance productivity in surrounding waters. Shallow depth allows rapid warming and continuous wind mixing result in temperature and oxygen regimes that make the shallow water zone an excellent spawning nursery and feeding area. The winter freezing of marsh lakes creates conditions which may result in winter-kill if fish cannot escape to deeper waters [35].

NLM provides spawning, nesting, nursery, and foraging habitat for bait and commercial fish. In the 1980s it was estimated that there were 25 different fish species in the marsh. NLM fish species composition exhibits seasonal changes resulting from cyclical movements by Red River and Lake Winnipeg fish populations into and out of the marsh. In April, NLM fish populations are

characterized by spring spawners (e.g., northern pike and yellow perch). These populations are replaced in May-June by summer spawners (e.g., bullhead and carp) and then later in the summer (July and August) by fish of the feeding assemblage (e.g., goldeye, sauger and yellow perch). The fall-winter fish assemblage in NLM is characterized by those fish tolerant of extreme conditions such as low oxygen levels (e.g, northern pike, bullhead and carp) [(16)].

The CDC identified the presence of chestnut lamprey within a two kilometre radius of the proposed Netley Lake work area. The chestnut lamprey is provincially uncommon (S3) and listed as Special Concern under SARA. The chestnut lamprey is found in some rivers of Saskatchewan and Manitoba and spawns from mid-June to late July, in areas of coarse gravel. The areas suitable for spawning of the lamprey are disappearing due to siltation and pollution. The deterioration of river environments also threatens their food supply. Toxic chemical pollution can cause mortality at all ages and eutrophication can cause mortality in the young [(36)]. In addition to the chestnut lamprey, the snail, *Physa winnipegensis*, was described as being endemic to Lake Winnipeg, Manitoba and assessed as Endangered by COSEWIC in 2002. Despite annual searches, the last observation of the taxon was in 2006. The taxonomic uncertainty and the lack of genetic material for further study have resulted COSEWIC designating the species as Data Deficient [(37)].

Large scale fisheries do not occur in NLM itself but fish species occurring in the marsh are valuable to the Lake Winnipeg commercial gillnet fishery which harvests 37% of Manitoba's total fish production, the Red River sport fishery which receives 15 to 20% of resident angling effort and the Red River - Lake Winnipeg bait fishery which produces 60 to 70% of Manitoba's bait fish production. The most valuable abundant NLM fish species are northern pike, yellow perch, sauger, shiners and goldeye [(35)].

Turbidity (suspended sediment) levels in the lakes of NLM are understood to be at least partly due to one of the primary aquatic residents: common carp [(5)]. Carp is a bottom feeder and while it is not predaceous and doesn’t compete with important commercial species for food it uproots aquatic plants and keeps the water so turbid that most other fish cannot live. Carp have a preference for shallow, stagnant ponds or bays where the bottom is muddy and there is a dense growth of submerged and emergent vegetation [(38)].

4.7 SOCIOECONOMIC

Archaeological evidence indicates that native peoples were present in the area surrounding present-day Lake Winnipeg as early as 8,000 years ago. The first permanent European settlers arrived on the shores of Lake Winnipeg in October 1875 when a group of 285 Icelanders established a community at Gimli. During the late 1890s and early 1900s, other ethnic groups joined the Icelanders in populating the western shore of Lake Winnipeg and the inland Interlake area [(39)].

Today, more than 23,000 permanent residents live in 30 communities along the shores of Lake Winnipeg, including 11 First Nations communities [(39)]. The lake and surrounding areas allow for a wide range of recreational activities including boating, sailing, canoeing and swimming. Provincial recreational developments are located at Patricia Beach, Netley Creek and Breezy Bend along the Red River [(5)] while Lake Winnipeg's beaches and associated parks, with camping and other facilities, have long been popular recreational destinations. Eight provincial parks are located along the south basin, with camping being a popular activity at these locations. Boating is a popular activity on the lake and fifteen harbours provide berthing facilities for recreational and commercial boats. The largest harbour, Gimli, has berths for over 220 recreational boats. Recreation and tourism expenditures in the area along the Red River and surrounding Lake Winnipeg generate an estimated to be $100 million per year [(39)].

Recreational fishing on the Red and Winnipeg rivers is a highly valued industry and estimated to contribute $17 million in direct expenditures annually [(39)]. Commercial fishing has been a major industry on Lake Winnipeg for nearly 125 years [(23)]. The lake supports the largest freshwater commercial fishery in western Canada and the largest commercial walleye fishery in the world. The freshwater fishery had average annual returns of $20 million between 1998 to 2003 [(39)]. Fish harvested from the lake include walleye, whitefish, sauger, and goldeye. Most of the fish are marketed through the Freshwater Fish Marketing Corporation to consumers in western Canada, the United States and Europe. Walleye dominate the harvest (3.8 million kg in 2004/2005) with whitefish having the second highest landed volumes (1.6 million kg in 2004/2005) [(23)]. The lake supports the livelihoods of one thousand commercial fishers, 80% of whom are First Nations or Métis. In addition to the licensed fishers themselves, the fishery provides a major source of income for those who work as packers, shippers, and processors,

and who generally reside in the shoreline communities. Subsistence fishing also plays a central role in the traditional cultural life of the First Nations communities along the shores of the lake, serving as a main source of income and food for many families [(39)].

4.8 HERITAGE RESOURCES

The Historic Resources Branch (the Branch) of the department of Sport, Culture and Heritage was contacted and provided with locations of areas to be affected by the Project. The project location was examined in conjunction with records held by the Branch [(40)] and it was determined that there are no known heritage resources located within the study area (Appendix G). As described previously, the locations of the proposed dredging works are regularly exposed to erosion and sediment deposition and it is unlikely that heritage resources would be present. In addition, the areas proposed for mudflat creation will not be subject to any subsurface disturbance as the dredged material will be deposited on top of the existing substrate.

5.0 POTENTIAL ENVIRONMENTAL EFFECTS ASSESSMENT

An environmental effect includes any change that the Project may cause to the environment (biological, physical, social and economic). Environmental effects were identified from interactions between project activities and environmental components. The Project is experimental in nature; however, if it shows that dredged material can be successfully used to construct mudflats for emergent plant habitat, it may be possible to reestablish the NLM as an ecological asset that, once restored, can improve water quality for Lake Winnipeg. Mitigation measures and follow-up activities were identified for environmental effects determined to be adverse.

5.1 AIR QUALITY

Increased fugitive dust will result in the local area from vehicle and construction equipment accessing the staging area. It is unlikely that this work will result in suspended particulate levels exceeding Manitoba's air quality guidelines and there will be a minimal increase in traffic. As such the potential adverse effect was assessed to be negligible. Any potential effects will be mitigated by controlling construction vehicle speeds, limiting construction activities during high wind events, and re-establishing vegetation on disturbed areas.

Temporary increases in greenhouse gases and vehicle exhaust emissions in the local area may result from transportation of materials to the site and from dredging and mudflat construction activities. Increased volatile organic carbon (VOC) levels will result from fuels and other hazardous substances used during construction activities. The engine on the Amphibex is said to emit few pollutants and during construction it will be returned to shore and refueled from slip tanks that will otherwise be stored off-site. It is unlikely that Manitoba's air quality guidelines would be exceeded during construction and any effects would be very short term. Therefore the potential adverse effects on air quality in the local area from greenhouse gases and VOC were assessed to be negligible to minor. Mitigation measures to control increased greenhouse gases and vehicle emissions include requiring a high standard of maintenance for vehicles, limiting unnecessary long-term idling, using low sulphur-containing fuels, using appropriate dispensing equipment and limiting fueling of vehicles and equipment. One of the purposes of the Project is

to successfully establish new vegetation, which would act as a carbon sink providing a long-term benefit to air quality.

5.2 SOILS

Soils in the staging area may become contaminated during construction from leaks and accidental spills or releases of fuels or other hazardous substances and waste. Potential spills would be restricted to a small area where equipment and materials are staged and would be cleaned-up immediately. There will be no equipment maintenance conducted in the staging area and only small quantities of fuels are likely to be on-site in slip tanks during refueling purposes. The potential adverse effects on soil quality were assessed to be minor. Proposed mitigation includes preventing leaks, spills and releases by providing secondary containment for fuel storage, requiring drip trays for equipment, providing fuel handling training for operators, providing spill clean-up equipment and materials, complying with provincial fuel storage and dispensing regulations, storing hazardous materials in approved containers, providing an emergency spill-response plan and periodic inspection for leaks, spills and releases. If a spill should occur the contractor would be responsible to notify the Manitoba Sustainable Development Emergency Response Program (204-944-4888) and the appropriate clean-up would be determined according to the size of spill and quantity of contamination. Small spills could be treated on-site with regular working of the soil to aerate. Larger spills, however, would be assessed and delineated following Phase III Environmental Site Assessment standards and a remediation program would be developed to ensure that the site is cleaned to meet Manitoba Sustainable Development soil remediation criteria.

5.3 GROUNDWATER

Groundwater in the staging area may become contaminated from leaks, accidental spills, or releases of fuels or other hazardous substances. Potential spills, as noted in Section 5.2, would be restricted to a small area and immediately cleaned-up. The soil in the staging area is a mix of Lacustrine clays and silts that would provide a barrier to migration of contaminants and there are no established pathways (such as wells). Additionally, groundwater in the region is identified as artesian with an upward gradient [41]. Therefore the potential adverse effects on groundwater quality were assessed to be negligible. Proposed mitigation includes preventing leaks, spills and

releases by providing secondary containment for fuel storage, requiring drip trays for equipment, providing fuel handling training for operators, providing spill clean-up equipment and materials, complying with provincial fuel storage and dispensing regulations, storing hazardous materials in approved containers, providing an emergency spill-response plan and periodic inspection for leaks, spills and releases.

5.4 SURFACE WATER

Surface water in the project area may become contaminated during construction from leaks and accidental spills or releases of fuels or other hazardous substances as the majority of the work is being done in the water. An Amphibex will be used to suction-dredge the material and the mudflats will be accessed by boat for vegetation and monitoring work. The Amphibex is designed to operate in the water and the hydraulics are run on vegetable oil. The Amphibex engine is located within a well that is designed to capture any engine contaminants and it will be returned to shore for refueling. Boat and Amphibex operators will follow the prescribed procedures for refueling and will exercise caution. A spill kit is available on the Amphibex. The potential adverse effects on surface water quality resulting from leaks and accidental spills or releases were assessed to be moderate to major. Additional proposed mitigation includes preventing leaks, spills and releases by providing secondary containment for fuel storage, requiring drip trays for equipment, providing fuel handling training for operators, providing spill clean-up equipment and materials for hydrocarbon spills including kits to deal with larger spills in aquatic environments, complying with provincial fuel storage and dispensing regulations, storing hazardous materials in approved containers, providing an emergency spill-response plan and periodic inspection for leaks, spills and releases.

Surface water in the project area may become more turbid as a result of project activities. Use of an Amphibex with a suction dredge rather than a backhoe will minimize disturbance of the dredged area and introduction of suspended sediments into the Red River and Lake Winnipeg. The area where the mudflats will be constructed is contained, with different containment options (hay bales, geobags, aquadams) being evaluated to determine which is most effective for managing suspended sediments. During construction, the site will be monitored to determine if suspended sediment is being held within the project's containment area. It has been noted that water in the Red River is more turbid than the water in Hardman Lake and Netley Lake and

should there be an increase in turbidity of the water in either of the lakes resulting from mudflat creation, it would be unlikely to have a noticeable effect on suspended sediment conditions in the Red River or Lake Winnipeg. The potential adverse effects on surface water quality in terms of turbidity are expected to be short-term and were assessed to be minor. If substantially increased levels of suspended sediments are observed outside of the containment area as a result of project activities, additional sediment and erosion control measures, such as turbidity curtains, will be implemented. The mudflats will be vegetated following their construction to provide additional stability to the mudflats and have a long-term benefit for water quality in the marsh.

The proposed dredging activities will alter the river bathymetry which could change hydraulic conditions and flow patterns in the Red River. Any change is anticipated to remain localized to the dredged area and is expected to be temporary. Natural shoreline processes on Lake Winnipeg and fluvial geomorphology in the Red River are expected to substantially infill the dredged area with sediments within a period of one to two years, as was observed after the federal government discontinued dredging at the mouth of the Red River in 1999 [(42)]. At dredging site A, increased flow depths and velocities may occur along the dredged area. The effects of those changes were assessed to be minor since the flow patterns would follow a path previously used for navigation prior to 1999. Upstream from Netley Creek, hydraulic conditions in the Red River are controlled by Lake Winnipeg water levels. Previous studies [(42)] concluded that the impact of dredging vs no-dredging on maximum flood levels in open water conditions would be very small and that the global effects on river ice jam potential are believed to be so small as to be negligible. On this basis, the level of effect of the project to the hydraulic conditions in the Red River were assessed to be negligible.

5.5 VEGETATION

Clearing of trees and vegetation is not anticipated; however, there may be temporary disturbance of vegetation in the vicinity of the constructed mudflats associated with relocating the suction dredge discharge pipe. The overall project footprint is small and the CDC identified no rare or protected plant species in the project area. The potential adverse effects to vegetation were assessed to be negligible. Mitigation measures include minimizing disturbance of vegetation by limiting construction activities to designated and previously disturbed areas as

much as possible and vegetating disturbed or reclaimed areas after construction. Any short-term disturbance will be offset by the long-term goal of the Project to establish vegetation on the constructed mudflats and increase the amount of emergent vegetation in NLM.

5.6 WILDLIFE

Tree and vegetation clearing for the Project is not anticipated although some minor temporary disturbance to vegetation may occur during construction. The CDC found no occurrences of rare or endangered wildlife species within the Hardman Lake project area. CDC records did however, indicate the species of conservation concern western grebe may be found within the Netley Lake project area and the yellow rail has potentially been identified within two kilometres of the Netley Lake project area. As discussed in Section 4.5.4, four SARA Schedule 1 species including the barn swallow, bank swallow, bobolink and western grebe were listed in the MBBA as being present in either one or both project areas. Based on habitat requirements for the species, it is possible that the western grebe and yellow rail could nest in the project area, although emergent vegetation such as that preferred by the western grebe and yellow rail is not in great supply in the area. Given that the overall project footprint is small and the disturbance will be short-term, the potential adverse effects on wildlife were assessed to be minor during construction. Mitigation measures include minimizing loss and disturbance of vegetation and habitat by limiting construction activities to designated areas as much as possible, maintaining sediment and erosion control measures, and vegetating disturbed or reclaimed areas after construction to restore wildlife habitat. Anecdotal evidence from the Audubon Louisiana Project indicated that many birds were able to feed on invertebrates that were part of the dredged slurry. Creating shallow, vegetated mudflats will increase habitat diversity in the marsh and, hopefully, increase the amount of emergent vegetation which will have a long-term positive effect for wildlife.

5.7 FISH AND AQUATIC HABITAT

Introduction of deleterious substances into watercourses from spills or releases of fuel or hazardous materials associated with construction equipment can reduce surface water quality, resulting in toxic effects to aquatic organisms, including fish. Hydrocarbons (oil, diesel, gasoline and lubricants) can enter watercourses during the use, maintenance and fueling of construction

equipment near or on watercourses. Deleterious substances may kill fish or other aquatic biota directly, or may result in impaired health, vigor, or productive capacity. Any spills in the staging area would be immediately contained and cleaned-up according to the contractor's spill-response plan, preventing contaminated run-off from reaching the water. The Amphibex will be returned to shore for refueling and the engine is located within a well that is designed to capture engine contaminants. The effect of the Project on fish from introduction of deleterious substances was assessed to be moderate. The mitigation measures outlined in Section 5.2 and Section 5.4 to reduce the potential effects to soil and surface water from leaks, spills or releases of fuel and hazardous materials would also mitigate potential effects to fish and aquatic habitat.

Erosion and sedimentation from construction activities causing suspension and deposition of sediments may decrease surface water quality, as described in Section 5.4. There are multiple adverse effects associated with increased levels of suspended and deposited sediment, including effects to primary producers, invertebrates and fish. A decrease in light penetration due to higher turbidity can lead to decreased photosynthesis by primary producers and affect the food chain for higher trophic levels, such as invertebrates and fish. Large influxes of deposited sediment can bury aquatic invertebrates, an important food item for many fish species, resulting in reduced invertebrate species diversity and abundance. Sedimentation may also result in the loss of spawning habitats; smother deposited eggs and/or decreased spawning success for some fish species. The effect of the Project on fish and fish habitat from increased erosion and sedimentation was assessed to be minor to moderate. Dredging will be completed using an Amphibex with a suction dredge rather than a backhoe to minimize disturbance of the dredging area and suspension of sediments. Various containment options will be used to prevent high levels of suspended sediments from migrating beyond the mudflat creation areas. The proposed containment area has been selected to provide abundant room for suspended sediments to settle and to allow any fish located within the containment area to move away from the slurry outfall area. Exposed mudflats will be monitored to ensure erosion is not resulting in the transport of material to Lake Winnipeg. If transport of material is observed beyond containment areas, additional measures such as turbidity curtains will be employed to prevent movement of highly turbid water from the project area into adjacent waterbodies, as required.

To avoid in-filling fish habitat, as described in Section 2.6.1, the design crest elevation for the mudflats after the material has settled will be a minimum of 0.1 m below the OHWM for Lake

Winnipeg. The Project will however result in the alteration of fish habitat in the areas proposed to be dredged and material deposited to create the mudflats. Past experience has demonstrated that this type of work can stimulate biological diversity and productivity of wetlands by increasing the abundance of littoral crustaceans in the flooded zone to the benefit of forage fish species [(43)]. Additionally the mudflats will be vegetated after construction such that any potential short-term disturbance will be offset by the long-term benefit to fish habitat that increased emergent vegetation would provide. As such the overall effects to fish habitat associated with altering the fish habitat were assessed as positive.

The use of equipment in-water during construction could increase the risk to spread aquatic invasive species (e.g. zebra mussels). The introduction and spread of invasive species can reduce the diversity and populations of native species and can result in habitat modification [(43)]. Aquatic invasive species, in particular zebra mussels, are already present in Lake Winnipeg and therefore could be transported from the Project area on boats and the Amphibex to other waterbodies. To mitigate concerns with the potential spread of aquatic invasive species, any equipment which has previously been in contact with an aquatic ecosystem in Manitoba with known aquatic invasive species and any equipment used during construction of the Project that comes in contact with Lake Winnipeg must be properly cleaned so as to prevent the spread of aquatic invasive species. This equipment must be cleaned, drained, dried and inspected before and after in-water work.

5.8 EMPLOYMENT / ECONOMY

The overall scale of the Project is relatively small; however, it may create temporary construction employment opportunities and increase the economy in the local and surrounding areas associated with purchase of construction materials, fuel, supplies and lodging. In particular youth from the Peguis First Nation may be hired for vegetation planting. If the pilot project proves successful and funding can be accessed, future marsh restoration work would create jobs for those providing services in mudflat creation, vegetation and monitoring activities. The Project could contribute positively to the employment and economy in the immediate area. As the effect is positive, no mitigation or follow-up has been proposed.

5.9 HUMAN HEALTH AND WELL BEING

Soil, groundwater and surface water in the project area may become contaminated during construction activities, from leaks and accidental spills or releases of hazardous substances, which could adversely affect human health. Any potential spills would be immediately cleaned up as described in Sections 5.2, 5.3 and 5.4 with no migration off-site. Therefore the potential adverse effects of the Project on human health were assessed to be negligible. Proposed mitigation measures include preventing leaks, spills and releases by providing secondary containment for fuel storage, requiring drip trays for equipment, providing spill clean-up equipment and materials, providing fuel handling training for operators, complying with provincial fuel storage and dispensing regulations, storing hazardous materials in approved containers, and providing an emergency spill-response plan.

5.10 PUBLIC AND WORKER SAFETY

Delivery of boats, construction equipment and supplies to the staging area will result in short term increased traffic flow which can increase the possibility of vehicle accidents. Dredging and mudflat creation activities pose a potential danger to the public. There are no residences near the site and public access and navigation around the construction area will follow guidelines from Transport Canada. The potential hazard to public safety was assessed to be minor. Proposed mitigation includes informing boaters of construction activities by posting notices at nearby boat launches and if required by Transport Canada erecting signage, buoys or lighting upstream and downstream of the work area. Transport Canada may also require that a navigation management plan be developed. Once completed the Project may have a positive effect for public safety as dredging the Red River could improve boat passage in the dredged areas.

Handling and storage of fuels and hazardous materials pose a threat to worker health and safety. Additional potential hazards to worker safety include working on or near water and working from a boat. The hazards to worker safety will only be for a short construction period and were assessed as moderate. Proposed mitigation includes providing appropriate personal protective equipment (PPE) and rescue equipment for workers, providing fuel handling training for operators, complying with provincial fuel storage and dispensing regulations, storing

hazardous materials in approved containers, complying with *The Workplace Safety and Health Act* (Manitoba) and regulations, making sure work areas on the Amphibex are clean, dry and clear of debris, keeping all gear secure when not in use, keeping stairs, ladders, doorways, ramps, walkways, and gangways clear, securing ramps or gangways when loading and offloading, conducting safety briefings with workers and providing employee training. Work will not be conducted on water when high winds, storms or lightening are forecasted.

5.11 HERITAGE RESOURCES

The project location was examined in conjunction with records held by the Manitoba Department of Sport, Culture and Heritage, Historic Resources Branch. It was determined that no heritage or archaeological resources are known to be located within the study area (Appendix G). As the locations of the proposed works are in water and regularly exposed to erosion and sediment deposition it is unlikely that heritage resources would be present. In addition, the areas proposed for mudflat creation will not be subject to any subsurface disturbance as the dredged material will be deposited on top of the existing substrate. As there is little reason to expect that heritage resources will be affected by the Project, a screening request was not submitted to the Historic Resources Branch. The potential for the Project to impact archaeological or heritage resources is considered negligible and no specific mitigation measures or follow-up are proposed. If any archaeological or heritage artifacts are uncovered during the Project, the proponent will contact the Historic Resources Branch for direction on how to proceed.

6.0 ENVIRONMENTAL MANAGEMENT PRACTICES

Environmental management practices proposed to be employed to prevent or mitigate environmental effects that were determined to be adverse, as described in Section 5.0, are summarized in the following sections. Mitigation is defined under the *Canadian Environmental Assessment Act* as the elimination, reduction and control of the adverse effects of a project and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means. Mitigation measures must be technically and economically feasible, and implemented.

6.1 AIR QUALITY

Controlling construction vehicle speeds, limiting construction activities during high wind events, and re-establishing vegetation on disturbed areas will mitigate increased fugitive dust levels generated by vehicles accessing the staging area and boat launch. By controlling fugitive dust levels it is unlikely that Manitoba's air quality guidelines would be exceeded during construction activities.

Requiring a high standard of maintenance for construction equipment and vehicles, limiting unnecessary long-term idling, using low sulfur-containing fuels, using appropriate dispensing equipment and limiting fueling, will mitigate increased levels of greenhouse gases and vehicle emissions from equipment and increased VOC levels from fuels and other substances during construction activities.

6.2 SOILS

Preventing leaks, spills and releases will mitigate potential adverse effects on soil quality. This will be done by providing secondary containment for fuel storage, requiring drip trays for equipment, providing fuel handling training for operators, providing spill clean-up equipment and materials, complying with provincial fuel storage and dispensing regulations, storing hazardous materials in approved containers, providing an emergency spill-response plan and periodic inspection for leaks, spills and releases. If a spill should occur the contractor would be responsible to notify the Manitoba Sustainable Development Emergency Response Program

(204-944-4888) and the appropriate clean-up would be determined according to the size of spill and quantity of contamination.

6.3 GROUNDWATER

The measures outlined in Section 6.2 to mitigate potential adverse effects on soil quality will also mitigate adverse effects to groundwater quality from potential leaks, spills and releases.

6.4 SURFACE WATER

The mitigation measures outlined in Section 6.2 to mitigate potential adverse effects on soil quality will also mitigate adverse effects to surface water quality from potential leaks, spills and releases. Additionally, as noted, the Amphibex engine is located within a well that is designed to capture any engine contaminants and it will be returned to shore for refueling.

Use of a suction dredge is a specific design mitigation to minimize disturbance of the dredged area and introduction of suspended sediments into the Red River and Lake Winnipeg. If substantially increased levels of suspended sediments are observed outside of the containment area, additional sediment and erosion control measures, such as turbidity curtains, will be implemented. The mudflats will be vegetated following their construction which will provide stability to reduce potential erosion of the mudflats and have a long-term benefit for the marsh.

6.5 VEGETATION

Limiting the area cleared during construction, limiting construction activities to designated and previously disturbed areas as much as possible, and vegetating disturbed or reclaimed areas after construction will minimize loss and disturbance of vegetation and mitigate effects on vegetation.

6.6 WILDLIFE

Limiting the area cleared during construction, limiting construction activities to designated and previously disturbed areas as much as possible, maintaining sediment and erosion control

measures and vegetating disturbed or reclaimed areas after construction will mitigate effects on wildlife.

6.7 FISH AND AQUATIC HABITAT

The design of the mudflats and the containment areas was selected to avoid in-filling fish habitat to mitigate adverse effects on fish and fish habitat while providing an overall benefit to fish habitat by increasing emergent vegetation. The mitigation measures outlined in Section 6.2 and 6.4 to mitigate potential adverse effects on soil and surface water quality from potential leaks, spills and releases will also mitigate effects on fish associated with deleterious substances. Using a suction dredge rather than a conventional backhoe will mitigate increased suspension of sediments in the dredging area. The various containment options that will be tested will mitigate high levels of suspended sediments from migrating beyond the mudflat creation areas. If transport of material is observed beyond containment areas, additional measures such as turbidity curtains will be employed to prevent movement of highly turbid water from the project area into adjacent waterbodies, as required.

Any equipment that has previously been in contact with an aquatic ecosystem in Manitoba with known aquatic invasive species must be properly cleaned so as to prevent the spread of aquatic invasive species. Likewise any equipment used during construction of the Project that comes in contact with Lake Winnipeg must be properly cleaned, drained, dried and inspected before and after in-water work.

6.8 HUMAN HEALTH AND WELL-BEING

The mitigation measures outlined in Section 6.2, 6.3 and 6.4 to mitigate potential adverse effects on soil, surface water and groundwater quality from leaks, spills and releases will also mitigate adverse effects to human health and well-being concerns.

6.9 PUBLIC AND WORKER SAFETY

Informing boaters of construction activities by posting notices at nearby boat launches will mitigate public safety concerns. Additional measures that may be required by Transport Canada

as part of their approval includes erecting signage, buoys or lighting upstream and downstream of the work area and development of a navigation management plan.

Hazards to worker health and safety will be mitigated by using appropriate PPE and rescue equipment for workers, providing fuel handling training for operators, complying with provincial fuel storage and dispensing regulations, storing hazardous materials in approved containers, complying with *The Workplace Safety and Health Act* (Manitoba) and regulations, making sure work areas on the Amphibex are clean, dry and clear of debris, keeping all gear secure when not in use, keeping stairs, ladders, doorways, ramps, walkways, and gangways clear, securing ramps or gangways when loading and offloading, conducting safety briefings with workers and providing employee training. Additionally, work will not be conducted on water when high winds, storms or lightening are forecasted.

6.10 RESIDUAL ENVIRONMENTAL EFFECTS

The significance of residual environmental effects, the effects remaining after the implementation of mitigation measures, was evaluated following procedures outlined in the Canadian Environmental Assessment Agency, Operation Policy Statement "Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the *Canadian Environmental Assessment Act*, 2012" [(44)]. The degree of change from the existing conditions and the value of the environmental components being affected determine the significance of an adverse effect. Criteria for this determination include:

- Societal value of the affected environmental components – includes nature and degree of protection provided
- Ecological value – includes rarity and uniqueness, fragility, importance within ecosystem, importance to scientific studies
- Duration – length of time the project activity will last
- Frequency – rate of reoccurrence of the project activity causing the effect
- Geographic extent – area over which the effect will occur
- Magnitude – predicted disturbance compared to existing conditions
- Timing – when the predicted disturbance may occur (e.g. at critical life stages)
- Reversibility – time the environmental component will take to recover after the source of the effect ceases

Based on the available information on the Project and the environment, the assessment of environmental effects outlined in this environmental assessment report, and the application of proposed mitigation measures and the conduct of required follow-up, dredging of the Red River and construction of mudflats using the dredged slurry material will not likely result in any significant residual adverse environmental effects.

7.0 FOLLOW-UP ACTIVITIES

Follow-up is defined under the *Canadian Environmental Assessment Act* as a program to verify the accuracy of the environmental assessment of a project and determine the effectiveness of measures taken to mitigate the adverse environmental effects of the Project. Follow-up activities include monitoring, surveillance, inspection, and may include data collection, analysis, evaluation, and reporting.

The performance of dredging activities and the development of mudflats will be monitored during construction to determine the rate of sediment accumulation, effectiveness of the various types of containment options in terms of supporting mudflat construction and preventing escape of turbid, sediment-laden water from the project area and into adjacent waterbodies. Throughout construction there will be visual assessment of sediment plume extent and movement using unmanned aerial vehicles.

In relation to wildlife, proposed follow-up includes monitoring to ensure that construction activities remain restricted to designated and previously disturbed areas as much as possible, ensuring that tree clearing occurs outside of the critical nesting and rearing period in accordance with *Migratory Birds Convention Act*, reporting sightings of rare species, and ensuring that reclaimed sites are appropriately revegetated.

In relation to public and worker safety, proposed follow-up includes periodic updates of information postings to boaters; periodic observations of the condition of any signs and buoys if they were installed; recording any occurrence of workplace accidents; adherence to contract specifications, conditions, codes, regulations and guidelines; confirming compliance with provincial fuel storage and dispensing regulations and updating training and safety guidelines as required.

As part of the pilot project a follow-up monitoring program will be developed to evaluate the effectiveness of project benefits to the marsh from dredging and mudflat construction. The monitoring program will consider components such as water quality, vegetation, wildlife, birds, fish, island or mudflat sustainability and silt accumulation. In particular the aerial extent, biomass

(per unit area), and phosphorus sequestration (P per unit biomass) of plants will be monitored over the duration of the first (2019) and second (2020) year of the pilot project.

The monitoring program will be designed such that sampling locations, frequencies and parameters assessed will be comparable to previous baseline data to better quantify measurable changes. To more accurately assess the benefits of the Project it is anticipated that monitoring data will need to be collected beyond the currently scheduled one year post-construction (2020), but this will depend on additional funding.

8.0 STATEMENT OF LIMITATIONS

8.1 THIRD PARTY USE OF REPORT

This report has been prepared for the Red River Basin Commission to whom this report has been addressed and any use a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

8.2 ENVIRONMENTAL STATEMENT OF LIMITATIONS

KGS Group prepared the environmental conclusions and recommendations for this report in a professional manner using the degree of skill and care exercised for similar projects under similar conditions by reputable and competent environmental consultants. The information contained in this report is based on the information that was made available to KGS Group during the investigation and upon the services described, which were performed within the time and budgetary requirements of the Red River Basin Commission. As the report is based on the available information, some of its conclusions could be different if the information upon which it is based is determined to be false, inaccurate or contradicted by additional information. KGS Group makes no representation concerning the legal significance of its findings or the value of the property investigated.

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FIGURES

650000 660000 670000

5590000 5580000 5570000

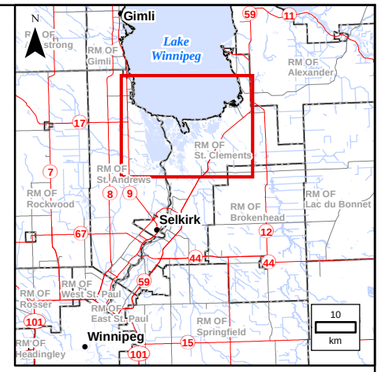
N W E S

Lake Winnipeg

Matlock
Sans Souci
Chalet Beach
Stoney Point
Beaconia Beach

Beaconia Lake
Salamonia Channel
West Channel
Main Channel
East Channel
Pruden Creek
Brokenhead River
Cochrane Lake
Hughes Lake
Netley Marsh Game Bird Refuge
Hardman Lake
Pruden Bay
Parisian Lake
Sullivan & Folster Lakes
Passawa Lake
McKay Lake
Ramsey Lake
Poplar Point Lake
The Forks
Oak Point Lake
Swedish Lake
Lower Devil Lake
Netley Lake
Netley Cut
Red River
Morrison & Starr Lakes
End of Main Boat Launch
Boyd Lake
Cooks Lake
Upper Devil Lake

17 9 12 59



LEGEND:

Game Bird Refuge

NOTES:
1. Image: Orthorefresh (2011–2014), from MLI (Manitoba Land Information).
2. All units are metric and in metres unless otherwise specified. Transverse Mercator Projection, NAD 1983, Zone 14. Elevations are in metres above sea level (MSL).

1 0 1 2 3 4
Kilometers

SCALE: 1:100,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	ISSUED BY	CHECK BY
0	19/03/19	ISSUED FOR INFORMATION	GS	SFM

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

RED RIVER BASIN COMMISSION

NETLEY–LIBAU MARSH PILOT PROJECT
ENVIRONMENTAL LICENCE APPLICATION AND PROJECT SUPPORT

SITE LOCATION

MARCH 2019 | FIGURE 01 | REV: 0

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

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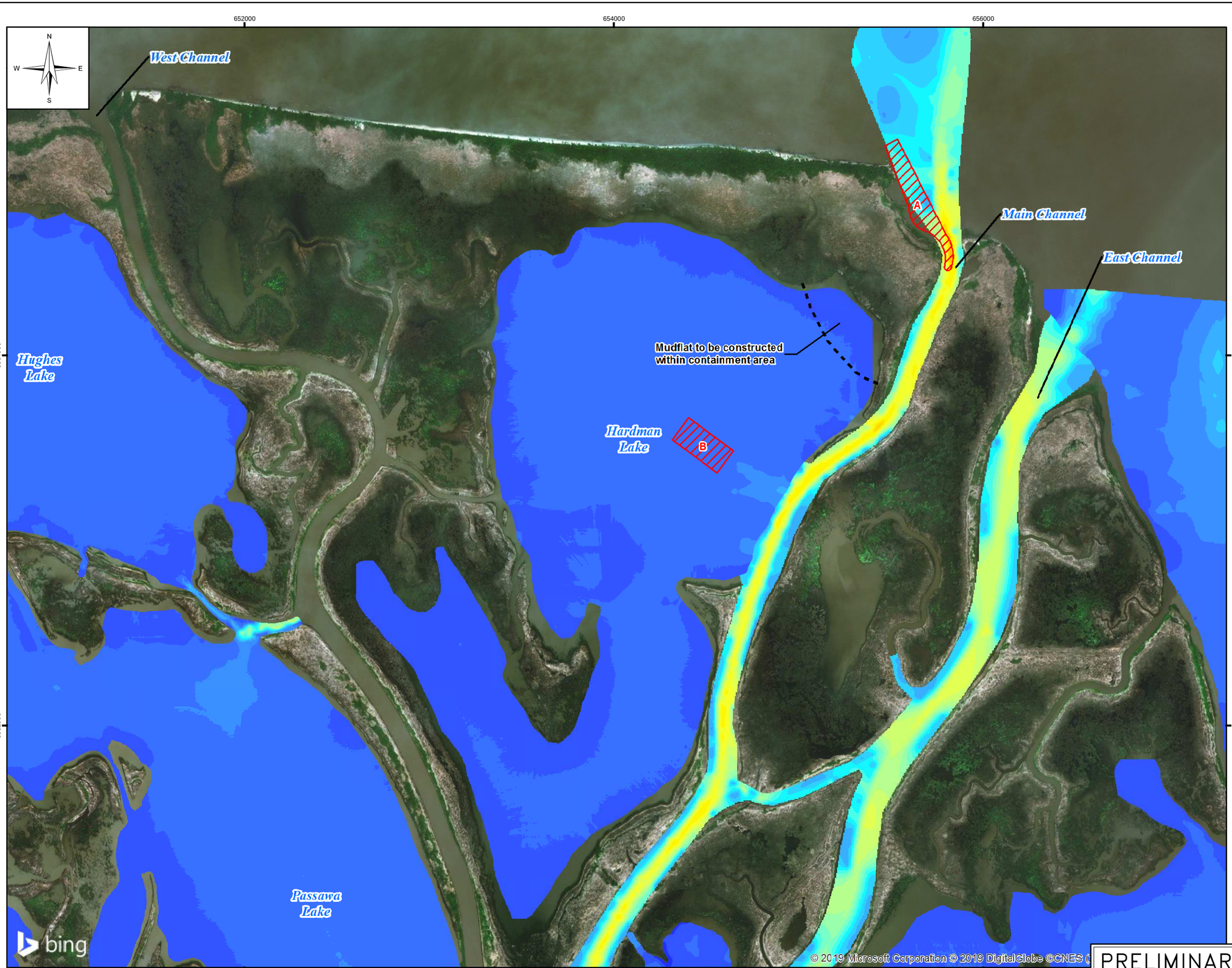
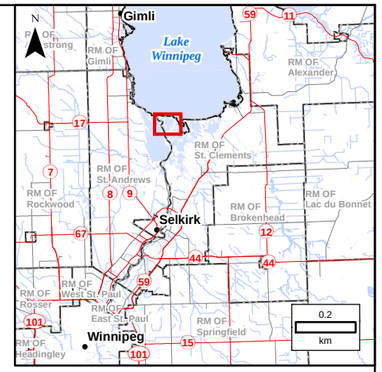
11"x17" PLOT SCALE 1:1





LEGEND:

Bed Elevation (m)

- < 207.5
- 207.5 – 208.0
- 208.0 – 208.5
- 208.5 – 209.0
- 209.0 – 209.5
- 209.5 – 210.0
- 210.0 – 210.5
- 210.5 – 211.0
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- 216.5 – 217.0
- 217.0 – 217.5
- 217.5 – 218.0
- > 218.0

Dredging Sites

Mudflat Containment

NOTES:

1. DEM data provided by Aquatics Environmental Services Inc. St. Andrews, Manitoba.
2. Image Source: Bing.
3. All units are metric and in metres unless otherwise specified. Transverse Mercator Projection, NAD 1983, Zone 14. Elevations are in metres above sea level (MSL).

0.2 0 0.2 0.4 0.6 0.8

Kilometers

SCALE: 1:20,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	ISSUED BY	CHECK BY
0	19/03/19	ISSUED FOR INFORMATION	GS	SFM

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

RED RIVER BASIN COMMISSION

NETLEY–LIBAU MARSH PILOT PROJECT
ENVIRONMENTAL LICENCE APPLICATION AND PROJECT SUPPORT

HARDMAN LAKE WORK AREA

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

MARCH 2019 | FIGURE 02 | REV: 0

FileName: P:\Projects\2018\18-3471-001\Dwg\GIS\MXD\18-3471-001_Fig03
11"x17" PLOT SCALE 1:1

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N W E S

Netley Lake

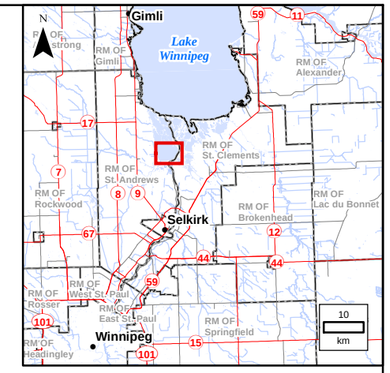
Mudflat to be constructed within containment area

Netley Cut

Red River

Boyd Lake

bing



LEGEND:

Bed Elevation (m)

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- 215.0 – 215.5
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- 216.0 – 216.5
- 216.5 – 217.0
- 217.0 – 217.5
- 217.5 – 218.0
- > 218.0

Dredging Sites

Mudflat Containment

NOTES:

1. DEM data provided by Aquatics Environmental Services Inc. St. Andrews, Manitoba.
2. Image Source: Bing.
3. All units are metric and in metres unless otherwise specified. Transverse Mercator Projection, NAD 1983, Zone 14. Elevations are in metres above sea level (MSL).

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Kilometers

SCALE: 1:20,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	ISSUED BY	CHECK BY
0	19/03/19	ISSUED FOR INFORMATION	GS	SFM

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

RED RIVER BASIN COMMISSION

NETLEY–LIBAU MARSH PILOT PROJECT
ENVIRONMENTAL LICENCE APPLICATION AND PROJECT SUPPORT

NETLEY LAKE WORK AREA

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

MARCH 2019 | FIGURE 03 | REV: 0

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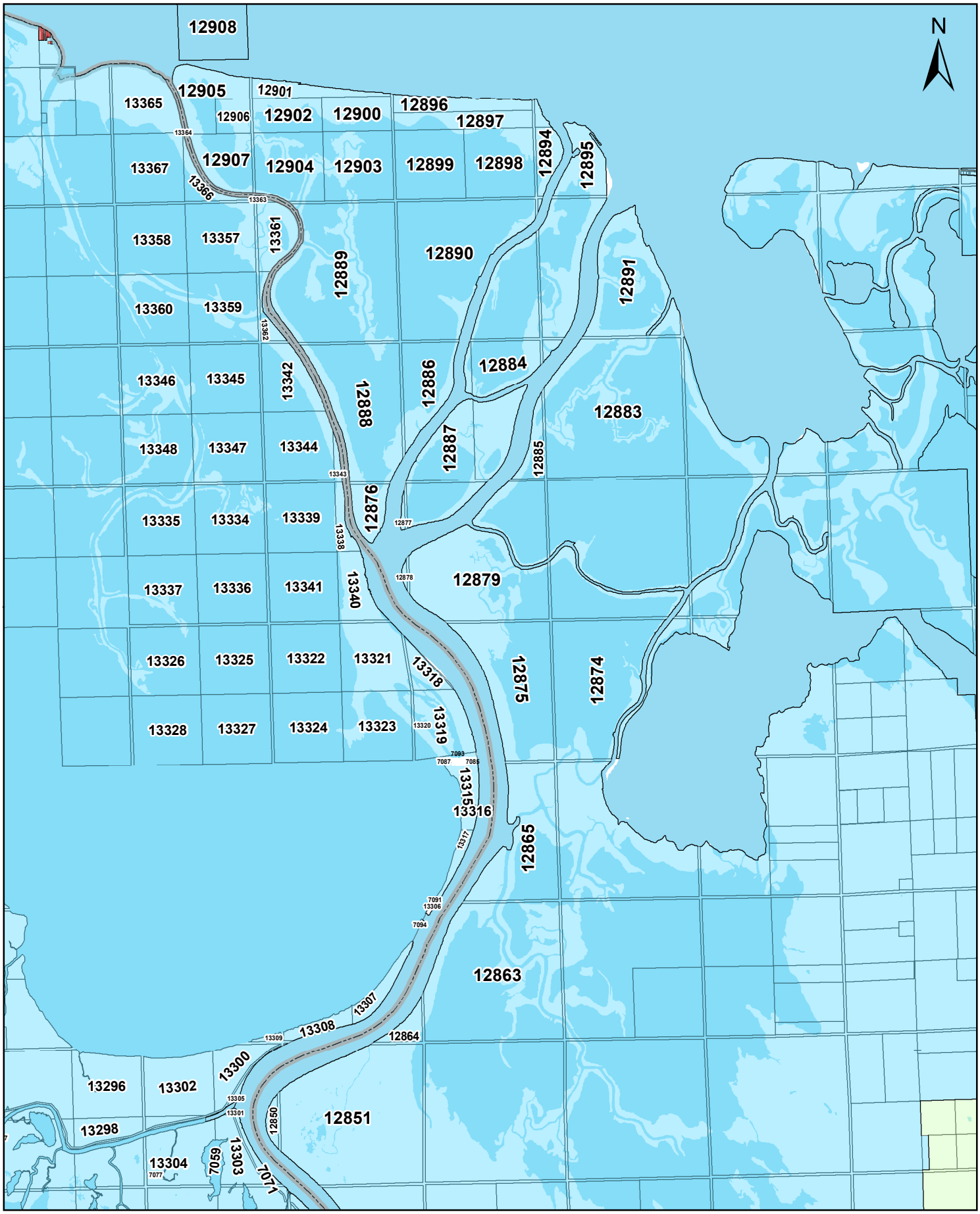
APPENDIX A

ZONING MAP AND NETLEY CREEK PROPERTY LIST

Letter 8.5 x 11



Netley Creek Map

Note: Not to Scale
Date: January 2019

St. Andrews Zoning
- HL
- SR

St. Clements Zoning
- A80
- HL

Municipal Boundary

RED RIVER PLANNING DISTRICT

St. Andrews							
OBJECTID *	**Roll ***	**Survey**	**Civic**	**Street**	**Full_Address**	**PrimaryOwner**	**SecondaryOwner**
13335	579800	NW8-16-5E	<Null>	<Null>	<Null>	HER MAJESTY THE QUEEN	<Null>
13321	578400	*NE4-16-5E	<Null>	<Null>	<Null>	HER MAJESTY THE QUEEN	<Null>
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13304	574700	*SW20-15-5E	<Null>	<Null>	<Null>	HER MAJESTY THE QUEEN	<Null>
13344	580800	*SW16-16-5E	<Null>	<Null>	<Null>	HER MAJESTY THE QUEEN	<Null>
13318	577800	*NW3-16-5E	<Null>	<Null>	<Null>	R. M. OF ST. ANDREWS	<Null>
13361	582600	*NW21-16-5E	<Null>	<Null>	<Null>	HER MAJESTY THE QUEEN	<Null>
7057	0	<Null>	<Null>	1	<Null>	<Null>	<Null>
7093	0	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
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13301	574450	*SE20-15-5E	3500	BREEZY POINT RD	3500 BREEZY POINT RD	HER MAJESTY THE QUEEN	<Null>
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13364	582900	*NE29-16-5E	<Null>	<Null>	<Null>	HER MAJESTY THE QUEEN	<Null>
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13357	582100	NE20-16-5E	<Null>	<Null>	<Null>	HER MAJESTY THE QUEEN	<Null>
St. Clements							
OBJECTID *	**Roll ***	**Survey**	**Civic**	**Street**	**Full_Address**	**PrimaryOwner**	**SecondaryOwner**
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12890	508100	NE22-16-5E	<Null>	<Null>	<Null>	HER MAJESTY THE QUEEN - MANITOBA	<Null>
12904	509400	SW28-16-5E	<Null>	<Null>	<Null>	HER MAJESTY THE QUEEN - MANITOBA	<Null>
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12899	508900	SW27-16-5E	<Null>	<Null>	<Null>	HER MAJESTY THE QUEEN - MANITOBA	<Null>
12880	507000	NE11-16-5E	<Null>	<Null>	<Null>	HER MAJESTY THE QUEEN - MANITOBA	<Null>
12897	508700	*NE27-16-5E	<Null>	<Null>	<Null>	HER MAJESTY THE QUEEN - MANITOBA	<Null>
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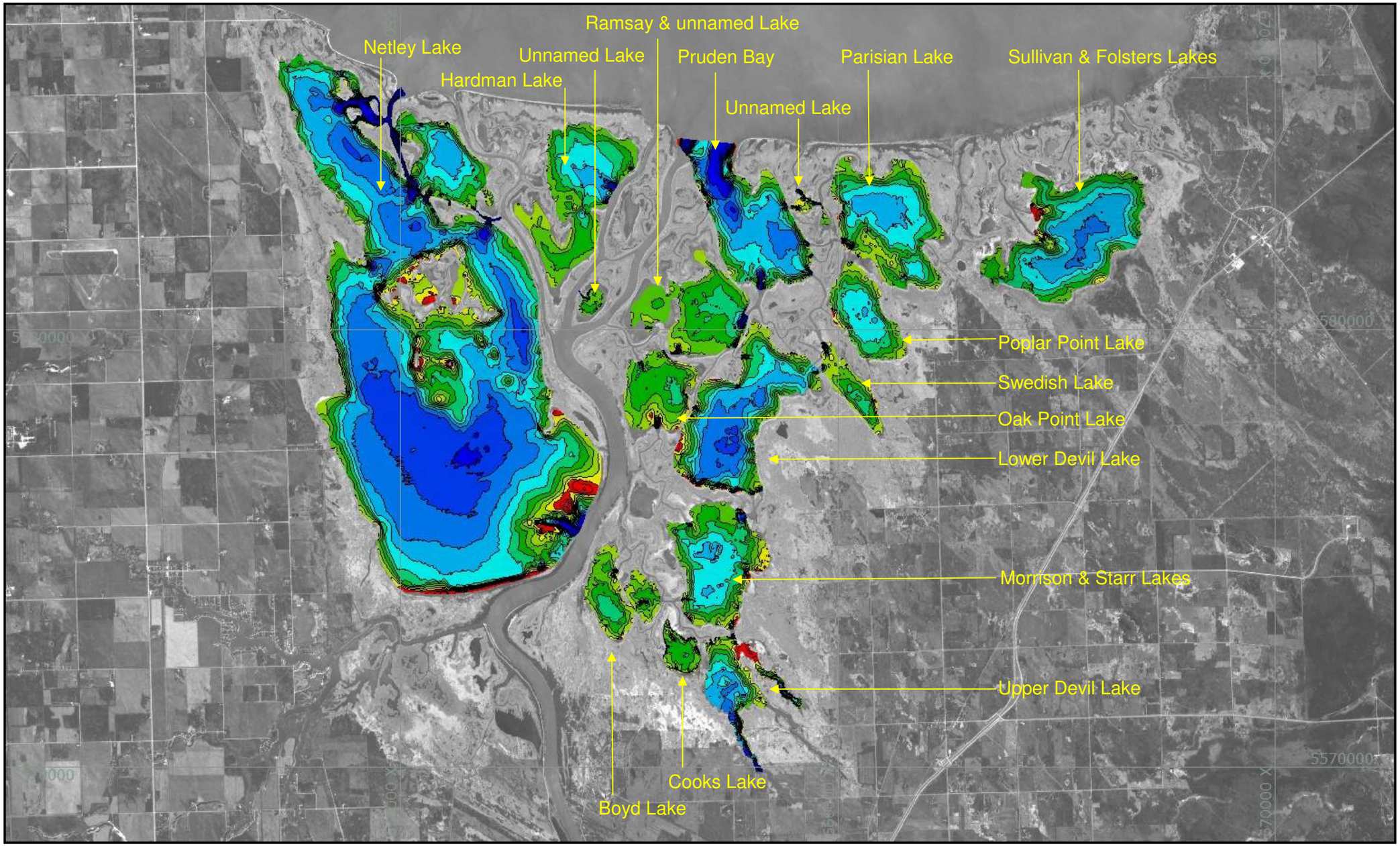
APPENDIX B

BATHYMETRY OF LAKES IN THE NETLEY-LIBAU MARSH

Index of Lakes



645000E 650000E 655000E 660000E 665000E 670000E

5585000N

5580000N

5575000N

5570000N

N

Meters 0 1000 2000 4000 6000 Meters

Aquatics Environmental Services Inc. St. Andrews, Manitoba

ALL LAKES - OVERALL

NETLEY - LIBAU MARSH, Red River at Lake Winnipeg

Manitoba, Canada

All elevations are shown in meters above Mean Sea Level

Ellipsoid: WGS 84 Grid: UTM North Zone 14

Background Satellite Image obtained from GeoSpace.ca

Date of Background Image: May 12, 2007. Panchromatic 10m resolution

Survey:	Survey Method:	Horizontal & Verticle Positioning:	Water Level:
Sept. 2010	Single Beam Sonar	RTK, Temporary Base Stations	RTK

SCALE 1 : 70 000	April 2011	Sheet 1 of 1

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652000E 654000E 656000E 658000E

5584000N

5582000N

N

Meters 0 500 1000 2000 3000 Meters

>= 217.30
217.20 - 217.29
217.10 - 217.19
217.00 - 217.09
216.90 - 216.99
216.80 - 216.89
216.70 - 216.79
216.60 - 216.69
216.50 - 216.59
216.40 - 216.49
< 216.40

Aquatics Environmental Services Inc. St. Andrews, Manitoba

HARDMANS LAKE
NETLEY - LIBAU MARSH, Red River at Lake Winnipeg
Manitoba, Canada

All elevations are shown in meters above Mean Sea Level

Ellipsoid: WGS 84 Grid: UTM North Zone 14

Background Satellite Image obtained from GeoSpace.ca

Date of Background Image: May 12, 2007. Panchromatic 10m resolution

Survey:	Survey Method:	Horizontal & Verticle Positioning:	Water Level:
Oct. 2010	Single Beam Sonar	RTK, Temporary Base Stations	RTK

SCALE 1 : 20 000	April 2011	Sheet 1 of 1

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645000E 650000E 655000E 660000E

5585000N

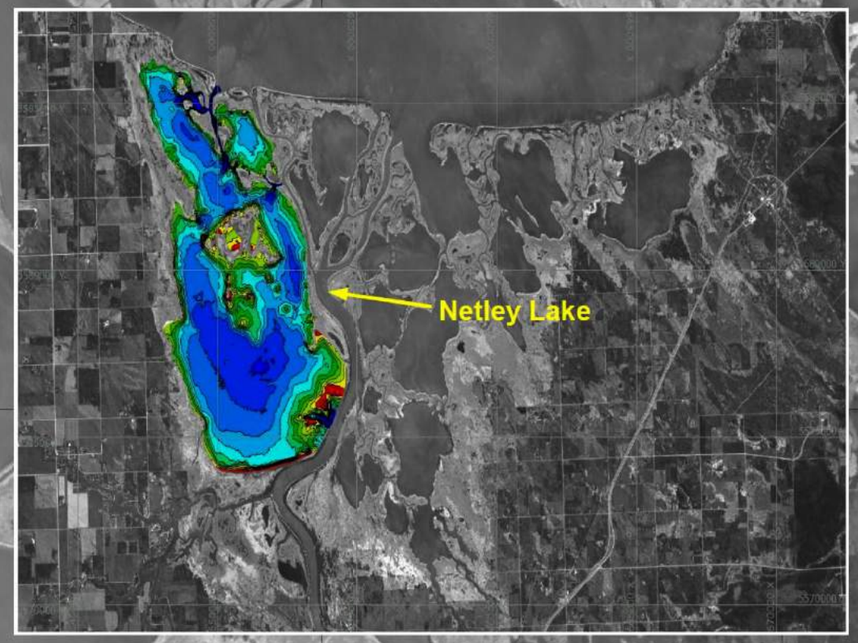
5580000N

5575000N

Meters 0 1000 2000 4000 6000 Meters

N

>= 217.30
217.20 - 217.29
217.10 - 217.19
217.00 - 217.09
216.90 - 216.99
216.80 - 216.89
216.70 - 216.79
216.60 - 216.69
216.50 - 216.59
216.40 - 216.49
< 216.40



Aquatics Environmental Services Inc. St. Andrews, Manitoba

NETLEY LAKE
NETLEY - LIBAU MARSH, Red River at Lake Winnipeg
Manitoba, Canada

All elevations are shown in meters above Mean Sea Level

Ellipsoid: WGS 84 Grid: UTM North Zone 14

Background Satellite Image obtained from GeoSpace.ca

Date of Background Image: May 12, 2007. Panchromatic 10m resolution

Survey:	Survey Method:	Horizontal & Verticle Positioning:	Water Level:
Nov. 2010	Single Beam Sonar	RTK, Temporary Base Stations	RTK

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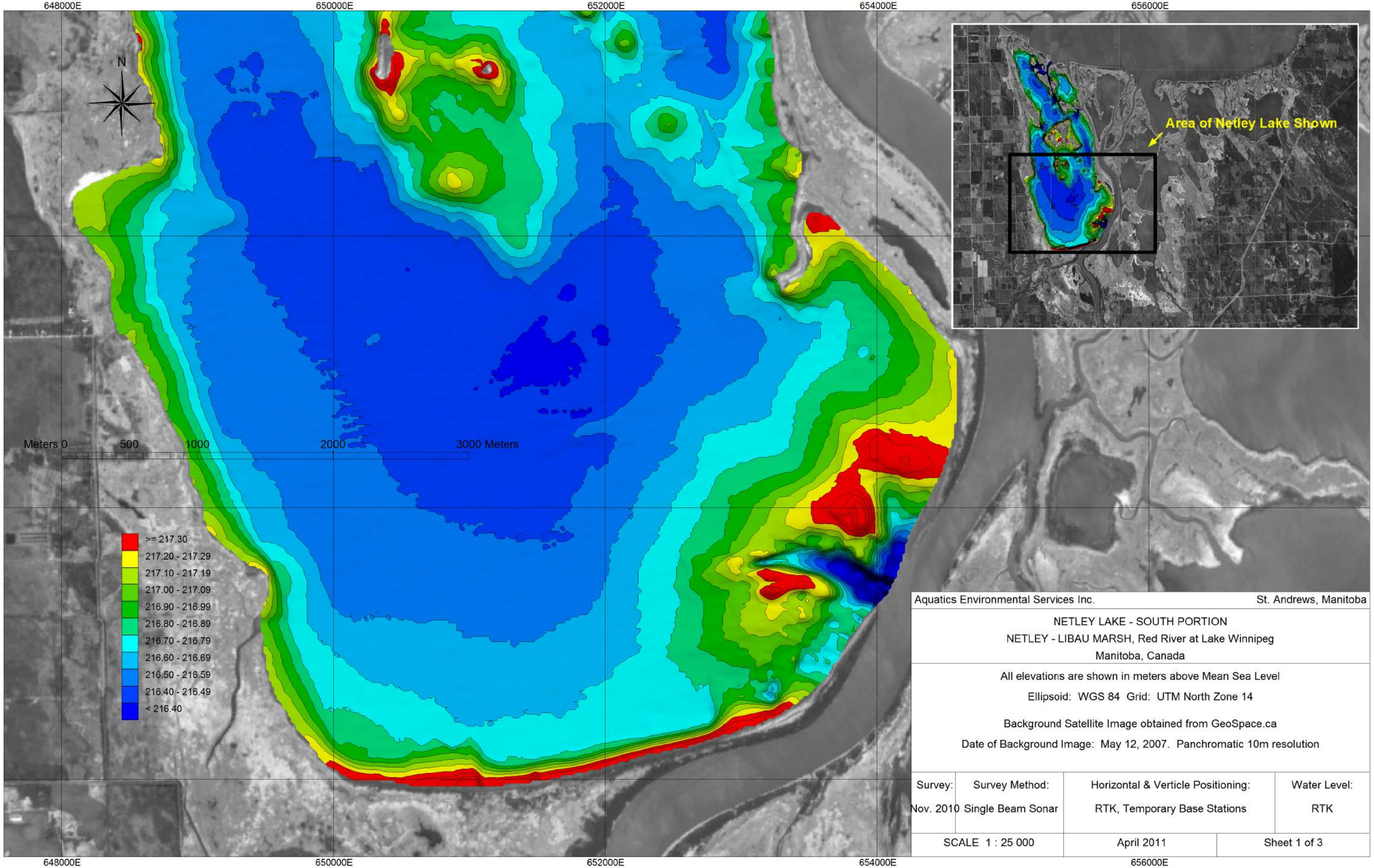

Aquatics Environmental Services Inc. St. Andrews, Manitoba

NETLEY LAKE - SOUTH PORTION

NETLEY - LIBAU MARSH, Red River at Lake Winnipeg

Manitoba, Canada

All elevations are shown in meters above Mean Sea Level

Ellipsoid: WGS 84 Grid: UTM North Zone 14

Background Satellite Image obtained from GeoSpace.ca

Date of Background Image: May 12, 2007. Panchromatic 10m resolution

Survey:	Survey Method:	Horizontal & Verticle Positioning:	Water Level:
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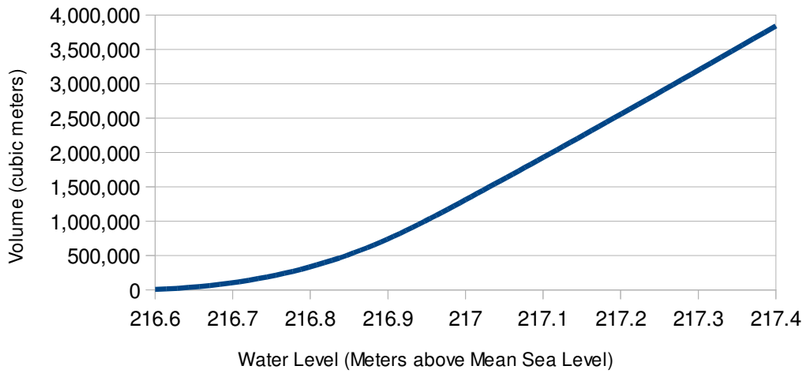
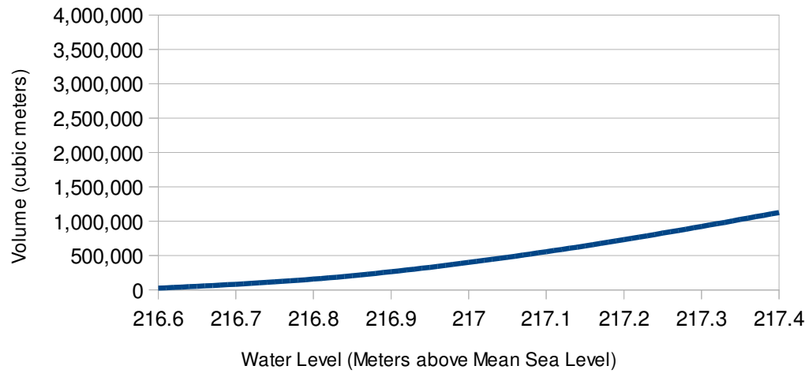
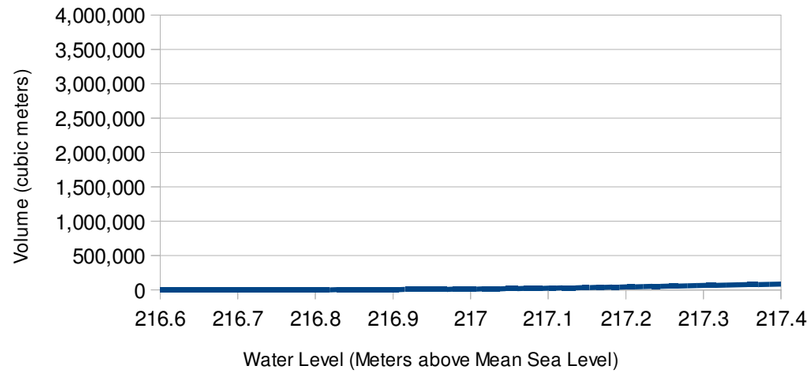
Sullivan & Folsters Lakes



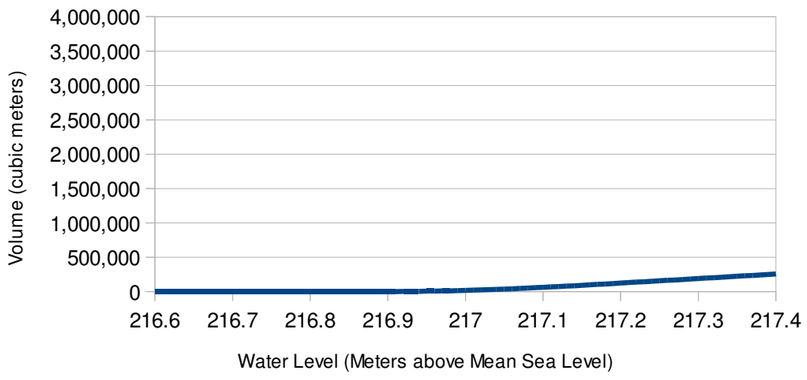
Upper Devil Lake



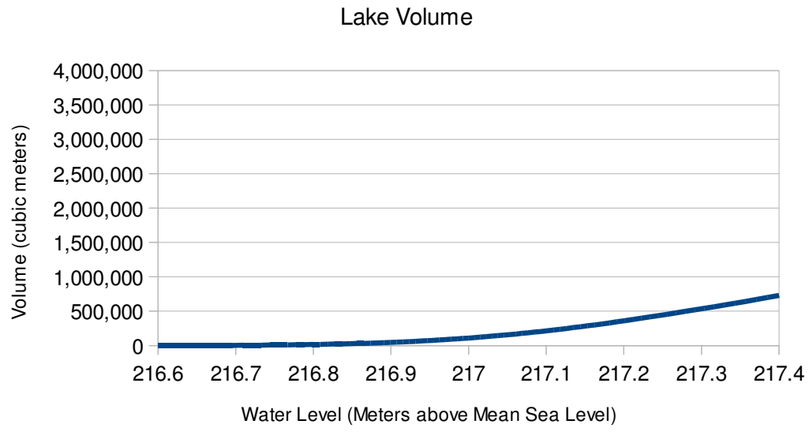
Unnamed Lake between Middle and East Channels



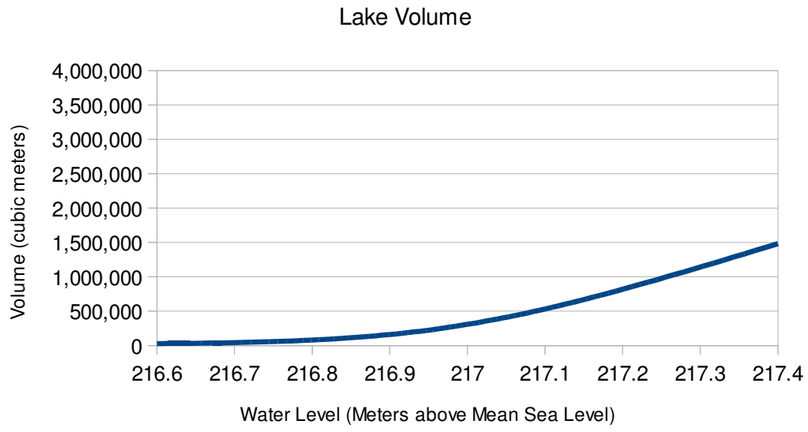
Cooks Lake



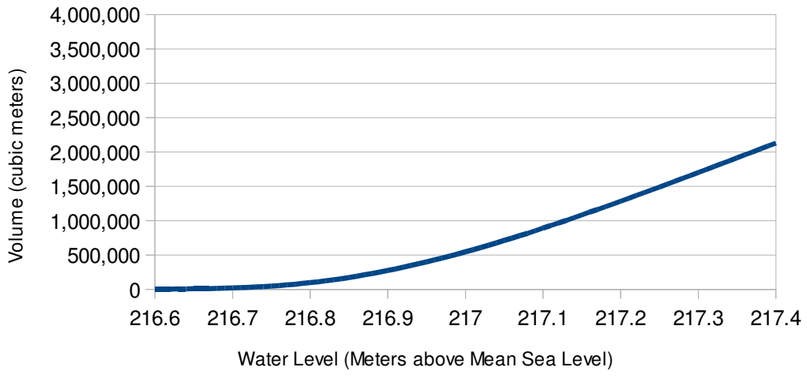
Boyd Lake



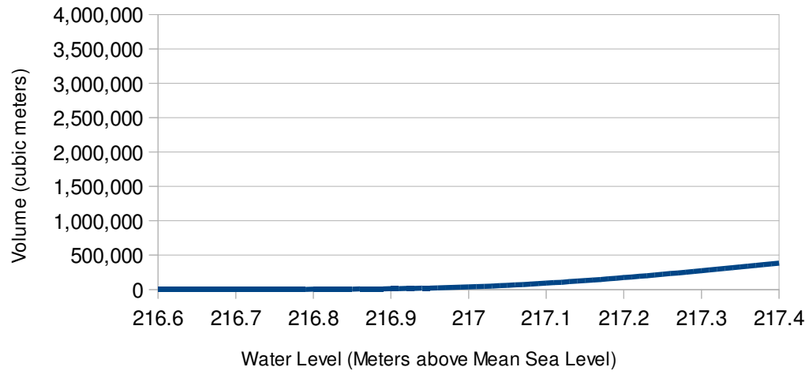
Ramsey & Unnamed Lakes



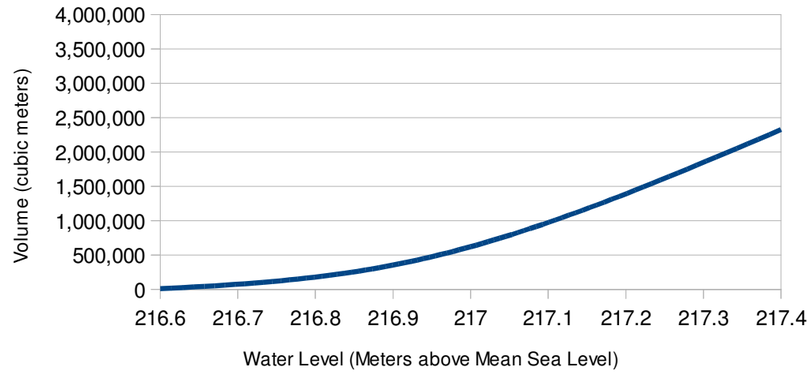
Morrison & Starr Lakes



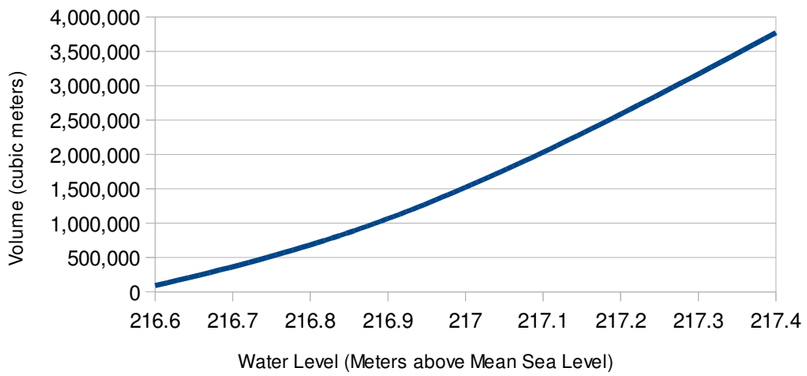
Sweedish Lake



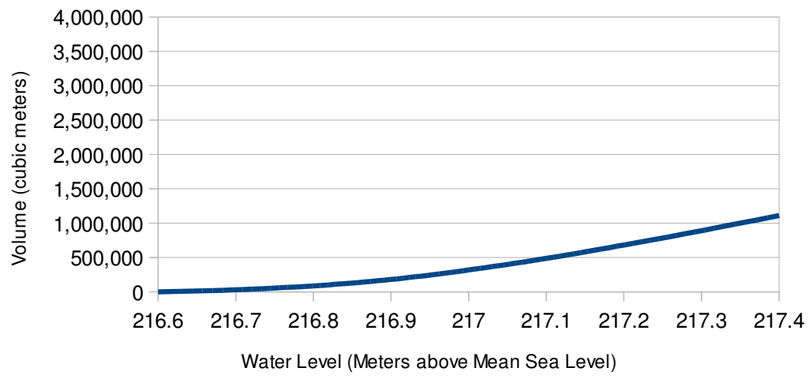
Hardman Lake



Lower Devil Lake

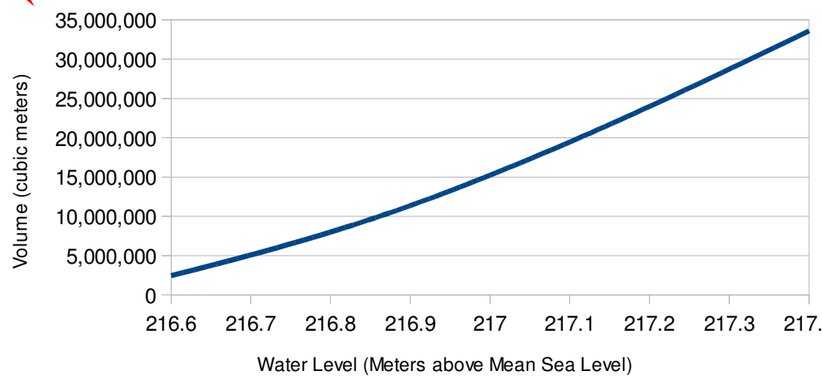


Poplar Point Lake

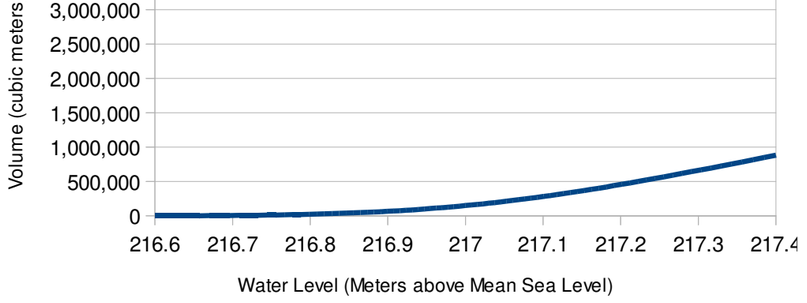


Note: Scale change Netley Only

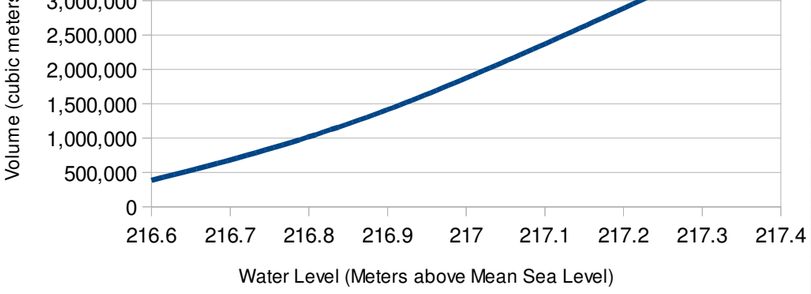
Netley Lake



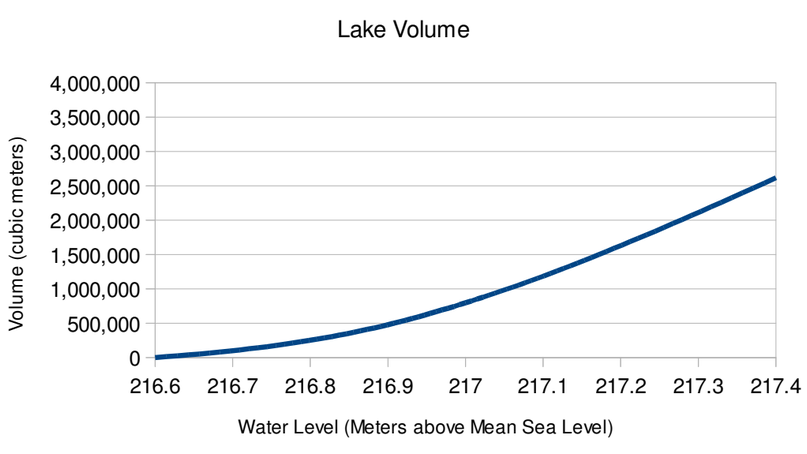
Oak Point Lake



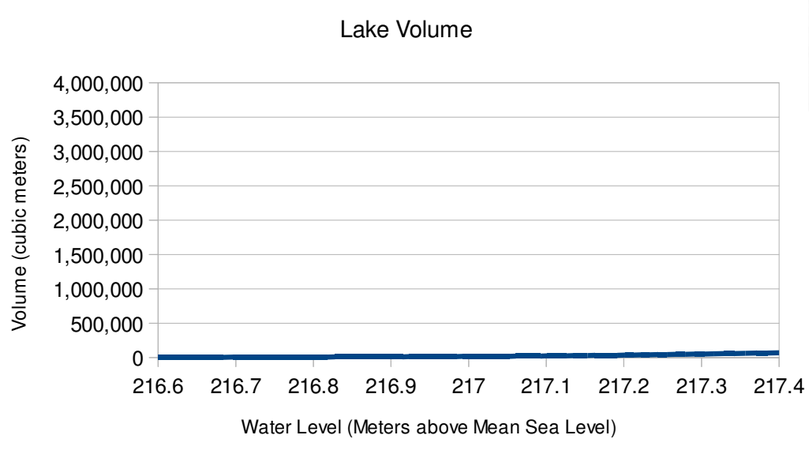
Pruden Bay



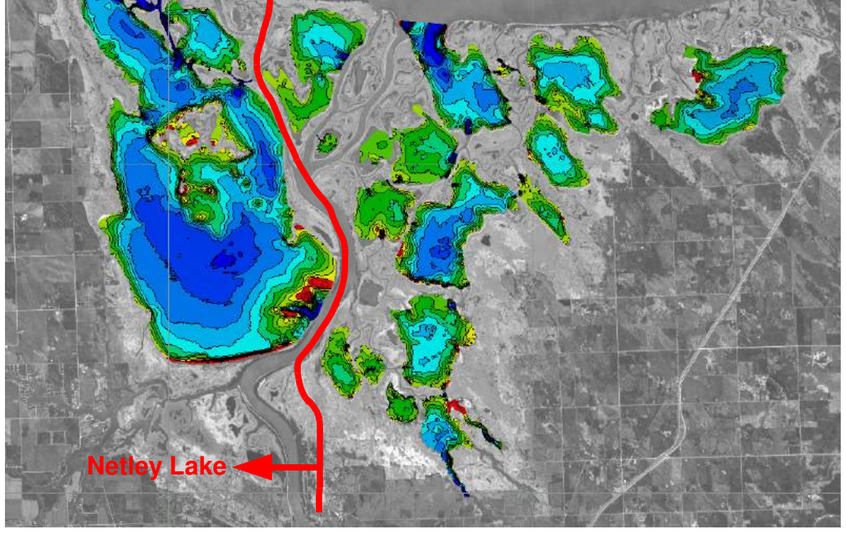
Parisian Lake



Unnamed Lake East of Pruden Bay



Summary



All Results Shown for a Water Elevation of 217.4 m

Total Volume – All Lakes:	**58,360,826 m^3**
All Lakes with exception of Netley Lake:	**24,768,477 m^3**
Netley Lake Only:	**33,592,349 m^3**
Netley Lake Volume as a percentage of Total:	**57.6 %**
All Lakes except Netley as a percentage of Total:	**42.4 %**

APPENDIX C

PHOTOGRAPHS AND SCHEMATIC DRAWINGS OF CONTAINMENT OPTIONS

STRAW BALE CONTAINMENT

Installation of straw bales using posts in a shallow marsh environment.

Vegetation establishing on a mudflat contained by straw bales.

AQUADAM CONTAINMENT

Use of an AquaDam to contain a section of marsh

The following schematics are from the "AquaDam User's Guide – 2004" available at:
http://www.aquadam.net/content/uploads/2019/02/Users_Guide2004.pdf

Figure 1: A TYPICAL FILLED AQUADAM®

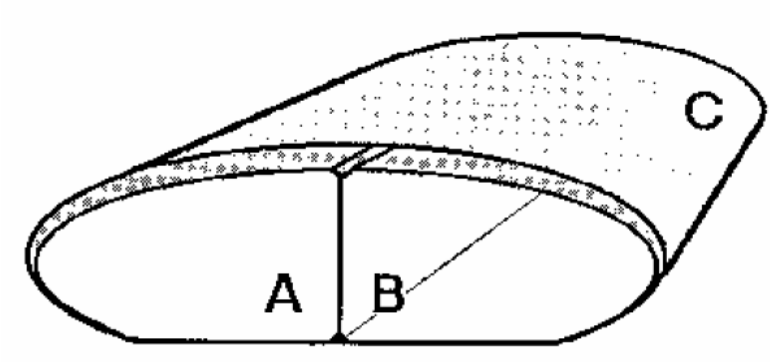


Figure 1. A cross section of a typical AquaDam®, illustrating the relationship between the two inner tubes which contain the water and the "master" tube that keeps the inner tubes parallel and in contact with each other.

A and **B** illustrates the two inner tubes inflated with water.
C is the outer or "master" tube made of very tough polypropylene woven geotextile fabric which confines the water filled inner tubes, making the AquaDam® a solid wall of water. These two confined columns of water provide the mass, weight, and pressure that gives the AquaDam® its stability.

Figure 4:

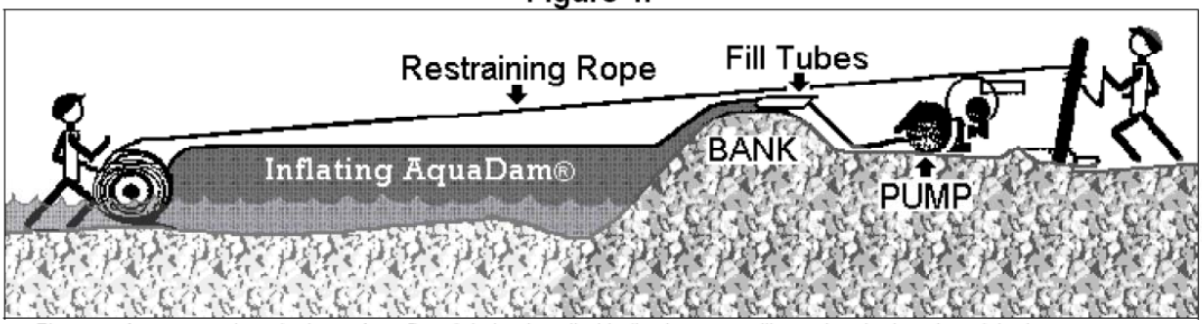


Figure 4. A cross section of a large AquaDam® being installed in flowing water, illustrating the location of the berm, pumps, ropes, laborers and the inside water head pressure, compared to the outside water levels.

Figure 7: CONNECTING AQUADAMS® USING COUPLING COLLARS

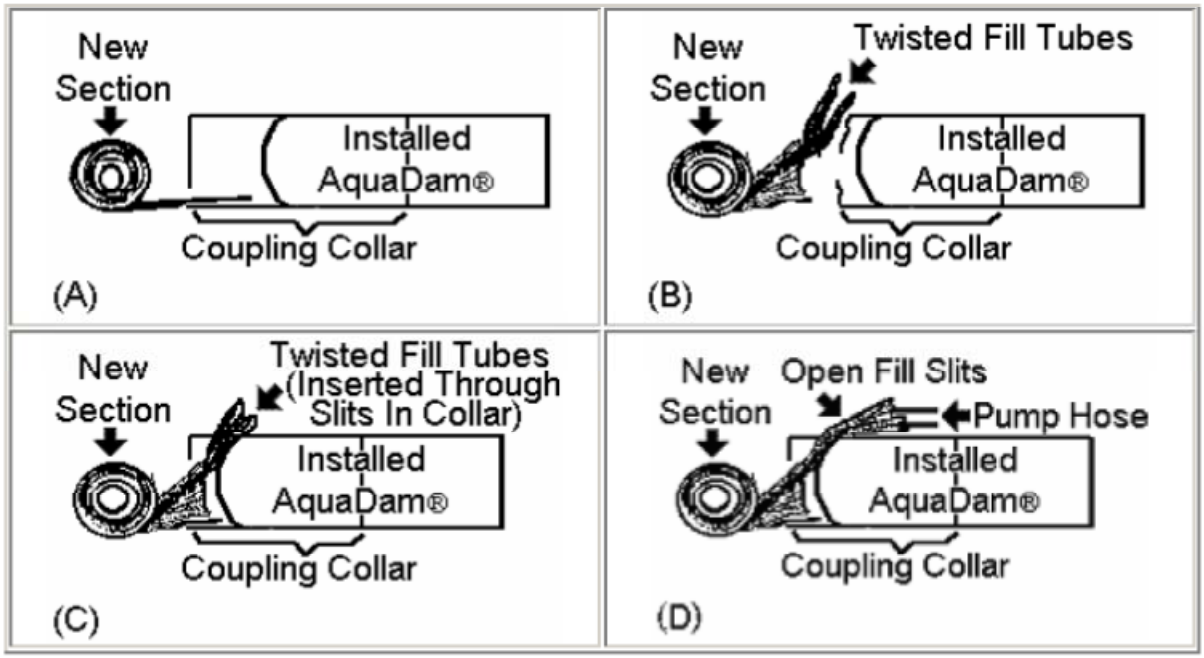
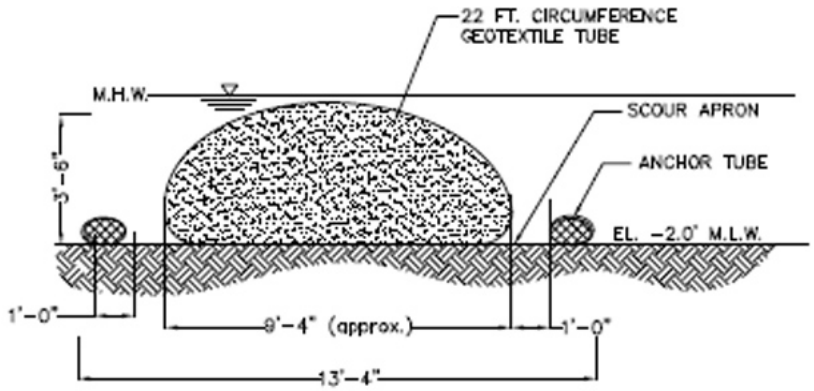


Figure 7, illustrations a, b, c, and d show the different steps taken in the process of joining two AquaDams® together using a collar.

GEOTUBE CONTAINMENT

Use of a geotube to contain a section of marsh

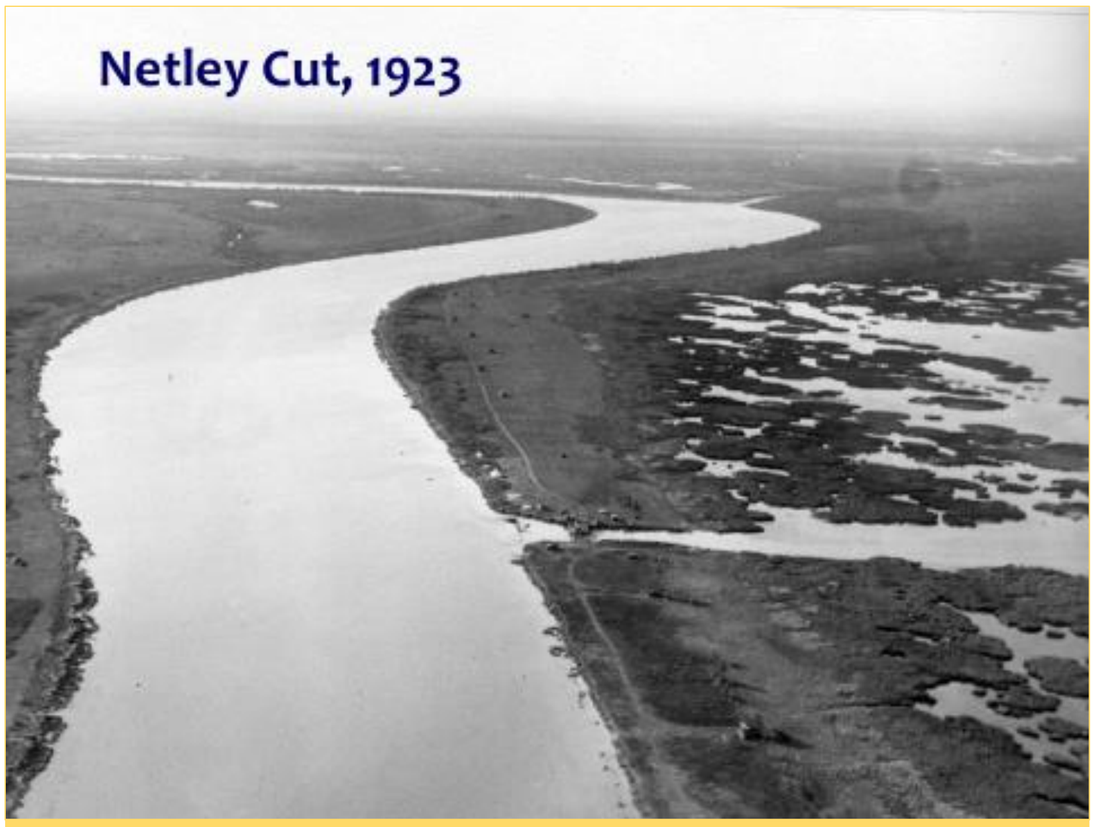
Schematic of how a geotube functions and a typical cross section



SECTION OF GEOTEXTILE SILL – OPTION A
SCALE: 1/2" = 1'

APPENDIX D

PUBLIC CONSULTATION MATERIALS

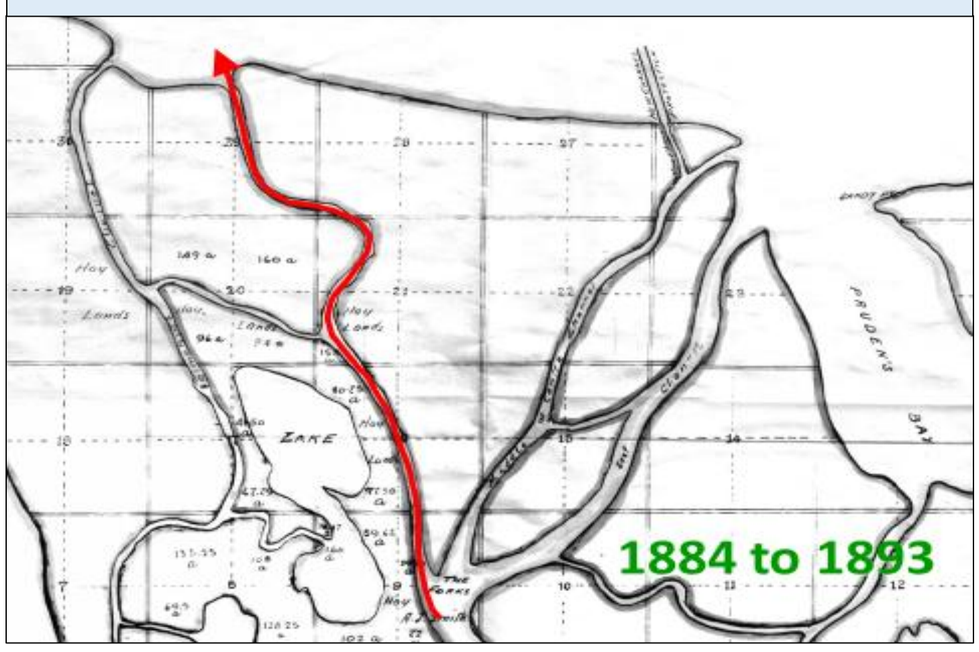


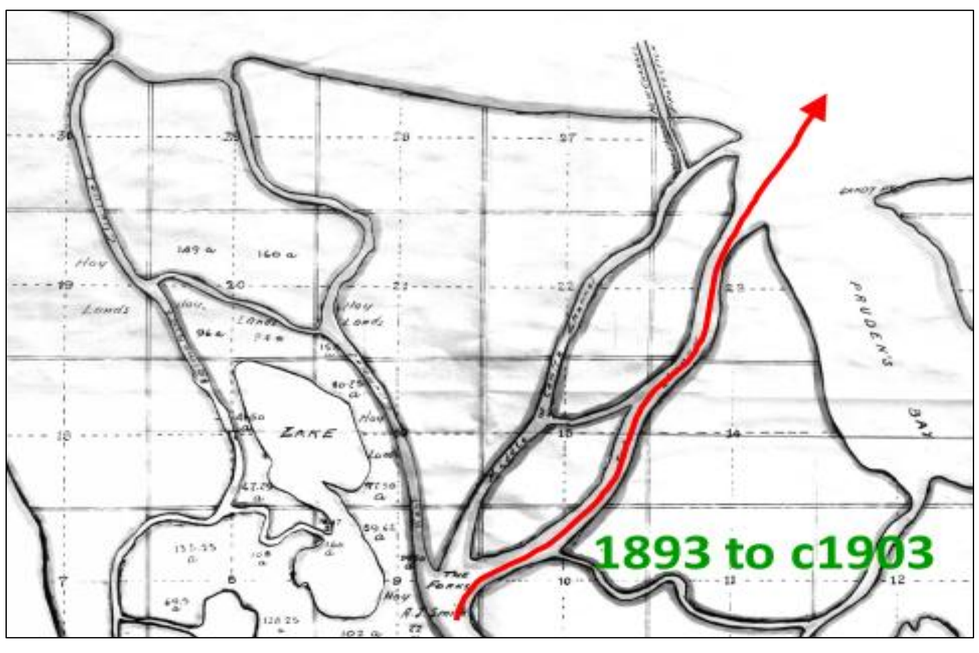
The Netley Cut was created in the early 1900's to help drain the marsh so that nearby farmers could harvest the hay from the marsh

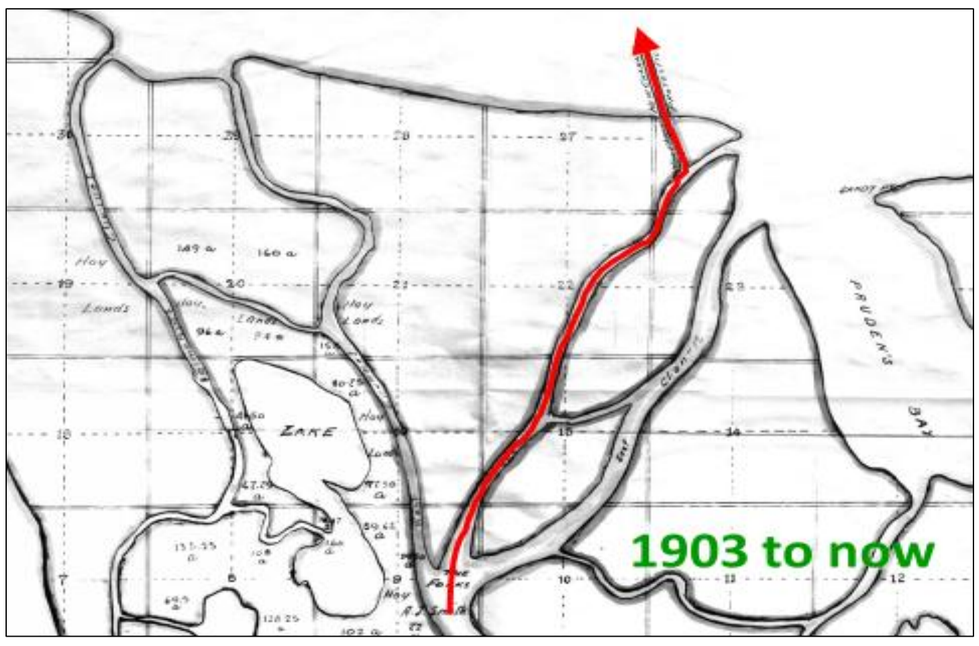
Since its creation, the Netley Cut has grown in width from several meters to more than 400 meters wide!

History of the Red River, Dredging, and the Netley Cut

The evolution of the "Main Channels" from the Red River to Lake Winnipeg over time







Dredging occurred on the Red River from 1883 to 1999. This was done to ensure access to Lake Winnipeg for recreational, commercial, local access, and for land drainage.

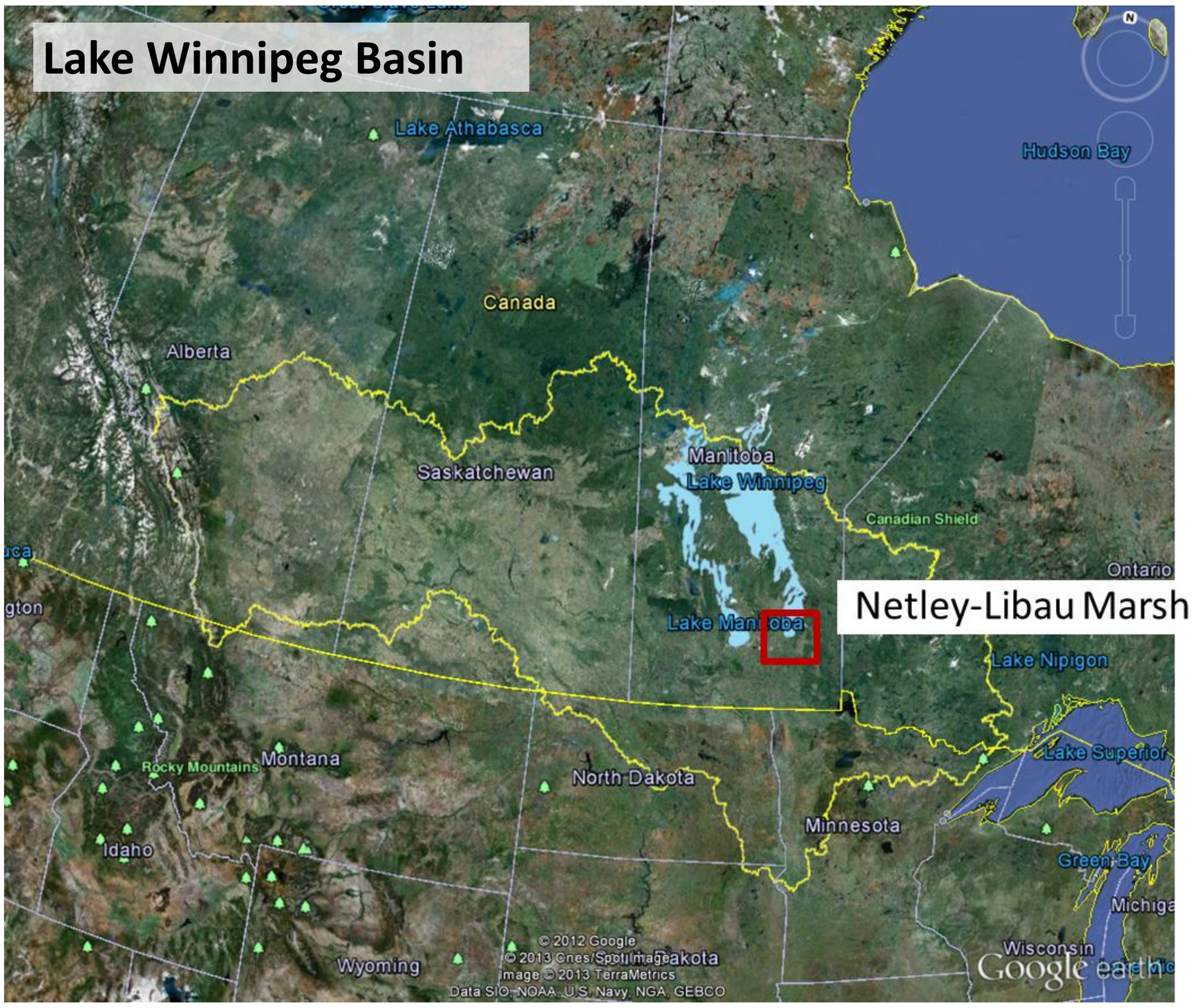
- When dredging ended, siltation at the river mouth has caused a backup of water, causing it to spill into the west area of the Netley-Libau Marsh through the Netley Cut.
- Now, the Netley Cut handles 1/3 to 1/2 of the total river flow!

RED RIVER BASIN COMMISSION North Chapter

Manitoba Hydro

Netley-Libau Marsh

Today's Tour Route



RED RIVER BASIN COMMISSION North Chapter

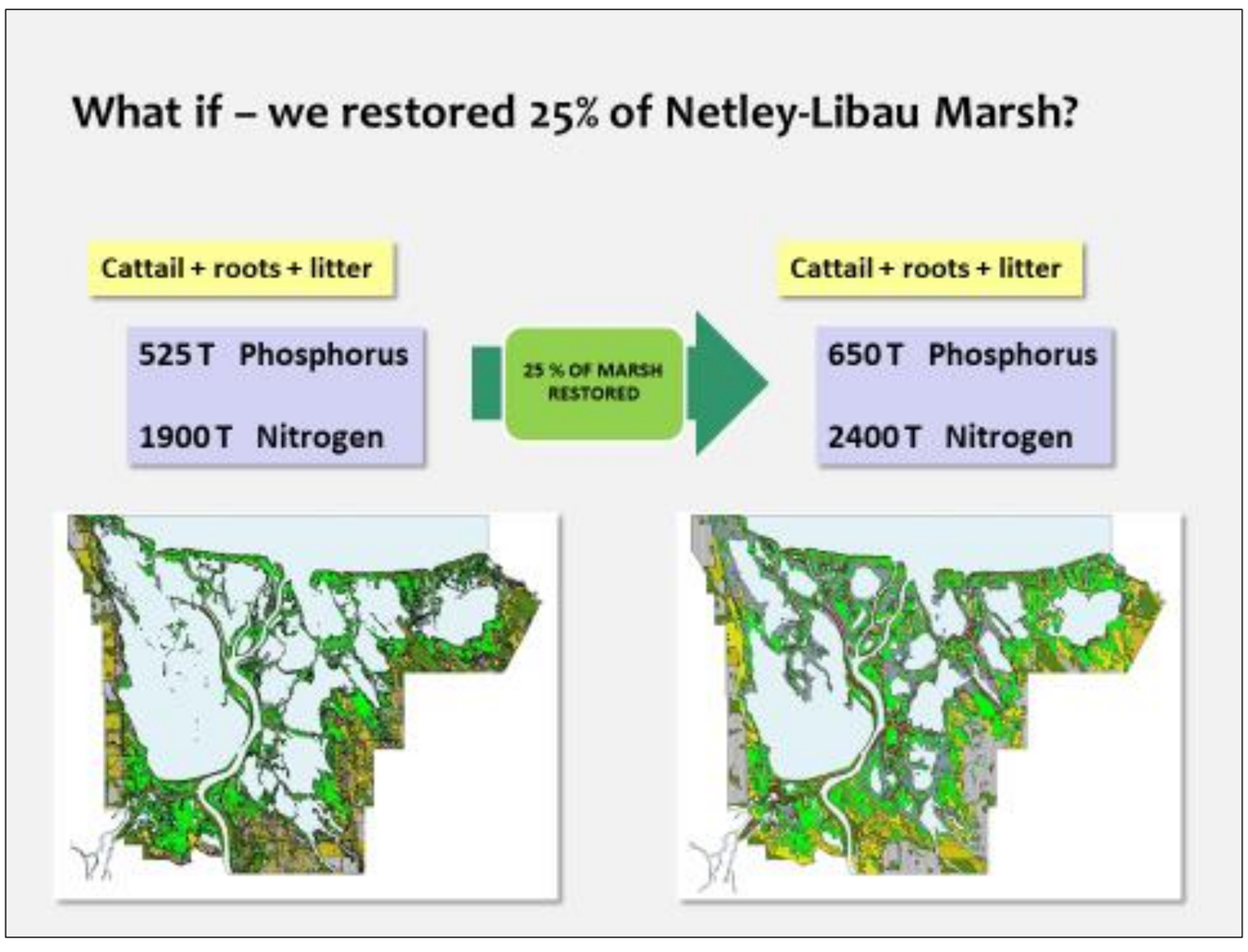
Manitoba Hydro

What is the Solution?

Proposed pilot project to investigate restoring Netley-Libau Marsh: Use Amphibex dredgers to dredge portions of the Red River near Hardman Lake and use removed siltation to create sediment "islands" to provide a substrate for cattail growth.

Hardman Lake: proposed location for marsh renewal pilot project

Cattails can filter excess nutrients and harmful toxins from the water. Marshes are referred to as "Nature's kidneys" due to their ability to improve the quality of surrounding waters.



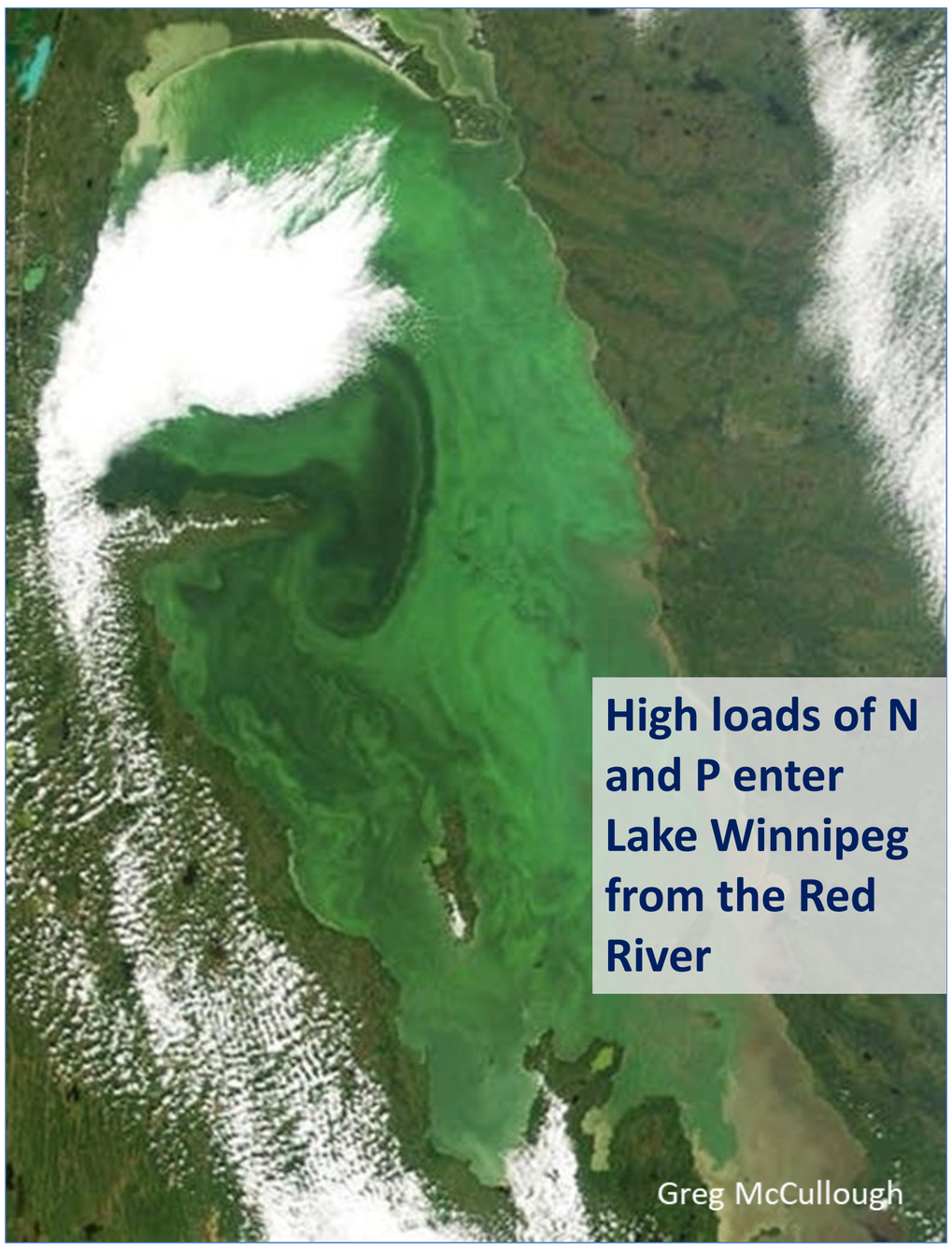
NOW is the time for Action!

RED RIVER BASIN COMMISSION North Chapter

Manitoba Hydro

Issues Facing Lake Winnipeg & Netley-Libau Marsh

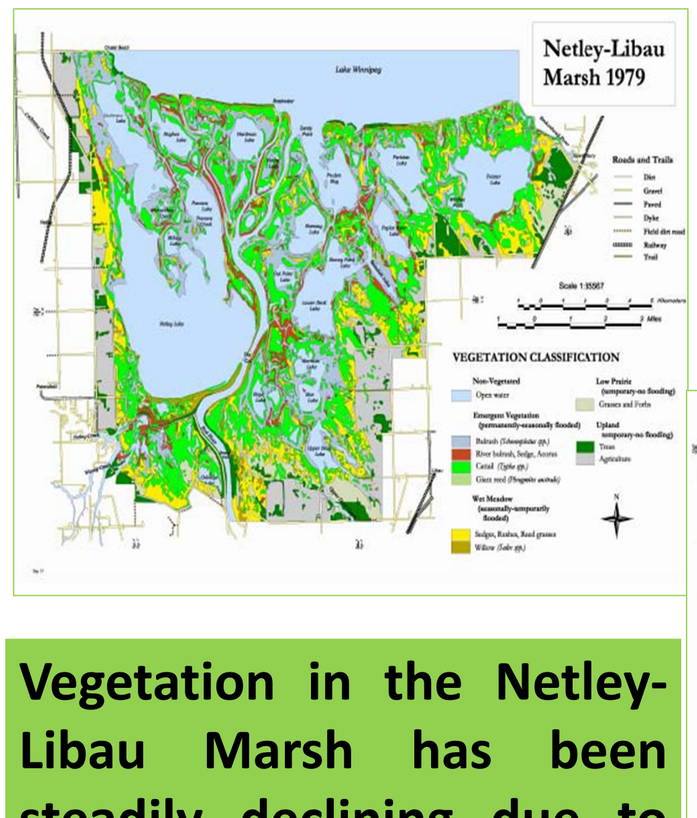
Excessive nutrients (nitrogen and phosphorus) increase the frequency and severity of toxic algae blooms

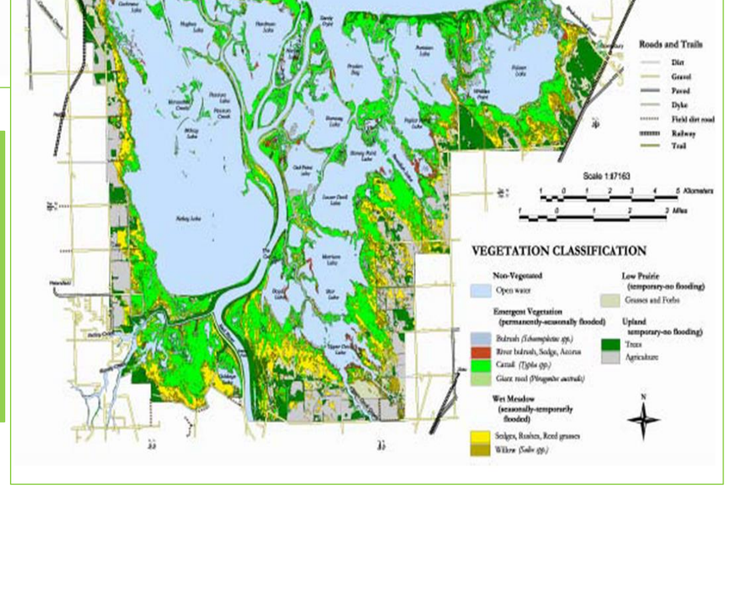


High loads of N and P enter Lake Winnipeg from the Red River

Shoreline erosion needs to be repaired to save the marsh

Annual ice jams on the Red River occur where the river is too shallow. Over 50% of the Red River flows into the Netley Marsh along with much of the ice during spring break-up





Vegetation in the Netley-Libau Marsh has been steadily declining due to several factors

Netley Marsh has begun to resemble a lake, more than a marsh in recent years

RED RIVER BASIN COMMISSION
North Chapter

Manitoba Hydro

Pilot Project Progress

- Steering Committee and Technical Advisory Committee are meeting regularly
- Bathymetry completed by MB Hydro in August 2018
- Siltation study to begin September 2018
- Gathering information required for environmental license
- Dredging and sediment islands to be done in summer 2019

Pilot Project Partners and In-Kind Support

- University of Manitoba
- Manitoba Hydro
- Southern Chiefs' Organization Inc.
- International Institute for Sustainable Development
- South Basin Mayors and Reeves
- Ducks Unlimited Canada
- Lake Winnipeg Foundation
- Native Plant Solutions
- City of Winnipeg
- Province of Manitoba

With Funding From

- Federation of Canadian Municipalities – MCIP Grant
- Lake Winnipeg Basin Program
- EcoAction Fund
- South Basin Mayors and Reeves
- Manitoba Fish and Wildlife Enhancement Fund – Wildlife
- Selkirk and District Community Fund
- Community Spirit Fund – South Beach Casino
- City of Winnipeg
- Peguis First Nation

Netley-Libau Marsh Restoration Pilot Project

Pilot project will investigate using Amphibex dredgers to dredge portions of the Red River near Hardman Lake. Removed siltation will be used to create sediment "islands" to provide a substrate for cattail growth

Hardman Lake: proposed location for marsh renewal pilot project

Similar technology has been used successfully around the world, including Louisiana (pictured here) to restore marshes

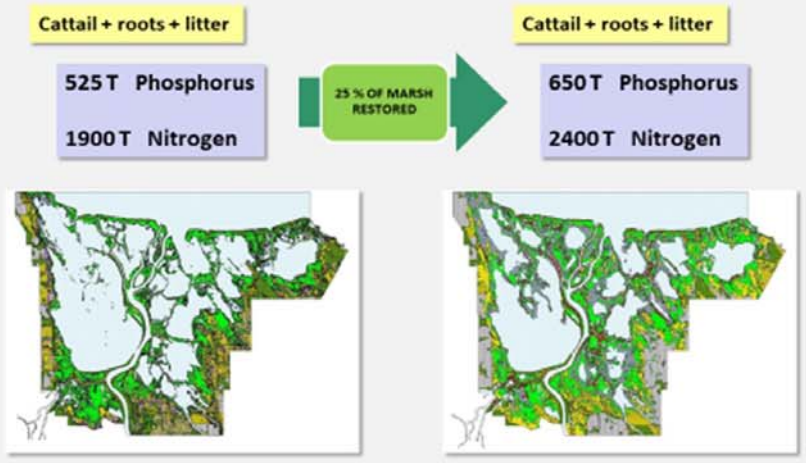
Why Are Marshes Important?

Cattails can filter excess nutrients and harmful toxins from the water. Marshes are referred to as "Nature's kidneys" due to their ability to improve the quality of surrounding waters.

Marshes provide important habitat for fish, birds, and other wildlife

Restoring Netley-Libau Marsh could remove significant amounts of Phosphorus and Nitrogen. These excess nutrients contribute to toxic algae blooms.

What if – we restored 25% of Netley-Libau Marsh?



Manitoba Hydro

NOW is the time for Action!

RED RIVER BASIN COMMISSION

The **Red River Basin Commission** is holding their first **Public Open House Presentation** on

Restoring the Netley-Libau Marsh by Dredging the Red River

Where: Clandeboye Community Hall, 108 Main St, Clandeboye, MB in the RM of St. Andrews
When: Monday, October 15, 6:00 pm – 8:30 pm (with a brief presentation at 7:00 pm)

Come and learn about the Netley Marsh and what's being done to save it!

RED RIVER BASIN COMMISSION

The **Red River Basin Commission and their Partners** are holding a **Public Open House Presentation** on

Restoring the Netley-Libau Marsh by Dredging the Red River

- Wednesday, **November 21**, 6:00 pm – 8:30 pm at the East Selkirk Hall in **East Selkirk**

*A brief presentation by Dr. Gordon Goldsborough will be given at 7:00 pm at both sessions

Come and learn about the Netley Marsh and what's being done to save it!

RED RIVER BASIN COMMISSION

The **Red River Basin Commission and their Partners** are holding a **Public Open House Presentation** on

Restoring the Netley-Libau Marsh by Dredging the Red River

- Thursday, **November 22,** Bronx Park Community Centre, 720 Henderson Hwy, in **Winnipeg**

*A brief presentation by Dr. Gordon Goldsborough will be given at 7:00 pm

Come and learn about the Netley Marsh and what's being done to save it!

RED RIVER BASIN COMMISSION

The **Red River Basin Commission and their Partners** are holding the final **Public Open House Presentation** on

Restoring the Netley-Libau Marsh by Dredging the Red River

- Thursday, **November 29**, 6:00 pm – 8:30 pm at the Gaynor Family Regional Library in **Selkirk**

*A presentation by Dr. Gordon Goldsborough will be given at 7:00 pm

Come and learn about the Netley Marsh and what's being done to save it!

The Netley-Libau Marsh is essential to the health of Lake Winnipeg
Join us to learn about the perils facing the mash and what its being done to save it!

NETLEY-LIBAU MARSH RENEWAL PILOT PROJECT

PUBLIC OPEN HOUSES

with presentations by Dr. Gordon Goldsborough

November 21 - 6pm
East Selkirk Hall
711 Old Henderson Hwy, East Selkirk

November 22 - 6pm
Bronx Park Community Centre
720 Henderson Hwy, Winnipeg

November 29 - 6pm
Gaynor Family Regional Library
806 Manitoba, Ave. Selkirk,

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With presentations by
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RED RIVER BASIN COMMISSION

University of Manitoba · IISD · LWF · Lake Winnipeg Foundation · SBMR South Basin Mayors & Reeves · Manitoba Hydro · Ducks Unlimited Canada · Native Plant Solutions

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East Selkirk Hall
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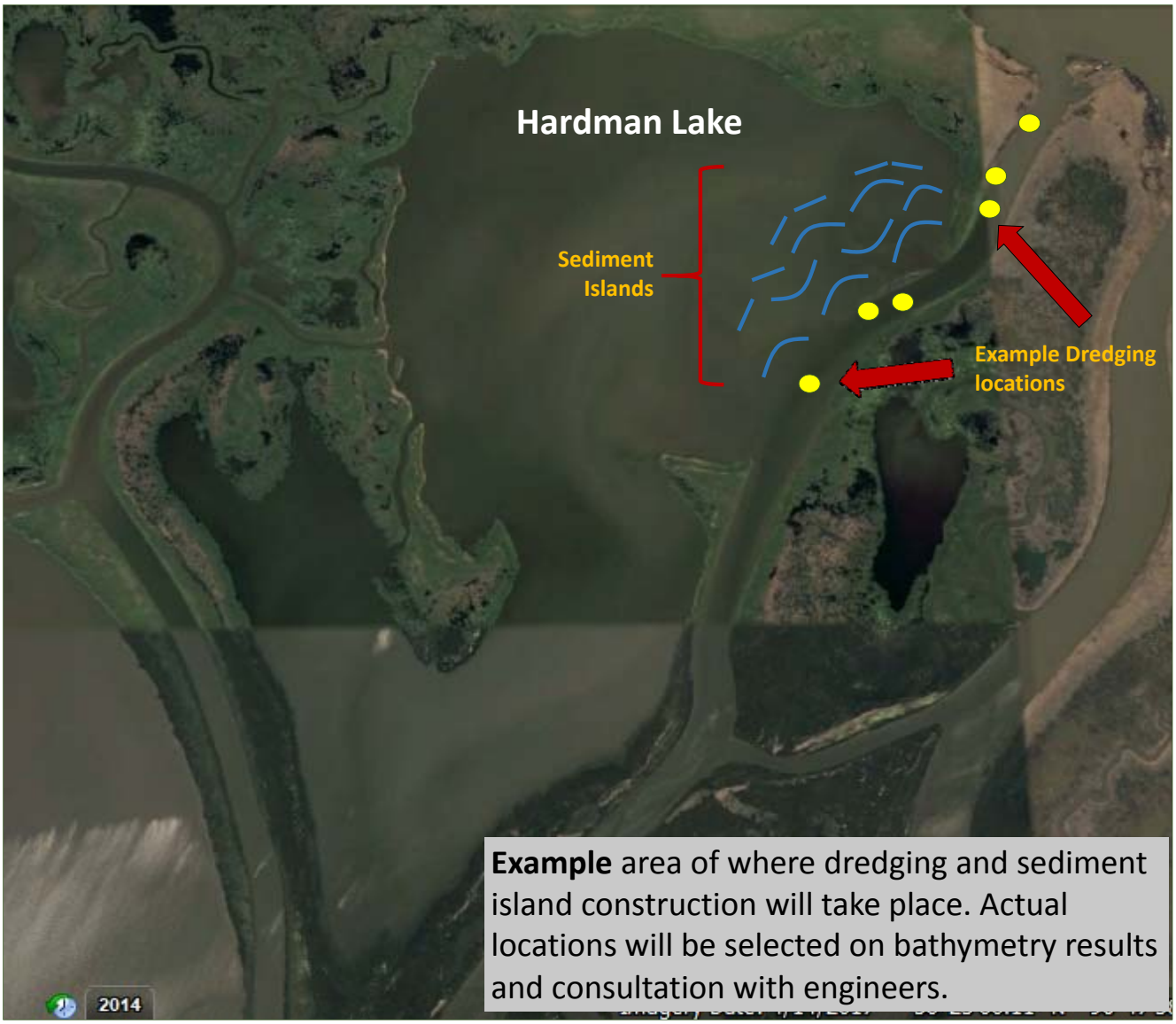
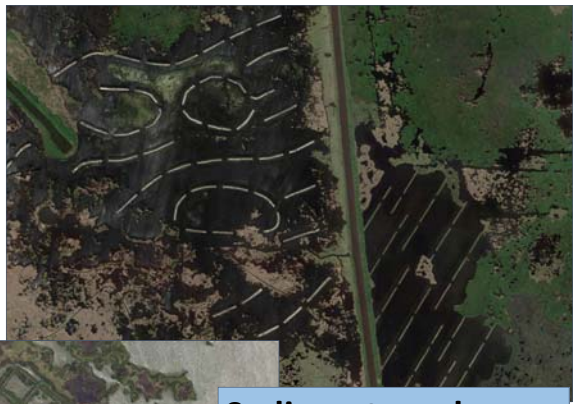
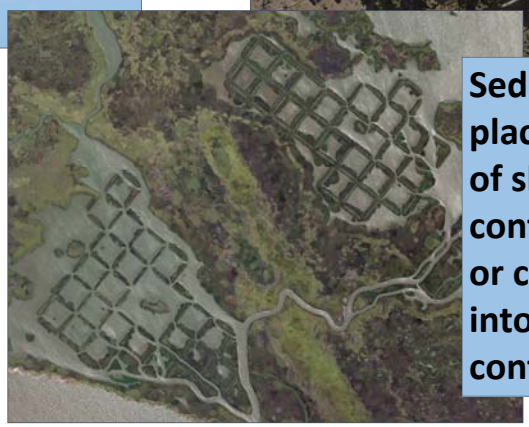
How it will work



Example area of where dredging and sediment island construction will take place. Actual locations will be selected on bathymetry results and consultation with engineers.

Dredged sediment can have the consistency of toothpaste. This can be ideal for construction of sediment structures.





Sediment can be placed into a variety of shapes of contained "islands" or can be pumped into larger, contained areas

A Success Story

In Audubon, Louisiana, the National Audubon Society used an Amphibex 400 to dredge a section of river. The dredged material was pumped into an adjacent marsh into a contained area. The Amphibex was able to move enough material to restore 10 acres of marsh in just two weeks.

Multiple Benefits of Dredging

Ice jam mitigation

Deeper channels on the Red River will allow water and ice to move more freely from the river to Lake Winnipeg, reducing the occurrence of ice jams

Improved channel for recreation and ecotourism improving boat movement from the Red River to Lake Winnipeg

Restored access to the Selkirk Dry Dock for larger vessels including the Lake Winnipeg Research vessel, the Namao

Lake Winnipeg Research Consortium Inc.

Multiple Benefits of Marsh Restoration

Improved water quality

Enhanced habitat for fish and wildlife. Improved water flow for fish travel

Enhanced environment for traditional Indigenous uses including hunting, trapping, fishing, and ceremonial uses

The Red River Basin Commission — Netley Marsh Restoration Pilot Project

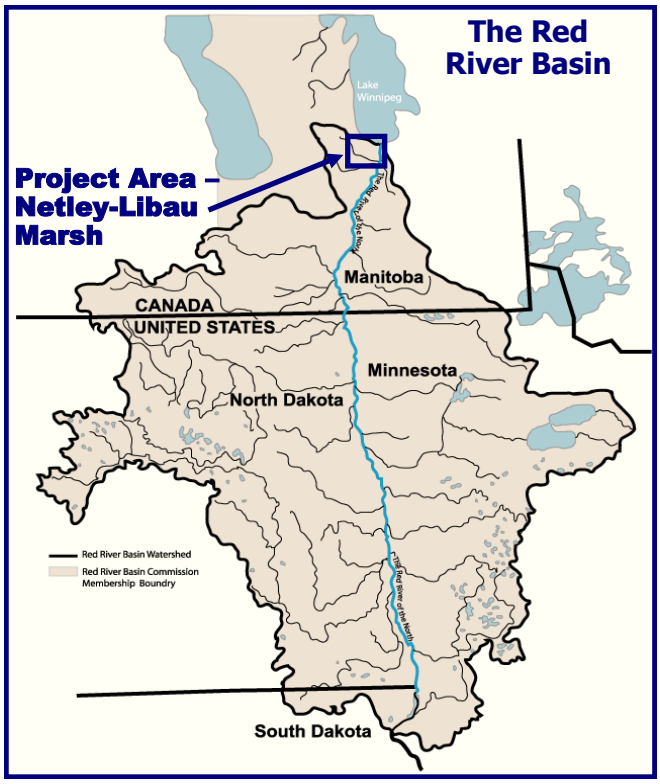
The Red River Basin Commission

We are a charitable, not-for-profit organization designed to help facilitate a cooperative approach to water management within the Basin and are a well-established forum for identifying, developing, and implementing solutions to cross-boundary issues.

Background

The Netley-Libau Marsh is the largest coastal wetland in North America and a critical wildlife /fish habitat area for Lake Winnipeg. This marsh has deteriorated due to a number of primarily anthropogenic factors (caused or influenced by humans) to the point where it is no longer a healthy, functional wetland. Healthy marshes can help filter out nutrient and toxins and improve water quality.

Dredging the Red River continued for over 100 years until 1999 where it was used to aid boat navigation and speed up the spring ice which was able to flush to Lake Winnipeg. Though much effort has been put into flood mitigation by diking, individual flood protection and buy-outs. Flooding is still occurring and most channels are silted, to the point where most are not navigable including that of the main channel.



Project Description

Wetlands provide numerous environmental benefits including reduction of erosion, enhanced flood control, recharge of groundwater, sequestration of nutrients, reduction of toxic materials, support for economically important animals (hunting, fishing, etc.), supply of agricultural and aqua cultural products, and provision of recreational and opportunities. The Indigenous communities use marshlands for traditional uses. It is an important pieces of their culture, as they use the water and land for traditional practices.

Increased water flows into the marsh from multiple causes are resulting in sustained, high water levels which drown out the vegetation. Riverbank erosion is occurring at a staggeringly fast pace.

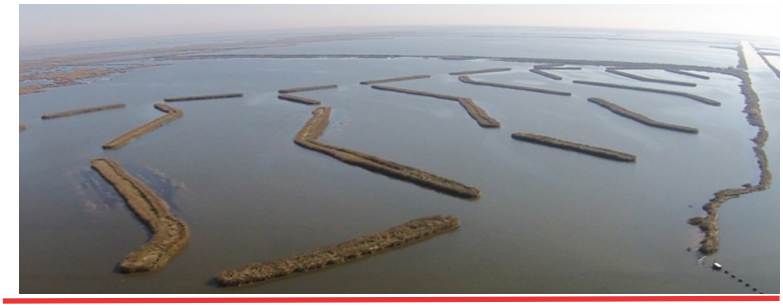
The RRBC and its partners are undertaking a restoration pilot project in a small section (Hardman Lake) to examine the feasibility of restoring the Netley-Libau Marsh. Specific sections of the Red River will be dredged using Amphibexes (currently utilized for ice breaking). The product extracted will be pumped into Hardman Lake to construct "islands" as shallow-water habitat appropriate for the growth of cattails and wetland vegetation.

This project has multiple benefits for the marsh, ice induced flooding and river navigation.

Project Phases

1. Planning and licensing
   - Creation of a Steering and Science Committee
   - Background study and project review
   - Bathymetric and sediment surveys
   - Fish and wildlife assessments
   - Provincial environmental licensing
   - Outreach and communication to municipalities, organization, and public
2. Implementation of Pilot Project
   - Determine specific location and design of sediment "islands"
   - Dredging and Sediment Island construction
   - Monitoring of fish, wildlife, and vegetation
3. Evaluation of preliminary results
   - Continued monitoring of fish, wildlife, vegetation and nutrient levels
   - Progress assessment and evaluation, and recommendations

Working Together on Today's Challenges
We Have a Plan



Key Objectives

- Enhance nutrient sequestration in the marsh and demonstrate its capacity to reduce phosphorus in Lake Winnipeg.
- Enhance the function of marsh in providing feeding and spawning habitat for fish, furbearers, and water birds.
- Enhance the function of the Netley-Libau Marsh for traditional Indigenous uses including hunting, trapping, fishing, and ceremonial uses for their holistic wellbeing.
- Assess the technology for reestablishment of emergent vegetation to provide ecological goods and services, including nutrient sequestration within the marsh, while also potentially providing biofuel benefits from harvestable macrophyte biomass.
- Demonstrate innovative, dredging related solutions that could be applied throughout the Lake Winnipeg Watershed, the Red River Basin and elsewhere across Canada.
- Reestablish the mouth of the Red River as the primary conduit of water to Lake Winnipeg and potentially reducing flooding upstream caused by ice jamming.

Project Partners

- ◊ **University of Manitoba**
- ◊ **International Institute for Sustainable Development**
- ◊ **Manitoba Hydro**
- ◊ **Southern Chiefs' Organization**
- ◊ **Lake Winnipeg Foundation**
- ◊ **Duck Unlimited Canada**
- ◊ **South Basin Mayors and Reeves**

RRBC Offices
1120 28th Ave. N., Suite C, Fargo, ND 58102
701-356-3183
205-1100 Concordia Ave., Winnipeg, MB R2K 4B8
204-982-7250

Through extensive basin-wide dialogue and consultation with citizens, land users, organizations, and governments, the RRBC developed the **Natural Resources Framework Plan (NRFP).** The NRFP was designed as a tool for moving the Basin forward in achieving common goals for water protection and management within the Basin.

The NRFP contains 13 goals. The first four focus on encouraging communication, research, and coordination across political jurisdictional boundaries. The remaining nine focus on improvements in water quality; water supply; flood damage reduction; drainage; conservation; and fish, wildlife, and outdoor recreation.

Basin Goals Addressed

Goal #4	**Education/Information**: Improve stakeholder participation and awareness of land and water issues.
Goal #6	**Flood Mitigation**: Reduce risk of flood damages for people, property and the environment in the mainstem floodplain and in tributary watersheds.
Goal #9	**Water Quality**: Maintain, protect, and restore surface and ground water quality in the Red River Basin.
Goal #11	**Conservation**: Increase soil conservation efforts within the Basin.
Goal #12	**Fish & Wildlife**: Conserve, manage, and restore diversity and viability of native fish and wildlife.
Goal #13	**Outdoor Recreation**: Enhance and develop recreational infrastructure and access to the Basin's natural resources.

October 2018

Netley-Libau Marsh Restoration Pilot Project

Your input is important to us and we would like your feedback on the Netley Restoration Pilot Project. Please complete this form and return it to our registration table, our RRBC staff or by emailing it to us at info@redriverbasincommission.org

1. **How did you hear about this Public Open House Event?**

2. **Do you support the principals of the Netley-Libau Marsh Restoration Pilot Project?**

3. **What is your interest in this project?**

4. **Do you support the City of Winnipeg in participating in the Netley-Libau Marsh Restoration Pilot Project?**

5. **Other thoughts or comments you may have on this project.**

(Over please)

Netley-Libau Marsh Restoration Pilot Project

6. *Are you interested in receiving further updates about the Netley Libau Marsh Pilot Project and the activities of the Red River Basin Commission?*

☐ YES ☐ NO

If yes, please list your preference of receiving further updates. Name, phone, email address.

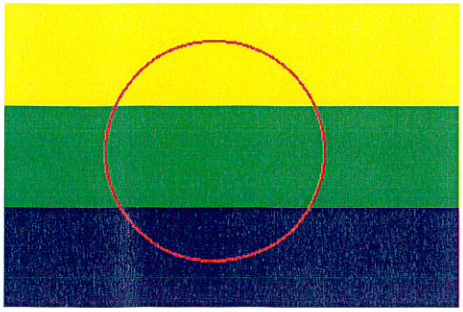
Name:

Phone:

Email Address:

Thank You!

Red River Basin Commission
205-1100 Concordia Ave.
Winnipeg, MB R2K 4B8



Peguis First Nation

P.O. Box 10
PEGUIS RESERVE, MANITOBA ROC 3JO
Telephone: (204) 645-2359 | Toll Free: 1-866-645-2359 | Fax: (204) 645-2360
Website www.peguisfirstnation.ca

To Whom It May Concern,

On behalf Peguis First Nation, a community located on the shores of Lake Winnipeg, I am writing you today in regards to the Netley-Libau Restoration Project that is being undertaken by the Red River Basin Commission (RRBC) and its partners.

Long before European immigrants, The Red River valley north of Selkirk, MB was the traditional territory (and now part of Treaty 1 Territory) of Chief Peguis, who in the late 1700's led a band of Saultaux people from Sault Ste. Marie, Ontario to this area. Peguis First Nation, or as it was originally called St. Peter's Indian Band chose to make the area near Netley Creek their home, here they built a thriving agricultural community, whose members also relied on the nearby marsh and river for fishing, hunting, trapping and gathering medicine from the rich bounty that was found there. This area was, and continues to be an important place for our people to practice our cultural traditions.

Unfortunately over the past number of decades the marsh has seen significant change, it has deteriorated to the point where our people can no longer utilize the marsh for our traditional uses. Wetland drainage in the Lake Winnipeg watershed, eutrophication, invasive species, and regulated water levels has prevented it from functioning as a healthy wetland. In addition, lack of dredging on the Red River has diverted much of the water from the Red River into the marsh; especially through the Netley "Cut". As a result, the flow of water has wash away much of the important vegetation and wildlife habitat in this area. This marsh no longer holds the thousands of muskrats, otter, or beaver we traditionally trapped here, nor the waterfowl we use to hunt.

The Red River Basin Commission and its partners have suggested auspicious pilot project that uses the Amphibex machines to dredged sediment from the bottom of the Red River to build vegetation islands in Hardman's Lake, then if successful, expanded further to other areas of the marsh. On behalf of Peguis First Nation and our councillors we fully support this vital initiative to restore the Netley-Libau Marshes and would like to partner with the RRBC whenever possible to ensure the success of this project. We also feel that closing in Netley "Cut" would also be important, as this would help restore our traditional hunting and trapping areas that once flourished in Netley Lake.

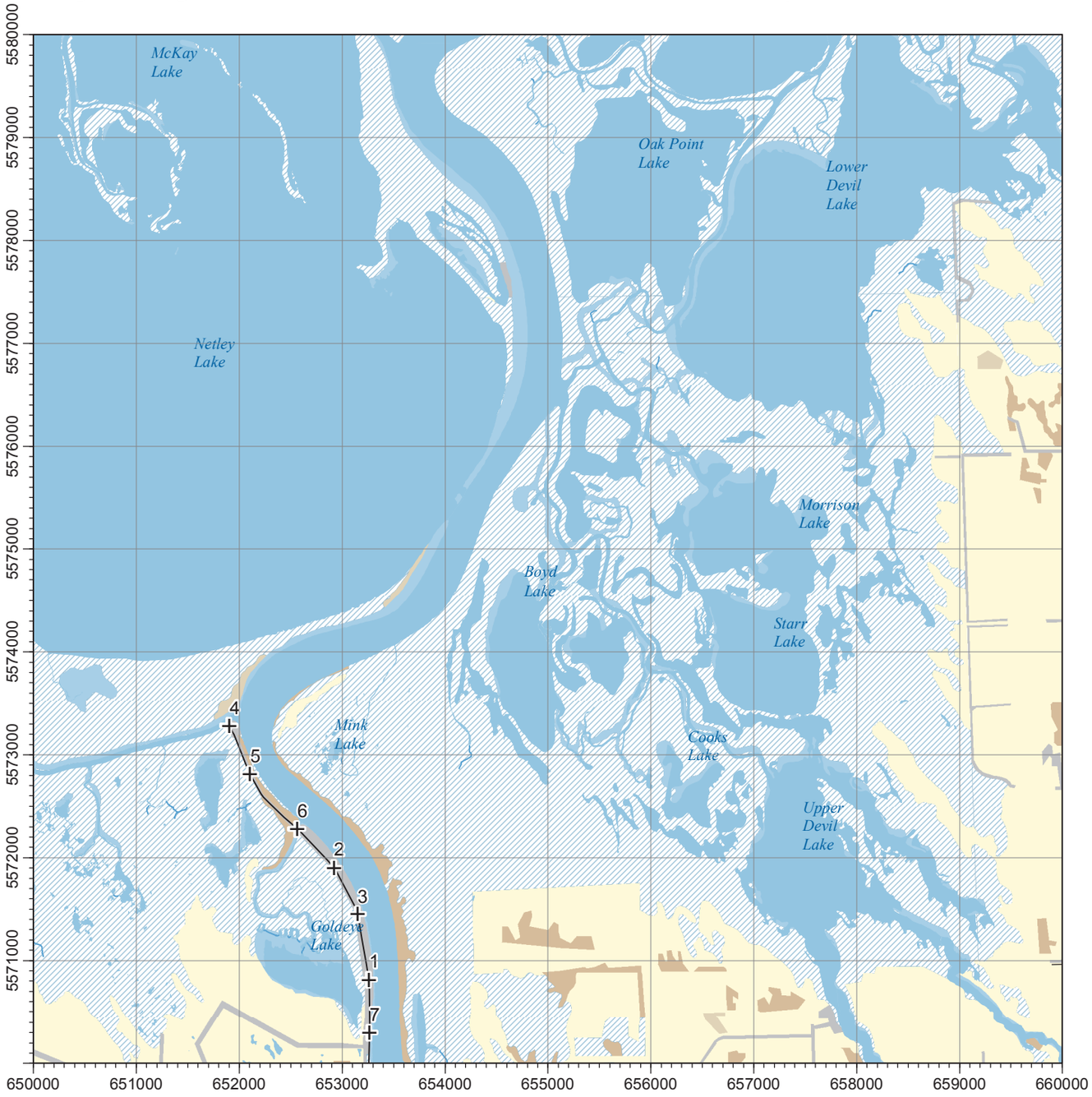
Miigwetch,

Glenn Hudson
Chief of Peguis First Nation

APPENDIX E

MANITOBA BREEDING BIRD ATLAS SPECIES COUNTS AND MAPS

Region / Région: 3 **Square / Parcelle: 14PA57**



MANITOBA BREEDING BIRD ATLAS

Predefined point count coordinates
Coordonnées des points d'écoute prédéterminés

POINT	EASTING UTM Est	NORTHING UTM Nord
1	653261	5570819
2	652923	5571903
3	653151	5571452
4	651905	5573285
5	652106	5572815
6	652564	5572282
7	653266	5570299
8		
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30		

Legend **Légende**

Expressway or highway	Autoroute ou route nationale (asphaltée)
Regional or local road	Route régionale ou locale (asphaltée ou non)
Rail line	Chemin de fer
Utility corridor	Ligne de transport d'énergie
Watercourse	Rivière ou ruisseau
Mature broadleaf forest	Forêt de feuillus (mature)
Young broadleaf forest	Forêt de feuillus (jeune)
Mature coniferous forest	Forêt de conifères (mature)
Young coniferous forest	Forêt de conifères (jeune)
Mature mixed forest	Forêt mixte (mature)
Young mixed forest	Forêt mixte (jeune)
Shrubland / other	Milieu arbustif / autre
Open wetland	Milieu humide (marais)
Agriculture / open country	Milieu agricole
Urban / unclassified	Mileu urbanisé / non classifié
Water	Eau

Cartographic production by Bird Studies Canada
Production cartographique par Études d'oiseaux Canada

6° Universal Transverse Mercator (UTM) Projection; Zone 14, Central Meridian -99°; North American Datum 1983 (NAD 83)
Projection universelle transverse de Mercator (UTM) 6° Zone 14, méridien central -99°; Système de référence géodésique nord-américain 1983 (NAD 83)

0 1 km

April 2010 / Avril 2010
http://www.birdatlas.mb.ca/

14PA57
Red River Valley
Region / Région: 3

Atlas des oiseaux nicheurs du MANITOBA Breeding Bird Atlas

Square Summary (14PA57)

#species				#hours	#pc done	
poss	prob	conf	total		road	offrd
25	21	18	64	44.2	7	9

Region summary (#3: Red River Valley)

#squares	#sq with data	#species	#pc done	target #pc
140	139	199	2670	525

Target number of point counts in this square: 7 road side, 8 off road (Open Wetland: 6, Agriculture / open country: 2). Please try to ensure that each off-road station is located such that the entire 100m radius circle is within the prescribed habitat.
Approximate time allocation for general atlassing:: Mature broadleaf forest: 1%, Open Wetland: 74%, Agriculture / open country: 21%, Urban / unclassified: 1%. Refer to the atlas PDF maps and online resources to locate habitats.

SPECIES	Code	%	SPECIES	Code	%	SPECIES	Code	%
Canada Goose	FY	90	Clark's Grebe †		0	Sandhill Crane		37
Wood Duck	FY	44	American White Pelican §		5	Piping Plover †		0
Gadwall	P	23	Double-cr. Cormorant §		5	Killdeer		97
American Wigeon		12	American Bittern		28	American Avocet		7
Mallard	FY	98	Least Bittern †		2	Spotted Sandpiper	T	48
Blue-winged Teal	AE	64	Great Blue Heron §	H	22	Solitary Sandpiper ‡		<1
Northern Shoveler		46	Great Egret ‡¤		5	Greater Yellowlegs ‡¤		<1
Northern Pintail		19	Cattle Egret ‡¤		<1	Willet		15
Green-winged Teal		31	Black-crown. N.-Heron §		12	Upland Sandpiper		50
Canvasback		14	White-faced Ibis ‡¤		<1	Marbled Godwit		47
Redhead		20	Turkey Vulture		23	Semipalmated Sandpiper †		0
Ring-necked Duck		23	Osprey		7	Wilson's Snipe	S	79
Lesser Scaup		20	Bald Eagle	AE	35	American Woodcock		20
Bufflehead		2	Northern Harrier		84	Wilson's Phalarope		18
Common Goldeneye		5	Sharp-shinned Hawk		7	Bonaparte's Gull ‡		0
Hooded Merganser		37	Cooper's Hawk		33	Franklin's Gull §		8
Common Merganser		<1	Northern Goshawk		0	Ring-billed Gull §	H	14
Ruddy Duck		17	Broad-winged Hawk	H	18	Herring Gull §		5
Gray Partridge		35	Swainson's Hawk		28	Caspian Tern §		<1
Ring-necked Pheasant ‡¤		0	Red-tailed Hawk	H	87	Black Tern §	H	18
Ruffed Grouse		20	Ferruginous Hawk †		0	Common Tern §		5
Sharp-tailed Grouse		30	Rough-legged Hawk ‡		0	Forster's Tern §	H	13
Wild Turkey		17	American Kestrel		77	Rock Pigeon		82
Common Loon		2	Merlin	H	56	Mourning Dove	T	98
Pied-billed Grebe	FY	26	Peregrine Falcon ¤		4	Black-billed Cuckoo		52
Horned Grebe ¤		4	Yellow Rail ¤		12	Eastern Screech-Owl		4
Red-necked Grebe §		10	Virginia Rail		14	Great Horned Owl	S	59
Eared Grebe §		7	Sora	T	57	Northern Hawk Owl ¤		0
Western Grebe §	FY	7	American Coot	FY	32	Burrowing Owl †		0

Manitoba Breeding Bird Atlas - Summary Sheet for Square 14PA57 (page 2 of 3)

SPECIES	Code	%	SPECIES	Code	%	SPECIES	Code	%
Barred Owl ¤		7	Loggerhead Shrike †		2	Mountain Bluebird		0
Great Gray Owl ¤		2	Yellow-throated Vireo		38	Veery	T	30
Long-eared Owl ¤		15	Blue-headed Vireo		<1	Swainson's Thrush		4
Short-eared Owl ¤		10	Warbling Vireo	S	97	Hermit Thrush		12
Northern Saw-whet Owl		10	Philadelphia Vireo		9	American Robin	T	96
Common Nighthawk ¤		4	Red-eyed Vireo	T	87	Gray Catbird	CF	92
Whip-poor-will ¤		10	Gray Jay		<1	Brown Thrasher		46
Chimney Swift ¤		9	Blue Jay		82	European Starling		93
Ruby-throated Hummingbird	H	38	Black-billed Magpie	AE	84	Sprague's Pipit ‡¤		2
Belted Kingfisher	H	36	American Crow	T	97	Cedar Waxwing	T	74
Red-headed Woodpecker ¤		33	Common Raven	T	88	Golden-winged Warbler ‡¤		1
Yellow-bellied Sapsucker		55	Horned Lark		56	Tennessee Warbler		17
Downy Woodpecker	S	63	Purple Martin §		50	Orange-crowned Warbler		2
Hairy Woodpecker	P	61	Tree Swallow	T	79	Nashville Warbler		10
Am. Three-toed Woodp.		0	North. Rgh-wing Swallow		4	Yellow Warbler	T	97
Black-backed Woodpecker		0	Bank Swallow §	NU	35	Chestnut-sided Warbler	S	27
Northern Flicker		77	Cliff Swallow §	AE	51	Cape May Warbler		<1
Pileated Woodpecker		26	Barn Swallow	AE	98	Yellow-rumped Warbler		8
Olive-sided Flycatcher ¤		2	Black-capped Chickadee	H	74	Black-and-white Warbler	H	26
Eastern Wood-Pewee		49	Red-breasted Nuthatch		15	American Redstart	S	45
Yellow-bellied Flycatcher		3	White-breasted Nuthatch		57	Ovenbird		26
Alder Flycatcher	T	53	Brown Creeper		1	Northern Waterthrush		5
Willow Flycatcher ‡¤		1	House Wren		94	Connecticut Warbler		1
Least Flycatcher	T	97	Winter Wren		<1	Mourning Warbler		5
Eastern Phoebe	NE	74	Sedge Wren		66	Common Yellowthroat	T	85
Say's Phoebe ‡¤		0	Marsh Wren	S	43	Eastern Towhee		9
Great Crested Flycatcher		74	Golden-crowned Kinglet		<1	Chipping Sparrow	S	87
Western Kingbird	H	76	Ruby-crowned Kinglet		2	Clay-colored Sparrow	DD	99
Eastern Kingbird	T	97	Eastern Bluebird		47	Vesper Sparrow		82

Manitoba Breeding Bird Atlas - Summary Sheet for Square 14PA57 (page 3 of 3)

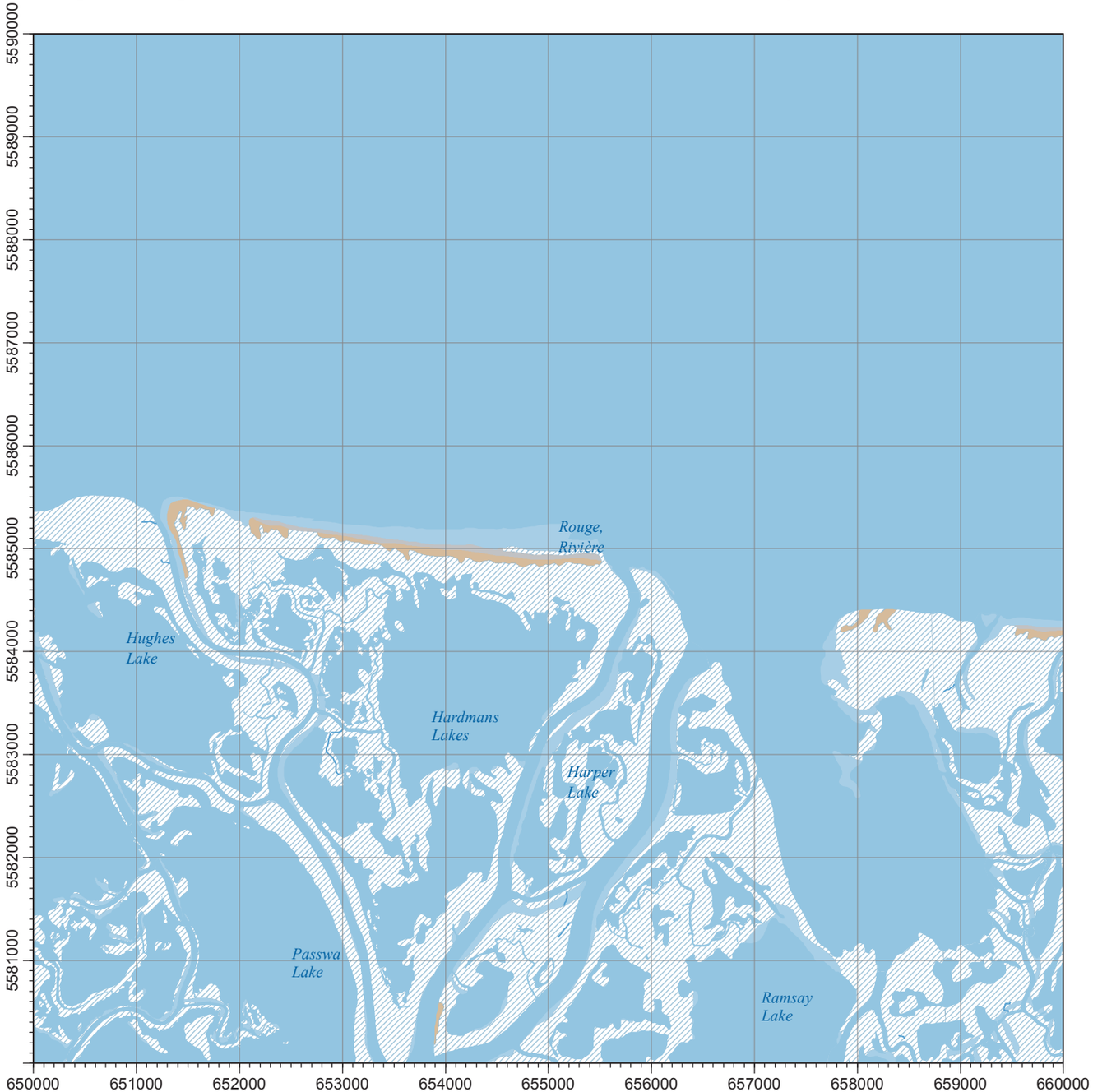
SPECIES	Code	%	SPECIES	Code	%
Lark Sparrow		34	American Goldfinch	T	97
Savannah Sparrow	S	98	Evening Grosbeak		2
Grasshopper Sparrow ‡¤		2	House Sparrow	H	89
Baird's Sparrow †		0			
Le Conte's Sparrow		60			
Nelson's Sparrow		22			
Song Sparrow	T	99			
Lincoln's Sparrow		6			
Swamp Sparrow	S	34			
White-throated Sparrow	S	25			
Dark-eyed Junco		4			
Chestnut-collared Longspur ‡¤		0			
Scarlet Tanager ¤		8			
Rose-breasted Grosbeak		65			
Indigo Bunting		13			
Bobolink	H	92			
Red-winged Blackbird	CF	100			
Western Meadowlark		97			
Yellow-headed Blackbird	NB	35			
Brewer's Blackbird		97			
Common Grackle	CF	94			
Brown-headed Cowbird	T	99			
Orchard Oriole		53			
Baltimore Oriole	T	91			
Purple Finch		20			
House Finch		25			
Red Crossbill †		4			
White-winged Crossbill ¤		1			
Pine Siskin		20			

This list includes all species found during the Manitoba Breeding Bird Atlas (2010-2014) in the region #3 (Red River Valley). Underlined species are those that you should try to add to this square (14PA57). They have not yet been reported during the atlas, but were reported in more than 50% of the squares in this region during the project so far. "Code" is the code for the highest breeding evidence for that species in square 14PA57 during the project so far. The % columns give the percentage of squares in that region where that species was reported during the project (this gives an idea of the expected chance of finding that species in region #3). Rare/Colonial Species Report Forms should be completed for species marked: § (Colonial), ‡ (regionally rare), † (rare in Manitoba) or ¤ (rare in Manitoba, documentation only required for confirmed records). Current as of 7/01/2019. An up-to-date version of this sheet is available from http://www.birdatlas.mb.ca/mbdata/summaryform.jsp?squareID=14PA57?lang=en

[single pages]

Region / Région: 3

Square / Parcelle: 14PA58



MANITOBA BREEDING BIRD ATLAS

Predefined point count coordinates
Coordonnées des points d'écoute prédéterminés

POINT	EASTING UTM Est	NORTHING UTM Nord
1		
2		
3		
4		
5		
6		
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27		
28		
29		
30		

Legend	Légende
Expressway or highway	Autoroute ou route nationale (asphaltée)
Regional or local road	Route régionale ou locale (asphaltée ou non)
Rail line	Chemin de fer
Utility corridor	Ligne de transport d'énergie
Watercourse	Rivière ou ruisseau
Mature broadleaf forest	Forêt de feuillus (mature)
Young broadleaf forest	Forêt de feuillus (jeune)
Mature coniferous forest	Forêt de conifères (mature)
Young coniferous forest	Forêt de conifères (jeune)
Mature mixed forest	Forêt mixte (mature)
Young mixed forest	Forêt mixte (jeune)
Shrubland / other	Milieu arbustif / autre
Open wetland	Milieu humide (marais)
Agriculture / open country	Milieu agricole
Urban / unclassified	Mileu urbanisé / non classifié
Water	Eau

Cartographic production by Bird Studies Canada
Production cartographique par Études d'oiseaux Canada

6° Universal Transverse Mercator (UTM) Projection; Zone 14, Central Meridian -99°; North American Datum 1983 (NAD 83)
Projection universelle transverse de Mercator (UTM) 6° Zone 14, méridien central -99°; Système de référence géodésique nord-américain 1983 (NAD 83)

0 1 km

April 2010 / Avril 2010
http://www.birdatlas.mb.ca/

14PA58
Red River Valley
Region / Région: 3

Atlas des oiseaux nicheurs du MANITOBA Breeding Bird Atlas

Square Summary (14PA58)

#species				#hours	#pc done	
poss	prob	conf	total		road	offrd
29	20	8	57	56.5	0	8

Region summary (#3: Red River Valley)

#squares	#sq with data	#species	#pc done	target #pc
140	139	199	2670	525

Target number of point counts in this square: 0 road side, 15 off road (Open Wetland: 15). Please try to ensure that each off-road station is located such that the entire 100m radius circle is within the prescribed habitat.
Approximate time allocation for general atlassing:: Mature broadleaf forest: 1%, Open Wetland: 98%. Refer to the atlas PDF maps and online resources to locate habitats.

SPECIES	Code	%	SPECIES	Code	%	SPECIES	Code	%
Canada Goose	T	90	Western Grebe §	P	7	American Coot	H	32
Wood Duck	T	44	Clark's Grebe †		0	Sandhill Crane		37
Gadwall		23	American White Pelican §		5	Piping Plover †		0
American Wigeon		12	Double-cr. Cormorant §		5	Killdeer	S	97
American Black Duck ‡¤	H	<1	American Bittern		28	American Avocet	H	7
Mallard	T	98	Least Bittern †		2	Spotted Sandpiper	T	48
Blue-winged Teal	T	64	Great Blue Heron §	H	22	Solitary Sandpiper ‡		<1
Northern Shoveler	D	46	Great Egret ‡¤		5	Greater Yellowlegs ‡¤		<1
Northern Pintail	H	19	Cattle Egret ‡¤		<1	Willet		15
Green-winged Teal	H	31	Black-crown. N.-Heron §	H	12	Upland Sandpiper		50
Canvasback		14	White-faced Ibis ‡¤		<1	Marbled Godwit		47
Redhead	P	20	Turkey Vulture		23	Semipalmated Sandpiper †		0
Ring-necked Duck		23	Osprey	T	7	Wilson's Snipe	H	79
Lesser Scaup		20	Bald Eagle	NY	35	American Woodcock		20
Bufflehead		2	Northern Harrier	T	84	Wilson's Phalarope		18
Common Goldeneye		5	Sharp-shinned Hawk		7	Bonaparte's Gull ‡		0
Hooded Merganser		37	Cooper's Hawk	H	33	Franklin's Gull §	FY	8
Common Merganser		<1	Northern Goshawk		0	Ring-billed Gull §	P	14
Ruddy Duck		17	Broad-winged Hawk		18	Herring Gull §	P	5
Gray Partridge		35	Swainson's Hawk		28	Caspian Tern §		<1
Ring-necked Pheasant ‡¤		0	Red-tailed Hawk		87	Black Tern §	CF	18
Ruffed Grouse		20	Ferruginous Hawk †		0	Common Tern §	FY	5
Sharp-tailed Grouse		30	Rough-legged Hawk ‡		0	Forster's Tern §	CF	13
Wild Turkey		17	American Kestrel		77	Rock Pigeon		82
Common Loon		2	Merlin		56	Mourning Dove	H	98
Pied-billed Grebe		26	Peregrine Falcon ¤		4	Black-billed Cuckoo		52
Horned Grebe ¤		4	Yellow Rail ¤		12	Eastern Screech-Owl		4
Red-necked Grebe §		10	Virginia Rail		14	Great Horned Owl		59
Eared Grebe §		7	Sora	S	57	Northern Hawk Owl ¤		0

Manitoba Breeding Bird Atlas - Summary Sheet for Square 14PA58 (page 2 of 3)

SPECIES	Code	%	SPECIES	Code	%	SPECIES	Code	%
Burrowing Owl †		0	Eastern Kingbird	T	97	Eastern Bluebird		47
Barred Owl ¤		7	Loggerhead Shrike †		2	Mountain Bluebird		0
Great Gray Owl ¤		2	Yellow-throated Vireo		38	Veery		30
Long-eared Owl ¤		15	Blue-headed Vireo		<1	Swainson's Thrush		4
Short-eared Owl ¤		10	Warbling Vireo	S	97	Hermit Thrush		12
Northern Saw-whet Owl		10	Philadelphia Vireo		9	American Robin		96
Common Nighthawk ¤		4	Red-eyed Vireo		87	Gray Catbird	S	92
Whip-poor-will ¤		10	Gray Jay		<1	Brown Thrasher		46
Chimney Swift ¤		9	Blue Jay	H	82	European Starling		93
Ruby-throated Hummingbird		38	Black-billed Magpie	H	84	Sprague's Pipit ‡¤		2
Belted Kingfisher	H	36	American Crow	T	97	Cedar Waxwing		74
Red-headed Woodpecker ¤		33	Common Raven	T	88	Golden-winged Warbler ‡¤		1
Yellow-bellied Sapsucker		55	Horned Lark		56	Tennessee Warbler		17
Downy Woodpecker	H	63	Purple Martin §		50	Orange-crowned Warbler		2
Hairy Woodpecker	H	61	Tree Swallow	H	79	Nashville Warbler		10
Am. Three-toed Woodp.		0	North. Rgh-wing Swallow		4	Yellow Warbler	S	97
Black-backed Woodpecker		0	Bank Swallow §	AE	35	Chestnut-sided Warbler		27
Northern Flicker		77	Cliff Swallow §		51	Cape May Warbler		<1
Pileated Woodpecker		26	Barn Swallow	NY	98	Yellow-rumped Warbler		8
Olive-sided Flycatcher ¤		2	Black-capped Chickadee		74	Black-and-white Warbler		26
Eastern Wood-Pewee		49	Red-breasted Nuthatch		15	American Redstart		45
Yellow-bellied Flycatcher		3	White-breasted Nuthatch		57	Ovenbird		26
Alder Flycatcher	H	53	Brown Creeper		1	Northern Waterthrush		5
Willow Flycatcher ‡¤		1	House Wren		94	Connecticut Warbler		1
Least Flycatcher		97	Winter Wren		<1	Mourning Warbler		5
Eastern Phoebe	S	74	Sedge Wren	S	66	Common Yellowthroat	T	85
Say's Phoebe ‡¤		0	Marsh Wren	A	43	Eastern Towhee		9
Great Crested Flycatcher		74	Golden-crowned Kinglet		<1	Chipping Sparrow	H	87
Western Kingbird		76	Ruby-crowned Kinglet		2	Clay-colored Sparrow		99

Manitoba Breeding Bird Atlas - Summary Sheet for Square 14PA58 (page 3 of 3)

SPECIES	Code	%	SPECIES	Code	%
Vesper Sparrow		82	Pine Siskin		20
Lark Sparrow		34	American Goldfinch		97
Savannah Sparrow		98	Evening Grosbeak		2
Grasshopper Sparrow ‡¤		2	House Sparrow		89
Baird's Sparrow †		0			
Le Conte's Sparrow		60			
Nelson's Sparrow		22			
Song Sparrow	T	99			
Lincoln's Sparrow		6			
Swamp Sparrow	S	34			
White-throated Sparrow		25			
Dark-eyed Junco		4			
Chestnut-collared Longspur ‡¤		0			
Scarlet Tanager ¤		8			
Rose-breasted Grosbeak		65			
Indigo Bunting		13			
Bobolink		92			
Red-winged Blackbird	T	100			
Western Meadowlark		97			
Yellow-headed Blackbird	NB	35			
Brewer's Blackbird		97			
Common Grackle	T	94			
Brown-headed Cowbird	H	99			
Orchard Oriole	H	53			
Baltimore Oriole	S	91			
Purple Finch		20			
House Finch		25			
Red Crossbill †		4			
White-winged Crossbill ¤		1			

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[single pages]

APPENDIX F

SPECIES OF CONSERVATION CONCERN WITHIN THE INTERLAKE PLAIN ECOREGION

Occurrence of Species by Ecoregion

Interlake Plain

Updated December 1, 2016

Category	Scientific Name	Common Name	Rank
Amphibian	Ambystoma laterale	Blue-spotted Salamander	S3S4
Amphibian	Ambystoma tigrinum	Eastern Tiger Salamander	S2?
Amphibian	Lithobates pipiens	Northern Leopard Frog	S4
Animal Assemblage	Bat Colony		SNR
Animal Assemblage	Colonial Waterbird Nesting Area		SNR
Animal Assemblage	Gull Colony		SNR
Animal Assemblage	Gulls	Gulls	SNR
Animal Assemblage	Snake Hibernaculum	Snake Hibernaculum	SNR
Animal Assemblage	Tern Colony		SNR
Bird	Accipiter cooperii	Cooper's Hawk	S4B
Bird	Aechmophorus occidentalis	Western Grebe	S4B
Bird	Ammodramus savannarum	Grasshopper Sparrow	S3B
Bird	Antrostomus vociferus	Whip-poor-will	S3B
Bird	Ardea alba	Great Egret	S2S3B
Bird	Ardea herodias	Great Blue Heron	S5B
Bird	Asio flammeus	Short-eared Owl	S2S3B
Bird	Cardellina canadensis	Canada Warbler	S3B
Bird	Chaetura pelagica	Chimney Swift	S2B
Bird	Charadrius melodus	Piping Plover	S1B
Bird	Chlidonias niger	Black Tern	S4B
Bird	Chordeiles minor	Common Nighthawk	S3B
Bird	Contopus cooperi	Olive-sided Flycatcher	S3B
Bird	Contopus virens	Eastern Wood-pewee	S4B
Bird	Coturnicops noveboracensis	Yellow Rail	S3B
Bird	Cygnus buccinator	Trumpeter Swan	S1B
Bird	Dolichonyx oryzivorus	Bobolink	S4B
Bird	Hirundo rustica	Barn Swallow	S4B
Bird	Hydroprogne caspia	Caspian Tern	S3B
Bird	Ixobrychus exilis	Least Bittern	S2B

Category	Scientific Name	Common Name	Rank
Bird	Lanius ludovicianus migrans	Loggerhead Shrike	S1B
Bird	Larus argentatus	Herring Gull	S4B
Bird	Larus californicus	California Gull	S3B
Bird	Larus delawarensis	Ring-billed Gull	S5B
Bird	Melanerpes erythrocephalus	Red-headed Woodpecker	S3B
Bird	Nycticorax nycticorax	Black-crowned Night-heron	S4B
Bird	Pelecanus erythrorhynchos	American White Pelican	S4B
Bird	Phalacrocorax auritus	Double-crested Cormorant	S5B
Bird	Pipilo erythrophthalmus	Eastern Towhee	S4B
Bird	Podiceps auritus	Horned Grebe	S4B
Bird	Podiceps nigricollis	Eared Grebe	S4B
Bird	Riparia riparia	Bank Swallow	S5B
Bird	Sterna forsteri	Forster's Tern	S4B
Bird	Sterna hirundo	Common Tern	S5B
Bird	Strix nebulosa	Great Gray Owl	S4
Bird	Strix varia	Barred Owl	S4
Bird	Vermivora chrysoptera	Golden-winged Warbler	S3B
Fish	Coregonus zenithicus	Shortjaw Cisco	S2
Fish	Ichthyomyzon castaneus	Chestnut Lamprey	SU
Fish	Macrhybopsis storeriana	Silver Chub	S5
Fish	Notropis dorsalis	Bigmouth Shiner	S4
Invertebrate	Amblema plicata	Threeridge	S3
Invertebrate	Danaus plexippus	Monarch	S3S4B
Invertebrate	Erynnis martialis	Mottled Dusky Wing	S1
Invertebrate	Fusconaia flava	Wabash Pigtoe	S3
Invertebrate	Hesperia dacotae	Dakota Skipper	S2
Invertebrate	Lasmigona complanata	White Heelsplitter	S3
Invertebrate	Lasmigona costata	Flutedshell	S2
Invertebrate	Ligumia recta	Black Sandshell	S3
Invertebrate	Oarisma powesheik	Powesheik Skipper	S1
Invertebrate	Orconectes immunis	Calico Crayfish	S3
Invertebrate	Quadrula quadrula	Mapleleaf Mussel	S1
Invertebrate	Strophitus undulatus	Creeper	S5
Invertebrate	Wallengrenia egeremet	Northern Broken-dash	S1
Mammal	Bison bison athabascae	Wood Bison	SNA
Mammal	Geomys bursarius	Plains Pocket Gopher	S3
Mammal	Myotis lucifugus	Little Brown Myotis	S2N,S5B
Mammal	Myotis septentrionalis	Northern Myotis	S3S4N,S4B
Mammal	Rangifer tarandus caribou	Woodland Caribou	S2S3
Plant	Achnatherum richardsonii	Richardson Needle Grass	S1S2

Category	Scientific Name	Common Name	Rank
Plant	Agalinis aspera	Rough Agalinis	S2
Plant	Agalinis tenuifolia	Narrow-leaved Agalinis	S2S3
Plant	Agrimonia gryposepala	Common Agrimony	S1S2
Plant	Alisma gramineum	Narrow-leaved Water-plantain	S1
Plant	Amorpha fruticosa	False Indigo	S1S2
Plant	Arabidopsis lyrata	Lyre-leaved Rock Cress	S1S2
Plant	Aralia racemosa	Spikenard	S2
Plant	Arethusa bulbosa	Dragon's-mouth	S2
Plant	Asarum canadense	Wild Ginger	S3S4
Plant	Asclepias verticillata	Whorled Milkweed	S3
Plant	Astragalus australis	Indian milkvetch	S1S2
Plant	Astragalus neglectus	Neglected Milkvetch	S1
Plant	Astragalus pectinatus	Narrow-leaved Milkvetch	S2
Plant	Boltonia asteroides var. recognita	White Boltonia	S2S3
Plant	Botrychium campestre	Prairie Moonwort	S1
Plant	Botrychium lunaria	Common Moonwort	S3S4
Plant	Botrychium matricariifolium	Daisy-leaf Moonwort	S1
Plant	Bouteloua curtipendula	Side-oats Grama	S2
Plant	Bromus kalmii	Wild Chess	S2S3
Plant	Bromus porteri	Porter's Chess	S2S3
Plant	Calamagrostis montanensis	Plains Reed Grass	S3
Plant	Calopogon tuberosus	Swamp-pink	S2
Plant	Canadanthus modestus	Large Northern Aster	S2
Plant	Cardamine bulbosa	Spring Cress	SH
Plant	Carex conoidea	Field Sedge	S1
Plant	Carex douglasii	Douglas Sedge	S2
Plant	Carex flava	Yellow Sedge	S2
Plant	Carex hystericina	Porcupine Sedge	S3
Plant	Carex livida	Livid Sedge	S3
Plant	Carex parryana	Parry's Sedge	S3
Plant	Carex pedunculata	Stalked Sedge	S3
Plant	Carex sterilis	Dioecious Sedge	S2
Plant	Carex supina ssp. spaniocarpa	Weak Sedge	S2S3
Plant	Carex tetanica	Rigid Sedge	S3
Plant	Carex vulpinoidea	Fox Sedge	S3
Plant	Caulophyllum thalictroides	Papoose-root	S2
Plant	Ceanothus herbaceus	New Jersey Tea	S2S3
Plant	Chrysosplenium iowense	Iowa Golden-saxifrage	S1

Category	Scientific Name	Common Name	Rank
Plant	Cladium mariscoides	Twig Rush	S2S3
Plant	Clematis ligusticifolia	Western Virgin's-bower	S1
Plant	Clematis virginiana	Virgin's-bower	S2?
Plant	Corallorhiza striata	Striped Coralroot	S3S4
Plant	Corispermum villosum	Hairy Bugseed	S1S2
Plant	Cyperus erythrorhizos	Red-root Flatsedge	S1
Plant	Cyperus houghtonii	Houghton's Umbrella-sedge	S2S3
Plant	Cypripedium arietinum	Ram's Head Lady's-slipper	S2S3
Plant	Cypripedium candidum	Small White Lady's-slipper	S1
Plant	Desmodium canadense	Beggar's-lice	S2
Plant	Drosera anglica	Oblong-leaved Sundew	S3S4
Plant	Epilobium brachycarpum	Annual Willowherb	SU
Plant	Festuca hallii	Plains Rough Fescue	S3
Plant	Fraxinus nigra	Black Ash	S2S3
Plant	Gentiana rubricaulis	Closed Gentian	S3
Plant	Geranium maculatum	Wild Crane's-bill	S1
Plant	Goodyera tesselata	Tesselated Rattlesnake Plantain	S2
Plant	Helianthus pauciflorus ssp. pauciflorus	Stiff Sunflower	SU
Plant	Hudsonia tomentosa	False Heather	S3
Plant	Hypoxis hirsuta	Yellow Stargrass	S3S4
Plant	Krigia biflora	Two-flowered Dwarf-dandelion	S2S3
Plant	Lactuca floridana	Woodland Lettuce	SH
Plant	Lechea intermedia	Pinweed	S1?
Plant	Leucophysalis grandiflora	Large White-flowered Ground-cherry	S3S4
Plant	Linum sulcatum	Grooved Yellow Flax	S3
Plant	Liparis loeselii	Yellow Twayblade	S3S4
Plant	Lomatium foeniculaceum	Hairy-fruited Parsley	S3
Plant	Lomatium macrocarpum	Long-fruited Parsley	S2S3
Plant	Lysimachia quadriflora	Whorled Loosestrife	S2
Plant	Maianthemum racemosum	False Spikenard	S1
Plant	Malaxis monophyllos	White Adder's-mouth	S2?
Plant	Malaxis paludosa	Bog Adder's-mouth	S1?
Plant	Malaxis unifolia	Green Adder's-mouth	S2?
Plant	Muhlenbergia andina	Foxtail Muhly	S1
Plant	Nassella viridula	Green Needle Grass	S3S4

Category	Scientific Name	Common Name	Rank
Plant	Oenothera perennis	Sundrops	S1
Plant	Onoclea sensibilis	Sensitive Fern	S3?
Plant	Ophioglossum pusillum	Northern Adder's-tongue	S1
Plant	Orobanche fasciculata	Clustered Broom-rape	S3
Plant	Orobanche ludoviciana	Louisiana Broom-rape	S2
Plant	Osmunda claytoniana	Interrupted Fern	S2S3
Plant	Oxytropis lambertii	Purple Locoweed	S3
Plant	Parietaria pensylvanica	American Pellitory	S3S4
Plant	Parnassia parviflora	Small Grass-of-parnassus	S1
Plant	Pellaea gastonyi	Gastony's Cliffbrake	S1
Plant	Pellaea glabella	Smooth Cliffbrake	S2
Plant	Pellaea glabella ssp. occidentalis	Western Dwarf Cliffbrake	S2
Plant	Penthorum sedoides	Ditch-stonecrop	S1S2
Plant	Phryma leptostachya	Lopseed	S3
Plant	Physostegia virginiana	False Dragonhead	S4
Plant	Platanthera orbiculata	Round-leaved Bog Orchid	S3S4
Plant	Platanthera praeclara	Western Prairie Fringed Orchid	S1
Plant	Polygala verticillata	Whorled Milkwort	S2
Plant	Pyrola americana	Round-leaved Pyrola	S2?
Plant	Ranunculus hispidus var. caricetorum	Bristly Buttercup	S2
Plant	Rhynchospora alba	White Beakrush	S3
Plant	Rhynchospora capillacea	Horned Beakrush	S2S3
Plant	Sceptridium multifidum	Leathery Grape-fern	S3
Plant	Selaginella densa	Prairie Spike-moss	S3
Plant	Selaginella selaginoides	Low Spike-moss	S3S4
Plant	Sisyrinchium campestre	White-eyed Grass	S3
Plant	Solidago riddellii	Riddell's Goldenrod	S2S3
Plant	Spiranthes magnicamporum	Great Plains Ladies'-tresses	S1S2
Plant	Symphyotrichum ericoides var. ericoides	White heath aster	S3?
Plant	Symphyotrichum sericeum	Western Silvery Aster	S2S3
Plant	Teucrium canadense	American Germander	S3
Plant	Thalictrum revolutum	Waxleaf Meadow-rue	S1
Plant	Utricularia cornuta	Horned Bladderwort	S3S4
Plant	Utricularia minor	Lesser Bladderwort	S3
Plant	Vaccinium caespitosum	Dwarf Bilberry	S3
Plant	Vernonia fasciculata	Western Ironweed	S1

Category	Scientific Name	Common Name	Rank
Plant	Veronicastrum virginicum	Culver's-root	S1S2
Plant	Viola labradorica	Early Blue Violet	S3
Plant	Vitis riparia	Riverbank Grape	S3S4
Reptile	Chelydra serpentina	Snapping Turtle	S3
Reptile	Opheodrys vernalis	Smooth Green Snake	S3S4
Reptile	Thamnophis radix	Western Plains Garter Snake	S4
Reptile	Thamnophis sirtalis	Red-sided Garter Snake	S4
Reptile	Thamnophis sirtalis parietalis	Red-sided Garter Snake	S4

APPENDIX G

GOVERNMENT CORRESPONDENCE

Gene Senior

From: Murray, Colin (SD) <Colin.Murray@gov.mb.ca>
Sent: Thursday, January 10, 2019 2:32 PM
To: Gene Senior
Subject: Data request Senior KGS 2019 SAR Netley-Libau Marsh

Hi Gene
Thank you for your information request. I completed a search of the Manitoba Conservation Data Centre's (CDC) rare species database for your area of interest. This includes the primary locations identified in the request's attached shapefile as areas 1 and 2; and a two kilometer radius buffer from the edge of each location.

The search resulted in the following occurrences:

Within the footprint or primary location(s):
Location 1 (north area of the delta):
No listed or tracked species occurrences found at this time.

Location 2 (south area of the delta):

TAXGROUP	SCINAME	COMNAME	SRANK	ESEA	SARA	COSEWIC
Vertebrate Animal	Aechmophorus occidentalis	(Western Grebe)	S4B	NA	Special Concern	Special Concern

Within 2km of the footprint boundary:
2km radius area around Location 1 (north area of the delta):

TAXGROUP	SCINAME	COMNAME	SRANK	ESEA	SARA	COSEWIC
Vertebrate Animal	Aechmophorus occidentalis	(Western Grebe)	S4B	NA	Special Concern	Special Concern

2km radius area around Location 2 (south area of the delta):

TAXGROUP	SCINAME	COMNAME	SRANK	ESEA	SARA	COSEWIC
Vertebrate Animal	Ichthyomyzon castaneus	(Chestnut Lamprey)	S3	NA	Special Concern	NA
Vertebrate Animal	Aechmophorus occidentalis	(Western Grebe)	S4B	NA	Special Concern	Special Concern

General area records low locational accuracy:
For both locations:

TAXGROUP	SCINAME	COMNAME	SRANK	ESEA	SARA	COSEWIC

Vertebrate Animal	Coturnicops noveboracensis	(Yellow Rail)	S3B	NA	Special Concern	Special Concern
Vertebrate Animal	Sterna forsteri	(Forster's Tern)	S4B	NA	NA	NA
Vascular Plant	Alisma gramineum	(Narrow-leaved Water-plantain)	S1	NA	NA	NA
Vascular Plant	Cyperus erythrorhizos	(Red-root Flatsedge)	S1	NA	NA	NA

Found in broader area and similar habitat:

TAXGROUP	SCINAME	COMNAME	SRANK	ESEA	SARA	COSEWIC
Vertebrate Animal	Dolichonyx oryzivorus	(Bobolink)	S4B	NA	Threatened	Threatened

Further information on this ranking system can be found on our website at: http://www.gov.mb.ca/sd/cdc/consranks.html.
These designations can be found at:
http://web2.gov.mb.ca/laws/statutes/ccsm/e111e.php,
https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife.html and
http://www.sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1.

Manitoba's recommended setback distances can be found at: http://www.gov.mb.ca/sd/cdc/pubs.html.

The information provided in this letter is based on existing data known to the Manitoba CDC of the Wildlife and Fisheries Branch at the time of the request. These data are dependent on the research and observations of CDC staff and others who have shared their data, and reflect our current state of knowledge. **An absence of data does not confirm the absence of any rare or endangered species.** Many areas of the province have never been thoroughly surveyed, however, and the absence of data in any particular geographic area does not necessarily mean that species or ecological communities of concern are not present. The information should, therefore, not be regarded as a final statement on the occurrence of any species of concern nor should it substitute for on-site surveys for species or environmental assessments. Also, because our Biotics database is continually updated and because information requests are evaluated by type of action, any given response is only appropriate for its respective request.

Please contact the Manitoba CDC for an update on this natural heritage information if more than six months passes before it is utilised.

Third party requests for products wholly or partially derived from the Biotics database must be approved by the Manitoba CDC before information is released. Once approved, the primary user will identify the Manitoba CDC as data contributors on any map or publication using data from our database, as the Manitoba Conservation Data Centre; Wildlife and Fisheries Branch, Manitoba Sustainable Development.

This letter is for information purposes only - it does not constitute consent or approval of the proposed project or activity, nor does it negate the need for any permits or approvals required by the Province of Manitoba.

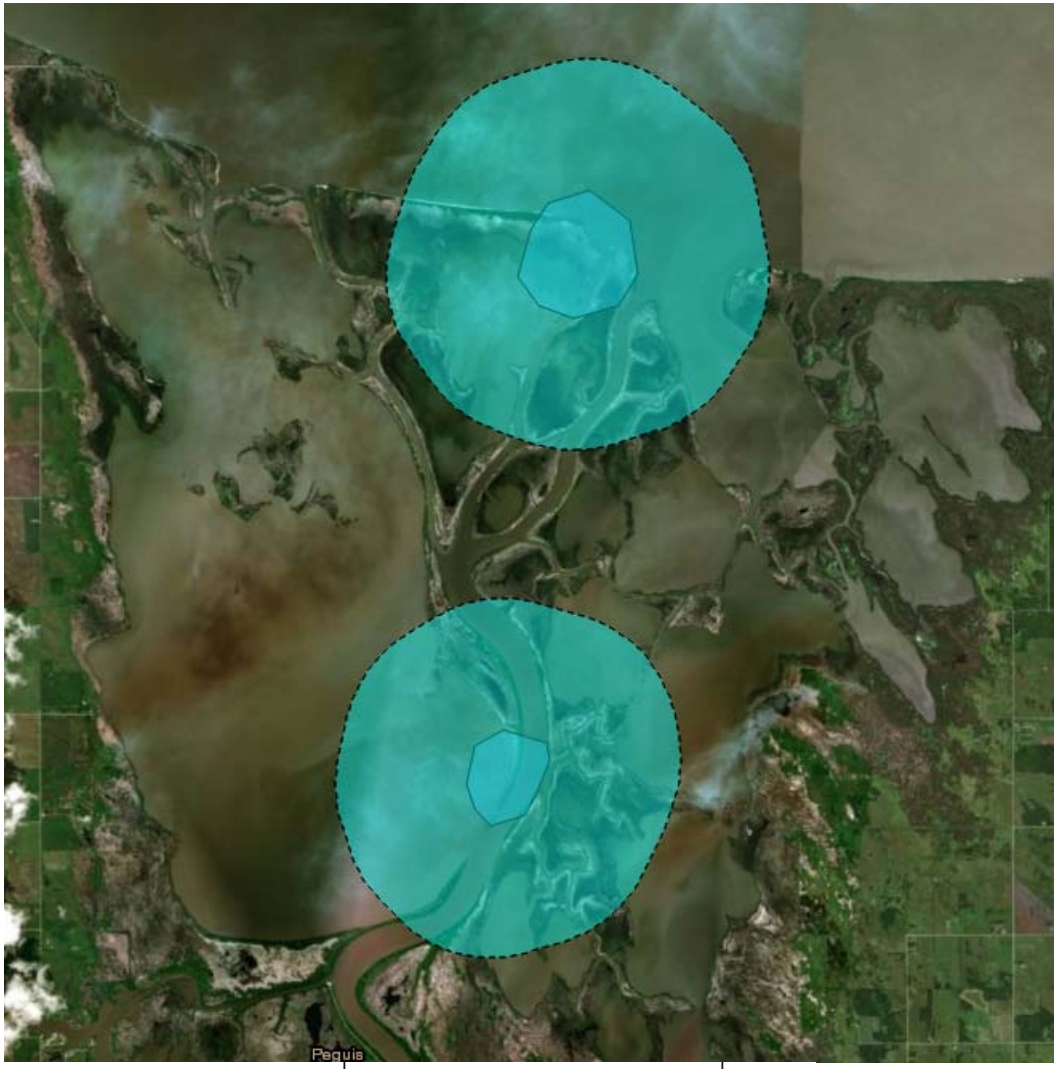
We would be interested in receiving a copy of the results of any field surveys that you may undertake, to update our database with the most current knowledge of the area.

If you have any questions or require further information contact me directly at (204) 945-7760.

Colin

Reference screen clip:


1
2
Table
Netley
FID
Shape
id
0
Polygon
1
1
Polygon
2
0
(0 out of 2 Selected)
Netley



Colin Murray
Information Manager
Manitoba Conservation Data Centre
Wildlife and Fisheries Branch
Department of Sustainable Development

200 Saulteaux Crescent
Winnipeg, Manitoba, R3J3W3
204-945-7760
colin.Murray@gov.mb.ca
http://www.gov.mb.ca/sd/cdc/index.html

From: Gene Senior <gsenior@kgsgroup.com>
Sent: January-03-19 11:26 AM
To: Murray, Colin (SD) <Colin.Murray@gov.mb.ca>
Subject: Data request: Species at risk - Netley-Libau Marsh

Colin:

KGS Group, the Red River Basin Commission (RRBC) and the University of Manitoba are conducting a pilot study at the mouth of the Red River. The RRBC and its partners are undertaking a restoration pilot project in a small section of Hardmans Lake and Netley Lake to examine the feasibility of restoring the Netley-Libau Marsh. Specific sections of the Red River will be dredged using Amphibexes (currently utilized for ice breaking on the Red River in the spring). The material dredged from the river will be pumped into Hardmanns Lake to construct "islands" or mud flats: shallow-water habitat appropriate for the growth of cattails and other wetland vegetation.

The attached shape file (coordinate reference system: NAD 83, UTM Zone 14N) includes the area of interest for the study. I have included a JPEG for reference as well.

We are requesting information regarding the locations of any plant, wildlife or aquatic Species at Risk occurrences on or near the project land. The information will be used to assess potential project impacts on species at risk and their habitat (if any) and to develop appropriate mitigation measures and follow-up.

If you have any questions, please don't hesitate to contact me.
Thank you,

Gene Senior <gsenior@kgsgroup.com>
Environmental Scientist

KGS GROUP CONSULTING ENGINEERS

865 Waverley Street
Winnipeg, Manitoba R3T 5P4
ph: 204.896.1209 ext. 357
fx: 204.896.0754
txt: 204.218.3285
http://www.kgsgroup.com

Gene Senior

From: McClean, Heather (SCH) <Heather.McClean@gov.mb.ca>
Sent: Friday, January 04, 2019 2:05 PM
To: Gene Senior
Cc: Tsukamoto, Suyoko (SCH); Cote, Holly (SCH); Nesbitt, Christina (SCH); Blomquist, Perry (SCH)
Subject: FW: Heritage data request: Netley-Libau Marsh
Attachments: Netley.dbf; Netley.prj; Netley.qgs; Netley.qpj; Netley.shp; Netley.shx

Hi Gene: A search of the database reveals that there are no **known** heritage/archaeological resources located within a 1km buffer of the two study areas.

Thank you.

Heather McClean
Heritage Resources Registrar
Historic Resources Branch
Main Floor, 213 Notre Dame Avenue
Winnipeg, MB R3B 1N3
Heather.McClean@gov.mb.ca
Phone: (204) 945-7146
Fax: (204) 948-2384

From: +WPG574 - HRB Archaeology (SCH) <HRB.archaeology@gov.mb.ca>
Sent: January 4, 2019 12:43 PM
To: McClean, Heather (SCH) <Heather.McClean@gov.mb.ca>
Subject: FW: Heritage data request: Netley-Libau Marsh

FYI

From: Gene Senior <gsenior@kgsgroup.com>
Sent: January-03-19 11:24 AM
To: +WPG574 - HRB Archaeology (SCH) <HRB.archaeology@gov.mb.ca>
Subject: Heritage data request: Netley-Libau Marsh

KGS Group, the Red River Basin Commission (RRBC) and the University of Manitoba are conducting a pilot study at the mouth of the Red River. The RRBC and its partners are undertaking a restoration pilot project in a small section of Hardmans Lake and Netley Lake to examine the feasibility of restoring the Netley-Libau Marsh. Specific sections of the Red River will be dredged using Amphibexes (currently utilized for ice breaking on the Red River in the spring). The material dredged from the river will be pumped into Hardmanns Lake to construct "islands" or mud flats: shallow-water habitat appropriate for the growth of cattails and other wetland vegetation.

We are requesting the location and description of any known heritage or archaeological resources located on or near the project land.

The attached shape file (coordinate reference system: NAD 83, UTM Zone 14N) includes the area of interest for the study. I have included a JPEG for reference as well.
Thank you!

Gene Senior <gsenior@kgsgroup.com>
Environmental Scientist

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