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IN THE MATTER OF AN ARBITRATION
UNDER ANNEX 14-C OF THE CANADA-UNITED STATES-MEXICO AGREEMENT (CUSMA), CHAPTER ELEVEN OF THE NORTH AMERICAN FREE TRADE AGREEMENT AND THE 2013 UNCITRAL ARBITRATION RULES

BETWEEN:

WINDSTREAM ENERGY LLC

Claimant

and

GOVERNMENT OF CANADA

Respondent

CLAIMANT'S THIRD BOOK OF EXPERT REPORTS
VOLUME 2 OF 3

TAB NOS. 5 - 7

TORYS LLP

Torys LLP
Suite 3000
79 Wellington St. W.
Box 270, TD Centre
Toronto, Ontario
Canada M5K 1N2

John Terry
Rachael Saab
Emily Sherkey
Jake Babad

Counsel for the Claimant,
Windstream Energy LLC

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TAB 5

WINDSTREAM ENERGY LLC

WINDSTREAM ENERGY LLC AND GOVERNMENT OF CANADA

RENEWABLE ENERGY APPROVAL AND PERMITTING

FEBRUARY 18, 2022

WINDSTREAM ENERGY LLC AND GOVERNMENT OF CANADA

RENEWABLE ENERGY APPROVAL AND PERMITTING

WINDSTREAM ENERGY LLC

PROJECT NO.: 211-00429-00
DATE: FEBRUARY 18, 2022

WSP
100 COMMERCE VALLEY DRIVE WEST
THORNHILL, ON
CANADA L3T 0A1

T: +1 905 882-1100
F: +1 905 882-0055
WSP.COM

February 18, 2022

WINDSTREAM ENERGY LLC
35 Faircrest Blvd
Kingston ON
K7L 4V1

Attention: Ian Baines

Dear Sir:

Subject: Windstream Wolfe Island Shoals REA and Permitting Review

WSP is pleased to submit this Updated REA and Permitting update with respect to the Wolfe Island Shoals Wind Project.

Thank you for the opportunity to complete this assignment. Please contact the undersigned if you have any comments or concerns

Yours sincerely,

C. Gentile

Catherine Gentile, MCIP, RPP
Team Lead – Environmental Assessment (GTA)
Earth & Environment

WSP ref.: 211-00429-00

100 COMMERCE VALLEY DRIVE WEST
THORNHILL, ON
CANADA L3T 0A1

T: +1 905 882-1100
F: +1 905 882-0055
wsp.com

SIGNATURES

APPROVED BY

February 18, 2022

Catherine Gentile, MCIP, RPP
Team Lead – Environmental Assessment (GTA)
Earth & Environment

Date

WSP Canada Inc. prepared this report solely for the use of the intended recipient, WINDSTREAM ENERGY LLC, in accordance with the professional services agreement. The intended recipient is solely responsible for the disclosure of any information contained in this report. The content and opinions contained in the present report are based on the observations and/or information available to WSP Canada Inc. at the time of preparation. If a third party makes use of, relies on, or makes decisions in accordance with this report, said third party is solely responsible for such use, reliance or decisions. WSP Canada Inc. does not accept responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken by said third party based on this report. This limitations statement is considered an integral part of this report.

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CONTRIBUTORS

CLIENT

Windstream Energy	Nancy Baines
Windstream Energy	Ian Baines
ORTECH Consulting	Hank van Bakel

WSP

Team Lead – Environmental Assessment (GTA)	Catherine Gentile
Project Ecologist	Robin LeCraw
ERI Specialist	Matthew Breakey
Indigenous Relations Lead	Douglas Yahn

EXECUTIVE SUMMARY

Conclusions

WSP updated a detailed, comprehensive permitting and approval schedule for the Project that considers regulatory changes since the NAFTA arbitration proceedings held in 2014 and 2015 ("NAFTA1"), notably the federal *Fisheries Act,* the federal *Impact Assessment Act* and changes to Ontario's *Endangered Species Act.* The scheduling confirms the major permitting milestones schedule. Overall, the schedule for completing the required and anticipated studies, reports and authorizations for the Renewable Energy Approval ("REA") and the noted permits and authorizations as detailed is 36 months (3 years). This is consistent with ORTECH's analysis of the approval times for large REA projects[1]. In WSP's opinion, but for the moratorium and the revocation of the FIT contract there are no material impediments in completing required and anticipated studies for the REA and other permits and authorizations. The nearby Kingston Third Crossing of the Cataraqui River project exhibits similar characteristics with respect to multijurisdictional permits, in-water works, potential drinking water threats and was successfully brought to construction.

The Project Schedule[2] includes the base Renewable Energy Approval technical submission documents, plus the additional studies outlined by the *DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects* under the REA Regulation[3]. The comprehensive schedule considers the mandatory public consultation process and timelines for publishing notices, holding public meetings and publishing draft documentation for Indigenous communities, municipalities and the public[4]. The Project Schedule's timelines are based on WSP's experience planning and completing REA projects. Agency reviews are based on statutory, published service standards or common timelines.

Background

On November 25, 2010, WSP Canada Inc ("WSP") (then GENIVAR) submitted a proposal in response to the request for proposal issued by ORTECH on Windstream's behalf for permitting and field investigation services for the Wolfe Island Shoals off-shore wind project. This proposal included work required to apply for REA. Our proposal included the full suite of studies required to apply for federal and provincial approvals. Our proposal acknowledged that there were project development risks (which is common to the development of all project types), that the Project would be the "first environmental assessment for an offshore wind facility in Canada" and that the Project would be "the first project of its type." However, to overcome the risks that we had identified and to avoid potential project delays, our execution strategy stressed that it would be based on early and frequent consultation with key agencies, strategic direction by our experienced team of environmental consultants, and our relevant technical expertise. Consistent with our work conducting environmental assessments, we identified numerous measures to avoid potential delays in the permitting of the Project, including early and frequent consultation with key agencies, and including team members with previous experience in offshore wind development.

On March 25 2015, WSP was retained by Windstream Energy LLC ("Windstream") to prepare an updated overall permitting schedule, developed in collaboration with Sgurr Energy, Baird & Associates Costal Engineering, Ocean-COWI and Weeks Marine, to respond to comments in the URS Windstream Arbitration Technical Report dated

[1] **C-2351,** L. Sun, ORTECH Report entitled "Timelines for REA Approved Large Wind Farm Projects – DRAFT for Discussion", to N. Bains, Windstream Energy Inc. (March 10, 2021).
[2] **C-2347,** ORTECH Development Programme Rev. 02., entitled "Wolfe Island Shoals Development Programme" (February 8, 2021).
[3] **C-0452,** Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.
[4] **C-2378**, Environmental Protection Act, Ontario Regulation 359/09, Sections 14, 15, 16.

January 20, 2015 ("URS Report"). The report was prepared in support of NAFTA1. WSP's report[5] made the following conclusions:

- But for the moratorium the REA and a federal screening under the Canadian Environmental Assessment Act ("CEAA") could have been achieved within a three-year development period.
- Aviation and radar interference issues were not a material risk. The Project was not located within the 10 km consultation zone of any Canadian aerodrome, the 50 km consultation zone for weather radar, or the 80 km consultation zone for NAV CANADA radar installations. Additionally, the Project Location was not within the 20,0000-foot consultation zone from American Soil for the United States Federal Aviation Administration.
- URS overstated risks around bird and bat surveying and permitting. Bird and bat surveys and associated studies are standard components of the REA natural heritage reporting and were included in the schedule.
- URS overstated the risk for turbine noise and noise impacts. Noise impact studies were conducted which demonstrated compliance with noise guidelines. Furthermore, as a standard condition of the REA, WIS would need to ensure that its turbines operated at the appropriate noise levels, and it would be required to complete acoustic audits to validate the modeling.
- URS overstated the risks for consultation on the Project. Consultation activities were accounted for in the Project Schedule. A consultation process for Indigenous communities, municipalities and the general public are outlined in the REA process. This is a streamlined mandatory consultation process with a specific set of consultation activities and the timing for notices and publications.
- URS overstated the risks for making modifications to the Project, including turbine locations or other components. In WSP's experience, project modifications are a normal part of the development process for renewable energy projects. Changes are required in the Draft Project Description Report filed as part of the REA in order to accommodate inputs from stakeholders, to respond to the environmental information derived from studies performed. Documenting changes and how a project proponent addresses comments from stakeholders is part of the final consultation document, which is required for a REA application. Furthermore, the MOE recognized that design and technical changes are a part of the development process, and it outlines the process to recognize and document changes in its Technical Guide[6].

On December 10, 2020 WSP was retained by Windstream to support a second round of NAFTA Arbitration proceedings ("NAFTA2"). WSP understands that NAFTA2 proceedings were launched in response to the government notification to Windstream on February 18, 2020 that the power purchase agreement (Feed-in-Tariff contract) issued for the Project has been cancelled. WSP's mandate was to review the NAFTA1 report and answer the following questions:

- What regulatory changes have occurred for the REA process or other environmental approvals since NAFTA1?
- What is the impact of these regulatory changes on the permitting and approvals segment of the development schedule?
- Are there any changes to WSP's conclusions on interference with communications or navigation radar?

WSP's previous study has been recently reviewed and has been updated to include regulatory changes since NAFTA1. WSP concludes that at the time of writing, this Study presents an accurate reflection of the expected permitting and approvals required to develop the Project. This study considers current information and experience since NAFTA1 and provides an opinion on the feasibility of the Project should it have been allowed to re-start the development process in February 2020 in the absence of restrictions imposed by the government.

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[5] **C-2018,** WSP Canada Inc. Report entitled "Windstream Energy LLC and Government of Canada Renewable Energy Approval and Permitting." (June 2015).
[6] **C-1983,** Ministry of the Environment Report entitled "Technical Guide to Renewable Energy Approvals" (2013).

WSP's Wind Energy Experience

WSP is an industry leader who has been delivering Wind Energy expertise to clients across the globe for nearly 30 years. WSP's team of dedicated wind energy engineers, permit specialists and environmental professionals has developed extensive experience providing technical services for hundreds of wind projects and various clients. This experience includes expertise in performing energy modelling; energy assessments; conceptual engineering; permitting and approvals; environmental studies; due diligence and lender's engineering services; Owner's engineering; detailed engineering design; and construction support.

WSP's Indigenous Consultation Experience

WSP provides technical expertise and strategic advice to Indigenous clients and those of our non-Indigenous clients working with Indigenous communities in a variety of sectors such as Energy, Transportation & Infrastructure, Property & Buildings, and Environment, Industry, Resources (including Mining and Oil & Gas). WSP offers project and program delivery and advisory services through ongoing, transparent and effective communication and engagement. Our experts include Indigenous Relations specialists, archaeologists, anthropologists, engineers, advisors, technicians, scientists, architects, planners and environmental specialists, as well as other design, program and construction management professionals. We are committed to identifying and maximizing opportunities for Indigenous clients and communities while applying our expertise in protecting cultural resources. By forming strategic partnerships with local Indigenous experts, we are strategically placed to understand the needs, expectations and beliefs of communities and respectfully apply traditional knowledge to projects and studies.

Permitting and Approvals Approach and Context

From the establishment of the Project, the WIS team would have developed a Quality Management System to list, manage and track environmental commitments and stakeholder approvals. Key elements include an approval working group ("AWG"), a dedicated lead Permits, Licences, Agreements and Approval ("PLAA") specialist, and maintenance of Project-wide approval registry. A key component of the PLAA strategy is early and frequent consultation with the approval agencies prior to any submissions.

WSP outlined the 2015 (NAFTA1) regulatory context for the WIS Project and updated the major PLAA required to develop the project to the 2020 context. Notable changes in regulatory context and updated information includes:

- The provincial REA is still required. No new guidance has been provided with the completion of 5 technical studies commissioned by Ontario. As in NAFTA1 , the Project uses the Draft checklist for off-shore projects[7];
- The replacement of the *Canadian Environmental Assessment Act* ("CEAA 2012") with the Federal *Impact Assessment Act* ("IAA"). As the WIS project is not Designated, it may require a "screening" if a federal authority exercises a power or funds the project. This has been accounted for in the overall Project schedule.
- Updated consideration of aerodromes, radar infrastructure and communications links for Transport Canada Aeronautical Obstruction Clearance and NAV CANADA land use applications. There are no impediments to the Project;
- The federal *Fisheries Act* has been updated with new guidelines. Timelines have been updated in the Project schedule.

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[7] **C-0452,** Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

The Renewable Energy Approval

Wood coordinated an overall development schedule for the Project[8]. WSP was asked to review and verify the REA and permitting activities, durations and linkages. The schedule timelines provided by WSP are based on our experience planning and obtaining REAs for renewable energy projects, including onshore wind projects in Ontario. Agency reviews are based on statutory, published service standards or common timelines based on our experience. The development timeframe of 36 months is consistent with the development timeframes of other large (>100 MW) REA projects in Ontario[9].

WSP prepared an updated plan for completing a full REA application and associated permitting for the Project. This includes the studies required under the REA Regulation, and includes those expected to be required to complete an Offshore Wind Facility Report[10]. Additional anticipated technical studies including hydrodynamic modelling, ice studies, wind/wave/water studies, coastal engineering and other technical reports have been included in the NAFTA2 Project Schedule. As documented in NAFTA1, the MOE was developing a set of requirements for a REA submission for off-shore wind projects. The list would have been used to confirm the completeness of an application, which is the first step of review[11]. These proposed studies in the schedule would have completed all the required material outlines in the submission checklist.

WSP included the mandatory REA consultations, complete with the appropriate timing for notifications, public meetings and the release of Draft reports to Indigenous communities, municipalities and the public in the Project Schedule. It is understood that the scope and provincial expectations around Indigenous consultation has evolved since NAFTA1. To address this, WSP has accounted for enhanced consultation and engagement activities including opportunities to develop positive working relationships with Indigenous communities that will extend through the life of the Project. Furthermore, the Project Schedule incorporates outreach efforts by Windstream to offer partnership sharing opportunities with Indigenous communities. These partnership opportunities would provide a basis for developing a business to business relationship with Indigenous communities to further enhance their participation and benefit in the Project.

Federal Impact Assessment Act

It is unlikely that the IAA would apply to the Project as the Project is not situated on federal lands, it would not be financed by federal authorities and it does not appear as a Designated Project. Nonetheless, for completeness a screening per the guidance document Projects on Federal Lands Interim Guidance on section 81 to 91 of the Impact Assessment Act[12] is included in the Project schedule.

Sections 82 through 91 of the IAA require that federal authorities that exercise power or finance a project must conduct a review (e.g. a "screening") to determine whether a project is likely to cause significant adverse environmental effects before making any decision that would allow a project to proceed.

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[8] **C-2347,** ORTECH Development Programme Rev. 02., entitled "Wolfe Island Shoals Development Programme" (February 8, 2021).
[9] **C-2351,** L. Sun, ORTECH Report entitled "Timelines for REA Approved Large Wind Farm Projects – DRAFT for Discussion", to N. Bains, Windstream Energy Inc. (March 10, 2021).
[10] **C-0452,** Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.
[11] **C-0452,** Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.
[12] **C-2235,** Impact Assessment Act, S.C. 2019, c. 28, s. 1

Radar and Communications Interference

WSP has demonstrated through GIS mapping that there are no material concerns with interference from the Project with respect to aeronautical infrastructure, weather radar, or communications links. Further there are no concerns regarding United States airports, wind farms or a consultation with a coastline (Lake Ontario) 20,000-foot buffer to the Project Area as required by the Federal Aviation Administration ("FAA")[13].

Fisheries Act

New provisions in the federal *Fisheries Act* since NAFTA1 do not pose any additional schedule risk to the Project. The Project Schedule has been constructed with the assumption that a Department of Fisheries and Oceans ("DFO") Authorization would be required. Additional Indigenous consultation required as part of DFO reviews are accommodated in the Project Schedule. Representative and published review and approval guidelines have been used in the development of the schedule.

Federal Species at Risk

Baird[14] concluded that listed species in the federal Species at Risk Act are unlikely to be present in the Project area[15]. If required, the work for SARA permits would be done concurrently with the REA, posing low risk to the Project Schedule. The need for permits under SARA would be determined as part of the routine agency consultation and field investigation components of the study. These consultation activities are reflected in the Project Schedule. Early consultation allows for the implementation of targeted surveys or adjustments to the proposed design layout in the event a permit under SARA was deemed necessary.

Conservation Authorities

The landing area for the submarine cable to connect the Project to the provincial electrical system, and any other associated works is located in an area regulated by the Cataraqui Conservation. A Permit under the Conservation Authorities Act, s28 – Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 148/06), is required. This process has not changed since NAFTA1, and such permits are routine and typically occur during the detailed design of the Project. This permitting activity has been included in the Project Schedule.

Endangered Species

Since NAFTA1 in 2015, the agency now responsible for the ESA has been changed from the MNR to the MECP. Since 2015, the list of species at risk in Ontario has been updated three times: June 15, 2016; June 2, 2017; and August 1, 2018.

Baird[16] affirms that none of the additional species listed in the updated list are expected to have suitable habitat in the Project Area. However, if required, the process to obtain ESA permits is well-established and is frequently completed in support of development applications.

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[13] **C-2389,** Federal Aviation Administration Analysis entitled "Obstruction Evaluation / Airport Airspace Analysis (OE/AAA)" (September 20, 2021).

[14] **C-2413,** W.F. Baird and Associates Coastal Engineers. Ltd. Report entitled "Windstream Wolfe Island Shoals Offshore Wind Energy Project NAFT 2 Lake Ontario Context." (November 26, 2021).

[15] **C-2413,** W.F. Baird and Associates Coastal Engineers. Ltd. Report entitled "Windstream Wolfe Island Shoals Offshore Wind Energy Project NAFT 2 Lake Ontario Context." (November 26, 2021).

[16] **C-2413,** W.F. Baird and Associates Coastal Engineers. Ltd. Report entitled "Windstream Wolfe Island Shoals Offshore Wind Energy Project NAFT 2 Lake Ontario Context." (November 26, 2021).

Crown Land Site Release

These permits are included in the Project Schedule and the process has not changed since NAFTA1. Applications for Crown Land site release, and Work Permits per the *Public Lands Act* have been included in the Project Schedule. Public Lands Act Work permits would be required for the construction of the Project foundations, submarine cable system and other works on the lakebed. Work Permit applications are completed in the detailed design phase of the project and are not on the critical path of the Project Schedule.

GLOSSARY

AWG	Approvals Working Group
CEAA	Canadian Environmental Assessment Act
CFB	Canadian Forces Base
CWS	Canadian Wildlife Service
DFO	Department of Fisheries and Oceans
DIA	Detailed Impact Assessment
DND	Department of National Defence
EA	Environmental Assessment
ECA	Environmental Compliance Approval
EPC	Engineer, procure, construct
ERT	Environmental Review Tribunal
ESA	Ontario Endangered Species Act
FAA	Federal Aviation Administration
FIT	Feed-in-tariff
GIS	Geographic Information Systems
HADD	Harmful alteration, disruption, or destruction
HONI	Hydro One Networks Inc.
IAA	Impact Assessment Act
IESO	Independent Electricity System Operator
KDM	Key Development Milestone
MECP	Ministry of the Environment, Conservation and Parks
MHSTCI	Ministry of Heritage, Sport, Tourism and Culture Industries
MNDMNRF	Ministry of Northern Development, Mines, Natural Resources and Forestry
MNR	Ministry of Natural Resources, now MNDMNRF
MNRF	Ministry of Natural Resources and Forestry, now Ministry of Northern Development, Mines, Natural Resources and Forestry
MOE	Ministry of the Environment, now MECP
MW	Megawatt
OPA	Ontario Power Authority, now IESO
PLAA	Permits, Licenses, Agreements and Approvals
PTTW	Permit to take water
REA	Renewable Energy Approval
RFP	Request for Proposal
SARA	Species at Risk Act
VHF	Very High Frequency
VOR	Very High Frequency Omni-Directional Range
WIS	Wolfe Island Shoals, the Project

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1 INTRODUCTION

1.1 WSP'S NAFTA1 STUDIES

WSP Canada Inc. (WSP) previously conducted a study for Windstream Energy Inc. (Windstream) in support of the NAFTA arbitration proceedings held in 2014 and 2015 (NAFTA1) related to the Wolfe Island Shoals (WIS) off-shore wind farm (the Project). This study is provided in Appendix A to this report for convenience. This previous study has been recently reviewed and updated to include regulatory changes since NAFTA1. WSP concludes that at the time of writing, the Study presented an accurate response to Canada's expert report on permitting and approvals save the following: WSP noted one error in the NAFTA1 Project Schedule related to bat surveys and studies. The timeframe was not shown correctly as the studies began too early. However, as bird and bat studies are conducted concurrently and the bird window is correct, there is no change in the overall development schedule of 36 months.

It is our understanding that on February 18, 2020, the government notified Windstream that the power purchase agreement (Feed-in-Tariff contract) issued for the Project has been cancelled. In response, Windstream submitted a Notice of Intent (February 2020) and Notice of Arbitration (November 2020), the initial steps in a second round of NAFTA arbitration proceedings (referred to in this report as NAFTA2).

In support of NAFTA2, WSP conducted a detailed review of the key conclusions related to the feasibility of the Project from an environmental permitting and scheduling perspective. This study considers current information and experience since NAFTA1 and provides an opinion on the feasibility of the Project should it have been allowed to re-start the development process in February 2020 in the absence of restrictions imposed by the government. The objective of this current study is to assess the feasibility of the Project should it have been allowed to progress in the absence of ("but for") restrictions imposed by various government agencies including:

- Proposed 5 km shoreline exclusion zone from off-shore wind development (Note: although this proposal does not appear to have been promulgated, the Project is designed to meet this proposed setback requirement) – MOE/MECP (June 2010);
- Removal of off-shore wind from the amended site release policy – MNR (June 2010);
- Proposed removal of additional areas from off-shore wind development – MNR (August 2010);
- Moratorium on off-shore wind development – MOE/MECP (February 2011);
- Removal of off-shore wind from the Technical Guide to Renewable Energy Approvals – MOE/MECP (April 2019);
- Cancellation of the FIT Contract – OPA / IESO (February 2020).

Note: In the absence of these government restrictions, the grid connection at the nearby Lennox Generating Station is considered to remain valid and committed to the Project as per the assessments conducted by IESO/HONI (2010).

2 EXPERIENCE

2.1 WSP WIND ENERGY EXPERIENCE

WSP is an industry leader who has been delivering Wind Energy expertise to clients across the globe for nearly 30 years. WSP's team of dedicated wind energy engineers, permit specialists and environmental professionals have developed extensive experience providing technical services for hundreds of wind projects and various clients. This experience includes expertise in performing:

- Energy modelling;
- Energy assessments;
- Conceptual engineering;
- Permitting and approvals;
- Environmental studies;
- Due diligence and lender's engineering services;
- Owner's engineering;
- Detailed engineering design;
- Construction support.

In our work with wind farm owners, EPC contractors, turbine suppliers and lenders, we have earned a reputation for value-added services, quality and professionalism. Working with these different entities, WSP has developed unique and unmatched expertise in all technical aspects surrounding the development and execution of a wind project.

Furthermore, WSP differentiates itself from other firms involved in wind power through our commitment to excellence in quality and innovation. We are an integrated, multidisciplinary firm with the resources available to achieve a cost-effective and successful project. We offer many value additions that reflect our deep understanding of project needs:

- Strong experience in wind power project planning and wind resource assessment;
- Working for lenders;
- Permitting wind power projects;
- Finding innovative solutions;
- Construction management;
- Quality assurance inspection for equipment;
- Flexibility and responsiveness, due to our extensive pool of expertise.

By leveraging internal coordination across all the required engineering, permitting and environmental disciplines nationally, WSP is able to provide a solution-oriented design, which is in line with the industry's best practices. Our approach meets clients' needs and objectives, is constructible, and is managed by a single project manager and multiple expert design leads, all having extensive experience in wind projects across North America.

The table below provides a selected list of Wind Power projects completed by WSP.

Table 2-1: Selected Wind Projects

PROJECT NAME	CLIENT	LOCATION	CAPACITY (MW)	FACILITY ENGINEERING	CONSTRUCTION RELATED SERVICES	PERMITTING /ENVIRONMENTAL STUDIES
Vineyard Wind	Vineyard Wind	MA (offshore)	800	●		
Chaleur Ventus	Naveco Power	NB	20			●
Strauss Wind	BayWa	CA	101	●		
New Creek Wind	Enbridge	WV	103	●	●	
Sugar Creek Wind	Apex Energy	IN	200	●		
Ninnescah Wind	Westar	KS	200		●	
Zonnebeke and Sukunka	Natural Forces	BC	24	●		
Western Lily	Borea	SK	20	●	●	
Henvey Inlet	CER	ON	300	●	●	●
Wisokolamson	Wisokolamson Energy	NB	18	●		●
Richibucto	Enercon	NB	3	●		●
Nation Rise Wind Project	EDPR	ON	100	●		●
Sharp Hills Wind Project	EDPR	AB	250	●		
Forty Mile Wind Project	Suncor Energy	AB	200	●		
Shaunavon Wind Project	Suncor Energy	SK	100/200	●		
Grey Highland ZEP	Capstone Infrastructure	ON	10	●	●	●
Grey Highlands Clean Energy	Capstone Infrastructure	ON	20	●	●	●
Ganaraska	Capstone Infrastructure	ON	20	●	●	●

PROJECT NAME	CLIENT	LOCATION	CAPACITY (MW)	FACILITY ENGINEERING	CONSTRUCTION RELATED SERVICES	PERMITTING /ENVIRONMENTAL STUDIES
Snowy Ridge	Capstone Infrastructure	ON	10	●	●	●
Settlers Landing	Capstone Infrastructure	ON	10	●	●	●
Ernestown	Horizon Wind Inc.	ON	10	●		
Big Thunder	Horizon Wind Inc.	ON	16	●		
Forty Mile Wind Project	Suncor Energy	AB	200	●		
Shaunavon Wind Project	Suncor Energy	SK	200	●		
Riverhurst	Capstone Infrastructure	SK	25	●		
Éolienne Belle Rivière	Algonquin Power/Valéo	QC	25	●		
Meikle	Borea Construction	BC	180	●	●	
Niagara	Boralex / Enercon / Borea Construction	ON	231	●	●	
Côte-de-Beaupré	Boralex / MRC Côte-de-Beaupré	QC	25	●	●	
SWEB	SWEB/Vestas	NS	24	●	●	●
South Canoe	Acciona	NS	102	●	●	
Saint-Damase	Algonquin Power	QC	24	●		
Témiscouata	Boralex / Hamel Construction	QC	75	●		
Saint-Philémon	Capstone Infrastructure	QC	24	●	●	
Blackspring Ridge	Mortenson	AB	300	●		
Pukwis	CGIFN	ON	20	●		
Ostrander	Gilead Power	ON	22.5	●		
FPLE Wind Farm Projects	NextEra	ON, QC	10-150	●		●
Arthur	Schneider Power	ON	10	●		
Spring Bay	Schneider Power	ON	10	●		
Georgina Island	Windfall Energy	ON	20	●		

PROJECT NAME	CLIENT	LOCATION	CAPACITY (MW)	FACILITY ENGINEERING	CONSTRUCTION RELATED SERVICES	PERMITTING /ENVIRONMENTAL STUDIES
Windstream Energy Projects	Windstream	ON	100+	•		•
Éoliennes de l'Érable	Elecnor	QC	100	•		
St. Joseph's	Pattern Energy	MB	130	•		
Des Moulins	Invenergy / Enercon	QC	100		•	
Seigneurie de Beaupré	Borea	QC	270	•		
SNEEC	TechnoCentre	QC	4.6		•	
Gros-Morne	Cartier Energy	QC	210		•	
Montagne-Sèche	Cartier Energy	QC	58		•	
Diavik Diamond Mine	Diavik	NWT	4	•	•	
Caribou	GDF Suez	NB	99	•	•	

2.2 WSP'S INDIGENOUS CONSULTATION EXPERIENCE

Ontario is home to more Indigenous people than any province or territory in Canada. To meet this growing population of communities and the ancestral lands and territories they have shared since time immemorial, WSP has developed a long-standing presence in the province with offices in every region: northern, central, eastern and southwestern. WSP staff in these offices have the knowledge and capacity to provide services for all projects with Indigenous communities. Our teams throughout Ontario are committed to building long-term relationships with clients based on partnership, trust and accountability. We do this by connecting with local Indigenous experts in every region to understand the needs, expectations, concerns and beliefs of the communities we are working with and apply those learnings to our projects. The Ontario landscape is diverse, but so is the WSP team. We have cultivated our existing relationships with First Nations and Métis communities throughout Ontario and we are committed to meaningful engagement with new clients. We will continue to consult, engage and maximize community benefits for our Indigenous clients within a culture of sharing and reconciliation.

In the eastern Ontario region, WSP has sustained its reputation for supporting local Indigenous communities by delivering a community first approach. WSP's work in the region has involved engagement and consultation with Indigenous clients and proponents on federal infrastructure projects such as the Centre Block Rehabilitation and Confederation Line light rail extension projects. WSP has developed the knowledge and expertise regarding the funding structures in place and is able to assist local communities become part of decision-making regarding future projects supported by federal and provincial government funding. Throughout all projects, WSP ensures community consultation and engagement is transparent, occurs frequently and satisfies the project team's requirements. WSP is well-positioned to be a primary firm to deliver projects and ensure participation and support in eastern Ontario.

3 PROJECT SCHEDULE

3.1 PERMITTING AND APPROVALS

3.1.1 APPROACH

From the establishment of the Project, a Quality Management System to list, manage and track environmental commitments and stakeholder approvals will be developed. Figure 3-1 Permits Licences Approvals and Agreements Process below illustrates the strategic process, which begins with confirming the required approvals, permits, and agreements.

The key elements of the Project strategy to delivering approvals for the Project includes the following:

— Creation of an approval team dedicated to the management of the approval processes and appointment of a lead person to work with authorities (PLAA Specialist);
— Identification of the approvals, permits and agreements and anticipation of processing timing periods which have been included in the Project Schedule;
— Development of specific strategies and work plans for the approvals, licenses and permits application and their acquisition;
— Establishment of formats and technical standards for the approval application process;
— Coordination, consultation and negotiation sessions with approval Agencies and Authorities;
— Maintenance of an approval registry containing information such as identification, record keeping, and tracking while also noting the priority level for each permitting requirement.

Figure 3-1 Permits Licences Approvals and Agreements Process

APPROVALS WORKING GROUP (AWG)

The Project will take a proactive approach to obtaining permits, licences, approvals and agreements to maintain the Project Schedule. An Approval Working Group (AWG) will be established to coordinate between technical disciplines, the Project design team, and environmental subject matter experts to provide expertise to deal with the requirements and timescales of each permit, licence, approval and agreement. Actions to achieve these approvals will begin upon project start-up and followed up with approving agencies until the approvals are received.

This group will manage the project-specific approval requirements, applications, timelines, and processes in order to facilitate communication among the members of the approval team, project management team and Windstream.

The AWG will initiate a tracking process that will be implemented by a the PLAA Specialist. The tracking process will follow each approval application process. This tracking process will identify progress to date on an ongoing basis, allowing the AWG to advise and work collaboratively with the Project Team to develop iterative solutions and provide additional information as required. Elements of the Schedule will be adjusted to reflect the progress of the approvals, with the ultimate goal to maintain the established milestone delivery dates. The tracking documents will form the basis of the Project's quality assurance checklists for approvals.

COORDINATE CONSULTATION AND NEGOTIATION SESSIONS WITH APPROVAL AGENCIES AND AUTHORITIES

Consultation with approval agencies prior to submissions is a key element of the Project that will ensure that there is an equal understanding of:

- Status of applications that have been submitted, and those that are about to be submitted;
- Approval agency internal processes and time frames for processing of application and issuance of approval;
- Approval agency processing / workload considerations and limitations;
- The required and the relative priority of approvals where multiple / concurrent applications are being made to a single approval agency;
- Identification of overdue decisions and identification of an approach for resolution;
- Schedule requirements with respect to priority applications required for critical path, approval-dependent construction works.

This will be achieved through:

- Agency-specific meetings to help the approval process;
- Providing clarification or additional information on a priority basis;
- Early, effective and regular communication / information exchange regarding the approval agencies and third parties;
- Regular meetings to facilitate further discussion and encourage collaboration on other project-wide work;
- Public input as per the Communications and Consultation Plans and the REA process to further support the approval process.

3.1.2 PERMITTING CONTEXT FOR WOLFE ISLAND SHOALS

The development of the Project will require approvals at the federal, provincial and municipal level. These approvals relate to the siting, development, construction, operation and ultimately the decommissioning of the Project. The major project components (in-water gravity base foundations, submarine electrical cables etc.) are well understood from a variety of other infrastructure projects in Ontario. Work plans had been formulated to address the full range of associated authorizations, permits and approvals. Requirements are provided in O. Reg. 359/09 (Renewable Energy

Approvals under Part V.0.1 of the Act)("the Regulation"), technical bulletins, a Technical Guide[17] as well as an indication that the Ministry of Environment ("MOE")(now the Ministry of Environment, Conservation and Parks "MECP") was developing specific guidance for Proponents of off-shore wind projects via a *DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09*[18].

In response to ORTECH's 2010 Request for Proposals ("RFP") GENIVAR[19] (now WSP Canada Inc.) identified a full range of expected permits that would have reasonably been required for the Project. A work plan was developed to complete the studies for the authorizations as well as a suite of technical studies that were expected to be part of a complete REA submission for an off-shore wind energy project. The need for these additional studies is validated by the completeness checklist included in the MOE checklist[20]. A comprehensive Project schedule, including the expected permits, licences, approvals and agreements as provided by WSP for NAFTA1[21]. This authorization matrix has been reviewed and updated as summarized in Table 3-1: Permits, Licences, Approvals and Agreements Summary. Each PLAA item is shown with the 2015 and 2020 context, and changes in the applicability or new information are noted.

No new standards or guidelines have been provided to proponents of off-shore wind projects. Citing uncertainty and the requirement for further scientific research, the province commissioned five technical studies between 2011 and 2017 related to off-shore wind projects. These studies have been completed in the subject areas of coastal engineering, fish and impacts to fish habitats, sound propagation over water and a survey of decommissioning methods for off-shore wind projects. To date, no further studies have been commissioned.

Table 3-1: Permits, Licences, Approvals and Agreements Summary

PERMIT/APROVAL	AUTHORIZING AGENCY	2015 (NAFTA1) CONTEXT	2020 CONTEXT	REPORT SECTION OR REFERENCE
— Renewable Energy Approval (REA)	— Ontario Ministry of the Environment, Conservation and Parks (MECP)	— Required — Relies on Draft checklist for off-shore projects[22].	— Required; — Relies on Draft checklist for off-shore projects[23]; — No new guidance provided with the completion of 5 technical studies.	— 3.2 The Renewable Energy Approval

[17] **C-1983,** Ministry of the Environment Report entitled "Technical Guide to Renewable Energy Approvals" (2013).
[18] **C-0452,** Ministry of the Environment, Undated. *DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09*.
[19] **CER-WSP** Appendix 2: GENIVAR 2010. *Wolfe Island Shoals Proposal for Permitting and Field Investigation Services.* Proposal to ORTECH Environmental.
[20] **C-0452,** Ministry of the Environment, Undated. *DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09*.
[21] **C-2018,** WSP Canada Inc. Report entitled "Windstream Energy LLC and Government of Canada Renewable Energy Approval and Permitting." (June 2015).
[22] **C-0452,** Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.
[23] **C-0452,** Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

PERMIT/APROVAL	AUTHORIZING AGENCY	2015 (NAFTA1) CONTEXT	2020 CONTEXT	REPORT SECTION OR REFERENCE
— *Canadian Environmental Assessment Act* (CEAA 2012)	— Transport Canada	— Required	— Not required; — CEAA 2012 was replaced in 2019 by the *Impact Assessment Act*	— 3.3 Federal Impact Assessment Act
— *Impact Assessment Act* (IAA)	— Impact Assessment Agency of Canada (IAAC)	— Not applicable	— Impact Assessment: Not required as the Project is not designated; — Screening: May be required if a federal authority exercises a power or funds the project	— 3.3 Federal Impact Assessment Act
— *Navigable Waters Protection Act* Permit	— Transport Canada	— Required	— Required	— See Baird[24]
— Aeronautical Obstruction Clearance Form	— Transport Canada	— Required	— Required; — Updated aerodromes, radar infrastructure and communication links	— 3.4 Radar and Communications Interference
— NAV CANADA Land Use form	— NAV CANADA	— Required	— Required; — Updated aerodromes, radar infrastructure and communication links	— 3.4 Radar and Communications Interference

[24] **C-2413,** W.F. Baird and Associates Coastal Engineers. Ltd. Report entitled "Windstream Wolfe Island Shoals Offshore Wind Energy Project NAFT 2 Lake Ontario Context." (November 26, 2021).

PERMIT/APROVAL	AUTHORIZING AGENCY	2015 (NAFTA1) CONTEXT	2020 CONTEXT	REPORT SECTION OR REFERENCE
— *Fisheries Act* Authorization	— DFO (possibly with Cataraqui Region Conservation Authority)	— Required (DFO possibly with Cataraqui Region Conservation Authority)	— Required, DFO only. — New requirements and guidelines; — Updated timelines in Project Schedule — Offsetting priorities are the same as 2015.	— 3.5 Fisheries Act; — See Baird[25]
— SARA Permit	— DFO or CWS	— Potential for species in Project area is low — May be required	— Potential for species in Project area is low — May be required	— 3.6 Federal Species at Risk Act (SARA) — See Baird[26]
— Shoreline, wetland or water crossing alteration permit	— Cataraqui Region Conservation Authority	— Required for transmission cable landing point	— Required for transmission cable landing point	— 3.7 Conservation Authority Authorization
— Species at Risk Permit	— MNRF	— Potential for species in Project area is low — May be Required	— Potential for species in Project area is low — May be required; — MECP now administers the *Endangered Species Act;* — New species added to SARA since 2015, but none are identified in the Project Area	— 3.8 Endangered Species; — See Baird[27]
— Crown Land Site Release	— MNRF	— Required	— Required	— 3.9 Crown Land Site Release;

[25] **C-2413,** W.F. Baird and Associates Coastal Engineers. Ltd. Report entitled “Windstream Wolfe Island Shoals Offshore Wind Energy Project NAFT 2 Lake Ontario Context.” (November 26, 2021).
[26] **C-2413,** W.F. Baird and Associates Coastal Engineers. Ltd. Report entitled “Windstream Wolfe Island Shoals Offshore Wind Energy Project NAFT 2 Lake Ontario Context.” (November 26, 2021).
[27] **C-2413,** W.F. Baird and Associates Coastal Engineers. Ltd. Report entitled “Windstream Wolfe Island Shoals Offshore Wind Energy Project NAFT 2 Lake Ontario Context.” (November 26, 2021).

3.2 THE RENEWABLE ENERGY APPROVAL

Most wind power projects in Ontario require the proponent to obtain a REA as the primary provincial environmental authorization to construct, operate and eventually decommission a project. The REA is a comprehensive review of environmental components, which includes a number of other individual siting and operational authorizations. The REA process has mandatory points of consultation with the public, municipalities, and Indigenous communities. The REA, when issued by the MECP, includes provisions that would otherwise require Environmental Compliance Approvals (ECAs) for emissions to air (noise) from turbines and transformers, as well as industrial sewage works for transformer station secondary oil containment. Further, construction related permits similar to a Permit to Take Water (PTTW) are included in the REA, and are common conditions given to proponents in the REA.

O. Reg. 359/09 (Renewable Energy Approvals under Part V.0.1 of the Act)("the Regulation") to the Ontario *Environmental Protection Act* provides the process, mandatory reports, studies, consultation program and application requirements for a proponent to obtain a REA. This is further expanded in a technical guide[28] (the "Guide") which was most recently updated in 2019.

Per the Table in s. 6 of the Regulation, Windstream's Wolfe Island Shoals Project would be a Class 5 wind facility[29]. Per s. 13(1) of the Regulation, proponents are required to prepare and submit a series of reports applicable to their facility class[30] shown Table 1. In addition to the standard suite of reports, Class 5 projects are required to complete and submit an off-shore wind facility report[31]. Since 2011, the provincial government has imposed a moratorium on off-shore wind development. Accordingly, the Guide provides no specific requirements or a "roadmap" for Class 5 off-shore wind projects. In fact the Guide states that the "…technical guide does not provide guidance for completing an application for an REA in respect of an off-shore wind facility.[32]" Importantly, draft checklists were developed by the Ministry of Environment[33] provided a listing of the additional technical studies that would be required for Class 5 wind projects.

3.2.1 INDIGENOUS CONSULTATION

The Project Schedule incorporates Indigenous consultation and engagement activities that meet and exceed the regulatory requirements under the REA process. Additional opportunities to develop positive working relationships with Indigenous communities will extend through the life of the Project. The plan also incorporates efforts by Windstream to offer partnership sharing opportunities with Indigenous communities. These partnership opportunities would provide a basis for developing a business to business relationship with Indigenous communities to further enhance their participation and benefit in the Project.

IDENTIFIED COMMUNITIES

In a letter from the Government of Ontario's Ministry of the Environment and Climate Change (now the MECP) dated August 25, 2017, in response to Windstream's draft Project Description Report, the following communities were identified as requiring consultation and engagement with respect to the Project. The Project Schedule also accounts

[28] **C-1983,** Ministry of the Environment Report entitled "Technical Guide to Renewable Energy Approvals" (2013).
[29] **C-2378,** Environmental Protection Act, Ontario Regulation 359/09, Sections 14, 15, 16.
[30] **C-2378,** Environmental Protection Act, Ontario Regulation 359/09, Sections 14, 15, 16.
[31] **C-2378,** Environmental Protection Act, Ontario Regulation 359/09, Sections 14, 15, 16.
[32] **C-1983,** Ministry of the Environment Report entitled "Technical Guide to Renewable Energy Approvals" (2013).
[33] **C-0452,** Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

for any additional Indigenous communities subsequently identified by the Ministry, and for a community delegates consultation to occur with a representative from outside the community (such as a tribal council or consultant).

INDIGENOUS COMMUNITY	LEVEL OF INVOLVEMENT (AS INDICATED BY MINISTRY OF THE ENVIRONMENT, CONSERVATION AND PARKS)
Alderville First Nation	Have or may have constitutionally protected Aboriginal or Treaty Rights that may be adversely impacted by the Project
Curve Lake First Nation	Have or may have constitutionally protected Aboriginal or Treaty Rights that may be adversely impacted by the Project
Hiawatha First Nation	Have or may have constitutionally protected Aboriginal or Treaty Rights that may be adversely impacted by the Project
Mississaugas of Scugog Island First Nation	Have or may have constitutionally protected Aboriginal or Treaty Rights that may be adversely impacted by the Project
Kawartha Nishnawbe First Nation	Have or may have constitutionally protected Aboriginal or Treaty Rights that may be adversely impacted by the Project
Huron-Wendat Nation Council	Will be notified if it is likely archaeological resources will be discovered or found
Mohawks of the Bay of Quinte	Having an interest in any negative environmental effects of the Project
Métis Nation of Ontario High Lands and Waters Metis Council	Having an interest in any negative environmental effects of the Project

REGULATORY REQUIREMENTS

In accordance with the T*echnical Guide to Renewable Energy Approvals* and the *Aboriginal Consultation Guide for Preparing a Renewable Energy Approval*, Windstream identified the following objectives for consultation, and WSP incorporated these objectives in the Project Schedule:

- To ensure that relevant information about the Project is provided to Indigenous communities;
- To obtain/identify relevant information/local knowledge from each Indigenous community regarding potentially impacted rights from the Project;
- To identify concerns that may arise from the proposed renewable energy project;
- To address concerns by way of providing additional information, explanation, changing project design or making commitments in response to local input;
- To establish whether accommodation is required, including discussing arriving at and implementing appropriate measures to avoid or minimize potential adverse effects; and
- To create a process by which an Indigenous community can support the project by maximizing involvement that leads to a positive and long-term relationship with each community.

O. Reg. 359/09 provides specific requirements for consultation and engagement activities. This includes consultation and engagement with Indigenous communities that may have constitutionally protected Treaty Rights that may be adversely impacted by the Project, or otherwise may be interested in any negative environmental effects of the project. The statutory consultation activities consist of the following:

- Submitting the Draft Project Description Report to the MECP to obtain the Director’s List of Indigenous communities to be consulted;
- Publishing a Notice of Project to the Public;

- Publishing a notice of the First Public Meeting;
- Holding the First Public Meeting;
- Providing Draft REA Reports to Indigenous groups in advance of municipalities and the public;
- Providing Draft REA Reports to Municipalities;
- Providing Draft REA Reports to the Public;
- Publishing a Notice of Final Public Meeting;
- Holding the Final Public Meeting;
- Producing a Consultation and Documentation Report to summarize the consultation activities completed as part of the process and demonstrating how the Project took stakeholder comments into account.

The Project Schedule accounts for Windstream providing the following documents to all identified Indigenous communities at the appropriate phase of the Project:

- A draft of the Project Description Report;
- Any information that Windstream has regarding any adverse impacts that the project may have on constitutionally protected Aboriginal or Treaty Rights that the community may have identified as being adversely impacted by the project;
- A written summary of each technical report that will be submitted as part of the REA application; and
- A written request to the community to provide any information that, in the opinion of the community, should be considered in preparing any of the REA technical reports.

As the Project has mandatory public meetings, this package of documents and request for information will be sent to all identified communities at least 60 days in advance of Windstream making draft reports available to the public (pursuant to section 16 of O. Reg. 359/09). Drafts of all of the written confirmations and comment letters from the Ministry of Natural Resources and Forestry ("MNRF") and the Ministry of Heritage, Sport, Tourism and Culture Industries ("MHSTCI") completed as part of the REA process, will be sent and made available to the identified Indigenous communities at least 60 days in advance of the final public meeting.

The Director for the MECP may determine that Indigenous consultation beyond the REA regulatory requirements is required. The Project Schedule anticipates the potential for such a decision and is designed to include additional consultation activities that exceed the standard regulatory requirements.

PARTNERSHIP SHARING OPPORTUNITIES

The Project Schedule incorporates time for Windstream to work with each Indigenous community to understand how a legal partnership structure can maximize benefits for those communities. These consultation activities include Indigenous communities receiving independent legal and financial advice to assist them in reviewing any potential business proposals put forward between Windstream and Indigenous communities. The Project Schedule also incorporates the creation of an Indigenous Working Group for the Project. For the working group, representatives from each community will take part in meetings and workshops to learn more about the Project and provide input on behalf of their community.

3.2.2 REA SCHEDULE

A viable and reasonable REA schedule has been prepared for the Project, with Wood[34] and the Project Team. WSP prepared an updated plan for completing a full Renewable Energy Approval (REA) application and associated permitting for the Project. This includes the studies required under the REA Regulation, and includes those expected to be required to complete an Offshore Wind Facility Report[35]. Additional anticipated technical studies including hydrodynamic modelling, ice studies, wind/wave/water studies, coastal engineering and other technical reports have been included in the NAFTA2 Project Schedule. These studies are consistent with those that have been documented under the *DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects*[36].

WSP included the mandatory REA consultations, complete with the appropriate timing for notifications, public meetings and the release of Draft reports to Indigenous communities, municipalities and the public in the Project Schedule.

The Project Schedule accounts for the following reports per s. 13 of the Regulation.

- Construction Plan Report;
- Consultation Plan Report;
- Decommissioning Plan Report;
- Design and Operations Report;
- Noise Study Report;
- Project Description Report;
- Off-shore Wind Facility Report;
- Specifications Report, Wind Facility;
- Natural Heritage Report, including:
  - Records Review Report;
  - Site Investigation Report;
  - Evaluation of Significance Report; and,
  - Environmental Impact Study;
- Cultural Heritage Report
- Stage 1 and Stage 2 Archaeological Assessment Reports;
- Enhanced consultations with Indigenous communities required under s.17 are accounted for in the Project Schedule;
- Consultation with the Public, public meetings and municipalities and production of a Consultation Report under s. 18 of the REA Regulation is accounted for in the Project Schedule;
- Based on the experience in the wind industry, an appeal would likely have been filed with the Environmental Review Tribunal (ERT). The appeal process takes six months. This is accounted for in the Project Schedule.

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[34] **C-2347,** ORTECH Development Programme Rev. 02., entitled “Wolfe Island Shoals Development Programme” (February 8, 2021)
[35] **C-2378,** ORTECH Development Programme Rev. 02., entitled “Wolfe Island Shoals Development Programme” (February 8, 2021).
[36] **C-0452,** Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

NATURAL HERITAGE STUDIES AND REPORTS

WSP included the required records reviews and site investigations in the Project Schedule[37]. The Project Schedule outlines avian field studies, including breeding birds, migration windows plus the associated reporting. The Project Schedule outlines bat studies, which include habitat assessments, migration windows plus the associated reporting. In association with Baird[38], WSP has provided input to the Project Schedule regarding aquatic (fisheries) surveying plus the associated reporting. The Waterbody Assessment required under s. 29, 30 and 31 of the REA Regulation have been included in the Project Schedule. Additionally, the Environmental Effects Monitoring Plan for birds and bats required under s. 23.1 of the REA Regulation has been accounted for in the Project Schedule.

ARCHAEOLOGY & CULTURAL HERITAGE

WSP included terrestrial stage 1 and stage 2 archaeological assessments for shore-based Project components per the standards and guidelines[39]. As there are no published standards and guidelines for marine archaeology, expected timelines including the development and confirmation of workplans with the Ministry of Heritage, Sport, Tourism and Culture Industries are captured in the Project Schedule. These schedules have been developed based on seasonal access for field work, and our experience in archaeological assessments in the REA context.

ADDITIONAL TECHNICAL STUDIES

In association with Baird[40], WSP also considered additional technical studies that were anticipated to be required in order to submit a complete REA application. These studies are also consistent with the *DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under the REA Regulation*[41]. The timing and duration of these studies are consistent with field windows and Baird's experience in coastal engineering and related work. The additional technical studies, are accounted for in the Project Schedule, including:

— Hydrodynamic Water Quality and Sediment Transfer Report;
— Coastal Hydraulics Report;
— Wind, Wave and Water Level Report;
— Coastal Processes and Engineering Study;
— Drinking Water and Spill Response Plan.

REA APPLICATION AND REVIEW

Once submitted to the MECP, the agency Screening for Completeness for the REA application is expected to be 70 days, per the assumed service standard. The MECP's REA Technical Review period is six months, represented as the service standard[42]. These timelines have been accounted for in the Project Schedule based on the service standards

[37] **C-2378,** ORTECH Development Programme Rev. 02., entitled "Wolfe Island Shoals Development Programme" (February 8, 2021).
[38] **C-2413,** W.F. Baird and Associates Coastal Engineers. Ltd. Report entitled "Windstream Wolfe Island Shoals Offshore Wind Energy Project NAFT 2 Lake Ontario Context." (November 26, 2021)
[39] **C-1965,** Ministry of Tourism and Culture Report entitled "Standards and Guidelines for Consultant Archaeologists." (2011)
[40] **C-2413,** W.F. Baird and Associates Coastal Engineers. Ltd. Report entitled "Windstream Wolfe Island Shoals Offshore Wind Energy Project NAFT 2 Lake Ontario Context." (November 26, 2021).
[41] **C-0452,** Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09
[42] **C-1983,** Ministry of the Environment Report entitled "Technical Guide to Renewable Energy Approvals" (2013)

provided. In WSP's experience, renewable energy developers account for these service standard periods in establishing project schedules.

3.3 FEDERAL IMPACT ASSESSMENT ACT

For NAFTA1, it was determined that the Federal Canadian Environmental Assessment Act ("CEAA 2012") would have applied to the Project. As demonstrated in NAFTA1, CEAA work was expected as a requirement as part of the work Program and scheduled to be completed parallel with REA and other permitting activities. It was shown that other area projects, such as the Wolfe Island Power Development engaged in a Screening level EA under CEAA in 2004 as they had applied for funding under the Wind Power Production Incentive ("WPPI") program[43].

CEAA 2012 was replaced by the *Impact Assessment Act* ("IAA") in 2019[44]. Therefore, the Project, or parts of the Project may be subject to the requirements of applicable federal laws, standards and permits. Projects defined in the IAA *Regulations Designating Physical Activities* require the full consideration of the federal impact assessment process. Wind Power projects including off-shore wind projects do not appear in the *Regulations,* therefore the full Impact Assessment process would not apply to Wolfe Island Shoals.

A federal Screening under the IAA has been included in the development schedule. Although it is unclear if this would ultimately be required for the Project, this is a conservative approach in the planning of the project development. The screening-level activities and reviews by an appropriate federal agency have been accounted for. This does not pose a material risk to the Project Schedule.

Sections 82 through 91 of the IAA requires that federal authorities that exercise power or finance a project must conduct a review (e.g. a "screening") to determine whether a project is likely to cause significant adverse environmental effects before making any decision that would allow a project to proceed. This includes projects to be located on federal lands, or funding provided for projects from a federal source. It is unclear if the IAA would apply to the Project as it does not take place on federal lands. Nonetheless, for completeness a screening per the guidance document *Projects on Federal Lands Interim Guidance on section 81 to 91 of the Impact Assessment Act*[45] is included in the Project schedule. The basic steps are noted below:

- **Step 1 Determination of Eligibility**: The proponent determines if the proposal is a 'project' per Section 81 of the IAA. Criteria include:
  - Physical activity: does the proposal include tasks such as construction, modification, operation, decommissioning?
  - Physical work or ministerial order: does the proposal include human built structures with a fixed locality, or is included in a ministerial order?
  - Federal lands: does the proposal take place on federal lands, or is it financially supported by a federal authority?
- **Step 2 Public Notice**: per ss 84 to 86 of the IAA, the minimum components for public participation include inviting comments from the public by posting a notice on the registry, considering public comments and posting a notice of determination. For Wolfe Island Shoals, this would be complemented with work done in parallel for the REA. This is a 30-day review process per the guidance as shown in Figure 3-2.
- **Step 3 Determination of Level of Analysis:** The proposal will be reviewed with the information provided and a risk analysis completed to identify whether there is a need for further environmental review. Depending on the

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[43] **C-1979,** Canadian Environmental Assessment Agency Report entitled "Archived – Wolfe Island Wind Power Development" Canadian Environmental Assessment Registry: 04-01-4667 Natural Resources Canada: ON 249 (December 5, 2012).
[44] **C-2235,** Impact Assessment Act, S.C. 2019, c. 28, s. 1
[45] **C-2235,**Her Majesty the Queen in Right of Canada, as represented by the Minister of the Environment. 2019. Projects on Federal Lands Interim Guidance on section 81 to 91 of the *Impact Assessment Act*.

results of this analysis the proposal would be classified as “basic” or “non-basic.” Regardless, the level of works proposed in the work program with the REA and other approvals would be adequate to cover either of these project categories.

— **Step 4 Implement Risk Management Approach**. All effects from the project to the environment would be considered, including fish and fish habitat, migratory birds, species at risk, air quality, water quality, soil, plants and wildlife, etc. Environmental effects also include health and socio-economic conditions, physical and cultural heritage, current use of land and resources for traditional purposes, structures, sites or things that are of historical, archaeological or architectural significance. For each adverse effect that is identified, mitigation measures should be proposed, with the intent of eliminating, reducing, or otherwise controlling that adverse effect. The IEA also requires the review of factors including adverse impacts to the rights of Indigenous peoples, Indigenous knowledge, community knowledge, and comments received from the public. All of these requirements are consistent with the overall work program proposed for the Project.

— **Step 5 Decision and implementation**. If the environmental review concludes that the project is unlikely to cause significant adverse effects, the Project may proceed and obtain the appropriate federal regulatory authorizations or funding to support the project.

Figure 3-2: IAA Public Participation Timeline[46]

3.4 RADAR AND COMMUNICATIONS INTERFERENCE

There are no material concerns with interference from the Project with respect to aeronautical infrastructure, weather radar, or communications links. Further there are no concerns regarding United States airports, wind farms or a consultation with a coastline (Lake Ontario) 20,000-foot buffer to the Project Area.

The Ministry of the Environment guidelines for the REA submission process specify that the applicant must contact Environment Canada with respect to potential interference with weather radar. Further, negative environmental effects on local interests and infrastructure, including telecommunications and local airports or aerodromes should be accounted for. Other applications for permits and approvals for wind energy project locations must be submitted to NAV CANADA and Transport Canada including locations and total structure heights.

WSP has updated the NAFTA1 data related to aeronautical infrastructure (Figure 3-3: Aeronautical Infrastructure), and radar infrastructure for weather and navigation (Figure 3-4: Radar Infrastructure). New information regarding communications links is shown in Figure 3-5: Microwave Links and Communications Towers. Figure 3-6 shows the coastline consultation zone, airports and wind farms in the United States as they relate to the Project location. To note:

— Aeronautical Infrastructure, Figure 3-3:
  — VHF omnidirectional range (VOR) radio navigation beacons and VOR buffers (15 km buffer), the aeronautical navigation and communication infrastructure are shown;

[46] **C-2235,** Her Majesty the Queen in Right of Canada, as represented by the Minister of the Environment. 2019. Projects on Federal Lands Interim Guidance on section 81 to 91 of the *Impact Assessment Act*. P. 23.

    - The Project is not within the consultation zone for any VOR or any other aeronautical navigation or communication infrastructure;
  - Airports with a 10 km consultation buffer are shown;
    - The Project is not within the consultation zone for any airport;
  - CFB Kingston and CFB Trenton have been added to the map, with airfield buffer of 10 km. It should be noted that CFB Trenton / the Department of National Defense (DND) operates radar whose location is not public.
    - It is assumed that the Project is within, or adjacent to the 80 km consultation zone for radar facilities at CFB Trenton. This is a consultation zone and is not an exclusion zone. As some radar facilities are not public, consultation with the DND and NAV CANADA is required regardless. WSP does not foresee material issues with the consultation, and both agencies have accepted similar, local wind project developments (e.g. Amherst Island). Consultation activities are fully accounted for in the Project Schedule.
- Radar Infrastructure, Figure 3-4:
  - NAV CANADA radar stations and their 80 km consultation zones are shown in the map;
    - The Project is not within the consultation zone;
  - Weather radar facilities (Canada) and their 50 km consultation zones are shown in the map;
    - The Project is not within the consultation zone;
  - A new Nexrad Radar (American) was added to the radar map;
    - The Project is not within the consultation zone for the radar facility;
- Communication Links and Towers, Figure 3-5
  - Microwave communication towers and linkages have been mapped.
    - There are no conflicts identified with microwave and communications links;
  - One SMS tower is located just south of the Project area;
    - No project interference with this tower is expected.
- US Airports, Windfarms and Coastal Consultation Zone, Figure 3-6:
  - There is clear definition of proximity limits that are recommended as sensitivity thresholds for projects as they relate to American permitting process. The Federal Aviation Administration cites regulations that require notification to the Administrator of the FAA including projects that are:
    - Within 20,000 feet of a public use or military airport which exceeds a 100:1 surface from any point on the runway of each airport with its longest runway more than 3,200 feet;
      - The Project location is not within these consultation limits;
    - Within 10,000 feet of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway no more than 3,200 feet
      - The Project location is not within these consultation limits;
    - Within 5,000 feet of a public use heliport which exceeds a 25:1 surface;
      - The Project location is not within these consultation limits;
    - Consultation required for construction of Projects within 20,000 feet of American Soil;
      - The Project location is not within these consultation limits.

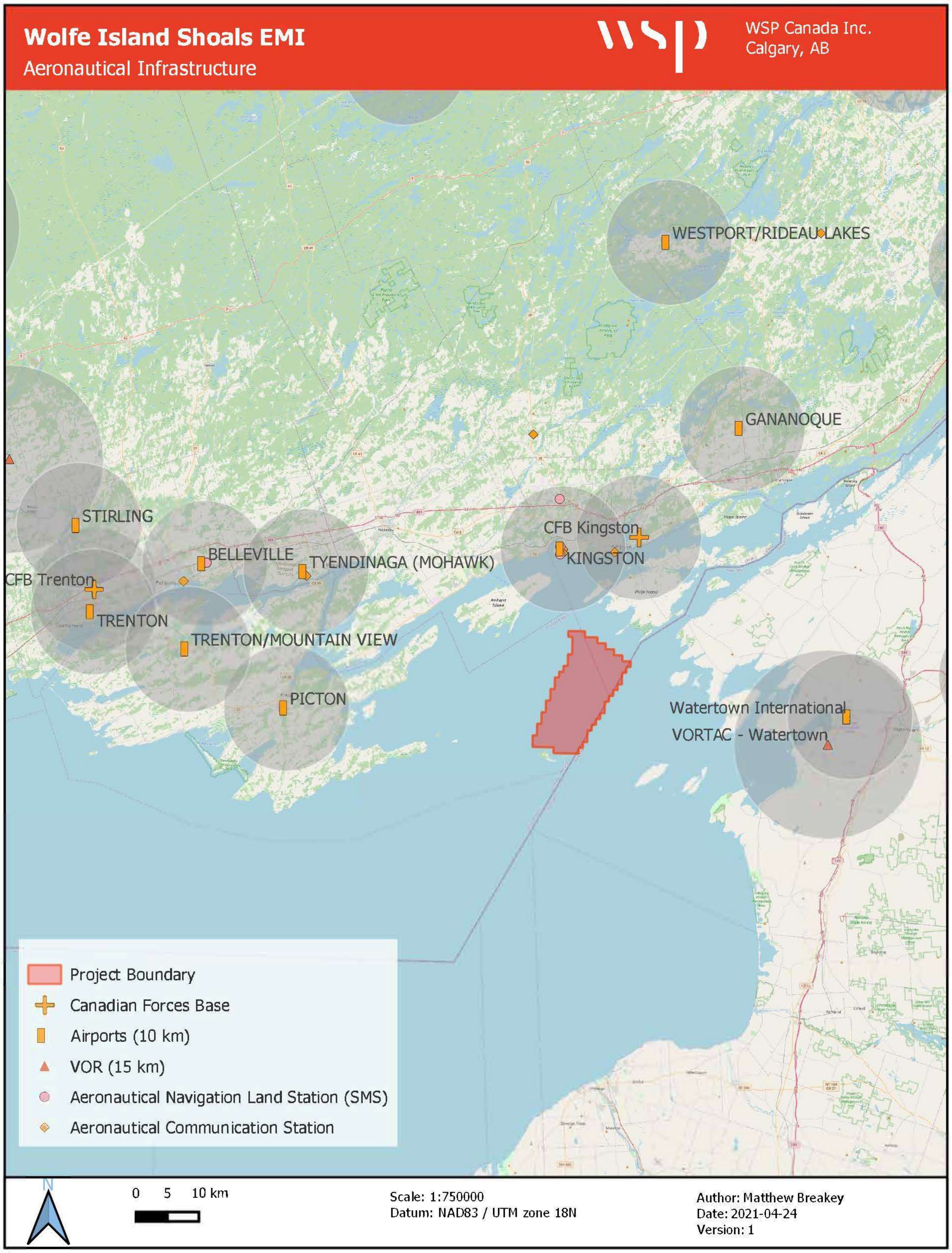

Figure 3-3: Aeronautical Infrastructure

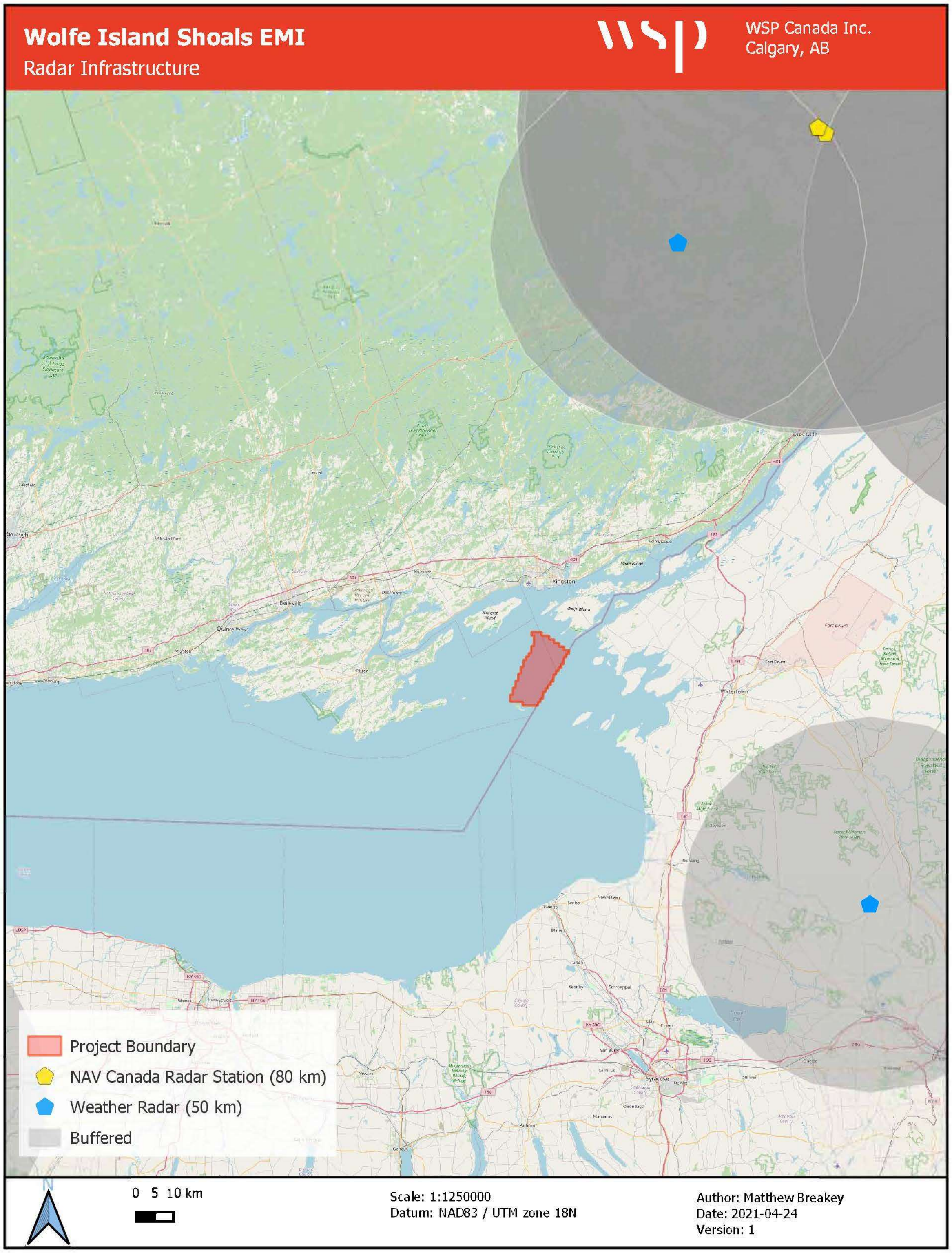

Figure 3-4: Radar Infrastructure

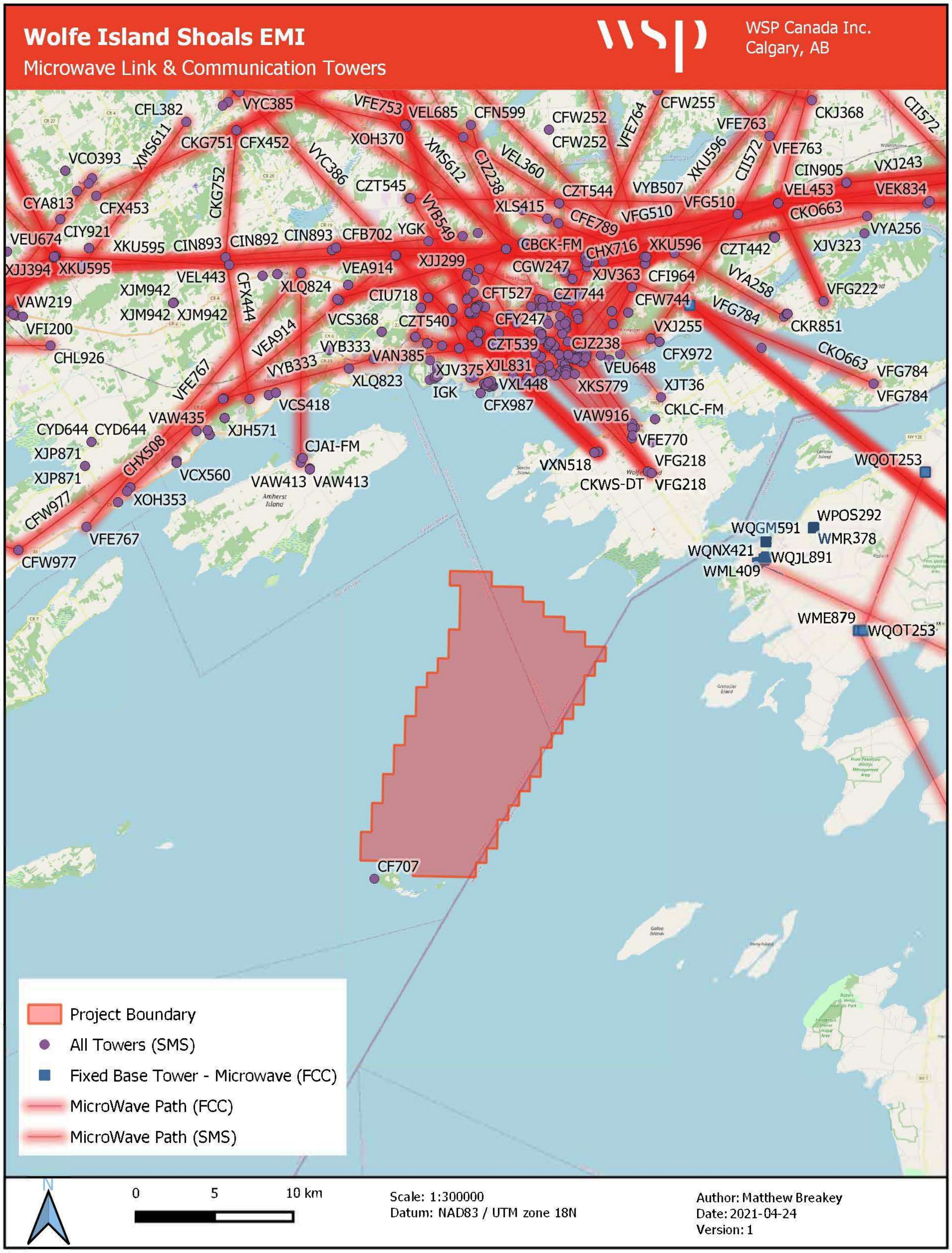

Figure 3-5: Microwave Links and Communications Towers

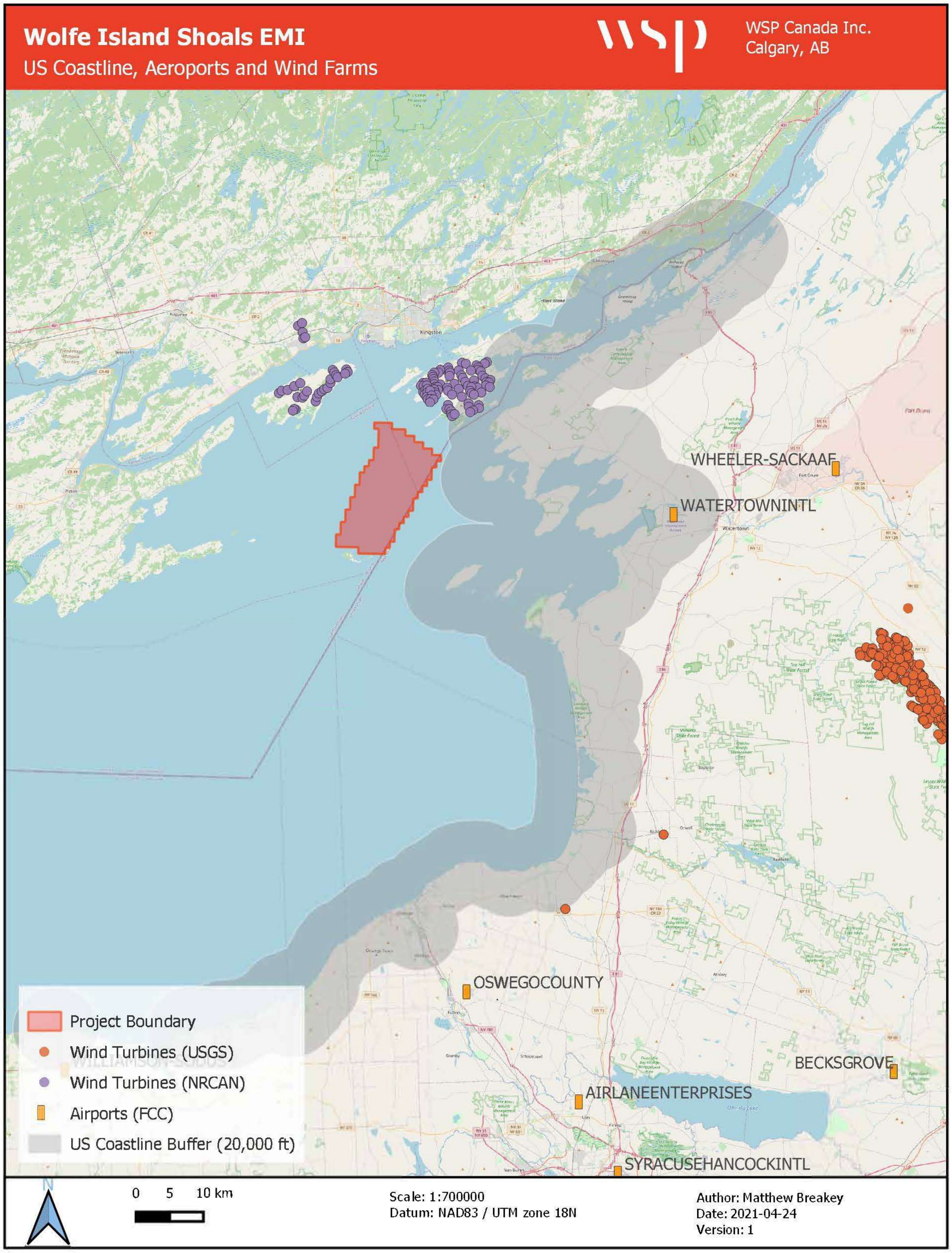

Figure 3-6: US Airports, Windfarms and Coastal Consultation Zone

3.5 FISHERIES ACT

New provisions in the federal *Fisheries Act* since NAFTA1 do not pose any additional schedule risk to the Project. The Project Schedule has been constructed with the assumption that a Department of Fisheries and Oceans ("DFO") Authorization would be required.

The purpose of the federal *Fisheries Act* is to maintain healthy, sustainable, and productive Canadian fisheries through the prevention of pollution and the protection of fish and their habitat. Work in and near water must comply with the fish and fish habitat protection provisions of the *Fisheries Act* by incorporating measures to avoid the following:

— Causing the death of fish;
— Harmful alteration, disruption, or destruction ("HADD") of fish habitat.

In 2019, new fish and fish habitat protection provisions under the *Fisheries Act* came into force. In general, these provisions increased protections for all fish species and their habitat. The provisions also provide clarity on which types of projects require authorizations through permitting and codes of practice and provide provisions to consider restoration priorities as part of development project reviews. These amendments put a greater onus on the Proponent to mitigate, restore, and compensate if harmful alteration to fish and fish habitat cannot be avoided.

Compared with the previous provisions of the Fisheries Act which were enacted in 2013, key changes in 2019 included:

— Protections against harm to fish supporting a Commercial, Recreational, or Aboriginal fishery have been expanded to include protection again harm to all fish species;
— Prohibition of "serious harm" to fish has been restored back to harmful alteration, disruption and destruction of fish habitat (HADD) as well as death of fish by means other than fishing;
— Fish habitat restoration must be prioritized in project design, as well as protection of Species at Risk ("SAR");
— Potential impacts include all footprints of work undertaken below the highwater mark or in-water;
— The previous provision for self-assessments has been removed, therefore if all prescribed measures to avoid harm to fish cannot be adhered to, the project must be reviewed for approval requirements for DFO;
— Interim Standards and Codes of Practice have been provided for beaver dam removal, culvert maintenance, water intake protection, routine maintenance dredging; temporary coffer dams and diversion channels, and temporary stream crossings[47].

All projects where work is being proposed that cannot avoid impacts to fish or fish habitat require a DFO project review. DFO will review the project to identify potential risks of the project to the conservation and protection of fish and fish habitat. If potential impacts can be avoided, project approval is not required. However, if it is determined that the project will result in death of fish or HADD of fish habitat, an authorization is required under the Fisheries Act. Proponents of projects requiring a Fisheries Act authorization may be required to also submit a habitat offsetting plan, which provides details of how the death of fish and/or HADD of fish habitat will be offset, and outlines associated costs and monitoring commitments. Proponents also have a duty to notify DFO of any unforeseen activities during the project that cause harm to fish or fish habitat.

Determination of the requirement for a project to be reviewed by DFO is based on the ability of proponents to adhere to all prescribed Measures to Protect Fish and Fish Habitat. Under previous provisions, proponents had the ability to conduct a 'self-assessment' to determine if any works within water were likely to cause serious harm to fish. As listed above, the option of self-assessment has been removed, therefore any project not able to adhere to all measures prescribed by DFO must be submitted for review to DFO. Most projects involving work in or near waterbodies or

[47] **C-2348,** Fisheries and Oceans Canada Report entitled "Standards and codes of practice." (February 10, 2021)

crossing watercourses will require a Request for Review due to not being able to meet the specific protection measures outlined by DFO under "Carrying out works, undertakings and activities on land". These measures include avoiding any work that includes the following:

- Conducting any work, undertaking or activity in water;
- Placing fill or other temporary or permanent structures below the high-water mark;
- Fording of the watercourse;
- Disturbing or removing materials from the banks, shoreline or waterbody bed, such as:
  - Sand, rocks, aquatic vegetation, natural wood debris;
- Building structures in areas that:
  - may result in erosion and/or scouring of the stream bed or banks
  - are inherently unstable, such as, bends, meanders, floodplains, alluvial fans, braided streams.

The above noted changes, in WSP's experience, have tended to result in an increase in the number of projects requiring DFO review, and subsequent authorizations under the *Fisheries Act*. Under the new provisions, it is assumed that the Wolfe Island Off-shore Wind Farm would require an Authorization under the *Fisheries Act*. This is reflected in the updated Project Schedule.

Other changes to the *Fisheries Act* as a result of the 2019 amendment include:

- Indigenous traditional knowledge must inform habitat decisions
- Restoration priorities must be a key part of decision-making
- Legal framework established to enshrine this policy approach into law to provide for and encourage the use of habitat banks for offsetting fish and fish habitat losses resulting from projects

Consultation with Indigenous groups was already included in the proposed Project Schedule and can be accomplished concurrent with the REA. Therefore, this change does not represent a change in the proposed scope or schedule. The provision to consider and establish Ecologically Significant Areas is not likely to impact the project, as existing 'Ecologically and Biologically Significant Areas' as identified by the Government of Canada are located in oceanic habitats. The Project Location is not an existing Ecologically Significant Area. The use of habitat banks may be relevant in establishing Offsetting Measures, however, these options were in use informally prior to the 2019 changes and would only be relevant if a federal habitat bank had previously been established by the proponent, or if they wish to establish one for future developments, therefore no significant impact to the project requirements would be expected.

The legislated timelines for review of an application for Authorization under the *Fisheries Act*, are shown in the Project; applications are screened for completeness within 60 days of submission and reviewed for authorization within 90 days from being confirmed complete. Submission of an application generally does not occur until a Request for Review has been submitted and reviewed by DFO (review time of 1-3 months), and once a decision requiring Authorization is issued, a process of consultation and negotiation with DFO is undertaken to determine agreed-upon Offsetting Measures. A complete request for review and magnitude of Offsetting Measures cannot be determined until the assessment of aquatic impacts in the Natural Heritage Report is complete. WSP has included a schedule of approximately one (1) year to complete the Request for Review (RfR) process and approximately one (1) year for the Authorization process.

It should be noted that a local project, the Third Crossing of the Cataraqui River Bridge, with arguably greater impacts to sensitive fish habitats was able to obtain projects with *Fisheries Act* authorization. This project, and the similarities in project components and authorizations if more fully discussed in Section 4.2.1, below.

3.6 FEDERAL SPECIES AT RISK ACT (SARA)

Based on the work by CER-Baird[48] in NAFTA1 and re-affirmed by Baird[49] in 2021, it is unlikely that a federal *Species at Risk Act* ("SARA") permits for aquatic species would be required as habitats for such species are deficient in the Project Area. During consultation with DFO on *Fisheries Act* matters, due care will be given to the habitats of aquatic SAR. Further, based on the work in NAFTA1 by Kerlinger[50], it is unlikely that SARA permits would be required for federally listed bird species.

If required, the work for SARA permits would be done concurrently with the REA, posing low risk to the Project Schedule. The need for permits under SARA would be determined as part of the routine agency consultation and field investigation components of the study. These consultation activities are reflected in the Project Schedule. Early consultation allows for the implementation of targeted surveys or adjustments to the proposed design layout in the event a permit under SARA was deemed necessary.

3.7 CONSERVATION AUTHORITY AUTHORIZATION

In NAFTA1, it was established that the Project would need authorizations for Project components located in areas regulated by the Cataraqui Conservation Authority. This is the landing area for the submarine cable to connect the Project to the provincial electrical system, and any other associated works.

Under the *Conservation Authorities Act*, s28 – Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 148/06), Cataraqui Conservation regulates development and site alterations near waterbodies and wetlands to protect residents from flooding, erosion and other natural hazards. This process has not changed since NAFTA1, and such permits are routine and typically occur during the detailed design of the Project. This permitting activity has been included in the Project Schedule.

Again, it should be noted that a local project, the Third Crossing of the Cataraqui River Bridge, with arguably greater permitting complexity for Conservation Authority regulated areas was able to obtain the authorization. This project, and the similarities in project components and authorizations if more fully discussed in Section 4.2.1, below.

3.8 ENDANGERED SPECIES

In NAFTA1, it was established that it would have been unlikely that that the Project would have required a permit under the provincial *Endangered Species Act*, 2007 ("ESA"). This was based on the background research that concluded the presence of species at risk or endangered species in the Project Location is unlikely[51].

Since NAFTA1 in 2015, the agency now responsible for the ESA has been changed from the MNR to the MECP. Since 2015, the list of species at risk in Ontario[52] has been updated three times: June 15, 2016; June 2, 2017; and August 1, 2018.

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[48] CER-Baird, *Wolfe Island Shoals Offshore Wind Project Lake Ontario Context.* Prepared for Torys LLP.
[49] **C-2413,** W.F. Baird and Associates Coastal Engineers. Ltd. Report entitled "Windstream Wolfe Island Shoals Offshore Wind Energy Project NAFT 2 Lake Ontario Context." (November 26, 2021).
[50] CER -Kerlinger. *Potential Impact of the Wolfe Island Shoals Offshore Wind Energy Power Project on Birds* (CER-Kerlinger Report). Prepared for Windstream.
[51] CER-Baird, *Wolfe Island Shoals Offshore Wind Project Lake Ontario Context.* Prepared for Torys LLP.
[52] **C-2166**, Endangered Species Act, 2007, S.O. 2007, c. 6, O. Reg. 230/08 Species at Risk in Ontario List .

Baird[53] affirms that none of the additional species listed in the updated list are expected to have suitable habitat in the Project Area. However, if required, the process to obtain ESA permits is well-established and is frequently completed in support of development applications. The permitting process involves consultation with MECP upon discovery of the Species at Risk and a determination if a permit is required. From WSP's experience with Overall Benefit Permits, this consultation process may take up to one year. During this time, the three phases of the application process, including Information Gathering, Activity Review and Assessment, and Permit Application and Assessment would be completed. If endangered or threatened species or their habitat(s) had been documented during the field investigation and impacts to the species and/or their habitat are deemed unavoidable, then an Overall Benefit Permit or Social or Economic Benefit Permit may be required.

Work towards a Species at Risk Permit (MNRF), if required, is generally completed concurrently with other aspects of the REA process field studies and data gathering. This is reflected in the Project Schedule.

3.9 CROWN LAND SITE RELEASE AND RELATED PERMITS

Applications for Crown Land site release, and Work Permits per the *Public Lands Act* have been included in the Project Schedule.

As recognized in NAFTA1, the *Public Lands Act* gives MNRF the authority to manage Crown land, including the beds of most lakes and rivers. The use and occupation of Crown land for a renewable energy project requires additional authorization by MNRF through a work permit, a Crown lease, a land use permit, an easement, a Crown patent and/or a licence of occupation. Note the MNRF had a defined site release process per the Windpower Development on Crown Land policy, (Wind Policy 4.10.04). This Policy included provisions for offshore wind. Windstream had engaged in that process in February of 2008. But for the moratorium and the revocation of the FIT contract, the process would have been followed and is indicated in the Project Schedule.

Public Lands Act Work permits would be required for the construction of the Project foundations, submarine cable system and other works on the lakebed. These permits are included in the Project Schedule and the process has not changed since NAFTA1. Work Permit applications are completed in the detailed design phase of the project and are not on the critical path of the Project Schedule. The application submission requires specific design deliverables in order for MNRF to process the application. For lakebed work, the MNRF "Works within a Waterbody Part 5" application indicates that it takes MNRF approximately 1 month to process the approval for the location of the proposed work, and an additional 2 months to process the detailed plans and specifications[54].

[53] **C-2414,** Endangered Species Act, 2007, S.O. 2007, c. 6, O. Reg. 230/08 Species at Risk in Ontario List

[54] **C-2003,** Endangered Species Act, 2007, S.O. 2007, c. 6, O. Reg. 230/08 Species at Risk in Ontario List.

4 PROJECT DEVELOPMENT

4.1 OFF-SHORE WIND DEVELOPMENT

Global development of more than 50 off-shore commercial wind projects demonstrates that off-shore wind projects are viable and understood from economic, permitting and approvals and environmental points of view. In the North American context, Kessler[55] reports there are currently twelve off-shore wind projects under development and regulatory review on the east coast of the United States.

— Vineyard Wind I, 800 MW;
— South Fork, 130 MW;
— Skipjack, 120 MW;
— MarWin, 270 MW;
— Revolution Wind, 704 MW;
— Ocean Wind, 1.1 GW;
— Empire Wind I, 816 MW;
— Sunrise Wind, 880 MW;
— Mayflower Wind, 804 MW;
— Park City Wind, 804 MW;
— New England Aqua Ventus I, 12 MW;
— Coastal Virginia Offshore Wind, 2.64 GW.

The 20.7 MW IceBreaker off-shore wind project to be sited in Lake Erie eight miles off-shore from downtown Cleveland was approved by the Power Siting Board, with some of the conditions regarding nighttime operation reversed[56].

Operational Projects in the United States include:

— Block Island Wind (Rhode Island), 30 MW operational in 2016;
— Coastal Virginia Offshore Wind - Pilot Project east of Cape Henry Virginia, 13 MW operational 2020.

4.2 PROJECT COMPONENTS AND COMPARABLE PROJECTS

Citing uncertainty and the requirement for further scientific research, the province commissioned five technical studies between 2011 and 2017 related to off-shore wind projects. These studies have been completed in the subject areas of coastal engineering fish and impacts to fish habitats, sound propagation over water and a survey of decommissioning off-shore wind projects. In general, these studies are meant to provide the Ontario regulatory authorities with background documentation for policy analysis and development. To date, no further studies have been commissioned. Studies include:

[55] **C-2355,** Kessler, R. Article entitled "Ocean's Twelve! America's first wave of offshore wind farms starts to build" - Recharge - Latest renewable energy news. (March 25, 2021).
[56] **C-2330,** Funk J., Utility Dive Brief entitled "Nation's first freshwater windfarm all but approved as Ohio siting board removes 'poison pill" (September 18, 2020).

- Nienhuis, S., and Dunlop E.S.. 2011. The potential effects of off shore wind power projects on fish and fish habitat in the Great Lakes. Aquatic Research Series 2011-01. Ontario Ministry of Natural Resources.
  - The Study concluded that if appropriate sites for project components that can avoid sensitive habitat areas, the use and development of mitigation measures and appropriate biological monitoring could reduce the potential impacts of offshore wind power production to minimal levels.
- Nienhuis, S., and Dunlop, E.S., 2011, Offshore Wind Power Projects in the Great Lakes: Background Information and Science Considerations for Fish and Fish Habitat, Aquatic Research Series 2011-02. Ontario Ministry of Natural Resources
  - The second research report concludes that while there are data gaps for impacts to fish and fish habitat from off-shore wind projects but provides options to guide effective strategies with minimal impacts on the aquatic ecosystem.
- Baird and Associates Coastal Engineers Ltd. and Beacon Environmental. 2011. Offshore Wind Power Coastal Engineering Report – Synthesis of Current Knowledge and Coastal Engineering Study Recommendations.
  - The report investigates the scientific and technical aspects of off-shore wind power development on the Great Lakes. Baird has produced documentation describing the coastal processes as part of NAFTA1 and NAFTA2.
- Valcoustics Canada Ltd. 2016. Sound Propagation Modelling for Offshore Wind Farms.
  - The Study provides a literature review and analysis of various sound propagation models used throughout the world. The Study provides a number of practical considerations for the development of appropriate models for use in Ontario.
- DNV-GL. 2016. Assessment of Offshore Wind Farm Decommissioning Requirements.
  - The Study provides an overview of decommissioning requirements in Canada (including the principles of the Ontario REA), the United States and Europe. The Study outlines the jurisdictional processes, environmental objectives, where appropriate and financial assurance considerations.

From a construction point of view each of the components of the Windstream proposal, taken separately, are tried and tested project components including:

- Submarine cables:
  - The wind project on Wolfe Island utilizes a submarine cable and the Project was successfully permitted and is in operation;
- Marine / lakebed foundations and environmental management:
  - Used on the Confederation Bridge connecting Prince Edward Island to the mainland.
  - Foundations and piers on lakebeds and in watercourses are common structural elements used for bridges in Ontario waters and worldwide;
  - The Kingston Third Crossing project underwent a Municipal Class EA[57] (MCEA), as well as a federal Detailed Impact Assessment (DIA)[58]. See section 4.2.1.

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[57] **C-1975,** Richard J.L. Report entitled "Third Crossing of the Cataraqui River Environmental Assessment Environmental Study Report - Under the Municipal Class Environmental Assessment." Sections 1.0 – 3.1.7 (April 16, 2012).
[58] **C-2202,** Hatch, City of Kingston Report entitled "Third Crossing of the Cataraqui River Parks Canada Environmental Impact Analysis - Detailed Impact Analysis Report" (2019).

ORTECH[59] completed a summary of timelines for onshore wind projects of greater than 100 MW in capacity to provide insight into the development schedule for large REA projects. Of the survey of fifteen REA Approved Large Wind Projects, fourteen had reached commercial operation with one having reached the IESO Key Development Milestone ("KDM"). The range of duration of the development of these projects was calculated to be approximately 35 months, with a range of 16 to 66 months. The short and long duration projects are considered to be outliers, and with their omission, the average development duration is approximately 34 months. Therefore, the WIS scheduled development duration of 36 months expressed in NAFTA1 and affirmed in the NAFTA2 schedule preparation is within the reasonable range for Large REA projects.

4.2.1 *KINGSTON THIRD CROSSING*

This project is currently under construction, and is relevant for comparison to Wolfe Island Shoals on the basis of:

- Layered, multi-jurisdictional assessments, permits and approvals;
- Similar range of Indigenous communities and Conservation Authorities to be consulted;
- Proximity to the City of Kingston and potential impacts to water supply intakes;
- In-water construction.

The Third Crossing Project was assessed in 2013 under the Municipal Class Environmental Assessment, Schedule 'C'. The Project was further assessed in 2019 under CEAA 2012 per the Parks Canada "Detailed Impact Assessment" process. Following the Class EA and DIA, a number of permits from various authorities would be required. These have not been listed in the above noted documents. Based on a review of the reports it appears that the gamut of federal, provincial and local permits were required.

The Third Crossing project area (the Cataraqui River and shoreland areas) provides significant habitat for terrestrial and aquatic species, including 30 listed terrestrial and aquatic wildlife and plant species at risk (SAR). It is expected that a federal DFO fisheries authorization, Navigable Waters permit, and provincial SAR permits would have been required. The area also contains an extensive number of archaeological sites, including marine resources (shipwrecks). A major component of the construction plan is the placement of a temporary causeway in the watercourse for construction purposes This can be seen in Figure 4-1. The causeway represents a substantial temporary impact to fish and fish habitat, and was acknowledged as having permanent impacts after rehabilitation, along with the bridge piers. By following the MCEA, DIA and the range of consultation and permitting processes, the appropriate permits were acquired to allow the project to move to construction. Contrast this to the Wolfe Island Shoals proposal where there is limited significant aquatic habitat, minimal disturbance to shorelines and no imposition of large and intrusive enabling works such as trestles or extensive causeways.

Additional concerns raised during the Class EA and DIA were related to the extensive deposits of contaminated sediments in the watercourse, as well as on shorelines from historic industrial uses. Sediments contained exceedances of the sediment quality guidelines for heavy metals such as lead, copper, chromium and zinc. During construction it was noted that these contaminated sediments could become re-suspended in the river, posing potential threats downstream. The DIA concluded that after the appropriate mitigation strategies (e.g. the delineation of contaminants, sediment control/curtains etc.) had been applied, that the effects were considered to be Not-Significant. Given Baird's[60] understanding of the coastal processes and sediments for the Wolfe Island Shoals, any sedimentation and contamination concerns related to intakes for Kingston's domestic water treatment would be managed through Ontario's established criteria and guidelines.

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[59] **C-2351,** L. Sun, ORTECH Report entitled "Timelines for REA Approved Large Wind Farm Projects – DRAFT for Discussion", to N. Bains, Windstream Energy Inc. (March 10, 2021)
[60] **C-2413,** W.F. Baird and Associates Coastal Engineers. Ltd. Report entitled "Windstream Wolfe Island Shoals Offshore Wind Energy Project NAFT 2 Lake Ontario Context." (November 26, 2021)

Figure 4-1: Kingston Third Crossing Under Construction April 2021

First Nations Engagement for the Third Crossing included:

- Ardoch Algonquin First Nation;
- Mississaugas of Alderville First Nation;
- Mohawk Nation Council of Chiefs;
- Mohawks of the Bay of Quinte;
- Shabot Obaadjiwan First Nation;
- Huron-Wendat Nation;
- Algonquins of Ontario;
- Algonquins of Pikwàkanagàn;
- Mohawk Council of Akwesansne;
- Metis Nation of Ontario;
- Six Nations Grand River;
- Mohawk Nation Council of Chiefs.

While the Ministers List received by Windstream differs from the above, the Project Schedule accounts for the potential need to consult additional Communities.

5 CONCLUSIONS

WSP updated a detailed, comprehensive permitting and approval schedule for the Project that considers regulator and regulatory changes since NAFTA1, notably the federal *Fisheries Act,* the federal *Impact Assessment Act* and changes to Ontario's Endangered *Species Act.* The scheduling confirms the major permitting milestones and construction schedule. Overall, the schedule for completing the required and anticipated studies, reports and authorizations for the REA and the noted permits and authorizations as detailed is 36 months (3 years). This is consistent with ORTECH's analysis of the approval times for large REA projects[61]. In WSP's opinion, but for the moratorium and the revocation of the FIT contract there are no material impediments in completing required and anticipated studies for the REA and other permits and authorizations. The Kingston Third Crossing of the Cataraqui River project exhibits similar characteristics with respect to multijurisdictional permits, in-water works, potential drinking water threats and was successfully brought to construction.

The Project Schedule[62] includes the base Renewable Energy Approval technical submission documents, plus the additional studies outlined by the *DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects* under the REA Regulation[63]. The comprehensive schedule considers the mandatory public consultation process and timelines for publishing notices, holding public meetings and publishing draft documentation for Indigenous communities, municipalities and the public[64]. The Project Schedule's timelines are based on WSP's experience planning and completing REA projects. Agency reviews are based on statutory, published service standards or common timelines.

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[61] **C-2351,** L. Sun, ORTECH Report entitled "Timelines for REA Approved Large Wind Farm Projects – DRAFT for Discussion", to N. Bains, Windstream Energy Inc. (March 10, 2021).

[62] **C-2347,** ORTECH Development Programme Rev. 02., entitled "Wolfe Island Shoals Development Programme" (February 8, 2021).

[63] **C-0452,** Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

[64] **C-2378,** Environmental Protection Act, Ontario Regulation 359/09, Sections 14, 15, 16.

APPENDIX

A

WSP'S NAFTA1 REPORT

IN THE MATTER OF AN ARBITRATION UNDER CHAPTER ELEVEN OF THE NORTH AMERICAN FREE TRADE AGREEMENT AND THE UNCITRAL ARBITRATION RULES

WINDSTREAM ENERGY LLC

AND

GOVERNMENT OF CANADA

RENEWABLE ENERGY APPROVAL AND PERMITTING

JUNE 2015

WSP

WINDSTREAM ENERGY LLC

AND

GOVERNMENT OF CANADA

RENEWABLE ENERGY APPROVAL AND PERMITTING

Project n^{o} : 151-08287-00
Date: June 2015

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WSP Canada Inc.
600 Cochrane Drive, 5th Floor
Markham, Ontario L3R 5K3 Canada

Phone: +1 905-475-7272
Fax: +1 905-475-5994
www.wspgroup.com

June 10, 2014

Mr. John Terry
Torys LLP
79 Wellington Street West, Suite 3000
Toronto, Ontario
M5K 1N2

Subject: Windstream Energy LLC and Government of Canada Renewable Energy Approval and Permitting

Dear Sir,

WSP is pleased to submit this Final Report in response to the URS Report for the Wolfe Island Shoals Wind Project.

Thank you for the opportunity to complete this assignment. Please contact the undersigned if you have any comments or concerns

Yours truly,

Andrew Roberts, B.A.A., M.A.Sc.,
Team Leader – Approvals and Permitting, Environment

WSP Canada Inc.
600 Cochrane Drive, 5th Floor
Markham, Ontario L3R 5K3 Canada

Phone: +1 905-475-7272
Fax: +1 905-475-5994
www.wspgroup.com

PRODUCTION TEAM

WSP CANADA INC. (WSP)

Project Manager	Andrew Roberts, B.A.A., M.A.Sc.
Project Biologist	Erin Fitzpatrick, B.Sc., M.Sc.
Renewable Energy Engineer	Errol Halberg, P.Eng.

Reference to mention:

WSP 2015. Windstream Energy LLC and Government of Canada Renewable Energy and Permitting. Report produced for Windstream Energy LLC. including tables, figures and appendices.

EXECUTIVE SUMMARY

On November 25, 2010, WSP (then GENIVAR) submitted a proposal in response to the request for proposal issued by Ortech on Windstream's behalf for permitting and field investigation services for the Project, including the work required to apply for a REA. Our proposal, which is attached as Appendix 2, included the full suite of studies required to apply for federal and provincial approvals, consistent with the studies that we set out in this report. Our proposal acknowledged that there were project development risks (which is common to the development of all project types), that the Project would be the "first environmental assessment for an offshore wind facility in Canada" and that the Project would be "the first project of its type." However, to overcome the risks that we had identified and to avoid potential project delays, our execution strategy stressed that it would be based on early and frequent consultation with key agencies, strategic direction by our experienced team of environmental consultants, and our relevant technical expertise. Consistent with our work conducting environmental assessments, we identified numerous measures to avoid potential delays in the permitting of the Project, including early and frequent consultation with key agencies, and including team members with previous experience in offshore wind development. Our proposal included a preliminary schedule for project permitting, which provided that work to apply for and obtain a REA would require approximately 22 months. It is important to emphasize that our schedule was conservative, since it was issued in the early days of the REA Regulation.

On March 25 2015, WSP Canada Inc. ("WSP") was retained by Windstream Energy LLC ("Windstream") to prepare an updated overall permitting schedule developed in collaboration with Sgurr Energy, Baird & Associates Costal Engineering, Ocean-COWI and Weeks Marine, to respond to comments in the URS Windstream Arbitration Technical Report dated January 20, 2015 ("URS Report") concerning (i) general project development risks associated with renewable energy development, (ii) the REA process, (iii) radar interference, (iv) birds and bats, (v) noise, (vi) stakeholder consultation and (vii) project changes. The URS Report was commissioned by the Government of Canada in relation to the development of the 300 MW Wolfe Island Shoals offshore wind farm (the "Project").

For more than 25 years, WSP's team of wind energy engineers has developed extensive experience providing technical services for hundreds of wind projects and various wind power companies. This experience includes vast expertise in performing energy assessments, detailed engineering design, environmental studies and owner's engineering services. In Ontario, WSP has successfully completed REA programs for wind and solar projects, including the Conestogo Wind Energy Centre and the East Durham Wind Energy Centre. Internationally, WSP is the lead environmental impact assessment consultant for the Scottish Power Renewables Argyll Array offshore wind farm.

Using this experience and expertise, WSP has developed the permitting and approvals section of the overall Project Schedule[1]. The scheduling confirms that more likely than not, the Project would have achieved the major permitting milestones within the contractual constraints of the FIT program. In WSP's opinion, there are no material impediments to the Project receiving a REA and other permits and authorizations. The Project Schedule[2] is comprehensive and includes all mandatory consultation, studies, permits and authorizations that would be needed to construct the Project at the federal, provincial, and local levels. The schedule timelines provided by WSP are based on our experience planning and obtaining REAs for renewable energy projects, including onshore wind projects in Ontario. Agency reviews are based on statutory, published service standards or common timelines.

1 CER-SgurrEnergy-2.

2 CER-SgurrEnergy-2.

WSP, formerly Genivar Consultants LP, was also retained by Windstream to (i) conduct electrical engineering work in support of the Project, including Windstream's applications for a System Impact Assessment and a Customer Impact Assessment from the IESO and Hydro One for the Project and other projects in 2009, (ii) in support of Windstream's application to the IESO for a connection recovery agreement and (iii) to prepare a report concerning submarine cables in Ontario. Genivar also submitted a proposal in response to a request for proposals from Ortech for a Conceptual Foundation and Substructure Design Analysis.

WSP is independent from the Parties to this arbitration, their legal advisors and the Tribunal. We believe that all the facts and opinions set out in this report are true.

General Project Development Process and Risks

There are no material schedule impediments to achieving the milestone permits, including the REA and a federal screening under the *Canadian Environmental Assessment Act* ("CEAA") within the three year development period.

URS does not acknowledge that many of the studies used to support permit applications are complementary, and work can be completed concurrently in order to meet several different permitting systems. A key example is the expected CEAA screening, where all of the REA document reviews, field work, evaluation of significance and environmental impact studies would be essentially the same for both processes. URS comments that the Project would have faced key challenges in obtaining the REA approval, plus a host of other provincial and federal approvals, permits or authorizations. While the Project would have required several approvals, these approvals are not unique and the processes and studies are well understood. Any project subject to the REA Regulation will have project-specific approvals; the anticipated permitting challenges arising from the need for those approvals are consistent with the range of authorizations for other renewable energy projects, including onshore wind projects.

General Regulatory Framework and Process

There are no material impediments to achieving the milestone permits including the REA Regulation and a federal screening under the CEAA within the three year period for obtaining the necessary regulatory approvals.

The permitting system set out in the REA Regulation is streamlined and prescriptive. It does not separate onshore and offshore components. Rather, the REA Regulation includes the key concept of the Project Location,[3] which encompasses all of the physical aspects of a renewable energy project during construction, operation and decommissioning. Thus all components of the Project would have been considered together as part of the REA application. Windstream would not have been required to permit onshore and offshore project components separately. URS ignores the key definition of a "Project Location" and divides the permitting process into offshore and onshore components.

Although the Project was the first of its type -- as the only offshore wind project with a FIT Contract and the first offshore wind project being developed in Canada -- URS fails to demonstrate how or why the offshore elements of the Project, including submarine cables (including both lake bed and terrestrial components) and lake bed foundations are novel. They are not. For example, the wind project on Wolfe Island utilizes a

3 **C-0103**, *Environmental Protection Act*, Ontario Regulation 359/09 ["REA Regulation"], s. 1(1).

submarine cable, and marine bed foundations were used on the Confederation Bridge[4] connecting PEI to the mainland. Additionally, there are more than 50 offshore wind projects globally, and the fully permitted Cape Wind project in the United States proves that there is precedent in the North American context[5].

URS overstates schedule risk to the Project because of the lack of guidance documents from MOE. The lack of guidance documents from MOE did not prevent the development of onshore wind projects. In fact, a full technical guide for onshore wind projects was not issued until 2011.

In the event of project delays as a result of regulatory uncertainty, waivers and extensions to the FIT contract, while not relied on in the Project Schedule[6], are often forthcoming. For instance, FIT Waterpower projects were granted three year extensions to achieve commercial operation as the result of regulatory delays.[7] However, the Project Schedule confirms that the Project would more likely than not have reached commercial operation without a FIT contract extension.

Radar Interference

WSP has demonstrated through geographic information system ("GIS") mapping that aviation and radar interference issues are low risk. The Project is not located within the 10 km consultation zone of any Canadian aerodrome, the 50 km consultation zone for weather radar, or the 80 km consultation zone for NAVCanada radar installations. Additionally, the Project Location is not within the 20,0000 foot consultation zone from American Soil for the United States Federal Aviation Administration[8]. Additionally, it should be noted that the Wolfe Island Power project that commenced operation in 2009 is located closer to the Unites States – Canada border, setting a successful precedent for constructing a project within the 20,000 foot consultation zone[9].

Birds and Bats

URS overstates the schedule risk regarding permitting for birds. The risk for the Project Schedule[10] for avian permitting is similar to risk for onshore wind projects, where it has not been a material impediment (approximately 30 Class 3 onshore wind projects have been permitted in Ontario). Avian studies, including birds, migratory birds and bats are standard components of REA natural heritage reporting[11] and have been included in the Project Schedule[12].

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[4] **C-1826**, Confederation Bridge 2015. *Design.* http://www.confederationbridge.com/about/confederation-bridge/design.html Accessed May 13, 2015.

[5] **C-1513**, Kransy, R. April 28, 2010 "Cape Wind, first U.S. offshore wind farm, approved." *Reuters. U.S. Edition.* http://www.reuters.com/article/2010/04/28/us-usa-windfarm-idUSTRE63R42X20100428?feedType=RSS&feedName=topNews. Retrieved April 20, 2015

[6] CER-SgurrEnergy-2.

[7] **C-1104**, Letter from Chiarelli, Bob (ENE) to Andersen, Colin (OPA) (June 26, 2013).

[8] **C-1835**, Federal Aviation Administration. *Obstruction Evaluation / Airport Airspace Analysis (OE/AAA).* https://oeaaa.faa.gov/oeaaa/external/portal.jsp Retrieved April 26, 2015.

[9] **C-1201**, TransAlta Brochure Wolfe *Island Wind Farm.*

[10] CER-SgurrEnergy-2.

[11] **C-1666**, LGL Limited 2012 *East Durham Wind Energy Centre Natural Heritage Assessment* Prepared for GENIVAR.

[12] CER-SgurrEnergy-2.

URS overstates the schedule risk related to permitting for bats. It is WSP's opinion that the risk to the Project Schedule posed by bats and bat habitat would be greater for onshore wind projects because bat habitat is located onshore. Concerns about impacts on bats have not been a material impediment to permitting onshore wind projects. Moreover, the potential for the Project to impact bats is also low because of the absence of hibernacula and maternity roosting habitat in offshore areas and because of the limited development proposed in onshore areas.

Noise

URS overstates the risk associated with noise from the Project. Using the noise propagation models that MOE was considering in 2010, HGC Engineering[13] established that the Project would have complied with MOE's 40 decibel sound limit. Aercoustics Engineering[14] confirms (i) that existing sound propagation models are adequate for predicting sound propagation over water and ice and (ii) that the Project would not exceed the MOE's 40 dBA sound level.

Furthermore, as a standard condition of the REA approval, WIS would need to ensure that its turbines operated at the appropriate noise levels, and it would be required to complete acoustic audits to validate the modeling.

Stakeholder Consultation

In WSP's opinion, stakeholder consultation poses no material risk to the Project Schedule. URS overstates the risk associated with stakeholder consultation: there is a statutory consultation process for Aboriginal communities, municipalities and the general public. The REA outlines a streamlined mandatory consultation process with a specific set of consultation activities and the timing for notices and publications. These have not been an impediment to the development of renewable energy projects.

Organized interest groups have not presented persuasive cases in appeals against REAs to the Environmental Tribunal ("ERT") . To date only a single REA has been overturned by the ERT: the REA for the Gilead Power Ostrander Point wind energy project. The ERT reached its decision because it found that the project would cause serious and irreversible harm to the endangered Blanding's Turtle, an endangered species that inhabits the project area. The issue of the appropriate remedy in this case, including possible amendments to the REA that would allow the project to proceed, remains before the Tribunal.

Stakeholder risks in wind development and the REA process are well understood, planned for and can be managed by an experienced development team.

Project Layout and Project Changes

In WSP's experience, project modifications are a normal part of the development process for renewable energy projects. Changes are required in the Draft Project Description Report in order to accommodate inputs from stakeholders, to respond to the environmental information derived from studies performed to apply for a REA, and to address specific design and engineering concerns. Changes can be accommodated while work on a REA application is ongoing. Documenting changes and how a project proponent addresses comments from stakeholders is part of the final consultation document, which is required for a REA application. Furthermore, MOE recognizes that design and technical changes are a part

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13 CER-HGC.

14 CER-Aercoustics.

of the development process, and it outlines the process to recognize and document changes in its Technical Guide[15].

[15] **C-0729**, Technical Guide to Renewable Energy Approvals (MOE) (2013).

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1 EXPERIENCE

1.1 WSP PROFILE

WSP is one of the world's leading professional services firms, working with governments, businesses, architects, and planners to provide integrated solutions across many disciplines. The firm provides services to transform the built environment and restore the natural environment, and its expertise ranges from environmental remediation to urban planning, from engineering iconic buildings to designing sustainable transport networks, and from developing the energy sources of the future to enabling new ways of extracting essential resources. It has approximately 17,000 employees – mainly engineers, technicians, scientists, architects, planners, surveyors, environmental experts, and design professionals – based in more than 300 offices, across 30 countries, on 5 continents.

WSP is also a Canadian leader in providing energy engineering and environmental services and delivering solutions based on an integrated project approach. With more than 5,500 employees and 90 offices in Canada, WSP provides a full range of services over the entire project cycle, from project development, studies, pre-design, detailed design, construction administration and/or management, and operational support.

We provide services in the following market sectors:

- Power and Industrial
- Transportation
- Municipal Infrastructure
- Buildings
- Environment

Wind Energy and Solar Energy are specialty areas of WSP and we are currently working for over 35 clients on a wide variety of renewable projects. We have comprehensive experience in all wind energy related services – wind resource assessment, engineering, environmental services, and permitting.

1.1.1 SELECTED PROJECTS

Our firm has executed a number of development, permitting, design and construction support projects for wind energy developers across Ontario, Canada and worldwide, including both onshore and offshore wind projects. Table 1 below outlines some of the most relevant completed and ongoing projects, and demonstrates our involvement in the following areas of wind energy development:

- Development and Wind Resource Assessment ("WRA")
- Facility Engineering/Detailed Design
- Advisory & Due Diligence
- Construction-Related Services
- Environmental Services & Permitting

Table 1: Select WSP Wind Project Experience

Project Name	Client	Location	Capacity (MW)	Development and WRA	Facility Engineering	Advisory & Due Diligence	Construction-Related Services	Environmental Services & Permitting
Argyll Array (Offshore)	Scottish Power Renewables	UK	1,800					●
Sherringham Shoal (Offshore)	Statoil	UK	316		●			
Grey Highlands Clean Energy*	Capstone Infrastructure	ON	18		●		●	●
Grey Highlands ZEP*	Capstone Infrastructure	ON	10		●		●	●
Settlers Landing*	Capstone Infrastructure	ON	10		●		●	●
Snowy Ridge*	Capstone Infrastructure	ON	10		●		●	●
St-Philémon	Capstone Infrastructure	QC	24	●	●		●	
Dufferin Wind Farm	DWP	ON	91.4				●	
Ernestown Wind Park	Ernestown Wind Park LP	ON	10		●			
SWEB	SWEB/Vestas	NS	24	●	●		●	
South Canoe	Acciona	NS	102		●		●	●
Saint-Damase	Algonquin Power	QC	24	●	●			●
Lakefield	TAQA	MN	205.5			●		
Portfolio of 10 projects	Confidential	Canada	1,000			●		
Morro Do Chapeu	Millenieum Participaçôes	Brazil	300		●			
Pukwis	CGIFN	ON	20		●			
Kemont	Kruger Energy	QC	100			●	●	
Ostrander	Gilead Power	ON	22.5	●	●			
Maddens	Confidential	Int'l	3	●				
Listuguj	SkyPower-Listuguj	QC	168	●	●			●
Saint-Cyprien	Kahnawàke SE	QC	24	●	●			
Shirley	Shirley Wind LLC	WI	20			●		
EDF EN Canada	Various	QC, ON	100+	●	●	●		●
Wildorado Wind Ranch II	Wildorado Wind	TX	80			●		
Northland Power	Various	QC	300+	●				●
Ghost Pine	Finavera	AB	75	●	●			
Shell Wind Projects	Shell Wind	AB	700	●	●			
Sky Harvest Wind Project	Sky Harvest	SK	140	●	●			
4 x Gamesa Projects	Algonquin Power	US	480			●		
Shady Oaks	Algonquin Power	IL	109.5			●		

Mont-Louis	Northland Power	QC	100					●
4 x First Wind Projects	Algonquin Power	US				●		
Anse-à-Valleau	Cartier Energy	QC	101			●	●	
Erie Shores (Ph. I)	AIM	ON	99		●	●		
FPLE Wind Farm Projects	NextEra	ON, QC	10-150	●	●			●
Arthur	Schneider Power	ON	10		●			
Spring Bay	Schneider Power	ON	10		●			
Eastern Ontario Project	Confidential	ON	24		●	●		●
TransCanada Energy	TransCanada	Eastern	500+	●	●			●
Pubnico	Greenwing	NS	31			●		
Éoliennes de l'Érable	Elecnor	QC	100		●	●		
St. Joseph's	Pattern Energy	MB	130		●			
Des Moulins	Invenergy	QC	100				●	
Seigneurie de Beaupre	Borea	QC	270		●			
Gros-Morne	Cartier Energy	QC	210			●		●
Montagne-Sèche	Cartier Energy	QC	58			●		●
Diavik Diamond Mine	Diavik	NWT	4	●	●	●	●	
Caribou	GDF Suez	NB	99		●		●	
Lamèque	Acciona	NB	45		●		●	
Wildmare	Finavera	BC	71	●	●	●		
Mt. Copper	FPLE Canada	QC	54		●	●		●
St. Ulric	Northland Power	QC	128		●	●		●
Confidential	Algonquin Power	NE	Confidential			●		
Témiscouata	Boralex	QC	75		●			●
Carleton	Cartier Energy	QC	110			●	●	
Confidential	Captona Parteners	MI	Confidential			●		
Tumbler Ridge	Finavera	BC	45	●	●	●		
Meikle	Finavera	BC	117	●	●	●		
Multiple projects	Enercon Canada	NS	10+		●			
Bullmoose	Finavera	BC	60	●	●	●		
Multiple projects	Enercon Canada	QC	1000+		●		●	
Castle Rock	Enercon Canada	AB	76		●			

*Ongoing Projects

1.2 WIND PROJECT EXPERIENCE

For more than 25 years, WSP's team of wind energy engineers has developed extensive experience providing technical services for hundreds of wind energy projects and to various wind power companies. This experience includes vast expertise in performing energy assessments, detailed engineering design, environmental studies and owner's engineering services. In our work with wind energy developers, EPC contractors, turbine suppliers and lenders, we have earned a reputation for value added services, quality and professionalism.

Working with these different entities, WSP has developed unique expertise in all technical aspects surrounding the development of a wind energy project. The following examples highlight the knowledge and experience we have developed.

1.2.1 DEVELOPERS

Working directly for wind project developers has allowed us to:

- Develop an excellent understanding of the activities required in the development, design, construction and operation phases of a wind project;
- Develop detailed schedules of the project development cycle including REA, detailed engineering and construction;
- Build experience in the permitting phases of offshore wind developments with work on the Scottish Renewables Argyll array;
- Build valuable experience working with the relevant stakeholders;
- Acquire a detailed understanding of the utility interconnection process;
- Provide valued engineering design services based on long-term wind farm energy production (revenue) and operations and maintenance efficiencies; and,

1.2.2 ENGINEERING, PROCUREMENT AND CONSTRUCTION CONTRACTORS

Our team has partnered with different Engineering, Procurement and Construction ("EPC") contractors to provide engineering services during EPC delivered projects. This type of mandate has allowed us to:

- Review and analyze multiple EPC bid document packages (general and technical specification);
- Better understand the different design and construction philosophies of the different Contractors;
- Have a good understanding of the EPC contractors' perspective and interpretation of the scope of work documents;

1.2.3 LENDERS

Working directly for wind project lenders and investors has allowed us to:

- Review and analyze different engineering designs;
- Review and analyze different project contracts (EPC contracts, turbine supply agreements, operation and maintenance agreements, power purchase agreements and interconnection agreements);
- Develop a deep understanding of the level of information expected by a lender when they are looking to finance a project or monitor the progress of a project (construction and operation).

1.2.4 TURBINE SUPPLIERS

Working directly for turbine suppliers has allowed us to:

- → Develop strategic relationships with technical experts who are able to help provide efficient and effective solutions to specific technical challenges;
- → Gain an excellent understanding of the turbine supplier mindset with regards to their design and the behavior of their system;
- → Have an excellent appreciation for the requirements and the most efficient approach for obtaining approval for modifications to turbine suppliers' standard practices and specifications.

2 PROJECT SCHEDULE

2.1 PERMITTING SCHEDULE

WSP has prepared a comprehensive plan for completing a REA application and associated permit schedule for the Project. This includes studies required under the REA Regulation, including those required to complete the Offshore Wind Facility Report, as well as additional technical studies such as hydrodynamic modelling, ice studies, wind/wave/water studies, coastal engineering and other technical reports. The studies are included in the Project Schedule, and are also consistent with the studies that would have been required under the DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under the REA Regulation[16]. Highlights of the Project Schedule[17] include:

- **Renewable Energy Approval.** WSP has included the mandatory REA consultation points and timing for notifications, public meeting and the release of Draft reports to Aboriginal communities, municipalities and the public in the Project Schedule.[18] Appeals of the REA go to the Environmental Review Tribunal ("ERT"), and this process takes 6 months. This is accounted for in the Project Schedule. The REA outline also includes the additional technical studies that are consistent with the DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under the REA Regulation.[19] Based on WSP's experience it is likely that:
  - The required reports for a Class 5 Wind Facility under s. 13 of the REA Regulation would likely have been completed by October 2012. This is accounted for in the Project Schedule, and includes the following reports:

    (1) Construction Plan Report;

    (2) Consultation Plan Report;

    (3) Decommissioning Plan Report;

    (4) Design and Operations Report;

    (5) Noise Study Report;

    (6) Project Description Report;

    (7) Off-shore Wind Facility Report;

    (8) Specifications Report, Wind Facility

    (9) Natural Heritage Report, including (i) Records Review Report, (ii) Site Investigation Report, (iii) Evaluation of Significance Report and (iv) Environmental Impact Study;

    (10) Cultural Heritage Report

    (11) Stage 1 and Stage 2 Archaeological Assessment Report.

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16 **R-0210**, Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

17 CER-SgurrEnergy-2.

18 **C-0103**, REA Regulation, ss. 14-16.

19 **R-0210**, Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

- Consultations with Aboriginal communities required under s.17 of the REA Regulation would have been completed by May 2012. This is accounted for in the Project Schedule;
- Consultation with the Public, public meetings and municipalities and production of a Consultation Report under s. 18 of the REA Regulation would have taken approximately 20 months, and would likely have been completed by October 2012. This is accounted for in the Project Schedule;
- An appeal would likely have been filed with the ERT. The appeal would likely have been concluded by February 2014. This is accounted for in the Project Schedule;

→ **Natural Heritage.** WSP included the mandatory records reviews and site investigations in the Project Schedule[20]. The Project Schedule outlines avian field studies, including breeding birds, a spring migration window and a fall migration window plus the associated reporting. The Project Schedule outlines bat studies, which includes habitat assessments, a spring migration window and a fall migration window plus the associated reporting. In association with Baird, WSP has provided input to the Project Schedule regarding aquatic (fisheries) surveying plus the associated reporting. Based on WSP's experience it is likely that:

- The Natural Heritage Assessment required under s. 24 of the REA Regulation would have been completed by May 2012. This is accounted for in the Project Schedule.
- The Waterbody Assessment required under s. 29, 30 and 31 of the REA Regulation would have been completed by May 2012. This is accounted for in the Project Schedule. The Environmental Effects Monitoring Plan required under s. 23.1 of the REA Regulation would have been completed by May 2012. This is accounted for in the Project Schedule.

→ **Archaeology & Cultural Heritage.** WSP included terrestrial stage 1 and stage 2 archaeological assessments for shore based Project components. In association with Baird, marine archaeology work has been included. These schedules have been developed based seasonal access for field work, and our experience in archaeological assessments in the REA context. Based on WSP's experience it is likely that:

- The terrestrial archaeology and cultural heritage assessment scheduled by WSP would have been complete by May 2011. This is accounted for in the Project Schedule.

  The marine archaeology scheduled by Baird would have been complete by August 2011. This is accounted for in the Project Schedule.

→ **Technical Studies.** In association with Baird, WSP also included in the Project Schedule technical studies that, based on our experience, were anticipated to be required in order to submit a complete REA application. These studies are also consistent with the DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under the REA Regulation[21]. The timing and duration of these studies are consistent with field windows and Baird's experience in coastal engineering and related work. The additional technical studies, which are consistent with the DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under the REA Regulation would be completed by February 2014. This is accounted for in the Project Schedule, and they include a:

(1) Hydrodynamic Water Quality and Sediment Transfer Report;

(2) Coastal Hydraulics Report;

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20 **C-0103**, REA Regulation, ss. 14-16.

21 **R-0210**, Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

(3) Wind, Wave and Water Level Report;

(4) Coastal Processes and Engineering Study;

(5) Drinking Water and Spill Response Plan.

→ **REA Application and Review.** MOE Screening for Completeness for the REA application is 40 days, per the service standard[22]. MOE's REA Technical Review period is six months. This has been represented at various times as a guarantee[23] and as the service standard[24]. These timelines have been accounted for in the Project Schedule based on the service standards provided by MOE. In WSP's experience, renewable energy developers account for these service periods in establishing project schedules.

→ **CEAA.** WSP has included timelines for a screening under CEAA, including the identification of a responsible agency and the production of a screening report concurrent with REA studies. This is consistent with WSP's experience and understanding of the CEAA process. Based on WSP's experience, it is likely that the CEAA screening would have been completed by May 2012 and submitted to the Responsible Agency for a review of 25 weeks, culminating in an approval by January 2013.

→ **Other Permits and Approvals.** WSP has included in the Project Schedule a comprehensive list of permits and authorizations that were anticipated to be required. These include:

- Transport Canada Aeronautical obstruction clearance by December 2011.
- NAVCanada land use clearance by December 2011.
- Screening/authorization under the *Fisheries Act*. In developing the schedule of additional permits, WSP (advised by Baird) assumed that Section 35(2) authorization under the *Fisheries Act* would be required. The agency review is commonly understood to be 120 days for DFO screening and authorization. The Authorization would likely have been obtained by May 2012;.
- Based on CER-Baird[25] it is assumed that a Section 17(2) (c) ESA permit would not be required as it is unlikely there are Endangered species using the Project location as there is insufficient habitat.
- Federal *Species at Risk Act* authorizations, although unlikely, are accounted for in the Project Schedule and would have been obtained by June 2013.
- Shoreline, wetland or water crossing alteration permits from the Conservation Authority would have been obtained by November 2013.
- Local municipal permits including building permits, road use agreements, entrance permits etc. would have been obtained by March 2014.

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[22] RWS-Dumais.

[23] **R-0244**, Ihantowycz, Roma (2011), "Ontario's Renewable Energy Approval system – How is it working?"; **C-0925**, Ministry of the Environment, "Information Notice, Renewable Energy Approval (REA) Fees" (EBR Registry No. 011-1203 (January 14, 2011)); **C-1177**, News Release (MOE), Regulatory Approvals and Permits (January 5, 2015); **C-1029**, Presentation (MOE), Feed-In Tariff Program, Director of Communications Branch Briefing (July 28, 2011); **C-1027**, Presentation (MOE), Renewable Energy Approval Turnaround, Premier's Office/Cabinet Office (July 14, 2011); **C-1067**, Presentation (Doris Dumais - MOE), Regulatory Approvals Process for Energy Projects in Ontario, Nishnawbe Aski Nation Energy Conference (February 1, 2012).

[24] **C-1825**, Ontario Ministry of Energy. 2015. *Regulatory Approvals and Permits*. Queen's Printer for Ontario. http://www.energy.gov.on.ca/en/archive/regulatory-approvals-and-permits Accessed April 27, 2015.

[25] CER-Baird.

3 DEVELOPMENT STAGE

WSP was retained to respond to comments in the URS Report concerning the following matters:

- → General project development risks associated with the renewable energy development;
- → Environmental permitting including the REA process and other associated permitting processes, such as CEAA, DFO screenings under the *Fisheries Act,* MNR work permits, etc.;
- → Radar interference;
- → Birds and bats;
- → Noise
- → Stakeholder consultation; and
- → Project changes.

3.1 GENERAL PROJECT DEVELOPMENT PROCESSES AND RISKS

URS Comment #72
"During the time from the assumed lifting of the Deferral (May 03, 2012) to the start of construction, Windstream would have faced several key challenges:

URS Comment #72(a)
Undertake environmental studies and obtain not only the REA Approval but also all other permits and consents to construct the facilities including both the onshore and offshore components, at the federal and provincial levels (discussed in Section 5.2.1).

Response:
URS overstates the risk to the Project Schedule. Based on WSP's experience, none of the authorizations would pose critical difficulties to bringing the Project to Commercial Operation in the timelines set out in the Project Schedule. These challenges are consistent with the range of authorizations and permits for onshore wind projects. The requirements were well understood and a work plan had been formulated to address the full range of authorizations, permits and approvals. The full range of permits, clearances and authorizations were understood and documented as early as 2010. But for the Moratorium, these permitting activities were scheduled to begin in February 2011.

In response to ORTECH's 2010 RFP, GENIVAR[26] (now WSP Canada Inc.) identified a full range of expected permits that could have been required for the Project as shown in Table 2: Federal, Provincial and Regional Authorizations. A work plan was developed to complete the studies for the authorizations as well as a suite of technical studies that were expected to be part of a complete REA submission for an offshore wind energy project. The need for these additional studies is validated by the completeness checklist included in MOE's *DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09*[27].

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[26] **C-0865**, Proposal (Genivar) to Ortech Environmental re Wolfe Island Shoals Offshore Wind Farm, Proposal for Permitting and Field Investigation Services (November 25, 2010).

[27] **R-0210**, Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

Table 2: Federal, Provincial and Regional Authorizations

PERMIT	AUTHORIZING AGENCY	NOTES
Canadian Environmental Assessment Act (CEAA) Screening	Transport Canada	Will Be required
Renewable Energy Approval (REA)	Ministry of the Environment	Will be Required
Navigable Waters Protection Act Permit	Transport Canada	Will be required
Aeronautical Obstruction Clearance Form	Transport Canada	Will be required
NAVCanada Land Use form	NAVCanada	Will be required
Fisheries Act Authorization	DFO (possibly with Cataraqui Region Conservation Authority)	Will be required
SARA Permit	DFO or CWS	May be required
Shoreline, wetland or water crossing alteration permit	Cataraqui Region Conservation Authority	Will be required for transmission cable landing point
Species at Risk Permit	MNR	May be required
Crown Land Site Release	MNR	Will be required
Building Land Use Permit	MTO	May be required if alterations to a provincial highway (or exit/entrance) is required for deliveries

Federal level CEAA work was expected as a requirement as part of the work Program. This not a novel requirement, as the Wolfe Island Power Development engaged in a Screening level EA under CEAA in 2004 as they had applied for funding under the Wind Power Production Incentive ("WPPI") program[28].

Environmental studies would have been conducted as part of the overall REA process, and were proposed by GENIVAR in 2010[29]. These studies include record reviews for waterbodies and terrestrial components (i.e. the Background Review Report), field studies to verify the extent and presence of environmental features (i.e. the Site Investigation Report), and additional field studies for aquatic and avian species. If additional studies were needed, these would have been identified through the iterative consultation process the REA Regulation requires and with authorities such as MNR, MOE and CWS. This is part of the standard environmental assessment and REA methodology. These activities have been included in the Project Schedule.

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[28] **C-1625**, Canadian Environmental Assessment Agency 2012. *Archived – Wolfe Island Power Development Canadian Environmental Assessment Registry: 04-01-4667 Natural Resources Canada: ON-249*. http://www.ceaa-acee.gc.ca/052/details-eng.cfm?pid=4667#desc Retrieved April 24, 2015.

[29] **C-0865**, Proposal (Genivar) to Ortech Environmental re Wolfe Island Shoals Offshore Wind Farm, Proposal for Permitting and Field Investigation Services (November 25, 2010).

Additional specific studies related to offshore wind are included and addressed in the Project Schedule[30] including hydrodynamic studies, water quality and sediment transfer modelling, icing, coastal hydraulics, wind/wave/water levels, coastal processes and engineering. Further, as part of a complete application, a report outlining the construction impacts related to water quality and quantity for drinking water intakes, the management and handling of wastes generated, accidental spills, sediment contamination and potential release from dredging would have been required[31]. Baird[32] deals with drinking water concerns in detail, and confirms that the Project would pose no material risk to drinking water systems.

The surveys proposed by GENIVAR in 2010 would have addressed the key concerns with respect to species and habitats associated with offshore wind facilities and the adjacent inland areas. Specific surveys for Significant Wildlife Habitat (SWH) were not considered as part of the terrestrial investigation (the current guidelines were not in place at the time this proposal was generated). The draft SWH documents relied on by MNR for current Natural Heritage Assessments were released in February 2012. Based on the proposed project timeline, it is possible that these new guidelines would not have been approved and additional surveys would not have been requested. If additional surveys were requested by MNR in 2012, there likely would have been an opportunity to complete these as pre-construction surveys without jeopardizing the Project Schedule. In WSP's experience, pre-construction surveys are common in the development of a renewable energy project, and are common REA conditions. For instance, WSP conducted pre-consultation surveys with respect to the following renewable energy projects in Ontario:

1. SunEdison 10 MW Lindsay Solar Farm: pre-construction amphibian surveys[33];
2. NextEra 23 MW East Durham wind project: pre-construction baseline surveys for bat maternity colony habitat, amphibian wetland breeding habitat and colonial nesting bird habitat[34].

3.2 ENVIRONMENTAL PERMITTING AND APPROVALS

3.2.1 GENERAL REGULATORY FRAMEWORK AND PROCESS

3.2.1.1 OFFSHORE AND ONSHORE PERMITTING

URS Comment #74
"With regards to permitting, there are two distinct activities:"

URS Comment #74 (a)
"Offshore wind farm permitting: The permitting of the offshore wind farm, including the electrical substation proposed on Pigeon Island, is perhaps the most challenging aspect of the work and Windstream, in its submission, has focused primarily on this activity. While this might be appropriate, there are examples of wind farms in the UK where the onshore and offshore planning applications were separated, and offshore consent was granted only to find their onshore works being refused, as witnessed with the first iteration of the Dudgeon onshore substation planning application."

Response:

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[30] CER-SgurrEnergy-2.

[31] **R-0210**, Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

[32] CER-Baird.

[33] **C-1737**, Ministry of the Environment, October 22, 2013. *Renewable Energy Approval Number 0568-9AMQAB*

[34] **C-1761**, Ministry of the Environment, January 20, 2014. *Renewable Energy Approval Number 7812-9E4QSC*

URS ignores the key concept and definition of a Project Location in the REA Regulation, which includes all physical aspects of the Project. The REA Regulation does not create two separate processes for permitting onshore or onshore components of renewable energy projects. Instead, the REA Regulation defines the Project Location as:

> "*a part of land and all or part of any building or structure in, on or over which a person is engaging in or proposes to engage in the project and any air space in which a person is engaging in or proposes to engage in the project*[35]."

In physical terms, this means that **all** Project components, including blade swept areas, construction disturbance areas and onshore laydown areas are used to define the Project Location. Additionally, the definition is inclusive of all project activity phases, including construction, installation, and operation and changing or decommissioning the facility. Furthermore, the proposed substation at Pigeon Island would be considered to be terrestrial component of the Project (i.e. onshore), and would be included in the Project Location.

URS Comment #74 (b)
Onshore facilities permitting: The permitting for the construction of the onshore facilities necessary to store equipment during construction and manufacture of the foundations is hardly discussed in the Windstream submissions. While most of these facilities will be temporary and therefore possibly subject to lesser scrutiny, some facilities such as the jetty and onshore grid connections will be permanent and subject to the same level of scrutiny as the wind farm. In fact, some of the onshore facilities, like transmission, on-shore site access, and construction/storage laydown facilities would be considered as part of the assessment of the offshore wind farm.

Response:
As above, the statement ignores the key concept and definition of a Project Location in the REA Regulation, which includes all physical aspects of the Project[36]. There is no distinction between onshore, offshore, temporary or permanent aspects of the Project under the REA Regulation.

3.2.1.2 SCHEDULING

URS Comment #75
"CER-Powell Report (Paragraph 3 (iii)) states that "it would have been commercially reasonable for a developer to assume that the permitting of an offshore wind power project could have been completed in approximately three years". This opinion does not give sufficient consideration to several unique features specific to this Project, nor does it fully consider permits that are required at the Federal level."

Response:
The three year timeframe is inclusive of federal, provincial and local permits, approvals and authorizations. The Project Schedule[37] demonstrates that the federal CEAA and provincial REA would, more likely than not, have been obtained within the three year period to obtain regulatory approvals. URS does not recognize that the field studies and background work required for approvals would be undertaken concurrently during the development phase of the Project, as with many other projects. The expected CEAA screening would have been aligned with the REA work, as is common with other environmental assessments that require assessments at the provincial and federal level.

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[35] **C-0103**, REA Regulation, s. 1(1).

[36] **C-0103**, REA Regulation, s. 1(1).

[37] CER-SgurrEnergy-2, Appendix 4, WWIS Project Schedule.

In 2010, GENIVAR[38] (now WSP Inc.) produced a proposal for permitting and field investigation for ORTECH in response to an RFP issued by Ortech in October 2010. While ultimately WSP was not awarded the mandate, the proposal outlined all of the expected federal, provincial and regional permit requirements that would be needed for the Project. The proposal also included an outline schedule confirming the three year timeframe. It is important to note that the Project required a REA to move forward with the Notice to Proceed ("NTP") request, and that federal approvals would overlap with NTP. Moreover, applications for federal approvals (e.g. Navigable waters permits) could only be undertaken during the detailed design phase, which would have started after Windstream obtained its NTP from the OPA and during the initial construction planning phase.

URS Comment #76

"Windstream also fails to take into account the fact that "First of a Kind" projects that employ innovative technologies or have not been undertaken before in the jurisdiction can experience considerable risk. The Project can be considered a First of Kind project since at the time of writing this Report, a commercial offshore wind enterprise had yet to be implemented in North America."

Response:

URS's statement is unsupported. The components of the Project are not "first of a kind." Global development of more than 50 offshore commercial wind projects demonstrates that this is not a "first of a kind project." While URS observes that a commercial offshore wind project had not yet been implemented in North America, the Cape Wind offshore project in the United States was fully permitted by April 2010[39].

Furthermore, the specific offshore elements of the Project, including submarine cables, their onshore transition, and lakebed foundations, are not novel. For example, the wind project on Wolfe Island utilizes a submarine cable[40], and marine bed foundations were used on the Confederation Bridge connecting Prince Edward Island to the mainland[41]. All of the components are similar to those that would have been used for the Project.

URS Comment #77

First of a Kind projects are generally much riskier than "normal" tried and tested projects and it is common for the project development process for a First of a Kind project to be protracted. The First of a Kind project risk in the case of Ontario is much higher given the absence of regulatory provisions or policy guidance for offshore wind projects.

Response:

The Project should not be considered as "first of kind" because more than 50 offshore wind projects have been developed globally, including the Vindpark Vänern constructed in Lake Vänern in Sweden, a freshwater lake. Also, the Cape Wind Project, which was proposed to be built in Nantucket Sound, south of Cape Cod Massachusetts has been fully permitted by the relevant authorities. It is also clear that the

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[38] **C-0865**, Proposal (Genivar) to Ortech Environmental re Wolfe Island Shoals Offshore Wind Farm, Proposal for Permitting and Field Investigation Services (November 25, 2010).

[39] **C-1513**, Kransy, R. April 28, 2010 "Cape Wind, first U.S. offshore wind farm, approved." Reuters. U.S. Edition. http://www.reuters.com/article/2010/04/28/us-usa-windfarm-idUSTRE63R42X20100428?feedType=RSS&feedName=topNews. Retrieved April 20, 2015.

[40] **C-1457**, Independent Electricity System Operator 2015 *Wolfe Island Wind Project (197.8 MW) – Wolfe Island.* http://www.powerauthority.on.ca/wind-power/wolfe-island-wind-project-1978-mw-wolfe-island Accessed April 13, 2015.

[41] **C-1826**, Confederation Bridge 2015. *Design.* http://www.confederationbridge.com/about/confederation-bridge/design.html Accessed May 13, 2015.

Project is not “first of kind” when it is broken down into its constituent parts. For instance, the Project’s submarine components, such as submarine cables and bridge piers have been permitted for other projects in Ontario; i.e, a high voltage submarine cable connects the Wolfe Island onshore wind project to the onshore substation. Ontario also has extensive experience with the construction of wind turbines. Put succinctly, each of the components of the Windstream proposal, taken separately, are “normal” tried and tested project components.

Furthermore, MOE developed a DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under the REA Regulation[42]. This document includes the studies, reports and submissions that would have made up a complete REA submission for an offshore wind project. This Draft Checklist is consistent with the studies and reporting that GENIVAR[43] proposed in 2010, and with the scheduling work produced in 2015.

3.2.1.3 STUDY METHODOLOGY

URS Comment #78

In the context of permitting, it is likely that delay could have occurred as a result of the authorities having to develop new methodologies to assess environmental and other risks and to issue the associated permits. As such, First of a Kind risks associated with permitting of the Project are considered HIGH with a HIGH impact on Project schedule.

Response:

The schedule risk is overstated by URS. It is WSP’s experience that new study methodologies are developed by MOE in collaboration with project proponents as projects move through the regulatory approvals process. This is standard practice in environmental assessments. MOE was developing a checklist of project reports and deliverables specific to offshore projects[44]. As the project components themselves and their potential impacts are not novel or unknown, based on WSP’s experience, it is reasonable to assume that Windstream, in consultation with the relevant ministries, would have adequately scoped an assessment methodology by adapting the ongoing Ontario experience with that of projects completed elsewhere. It is typical in Ontario and elsewhere for processes and evaluation methodologies, including REA requirements, to evolve through in response to feedback from industry.

For example: Earlier in the REA program, proponents needed to receive concurrence letters from MNR and MTCS for the natural heritage and archaeological/cultural heritage work before PIC #2 could be held. PIC #2 is a major milestone in the REA process that must be met before the REA application can be submitted. There were significant delays in receiving these concurrence letters, so the REA legislation was amended to make these concurrence letters a part of the REA application itself.

Further, waivers and extensions to contract milestones to acknowledge regulatory delays are not uncommon in the renewable energy industry, as illustrated by extensions to commercial operation dates for FIT waterpower projects[45]. However, as indicated, the Project would, more likely than not, have achieved the relevant permitting milestones without an extension or a waiver.

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[42] **R-0210**, Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

[43] **C-0865**, Proposal (Genivar) to Ortech Environmental re Wolfe Island Shoals Offshore Wind Farm, Proposal for Permitting and Field Investigation Services (November 25, 2010).

[44] **R-0210**, Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

[45] **C-1104**, Letter from Chiarelli, Bob (ENE) to Andersen, Colin (OPA) (June 26, 2013).

3.2.1.4 PROVINCIAL PERMITS AND AUTHORIZATIONS

URS Comment #79
"The following permits and approvals would be required for the realisation of the Project:"

Response:
URS provides a listing of permits and approvals that would be required for the Project. These have been provided in the Project Schedule. Note that in many cases where jurisdictions overlap, the activities and studies to make complete applications can be accomplished concurrently.

URS Comment #79(a)
"Permits/Authorizations issued by the Government of Ontario:"

URS Comment #79(a)(i).
"Permits to conduct on-site field studies and install testing facilities under the Public Lands Act."

Response
These authorizations do not present a substantial schedule risk. These permits and approvals were known in 2010[46], and have been further documented in the Project Schedule. The primary approval for field studies would be a scientific collection permit for aquatic species.

A Licence to Collect Fish for Scientific Purposes is necessary when collecting fish for scientific or education purposes in Ontario. An *Application for a Licence to Collect Fish for Scientific Purposes* is completed and submitted to the Ministry of Natural Resources ("MNR") district office prior to undertaking the activity. The standardized two page application form must be completed with applicant contact information, identify support staff, a description of the equipment to be used, the name of the waterbody, as well as the targeted species, age class, numbers and proposed schedule for sampling. The application is generally also supported by a figure of the study area, and brief description of the purpose of the study. The application is submitted to MNR district office for review and approval.

Where the application is completed to the satisfaction of MNR and where information for the identified waterbody is lacking, a licence is issued, containing applicant information, effective and expiry dates, and Schedule A – Licence Conditions. The Licence Conditions will vary for each licence, but they typically contain similar recommendations, such as a request for a minimum of one week's notification prior to sampling, request to notify MNR of any observed invasive species, and identifies the mandatory reporting requirements.

Upon completion of the sampling activity or as identified in Schedule A of the licence, the applicant must complete and submit the standardized excel reporting form to MNR, identifying the sampling methodology, dates, capture results, and sampling location(s). The turn-around time between submission of the application and receipt of a licence varies, typically taking anywhere between a single day to three months.

URS Comment #79(a)(ii).
"A well license to drill into the lakebed under the Oil, Gas and Salt Resources Act."

Response:
This license does not present a substantial schedule risk. This licence has been documented in the Project Schedule, concurrent with other permitting activities. ORTECH[47] undertook coordinated efforts in

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46 **C-0865**, Proposal (Genivar) to Ortech Environmental re Wolfe Island Shoals Offshore Wind Farm, Proposal for Permitting and Field Investigation Services (November 25, 2010).

2012 to obtain this license, beginning with consultations with MNR (the licensing agency) in 2010. Based on the efforts described by ORTECH, it is assumed that a permitting period of 22 months would be sufficient to obtain the license.

URS Comment #79(a)(iii).
"A provincial renewable energy approval (REA) under the Environmental Protection Act."

Response:
But for the moratorium, Windstream would have pursued this approval. Windstream had planned a full suite of studies, reports and consultations to satisfy REA as evidenced by early work plans and proposals from GENIVAR[48] and Stantec[49] in 2010, and consultations with government agencies as evidenced by ORTECH[50].

URS Comment #79(a)(iv).
"Permits under the Endangered Species Act (if deemed to be required by the Ministry of Natural Resources and Forestry)."

Response:
It is unlikely that the need for an *Endangered Species Act*, 2007 ("ESA")permit would have posed significant risk to the Project Schedule. This is based on the background research that concludes the presence of species at risk or endangered species in the Project Location is unlikely[51]. Additionally, the process to obtain these permits is well-established and is frequently completed in support of many development applications.

Permits under the ESA are sometimes required as part of proposed development applications, including those for renewable energy projects. The need for a permit under the ESA does not preclude MOE from issuing a REA for the Project; however, the REA may specify terms and conditions which prevent the commencement of activities requiring authorization under the ESA until necessary authorizations are in place. Work towards an ESA permit, if required, is generally completed concurrently with other aspects of the REA process.

If endangered or threatened species or their habitat(s) had been documented during the field investigation, and impacts to the species and/or their habitat are deemed unavoidable, then an Overall Benefit Permit or Social or Economic Benefit Permit may have been required.

The permitting process involves consultation with MNR upon discovery of the Species at Risk and determination that a permit is required. From WSP's experience with Overall Benefit Permits, this consultation process may take up to one year. During this time, the three phases of the application process, including Information Gathering, Activity Review and Assessment, and Permit Application and Assessment would be completed. Once the permit application has been deemed complete by the Ministry, a permit is typically issued within three to six months. The Ministry currently has a 3-month (90 day) service standard for permitting decisions.

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[47] **C-0619**, Report, (ORTECH), Wolfe Island Shoals Wind Farm MNR Well License Application (June 12, 2012).

[48] **C-0865**, Proposal (Genivar) to Ortech Environmental re Wolfe Island Shoals Offshore Wind Farm, Proposal for Permitting and Field Investigation Services (November 25, 2010).

[49] **C-0873**, Request for Proposal (Stantec Consulting Ltd.), Wolfe Island Shoals Offshore Windfarm Permitting and Field Investigation Services (November 25, 2010)

[50] **C-0619**, Report, (ORTECH), Wolfe Island Shoals Wind Farm MNR Well License Application (June 12, 2012).

[51] CER-Baird.

URS Comment #81

"The Public Lands Act gives the MNRF the authority to manage Crown land, including the beds of most lakes and rivers. MNRF "authorizes the use or occupation of Crown land for a renewable energy project through a variety of instruments issued under the Public Lands Act for a fixed term." Access to Crown land and authorization to carry out initial testing for a potential renewable energy project are normally granted through a letter of authorization, a land use permit, or a work permit. This initial access to Crown land for testing "does not guarantee regulatory approvals… [or] tenure (the legal agreement between the ministry and occupant spelling out the terms and conditions of occupancy on Crown land.)" Use and occupation of Crown land for a renewable energy project require additional authorization by MNRF through a work permit, a Crown lease, a land use permit, an easement, a Crown patent and/or a licence of occupation."

Response:

In WSP's opinion, the environmental assessment requirements of the Crown Land Site release process do not pose a material impediment to the Project Schedule. Based on Windpolicy 4.10.04 and our experience conducting environmental assessments in Ontario, it is our opinion that the studies that would likely be required in support of a Crown Land Site Release application and environmental assessment are studies that would be required as part of an application for a REA. They are therefore accounted for in the Project Schedule.

On August 9, 2010, Windstream received a letter from MNR saying that MNR would discuss reconfiguring Windstream's Crown land applications so that the Project could comply with MOE's proposed 5 km shoreline exclusion zone. MNR indicated that they would "…move as quickly as possible…"[52] so that the Project could obtain Applicant of Record status.

MNR procedure PL 4.10.04[53] outlines the Crown Land site release process, including the environmental assessment required for MNR approval. In this procedure, Applicants of Record are directed to use the environmental screening process per the Electricity Projects Regulation[54].

The base activities in the screening process are defined broadly, and include the following:

- Mandatory notifications (consistent with REA requirements for notifications);
- Consultation with the public, agencies, First Nations and other Aboriginal communities (the REA requires a more extensive set of consultations);
- Preparing a project description (consistent with REA requirements for a Project Description Report);
- Producing a screening report including
    - Background information, including a project description and outline of the technology to be used (consistent with the REA Project Description Report and a Turbine Specification Report);
    - A map of the project location (Consistent with the REA requirements);
    - A description of the local environment and conditions (consistent with the REA Natural Heritage Report);

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[52] C-0334 Ministry of Natural Resources. August 9, 2010. Letter to Ian Baines *Re-Configuration of Windpower Applications (File No.'s WP-2008-213 TO WP-2008-215 & WP-2008-292 TO WP-2008-296).*

[53] WS0009072 Ministry of Natural Resources. 2008. *Wind Power Site Release and Development Review – Crown Land*. Procedure PL 4.10.04

[54] O.Reg. 116/01

- A description of other required approvals and permits (a standard section in the Project Description Report for REA);
- Analysis and discussion of mitigation and impact management for any potential negative effects (consistent with the REA Construction Plan Report, Design and Operations Report and the Environmental Impact Study that forms part of the Natural Heritage Report)
- Information on public and agency consultation (consistent with the REA Consultation Report).

All of this work is consistent with the work that would have been conducted for the REA as shown in the Project Schedule.

Additionally, the MNR Approval and Permitting Requirements for Renewable Energy Projects [55](“APRD”) requires additional information including:

- A site plan including the following additional information:
  - Location of shipping channels (these have been identified by CER-Baird-2 and shown to pose no material risk to the Project);
  - Location of commercial fisheries zones (CER-Baird has identified that fish habitat is scare at the Project site);
  - Proposed location of submarine cables, including land/water interface and connection to on-shore transmission (consistent with the Project Location that would have been described in the Project Description Report);
  - Location of existing dispositions of the lake bed (these would have been identified through the Site Release Process);
  - Location of offshore oil and gas licenses, leases, wells and works ((these would have been identified through the Site Release Process);
- A records review as described in section 25 of the REA regulation including the following additional information:
  - Fish and fish habitat (the Project Schedule includes fisheries surveys);
  - Fish populations and fisheries (the Project Schedule includes fisheries surveys);
  - Rare vegetation communities as defined by the MNR’s Natural Heritage Information Centre (included in the Records Review phase of the Natural Heritage Report);
  - Species protected under the *Endangered Species Act* (endangered species and their habitat are unlikely to be present in the Project area, but would have been documented through the Natural Heritage Report shown in the Project Schedule);
  - Wildlife species and their habitat (included in the Natural Heritage Report);
  - Hazard Lands (these would have been identified by consulting with the Conservation Authority and/or the municipality as applicable).
- A coastal engineering study to address the potential effects of the proposal on natural erosion and accretion (this is included in the Project Schedule and detailed by CER-Baird).

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[55] C-0136 Ministry of Natural Resources. 2009. *Approval and Permitting Requirements Document of Renewable Energy Projects.*

URS Comment #82

"Under the Public Lands Act, it is unlawful to construct and/or conduct certain activities on Crown lands without a work permit. An application for a permit must be submitted to the MNR well in advance of the start date. The MNR may approve the work permit with or without conditions (including timing restrictions) or decline the application. If MNR declines the work permit the decision may be appealed."

Response

URS overstates the risk and the review times for Public Lands Act Work Permits. These permits are included in the Project Schedule, and pose no significant risk to the Project Schedule. Work Permits are normally applied for during the detailed design phase of the project and are not on the critical path of the Project Schedule. The submission requires specific design deliverables in order for MNR to process the application. For lakebed work, the MNR "Works within a Waterbody Part 5" application indicates that it takes MNR approximately 1 month to process the approval for the location of the proposed work, and an additional 2 months to process the detailed plans and specifications[56].

URS Comment #86

"The provincial Endangered Species Act (administered by MNRF) was enacted in 2007 and protects species at risk in Ontario. Permitting requirements under the Act continue to change, but at the relevant time Ontario Regulation 242/08 was in effect and was later amended to 293/11. The Endangered Species Act "protects species at risk by restricting activities that may affect plants, animals or their habitats".[25] Sections 9(1) and 10(1) of the Act offer protection to the species-at-risk as well as its habitat. Permits or authorization are required for activities that would otherwise not be allowed under the Act. Permits or authorizations can be granted by the MNRF sometimes "with conditions that are aimed at protecting and recovering species at risk".[26] There are, "5 types of permits issued under the Endangered Species Act: health or safety, protection or recovery, social or economic benefit to Ontario, Aboriginal, and overall benefit".[27] It is likely that if species-at-risk were identified to be impacted by the WWIS project (i.e. impacts on the species and habitat that could not be avoided), a social or economic benefit to Ontario permit or overall benefit permit would likely have been required. To avoid authorization or permitting, measures must be put in place to work around the protected species and habitats (i.e. timing, location, method).[28]"

Response:

As indicated in the response to URS Item #79(b)(iv), it is WSP's opinion that the need for a permit under the ESA would not have posed a significant risk to the Project Schedule, even if one were required. Considering the limited nature of the proposed development in onshore areas, impacts to these terrestrial and wetland species may be more easily avoided or mitigated without the need for an ESA permit.

The permit process is well understood and the field work and consultation required determining the need for a permit is a standard component of developing a renewable energy project. Furthermore, the need for such a permit would only be triggered by the presence of an endangered or threatened species or its habitat within the proposed development area. Opportunities to avoid authorization or permitting under the ESA would have been explored during the project design and development phase of the Project. It is likely that even if endangered or threatened species had been documented within the study area, that a permit could have been avoided.

The available habitat makes it unlikely that any species at risk would be found in the study area. The Natural Heritage Information Centre (NHIC) database suggests that of the 32 threatened and endangered aquatic species listed on the Species at Risk in Ontario List, only Lake Sturgeon (END) has been recorded in the study area, but is unlikely to have suitable habitat[57]. American Eel (END) and Shortnose

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[56] **C-1759**, Ministry of Natural Resources and Forestry 2014. *Works Within a Waterbody Part 5.* Form 018-2368E (2014/08).

[57] CER-Baird.

Cisco (END) may also be found in Lake Ontario, but documented occurrences were not recorded for the study area.

A review of the Environmental Registry maintained by the Government of Ontario indicates that Overall Benefit Permits have been issued for a variety of development applications impacting Threatened (THR) or Endangered (END) species or their habitat including Redside Dace (END), Butternut (END), Eastern Foxsnake (END), Butler's Gartersnake (END), Dense Blazing Star (THR), Willowleaf Aster (THR), Bobolink (THR), Eastern Meadowlark (THR), Whip-poor-will (THR), and Blanding's Turtle (THR).

3.2.1.5 FEDERAL PERMITS AND AUTHORIZATIONS

URS Comment #79(b)(i)
"Permits under the Species at Risk Act (if deemed to be required by Environment Canada)."

Response:
Based on the work by CER-Baird[58], it is unlikely that *Species at Risk Act* ("SARA") permits would be required for aquatic species, or bird species on Pigeon Island. Similarly, it is unlikely SARA permits would be needed for birds on Pigeon Island, per CER-Kerlinger[59]. Even if required, the work for SARA permits could be done concurrently with the REA, posing low risk to the Project Schedule. The need for permits under SARA would have been determined as part of the routine agency consultation and field investigation components of the study, as with any other development application or renewable energy project. These consultation activities are reflected in the Project Schedule. Early consultation would have allowed for the implementation of targeted surveys or adjustments to the proposed design layout in the event a permit under SARA was deemed necessary by Environment Canada. Based on what is known about the Project area, it is unlikely that SARA permits would be required for the Project.

If a permit was required, there is a standard process for obtaining the permit and this would not likely adversely impact the Project Schedule. Once a permit application has been submitted, a decision is issued within 90 days. To qualify for a permit, the applicant must be able to demonstrate, to the Minister's satisfaction, that (i) all reasonable alternatives have been considered and the best solution has been adopted, (ii) all feasible measures to minimize the impact of the activity on the species or its habitat will be taken, and (iii) that the activity will not jeopardize the survival or recovery of the species. Impacts associated with the operation of the turbines on listed species themselves (e.g. bat/bird mortality) would be considered incidental and the permit could be obtained, provided efforts were made to reduce impacts to these species as much as possible.

URS Comment #79(b)(ii)
"Authorizations under the Fisheries Act (if impact to fish and fish habitat is determined).

Response:
The screening and authorization under the *Fisheries Act* are included in the Project Schedule, and does not pose a significant schedule risk to the Project. WSP (previously GENIVAR) recognized the requirement for an authorization under the *Fisheries Act* as early as 2010 in the proposal for permitting services[60]. The Authorization would have been a potential trigger for a CEAA screening, and the DFO could have been the Responsible Agency.

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[58] CER-Baird.

[59] CER –Kerlinger.

[60] **C-0865**, Proposal (Genivar) to Ortech Environmental re Wolfe Island Shoals Offshore Wind Farm, Proposal for Permitting and Field Investigation Services (November 25, 2010).

The expected preparation time to consult and develop and application is 6 months, with a 120 day review by the DFO or the Conservation Authority if it had a DFO service agreement to review applications.

URS Comment #90

"As part of any permit under the Fisheries Act, consideration should be given to the Species at Risk Act (SARA, administered by Environment Canada). The SARA was enacted in 2002. This Act protects wildlife (including fish and molluscs) and their habitats in Canada. The purposes of the SARA, "are to prevent wildlife species in Canada from disappearing, to provide for the recovery of wildlife species that are extirpated (no longer exist in the wild in Canada), endangered, or threatened as a result of human activity, and to manage species of special concern to prevent them from becoming endangered or threatened". SARA is applicable, "to any species at risk that is found at any time throughout the year on a property in which there is an interest".[33] Permits and/or agreements can be issued authorizing a person to engage in activities affecting a listed wildlife species, any part of its critical habitat or it's residences.[34]"

Response:

As CER-Baird demonstrates, it is unlikely that the Project area contains habitat that would support species listed in SARA[61].

As discussed in the response to URS item #79(b)(i), the need for a permit under SARA would have been determined as part of the routine agency consultation and field investigation components of the Project. Opportunities to avoid impacts and therefore the need for a permit would have been investigated during early stages of the project.

URS Comment #92

The Canadian Aviation Regulations (administered by Transport Canada) establish regulatory requirements designed to enhance air safety. "In 1996 a revised set of aviation safety rules came into force in a consolidated and simplified format known as the Canadian Aviation Regulations (the CARs). The CARs are a culmination of several years of work, incorporating a new rule-making process and several new principles and recommendations".40 The new regulatory structure consists of four elements: The Aeronautics Act, Canadian Aviation Regulations, Standards, and Advisory Materials.41 Standard 621 Obstruction Marking and Lighting (Amended 2011/12/31). Chapter 12 discusses the requirements that "govern the marking and lighting of a wind turbine and a wind turbine farm".[42]

Response:

Aviation regulations, consultations and clearances do not pose a significant risk to the Project Schedule. Specific aviation and radar interference issues are discussed in Section 3.2.2 of this Report. Lighting recommendations from Transport Canada are made when a Proponent files a routine Aeronautical Obstruction Clearance application. Transport Canada defines which turbines require marking and lighting. This process has been outlined in the Project Schedule.

URS Comment #93

"The Migratory Birds Convention Act, 1994 (MBCA, administered by Environment Canada) determines protection to migratory birds. Generally, application of a nesting timing constraint protects eggs and nestlings. The MBCA makes it unlawful to pursue, hunt, take, capture, kill or sell birds listed therein ("migratory birds"). Compliance with the MBCA regulations and guidelines for vegetation clearing or demolition, as recommended by Environment Canada, needs to be considered during the project's construction and operation phases. In order to minimize the potential for incidental take of any nesting migratory birds, clearing of vegetation and any proposed work activities in migratory bird habitat must be undertaken outside of the active breeding season (generally April 15 to August 8 in Southern Ontario). If

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[61] CER-Baird.

clearing (or other work is required during the nesting season, a nest survey must be conducted by a qualified avian biologist immediately prior to commencement of the works to identify and locate active nests of species covered by the MBCA."

Response:
Migratory bird work does not pose a significant risk to the Project Schedule. Surveys for avian species, including migratory birds, are standard components of the REA process and would likely have been completed within the anticipated project timelines. Surveys of migratory and/or breeding bird surveys are completed as part of the Natural Heritage Assessment and results inform recommendations within the Environmental Impact Study. Measures to ensure compliance with the MBCA with respect to vegetation removal are standard best management practices included within the Construction Plan and Design and Operations Report. These measures include avoidance of vegetation removal during the breeding season, and the potential for nest sweeps by a qualified avian biologist in the event limited vegetation removal is required during the breeding window. CER-Kerlinger provides an expert opinion that it is improbable that the Project would cause biologically significant impacts to birds[62].

3.2.2 RADAR INTERFERENCE

URS Comment #114
"The Project is located near several airports, in Canada and the US"

- *a) Kingston Airport at an approximate distance of 17 km.*
- *b) Picton Airport at an approximate distance of 50 km.*
- *c) Belleville Airport at an approximate distance of 65 km.*
- *d) Gananoque Water Aerodrome at an approximate distance of 40 km.*
- *e) Watertown International Airport in the US, at an approximate distance of 40 km.*
- *f) Maxson airfield in the US, at an approximate distance of 56 km.*

URS Comment #115
*"More than half of wind farm developments in the UK are subject to objections from the aviation sector, and are treated comparably to other tall structures such as high-rise buildings, transmitter masts and chimneys. This has led to the establishment of an industry led Aviation Fund in the UK, which promotes research into methods of reducing the effects of wind farms on radars, and the establishment of an Aviation Management Board chaired by the Department for Energy and Climate Change (*DECC*), which meets regularly to address wider issues."*

URS Comment #116
"The total height of each WTG is around 145m (approximately the height of a 50 storey building. Windstream does not appear to have factored into its schedule any consultations or permitting related to potential radar interference, nor has it accounted for additional time that will likely be required because of the presence of the airports in the US and the likely involvement of US aviation authorities (Federal Aviation Administration) in the approval process".

URS Comment #117
"The risk associated with the permitting related to radar interference is MEDIUM with a MEDIUM impact on schedule due to potential increased consultation requirements."

Response:
URS overstates the risk for radar interference and aviation concerns. The consultation requirements for Canadian airfields do not pose a significant risk and are not expected to affect the Project Schedule. The

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[62] CER-Kerlinger.

radius of the consultation zone around a civilian airfield is 10 km. As shown in Figure 1, there are no airports within 10 km of the proposed project area.

The Ministry of the Environment published guidelines for the REA submission process which specify that the applicant must describe negative environmental effects on local interests and infrastructure, including telecommunications and local airports or aerodromes[63]. In addition, proposed wind energy project locations and total structure heights must be provided to NAVCanada and Transport Canada. As there are no Canadian airports within the threshold consultation zone of 10 km, there is no expected schedule risks associated with Canadian airports.

The consultation requirements for Canadian NAVCanada and Environment Canada radar systems do not pose a significant risk and are not expected to affect the Project Schedule, The radius of the consultation zone around NAVCanada Air Traffic Control Primary Surveillance Radar ("PSR") is 80 km and the radius of the consultation zone around an Environment Canada Weather Radar is 50 km. As shown in Figure 2, there are no NAVCanada Air Traffic Control Primary Surveillance Radar systems within 80 km nor are there Environment Canada Weather Radar systems within 50 km of the Project.

There is clear definition of proximity limits that are recommended for detailed consultation as they relate to Canadian project development. The Radio Advisory Board of Canada and CanWEA published guidelines for the consultation process regarding radar, communication systems, and airports/aerodromes[64]. The document provides a series of analytical methodologies and thresholds that help to indicate where a potential interference may occur, thereby acting as a voluntary (but highly recommended) trigger for the proponent to notify the applicable authority. As there are no NAVCanada or Environment Canada radar systems within 80 km and 50 km respectively from the turbines, there is no expected schedule risk associated with Canadian radar facilities.

Consultation requirements with the United States Federal Aviation Administration (FAA) do not pose a significant risk and are not expected to affect the Project Schedule. As shown in Figure 3, the proposed project is not within 20 000 ft of American civilian or military airports, nor is it within 20 000 ft of American soil. The consultation requirements with the FAA do not pose a significant risk and are not expected to affect the Project Schedule.

There is clear definition of proximity limits that are recommended as sensitivity thresholds for projects as they relate to American permitting process. The Federal Aviation Administration cites regulations that require notification to the Administrator of the FAA for:

→ any construction or alteration exceeding 200 foot above ground level

→ any construction or alteration:

  - within 20,000 feet of a public use or military airport which exceeds a 100:1 surface from any point on the runway of each airport with its longest runway more than 3,200 feet
  - within 10,000 feet of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway no more than 3,200 feet

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[63] **C-0729**, Technical Guide to Renewable Energy Approvals (MOE) (2013).

[64] **C-1514**, Radio Advisory Board of Canada (RABC) and Canadian Wind Energy Association (CanWEA) 2010. *Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar Systems.*

- Within 5,000 feet of a public use heliport which exceeds a 25:1 surface[65].

Finally, as shown in Figure 1 Canadian Airports and Aerodromes near the Proposed Windstream Project, the Wolfe Island Wind Power Project is in close proximity to the proposed Project and is within 20 000 feet of American Soil. This sets a precedent for REAs concerning radar systems and airports/aerodromes as well as precedent for constructing projects within the consultation zone of the FAA.

[65] **C-1835**, Federal Aviation Administration. *Obstruction Evaluation / Airport Airspace Analysis (OE/AAA).* https://oeaaa.faa.gov/oeaaa/external/portal.jsp Retrieved April 26, 2015.

Figure 1 Canadian Airports and Aerodromes near the Proposed Windstream Project

Figure 2 NAVCanada and Environment Canada Radar Systems near the Proposed Windstream Project

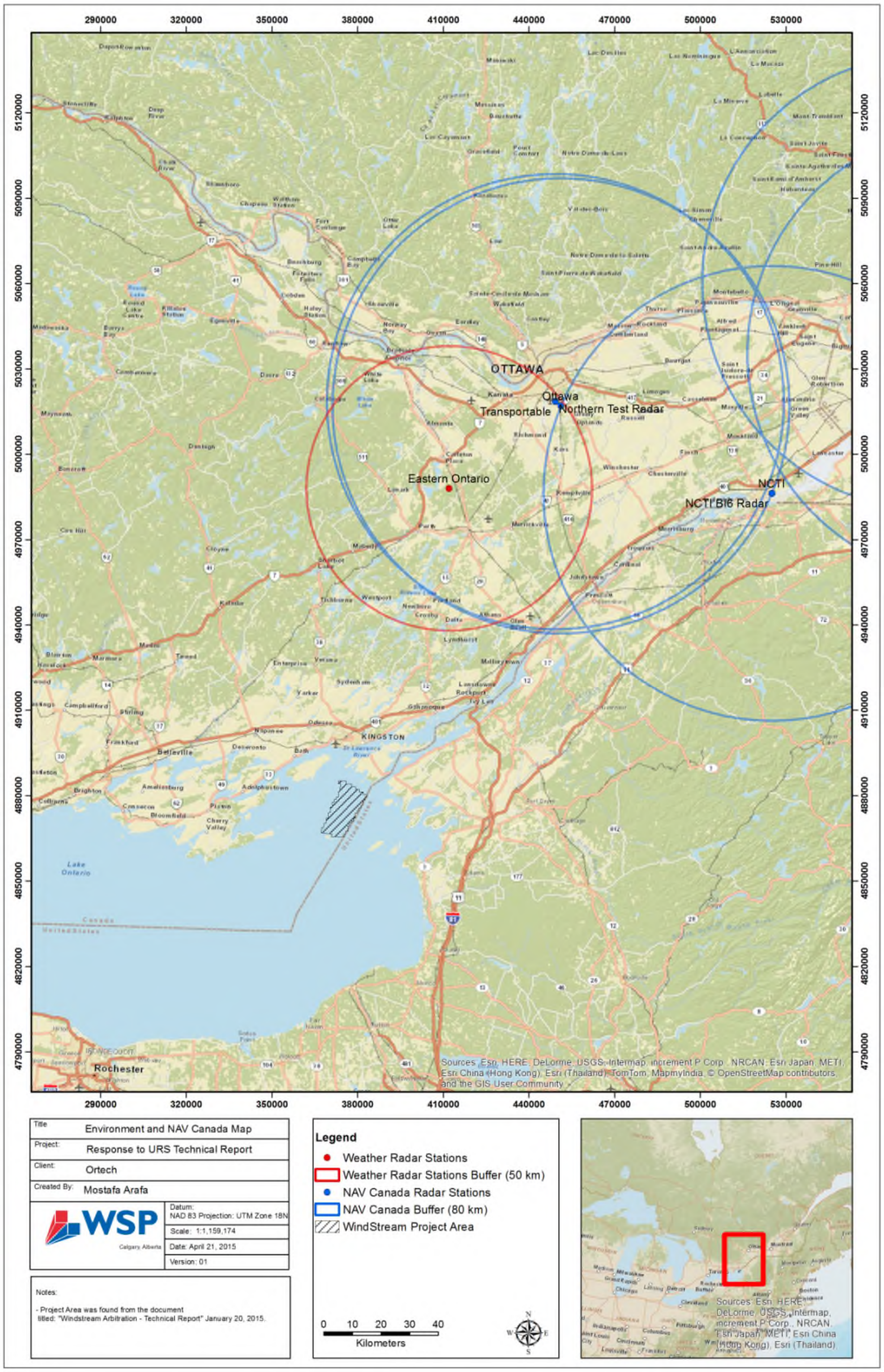
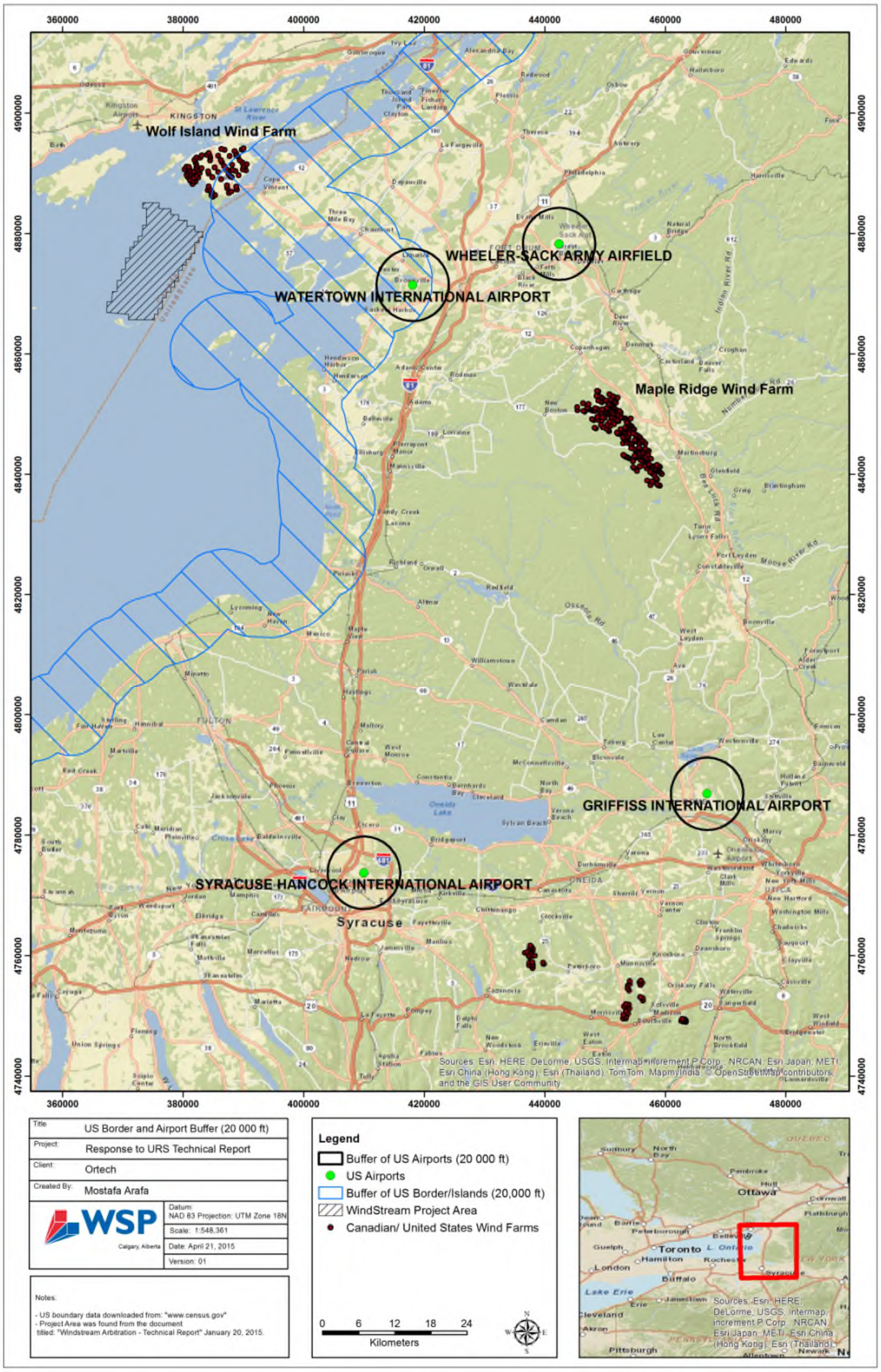


Figure 3 American Airports and Existing Wind Power Projects near the Proposed Windstream Project



3.2.3 BIRDS AND BATS

URS Comment #129
"As part of its REA process, Windstream would have to consider potential impacts on birds. Further, to the extent that migratory birds are impacted, Windstream would also have to be involved in consultations with Environment Canada with respect to how those impacts can be mitigated. In this regard, it appears that the Project is in an area frequented by migratory bird species"

Response:
In order to comply with the requirements of the MBCA, timing windows associated with vegetation removal are built into project schedules. In this case, there is little work being proposed in onshore areas, and therefore the risk to the Project Schedule associated with MBCA requirements is considered low.

Bird studies, impact assessment and consultation on migrating birds are common for many wind projects, including onshore wind energy projects. WSP has included consultation with Federal authorities, as well as a CEAA screening to deal not only with aquatic issues, but also migratory birds issues.

With respect to birds protected by MBCA, avoidance and mitigation measures are frequently used to avoid the need for permits, by completing work outside of the breeding season or adjusting the project design.

URS Comment #131
"Further, the electrical sub-station is planned to be located on Pigeon Island (see picture below). As CER-Kerlinger acknowledges, Pigeon Island is "designated as Significant Wildlife Habitat by the Ontario Ministry of Natural Resources. As such, the Ministry would require mitigation to compensate for the loss of habitat for Ring-billed Gulls". Pigeon Island and the vicinity is used by migratory birds for flight staging purposes both during seasonal migration and nesting/rearing activities during spring to fall yearly."

Response:
This does not provide a significant schedule risk, and the activities are included in the Project Schedule. Identification and assessment of potential impacts to significant wildlife habitat is a standard component of any REA application. The potential for impacts to the significant habitat for colonially nesting species, including Ring-billed Gulls and Caspian Terns on Pigeon Island would have been evaluated during the Environmental Impact Study component of the Natural Heritage Assessment. Where possible, opportunities for mitigation and/or compensation would have been identified and discussed with relevant regulatory agencies to determine if development on the island is possible. If construction of a substation could not be supported on Pigeon Island, an alternative location would have been considered and the Project Location and Project Description would have been updated accordingly. One possible measure is to construct an additional offshore platform to support a transformer station.

The CER-Kerlinger report provides a set of mitigation measures for the loss of habitat for nesting ring billed gulls and cormorants. This includes either providing man made islands (e.g. New York Harbor), the use of roof-tops, concrete slabs, docks as a nesting substrate[66]. An alternative strategy would be to develop conservation projects to assist other species. CER-Kerlinger opines that:

> *"Although it appears that mitigation for loss of Ring billed Gull nesting habitat is indicated as a means of compensating for habitat loss, other types of mitigation would certainly be better from a short and long-term conservation perspective. For example, instead of creating gull nesting habitat, there are numerous projects that the Ontario Parks and other agencies and*

[66] CER–Kerlinger.

environmental organizations would undoubtedly prefer. Such projects would focus on building the populations and increasing geographic area of species that the population explosion of Ring-billed Gulls and Double-crested Cormorants have negatively impacted." [67]

URS Item #132
"In particular, ring-billed gulls and double-crested cormorants nest on Pigeon Island and will be impacted by the construction and operation of the WWIS Project as outlined in the CER-Kerlinger Report. The substation that will be constructed and operated on Pigeon Island will result in the "loss of about one-third of Pigeon Island as nesting habitat could, potentially reduce the number of nesting pairs of Ring-billed Gulls, likely by about 30-50%"[60]*. The CER-Kerlinger Report suggests potential mitigation measures including compensation for habitat loss or mitigation for species that have been negatively impacted. These mitigation measures would need to be assessed to determine if they are acceptable through consultation with related agencies. The CER-Kerlinger Report recognizes that consultation with various wildlife agencies in Ontario and the Canadian Wildlife Service "should be proactive, well in advance of the construction of the project so as to have such projects initiated at the same time as construction."*

Response:
Consultation with regulatory agencies and the preliminary review of background information, which are included in the Project Schedule, would have identified potential concerns with respect to development on Pigeon Island, and would allowed ample time to investigate opportunities to minimize, mitigate or avoid impacts to this habitat.

The species known to colonize Pigeon Island, including Ring-billed Gulls, Caspian Terns, and Herring Gulls, are not identified at the provincial or federal level as Species at Risk or Species of Conservation Concern. However, these species are protected under the MBCA. Double-crested Cormorants have also been documented on Pigeon Island in high numbers, but this species is not protected by the MBCA. The MBCA provides protection to migratory birds and their nests. Impacts to birds and/or their nests can be mitigated by restricting work to periods outside the nesting windows for these species.

As indicated in the response to URS Item # 131, if an agreement could not be reached with regulatory agencies for the compensation or mitigation of impacts to nesting habitat, then opportunities for the relocation of the substation would have been investigated. One possible measure is to construct an additional offshore platform to support a transformer station. This is a standard practice in environmental assessment projects.

URS Item #133
"The CER-Kerlinger Report also suggests a mitigation plan that includes the creation of artificial islands and notes that this would require experts perhaps from universities in Ontario, the Canadian Wildlife Service and the Ontario Ministry of Natural Resources. To build additional islands would also likely require additional permitting and approvals. Consultation with agencies is paramount; however, it is not evident in the Windstream's schedule when or how this consultation and determination of mitigation/compensation measures would take place prior to construction."

Response:
Consultation with regulatory agencies and the preliminary review of background information appear in the Project Schedule, and would have continued throughout the study on an iterative basis. This does not present a significant schedule risk, as these consultations would have identified potential concerns with respect to habitat loss, and would allowed ample time to investigate opportunities to minimize, mitigate or avoid impacts to this habitat.

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[67] CER–Kerlinger.

WSP has included consultations with CWS, MNR and other agencies in the Project Schedule. While not specifically for the mitigation plan, these consultations would include possible comments and concerns about available mitigation options. URS appears to assume that the creation of additional islands would be the mitigation plan, and that it would need to be fully permitted during the development phase of the Project. First, it is unclear what if any mitigation measures would be required. Second, if an agreement could not be reached with regulatory agencies for the compensation or mitigation of impacts to nesting habitat, then opportunities for the relocation of the substation would have been investigated. For instance, Windstream may have explored constructing the substation on a platform.

URS Comment #134

"The CER-Kerlinger Report outlines that, "Mitigation protocols or impact thresholds for offshore wind projects in Canada have not yet been established for Ontario. However, as with REAs for onshore wind projects it would be important for thresholds and recommended mitigation measures to be formulated prior to granting permits for offshore wind development. Such mitigation could be based, in part, on what the Ministry of the Environment has established for onshore projects and adapted for offshore situations".63 The guidelines suggest, "those monitoring methods include ground searches for carcasses under turbines"4 since the WWIS Project is offshore, standard carcass searches cannot be performed. The CER-Kerlinger Report states multiple methods of how to modify the MNRF guidelines for the off-shore situation including direct visual studies, thermal imaging devices, carcass searches and radar. Since none of these methods has been approved by MNRF it is likely that time will be required for consultation and possible permitting. Some of the suggestions may also lead to further required permits and research, including carcass searches which involve "nets [which] could extend down into the water column far enough to catch drifting bats and birds after collisions. This methodology needs improvement and testing. The development of this and other technologies for the WIS project could go a long way toward providing better means of determining impacts from offshore wind turbines in the Great Lakes. One potential drawback of nets is that some birds may be caught in them as they dive, just as birds (loons, waterfowl, seabirds) are killed by commercial fishing nets. However, mesh size could be adjusted to eliminate this potential hazard". The nets however may pose a threat to fish and fish habitat."

Response:

Delays in project development have not occurred as a result of the development of guidelines for onshore wind projects. Although additional requirements were added over time, proponents of other types of renewable energy technologies were able to move ahead with the permitting of their projects in the absence of permitting guidance from MOE. In general, the development of mitigation measures in WSP's experience is an iterative process. In this case, consultation planned at the outset in the Project Schedule[68] would have continued throughout the execution of the REA phase. Where regulatory delays for other renewable projects have occurred, contract extensions or waivers have been forthcoming (e.g. waterpower projects[69]).

URS Comment #135

"The risk associated with permitting related to birds is not definable until natural heritage investigations are undertaken during appropriate seasons. Depending on the outcome of the natural heritage investigations; if migratory birds or species at risk are identified to be impacted by the Project the risk to the project schedule could be considered MEDIUM to HIGH; however, if no impacts are identified the risk can be considered LOW."

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[68] CER-SgurrEnergy-2.

[69] **C-1104**, Letter from Chiarelli, Bob (ENE) to Andersen, Colin (OPA) (June 26, 2013).

Response:
In order to comply with the requirements of the MBCA, timing windows associated with vegetation removal are routinely built into project schedules during the construction phase. URS overstates this schedule risk. The risk for the Project Schedule for avian permitting is similar to those for onshore wind projects which is low. In this case, there is little work being proposed in onshore areas, and therefore the risk to the Project Schedule associated with MBCA requirements is considered low.

Bird studies have not been historically a major impediment to development of projects. This is evidenced by the approximately 30 onshore wind projects that have received REA. The potential for impacts to Species at Risk would have been first identified at the background review stage, and further identified/confirmed during the avian surveys that are routinely completed as part of every renewable energy project. Consultation with MNR or other applicable regulatory agencies is initiated at the outset of a project and continues throughout a project's development, allowing SAR and permitting concerns to be completed concurrently with other aspects of the Natural Heritage Assessment. Furthermore, the number of SAR that occupy offshore areas during key life cycle stages (e.g. breeding, rearing and fledging) is much lower than those in onshore habitats, thereby decreasing the likelihood of impacts to SAR or critical components of their habitat associated with this Project.

With respect to birds protected by the MBCA, avoidance and mitigation measures are frequently used to avoid the need for permits, by completing work outside of the breeding season or adjusting the project design to avoid more sensitive habitats where necessary.

URS Comment #136
"As part of its REA process, Windstream would also have had to address potential impacts on bats. Further, as with birds, to the extent that migratory bats are involved, consultations with Environment Canada will be necessary in order to determine ways to mitigate any impacts."

Response:
The Project Schedule includes consultations with both MNR provincially and CWS federally. Consideration for impacts to bats and bat habitat is a critical component of the Natural Heritage Assessment and the larger REA process and has been included in the Project Schedule.

MNR has established clear guidelines for wind power projects to address concerns with respect to significant wildlife habitat for bats. Guidelines for setbacks from significant bat habitats (hibernacula, bat maternity roost sites) are outlined within the Bats and Bat Habitats: Guidelines for Wind Power Projects along with recommended operational mitigation measures to reduce bat mortality[70]. Approximately 90% of bat fatalities from wind turbines occur between mid-July to the end of September during the fall migration. To reduce bat mortality due to collisions with turbines, a reduction in turbine speed and blade feathering may be used to drastically reduce fatalities without significantly impacting energy production.

Bat surveys would have been completed as part of the Natural Heritage Assessment for this Project. Data generated would have been used to provide preliminary information on migration patterns in the area and peak migration times. If significant bat habitats or concentrations of bats were noted during the field investigation, an Environmental Impact Study and Environmental Effects Monitoring Plan would have been developed to mitigate impacts to these species.

URS Comment #137
The CER-North East Ecological Services Report states that there are three species of bats (the tricolored bat, the little brown myotis, and the northern myotis) that are known to occur in Ontario that are listed as

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[70] **C-1872**, MNR (2011), Bats and Bat Habitats: Guidelines for Wind Power Projects.

Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and two (the little brown myotis, and the northern myotis) that are listed as Endangered by the Committee on the Status of Species at Risk in Ontario (COSSARO).

Response:
These species were not listed at the time of the moratorium in 2011. Nevertheless, these bat species do not constitute a significant risk to the Project, as there is limited habitat available in the Project area that would be impacted. Bat studies have been included in the Project Schedule, capturing both spring and fall migratory periods, and the assessment of potential roosting habitat. Bat conservation focuses mainly on protection of roosting habitat, maternity colony habitat and hibernacula[71], all of which are limited in the study area[72]. Currently, there are three species listed as Endangered at the federal level (Little Brown Myotis, Northern Myotis and Tri-colored Bat) and three listed as Endangered at the provincial level (Little Brown Myotis, Northern Myotis, and Eastern Small-footed Bat). These species are thought to be year-round residents of Ontario and the northeastern United States that overwinter in caves and abandoned mines. They are considered short-distance migrants that move between summer roost sites and winter hibernacula during the spring and fall.

Bats species including the Hoary Bat, Silver-haired Bat and Red Bats that are typically considered long-distance migrants have higher rates of turbine-related mortality. The large geographic ranges and migratory behaviour of these bat species may be a contributing factor to higher mortality rates, though more research is required to confirm this relationship.

Data specific to bat migration within the Lake Ontario basin is limited. The studies proposed as part of the Project would have provided additional information on the presence of bat species within the study area and would have identified whether provincially and federally listed Endangered bat species may be found in offshore areas of Lake Ontario during summer foraging or spring and fall migration activities. If significant bat migration was noted during the field investigation, an Environmental Impact Study and Environmental Effects Monitoring Plan would have been developed to mitigate impacts to these species, and the appropriate federal or provincial permitting process would have been initiated.

URS Comment #138
"According to the CER-North East Ecological Services Report, there are also five other types of bats including three migratory bats that have the potential to be found in the Project area. The North East Ecological Services Report concludes that "the only potential impact of the WIS project site on bats is the risk of turbine-related collision".[69] The Report states that there is, "relatively little data on the pattern or scale of coastal or off-shore bat migratory activity". The report also acknowledges that non-migratory bats can be found several kilometres offshore even though the majority of offshore bat activity is migratory tree bats. Further research may be required by agencies such as MNRF and EC."

Response:
There is minimal risk associated with bats for the Project. CER-North East Ecological Services Report established that there is very little habitat present, and that total bat activity is substantially lower and more temporally concentrated than bat activity across terrestrial habitats[73]. Per the *Bats and Bat Habitats Guidelines for Wind Power Projects,* the potential for collisions with wind turbines can be mitigated by changing the wind turbine cut-in speed to 5.5 m/s, or feathering of wind turbine blades when wind speeds are below 5.5 m/s between sunset and sunrise during periods of high bat activity, such as fall migration.

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[71] **C-1872**, MNR (2011), Bats and Bat Habitats: Guidelines for Wind Power Projects.

[72] CER-Reynolds.

[73] CER-Reynolds.

Such mitigation measures have been shown to reduce impacts to bats in onshore areas. These same mitigation measures would be effective in offshore areas, where bat activity is likely to be lower and restricted to migratory activity and occasional offshore foraging activity[74].

The field program proposed for the Project included acoustic and radar surveys to document bat species composition and the landscape in a way that would allow for the identification of key habitats (hibernacula and maternity colonies) and possibly migration or movement corridors.

URS Comment #139
"In particular, little brown myotis are present in Southern Ontario and around the Lake Ontario basin. This bat was also on the Species at Risk in Ontario (SARO) List in 2013 and therefore, may require appropriate seasonal investigation to determine their presence in impacted habitats by the MNRF. This newly listed species can possibly impact the current Windstream schedule in terms of investigations/regulatory consultation, but also construction location, sequence, timing and potential implementation of compensation/mitigation measures if determined to be present and impacted by the Project."

Response:
Surveys for bats and bat habitats are standard for REA projects and have been accounted for in the Project Schedule. With the listing of Little Brown Myotis and Northern Myotis on the SARO List as Endangered in January 2013, and Eastern Small-footed Bat in June 2014, protocols for the identification of bat habitat have not changed significantly[75]. Identification of specific bat species would have been possible with the acoustic analysis proposed as part of the preparation of the REA application for the Project, thereby allowing for appropriate discussions and consideration for SAR species, including the Little Brown Bat, if present.

Key bat habitats that are protected as significant wildlife habitat or as habitat for endangered bat species are located in onshore habitats, typically in woodlands, swamps or anthropogenic areas where bats can roost and forage. As an insectivorous bat, the Little Brown Bat is most likely to be found in areas with high insect populations, including wetlands, small waterbodies, and upland meadows and woodlands. While it is possible that this species may occasionally venture into offshore areas to forage, it is unlikely that the species would spend large amounts of time in offshore habitats where roost sites and prey are in low supply. Due to the limited development proposed in onshore areas, risks to the Project Schedule posed by Little Brown Bat is thought to be lower for the Project than for a similar onshore wind project. In the event the species was detected in offshore areas during the field program, operational mitigation measures would have been investigated to decrease the potential for incidental contact with this species.

URS Comment #140
"The risk associated with permitting related to bats is not definable until natural heritage investigations are undertaken during appropriate seasons. Depending on the outcome of the natural heritage investigations; if bats or species at risk are identified to be impacted by the project the risk to the project schedule could be considered MEDIUM to HIGH; however, if no impacts are identified the risk can be considered LOW."

Response:
It is WSP's opinion that URS overstates the potential project risk. The risk to the Project Schedule posed by bats and bat habitat is low. The schedule risk for bat species would be greater for onshore wind power projects due to the nature of significant bat habitat which is associated with terrestrial environments[76].

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[74] **C-1872**, MNR (2011), Bats and Bat Habitats: Guidelines for Wind Power Projects.

[75] **C-1872**, MNR (2011), Bats and Bat Habitats: Guidelines for Wind Power Projects.

[76] CER-Reynolds.

The relative risk to the Project would be low in comparison due to the absence of hibernacula and maternity roosting habitat in offshore areas and the limited development proposed in onshore areas.

Identification and assessment of potential impacts to bats and bat habitat is a standard component of every Natural Heritage Assessment. Bat species and habitat presence would be identified through agency consultation, background review and the field program. Where possible, opportunities to avoid or mitigate impacts would be investigated. The need for permitting would only arise where impacts to endangered species are anticipated and impacts could not be avoided. If endangered species were not identified, measures to compensate for potential impacts to onshore habitat (if present), or incidental operational impacts would be recommended as part of the Environmental Impact Study and Environmental Effects Monitoring Plan, and would not require specific permits, as a standard part of project development.

3.2.4 NOISE

URS Comment #150

"*Noise is regulated by the MOECC as part of its REA process*. Windstream would have had to consider noise and *potential impacts related to the offshore wind farm development and consult with MOECC regarding the results of the report which could be anticipated to require time in the Windstream's project schedule. In addition to determining potential noise impacts on sensitive receivers, noise impacts relating to fish and wildlife should also be considered as noted and discussed in both the CER-ORTECH Report and CER-Baird Report."*

Response:

HGC Engineering has established, by applying the ISO 9613-2 model and the Swedish EPA model, that the Project would comply with MOE's Class 3 sound limits of 40 dBA. Noise models, including the ISO 9613-2 are inherently conservative in their assumptions.

Aercoustics conducted sound propagation testing over water and ice. Subsequent acoustic modeling of the Project has been completed. Based on a spherical propagation model (corroborated by the field measurement data), the noise impact of the Project was computed. Worst case noise impacts were computed to be well below the 40 dBA limit set by MOE[77].

Acoustic assessments are a standard part of the REA process for wind projects. These studies have been included in the Project Schedule, and post a low risk to the Project. Noise modelling is conservative in assumptions and is performed for the worst-case scenario. This assumes the highest sound power level from each wind turbine and concurrent propagation of noise from each wind turbine to each point of reception, compared with the lowest MOE Class 3 sound level criterion of 40.0 dBA. This assumption means that the calculated noise impact on receptors located between two groups of turbines is higher than what would be observed under real operating conditions. Receptors located between two groups of turbines would never be downwind of all turbines concurrently, therefore, the actual noise impact on these receptors would be less than that indicated for the worst case scenario.

URS Comment #151

"A preliminary report discussing the acoustic impact of the Project and the cumulative noise impact of the Project and the nearby TransAlta Wolfe Island Wind Energy Project, concludes that "Calculations using both ISO 9613-2 with adjustments and the 2010 version of the Swedish model indicate the proposed project will be less than the 40 dBA sound level criteria of the Ontario Ministry of the Environment ("MOECC") at all receptors"

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[77] CER-Aercoustics.

Response:
HGC Engineering[78] and Aercoustics Engineering[79] have both demonstrated that the Project would comply with MOE's noise limits, including cumulative effects from nearby projects. Noise modelling is conservative and is performed for the worst-case scenario.

As a REA condition, Projects are required to ensure that their equipment meets the sound level limits prescribed in their REA applications and the Guidelines as demonstrated as Condition C in a recently issued REA (1426-9RWTSS)[80] .

> "C1. The Company shall ensure that:
> (1) the Sound Levels from the Equipment, at the Points of Reception identified in the Acoustic Assessment Report, comply with the Sound Level Limits set in the Noise Guidelines for Wind Farms, as applicable, and specifically as stated in the table below:

Wind Speed (m/s) at 10 m height	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Sound Level Limits, dBA	40.0	40.0	40.0	43.0	45.0	49.0	51.0

As a standard condition, Proponents are required to carry out acoustic audits of their projects in order to demonstrate that they meet the noise impact criterion (for example, see Condition E, F of REA 1426-9RWTSS). The results of the audits must be submitted to the Director and the appropriate District Manager of MOE within the prescribed timeline.

URS Comment #152:
"The Report also confirms that "At this time, the MOECC has not specified which approach it will eventually take in the assessment of offshore wind turbine noise". This indicates, as for other environmental aspects, that time will be required for the MOECC to define appropriate methodologies to assess the Project."

Response:
WSP has demonstrated that URS overstates the risk to the Project Schedule. Windstream would have been required to include a noise report as part of the REA submission[81]. It has been demonstrated that under several modeling scenarios by HGC Engineering[82] and Aercoustics Engineering[83] that the Project would comply with the noise criterion. It would not have taken years of research for a guideline to be developed for offshore wind noise impacts. It has been demonstrated using a number of modeling techniques that the noise impacts to receptors falls within MOE guidelines.

URS Comment 153:
"The risk associated with noise is considered LOW, however delays in the MOECC defining appropriate assessment methodologies may have a MEDIUM impact on Project schedule."

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[78] CER-HGC.

[79] CER-Aercoustics.

[80] **C-1830**, Ontario Ministry of the Environment 2015 *Renewable Energy Approval Number 1426-9RWTSS*.

[81] **R-0210**, Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

[82] CER-HGC.

[83] CER-Aercoustics.

Response:
WSP believes that URS overstates the risk on Project Schedule. It has been demonstrated that under several modeling scenarios by HGC Engineering[84] and Aercoustics Engineering[85] that the Project is compliant with MOE noise criterion. As part of the REA application, Windstream would have been required to satisfy MOE that the Project met MOE noise limits.

3.2.5 STAKEHOLDER CONSULTATION

URS Comment # 160
"This description of the project development process is overly simplistic and disregards the considerable risks arising from stakeholders seeking to influence the Project. It also undermines the nature of stakeholder consultation, which is an essential and integral part of any development. URS notes that Ontario's REA process requires applicants to consult with the public, municipalities and Aboriginal communities as part of the permitting process."

General Response:
URS overstates the risk associated with stakeholder consultation, as there is a statutory stakeholder consultation process for Aboriginal communities, municipalities and the general public in the REA Regulation. The REA Regulation provides mandatory notification periods before Public Meetings, and strict timing for the release of the Draft reports to Aboriginal groups, municipalities and the public. These are documented in the Project Schedule.

This process is streamlined. Proponents must engage in consultation activities in accordance with the REA Regulation. The statutory consultation activities consist of the following:

- → Submitting the Draft Project Description Report to MOE to obtain the Director's List of Aboriginal communities to be consulted;
- → Publishing a Notice of Project to the Public;
- → Publishing a notice of the First Public Meeting;
- → Holding the First Public Meeting;
- → Providing Draft REA Reports to Aboriginal groups;
- → Providing Draft REA Reports to Municipalities;
- → Providing Draft REA Reports to the Public;
- → Publishing a Notice of Final Public Meeting;
- → Holding the Final Public Meeting;
- → Producing a Consultation and Documentation report to summarize the consultation activities completed as part of the process, and demonstrating how the Project took stakeholder comments into account.

URS Comment # 161
"Typical key stakeholders for a project of this type include but are not limited to:"

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[84] CER-HGC.

[85] CER-Aercoustics.

URS Comment # 161 a)
"Electricity consumers pressurising utilities and governments to purchase reliable and inexpensive power i.e. providing security of supply at the cheapest cost."

Response:
The URS report identifies a potential group of stakeholders whose comments would have no bearing on any of the prescribed REA processes or documents. Electricity rates and system reliability standards are not addressed in any part of the REA or other associated environmental permitting processes. This group of stakeholders poses no extraordinary risk to the Project versus any other onshore wind project.

URS Comment # 161 b)
"Non-governmental organisations seeking to minimise the environmental impact of specific technologies, such as pressure groups and local communities seeking to restrict the development of new infrastructure in the locality (i.e. St. Lawrence Seaway Management Corporation etc.)".

Response:
This group of stakeholders poses no extraordinary risk to the Project URS does not provide any substantive argument as to what outcomes these groups could exert on the REA process. Non-governmental organizations and other "pressure groups" would be consulted in the manner required by the REA, as previously described (i.e. the public). Their comments would be have been collected, responded to and summarized in the Consultation Documentation Report as required by the REA Regulations. Organized pressure groups have not presented persuasive cases at appeals against REAs at the Environmental Tribunal. A single REA has been overturned by the ERT: the REA for the Gilead Power Ostrander Point wind power project. However, the ERT overturned the REA because it found that there was evidence that the project would cause serious and irreversible harm to the Blanding's turtle, an endangered species that inhabits the project area. The issue of the appropriate remedy in this case, including potential modifications to the REA that would allow the project to proceed, currently remains before the Tribunal.

The following wind projects have been successful in obtaining a REA despite stakeholders pressure groups and communities seeking to restrict the development of new infrastructure in their locality:

1. Bow Lake Phase 1;
2. Bow Lake Phase 2a;
3. Bow Lake Phase 2b;
4. Port Dover and Nanticoke Wind Project;
5. Comber East –C24Z Wind Project;
6. Comber West –C23Z Wind Project;
7. Conestogo Wind Energy Centre;
8. Goulais Wind Farm;
9. Dufferin Windfarm (Farm Owned Power Melancthon Ltd.);
10. Grey Highlands Clean Energy;
11. Pointe Aux Roches Wind;
12. McLean's Mountain Wind Farm 1;
13. South Branch Wind Farm;
14. Summerhaven Wind Energy Centre;
15. ZEP Windfarm Ganaraska;
16. Niagara Region Wind Farm;
17. Bluewater Wind Energy Centre;
18. Jericho Wind Energy Centre;
19. Bornish Wind Energy Centre;
20. Goshen Wind Energy Centre;
21. Cedar Point Wind Power Project Phase II;

22. Adelaide Wind Energy Centre;
23. East Durham Wind Energy Centre;
24. Grand Bend Wind Farm;
25. Grand Valley Wind Farms (Phase 3);
26. Erieau Wind;
27. East Lake St. Clair Wind;
28. Adelaide Wind Power Project;
29. Settlers Landing Wind Park;
30. Ernestown Wind Park.

URS Comment #161 c)
"Pressure groups and local communities seeking to restrict the development of new infrastructure in the locality."

Response:
This group of stakeholders poses no extraordinary risk to the Project. URS does not provide any substantive argument as to what outcomes these groups could exert on the REA process. The REA Regulation sets out a streamlined consultation process. Pressure groups would be consulted in the manner required by the REA as previously described (i.e. the public). Their comments would have been collected, responded to and summarized in the Consultation Documentation Report as required by REA. The Project would have demonstrated how comments were taken into account. As we explain in our response to URS #161 b), organized pressure groups have not been successful in having REAs overturned by the Environmental Review Tribunal.

URS Comment #161 d)
"Aboriginal communities that may be concerned about a potential adverse impact by the Project on Aboriginal or treaty rights."

Response:
Aboriginal consultation is a standard item in the REA process and is included in the Project Schedule. Obtaining the Director's List of Aboriginal Communities through the submission of a Draft Project Description Report is one of the first steps in the REA process. Windstream would have been able to engage with the communities on the list in order to determine if:

- → The communities had an interest in the Project;
- → What, if any potential adverse effects could impact their Treaty rights;
- → Mitigation of any potential adverse effects on Treaty rights.

Additionally, the Project could have benefited from engaging with Aboriginal communities in the transfer of traditional knowledge about the Project Location.

URS Comment #161 e)
"Governmental *authorities (i.e. Federal, Provincial, Municipal, conservation authorities, International Joint Commission etc.)"*

Response:
URS does not recognize that governmental authorities at the Federal and Provincial level are not stakeholders in the traditional sense and they pose a low risk to the Project. These stakeholders are typically regulators with a specific role. Federal authorities would have been contacted very early in the process in order to determine and review proposed work plans for project studies in their purview.

Additionally, Provincial authorities were engaged with the Project in discussions relating to lake-bed drilling licenses[86].

Municipalities need to be consulted in the statutory manner as described in the REA. Their comments would have been collected in a Municipal Consultation Form as part of the REA application process. Municipalities are responsible for reviewing applications under the Ontario Building Code, and enforcing some of their by-laws with respect to the use of roads, encroachments and property entrances. Municipalities cannot impose their zoning by-laws with respect to renewable energy projects as a valid land use, or setbacks, as these are regulated specifically in the REA Regulation.

Conservation authorities would have been consulted throughout the Project, both as a stakeholders and also as an authority that may have information useful for the Project. Primarily Conservation Authorities act a regulator and not a traditional stakeholder. Permits for the Development, Interference with Wetlands, and Alterations to Shorelines and Watercourses are under the purview of Conservation Authorities, and these permits would have been applied for during the detailed design phase of the Project.

As an overarching response, these authorities are primarily regulators and not traditional stakeholders. They would have been engaged at the appropriate phases of the Project, and consulted in the appropriate manner.

URS Comment #162
URS is not aware of Windstream undertaking any formal consultation or entering into negotiations with the governmental or non-governmental agencies as identified in Paragraph 161). Consultation with these agencies to obtain concurrence or regulatory approval is paramount and can significantly and negatively impact Windstream's schedule.

Response:
We understand that Stantec was selected as Windstream's REA consultant for the Project. Stantec and Windstream had scheduled the agency consultations in their work plan[87].

Some agency consultations depend entirely on the submission of documents for review. For example, concurrence letters from MNR for natural heritage and the MTCS for archaeology and cultural heritage can only be obtained after report submissions are made. These concurrence letters are needed only for REA completeness. Windstream did enter into discussions with governmental organizations as evidenced by ORTECH[88], even if these are not recognized as being "formal".

URS Comment #163
URS could not find any evidence of Windstream having initiated consultation with Aboriginal communities, municipalities, or the public (as required by the REA Regulation). In fact there are several references in the Memorial of the Claimant to potential strong opposition to projects of this type.

Response:
Windstream was unable to obtain the Director's list of Aboriginal communities with which to consult as a result of the moratorium. The Aboriginal engagement process is included in the Project Schedule. In order

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86 **C-0619**, Report, (ORTECH), Wolfe Island Shoals Wind Farm MNR Well License Application (June 12, 2012).

87 **C-0873**, Request for Proposal (Stantec Consulting Ltd.), Wolfe Island Shoals Offshore Windfarm Permitting and Field Investigation Services (November 25, 2010).

88 **C-0619**, Report, (ORTECH), Wolfe Island Shoals Wind Farm MNR Well License Application (June 12, 2012).

to satisfy the requirements, Windstream would have needed to produce a Draft Project Description Report and submit it to MOE to obtain the Director's List. Without this list, Windstream would be guessing at which communities should be consulted, and consultations would have been premature. Windstream was prevented from developing the required documents, obtaining the Director's list and from entering into any formal discussions because of the moratorium.

URS Comment #164
"The risk of public opposition influencing the permitting authorities is real, particularly for a "First of a Kind" project. Stakeholders may have considerably more power to influence and delay a project since there are no precedents to previous projects having been built."

Response:
URS overstates this risk, since there is no proof that permitting authorities change their internal guidance, guidelines and evaluation criteria based on pressure from the public. Their decisions need to be defensible from a technical standpoint. Public opposition to wind power projects in Ontario is well understood, expected and planned for in the development of the Project. Stakeholders would have had the same amount of influence with the Project as they do with onshore wind projects and other projects subject to the REA Regulation, which is very little.

URS Comment #165
In conclusion, stakeholder risks are considered HIGH with a HIGH impact on the Project, primarily from a schedule rather than financial perspective. However severe financial implications may also arise.

Response:
Stakeholder risks are overstated by URS, and are likely no higher than for onshore wind projects. The REA Regulation was promulgated to expedite the permitting of renewable energy projects, as part of Ontario's drive to increase renewable energy generation capacity in the province. Stakeholder risks in wind development and the REA process are well understood and are accounted for in the Project Schedule.

3.2.6 WIND FARM LAYOUT AND PROJECT CHANGES

URS Comment #207
On iinspection, it appears that one of the primary criteria used by Windstream to design the WTG layout is water depth. This approach seeks to minimise foundation costs, however fails to recognise:

URS Comment #207 c)
The results of environmental investigations (not yet carried out), to minimise adverse environmental impacts.

Response:
Windstream was not given the opportunity to conduct the detailed studies as required by REA because of the moratorium. Windstream conducted a primary level of constraints analysis in its assessment of the Project, which is standard in the project development process. Finalizing the Project Layout comes later in the process and includes additional constrains analysis that are generated from environmental studies and other engineering studies. The REA studies provide a logical process of desktop research, field investigations, evaluation of significance and finally environmental impact statements. It is at the EIS phase of the Natural Heritage Assessment where specific impacts are identified and evaluated for potential mitigation. This is similar to other environmental assessment processes where general descriptions and locations of project components are assessed first at a preliminary level, and then fine-tuned with additional analyses, permits and approvals. Micrositing and the removal or relocation of turbine

locations and other Project infrastructure is common in REA projects (for example, the recently approved Grey Highlands Clean Energy Project[89]). Alternative turbine locations are proposed and unsuitable ones discarded if needed as the project evolves. This iterative approach also allows the projects to change in response to stakeholder comments and concerns. REA approvals make allowances for minor variations in the location of turbines. This variance is stated in the REA condition as a variation of +/- 10 m from the published coordinates.

URS Comment #322
"Not only is the negotiation of a modified shipping lane likely to take considerable time, but it also appears likely that the layout of the wind farm would need to be revised, possibly requiring a change of WTG so as to maintain the wind farm output required by the FIT Contract. This in turn would require modifications to the REA submission, extending the time required to achieve REA approval and might have required Windstream to gain access to Crown land from MNRF that it did not have access to."

Response:
URS does not recognize the iterative process created by the REA Regulation and would seem to insist that the project be static and crystalized at the outset. Contrary to this, MOE encourages proponents to demonstrate how the Project changed based on the environmental analyses and stakeholder comments.

In WSP's experience, Project modifications are a standard part of the project development process. Project changes to accommodate inputs from stakeholders and to respond to unforeseen or unknown factors uncovered in the study process, or to address specific environmental or engineering concerns are commonplace. This has not proved to be a material schedule risk for projects. See for instance the recently approved Capstone Grey Highlands Clean Energy Project[90] where an alternative turbine location was selected for the final project design during the REA technical review. Guidance is provided to proponents on technical and design changes in Chapter 10 of the *Technical Guide to Renewable Energy Approval*[91]*.*

URS Comment #323
"European experience is that aviation authorities, both civilian and military are also concerned about the interference to radar system caused by wind turbines. In this case, the proximity of the site to the US border is likely to require the aviation authorities in both Canada and the US to approve the development. The time required to obtain the required permits is uncertain and any change in layout or wind turbine selection would require any agreement reached to be revisited."

Response:
In WSP's experience, this is routine for onshore wind projects where turbine locations change and poses little risk to the Project Schedule. Aviation issues pose no impediment to developing the Project. WSP has documented in Section 3.2.2 Radar Interference that the Project is far outside the consultation zones for Canadian military and civilian aviation radar. Furthermore, the Project lies far outside the area of concern for the United States FAA.

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[89] **C-1832**, Stantec Consulting Ltd. March 3, 2015. Notice of Project Design Change - Grey Highlands Clean Energy Project MOE Ref. No. 3975-97CQZA.

[90] **C-1832**, Stantec Consulting Ltd. March 3, 2015. Notice of Project Design Change - Grey Highlands Clean Energy Project MOE Ref. No. 3975-97CQZA.

[91] **C-0729**, Technical Guide to Renewable Energy Approvals (MOE) (2013).

Should turbine locations change during the course of the Project, agencies such as NAVCanada and Transport Canada would be consulted and the land use clearances and aeronautic obstruction would be updated.

URS Comment #324

"As per the CER-Powell Report URS has assumed a three years period to obtain all necessary permits, starting in May 2012 (as per the Windstream schedule129). Based on the discussion in Section 5.2.1 this assumption may be overly optimistic. The three years appears to over simplify the inter-dependency of various permits and fails to specifically address issues with obtaining federal permits."

Response:

It is more likely than not that these interdependent permits, including Federal permits (CEAA screening, DFO etc.) would have been obtained within the three year timeline as shown in the Project Schedule[92]. Some permits are not required until close to construction activities (e.g. conservation authority permits, building permits), and require specific detailed engineering deliverables. These engineering activities are generally not initiated until the project is crystalized or the REA has been issued.

URS Comment #325

No allowances have been made for potential delays in the REA process resulting from changes in design of the facilities. Based on the discussion in Section 5.2.2, URS considers it highly likely that changes in design would have taken place because of changes in WTGs layout and possibly turbine model.

Response:

As stated in the response to Comment #322, In WSP's experience, Project modifications are a natural part of a REA project to accommodate inputs from many stakeholders and to respond to unforeseen or unknown factors uncovered in the study process, or to address specific environmental or engineering concerns. This has not proved to be a specific major schedule risk for projects such as the Capstone Grey Highlands Clean Energy Project[93]. Design changes can be accommodated under Chapter 10 of the *Technical Guide to Renewable Energy Approvals*[94].

URS Comment #326

"Note that the three years period assumed by URS to obtain permits, includes not only the REA Approval but also those permits outlined in Section 5.2.1 such as Federal Fisheries Act Authorization for the offshore wind farm. This is consistent with the reference made in an earlier section relating to the CER-Powell Report130 which states that "it would have been commercially reasonable for a developer to assume that the permitting of an offshore wind power project could have been completed in approximately three years". However, in recognition of the complexity of this Project and that fact that it is a first of its kind, there is a material risk that permitting could extend beyond 3 years."

Response:

As already indicated, Federal permits (CEAA screening, DFO etc.) have been included in the overall Project Schedule, which is comprehensive. Some permits are not required until just prior to the initiation of construction activities (e.g. conservation authority permits, building permits), and require specific detailed engineering deliverables. These engineering activities are generally not initiated until the project

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92 CER-SgurrEnergy-2.

93 **C-1832**, Stantec Consulting Ltd. 2015 *Notice of Project Design Change – Grey Highlands Clean Energy Project MOE Ref. No. 3974-97CQZA*

94 **C-0729**, Technical Guide to Renewable Energy Approvals (MOE) (2013).

is crystalized or the REA has been issued. Windstream has demonstrated through the detailed Project Schedule[95] that the milestones would more likely than not have been achieved.

[95] CER-SgurrEnergy-2.

4 GENIVAR'S 2010 PROPOSAL

In 2010, in response to an RFP issued by ORTECH, GENIVAR (now WSP) submitted a response to the request for proposal issued by Ortech for a consultant to conduct environmental assessment work for the Project. GENIVAR's proposal included permitting work, ecological field work, technical field work, and cultural heritage and archeology studies. Our proposal indicated that there were development risks for the Project (as there are for all projects), and we proposed the following execution strategy for the Project to deal with these risks: (i) early and frequent consultation with key agencies and the public, (ii) strategic direction provided by senior team members, (iii) the use of our world class technical team to address issues raised during the EA process, and (iv) using team members from GENIVAR associates with experience in offshore wind development.

4.1 PERMITTING WORK

Our proposal included the necessary studies under the CEAA, and the REA Regulation. It also identified various other permits (including Fisheries Act authorizations), which are accounted for in this report. GENIVAR also outlined a detailed stakeholder consultation strategy for engagement with the public, aboriginal groups, and various agencies. Genivar outlined numerous supporting studies that would be required and helpful for the REA and CEAA processes, including: noise studies (including noise modelling), shadow flicker study, visual impact assessment, telecommunications interference study.

4.2 ECOLOGICAL FIELD WORK

Our ecological field study proposal included proposals for a full-suite of studies that are also accounted for in this report, including bird surveys (including migratory birds), bat surveys, fisheries surveys, and terrestrial and environmental impact assessments.

4.3 TECHNICAL FIELD WORK

GENIVAR proposed a full-suite of technical studies that we believed were required in order to gain a baseline study of the physical environment and to complete the Offshore Wind Facility Report under the REA Regulation. These studies are accounted for in this report, and which are also consistent with the reports outlined in MOE's DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under the REA Regulation.[96] These included studies in the following areas: hydrology and hydraulics, wave, water quality and sediment transfer, icing and coastal engineering,

4.4 HERITAGE AND ARCHAEOLOGY

GENIVAR's proposal included background archeological work, marine archeological investigations and terrestrial archeological work. The proposal set out a detailed explanation of the marine archeological work that would be required to account for the turbines and the underwater cable.

4.5 SCHEDULE

GENIVAR's proposal also included a detailed (but preliminary) schedule for permitting the Project under both federal and provincial processes. Because the schedule was preliminary, and produced in the early days of the REA Regulation, it was conservative. The proposal schedule is generally consistent with the

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96 **R-0210**, Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

updated Project Schedule[97]. The Project Schedule is comprehensive, and activity timing reflects WSP's experience in permitting renewable energy projects.

97 CER-SgurrEnergy-2.

5 CONCLUSION

WSP contributed a detailed, comprehensive permitting and approval schedule for the Project. The scheduling confirms that more likely than not the Project would have achieved the major permitting milestones and been constructed within the contractual constraints of the FIT program. In WSP's opinion, there are no material impediments in receiving the REA and other permits and authorizations.

The Project Schedule[98] includes the base Renewable Energy Approval technical submission documents, plus the additional studies outlined by the DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under the REA Regulation[99]. The comprehensive schedule takes into account the mandatory public consultation process and timelines for publishing notices, holding public meetings and publishing draft documentation for Aboriginal communities, municipalities and the public[100]. The Project Schedule's timelines are based on WSP's experience planning and completing REA projects. Agency reviews are based on statutory, published service standards or common timelines.

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[98] CER-SgurrEnergy-2.

[99] **R-0210**, Ministry of the Environment, Undated. DRAFT Complete Submission Requirements Checklist for Off-shore Wind Projects under O.Reg. 359/09.

[100] **C-0103**, REA Regulation, ss. 14-16.

6 APPENDIX 1 – CURRICULUM VITAE

ANDREW ROBERTS, MASc.

TEAM LEADER, APPROVALS AND PERMITTING

AREAS OF PRACTICE

Renewable Energy

Environmental Assessment & Baseline Studies

Compliance Auditing and Regulatory Affairs

Environmental Compliance Approvals

PROFILE

Andrew Roberts is Team Leader, Approvals and Permitting at WSP. Andrew is an expert in energy approvals and has extensive technical and project management experience with solar and wind developments. These projects have included the coordination and review of disciplines including environmental sciences, noise and vibration assessments, geosciences, engineering and archaeology. Additionally, Andrew has contributed to environmental baseline studies and environmental assessments for projects in Ontario, Manitoba and New Brunswick. Post assessment permitting includes Environmental Compliance Approvals, toxic reduction planning and municipal permitting.

Andrew has specialized experience in environmental projects internationally (Argentina, Colombia, Mexico, Peru, Venezuela), including environmental due diligence, environmental health & safety audits, environmental compliance audits in the electrical utility, manufacturing and oil & gas sectors.

EDUCATION

MASc, Environmental Applied Science and Management, Ryerson University	2005
BAA, Urban and Regional Planning, Ryerson University	1994

ADDITIONAL TRAINING

Best Management Practices for the Mitigation of Waterpower Facility Construction Impacts, Ontario Waterpower Association	2013
WHMIS, OSG	2013
ISO 9001:2000 – 2 Day Internal Auditor Course, Canadian Standards Association	2009
Electrical Safety & Awareness – Substation, Electrical & Utilities Safety Association of Ontario	2001

CAREER

Team Leader, Approvals and Permitting, Environment, WSP Canada Inc. (Formerly GENIVAR)	2013 - Present
Environmental Scientist, Environmental Assessment, Permitting & Natural Resources, Tetra Tech, Toronto ON	2010 - 2013
Environmental Technical Specialist, Power, Wardrop Engineering Inc., Markham ON	2006 - 2010
Environmental Planner, Elecsar Engineering Ltd., Thornhill ON	1995-2006

ANDREW ROBERTS, MASc.

PROFESSIONAL EXPERIENCE

Renewable Energy

- Permitting Manager, Ontario (2014-Ongoing): Manages a multi-disciplinary team for technical inputs for post-REA permitting including building permits, entrance permits, encroachment permits and Conservation Authority permits for a portfolio of 5 FIT wind projects. Projects include ZEP Windfarm Ganaraska, Grey Highlands Clean Energy, Grey Highlands Zero Emission People, Settlers Landing and Snowy Ridge. Client: Capstone Power Development.
- Passadumkeag Mountain Due Diligence Review, Penobscott Maine (2015): Mr. Roberts conducted a critical issues and fatal flaw review of federal, state and local permits as part of a Due Diligence Assessment mandate for the 42 MW Passadumkeag Mountain Project currently under construction. Client: Confidential.
- Transformer Containment Design Brief and Spill Containment Plan, Ontario (2015). Developed a spill response plan and operations & maintenance procedures for the transformer station oil containment system at the 91 MW Dufferin Wind Power project. Client: DWP.
- East Durham Wind Farm REA Program, Ontario (2012-Ongoing): Project manager for a REA program and post-REA permitting for a 23 MW FIT wind power project. Client: NextEra Canada.
- Independent Engineer Due Diligence Review Round 2, for a 200+ MW Wind Power Project, Ontario (2015): Managed a multi-disciplinary Independent Engineer review of a 230 MW wind generation project. The due diligence mandate includes reviews of land constraints and constructability, key agreements and material contracts, Renewable Energy Approval documentation package, Additional work included wind resource assessment validations and a noise assessment validation. Client: EDF EN Canada.
- Fatal Flaws Analysis, Ontario (2014): Provided a critical issues and fatal flaws analysis of environmental permitting and environmental baseline studies for a proposed 170 MW wind power project in southwestern Ontario. Provided a regulatory overview of federal, provincial and municipal permit processes and permit status. Client: EDF EN Canada.
- SunEdison/Natural Heritage Construction Monitoring Programs
  - SunE Bruining 1 Solar Farm, Ingleside, Ontario (2014-Ongoing): Project Manager for an onsite monitoring program for the construction, commissioning and site restoration of a 10 MW solar project to ensure compliance with the terms of the REA and environmental impact study.
  - SunE Lindsay Solar Farm, City of Kawartha Lakes, Ontario (2014-Ongoing): Project Manager for an onsite monitoring program for the construction, commissioning and site restoration of a 10 MW solar project to ensure compliance with the terms of the REA and environmental impact study.
- Ernestown Wind Park, Loyalist Township, Ontario (2013): Project Manager for the detailed design of a 10 MW wind project. The project scope included the design and specification of a switching station, protection and control system, line routing,

and collector system design. Management and interface with Hydro One Networks and their COVER process. Client: Horizon Legacy.

- Big Thunder Wind Park, Thunder Bay, Ontario (2013); Project Manager for the detailed design of a 16 MW wind project. The project scope included the design and specification of a switching station, protection and control system, line routing, and collector system design. Management and interface with the local distribution company, Thunder Bay Hydro. Client: Horizon Legacy.
- Independent Engineer Due Diligence Review 200+ MW Wind Power Project, Ontario (2013): Managed a multi-disciplinary Independent Engineer review of a 230 MW wind generation project for a potential investor. The due diligence mandate included reviews of land constraints and constructability, key agreements and material contracts, Renewable Energy Approval documentation package, an analysis of curtailment, validation of CAPEX and OPEX cost estimates and the development of implementation schedules. Additional work included wind resource assessment validations, noise assessment validation and an electromagnetic interference (EMI) study. Client: EDF EN Canada.
- Darby TA Due Diligence Assessment, Ontario (2013): Senior review and compliance assessment of environmental permits and license conditions for the 200 MW Melancthon I & II and 198 MW Wolfe Island wind power projects. Client: TransAlta.
- Emergency Response Planning, Ontario (2013): Developed an emergency response plan and associated procedures including environmental emergencies, loss of utility service, natural disasters, transportation & vehicle injuries and site safety/evacuations. Developed the IESO Restoration Participant Attachment for the 100 MW Dufferin Wind Farm in Melancthon, Ontario. Client: Longyuan Canada.
- SunEdison/Renewable Energy Approvals
  - SunE Bruining 1 Solar Farm, Ingleside, Ontario (2013): REA Project Manager for a 10 MW ground-mount solar photovoltaic renewable energy project.
  - SunE Lindsay Solar Farm, City of Kawartha Lakes, Ontario (2013): REA Project Manager for a 10 MW ground-mount solar photovoltaic renewable energy project.
  - SunE Newboro 1 Solar Farm, Township of Rideau Lakes, Ontario (2013): REA Project Manager for a 10 MW ground-mount solar photovoltaic renewable energy project.
  - SunE Newboro 4 Solar Farm, Township of Rideau Lakes, Ontario (2013): REA Project Manager for a 10 MW ground-mount solar photovoltaic renewable energy project.
  - SunE Oro 4 Line Solar Farm, Township of Oro-Medonte, Ontario (2013): REA Project Manager for a 10 MW ground-mount solar photovoltaic renewable energy project.
  - SunE Westbrook Solar Farm, Kingston, Ontario (2013): REA Project Manager for a 10 MW ground-mount solar photovoltaic renewable energy project.

- Renewable Energy Approval Due Diligence Study, Ontario (2012):* As part of a renewable energy project transaction, performed risk and quantitative analyses of natural heritage, archaeological and other environmental studies for a portfolio of 16 utility-scale solar projects in the Ontario Renewable Energy Approval process (REA). Client: Confidential.
- Critical Issues / Fatal Flaws Analysis, Various locations, Ontario (2010):* Developed a critical issues and fatal flaws analysis to analyze potential permitting, physical and design limitations to solar capacity for a portofilio 19 solar photovoltaic generation sites. Client: Recurrent Energy.
- REA Program Support, Ontario (2010)*: Prepared Construction Plan Reports, Design and Operations Reports and Decommissioning Plan Reports for a portfolio of solar photovoltaic generation projects to 10 MW. Projects include Adelaide 1, Breen 2, Ingersoll 1, Midhurst 2, Midhurst 3, Midhurst 4, Midhurst 6, Orillia 1, Orillia 2, Orillia 3, Smiths Falls 1, Smiths Falls 2, Smiths falls 3, Smiths Falls 4, Smiths Falls 5, Smiths Falls 6, Waubaushene 3, Waubaushene 4, and Waubaushene 5. Client: Recurrent Energy.

Environmental Assessment & Environmental Baseline Studies

- Seaton MTS Class Environmental Assessment, Pickering Ontario (2015-Ongoig). Project Manager and EA expert for a Category 'B' transformer station and transmission line tap environmental assessment subject to the Class Environmental Assessment for Minor Transmission Facilities. Client: Veridian Connections.
- East-West Connection Mount Pleasant GO Station to West of Mississauga Road Municipal Class Environmental Assessment, Brampton, Ontario (2014-Ongoing). Responsible for planning and executing the public consultation plan and the management of environmental tasks including terrestrial and aquatic biology, archaeology and built heritage. Client: City of Brampton.
- Yorktech Road Municipal Class Environmental Assessment, Markham, Ontario (2013-Ongoing): Responsible for planning and executing public consultation component and coordinating the environmental tasks including terrestrial and aquatic biology, archaeology and built heritage. Client: City of Markham.
- Peer Review, Proposed Energy from Waste Facility Screening, Hamilton, Ontario (2015). As part of a multi-disciplinary review team, contributed a peer review of the assessment methodology and potential socio-economic impacts of a proposed energy from waste facility. Client: City of Hamilton.
- Transmission Line Feasibility Assessment (2014), Ontario. Provided an environmental planning and permitting roadmap as part of a high voltage direct current (HVDC) transmission line pre-feasibility assessment. Client: Confidential.
- New Transmission Line to Pickle Lake Project, Ontario (2014): Bridging environmental and engineering design work, provided high-level strategic advice as part of an ongoing individual Environmental Assessment for the project. Client: Goldcorp.
- McClellan Mine Environmental Baseline Study, Lynn Lake, Manitoba (2012):* Collected and analyzed physical environmental data including physiology, surficial

geology and climate data. Managed a field program for archaeological and cultural heritage studies. Client: Carlisle Goldfields Limited.

- Monument Bay Environmental Baseline Study, Monument Bay, Manitoba (2012):* Collected and reviewed climate data from an on-site meteorological station. Client: Mega Precious Metals.
- Arlen MTS, Guelph, Ontario (2011):* Technical lead for an Environmental Assessment of a Category 'B' transformer station and transmission line tap connection. Completed all phases of the EA process including a needs assessment, identification and evaluation of alternative sites, environmental inventory, stakeholder consultation program and environmental mitigation plan. Managed specialized studies including a Stage 1 and 2 archaeological assessments, an acoustic assessment and a Phase 1 Environmental Site Assessment. Principal author of Draft and Final Environmental Study Reports. Client: Guelph Hydroelectric Systems Inc.
- Wetland Reconstruction Strategy Study, Thunder Bay, Ontario (2010).* Provided a regulatory review for an environmental assessment and permitting strategy study to rehabilitate a wetland and create park facilities. Client: Hilderman Thomas Frank Cram Landscape Architecture & Planning.
- Halfmile Lake Mine Determination Review, Bathurst, New Brunswick (2010):* Prepared the terrestrial environment sections for an EIS Registration document as part of a New Brunswick Department of Environment determination review. Provided ArcInfo GIS maps and analysis of key environmental features. Client: Kria Resources Ltd.
- Elwood MTS, Ottawa, Ontario (2009):* Technical lead for an Environmental Assessment of a Category 'B' transformer station and associated transmission line tap connection including a stakeholder consultation program. Principal author of Draft and Final Environmental Study Reports. Client: Hydro Ottawa
- Tanco Mine Relicensing, Bernic Lake, Manitoba (2009):* Contributed terrestrial environment and vegetation reviews for a multi-disciplined environmental assessment report and mine closure plan with the purpose of updating the Environment Act License for an existing operation. Produced GIS mapping including rare species ranges (e.g. woodland caribou) and cultural heritage sites. Client: Cabot Corporation.
- Cyrville MTS, Ottawa, Ontario (2007).* Technical lead for an Environmental Assessment of a Category 'B' transformer station and associated transmission line tap connections. Principal author of Draft and Final Environmental Study Reports. Executed a comprehensive stakeholder consultation program. Client: Hydro Ottawa.
- Powerline MTS, Brantford, Ontario (2004).* Technical lead for an Environmental Assessment of a Category 'B' transformer station and transmission line tap connection. Principal author of Draft and Final Environmental Study Reports. The project approvals were completed ahead of an aggressive client schedule. Client: Brantford Power / Brant County Power.
- Niagara West MTS, West Lincoln, Ontario (2003):* Technical lead for an Environmental Assessment of a Category 'B' transformer station and transmission line tap connection. Principal author of Draft and Final Environmental Study

Reports. Designed and executed a comprehensive stakeholder consultation program. Client: Niagara West Transformation Corporation.

- Bloomsburg MTS, Norfolk, Ontario (2002):* Technical lead for an Environmental Assessment of a Category 'B' transformer station and line tap connection. Principal author of Draft and Final Environmental Study Reports. Designed and executed a comprehensive stakeholder consultation program. Client: Norfolk Power.
- St. Marys MTS, St. Marys, Ontario. (2000):* Technical lead for an environmental assessment of a transformer station and associated line tap connection. The study determined alternatives to the project were preferred. Client: Festival Hydro.
- Jim Yarrow TS, Brampton, Ontario (1999):* Technical lead for an Environmental Assessment of transformer station and associated line tap connections. Principal author of Draft and Final Environmental Study Reports. Designed and executed a comprehensive stakeholder consultation program. Client: Brampton Hydro (now Hydro One Brampton).
- Lorna Jackson MTS, Vaughan Ontario (1998):* Environmental Planner for a transformer station Class EA. Compiled environmental inventories and assessed potential sites against selection criteria based on environmental features, technical feasibility and cost. Participated in public information centres for the project. Client: Vaughan Hydro (now PowerStream Inc.).

Environmental Management, Compliance Auditing and Regulatory Affairs

- Waterloo Light Rail Transit Design Review, Waterloo, Ontario (2014-Ongoing). Responsible for reviews of the environmental management system (EMS), environmental studies including noise and related plans for the WLRT project. Client: City of Waterloo.
- Environmental Health and Safety Audit, Cambridge Ontario (2015): Project Auditor for a PVD (plasma vapor deposition) and CVD (chemical vapor deposition) coating plant. The audit assessed compliance with environmental and safety regulations and examine best management practices. Client: Ionbond.
- BMW Manufacturing Co. LLC/Environmental Compliance Auditing
  - BMW University Environmental Compliance Audit, Whitby, Ontario (2012):* Project Auditor for an environmental compliance audit of an automotive repair training facility.
  - PDC Environmental Compliance Audit, Whitby, Ontario (2012):* Project Auditor for BMW's Parts Distribution Centre operated by DB Schenker.
  - BMW Canada Headquarters Environmental Compliance Audit, Richmond Hill, Ontario (2012):* Project Auditor for an environmental compliance audit of BMW's Canadian headquarters.
- Vision in Motion, Port Hope, Ontario (2012):* Regulatory expert for a large-scale remediation feasibility study for a uranium conversion facility. Contributions included regulatory assessment and input for demolition plans, waste

management plans and hazardous materials abatement plants. Client: Cameco Corporation.

- Environmental Regulatory Guidance Document, Canada-wide (2012):* Principal author of an environmental regulatory guidance document for a major US retailer planning to develop retail outlets throughout Canada. Client: Target.
- Mine Site Audits and CSR Program, Argentina, Mexico, Peru (2011):* Reviewed field notes, audit reports and prepared findings matrices for an environmental compliance audit and corporate social responsibility (CSR) program for mine sites throughout Latin America. Client: Pan American Silver.
- GE Oil and Gas Logging Services/Environmental Compliance Auditing
  - Anaco Compliance Audit, Anaco, Venezuela (2011):* Auditor for a well logging service facility and satellite service area in El Tigre, Venezuela. Additionally, the scope of work included a Phase I Environmental Site Assessment, a health and safety audit, and recommendations for the environmental management system.
  - Ciudad Ojeda Compliance Audit, Ciudad Ojeda Venezuela (2011):* Auditor for a well logging service facility that included administrative offices, vehicle parking and storage of explosives and chemical cutting agents. Additionally, the scope of work included Phase I Environmental Site Assessment activities, a health and safety audit, and recommendations for the environmental management system.
- GE Oil and Gas ESP/Environmental Compliance Auditing
  - Storage Yard Compliance Audit, Maracaibo, Venezuela (2011):* Project Auditor for an environmental compliance audit of an oilfield electro submersible pump storage yard, handling customer equipment returned from the field.
  - Bogotá Assembly Plant Audit, Bogotá, Colombia (2011):* Auditor for an electro submersible oil pump manufacturing facility.
- Comprehensive Environmental Compliance Audit, Guelph, Ontario (2011):* Project Auditor for a comprehensive audit conducted at four Guelph Hydro facilities including an operations and maintenance centre, two distribution stations and a landfill gas generation plant. The Audit assessed compliance with environmental regulations in order to provide a baseline gap analysis for the future development and implementation of a formal environmental management system (EMS). Client: Guelph Hydroelectric Systems.
- ISO 9001:2008 Quality Auditing, Toronto, Ontario (2009-2010):* As an internal Quality Coordinator, performed more than 30 quality audits for a multidisciplinary engineering and environmental consulting company. Client: Tetra Tech.

Environmental Compliance Approvals

- Sherwin-Williams/ Environmental Compliance Support
  - Grimsby Plant Toxic Reduction Plan, Grimsby, Ontario (2012):* Coordinated reporting for a toxic reduction plan for a powder coat manufacturing facility per the *Toxics Reduction Act, 1999*, O.Reg. 455/09.

  - Grimsby Plant Air ECA, Grimsby, Ontario (2012):* Coordinated reporting and ESDM modelling for an air emission environmental compliance approval for a powder coat manufacturing facility.
  - Brantford Plant Toxic Reduction Plan, Brantford, Ontario (2012):* coordinated reporting for a toxic reduction plan for a paint manufacturing and test lab facility per the *Toxics Reduction Act, 1999*, O.Reg. 455/09.
  - Brantford Plant Air ECA, Brantford, Ontario (2012):* Coordinated reporting for and EDSM modelling for a paint manufacturing and test lab facility.

- Guelph Hydroelectric Systems Inc. / Environmental Compliance Support
  - Rockwood MS 1 Noise ECA, Rockwood, Ontario (2012):* Coordinated an Environmental Compliance Approval application under Section 9 of the *Environmental Protection Act* for noise emissions
  - Rockwood MS 2 Noise ECA, Rockwood, Ontario (2012):* Coordinated an Environmental Compliance Approval application for noise emissions.
  - Arlen MTS Industrial Sewage Works, Guelph, Ontario (2011):* Coordinated an Environmental Compliance Approval for industrial sewage works for a transformer station oil containment and separation system. Produced spill response and operations & maintenance procedures for the facility.
  - Arlen MTS Acoustic Assessment, Guelph, Ontario (2011):* Coordinated a Certificate of Approval for noise emissions from a Category 'B' transformer station.
- Lac des Iles Mine Toxic Reduction Plan, Lac des Iles, Ontario (2012):* Coordinated reporting for a toxic reduction plan per the *Toxics Reduction Act, 1999*, O.Reg. 455/09. Client: North American Palladium.
- Eby Rush MTS Industrial Sewage Works, Waterloo, Ontario (2012):* Coordinated an Environmental Compliance Approval for industrial sewage works for a membrane-type oil containment system in a substation yard. Produced spill containment and operations & maintenance procedures for the facility. Client: AECOM / Waterloo North Hydro Inc.
- Lake Erie Steel Works ECA, Nanticoke, Ontario (2012):* Contributed industrial process descriptions and municipal planning background research supporting an EDSM report. Client: U.S. Steel Canada.
- PowerStream Inc./ Environmental Compliance Support
  - Aurora MS 6 Industrial Sewage Works, Aurora, Ontario (2009):* Produced spill containment and operations & maintenance procedure as part of a industrial sewage works Certificate of Approval for a distribution station oil containment system
  - Aurora MS 7 Oil Industrial Sewage Works, Aurora, Ontario (2007):* Produced spill containment and operations & maintenance procedure as part of Certificate of Approval for a distribution station oil containment system.

ANDREW ROBERTS, MASc.

* denotes projects completed with previous employers

PRESENTATIONS

Roberts, A. 2013, "Ontario's Feed-In Tariff: Learning As We Go – Transition to FIT 2.1", Financing the Future Wind Farm - A Look at the Canadian FIT and Recent Changes to the Production Tax Credit, Webinar, Windpower Engineering & Development.

WSP

ERIN FITZPATRICK, B.Sc., M.Sc.

BIOLOGIST

AREAS OF PRACTICE

Natural Sciences

PROFILE

Erin Fitzpatrick (née Corstorphine) is a terrestrial biologist with more than five years of experience in the natural sciences. Erin has developed and implemented detailed work programs for a variety of natural heritage studies, including Oak Ridges Moraine Conformity Studies, Environmental Impact Studies, and Natural Heritage Assessments under the Renewable Energy Approvals Process. She regularly works on Class Environmental Assessments and Aggregate Resource Investigations where she applies sound biological principles to the assessment and mitigation of impacts to the natural environment. Erin has extensive experience completing floral and faunal species at risk surveys, habitat assessments, tree inventories, natural heritage feature review and mapping, and vegetation assessments including the use of Ecological Land Classification.

Through various roles in the public and private sectors, Erin has gained valuable experience with project design, implementation and management, and has developed the skills necessary to work co-operatively within a multi-disciplinary team to meet project requirements and deadlines.

EDUCATION

M.Sc., Integrative Biology, University of Guelph, ON	2010
B. Sc. (Honours), Applied Ecology, University of Guelph, ON	2000

PROFESSIONAL DEVELOPMENT

Ontario Wetland Evaluation System (OWES) Certification, MNR	2014
Aquatic Insect Family Level Identification Course, OBBN	2014
Standard First Aid, CPR and AED Certification	2010
Ecological Land Classification, MNR	2012
Northeast Forest Ecosystem Classification Workshop, MNR	1998
Grass, Sedge and Rush Identification Workshop, MNR	1998

CAREER

Biologist, Environment, WSP	2014 - Present
Biologist, Environment, GENIVAR (now named WSP)	2011 - 2013
Project Co-ordinator, Biodiversity Institute of Ontario, University of Guelph, ON	2010 - 2011
Lab Technician, Biodiversity Institute of Ontario, University of Guelph, ON	2007
Wildlife/Species at Risk Biologist Intern, Ministry of Natural Resources, NE Region, South Porcupine, ON	2002

ERIN FITZPATRICK, B.Sc., M.Sc.

PROFESSIONAL EXPERIENCE

Natural Sciences

- 2014 Northeastern Region Aggregate Source Investigations, North Bay, Matheson, Massey, Thessalon, Shining Tree, Gogama, and Britt (2014): Field surveys for eight potential aggregate sites were completed to document natural heritage features, significant wildlife habitat, and species at risk. Specific species at risk surveys included basking surveys for Blanding's Turtle, gestation and hibernation habitat surveys for Massasauga Rattlesnake, and evening surveys for Whip-poor-will. Client: Ministry of Transportation of Ontario.
- Class Environmental Assessment, East-West Connection from Mount Pleasant GO Station to West of Mississauga Road, Brampton, Ontario (2014): Assessments of the natural environment will be completed to inform the evaluation of the alternative alignments and determination of a preferred planning solution. Additional support will be provided in the form of regulatory agency consultation and securement of relevant permits and approvals, including those associated with species at risk. Client: City of Brampton.
- Yorktech Drive Extension – Class C Environmental Assessment, Markham, Ontario (2014): As part of a Schedule C Class EA, a Natural Heritage Existing Conditions report was completed. Work on the project included consultation with appropriate regulating agencies, a full field program for vegetation, wildlife, and potential species at risk in the area, and an impact assessment for the alternative routes. Client: City of Markham.
- 2013 Northeastern Region Aggregate Source Investigations, Wawa, Timmins, Copper Cliff, North Bay, Marten River, and Mattawa, ON (2013): Conducted surveys for natural heritage features and species at risk for seven proposed aggregate sites in Northeastern Ontario. Species specific surveys of note included evening Whip-poor-will surveys for all seven sites. Client: Ministry of Transportation of Ontario.
- Minto Mine Project, Shining Tree, ON (2013): Conducted surveys for natural heritage features and species at risk in support of an advanced exploration mining permit for a mining exploration company. Work included the collection of background information, consultation with appropriate regulating agencies, field investigations, and reporting. Client: Creso-Nichromet.
- Innisfil Closed Landfill Remediation, Innisfil, ON (2013): The County of Simcoe was tasked with remediating a historic closed landfill site. The landfill was located within a mapped Provincially Significant Wetland, as well as within some sensitive natural areas. Provided an existing conditions report, applied for appropriate permitting, and developed a mitigation and planting plan for the site to ensure that the surrounding natural environment was not negatively impacted by the refuse removal. Client: County of Simcoe.
- Ramara Closed Landfill Remediation, Ramara, ON (2013): The County of Simcoe was tasked with remediating a historic closed landfill. The landfill was located within a large wetland complex, as well as within some sensitive natural areas. Provided an existing conditions report, applied for appropriate permitting, and developed a mitigation and planting plan for the site to ensure that the

surrounding natural environment was not negatively impacted by the refuse removal. Client: County of Simcoe.

- Ontario Science Centre Tree Inventory and Preservation Plan, Toronto, ON (2013): An inventory of trees within the ravine surrounding the Ontario Science Centre was completed in support of plans to install new retaining walls. Field observations contributed to the development of a preservation plan to minimize the impact to trees within the development zone. Client: Ontario Science Centre.
- Existing Conditions Reports, Two Bridge Sites, Hamilton, ON (2013): A survey of existing conditions and potential for species at risk was conducted as part of a roster assignment for the City of Hamilton. Surveys were conducted for flagged species at risk in the study area, including bird, fish, plant, mammal, and herptile species. Client: City of Hamilton.
- Carlisle Well Class Environmental Assessment, Carlisle, ON (2013): As part of a Schedule C Class EA, a Natural Heritage Existing Conditions and Impact Study was completed. Work on the project included consultation with appropriate regulating agencies, a full field program for potential species at risk in the area, and an analysis of potential impacts. Client: City of Hamilton.
- Pickering Class Environmental Assessment, Pickering, ON (2013): As part of a Schedule B Class EA, a Natural Heritage Existing Conditions Report was prepared for the re-routing of three sanitary sewers in the City of Pickering. The field investigation focused on the terrestrial environment surrounding four alternative alignments, and included surveys of vegetation, breeding birds and an assessment of habitat potential for species at risk and other wildlife species. Client: Regional Municipality of Durham.
- Scoped Environmental Impact Studies for Pipeline Maintenance, Toronto, Whitby, ON (2013): Scoped environmental impact studies were prepared to obtain permits and approvals required to complete pipeline inspection and repair work at six sites within Southern Ontario. The reports included detailed site plans outlining site mitigation, tree protection and removal specifications, as well as site restoration. Conservation Authority permits, Parks Access Agreements and approvals for work within Ravine and Natural Feature Protection areas were obtained for the sites. Client: Trans-Northern Pipelines Inc.
- 2012 Northeastern Region Aggregate Source Investigations, Englehart, Elk Lake, Foleyet, Wawa, Chelmsford, Sudbury, North Bay and Mattawa, ON (2013): Conducted surveys for natural heritage features and species at risk for nine proposed aggregate sites in Northeastern Ontario. Specific species at risk surveys included evening Whip-poor-will surveys for twelve sites and surveys for Massasauga Rattlesnake habitat on two sites. In addition to preparing Natural Environment reports for nine of these sites, assisted the client with Endangered Species Act Overall Benefit Permit Applications and Avoidance and Mitigation Measures Reports for five of the sites. Client: Ministry of Transportation of Ontario.
- 2011 Northeastern Region Aggregate Source Investigations, Cochrane, Englehart, Chapleau, Chelmsford, Massey and Espanola, ON (2012): Surveys of natural heritage features, including species at risk, were conducted for eight proposed aggregate sites in Northeastern Ontario. As part of the Aggregate Permit Application process, Natural Environment reports were prepared to identify

the presence of significant natural heritage features, assess the potential for negative impacts on these features and their ecological functions, and to provide suggestions for preventative, mitigative and/or remedial measures. Client: Ministry of Transportation of Ontario.

- Species at Risk Survey, Waterdown Class Environmental Assessment, Waterdown, Hamilton, ON (2011): A species at risk survey was conducted as part of the Class B Environmental Assessment for new road corridors in the Waterdown area. Surveys were conducted for 35 species at risk in the study area, including bird, plant, mammal, herptile and invertebrate species. Scientific Collector's Permits and approved Animal Care Protocols were required for live-capture trapping of Woodland Vole and Jefferson Salamander. Client: City of Hamilton.
- Mayfield Road Class Environmental Assessment, Brampton, ON (2011): An existing conditions report focusing on the terrestrial environment, including vegetation and wildlife species and their habitat, was prepared as part of the initial stages of the Class Environmental Assessment. Ongoing consultation with the client, design team and regulating agencies will continue in the design stages and impact assessment phases of the project. Client: Region of Peel.
- Renewable Energy (Solar and Wind) Natural Heritage Assessments, Various locations, ON (2011-2013): Ontario Regulation 359/09 requires proposed alternative energy projects to complete Natural Heritage Assessments investigating significant wildlife and their habitats, and the potential for proposed projects to have impacts on existing natural features. Completed numerous desktop studies and reports assessing the potential impacts on natural heritage features, including surface water features, associated with proposed renewable energy projects. Client: Various.
- Renewable Energy (Solar) Natural Heritage Assessments, Lindsay and Oro-Medonte, ON (2011-2014): As part of a multi-disciplinary team, Natural Heritage Assessments and species at risk surveys were completed to meet the environmental requirements outlined with Ontario Regulation 359/09. As part of these assessments Ecological Land Classification, habitat assessment, and environmental impact studies were completed to mitigate potential negative impacts to identified natural heritage features within the vicinity of the proposed solar farms. Following extensive consultation with regulatory agencies, desktop studies and field investigations, MNR approvals were obtained for both sites. Pre-construction surveys were completed in 2013 to meet REA approval requirements for construction in 2014. Client: SunEdison.
- West Trunk Sewer Compound Class Environmental Assessment, Mississauga, ON (2011-2014): A general tree inventory and vegetation overview was prepared for four sites as part of a larger Class Environmental Assessment. In addition, a mitigation and restoration plan was completed for an open-cut crossing at Loyalist Creek to obtain agency approvals and permitting at the detailed design stage. Client: Region of Peel.
- Woodend Conservation Area, Outdoor Living Campus, Niagara-on-the-Lake, ON (2012): A scoped Environmental Impact Study was required for the approval of the proposed re-development of two buildings at the Outdoor Living Campus. As part of the EIS, a survey for Species of Conservation Concern, including surveys for breeding birds, and a Tree Inventory and Preservation Plan was completed. Field

observations and secondary source information were used to develop measures to eliminate or mitigate environmental impacts associated with the proposed development. Client: District School Board of Niagara.

- Region of Waterloo Trunk Watermain Class Environmental Assessment, Kitchener, ON (2011): A description of existing conditions and natural heritage features, including species at risk and their habitat, must be considered in initial stages of a Class Environmental Assessment. An existing conditions report was prepared to inform the design team of potential natural heritage constraints leading into the design phase of the project. Client: Region of Waterloo.
- Stream Clearing and Rehabilitation Plan, Beaverton, ON (2011): A stream clearing and rehabilitation plan was created to improve the channelization and flow of an ephemeral stream providing drainage on an agricultural property. A constructed wetland and defined drainage channels were incorporated into the design plan to attenuate surface run-off and groundwater seepage responsible for soil erosion along the agricultural fields. Client: Goodyear Farms Limited.
- Remediation Plan for Wutai Shan Buddhist Temple, Township of Cavan, ON (2012): Helped to develop a remediation plan to ensure that past and future development at the temple site would comply with requirements laid out by the local Conservation Authority and the Ministry of Natural Resources. As part of this remediation plan, a description of existing conditions with respect to terrestrial and aquatic natural heritage features was prepared to assess the potential for future environmental impacts, and mitigate existing impacts associated with development and site alteration. Client: Cham Shan Temple.
- 1691 Adjala Tecumseth Townline, New Tecumseth, ON (2012): A Natural Heritage Evaluation was prepared to satisfy the requirements of the Oak Ridge's Moraine Act for a proposed single family dwelling and detached garage. Client: Georgiy Davydenko.

PUBLICATIONS AND PRESENTATIONS

Publications

- Mincks, Hardy, S., C.M. Carr, M. Hardman, D. Steinke, E. Corstorphine, and C. Mah. “Biodiversity and phylogeography of Arctic marine fauna: insights from molecular tools.” *Marine Biodiversity*, 2010, 41(1): 195-210.
- Corstorphine, E.A. 2010. “DNA Barcoding of Echinoderms: Species Diversity and Patterns of Molecular Evolution” M.Sc. Thesis. University of Guelph.

Presentations

- Corstorphine, E. and P.D.N. Hebert. “Do life histories and environmental factors affect molecular evolution of the cytochrome c oxidase subunit I gene in the Echinodermata?” Evolution, University of Minnesota, Minneapolis, MN (*poster presentation*), 2008.
- Corstorphine, E. and P.D.N. Hebert. “Do life histories and environmental factors affect molecular evolution of the cytochrome c oxidase subunit I gene in the Echinodermata?” The 2nd annual symposium of the Canadian Barcode of Life Network, Toronto, ON (*poster presentation*), 2008.

ERROL HALBERG, P.Eng.

MANAGER, RENEWABLE ENERGY ASSESSMENT

AREAS OF PRACTICE

Wind and Solar Project Due Diligence

Power Performance Testing

Risk, Uncertainty, and Losses

Wind Energy Estimates

Solar Energy Estimates

Operational Project Evaluation

Environmental and Permitting

PROFILE

Errol Halberg is the manager and technical lead of the renewable energy assessment department at WSP. He has been involved in energy assessment of preconstruction and operational wind and solar projects worldwide with a portfolio of thousands of megawatts. Errol is a recognized expert in his field and has spoken at a number of conferences on subjects including meteorological measurements, energy losses, uncertainty, and the interpretation of wind resource assessment results for the finance community.

EDUCATION

Master of Science in Chemical Engineering, University of Alberta	2007
Bachelor of Science in Materials Engineering, University of Alberta	2002

PROFESSIONAL ASSOCIATIONS

Association of Professional Engineers and Geoscientists of Alberta	APEGA

CAREER

Manager, Renewable Energy Assessment, WSP, Calgary AB	2014 - Present
Manager, Renewable Energy Assessment, GENIVAR	2012 - 2014
Wind Resource Engineer, GENIVAR	2008 - 2012
Wind Resource Engineer, Phoenix Engineering	2007 - 2008

PROFESSIONAL EXPERIENCE

Wind and Solar Project Due Diligence

- Advised lenders and developers for mergers, acquisitions, and IPOs of large portfolios by identifying inputs for project valuation.
- Evaluated third party energy estimates, production statistics from operating projects, operations and maintenance history, and turbine performance.
- Identified risk factors from a permitting perspective including sound, turbine suitability, shadow flicker, and radar interference.

Power Performance Testing

- Planned, designed, and executed power performance tests for various wind turbine technologies according to the IEC 61400-12-1 standard.

- Acted as an advisor for negotiations between project developers and turbine manufacturers in context of the turbine power curve and master service agreement.

Wind Energy Assessments

- Extensive experience in generating yield estimates for wind energy projects throughout Canada, USA, and internationally.
- Special expertise in interpretation of uncertainty, inter-annual variability of production, and validation using actual performance of built facilities.
- Expert in meteorological campaigns, wind flow modeling using WA^{s}P, WindPRO, and Meteodyn, layout design, climate suitability, losses, and uncertainty,

Solar Energy Assessments

- Current lead of the WSP Global Solar Network
- Conducted energy assessments for both preconstruction and built solar projects
- Design of meteorological deployment campaigns
- Evaluation of losses and uncertainty for solar projects.

Operational Assessment

- Evaluation of energy estimates operating wind and solar facilities using production data
- Review of historical performance relative to budget expectations (monthly and quarterly operational reporting)

Environmental and Permitting

- Prepared third party reports and assessed risk factors for the permitting process including sound, shadow flicker, viewshed, electromagnetic interference, and curtailment

PUBLICATIONS AND PRESENTATIONS

Publications

- Dvorak, Paul. Halberg, Errol. “Taming Uncertainty for Wind Project Financing” WindPower Engineering & Development, November 2012.
- Wershof, Stuart., Halberg, Errol., Shoucri, Andre. “Quantification of the Impact of NRG Sensor Drag on Yield Assessments” GENIVAR, December, 2008.

Presentations

- Breakey, Matthew., Halberg, Errol., “On-Shore Wake Validation Study: Wake Analysis Based on Production Data”, AWEA Wind Resource Assessment Symposium, Las Vegas, December 2013.
- Halberg, Errol. “Monetizing Wind Resource Assessment: Bank Survey” AWEA Wind Resource Assessment Workshop, Pittsburgh, PA. September 2012.
- Halberg, Errol., “Power Performance Testing Best Practices”, GENIVAR, 2011.
- Halberg, Errol., “Remote Sensing Best Practices”, GENIVAR, 2011.

7 APPENDIX 2 – GENIVAR’S 2010 PERMITTING PROPOSAL

WINDSTREAM ENERGY INC.

WOLFE ISLAND SHOALS

P-10-11107-76

Proposal for Permitting and Field Investigation Services

GENIVAR

November 25, 2010

GENIVAR Consultants LP 600 Cochrane Drive, 5th Floor, Markham, Ontario, L3R 5K3
T 905.475.7270 F 905.475.5994 - www.genivar.com

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Proposal No. P10-11107-76

November 25, 2010

Leah Deveaux
ORTECH Environmental
804 Southdown Road
Mississauga, ON L5J 2Y4

Re: Wolfe Island Shoals Offshore Wind Farm
Proposal for Permitting and Field Investigation Services

Dear Leah:

GENIVAR is pleased to submit this proposal for services in accordance with your RFP. Wind energy is a key service area for GENIVAR; we have an excellent understanding of the risks and issues associated with this project and have proposed appropriate strategies. Our core team is Ontario based, and is supplemented by global technical expertise which is not yet locally available as this will be the first offshore wind farm in Canada.

We have been involved with this project for the last year and look forward to the opportunity of expanding our role. Please do not hesitate to contact us if you have any questions.

Respectfully submitted.

GENIVAR Consultants LP

Pierre Lacombe, Eng., M.Sc. MBA
Vice-President Industrial and Power

Sunil Kumar, P.Eng. MBA
Director - Energy

/initials

APPENDICES

1. EXECUTIVE SUMMARY

The Wolfe Island Shoals facility is the first offshore wind project in Canada to receive a Power Purchase Agreement. GENIVAR's proposal is in conformance with the RFP issued on October 8, 2010 and subsequent addendums. In this summary, we highlight the key aspects of our approach and our unique capabilities.

Scope of Services

We are submitting proposals for the following:

- Option 1: Permitting Work
- Option 2: Ecological Field Work
- Option 3: Technical Field Work
- Option 4: Cultural Heritage Study and Archaeology Study

We believe that having a single entity responsible for these tasks will result in better co-ordination and cost efficiencies. We have assumed that the EA will need to cover the offshore facilities, onshore facilities (transmission line, switching station, and any new/upgraded permanent docks), as well as construction activities.

GENIVAR Background

GENIVAR is a large multi-disciplinary Canadian consulting firm offering full services for the wind energy sector including wind resource assessment, environmental assessments, and engineering. We have over 5000 employees in total and over 15 offices in Ontario. GENIVAR already is familiar with this project, having completed the following:

- Preparation of the electrical part of the original FIT application
- Preparation of SIA and CIA applications and subsequent discussions with OPA and HONI
- Presentation to Windstream on engineering aspects of an offshore wind farm (together with Lahmeyer and Overdick)
- Preparation of a preliminary "Permitting Services Scope and Budget Analysis" for this project
- Communications with various turbine suppliers who are interested in this project

Our Approach

As this is the first project of its type, there are inherent risks which must be carefully evaluated and managed. Our execution philosophy will be based on the following principles:

- Early and frequent consultation with key agencies and the public. We will be pro-active rather than reactive. We will seek to obtain "buy-in" by agencies of field studies prior to starting the work.
- Strategic direction provided by a senior team who are experienced in environmental approvals of complex projects
- World class technical team who can address the issues raised during the EA process. The project will be led by our Toronto area office and we will be well above the 50% Ontario domestic content threshold.
- Project team which includes members who have previous experience with offshore wind farms (Lahmeyer and Overdick). As an option, we have suggested a general technical presentation to key agencies (MNR, DFO, Transport Canada, MOE and others) at an early stage describing what an offshore wind project consists of and related issues. This could be somewhat similar to the

presentation we made to Windstream/Ortech in early summer 2010. As a result, the agencies will have facts, based on real world experience, on which to understand the project components.

- Utilization of local Kingston area expertise. Lakebed sediment transport could be a major concern for both the construction and operation phases. Our team includes Dr. Boegman of Queen's University; he has experience with modeling of eastern Lake Ontario/St. Lawrence River for the Ontario Ministry of the Environment & Cataraqui Region Conservation Authority. The Cataraqui Archaeological Research Foundation will do the terrestrial archaeological study.

Experienced Project Manager

Our Project Manager will be Pat Becker, M.E.S. She has over 20 years of experience in environmental planning and public/agency consultation. Areas of expertise include, environmental assessments (provincial and federal) for individual and class Environmental Assessment (EA) projects for both the private and municipal sectors, public consultation, aboriginal consultation and government/agency consultation. She has been involved in EAs for wind projects for over 7 years. She has also consulted to the Ontario Ministry of Environment for the development of new EA processes. Her relevant experience includes:

- **Renewable Energy Approvals** (REA) for four private sector wind turbine projects located in southwestern Ontario. The REA involves the development of consultation programs and undertaking public, aboriginal, government and agency consultation activities.
- **Environmental Screening** - Completed nine environmental screening reports for wind turbine projects located in communities in southwestern Ontario. This involved the development of consultation programs and undertaking public, aboriginal, government and agency consultation activities. In addition, SARA requirements were identified and met.
- **Erie Shores Wind Farm**: Completed an environmental screening including developing a consultation program and undertaking the public, aboriginal, government and agency consultation activities.
- **Lake Simcoe Water Treatment Facility Class EA**: Completed Phases 3 and 4 of the Class EAs process, including assisting on developing and undertaking the public, government and agency consultation activities.
- **Department of Fisheries & Oceans**: Completed property transfer assessments and federal environmental assessments (under the Canadian Environmental Assessment Act) for the divestiture of approximately 45 federal harbours located throughout Ontario.

Due to the unique nature of this work, we anticipate that there will be changes in scope which will require changes in budget. We will establish a project management system whereby Windstream approves tasks/budgets and monthly reporting is provided for this. As changes in scope (such as additional studies requested by government agencies) are required, we will prepare requisitions which will require Windstream's approval.

2. INTRODUCTION

2.1 PROJECT BACKGROUND

The Wolfe Island Shoals facility is the first offshore wind project in Canada to receive a Power Purchase Agreement (through the FIT program). The facility will be developed entirely on crown land in Lake Ontario off the shore of Wolfe Island, Ontario. It is anticipated that between 80 and 130 wind turbines will be placed in the project area. The turbines will be connected through a series of underwater cables to a single offshore substation. A 230 kV submarine cable, approximately 27 km in length, will connect to the Lennox TS.

GENIVAR is intimately familiar with this project having provided assistance to Windstream for the preparation of the electrical part of the original FIT application, subsequent SIA and CIA applications to IESO and Hydro One and participation in discussions on the electrical interconnection, presentation to

Windstream on the engineering and logistics of offshore wind projects, and the preparation of a preliminary Environmental Permitting Services Scope and Budget Analysis.

2.2 PHILOSOPHY OF APPROACH

This project will be the first environmental assessment for an offshore wind facility in Canada. Consequently, there are inherent risks which must be carefully evaluated and managed. Otherwise there is the potential for serious project delays, increases in capital cost, or even the risk of the project not obtaining the necessary approvals.

Therefore our execution philosophy will be based on the following principles:

- Early and frequent consultation with key agencies. We will be pro-active rather than reactive.
- Strategic direction will be provided by a senior team who are experienced in environmental approvals of complex projects
- World class technical team who can address the issues raised during the EA process
- Project team which includes members who have previous experience with offshore wind farms
- Local Resources. It is our intent to engage and employ local resources and experts.

2.3 KEY STRATEGIC ISSUES

Issue: “Buy-in” by Agencies of Field Studies. There are a large number of technical field studies to be completed, including avian surveys, bat surveys, natural heritage studies, marine archaeology, and others. If the agencies do not accept the methodology, additional work may be required which could negatively impact the project schedule.

> *GENIVAR’s approach: The first part of the project will consist of developing draft field study plans for discussions with the various agencies including MNR, DFO, Transport Canada, Environment Canada and others. We will try to obtain their approval, or at the very least their comments on the workplan, prior to executing the fieldwork.*

Issue: Level of Public Consultation. The REA for “onshore” projects requires minimum two meetings. For this project, we anticipate several meetings will be required.

> *GENIVAR’s approach: We propose the following for discussion with Windstream and your Public Consultation team:*
>
> - *Early “information” meeting before starting the formal government processes*
> - *“Formal” public meetings. More than the minimum two may be required.*
> - *Individual meetings with individual local community groups who have specific concerns. Due to the large geographic expanse of the project, there may be different concerns for different groups which may be better addressed in separate meetings. For example, a yachting association would be concerned about obstructions and construction impact whereas landowners along the 230 kV overhead line route may be more concerned about EMFs.*

Issue: Poor understanding by Agencies of what is an Offshore Wind Farm project. This could result in delays during the report review stage or misunderstanding of impacts.

GENIVAR's approach: We suggest, as an additional task, that our team visit key agencies (MNR, CEAA, MOE, Environment Canada, DFO, Transport Canada) and provide them with a general presentation of the technical elements of an offshore wind farm and construction processes. For this activity, our team would include members of Lahmeyer. For efficiency, we would try to meet several agencies together.

Issue: Resource Requirements. This is a large project requiring many staff with specific skill sets. Inadequate resourcing could delay the project.

GENIVAR's approach: GENIVAR is a large firm with over 5000 employees Canada wide and over 1200 in Ontario. Together with our sub-consultants, we have a large pool of resources that we can draw upon to meet your timelines.

Issue: Lakebed sediment impact could be a major concern for Agencies. Sediment impact during construction is typically a major concern for agencies.

GENIVAR's approach: As this is potentially a major technical concern, we have included Dr. Boegman of Queen's University on our team. His activities focus on transport and mixing processes in the aquatic environment and their impact upon water quality. His expertise includes hydrodynamic and water-quality modelling, bio-physical coupling, and open channel hydraulics. He has completed modeling of eastern Lake Ontario/St. Lawrence River for the Ontario Ministry of the Environment & Cataraqui Region Conservation Authority.

2.4 COMMITMENT TO THE LOCAL COMMUNITY

It is our belief that the success of the EA and REA permitting process can be influenced by the support of the local community. GENIVAR is committed to utilizing local resources as much as possible. To this end, GENIVAR has taken the following steps:

- Having the Cataraqui Archaeological Research Foundation as a member of our team;
- Engaging Queens University. Dr. Boegman, has joined our team to complete the water quality and sedimentation work and we hope to add more faculty members to our team in the near future;
- We are committed to hiring graduate and/or summer students to assist in the Ecological and Technical Field Work;
- Utilization of our local Kingston office; and
- Preferentially procure local supplies and services whenever practical.

3. GENERAL ASSUMPTIONS

Our proposal is based on the following:

→ Turbine layouts, including GPS co-ordinates, to be provided by others. Our cost estimate is based on one original layout and 2 revisions.

→ Electrical collector line layout, substation location to be provided by others.

→ For the land portion of the transmission line, evaluation of two routes (to be jointly determined between Windstream, GENIVAR and the electrical consultant).

→ Conceptual design of foundations by others

→ Determination of dock requirements for construction phase and operation phase by others

- Definition of construction logistics, techniques and schedule, at a level of detail adequate for the environmental studies, by others.
- Environmental assessment and studies work to be undertaken over an eighteen month period commencing January 2011. This is to meet the Summer 2012 construction start date provided in the RFP documents. Based on our recent experience with the permitting of onshore wind projects, this is an aggressive timeline.
- The Site Release Process is not included in the scope of work. GENIVAR can assist Windstream with this process if requested.

There are a number of field related studies to be conducted – some are already underway by Windstream, others are to be part of this RFP, and others yet to be determined. The table below summarizes our understanding.

Type	Description	Responsibility
Technical	Bathymetry	Windstream – underway
	Side Scan Sonar	Windstream – underway
	Sub Bottom Profiling	Windstream – underway
	Surface Sediment Sampling	Windstream – underway
	Seabed Geotechnical	Windstream – spring 2011
	Land Geotechnical at submarine cable landing	TBD
Ecological	Avian	GENIVAR
	Bats	GENIVAR
	Terrestrial Ecology	GENIVAR
	Aquatic Ecology	GENIVAR
General	Noise – during operation	GENIVAR
	Noise – during construction	TBD
	Shadow Flicker	GENIVAR
	Visual Impact Assessment	GENIVAR
	Telecommunication Interference Constraints study	GENIVAR
	Interference EMI Modelling (if required)	TBD

Type	Description	Responsibility
Technical Field	Waves and Currents data collection using ADCP	GENIVAR/ Environnement Illimite
	Hydrology	GENIVAR
	Wave Studies	GENIVAR
	Beach sediment sampling	GENIVAR
	Bottom sediment sampling	GENIVAR
	Sediment Transport modelling	GENIVAR/ Queen's University
	Icing Studies	Groupe-conseil Lasalle / Lahmeyer
	Costal Engineering	GENIVAR
Archaeological/Heritage	Terrestrial and Marine Archaeology – Stage 1	GENIVAR/SJACHE/CARF
	Terrestrial Archaeology – Stage 2	GENIVAR/CARF
	Marine Archaeology – Stage 2	GENIVAR/ SJACHE
	Cultural Heritage	GENIVAR/CARF

4. PERMITTING WORK (OPTION 1)

4.1 APPROVALS

Each of the primary approvals processes (EA and REA) will require separate reporting but will have considerable overlap with respect to the technical studies and consultation activities. The following subsections will provide a background on the major steps in the EA, REA and Site Release process.

4.1.1 Federal EA Process

The Federal EA process is administered by the Canadian Environmental Assessment Agency (CEAA) however, the process is driven by "Responsible Authority or Authorities" based on what triggers the need for a federal EA to be completed. For this project it is anticipated that the Responsible Authority will likely be the Department of Fisheries and Oceans (DFO) and/or Transport Canada (TC). The major steps of the process are:

1. Identification of Responsible Authority (by CEAA)
2. Notification of relevant federal authorities/experts (by CEAA)
3. Determine scope of EA (collaboration between proponent and Responsible Authority)
4. Establish timeline of project (collaboration between proponent and Responsible Authority)

5. Conduct Analysis (proponent)
6. Create EA Report (proponent)
7. Review of EA by Responsible Authority
8. Decision on EA released

4.1.2 Provincial REA Process

The Provincial REA process is administered by the Ministry of the Environment (MOE) but shares regulatory jurisdiction with the Ministry of Natural Resources (MNR), Ministry of Tourism and Culture (MTC) and the Ministry of Transportation (MTO). The major process steps are:

1. Notification of Project and Public Meeting #1
2. Public Meeting # 1
3. Completion of Technical and Environmental Studies (Avian, Bat, Natural Heritage, Noise, Archaeological, Shadow Flicker and Water studies)
4. Completion of Draft Required Reports
5. Completion of Municipal Consultation Form
6. Sign off from Ministry of Natural Resources and Ministry of Tourism and Culture
7. Notice of Public Meeting #2 and Release of Draft Required Reports for Public Review
8. Public Meeting #2
9. Completion of Consultation Report and Final Required Reports
10. Submission of REA Application

In addition to these specific tasks, the REA regulation requires on-going consultation activities with aboriginal groups.

4.1.3 Additional Permitting

In addition to the main REA and CEAA permitting processes, several other permits may be necessary. GENIVAR will contact each agency in the early stages of the process in order to determine if permitting is necessary and agree upon a scope of work. Likely permits are listed in the table below.

Permit	Authorizing Agency	Notes
Navigable Waters Protection Act Permit	Transport Canada	Will be required
Aeronautical Obstruction Clearance Form	Transport Canada	Will be required
NavCanada Land Use form	NavCanada	Will be required
Fisheries Act Authorization	DFO (possibly with Cataraqui Region Conservation Authority)	Will be required
SARA Permit	DFO or CWS	May be required
Shoreline, wetland or	Cataraqui Region	Will be required for

Permit	Authorizing Agency	Notes
watercrossing alteration permit	Conservation Authority	transmission cable landing point
Species at Risk Permit	MNR	May be required
Crown Land Site Release	MNR	Will be required
Building Land Use Permit	MTO	May be required if alterations to a provincial highway (or exit/entrance rap) is required for deliveries
Permit to Take Water	MOE	May be required

4.2 STAKEHOLDER CONSULTATION STRATEGY

Both the REA and CEAA processes involve stakeholder consultation but to differing degrees. The REA process requires consultation with various agencies, aboriginal groups and the public. There is also a requirement that a proponent consult with municipalities through formal and informal discussions and they must jointly complete a municipal consultation form.

For the public consultation component, the REA process requires that a minimum of two (2) public meetings be held within any municipality which has project components the first at the beginning of the process and the second once the draft REA reports have been completed. This will likely be Loyalist Township, Frontenac Islands and potentially the City of Kingston. The CEAA process has less specific requirements and focuses on public participation (e.g. posting of the project on the public registry) and consultation with federal departments but does not specify the process. To address the EA requirements the consultation process will include public meetings, as well as formal and informal conversations and meetings with various stakeholder groups and every effort to combine the two processes will be made.

With the large number of agencies likely to be involved in this process, it is important to engage as many as possible early on to avoid the emergence of a new government agency requirements or objections late in the process.

The stakeholder consultation process will involve an initial meeting with the key provincial ministries (MOE, MNR, MTC) to identify concerns and opportunities for setting up workplans that will be conducted to address their requirements and/or needs. In some instances it may be appropriate to have both the federal and provincial agencies combined into one meeting but at present we propose to meet separately since they have slightly different interests.

We propose an initial meeting with the federal departments (DFO, TC, EC, CEAA) for the same purpose as the meeting with the provincial agencies.

Following the initial "kick-off" meeting we would then meet with the key agencies (provincial and federal, conservation authorities, etc.) to develop and/or approve the actual workplans. Additional meetings would be held as the technical studies outlined in the workplans are completed and prior to submission of the REA reports and/or CEAA documentation. In particular on-going consultation with agencies regarding bird, bat and fisheries issues will be undertaken so that key agencies concerns have been identified and addressed prior to final submission of documentation. This may help to shorten the review time required by the agencies.

It is recognized that on-going consultation activities will be undertaken with the municipalities (likely 3) and GENIVAR will need to be part of this process to address the municipal consultation form. Currently there is no mandatory requirement that municipalities complete the consultation form, however when the final REA documentation is submitted it will be easier for the technical review to occur if all forms have been completed and submitted.

A separate part of the consultation process, that is not addressed in this proposal, will be the requirement for consultation with potentially affected aboriginal groups.

The following is a summary of the consultation activities proposed. This does not include additional participation by the stakeholders in general consultation activities (e.g., Public Meetings), which are addressed under the Public Consultation Strategy.

STAKEHOLDER CONSULTATION TASKS
Prepare Consultation Plan
Preparation and initial meeting with provincial ministries
Preparation and initial meeting with federal and other key agencies
Preparation of material for technical meetings with provincial & federal agencies
Meetings with MOE, MNR & REFO to develop workplans (bird & bat)
Meetings with TC, CEAA, DFO to develop workplans (bird and fisheries)
Revise Communications & Consultation Plan
Consultation with Local Municipalities (form to 3 municipalities)
Ongoing Consultation with Local Municipalities
Ongoing meetings with provincial, federal and other key agencies, such as MOE, MNR, MTC, DFO, MTC, CEAA, IJPC
Summarize Stakeholder Consultation Process (including activities, responses, etc.)
Develop Consultation Report and incorporate Stakeholder consultation in the discussions

4.3 PUBLIC RELATIONS STRATEGY

Effective public and agency consultation is essential for the successful completion of environmental and planning processes. Stakeholders such as agencies, interested parties, ratepayer groups and the general public all have an interest in what happens in their community and want to have a voice in shaping their community's future. We understand that Windstream will engage a Public Relations firm for overall communications strategy development.

The federal CEAA requirements do not specify a public consultation component and thus consultation activities undertaken to satisfy the REA process will address the consultation needs for the project for both the federal and provincial EA process.

It is important to ensure that the consultation process meets the needs of both the stakeholders and the proponent. The following summarizes how stakeholders will be kept involved:

1. **Notice of Project** – The purpose of this point of contact is to inform potentially affected and interested parties of the start of this project and to provide an opportunity for commenting on the project. This includes circulating the Notice and/or letters key agencies/ministries (e.g., MOE, DFO, Conservation Authority, sailing clubs). As part of this task, the stakeholder list of community groups and agencies/ministries will be initiated that will be used as a basis for the distribution of future notices related to the two public meetings.

2. **Public Meetings** (mandatory contact) **-** The purpose of Public Meeting #1 is to interact with the public to present the project and to discuss their issues, concerns prior to finalization of the technical REA reports. A Notice will be developed to announce commencement of the proposal and provide specifics on Public Meeting #1. This Notice will be posted in local newspapers and distributed as required by the Regulation. The format of the Notice will follow MOE requirements.

   Public Meeting No. 1 is used to provide general information on the project (including a general understanding of offshore wind), project components, environmental studies to be undertaken and timeframes for these studies, noise and other project specific issues that may arise during the process. It offers the opportunity to seek public input on the wind project and to identify community concerns and possible solutions.

   60 days prior to holding of Public Meeting #2, the REA documents will be released for public review. A Notice will be posted in local newspapers and distributed to the stakeholder list (which government agencies, attendees of Public Meeting #1, etc.) and others, as required by the Regulation.

   Public Meeting #2 would be held following completion of the REA reports. The purpose of this meeting is to present the final project and to discuss the project with the public. Any input received would then be incorporated into the Consultation Report.

3. **Notice of Posting on Environmental Registry** – The MOE is required to forward a notice that the proposal is being posted on the Environmental Registry. However, the MOE has indicated in their draft technical bulletins that they proponent could issue this notice to provide an update on the status of the project. Given the uniqueness of this project, we suggest that the notice be posted by Windstream.

The following is a summary of the tasks required under the Regulation for an REA submission.

PUBLIC CONSULTATION TASKS
Develop Communications & Consultation Plan
Review and Revise Communications & Consultation Plan with Windstream
Posting of draft Project Description Report on the website and hard copies provided in the area municipalities at least 30 days prior to Public Meeting #1
Notice of Public Meeting #1 (Aboriginals & Public) - identifying meeting locations - posting in local area newspapers and on project website
Preparation for Public Meeting #1 - develop presentation boards
Participate in Public Meetings #1 - 1 meeting per municipality
Summarize Comments from Public Meeting #1
Posting of REA documents on the website and hard copies provided in the area municipalities at least 60 days prior to Public Meeting #2
Notice of Public Meeting #2 (Aboriginals & Public) - identifying meeting locations - posting in local area newspapers and on project website
Preparation for Public Meeting #2
Participate in Public Meetings #2 - 1 meeting per municipality
Summarize Comments from Public Meeting #2
Develop Consultation Report (as required for REA submission)

Additional Consultation Activities (Beyond REA Requirements)

1. **Project Website** – Through our extensive EA experiences we have found that a more interactive project website provides an excellent opportunity for information to be disseminated. A project website is required by the Regulation 359 however wind developers tend to include only the REA project related documents on the site. We propose that the website include copies of Public Meeting boards, newsletters, upcoming events, project contact information, etc., in addition to the REA reports.

2. **Newsletters** – We will develop newsletters for distribution at the two Public Meetings. In addition, we propose that two additional newsletters be developed and posted on the project website and forwarded to key stakeholders (including the Community Liaison Committee) as updates on the project status.

3. **Community Liaison Committee**

During the EA process, it is anticipated that there could be interest from the public regarding the project, since it will be the first offshore wind project to be developed in Ontario. In recognition of this public interest, a Community Liaison Committee (CLC)) could be set up to provide an open and cooperative environment for the exchange of ideas throughout the project. The CLC provides a general forum for interested parties to review and discuss the planning related issues openly, so that a mutual understanding of the project can be achieved.

The purpose of the CLC would be to communicate information about, and obtain input on, topics related to the project.

The Project Team, consisting of Windstream, Ortech, the public relations firm, GENIVAR, and the CLC would cooperate for the purposes of exchanging information during the REA process and identify, discuss and work to resolve issues and concerns (where possible) relating to the project. The exchange of information between the Project Team and the CLC could be done through:

- Specific meetings
- Ongoing communication (e.g., through emails, verbal discussions to address simple/quick queries, and/or clarifications)
- Newsletters
- Project Website

GENIVAR has developed and worked with Community Liaison Committees for several high profile projects for various municipalities. The concept of an “advisory” group works well however we have found that by naming them a “liaison” group better defines their function in the project. The proposed Community Liaison Committee could be comprised of local politicians and key stakeholder representatives that would be formed to help in reviewing information and providing input on key concepts.

To be most effective, we will develop Terms of Reference or Memorandum of Understanding for the group, which outlines such items as the purpose of the group, roles and responsibilities, forms of communication, etc. GENIVAR will chair and facilitate the Community Liaison Committee meetings.

We recommend that during the planning process 4 CWG meetings be held. The first meeting should be held early in the process to set-up the group and to get issues/concerns they may identify incorporated into the process. Two of the meetings would be held prior to each public meeting so that the CLC can review the information to be presented (prior to the holding of the public meetings) and provide input on the material. The final meeting would be held prior to posting on the Environmental Registry to update the CLC on the project and to obtain final comments on the REA submission.

4. Communication Plan – a communication plan for the project will be developed with input from Windstream, to ensure stakeholders, residents, businesses, Council, government agencies, etc., are kept informed of the progress of the project. Incorporating this into the planning process allows for identification of additional consultation activities as part of the environmental assessment phase of the project. It can also be updated during the project and used to identify additional consultation activities for future phases of the project.

Integrating stakeholders and the public's issues and concerns into process will be an essential component of the project. If issues and concerns are not acted upon, trust in the process and its results could be eroded. Our team and the public must work together to ensure that the team understands and considers the concerns of the public and the public understands the technical issues and process limitations.

We will ensure the public, key stakeholders and agencies are provided a more direct opportunity for input through correspondence and/or meetings (as necessary) to be held during the EA process. To maximize public and agency access to information the various project notices will be posted in local newspapers, placed on the project's website and forwarded directly to key stakeholders (agencies and public). Newsletters will also be developed and made available on the project website and distributed at the public meetings. Any other key project documents should also be considered for posting on the project website.

4.4 PROJECT MANAGEMENT STRATEGY

Proper project management is key to the successful completion of any project. Due to the size, complexity and number of sub-contractors, GENIVAR will assign a dedicated project manager and a back-up project manager to ensure the success of this project. The primary tasks of this project manager will be to ensure scope, schedule, budget and quality objectives are met. This manager will also facilitate and track communications between the client, stakeholders, regulators and sub-contractors.

GENIVAR proposes the following approach to project management.

1. Project Scope: Upon the awarding to the contract GENIVAR will hold a project kick-off meeting with Windstream and Ortech to confirm the scope activities proposed. During this meeting a mutually acceptable method for requesting and approving scope changes will be established If scope changes arise during the course of the project, a scope change, in the agreed upon format, will be forwarded to Windstream and Ortech for approval prior to the commencement of additional scope items. GENIVAR will also ensure that sub-contractors adhere to the project management policies. The process for tracking Ontario Content will also be established.

2. Project Schedule: GENIVAR will, in conjunction with the various sub-consultants, develop a master project schedule using a Work Breakdown Structure (WBS) which will be sent to Windstream and Ortech for approval and comment. Microsoft Project software will be used for this task. If changes in the schedule are required, GENIVAR will notify Windstream and Ortech of the issue and present a revised timeline with options to offset any delays. Monthly updates will be provided throughout the project and updates for critical tasks will be provided on a weekly basis.

3. Project Communication: Communication is one of the most important components of any project. Upon the commencement of the project GENIVAR will develop an internal communications plan which will detail the communication process and document tracking policy. Once approved by Windstream, it will be distributed to all subcontractors. The plan will contain the following key items: a) Provide monthly budget, scope and schedule updates; b) bi-weekly conference calls between the GENIVAR and Windstream and Ortech project managers to discuss schedules, potential risk and roadblocks and any changes on scope; c) Face to face meetings on a bi-monthly basis to review the above noted tasks, project budgets and review strategies to complete the permitting process.

4.5 SUPPORTING STUDIES

Several supporting studies are required or helpful for the REA and CEAA including Noise, Shadow Flicker, Visual Impact and Telecommunication Interference studies. Details of each are described below.

4.5.1 Noise Studies

Modelling of sound emitted by a wind farm is one of the most critical aspects to the design and permitting of a wind farm. Early and accurate identification of all potential Points of Reception (PORs) is critical information in the design of the turbine layout. In order to present an accurate and timely noise study GENIVAR is proposing the following tasks.

It is our understanding that construction noise is a large concern with offshore wind projects in Europe, especially the impacts on aquatic life. This has not yet been raised as an issue by any provincial or federal agency and as such only post-construction modelling has been included in this proposal. GENIVAR and our Lahmeyer partners are prepared to develop a construction noise assessment should it be necessary.

4.5.1.1 Information Gathering

Immediately after the awarding of the contract GENIVAR will obtain digital information necessary to identify all receptors. This will initially include GIS data such as building layers and lot fabric layers obtained from the Land Information Office and/or the local/regional municipality. We will also acquire high resolution air photos of the project areas. These will be used to create an initial receptor map which will initially include all buildings as receptors and <u>every</u> vacant lot, where a residence could be built, will be assigned a receptor based on the criteria in the *Noise Guidelines for Wind Farms, October 2008*. This will primarily apply to lots and residences along the coast of Wolfe and Amherst Islands.

4.5.1.2 Receptor Groundtruthing

Once the initial information gathering is complete GENIVAR will undertake field work to verify the receptors identified in the information gathering stage. To complete this, a technician will be given a map of the project area with the lot fabric and the buildings layer over-laid onto the air photos. Using GIS software coupled with a GPS transceiver, each lot will be surveyed from the nearest road to determine if:

1. The buildings identified on the lot are receptors;
2. There are buildings on the lot which are not present in the GIS data; or
3. The buildings present in the GIS data are no longer on the lot.

As noted above, this will primarily apply to lots and residences along the coast of Wolfe and Amherst Islands. Upon the completion of the groundtruthing, the data will be plotted on a map. This map will be scrutinized to ensure that there are no discrepancies between the receptor locations and the GIS building locations and to ensure that all vacant lots are identified. The results of these activities will presented to Windstream as a receptor map and shapefiles of all PORs will be forwarded for layout design purposes. The location of all Points of Reception (including vacant lots) will be reviewed with Windstream.

4.5.1.3 Noise Modelling

GENIVAR will undertake a CADNA noise model in accordance with the *Noise Guidelines for Wind Farms, October 2008*. This will be completed upon the receipt of the final turbine layout and upon receipt of the noise spectrum breakdown from the turbine manufacturer. The analysis will take into account any cumulative effects from existing wind farms, wind farms which have received REA approval or have filed an REA application within 6 km of each projects turbines. For the purpose of this proposal we have assumed that 3 iterations of the model will be run to allow for changes in the layout.

The results of the noise modelling will be presented to Windstream as a site plan drawing with noise level contours and in excel format, if requested. The results of the analysis will be incorporated into a report to be submitted as a part of the REA application package and in a format acceptable to the MOE.

4.5.2 Shadow Flicker Study

GENIVAR will complete a Shadow Flicker Study to support the public consultation activities. This study is not specifically required in the REA regulations, however it is an industry best practice and shadow flicker is a common concern raised during public consultation. Upon receipt of the final turbine layout and wind direction data from the met tower(s), GENIVAR will undertake the shadow flicker modelling using the WindFarmer software. This will be presented as a stand alone report to be included in the draft and final REA reports.

4.5.3 Visual Impact Assessment

GENIVAR will complete a visual impact assessment for the proposed project. Photographs will be taken from key vantage points on Wolfe Island, Amherst Island, the City of Kingston and any other vantage point identified as “key” or “scenic” by the permitting team or stakeholder groups. These will be georeferenced and used in the creation of photomontages.

4.5.4 Telecommunications Interference Study

Due to their large size, wind turbines can interfere with radio waves emitted from telecommunication and radar systems. In response to these potential conflicts, the Radio Advisory Board of Canada (RABC) and the Canadian Wind Energy Association (CanWEA) has issued a set of guidelines which describe the methodology for assessing electromagnetic interference caused by wind turbines. In this guideline, areas surrounding communication transmission systems (consultation zones) have been specified based on system type and function. If a potential turbine location is within a consultation zone, the owner should be contacted to assess how the potential interference will impact both parties.

GENIVAR will gather information about radio transmitters and receivers from the Technical and Administrative Frequency Lists (TAFL) database which is administered by Industry Canada, and via requests sent to the Department of National Defence, the Royal Canadian Mounted Police (RCMP), Environment Canada, Coast Guard, the St. Lawrence Seaway Management Corporation, and Natural Resources Canada. From this data Maps will be created which identify all nearby communication tower locations and potential interference between the proposed wind facility and communication towers. These will be broken down into the following categories:

- Point-to-Point Systems (Microwave Hops, STLs, TTLs, NTLs)
- Over-the-Air Reception (Master Antenna TV (MATV), Cable TV (CATV) Head
- Ends, MMDS Systems, VHF TV, UHF TV, DTV)
- Cellular Type Networks
- Satellite Systems (DTH, Satellite Ground Stations)
- Land Mobile Networks
- Seismoacoustic Monitoring Equipment
- Weather Radars
- Marine radars and navigational aids

Any system with a potential conflict will be identified and ranked for the severity (low to extreme).

4.6 DOCUMENT TRACKING

With any large project the number of documents which are produced can be cumbersome. In order to ensure that the proper document is used and that all documents are properly reviewed prior to release, GENIVAR proposes the following document numbering system and categories:

1. Working Documents. These are active documents used by GENIVAR and sub-contractors. The numbering system will be **W - 3 letter consultant code - date saved – Document Name – version #**. e.g. W-GEN-26/11/2010 –Project Description Report-1

2. Draft Documents. These are draft documents submitted by GENIVAR for review by WIndstream. The numbering system will be **D - 3 letter consultant code - date saved – Document Name- version** #. e.g. D-GEN-26/11/2010 – Draft Project Description Report-1
3. Reviewed Documents. These are the draft documents which have been reviewed by Windstream and contain changes or revisions. The numbering system will be **R - 3 letter consultant code - date saved – Document Name- version #.** e.g. R-GEN-26/11/2010 – Draft Project Description Report-1
4. Final Documents. These are final documents which have had all revisions made and can be released to regulatory agencies or the public, as applicable. The numbering system will be **F - 3 letter consultant code - date saved – Document Name.** e.g. F-GEN-26/11/2010 – Final Project Description Report
5. Revised Documents. In some instances, “Final” documents may need to be revised. The numbering system will be **Revised- (W, D, R or F, as applicable) - 3 letter consultant code - date saved – Document Name- version #.** e.g. REVISED-D-GEN-26/11/2010 – Draft Project Description Report-1

This system will ensure that the proper documents are utilized and released.

An electronic log of internal and external documents will be maintained. For internal documents the log will record all draft documents sent for internal review, all comments received, all final and revised documents produced. Electronic copies of these will also be kept. GENIVAR proposes to send hard copies of all Final and Revised documents to Ortech and Windstream.

A separate log will be kept for all external documents. The log will track the source, date received and type document. These will be stored in the following categories:

1. Informational documents;
2. Public comments and inquiries;
3. Agency comments and inquiries;
4. Approval/confirmation letters; and
5. Issued reports and/or responses

The log will be available to Ortech and Windstream to review at any time.

4.7 REPORTING STRATEGY

REA Reporting The REA (including the MNR’s Site Release Policy) and EA process have overlap in the information required for inclusion in the documentation but have different formats for reporting. The REA process requires specific reports that build in the completed studies including: Project Description, Construction, Design & Operations, Decommissioning Plan, Wind Turbine Specification, Consultation and Off-shore Wind Facility reports. For CEAA, the EA report generally includes the following sections: project summary and description, scope of the assessment, environmental characteristics of the project area, assessment of impacts, mitigation requirements and residual effects (including cumulative effects), follow-up measures (e.g., monitoring) and consultation summary.

4.7.1 REA Reporting

The reporting is composed of three phases: Draft Project Description Report; Draft REA Reports; and final REA Reports. GENIVAR’s approach to the reporting is detailed below. The reports will be written to meet the requirements described in the MOE technical bulletins (currently draft).

4.7.1.1 Draft Project Description Report

A draft version of this report is to be made available at the first public meeting and on the proponent's website as well as being sent to the MOE in order to get an official list of aboriginal communities to consult. The project description report will contain the following:

1. A map of the project area;
2. Contact information;
3. Project name and nameplate capacity;
4. A description of the REA and CEAA approvals process;
5. Details of the proposed turbines (if known);
6. An identification of the potential project components (turbines, transformers, collector lines);
7. Land ownership; and
8. A preliminary identification of possible environmental impacts.

4.7.1.2 Draft REA Reports

The draft REA documents will be required to be released to the public a minimum of 60 days prior to the final public meeting. It is also understood that the Construction Plan Report and Design & Operation Report should be included with the Municipal Consultation Form when it is submitted to lower and upper tier municipalities. The core reports which will be included in the reports to be released to the public include:

1. Revised Project Description Report – An updated version of the Project Description Report;
2. Design & Operations Report - Includes site plans; transmission line routing; considerations that went into the design (Archaeological, Natural Heritage features, etc.); environmental effects monitoring plan; and a communications and emergency response plan to address emergencies and public complaints;
3. Construction Report - Details of the construction plan include a proposed timeline, a description of the proposed construction activities (including transmission line construction), any potential environmental effects from construction activities and proposed mitigation measures to address these impacts (if any);
4. Decommissioning Report - Details of the decommissioning procedures, land restoration (if necessary) and procedures for managing excess waste. This will also include any potential environmental effects and proposed mitigation measures to address impacts;
5. Noise Study Report – Methodology and results of the Noise Study report conducted in accordance with the MOE *Noise Guidelines for Wind Farms, October 2008*;
6. Consultation Report - A summary of public consultation activities which includes documentation of public notices and comments received. This report must demonstrate that all concerns were addressed (but not necessarily adopted). It is assumed that the aboriginal and municipal consultation reports will be completed by their respective consultants; and
7. Wind Turbine Specification Report – Details of the technical and noise specifications for the wind turbine proposed to be used in the project.

The reports will be completed and sent to Windstream for review. After comments are received, reports will be published in secured pdf format and hard copies. Hard copies will be released to municipalities (for review and public consultation), aboriginal groups, conservation authorities and the ministries of Environment, Culture and Natural Resources.

4.7.1.3 Final REA Reporting

After the final public meeting GENIVAR will complete the Consultation Report summarizing the consultation activities completed to date, comments received from the public and responses to questions and concerns raised. In addition, GENIVAR will make any edits to the Draft REA Reports due to comments received or changes to the project occurring since the release of the Draft Reports. Copies of the Final REA Reports will be submitted to Windstream for review. Final copies of the REA Reports will be submitted to the MOE, MNR and MTC and to any other approvals agency which may require them for review.

4.7.2 CEAA Reporting

In general, the first step is to contact the Canadian Environmental Assessment Agency and to determine the Responsible Authority and Federal Departments that would be involved in the project. For this project, Department of Fisheries and Oceans (DFO) and Transport Canada would likely be the Responsible Authority(ies).

The first step will be completion of the project description for inclusion on the federal registry and to initiate work with the Responsible Authority. This project description assists in determining what federal departments will need to be specifically involved in the Environmental Screening process. An Environmental Screening Report will be developed to address the CEAA requirements. In general the type of information that will be required is as follows:

Description of Project Activities – A specific description of the activities and their locations and estimates of their scale will need to be developed.

Description of the Environment – The report will need to identify the environmental components of the project area, their interrelationship and provide a discussion of their sensitivity to disturbance.

Environmental Effects – A summary of the effects of the project activities on the components of the environment considered at risk. This will include consideration of the cumulative environmental effects.

Along with the issue of navigable waterways impacts another component of the project that requires further evaluation will be the offshore construction since the construction impacts may result in HADD of fish habitat. As required under the CEAA, a Cumulative Effects Assessment will be undertaken on the three main aspects outlined in the "*Cumulative Effects Assessment Practitioners Guide*".

Are there potential effects of the project from the perspective of general trends of concern affecting valued ecosystem components (VECs)?

Does the project take place in an area where numerous other actions have taken place?

This will expand on the requirements for cumulative effects under the provincial process (REA) in regards to the noise modelling.

Are there overall policies, thresholds or objectives that have been established at a strategic level of decision making that would be relevant?

Proposed Mitigation Measures – A discussion on the mitigation measures, referenced to the environmental effects they are designed to eliminate or reduce, will need to be documented. (e.g., Hydrology and Fisheries; Terrestrial Environment; Flora and Fauna; Social Environment; Cultural Environment; and Existing Utilities and Infrastructure).

Determination of Significance – The environmental screening report will need to conclude whether significant adverse environmental effects are expected.

Screening Conclusion – A conclusion on the screening will note whether the environmental features particularly sensitive to disturbance have generally been avoided. The screening conclusion would state that no significant environmental impacts are expected as a result of this project.

Information provided in the REA reports will be incorporated into the federal Environmental Screening Report to the fullest extent possible. Prior to release of the REA process, the provincial and federal EA documents could be combined together. However, with the reporting format and requirements needed under REA and the MOE's technical bulletins this is more difficult and thus a separate Environmental Screening Report will be developed to meet the CEAA requirements but it will largely be developed from the REA reports.

4.8 REGULATIONS, GUIDELINES AND POLICIES

Title	**Type (regulation, guideline, policy)**	**Regulatory Agency**
Province of Ontario		
Renewable Energy Regulation, O.Reg. 359/09	Regulation	MOE
Noise Guidelines for Wind Farms, October 2008.	Guideline	MOE
Windpower Site Release And Development Review - Crown Land	Policy	MNR
Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulations (Ontario Regulation 148/06)	Regulation	Conservation Authority
Approval and Permitting Requirements Document	Policy	MNR
Endangered Species Act, 2007	Legislation	MNR
Canadian Federal Government		
Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar Systems	Guideline	RABC
Navigable Waters Protection Act	Legislation	Transport Canada
Canadian Environmental Assessment Act	Legislation	Canadian Environmental Assessment Agency
Aeronautics Act	Legislation	Transport Canada
Fisheries Act	Legislation	Department of Fisheries and Oceans
Species at Risk Act	Legislation	Environment Canada (CWS), DFO
Migratory Birds Convention Act	Legislation	Environment Canada (CWS)

4.9 TEAM SUMMARY

GENIVAR has assembled a team of talented and experienced individual to lead the permitting and consultation. The key team members, all with extensive permitting and public consultation experience include:

Pat Becker

Pat has over 20 years experience in environmental planning and public/agency consultation. Areas of expertise include environmental assessments for individual and class EA projects for private and public sectors, public consultation, aboriginal consultation. Specifically with respect to wind projects, she has been involved with EAs / environmental approvals for over 12 wind projects including using the new REA process.

Sunil Kumar, MBA, P.Eng.

Sunil is the Director – Energy, Ontario at GENIVAR with over 28 years experience. He has been involved with over 25 wind projects including roles as Project Manager for project development activities, environmental assessments/approvals, engineering, RFP responses to government, feasibility studies, senior consultation. He has been GENIVAR's Project Manager to date on the tasks for the Wolfe Island Shoals project.

His experience also includes engineering for large international energy projects involving several global contractors from North America, Japan, and Europe. Recently he has been directing the environmental assessment or engineering for large scale wind and solar projects. He is very familiar with the project area, through other projects, and has participated in meetings with some of the local Aboriginal communities.

Terence Rasmussen, MBA, M.A.Sc.

Terry is a Project Manager in the energy group at GENIVAR with over 9 years experience. He is currently the Project Manager for all aspects of the environmental permitting work related four Ontario wind projects and eight solar projects including the submission of Renewable Energy Approvals documents. He has experience with public consultation, large energy EAs, and is experienced in applying and interpreting the REA regulations.

His experience also includes managing the regulatory processes and communications with multiple levels of governments for the purpose of permitting renewable energy projects. He is familiar with the processes and protocols necessary to manage large teams on projects with numerous stakeholders.

5. ECOLOGICAL FIELD WORK (OPTION 2)

The ecological studies will provide a baseline assessment of the natural features of the project area and will contribute valuable information to the Federal EA and Provincial REA processes. The main areas to be looked at include: bird and bat surveys, aquatic (fisheries and benthic communities) and natural areas and wildlife habitat (aquatic and terrestrial). These studies have been designed to meet the regulatory requirements of the Natural Heritage section of O.Reg. 359/09, the REA regulation.

5.1 SCOPE OF WORK – AVIAN AND BATS

5.1.1 Bird Survey

GENIVAR anticipates that the avian and bat component of the ecological work will attract the most attention from the provincial and federal regulatory agencies.

The MNR has historically been interested in species at risk and raptors, while the Canadian Wildlife Service (CWS) has been interested in impacts to migratory birds. The requirements of both agencies will be incorporated into one study which will address migratory, resident and nesting birds.

Federal guidelines concerning bird surveys for offshore wind projects indicate that: “Because of the potential for large year to year variation in activities, pre-construction (baseline) studies should extend over at least two years” (*Wind Turbines and Bird - A Guidance Document for Environmental Assessment*, April 2007). However, since the installation of turbines’ foundation systems should begin during summer 2012 (according to the RFP documents), the project timeline is not compatible with a two-year bird survey. It is our intent to engage both the CWS and MNR early on in the process and negotiate a single year pre-construction survey. If unsuccessful, our alternate approach would be to propose the second season as a condition of approval, so as not to delay the foundation construction. There is a reasonable probability that the agencies will want two years of pre-construction data.

Consequently, the present proposal aims for a one-year bird survey, with sampling efforts and follow-up activities that have been adapted to maximise the amount of collected information. For example, we propose eight months of radar monitoring that should allow us to document quite precisely the behaviour of birds into the project area. If a second year of bird survey is required by government agencies, the sampling effort may be less in the second year of survey.

Furthermore, for all periods and bird species, existing data will be collected from ministries and other organizations (for example data from Bird Studies Canada), and analyzed in regards to the project. Meteorological radar could also be considered in documenting major bird migration corridors in or in the vicinity of the study area and existing bird data from the operating onshore Wolfe Island wind farm.

All of this data will be used to evaluate the potential impact of the turbines and, when combined with post-construction monitoring data, to verify the actual impact and effectiveness of mitigation measures.

5.1.1.1 Migrating Birds

Birds in migration flying through project site may be at risk of colliding with turbines. Spring and fall migration surveys will be performed, at dawn and dusk for songbirds, and mid-day for raptors. Data collection will focus on movement of bird species within or in the vicinity of the study area. Since migration rates vary considerably from one day to the next depending on weather conditions, fairly intensive surveys are required to get a quantitative understanding of migration at a site.

Spring migration will be monitored through three surveys of five consecutive days to document early (between April 1st and April 15th), mid (between April 16th and May 15th), and late (between May 16th and May 31st) migrants.

Survey stations will cover the whole project area: one stationary (on the meteorological tower platform), and the other mobile (either on land or on boat) to cover the area. Long-range radar monitoring will be coupled to short-range visual identification of bird species to document migration corridors and flying heights.

Fall migration will also be monitored through three surveys of five consecutive days to document early (between August 16th and September 15th), mid (between September 16th and October 15th), and late (between October 16th and November 15th) migrants. Surveys will be performed at the same sites and using the same methodology as the one used for spring surveys (e.g. visual observations and radar monitoring).

5.1.1.2 Breeding Birds

Breeding season surveys have been designed to determine which species regularly use the study area for nesting, for foraging during breeding season, or for raising their young. These surveys will also contain measures to identify the type and numbers of bird species using the area.

Surveys will be conducted in the spring between May 15th and July 15th, which corresponds to breeding period for most bird species.

Survey stations will cover the whole project area. Five automatic survey stations (i.e. automatic call & song recorder) will be installed: one on the meteorological tower platform and the other four in selected inland key habitats (particularly near coastal wetlands of Wolfe Island and Amherst Island). These automatic survey stations will document bird species frequenting this area during breeding season. In parallel, these survey stations will be used for visual observations for five days distributed during the breeding season, and long-range radar monitoring will be performed at these selected stations for one day each to document local movement corridors and flying heights.

5.1.1.3 Resident Birds

Specialized survey methods are required for offshore projects. Although there is some concern about direct bird mortality from turbines, European studies show that the major issue is in fact displacement of birds from areas that may be important for feeding or commuting. Consequently, particular attention will be paid to resident birds resting and feeding areas, and to movement corridors between those areas (with special regards to waterfowl and seabirds).

Specific surveys will be conducted in summer between July 15th and August 15th, to fill the gap between spring and fall migrating birds surveys.

Survey stations will cover the whole project area. Three survey stations will be set up: one on the meteorological tower platform and the other two in selected inland key habitats (particularly near coastal wetlands of Wolfe Island). These survey stations will be used for visual observations, and completed with boat visual surveys for twenty days distributed during the survey period.

In addition to this visual survey, 8 months of radar monitoring of resident birds will be performed between April and November. This radar monitoring will use both stationary and mobile survey stations, and will allow documentation of local movement corridors and flying heights.

5.1.1.4 Wintering Birds

Wintering birds (e.g., songbirds, raptors, and waterfowl) are not usually expected to be of major concern in the case of offshore projects. However, both Wolfe Island and Amherst Island have some of the highest recorded densities of overwintering raptors. Consequently, even if the risk of collision with offshore turbines during winter is probably low, it could be important to document significant use of the areas by overwintering birds.

Favourable habitats for the various species will be identified during the first year of spring to fall surveys conducted on the study area. Survey stations will cover the whole project area. During early winter, four automatic survey stations (i.e. automatic call & song recorder) will be set up in order to verify the presence of targeted key species of Strigidae (owls).

In parallel, areas of winter concentration of waterfowl will be documented by visual observation for ten days distributed during the winter.

5.1.2 Bat Survey

Bats are more and more in the scope of federal and provincial governments as wind farms may have some negative impacts on this faunal component. Indeed, studies conducted in many countries have demonstrated that wind turbines can be a cause of mortality in chiropteran populations, either by direct collisions or barotraumas.

Eight species of bats are potentially present in the study area: five resident species, which overwinter locally (i.e. make shorter migrations to hibernacula); and three that are considered to be migratory species because they spend winter in the south.

To ensure accurate consideration of this wildlife component, MNR is currently developing a bat inventory and monitoring protocol specifically for wind farm projects (Bats and Bat Habitats - Guidelines for Wind Power Projects, Draft Guidelines March 2010). According to this document, the significance of bat habitat (e.g. bat migration corridors) cannot currently be assessed at offshore sites in Ontario, because information and knowledge related to bat movement and behaviour in offshore environments is lacking. Consequently, MNR does not formally require any pre-construction field survey of bats for offshore wind projects. If there is the potential for significant wildlife habitat for bats, pre-construction monitoring may be required. MNR recognizes that there is a lack of data on bat behaviour over the Great Lakes. As such, they have proposed mandatory mitigation measures of raising the cut-in speed to 5.5 m/s from sunset to sunrise from July 15th to September 30th.

We do believe that coupled acoustic and radar bat surveys could document bat species composition and landscape use in a way that would allow identifying key habitats (hibernacula, maternity colonies) and migration or movement corridors. In addition, terrestrial habitats that are potential key habitats for bats are present in the study area, and should therefore be surveyed for confirmation. In particular, coastal wetlands with mature forested areas represent excellent habitats both for resting and feeding bats. We do think that pre-construction bat survey data would help refining this potential constraint, in terms of geographic limits and flying heights, and therefore limit post-construction mitigation.

Pre-construction acoustic bat surveys will be performed during a one-year survey. The detectors will operate from dusk until dawn during two key periods: 1. June 1 to June 30th to assess the risk proposed by potential maternity colonies; and from July 15th to September 30th to assess the potential risk during the fall migration period. Data will be downloaded every two weeks. From this period, a total of 30 nights will be selected randomly for data analysis.

Survey stations will cover the whole project area. Four automatic acoustic survey stations will be set up: one on the meteorological tower platform and three in selected inland key habitats (particularly near coastal wetlands of Wolfe Island and Amherst Island). Another bat detector will also be used during bat radar monitoring. Acoustic data will allow to document present bat species in the study area, as well as to compare their relative densities between inland and offshore locations.

In parallel, radar monitoring of bat will be performed for 35 nights during the acoustic survey period, at locations of automatic survey stations and using mobile survey stations, to document local movement or migration corridors, and flying heights.

5.1.3 Post-Construction Bats & Birds

Traditional bats and birds post-construction monitoring techniques cannot be applied for an offshore wind project, since it is based on carcass searching. For bats, MNR guidelines establish that in the absence of post-construction bat mortality monitoring, operational mitigation will be applied at all offshore wind power sites during the fall bat migration season. For birds, federal guidelines recommend a post-construction monitoring using similar methodology to pre-construction monitoring to address bird displacement effects and evaluate collision risk.

It is our opinion that some form of post-construction monitoring work will be required. We do think that both for bats and birds, a follow-up study using similar methodology to pre-construction surveys (including radar monitoring) should allow us to document precisely birds and bats displacements. With this evidence, we will be able to present a strong case to the MNR to reduce or eliminate the raised cut-in speed mitigation restriction currently proposed by the MNR. This post-construction monitoring will use the same survey stations, and will look at each component addressed in pre-construction surveys. We estimate that the sampling effort will be 25 to 50 % of that of the pre-construction survey for each year of follow-up, depending on data collected during pre-construction study and the position of the agencies (MNR & CWS). This is presented as an optional task and has not been included in our opinion of cost.

Spring migration will be monitored to document early (between April 1st and April 15th), mid (between April 16th and May 15th), and late (between May 16th and May 31st) migrants. Both visual observation and radar monitoring will be used.

Fall migration will be monitored to document early (between August 16th and September 15th), mid (between September 16th and October 15th), and late (between October 16th and November 15th) migrants. Both visual observation and radar monitoring will be used.

Breeding birds' surveys will be conducted in the spring between May 15th and July 15th, which corresponds to breeding period for most bird species. Since the objective of the follow-up is to document potential changes in the birds' behaviour and displacements, no automatic call & song recorders will be installed. Both visual observation and radar monitoring will be used.

Resident birds' surveys will be conducted in summer between July 15th and August 15th, to fill the gap between spring and fall migrating birds surveys. Both visual observation and radar monitoring will be used.

Areas of winter concentration of waterfowl will be documented by visual observation for ten days distributed during the winter.

Finally, radar monitoring of bat will be performed from June 1st to June 30th and July 15th to September 15th, to document local movement or migration corridors, and flying heights.

It is important to point out that the appropriate sampling design and duration of the follow-up studies will depend both on the characteristics of the installation and on the information collected through pre-construction studies. Factors to be considered include the final location of the turbines, their distance from shore, the species of birds present, the sensitivity and level of concern for these species, and the size both in surface area and the number turbines for the wind energy installation. Consequently, sampling effort and survey duration presented here should be considered as a preliminary estimate, and modifications could be implemented in accordance to pre-construction observations and agency requests.

Finally, concerning operational mitigation, we are currently developing an Impact Detection System that could be incorporated for turbines. This way, mitigation measures (like cut-in speed) could be implemented only during periods of actual elevated risk of collision, instead of using a precautionary principle on a systematic basis.

5.2 SCOPE OF WORK – FISHERIES AND BENTHICS

The following workplan pertains to fisheries and potential benthics work in order to satisfy legislative requirements for the installation of wind turbines for the Wolfe Island Shoals Offshore Wind Project.

In order to gain approval for in-water works, we must: describe the existing conditions of the site (i.e. fisheries and their habitat); assess the related project impacts; and describe how to mitigate and compensate for the impacts. The level of impact, and compensation required to offset the impacts, will be dependant upon the type of foundation selected to secure a respective turbine in place. In general, the option with the least footprint and interference with water movement will have the lowest level of impact and compensation requirements.

Describing the existing conditions of the study area begins with obtaining all available secondary source information related to the local aquatic ecology. This information will include that gathered for the environmental studies for the Wolfe Island project, including in-water studies related to the submarine cable. This information may be used to reduce the need for further study related to the submarine cable from the area between Wolfe Island and the mainland.

Once all the available literature has been gathered, it will be reviewed, summarized, and analyzed to characterize the local fisheries and how these fish depend on the habitat of the study area. More specifically, we will determine the significance of the habitat in fulfilling life stage requirements of specific fish. The existing conditions report will be used to minimize project impacts through project re-design, and to develop mitigation strategies to minimize impacts to the most sensitive and important fish habitats, as well as fish habitat in general. For example, if there is a type of habitat that has been identified as "limiting" the productive capacity of an important fish species, this habitat must be protected, and our compensation work may focus on creating this type of habitat if possible.

For a project of this magnitude, it is likely that there will be unavoidable data-gaps that will require field inventory. For example, it is likely that the literature will provide us with a good general idea of the habitat and fish community through the study area, but it is very unlikely it will be able to provide us with site-specific habitat conditions at a given turbine. Therefore, the aim of the field survey is to fill in all data-gaps identified in the literature review. Field study components may include multi-panel gillnetting, which is used to sample fishes of various sizes to provide information on relative abundance of various size classes, of various species. Trawling would be used to sample smaller fishes, including the forage fish community, which form the food base of important piscivorous (fish-eating) species. This study component provides information on prey abundance (productivity), as well as recruitment (abundance of young-of-the-year fishes). In addition, egg traps may be used to identify spawning habitat of various species at the proposed tower locations.

It is important to note that the Lake Ontario Management Unit (LOMU) has been sampling eastern Lake Ontario for decades using established protocols. It is essential that our study design follow their protocols to allow for statistical comparison with their long-term data sets. It is also important that the study be designed in collaboration with LOMU in order to facilitate agency buy-in, but also to maximize the efficiency of the study (and minimize unnecessary study components) by taking advantage of their knowledge and experience in the area.

Benthic invertebrate sampling will follow LOMU protocol, assuming they conducted this type of sampling in addition to their extensive fisheries monitoring work.

All of the above information will be used to assess the project to minimize impact to the fisheries, and to develop an intelligent compensation plan that will benefit the residents of eastern Lake Ontario through increased fish production. This information will be presented in a report to support the CEAA requirements, the application for Authorization under the federal Fisheries Act, and all other permits and approvals related to in-water works.

This project is the first of its kind in Canada, the level of study requirements required by the regulatory authorities will likely be high. As such, the scenario presented involve one year of field work to complete a baseline that will cover at least one year of different hydraulic, biologic and meteorological conditions.

Studies conducted for off-shore wind projects in other parts of the world, or other studies that we suspect may be required include: the effects of electromagnetic fields from transmission cables on fish; and the effects of noise/vibration from windmills on fish. Again, it is uncertain if these studies will be required since they have already been conducted elsewhere in the world and the results can be extrapolated to the study area, so therefore they have not been budgeted. A detailed work plan and budget for these secondary studies can be provided should they be required. It would be our intention to conduct these types of studies through the involvement of Queens University to minimize costs and involve the local community, and we will seek opportunities to involve/employ the local community wherever possible during the project.

The fisheries field sampling, as stated earlier, is most likely to follow the long-term sampling protocols of LOMU in order to facilitate comparison to historical data.

The work plan will be:

1. Background information (6 weeks):
    a. Contact with MNR and DFO representatives.

b. Review of the Wolfe Island project ESIA.

c. Literature review.

2. Field inventories (12 weeks over 1 year):

   a. Aquatic habitat, fisheries and spawning surveys:

      i. Stratification of aquatic habitat using Aqua-View camera transects to initially map the aquatic habitat and do substrate characterization.

      ii. Stratified random sampling of habitat using multiple gears (gill nets, trawl, egg trap) for fisheries inventories.

      iii. Summer (July and August) inventories for habitat utilization and Fall inventories on the potential spawning grounds.

      iv. Additional characterization of aquatic habitat and potential spawning ground at the exact location of the wind towers.

   b. Benthos sampling:

      i. Sampling the exact location of the wind towers using Environment Canada protocol.

      ii. Laboratory identification of benthos samples to the gender.

   c. Analysis of data in relation with the stratification and the location of the wind towers.

3. Reports:

   a. Existing conditions report:.

   b. ESIA report:

      i. Impact assessment.

      II. Mitigation/compensation/monitoring

5.3 SCOPE OF WORK – TERRESTRIALS AND ENVIRONMENTAL IMPACTS ASSESSMENT PROVISIONS

The majority of the proposed development and operational activities will take place within open water areas outside the area of influence for terrestrial natural feature areas. The proposed export cable will; however, connect to the mainland grid via overland passage. Further, it is recommended that a background review for nearby coastal terrestrial habitats is conducted to ensure that the proposed development will have no negative effects on identified features.

5.3.1 Pre-consultation and Background Review

Pre-consultation for Renewable Energy projects is required and will include continuing discussion with staff from appropriate regulating agencies and planning staff from the Regional offices completed in conjunction with consultations on bird, bat and fisheries issues. The level of depth required for the preparation of biophysical inventories and feature assessments on-site will be determined through pre-consultation discussions, Ecological Land Classification (ELC) mapping, and upon other supporting studies will be conducted as part of this project, and will include:

- A description of relevant physical, hydrologic, and environmentally significant features, and an assessment of the linkages between them;

- A tree inventory within the defined buffer area around the development site, to include species, location, diameter at breast height (dbh), growth conditions, and general tree health;
- Mapping of the property showing the boundaries of environmentally significant features and the distances to the proposed development site;
- An assessment of Natural Heritage Features as defined in the Provincial Policy Statements (2005), including:
    - Significant Wetlands;
    - Fish Habitat;
    - Areas of Natural and Scientific Interest (ANSI);
    - Endangered or Threatened Species;
    - Significant Wildlife and their Habitats;
    - Significant Valleylands; and
    - Significant Woodlands.

5.3.2 Biological Inventories

5.3.2.1 Vegetation

Mapping of relevant vegetation communities will be compiled, and ELC polygons will be superimposed over the development area and relevant adjacent lands. A comprehensive in-field survey will be completed to include vegetation communities, with emphasis on rare or endangered plant species known to occur within the area. Plant species present on the site will be compiled and included in an Appendix to be attached to the final report. The following resources will be used in addition to accepted in-field protocols:

- Ecological Land Classification (ELC) information;
- Forest Ecosystem Classification (FEC) information;
- Natural Heritage Information Centre (NHIC) database/mapping;
- FRI maps and woodland polygon mapping;
- CA watershed studies;
- Local ESA mapping and reports;
- Relevant studies in the area; and
- Ontario Ministry of Natural Resources (OMNR) reports of rare species.

5.3.2.2 Terrestrial Wildlife / Habitat / Herpetofauna

Field surveys will be completed to inventory the wildlife species using the relevant lands and the surrounding areas. The field program will be developed upon consultation with the client, and relevant regulating agencies, and will be based on any identified species at risk, and natural features such as woodlots, wetlands, valleylands and wildlife habitat in the area. Field surveys will ensure that appropriate species specific timing windows are used, and an appropriate amount of field time is logged. Emphasis for field surveys will be on determining the presence of rare or endangered species identified to be in the area, and significant natural features.

The wildlife evaluation will include assessments of mammals, reptiles, amphibians, and birds, as well as any other incidental observations. Species present on the site will be compiled into an Appendix to be included in the final report. The following resources will be used in addition to accepted in-field protocols:

- Committee on the Status of Endangered Wildlife in Canada (COSEWIC) reports;
- Ontario Rare Breeding Bird data;
- Marsh Monitoring Program Reports (MMP);
- Fish and Wildlife files – OMNR / Conservation Authority;
- OMNR Ecological Land Classification Maps;
- NHIC Database / Mapping;
- Municipal and Regional ESA and ANSI life sciences mapping and reports;
- Conservation Authority watershed studies;
- Species at Risk Public Registry (SARA); and
- OMNR reports of rare species.

5.3.3 Assessment of Impact and Mitigative Measures - Terrestrial

An Assessment of Impacts is required for the planning process and will be based upon the findings of the earlier stages of the study. The assessment of impact stage includes:

- A detailed description of anticipated environmental impacts, direct or indirect, based on the proposed development. Focus being on the natural features and ecological functions that are identified on or adjacent to the development footprint, or deemed significant;
- A determination of the degree or magnitude that threatened or endangered species, significant areas, or habitats that may be impacted by the proposed development will be completed;
- The study will define cumulative, short-term, long-term, permanent and temporary impacts including sediment transport, water run-off volume and quality if applicable; and
- Potential impacts identified in completed studies for the subject areas will be reviewed and included where applicable.

If it is determined that the proposed development has the potential to influence an identified natural heritage feature, it is necessary to develop measures to mitigate the threat. The proposed site plan will be reviewed, and measures to mitigate impacts during construction and completed development phases will be provided including:

- Descriptions of measures that may be utilized to avoid or to minimize all identified impacts on predefined natural features, functions, or surface waters will be documented;
- Where negative impacts cannot be avoided, mitigative measures will be detailed that should be used to reduce the impacts on natural features;
- A direct assessment of the use of set-backs will be conducted to mitigate any potential impacts in natural features, if relevant; and
- Where required, monitoring programs will be recommended.

5.4 REGUALTIONS, GUIDELINES AND POLICIES

Title	**Type (regulation, guideline, policy)**	**Regulatory Agency**
Province of Ontario		
Renewable Energy Regulation, O.Reg. 359/09	Regulation	MOE
Bats and Bat Habitats - Guidelines for Wind Power Projects, Draft Guidelines, March 2010	Guideline	MNR

Title	Type (regulation, guideline, policy)	Regulatory Agency
Birds and Bird Habitats - Guidelines for Wind Power Projects, Draft Guidelines, October 2010	Guideline	MNR
Significant Wildlife Habitat Guide	Best Practices Guide	MNR
Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulations (Ontario Regulation 148/06)	Regulation	Conservation Authority
Approval and Permitting Requirements Document	Policy	MNR
Endangered Species Act, 2007	Legislation	MNR
Provincial Policy Statement 2005	Policy	MNR
Canadian Federal Government		
Wind Turbines and Bird - A Guidance Document for Environmental Assessment*, April 2007*	Guidance Document	Canadian Wildlife Service
Canadian Environmental Assessment Act	Legislation	Canadian Environmental Assessment Agency
Fisheries Act	Legislation	Department of Fisheries and Oceans
Species at Risk Act	Legislation	Canadian Wildlife Sevices, DFO
Migratory Birds Convention Act	Legislation	Environment Canada (CWS)

5.5 TEAM SUMMARY

GENIVAR has assembled an extremely experienced team to lead and support the Ecological Field Work. They have extensive experience with radar and acoustic monitoring of birds and bats, which is an essential part of our field program.

GENIVAR recognizes that some of our expertise resides outside of Ontario, however we feel that the level of expertise far exceeds that which can be found in Ontario. In order to maximize our Ontario content GENIVAR is committed to utilizing Ontario staff as well as local students and experts for the bulk of the field work. As noted in or “Local Content” section we plan to utilize Queens University experts and students to assist in our work.

GENIVAR draws its expertise primarily from a highly qualified team which includes biologists and botanists with graduate degrees in their fields, wildlife technicians and specialists in electronics and computer and digital systems. This team has been responsible for most of our projects, developing unique expertise in many aspects of wildlife and plant resource evaluation and management.

The team is supported by a highly structured network of outside resources, including specialized technicians, university researchers, and other professionals. This network provides the benefit of professional skills in closely and more distantly related fields, skills that are vital to the combined activities of environmental consultants and developers of related technologies. Over the years, our multidisciplinary team has completed hundreds of environmental assignments: applications for permits and authorization certificates, expert testimony in court, literature reviews, ecological diagnoses of land and water environments, wildlife and plant inventories, searches for species at risk, etc. These activities have been carried out in all kinds of contexts: on private land, in national parks, at film shooting sites, in remote areas and at National Defence military bases.

During last 15 years, our team has been recognized by the MRNF as well as by other professionals working in this field of activity, as a leading expert in the acoustic analysis and identification of chiropteran calls, detection of migratory paths and evaluation of winter habitats. Since 1994, our team has identified hundreds of thousands of bat calls, among which those from the “Quebec network of acoustic bat inventories”. In recent technological modifications of the identification process, we have succeeded in automating part of the procedure, allowing us to process over 20 000 bat calls in a week. Our large bank of reference calls allows us to increase the reliability of atypical bat call identification. Our company’s recognized expertise and sustained R&D efforts have allowed the development of a number of cutting-edge tools for chiropteran inventories, such as a mobile, wide-range, high-resolution radar for detection of bat migration corridors. Finally, our knowledge of the biology of the different bat species allows us to identify, on a given site, key habitats and flying corridors.

5.5.1 Key Team Members

RICHARD BRUNET, Ph.D, biologist

Richard Brunet, senior biologist, has a PhD degree in ornithology and faunal toxicology from the University of Sherbrooke. However, he has developed, through more than 20 years of experience, a solid expertise in many other fields including fish and bat populations monitoring. Expert in identifying its client’s needs, he is behind the development of specialized methodologies and technological tools serving the joint management of human and natural environments. Issued from a longstanding collaboration, his close contacts within departments and universities are a major asset for the management of sensitive projects. These last 20 years, he led hundreds of projects in environment, for public and private clients, throughout Quebec, the Maritimes, Ontario and Alberta.

REMI DUHAMEL,

Rémi Duhamel, M.Sc., is a senior biologist and small mammal specialist with GENIVAR. Mr. Duhamel has devoted his post-graduate studies to the study of small mammals. In 1999, he was in charge of training professionals from Quebec ministry of natural resources and wildlife (MRNF) regarding the biology and survey techniques of small mammals. In 2006, he was retained by the MRNF to write a report on the situation of Rock vole (*Microtus chrotorrhinus*), a species of concern, in Quebec. In the past 20 years, Rémi Duhamel has conducted numerous wildlife surveys (small mammals, big game, herpetofauna, bats, etc.). Among those surveys, about a hundred focused specifically on small mammals in France, Quebec and other Canadian provinces (Maritimes and Alberta). Within GENIVAR, Mr. Duhamel is also in charge of projects in other fields, including wildlife habitat assessment and management as well as environmental impact studies.

PROPOSAL,

Julie Mc Duff, senior M.Sc. biologist, is a Project director with GENIVAR. Ms. Mc Duff is one of the very few recognized bat experts in Quebec with respect to the evaluation and management of their wintering habitats, the establishment of inventory techniques and the identification of species based on sonograms. For more than 15 years working in environment, Ms. Mc Duff has also developed a strong expertise in plant ecology, from vegetation surveys to habitat delineation and habitat quality assessments. She has also built a reliable knowledge of ArcGIS and its applications to environmental projects. Her great organisational and communication skills help her to efficiently lead multi-disciplinary teams.

ANN ROCCHI, M.Sc.

Ann Rocchi, M.Sc., has over 17 years of experience in fish and wildlife studies in both Canada and abroad. Ms. Rocchi’s experience includes launching detailed bio-inventories and environmental impact assessments as both project manager and as part of a multi-disciplinary team. Collective work in lake and river systems includes: fish inventories, habitat assessment, fish habitat compensation design, implementation and monitoring, comparative community studies, age and diet analysis, and zooplankton, benthos and water chemistry collection. She has designed sampling programs, supervised installation works and monitored post-construction success of numerous fish habitat compensation projects throughout Ontario, Quebec and British Columbia. She has also worked closely with First Nations and remote communities in northern Canada to co-operatively develop fisheries projects, including consultation and the collection and interpretation of baseline data.

In addition, Ms. Rocchi is a Fisheries Assessment Specialist under the MTO/DFO/MNR Fisheries Protocol. She is thereby qualified to identify the sensitivity of fish and fish habitat to the potential impacts of proposed construction projects, recommend mitigation and compensation methods and provide all aspects of reporting and auditing with minimum guidance from the federal Department of Fisheries and Oceans

DAN J. REEVES, B.Sc., M.Sc.

Mr. Reeves, B.Sc., M.Sc. is a biologist with GENIVAR who has a diverse background in environmental sciences, ecology, and biology gained through experience in academia, and work experience in both the private and public sectors. He has conducted multi-scale vegetation assessments and worked on a variety of long-term abundance and diversity indices. Dan has extensive experience collecting, analyzing, and reporting publication quality scientific data through experiences at several institutions. Work history paired with educational background has given him a well rounded knowledge of scientific methods, an understanding of the scientific process from concept to publication, and solid scientific communication skills.

Dan has worked on and completed Natural Heritage Assessments for numerous renewable energy projects across Ontario. He is familiar with MNR protocols, guidelines and expectations and has successfully completed Environmental Impact Studies for terrestrial and aquatic projects.

Resumes for the key resources proposed for this project are annexed to the present proposal.

6. TECHNICAL FIELD WORK (OPTION 3)

6.1 SCOPE OF WORK – COASTAL ENGINEERING (HYDROLOGY, SEDIMENT TRANSFER AND WAVE)

This section presents our understanding of the technical field work that must be done in order to have a baseline study of the physical environment and also to get all of the relevant environmental data required for the design of the project and to complete the Off-shore Wind Facility Report noted in Table 1 of the REA regulation. The details of this report is very generic and includes a description of:

- The nature of the existing environment in which the renewable energy project will be engaged.
- Any negative environmental effects that may result from engaging in the renewable energy project.
- Mitigation measures in respect of any negative environmental effects identified in paragraph 2 and the negative environmental effects that are expected to result if the measures are implemented.

It is our plan to engage the MOE to establish clear expectations as to the requirements of this report. Also, prior to implementing the technical field work, a meeting with governmental agencies representatives (Federal and Provincial) and St. Lawrence Seaway representative shall be done, in order to include their issues and to obtain approval of our scope of work. **GENIVAR will leverage the experience of our partner, Lahmeyer, which has real experience developing offshore wind projects to provide peer-review of the work plans and final reports**.

6.1.1 Hydrology and Hydraulics

This project is located in a region which is under the scrutiny of the International Joint Commission. The International Joint Commission (www.ijc.org) “prevents and resolves disputes between the United States of America and Canada under the *1909 Boundary Waters Treaty* and pursues the common good of both countries as an independent and objective advisor to the two governments.”

In particular, the Commission rules upon applications for approval of projects affecting boundary or transboundary waters and may regulate the operation of these projects; it assists the two countries in the protection of the transboundary environment, including the implementation of the *Great Lakes Water Quality Agreement* and the improvement of transboundary air quality; and it alerts the governments to emerging issues along the boundary that may give rise to bilateral disputes."

Part of its mandate is to review water levels and flows regulation for the Lake Ontario – St. Lawrence River system. Water level fluctuations are maintained within predefined limits, by following a set of rules accepted by both the US and Canada. Currently, plan 1958-D is applied, which gives discretionary authority to the board in case of exceptional situations. Since water levels could exceed the predetermined limits, a review of monthly mean water levels and flows time series for the Great Lakes will be performed. Rules from the plan will be looked at to see if they could have an impact on the project.

Historical mean, minimum and maximum water level shall be evaluated. Climate change impact will be addressed, based on this review and on the analysis of literature on this subject.

In order to complete the general data available from a desk study and obtain a full baseline study, we suggest monitoring hourly water level, current velocities and waves through the installation of two ADCP units (Acoustic Doppler Current Profiler) at two different locations, for a period of three month, from late spring to the end of the summer of 2011. This will help in assessing the short term variation on an hourly or daily basis, in contrast with monthly mean data. Data will also help in calibrating numerical models of wave hindcast. Relations between changing atmospheric conditions and current circulation will also be looked at.

To better understand the current patterns in this region and to help in the calibration of a 3D numerical model, it is also proposed to measure velocity profiles after ice break-up in 2011 at 100 strategically positioned points. The area to be covered would be roughly of 20 X 20 km^2. Environnement Illimité Inc., a company specializing in environmental and technical field survey (aquatic), will be responsible for the mooring of instruments and hydrodynamic measurements. The firm has experience with many hydrometric and bathymetric surveys and installs numerous moorings for hydroelectric utilities including Hydro-Québec and Manitoba Hydro and governmental agencies (www.envill.com)

This information will allow us to describe the hydrology of the Ontario Lake and, with the help of the results from numerical modeling, describe the hydrodynamics of eastern Lake Ontario and to validate results of modelling. Normal, mean and extreme values (2, 25, 50 and 100 years return period) will be calculated.

6.1.2 Wave

Winds and waves are major physical components that will interact with the wind turbines and maritime structures. Forces acting on these structures must be assessed for proper design. Since wind turbines are separated from another, their presence shall not have any significant impact on the wave climate of the lake. No significant impacts from the wind farm are anticipated on wave direction, however, other infrastructures like a wharf could have significant impacts on the shoreline in terms of modification to erosion/deposition patterns and on sediment transport. A wave propagation study shall be performed in this area.

Wave measurements in the vicinity of the wind farm sector will serve for the calibration of a wind-wave generation model. Using long term wind measurements from nearby stations, we will obtain a long time series for both wind and waves climates. Wind and Wave Frequency Roses, normal, mean and extreme (2, 25, 50 and 100 years return period) values will be evaluated along with wind measurements for the project.

Numerical modelling of the wave propagation (shoaling, refraction and diffraction) along the shoreline shall also be performed to study the impacts associated with building a new wharf. SMS Coastal Package (STWAVE, CGWAVE, BOUSS-2D) will be used for the wave propagation modelling. If wave climate has the potential to affect the wharf activities, a wave agitation study around the wharf could be done. Implementation of these models requires sufficient bathymetric data that could be gathered from the civil field studies already planned.

6.1.3 Water Quality and Sediment Transfer

Technical field work will be undertaken by Dr. Boegman, of Queens University and his engineering research staff, to determine the potential impacts of the proposed turbines on the hydrodynamic conditions and water quality at the wind farm site. This work will be based on analysis of high-resolution three-dimensional computational flow modelling using the coupled hydrodynamic biogeochemical model ELCOM-CAEDYM. The model will be applied to simulate the flow in the Kingston basin region of eastern Lake Ontario on a computational grid with horizontal spacing ranging from ~ 10 m (at the turbine site) to ~ 500 m (near the edges of the domain). The model will be forced with, and validated against, observed field data collected south west of Simcoe Island during 2006. This data includes surface meteorology and current and temperature profiles. The open boundary flow to the main body of Lake Ontario will be computed from observed water levels and temperature profiles and the St. Lawrence River outflow will be specified using observed flow data.

ELCOM-CAEDYM has been successfully applied to eastern Lake Ontario and the upper St. Lawrence River, in a previous study, and was shown to reproduce water temperatures to within 2°C, current directions and current speeds to within 5 to 10 cm s-1. Time series analysis reveals that the model captures the fundamental physical processes driving the circulation in this region (i.e. hydraulic flow, wind drift, surface seiches and internal Kelvin and Poincaré waves).

Turbine foundations will be introduced (at ~10 m by ~10 m scale) and the validated model will be applied to determine the impacts on hydrodynamics (water currents and circulation) as well as water quality (sediments and temperature). Sediments are modelled in ELCOM-CAEDYM to be re-suspended as a function of mean current speed and surface-wave orbital velocities. Sediment transport scenarios will include pre-construction, post-construction and plume transport from drilling activities during construction. The influence of typical weather conditions, at the planned time of construction, as well as storm events and high/low water levels will be assessed.

Sediment transfer along the shoreline is mainly related to wave action, which could be affected by the construction of a new wharf. In order to evaluate modifications to the sediment transport and to erosion/deposition patterns, wave-induced current and shear stress will be calculated through the wave propagation modeling. In order to complete the data, sediment sampling will be performed along the shoreline where the wharf is planned. Sediment transport pattern and modification to it will be addresses and mitigation measures will be proposed if required.

6.1.4 Icing

Ice engineering expertise will be led by Jean-Philippe Saucet, from Groupe-conseil Lasalle. Available data of ice conditions (freezing, break-up, pill-up, thickness, etc.) in Ontario Lake, from Environment Canada and the Coast Guard, will be summarized in order to define design criteria for wind turbine foundation structures, such as ice load. Blade icing will be analyzed with Lahmeyer, a German Engineering Firm which has offshore wind farm engineering experience. During desk study, if more data is required for engineering design purpose, additional monitoring could be performed. If so, GENIVAR and its partners will define a specific field work program.

6.1.5 Coastal Engineering

In order to provide technical support for the design of the coastal structures (wharf, submarine cables, wind turbine foundations), all the environmental forces must be evaluated. The static and dynamic forces exerted by water level and waves, by wind and by ice on the structure must be evaluated. Potential failure mechanism must be addresses, such as scour, and mitigation must be proposed to avoid failure of the structure and impacts on neighbour infrastructure or shoreline. This study does not include any design work, which we understand will be undertaken during the civil design phase.

Appropriate solutions to avoid shoreline modifications will be proposed here, if required, such as revetment protection design, wave attenuation and other mitigation work, etc. Preliminary design and cost estimation of the mitigation structures will be done.

6.2 REGUALTIONS, GUIDELINES AND POLICIES

Title	Type (regulation, guideline, policy)	Regulatory Agency
Province of Ontario		
Renewable Energy Regulation, O.Reg. 359/09	Regulation	MOE
Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulations (Ontario Regulation 148/06)	Regulation	Conservation Authority
Approval and Permitting Requirements Document	Policy	MNR
Canadian Federal Government		
Canadian Environmental Assessment Act	Legislation	Canadian Environmental Assessment Agency
Navigable Waters Protection Act	Legislation	Transport Canada
Fisheries Act	Legislation	Department of Fisheries and Oceans
International or Other		
1909 Boundary Waters Treaty	Treaty	
Great Lakes Water Quality Agreement	Treaty	

6.3 TEAM SUMMARY

GENIVAR has assembled an extremely experienced team to lead and support the Technical Field Work including several industry leading experts in the fields of hydrology, icing, and water quality and sedimentation.

GENIVAR recognizes that some of our expertise resides outside of Ontario; however, we feel that the level of expertise required for this project exceeds that which can be found in Ontario. In order to maximize our Ontario content GENIVAR is committed to utilizing Ontario staff as well as local students and experts for the bulk of the field work. As noted in or “Local Content” section we plan to utilize Queens University experts including Dr. Boegman and students to assist in our field programs.

Senior Coastal Engineer: Pierre Dupuis

M. Dupuis is a civil engineer who is specialized in hydraulics and hydrology, with 30 years of experience in the fields of numerical modeling, data acquisition campaigns and data analysis. When working at “La Société d’Énergie de la Baie James (SEBJ)”, he was involved in acquisition and treatment of data in the rugged climate of Northern Québec. He was in charge of wind, waves measurements and analyses in order to assess damages that occurred to dams and riprap dikes under wave attack. He created software to quickly analyze and visualize the data gathered and predict the wave climate on large reservoirs.

He specializes in tidal data and wave climate analyses for the design of riprap works at shorelines or weirs. Author of several important papers in different fields of hydraulics, he has attended many conferences in the United States, Canada and Europe. He was co-founder of Aquapraxis Inc, a consulting firm that specializes in water resources analyses and is now a division of GENIVAR.

PEO-DESIGNATED HYDRAULIC SPECIALIST : Alan Fok

Dr Fok, P. Eng., earned his Master degree in river and coastal engineering at Queens University (under Dr. Yalin) and founded a specialized firm after his Ph.D. – now GENIVAR’s Environmental Hydraulics team in Markham, Ontario. He has contributed over 30 papers and developed innovative (now proven) coastal engineering designs, notably two self-scouring outfalls on Lake Ontario, based on original work at Queens. Alan has been involved as expert witness in two major flooding and erosion legal cases, once for the plaintiff and the other for the defendant. He brings a lifetime of practical consulting experience backed by a strong relationship with Queens and the National Water Resources Institute (NWRI) – until recently headed by Dr. Krishnappan who was a fellow graduate student under professor Yalin.

HYDRAULIC SPECIALIST : Jean-Luc Daviau

Mr Daviau has over 20 years of experience and earned his Master degree in Civil Engineering based on geo-statistical and GIS work. He leads GENIVAR's Centre of Excellence in Hydraulics from the Markham, Ontario office, with many, in-depth collaborations with our Quebec office. An example is the 95 m of shoreline protection works and self-scouring outfall to Lake Ontario, recently constructed in Hamilton under his management.

Water Quality and Sediment Transport Specialist: Dr. Leon Boegman (Queen's University)

Dr. Leon Boegman is an Assistant Professor of Civil Engineering at Queens' University. He is an international expert on lake hydrodynamics and water quality and has consulted on numerous hydraulic engineering projects to protect source water. He has authored over 70 engineering publications, including invited review articles on currents in lakes. Over the past decade, his pioneering application of computational engineering models to the Great Lakes has been recognized through the receipt of an Early Researcher Award from the Ontario Ministry of Research and Innovation and a Leaders Opportunity Fund Award from the Canada Foundation for Innovation.

ICE ENGINEERING EXPERT: Jean-Phillipe Saucet (Groupe-conseil Lasalle, inc.)

Mr. Jean-Philippe Saucet joined the Groupe-conseil Lasalle in 1978, and has carried out a number of field observation programs on the ice regimes of the northern rivers in Quebec. He is also responsible for developing the last numerical models dealing with both heat balance and ice cover evolution. Mr. Saucet is regularly invited as a member of Experts Committee or panel by utilities such as SEBJ, Hydro-Quebec, Manitoba Hydro, Newfoundland Hydro. He would be in charge of assessing the hydraulic and ice conditions in the vicinity of the proposed facility, and evaluating the design ice loads on the proposed structures.

Coastal Engineer: Steve Renaud

Steve Renaud has more than 10 years of experience in hydraulic modeling and design of coastal and river works. He has contributed to many complex river and coastal engineering projects, including bridges, wharfs and shoreline protections design, dispersion modeling and environmental impact assessment. Recent projects include:

- Shoreline Alternatives Protection Studies for Municipalities along the Saint-Lawrence River and Estuary;
- Currently working on the Physical Environment Impacts Assessment Study for a wharf at Port-Cartier, Quebec, for Arcelor Mittal Mines Canada.

Technical Survey Specialist: Stéphane Lorain ((Environnement Illimité inc.)

Stéphane Lorrain, M.Sc. is a senior oceanographer. His experience encompasses 20 years of work in hydrosedimentological studies, geochemistry and water quality studies as well as technical aquatic surveying (physical oceanography, hydrography, hydrology, glaciology). He joined Environnement Illimité inc. in 1996 and is now a senior associate and project director overseeing projects in oceanography, hydrology, contamination and greenhouse gas emission studies and hydrography, mainly in the context of environmental impact studies. He has participated in recent studies linked to hydroelectric development, dredging projects, coastal and estuary erosion studies and operational oceanography for port design studies in the Gulf of St. Lawrence, James Bay, Ungava Bay, Hudson Bay and Africa.

7. CULTURAL HERITAGE & ARCHAEOLOGY STUDIES (OPTION 4)

GENIVAR's experience permitting onshore wind projects under the REA process has shown that archaeological study and more importantly, the review of archaeological studies can be a key timeline. AS such, GENIVAR proposes the following key activities to minimize the time taken for these studies and reviews:

- Early start to the Stage 1 studies
- Early and frequent meetings with the archaeological review officers to establish scope and to discuss review periods;
- Requests to the review archaeologists for expedited reviews; and
- An early meeting with Parks Canada to confirm that federal studies are not needed.

7.1 SCOPE OF WORK – BACKGROUND (STAGE 1)

The Stage 1 archaeological assessment will follow the *Standards and Guidelines for Consultant Archaeologists* (2010) produced by the Ministry of Tourism & Culture of the Province of Ontario. For the terrestrial portion it includes examination of historical maps and documents, land registry records, aerial photographs and identifying known areas of archaeological and historic significance. For the marine aspect of the project it will consist of accumulating available data from three source types: documentary (wreck lists, harbour plans, shipping information, sessional Papers, newspaper accounts, review of existing reports and research in consultation with the Ministry of Culture and other relevant agencies/institutions; dredging events; Great Lakes Pilot, etc.); cartographic (historic and current charts; navigational charts); and illustrative material (paintings, drawings and photographs). Background research is essential when conducting archaeological studies. Thorough background research will provide a more informed assessment of potential impacts and assist in identifying alternatives early in the process. The data collected provides a sense of place, a history, and the probability of cultural resources being located within the project area.

A site visit will also be conducted to review the current conditions of the potential terrestrial routes. Two reports will be produced detailing the stage 1 assessment results and recommendations. One will be produced for the terrestrial and one for marine. This is due to the separate licences for the terrestrial and marine work.

The Stage 1 work will be carried out by licensed archaeologists (both marine and terrestrial), historian and marine historian, and archaeological technician.

- Work will be conducted under the direction of a consultant archaeologist holding a professional licence issued by the Ministry of Tourism & Culture of Ontario (O. Reg. 8/06 Ontario Heritage Act)
- A report must be produced detailing the results of the work and must comply with Ministry standards
- 3 copies of the report must be sent to the Ministry by the archaeological consultant
- once a report is submitted to the Ministry a response may not be received for up to 60 working days - currently wait time is approximately 6 months, but expedited reviews are available for renewable energy projects and high priority projects such as those with funding or emergency requirements - an expedited review will be requested with report submission
- no ground disturbance can occur until a letter of concurrence is received from the Ministry
- in the event that human remains are encountered all work has to cease and the Registrar of Cemeteries, Ministry of Tourism & Culture, Medical Officer of Health and the local police must be contacted
- concurrence letters can only be issued by the Ministry of Tourism & Culture, not by the consulting archaeologist

It is anticipated that the licensed archaeologist for both terrestrial and marine will be required to attend meetings and open houses to discuss or present findings of the stage 1.

7.2 SCOPE OF WORK – MARINE ARCHAEOLOGY

GEOTECHNICAL/ARCHAEOLOGICAL INVESTIGATION

It is understood that the area of the proposed establishment of turbines and underwater cables between turbines will be the primary area of investigation, and that the proposed 27 km length of submarine cable, will also form part of the assessment area.

It is understood that civil/structural field studies are proposed which will include sub bottom profile, side scan sonar and bathymetric survey, and geotechnical drilling. Discussions with Dr. Simon Spooner have suggested that these will have to be completed again for archaeological purposes. Regardless, access to these reports and their results will be incorporated into the archaeological assessment.

The archaeologist will be present on site during all aspects of the underwater assessment.

All work will be conducted in accordance with the Ontario Heritage Act and the Ontario Ministry of Labour Occupational Health and Safety Act and Regulation for Diving Operations Reg. 629/94.

Throughout the process, the archaeologist will photograph and document activities and finds. In the event that cultural remains or cultural features are exposed and/or located, location will be mapped and further documented. No excavation will occur during the Stage 2 assessment.

To ensure a thorough underwater survey this proposal shall include the use of a Side Scan Sonar, Multi-Beam Sonar, Sub-bottom profiling, magnetometer and a Remotely operated Vehicle (ROV). Shark Marine Technologies Inc.'s large base of survey equipment allows us the ability to select the best suited equipment for each portion of the survey process. Utilizing one or more of Shark Marine's survey vessels equipped with accurate positioning systems and accurate motion compensation systems, recorded results ensure accuracies beyond IHO (International Hydrographic Organization) and NOS (National Ocean Service) typical standards. Shark Marine's survey technicians possess the experience and skill to execute this type of survey. Our detailed calibration procedures ensure and verify all survey data accuracy

The large expanse of the survey area and varying water depths requires a methodology that will allow for the primary identification of cultural materials dependent on water depth; and then when cultural features are identified, a more intensive archaeological/geotechnical assessment of those "targets". Therefore, the following procedures are proposed:

We propose to run a multiple sensor survey using Side Scan Sonar, Multibeam Sonar and Magnetometer as the primary survey sensors. All three of these systems can be operated from the vessel at the same time, providing the best data for time arrangement.

A Side Scan Sonar Survey consists of pulling a tow fish through the water in a series of straight lines, called survey routes. These routes are pre-planned to cover the bottom with enough overlap as to ensure complete coverage (generally 120% coverage). This procedure is also commonly referred to as mowing the lawn. A fan-shaped sonar beam, projected from each side of the tow fish scans the area, and returns information of time and strength of return. This data is used to paint an image on the computer that represents a visual image as if viewed from above, (aerial view). These visual images provide the viewer with enough data to draw conclusions about the environment being scanned. The operator should be able to recognize sizes, shapes and surface reflecting characteristics. The primary purpose of Side Scan Sonar is to locate objects, or targets, and to determine characteristics of these targets and the surrounding bottom. We propose a scan width (swath) of 60 metres per side. This would provide a range resolution of 6 centimetre per pixel. We believe that this would provide the required detail to evaluate the nature of moderately small targets. A larger swath would reduce survey time, but would jeopardize smaller target identification, whereas a smaller swath would increase the survey time drastically. This strategy would be in keeping with recent discussions with the Ministry of Tourism and Culture.

The Multibeam Sonar provides a series of depth points across the swath area which can be used to determine contours and heights of targets. This data is also used to provide a bathymetric chart of the area. Due to the large depth fluctuations in the survey area both the ``Delta T`` and the ``Interferometric`` sonar listed under equipment would be used to ensure the best possible data for the depth ranges.

The Magnetometer measures the earth's magnetic field and any anomalies created by ferrous objects lying on or below the seafloor. Its main use in archaeological surveys is to aid in detecting man-made objects of ferrous content. The magnetometer is towed behind the vessel much like the Side Scan Sonar to keep it distant from the effects of any ferrous materials in the survey vessel.

The Combination of Side Scan Sonar, Multibeam Sonar, and Magnetometer will provide data of any targets on bottom and buried ferrous targets along with depths and target heights. Additional lines can be run over possible target areas to provide more precise data. This will be determined at the time depending on the nature of the target area.

The sub-bottom profiling sonar is mounted to the survey vessel and used to determine the physical properties of the seafloor as well as to identify location of buried targets. It uses a single channel sound source to send pulses into the sub-surface sediments below the seafloor. These sound pulses bounce off different objects according to their hardness to provide an image of the strata below the seafloor. The area covered by the sub-bottom is much narrower than the multi-beam making 100% coverage unrealistic. Target areas may be revisited for a more detailed inspection.

Calibration and motion reference is an important aspect in maintaining data accuracy. Calibrations on the equipment for speed of sound in water will be performed each day. Water level adjustments will be made on a continual basis for variations in the Lake water level referenced to International Great Lakes Chart Datum (IGLCD). Latency and Patch tests are also performed to ensure GPS and sonar data are precisely matched. Precise Heading Pitch Roll and Heave sensors mounted to the surface vessel continually adjust data as the vessel attitude changes due to wave conditions.. These calibrations will ensure accuracies beyond IHO and NOS typical standards.

A ROV (Remotely Operated Vehicle) will be employed to investigate potential target locations. The ROV is equipped with its own sonar to allow for fast target relocation, and measurements of the targets. Laser scaling will also provide detailed measurements. High resolution cameras and lighting will provide video of the targets.

As the number of potential targets located is an unknown until completion of the archaeological survey as detailed above, the time needed to "truth" objects is also an unknown.

Various computer programs will be incorporated within the survey operations. The major packages include the SeaSAR software which will be used for route generation, tracking, side scan and recording of targets, while RD-39, CAD and Hypack will be used for the data collection, processing and report generation.

The results of the Stage 2 archaeological resource assessment may lead to recommendations of Stage 3 (mapping of the archaeological site, additional historic research) and Stage 4 (mitigation, which can include avoidance).

If cultural materials are located during the assessment, the first recommendation will always be avoidance. Underwater archaeological cultural resources are inherently more costly to preserve, because once out of the water, they need to be conserved (dealing with water saturated materials requires special conservation procedures). Stage 3 and 4 archaeological assessments are not addressed herein – as avoidance of cultural materials will be the least expensive option for the client.

A report of the archaeological resource assessment will be submitted in draft form to the client, and upon approval, to the Ministry of Tourism and Culture. In cases of the underwater assessment, there is a requirement to also provide copies of the raw technical data for the project (Dr. Simon Spooner, MTC). In addition, copies of the video will also be supplied to the Ministry. The cover letter will request an expedited review of the REA project, archaeological report. A FIT number must accompany all correspondence.

It should be noted that the Ministry of Tourism and Culture will require a project licence for conducting the underwater archaeological assessment. At present, there are no Standards and Guidelines for conducting underwater archaeology in the province of Ontario, and SJAHCE has developed its strategy by reviewing Best Practices of other jurisdictions.

There is no requirement for federal permits with respect to conducting underwater archaeology, except if these are lands owned/managed by Parks Canada (Jonathan Moore, personal communication, November 15, 2010).

MEETINGS AND OPEN HOUSES

SJAHCE and CARF will make itself available for required meetings and open houses. There will be a set rate depending on the person required to attend these meetings. If special exhibits are required, the expense associated with these exhibits and transportation thereof, will be charged to the client. SJAHCE is also able to assist or lead with media relations with respect to Option 4 of the project.

7.3 SCOPE OF WORK – TERRESTRIAL ARCHAEOLOGY

The Stage 2 archaeological assessment will follow the *Standards and Guidelines for Consultant Archaeologists* (2010) produced by the Ministry of Tourism & Culture of the Province of Ontario and is based on the findings of the stage 1 assessment. The determined study area(s) and route(s) would need to be shovel test-pitted at 5 metre intervals due to the proximity to water and historic transportation route. Any areas of low to moderate potential would require assessment at 10 metres. If any area has been recently ploughed, it may be ploughed again and field walked. Depending on the selected route(s) and whether the cable is buried or on posts overhead, sections of the route(s) may not require testing. A report will be produced detailing the stage 2 assessment results and recommendations. It is not anticipated that a federal review is required.

The Stage 2 field work will be carried out by a licensed archaeologist and experienced field crew of archaeological technicians. An archaeological technician experienced in material culture will be responsible for the artifact inventory and interpretation of the material culture. Technical aspects will be addressed by archaeological and graphics technicians.

- Work will be conducted under the direction of a consultant archaeologist holding a professional licence issued by the Ministry of Tourism & Culture of Ontario (O. Reg. 8/06 Ontario Heritage Act)
- A report must be produced detailing the results of the work and must comply with Ministry standards including a complete artifact inventory (for stage 2 only)
- 3 copies of the report must be sent to the Ministry by the archaeological consultant
- once a report is submitted to the Ministry a response may not be received for up to 60 working days - currently wait time is approximately 6 months, but expedited reviews are available for renewable energy projects and high priority projects such as those with funding or emergency requirements - an expedited review will be requested with report submission
- no ground disturbance can occur until a letter of concurrence is received from the Ministry
- in the event that human remains are encountered all work has to cease and the Registrar of Cemeteries, Ministry of Tourism & Culture, Medical Officer of Health and the local police must be contacted
- concurrence letters can only be issued by the Ministry of Tourism & Culture, not by the consulting archaeologist

It is anticipated that the licensed archaeologist will be required to attend meetings and open houses to discuss or present findings of the stage 2.

7.4 SCOPE OF WORK – HERITAGE STUDY

A heritage study identifying any significant built heritage resources or cultural heritage landscapes, streetscapes and view-planes will be conducted. This will include an inventory of resources within the study area and an assessment of impact to those resources as well as recommendations. There are currently no guidelines for the preparation of heritage assessments and heritage impact assessment for GEA/REA projects. The Ontario Government's Heritage Resources in the Land Use Planning Process document on the Provincial Policy Statement of 2005 contains information sheets that are relevant to conducting a heritage study and includes Info Sheet # 1: Built Heritage Resources, Info Sheet # 2: Cultural Heritage Landscapes, and Info Sheet # 5: Heritage impact Assessments & Conservation Plans (2006). Reports are reviewed by the Ministry of Tourism & Culture regional heritage planner on a first in basis, but a review of these reports is considered a priority by the Ministry. Once the report is received by the Ministry regular contact will be made with the planner responsible for the region.

The heritage study assessment work and report will be carried out by an historian who will utilize research material from the stage 1 terrestrial archaeological assessment and marine research if warranted. A site visit will also be conducted to document any extant resources. It is not anticipated that a federal review is required.

It is anticipated that the historian will be required to attend meetings and open houses to discuss or present findings of the heritage study.

7.5 REGUALTIONS, GUIDELINES AND POLICIES

Title	Type (regulation, guideline, policy)	Regulatory Agency
Province of Ontario		
Renewable Energy Regulation, O.Reg. 359/09	Regulation	MOE
Standards and Guidelines for Consultant Archaeologists (2010)	Guideline	MTC
Ontario Government's Heritage Resources in the Land Use Planning Process document on the Provincial Policy Statement of 2005	Policy	MTC
Heritage impact Assessments & Conservation Plans	Best Practices	MTC
Canadian Federal Government		
Canadian Environmental Assessment Act	Legislation	Canadian Environmental Assessment Agency
International or Other		
1909 Boundary Waters Treaty	Treaty	

7.6 TEAM SUMMARY

7.6.1 Cataraqui Archaeological Research Foundation

Terrestrial Archaeology Project Leader

Susan Bazely is Senior Archaeologist with the Cataraqui Archaeological Research Foundation and has conducted and subsequently directed archaeological and historical research in Kingston from 1983 to the present. Projects and investigations around the Kingston region include the Naval Cottages, Fort Frederick, Guard House & Porter's Lodge, Naval Hospital, Stone Frigate, ND2 site, and investigations for various other utilities installations and upgrades to buildings on Point Frederick; Fort Henry NHSC; Fort Frontenac NHSC; North Block adjacent Military Reserve; Kingston Market Square; other small archaeological projects in down town Kingston; in addition stage 1 and 2 assessments have been completed in Bath. Ms Bazely has also participated in the preparation of several planning and management studies including Commemorative Integrity Statements for Fort Henry NHSC, Kingston Navy Yard and Point Frederick Buildings NHSC, Kingston City Hall NHSC, Kingston Drydock NHSC, Management Plan for Fort Henry, Stage 1 Archaeological Assessment of RMC Point Frederick, Stage 1 Archaeological Assessment of CFB Kingston, Archaeological and Heritage Assessment of the Lake Bastion Point Frederick, and the initial Kingston Archaeological Master Plan Study.

Historian

Andrew Hill has been an historian and researcher with the Cataraqui Archaeological Research Foundation since 2008. He has conducted historical research for stage 1 archaeological assessments for properties throughout the Kingston area, and for outlying regions such as the St. Lawrence River, the Rideau Canal, and Quinte West. His work draws on existing historical literature, land registry records, historical cartographic evidence, and a variety of archival facilities; as well as the extensive use of online resources and reliable primary sources. Mr. Hill also works on a contract basis for the City of Kingston, assessing heritage properties and writing heritage by-laws compliant with Section 9/06 of the Ontario Heritage Act.

7.6.2 Scarlett Janusas Archaeological and Heritage Consulting and Education

Marine Project Leader: Scarlett Janusas

Scarlett, the President of SJAHCE, will be the project leader for this task. She has had over 32 years of archaeological experience, and has been the president of her own consulting firm since 1985. She was the former Regional Archaeologist for the Regional Municipality of Waterloo for seven years and created the first archaeological Master Plan in the Province of Ontario, and built up an archaeology division in the Planning Department of the Region, providing her with a base for managerial skills. Scarlett Janusas will be the underwater archaeologist for the project. She has over 30 years of experience in underwater archaeology, and over 32 years in land archaeology. Her first REA project was conducted in 2005 for M.K. Ince and Associates in Simcoe County. She has had experience with renewable energy projects since Ms. Janusas held the position of the President of the Ontario Marine Heritage Committee for 10 years. She remains a member of the OMHC. She is also currently the President of the Ontario Association of Professional Archaeologists.

Marine Historian

Patrick Folkes has worked with SJAHCE since its inception in 2002, and prior to that with Scarlett Janusas and Associates since 1985, and worked with Scarlett Janusas on projects in the Kingston, Thunder Bay, Barrie, Pembroke, St. Lawrence River at Cornwall, Prescott on the St. Lawrence River, St. Clair River, etc. areas. Patrick has been a marine historian since 1976. He was also the assistant curator at the local Marine Museum of the Great Lakes in the mid-1980s, and has authored many marine heritage articles. He has been a member of the Ontario Marine Heritage Committee for over 40 years.

Shark Marine Technologies Inc. main office is located in St Catharine's Ontario. All of its current employees are from the province of Ontario and presently living within the Niagara region.

Project Leader for Geotechnical Team (under leadership of archaeologist, Scarlett Janusas)

Jim Garrington is Shark Marine's company president and senior survey technician with over 26 years of relevant experience.

Mike Aitken is Shark Marine's secondary **survey technician** and ROV with over 7 years of operational experience. Mike's complete CV is also attached in Appendix A of this proposal.

8. COST AND SCHEDULE

8.1 OPINION OF COSTS

GENIVAR has developed an opinion of costs based on the scope of work detailed above. There were several optional items which were discussed but not included in the opinion of costs including:

- Post-Construction Bird and Bat Surveys
- A general presentation of the technical elements of an offshore wind farm to key agencies
- The cost of developing a project website
- Expenses associated with holding public meetings (room rentals and refreshments)

The estimated costs are presented below.

Task	% Ontario Content on Cost Basis	Total
OPTION 1 - Permitting		
Permitting	100	N/A
Stakeholder Consultation	100	$ 124,600
Public Consultation	100	$ 108,160
Project Management, Co-ordn, team meetings	100	$ 158,000
Reporting	100	$ 124,000
Noise	100	$ 27,500
Shadow Flicker	80	$ 12,500
Visual Simulation	80	$ 20,000
Telecommunications	80	$ 10,000
Option Sub-Total	98%	$584,760
Option 2 - Ecological Field Work		
Avian Surveys	30	$ 365,000
Bat Surveys	30	$ 130,000
Project Management, Co-ordn, team meetings	100	$ 85,000
Fisheries Study	70	$ 547,900
Natural Heritage Evaluation	100	$ 32,320
Option Sub-Total	55%	$ 1,160,220
Option 3 - Technical Field Work		
Hydrology	40	$ 90,000
Wave Studies	50	$ 95,000
Sediment Transfer	75	$ 75,000
Icing Studies	10	$ 55,000
Costal Engineering	10	$ 54,000
Project Management, Co-ordn, team meetings	100	$ 80,000
Water Quality	75	$ 140,000
Option Sub-Total	59%	$ 589,000
Option 4 - Cultural Heritage & Archaeology Study		
Stage 1 Study	100	$ 23,300
Stage 2 Marine	100	$ 561,000
Stage 2 Terrestrial	100	$ 26,700
Cultural Heritage Study	100	$ 3,700
Option Sub-Total	100%	$ 614,700
Grand Total	76%	$ 2,948,680

GENIVAR will offer discounts for multiple awards as follows:

Option 1 & 2: 2.5% of labour costs

Option 1 & 3 2.5% of labour costs

Option 1, 2 & 3 3.0% of labour costs

No discounts will be given for option 4 work.

8.2 SCHEDULE OF HOURLY RATES

The Schedule of Rates are provided below.

Category	Hourly Rate ($/hour) for 2011
Rates for Permiting, Ecological Field Work and Technical Field Work	
Director	160
Technical Specialist	160
Senior Project Manager	135
Senior Biologist	130
Intermediate Biologist	100
Field Survey Technicians	70 - 90
Senior Engineer	130
Intermediate Engineer	105
Intermediate GIS/CADD	85
Lahmeyer Technical Expert	USD 190 /hour
Sub-consultants	Provided upon request
Archaeology Rates	
Licenced Archaeologist - terrestrial	100
Licenced Archaeologist – marine	100
Historian - terrestrial	62.50
Historian – marine	81.25
Archaeological Technician	50
Graphics Technician	50
Administration	100

Note: The above rates are for work in 2011 and exclude taxes and expenses. For work in 2012, an overall escalation of approximately 3.0% would apply. Expenses will be invoiced at cost + 10%.

8.3 SCHEDULE

GENIVAR has developed preliminary schedules for the four options detailed in our proposal. Detailed Gantt Charts for the Permitting, Ecological Field Work, Technical Field Work and Cultural Heritage & Archaeological Studies are found in Appendix C. Tasks in red are government review periods and are estimates based on previous experience.

9. EXPERIENCE AND PROJECT TEAM

9.1 CORPORATE EXPERIENCE

9.1.1 GENIVAR

GENIVAR is a Canadian leader in providing energy engineering services and delivering solutions based on an integrated project approach. With more than 5,000 employees and 85 offices, GENIVAR provides a full range of services over the entire project cycle, from project development, studies, pre-design, detailed design, construction administration and/or management and operational support.

We provide services in the following market sectors:

- Power and Industrial
- Transportation
- Municipal Infrastructure
- Buildings
- Environment

Wind Energy is a specialty area for GENIVAR and we are currently working for over 50 clients on a wide variety of renewable projects. We provide "one stop shopping" for all wind energy related services – wind energy assessment, engineering, environmental and permitting. Our energy sector clients include: Windstream, TransCanada Energy, NextEra Energy, Gilead Power, Suncor, TransAlta, Ontario Power Generation, Brookfield Power, Suez, enXco, SunEdison, Northland Power, as well as several construction companies.

We have experience in both planning and implementation of a wide range of renewable energy projects including: solar, wind, biogas and geothermal projects. This expertise is key to the development of a fully integrated renewable energy and energy management program that not only looks at the immediate potential to apply renewable energy and energy efficiency, but also at an effective long term management of assets. We are active members of Canadian Solar Industry Association, Canadian Wind Energy Association and Ontario Energy Association.

GENIVAR has been a key player in the Wind Industry in Ontario. Staff have been involved with the Renewable Energy Approvals process since the release of the draft rules in June 2009. GENIVAR has provided our clients with strategic analysis and advice on the implication of the ever-evolving REA process and has helped transition several existing wind projects from the Environmental Assessment process to the REA process. Our expertise has led numerous clients to seek our advice when in the early planning and development stages of renewable energy projects.

9.1.2 Cataraqui Archaeological Research Foundation (Sub-Consultant)

The Cataraqui Archaeological Research Foundation is a well-established research and educational organization. In twenty-seven years in Ontario archaeology it has amassed a tremendous amount of data and resources to support the efforts of staff in historical research and archaeological investigation. Founded in 1983, as a non-profit organization incorporated under the statutes and laws of Ontario, the Cataraqui Archaeological Research Foundation is dedicated to the recognition, investigation and preservation of Ontario's rich archaeological resources. The Foundation seeks to promote archaeological research and resource management through public education and awareness. Initially established to deal with resources in the Kingston area, the organization has expanded its geographic focus to serve all of Ontario. Activities have been supported through various funding sources including memberships, government programs and donations. The Foundation also provides consulting services to the public and private sectors. Over the past twenty-seven years Foundation staff have worked extensively with other heritage organizations, particularly in the Kingston area, as well as the Kingston museums, Parks Canada, Department of National Defence, First Nations from the Tyendinaga Mohawk Territory, and the City of Kingston.

The Staff of the Cataraqui Archaeological Research Foundation are proficient in the identification and investigation of archaeological sites, in delivering presentations to both the public and private sectors, and in creating educational and promotional displays. The Foundation has extensive archaeological fieldwork experience in the Kingston area and has completed numerous projects. Foundation staff are licenced to conduct archaeology in the Province of Ontario and are familiar with provincial regulations pertaining to archaeology as legislated through the Ministry of Tourism & Culture's requirements for consulting archaeologists, and under the Provincial Policy Statement of the Planning Act. A key component of archaeological assessments is historical research, particularly regarding a detailed history of a property, involving intensive use of historical maps, other archival materials and the land registry system. As part of its mandate to educate and involve the public in archaeology and history programs the Foundation maintains an interpretive exhibit at its Princess Street location and is also actively involved in web based exhibit design and display.

The Cataraqui Archaeological Research Foundation is located in Kingston, Ontario and all current employees live in the city of Kingston.

9.1.3 Scarlett Janusas Archaeological and Heritage Consulting and Education (SJAHCE)

SJAHCE and associate Shark Marine Technologies Inc. have undertaken many underwater archaeological projects together, and our collective experience makes us the leaders in underwater archaeology. Until recently, SJAHCE was the only professional archaeologist in the province of Ontario eligible to hold an underwater archaeological licence. .

Scarlett Janusas Archaeological and Heritage Consulting and Education (SJAHCE) has been conducting business under this company name since 2002, and prior to that under the name of Scarlett E. Janusas and Associates Inc. since 1986. Our mission is to provide government and private industry/development with quality archaeological services delivered in a timely manner.

We conduct both land and underwater archaeological assessments from Stage 1 (background research) to Stage 4 (full archaeological mitigation). The company president, Scarlett Janusas, has until recently, been the only professional underwater archaeologist in the province of Ontario, and has conducted underwater archaeology projects since 1978. As a result of the expertise SJAHCE has been able to provide, we are considered leaders in the field of underwater archaeology. Our approaches to underwater archaeology are innovative and recognized across the province. The company has been unique in being able to provide both land and underwater archaeological services, and has recently added cultural heritage and cultural heritage impact assessments to its services.

Our geographic areas include the entire province of Ontario, and our associate, Shark Marine Technologies conducts projects globally. SJAHCE's associate, Shark Marine Technologies, incorporated in 1984, and the company's mandate has been to offer products and services that are innovative, high quality, dependable and cost effective.

Over the years, the firm has gained global respect for developments in undersea technology and the expertise we bring to on-site operations. As a manufacturer we have made significant advancements in underwater imaging equipment, remotely operated vehicles and other survey systems. In our services we have provided consultation, software development, custom manufacturing, hydrostatic testing, equipment rentals and location operations.

The customer base has grown to include gas and oil exploration, commercial diving, various government's navies and fisheries, search and rescue organizations, as well as engineering and survey firms, and has spread to include all continents. Our location services have taken us from the warm waters of the Caribbean to the frozen Arctic, where we have gained international recognition for our efforts. These include pipeline surveys, locating of sunken vessels and other objects, search and recovery, as well as magnetic, bathymetric and sonar mapping. Our experience in the diverse aspects of this field allows us the ability to create innovative solutions to often difficult or costly tasks. All of its current employees and associates live in the province of Ontario.

9.1.4 THE LASALLE CONSULTING GROUP

The LaSalle Consulting Group (*www.gcl.qc.ca*), which celebrated his 50th birthday in 2006, is a North American leader in the field of hydraulics and applied fluid mechanics. The LaSalle Consulting Group has long been involved in the development and use of numerical modelling tools. Initially developed in the sixties, our river ice models are continuously improved and still represent today the state-of-the-art for the hydraulic modelling of Nordic rivers.

The LaSalle Consulting Group had its first ice study contract from Hydro-Quebec in 1957 on the Beauharnois Powerplant supply canal on the St. Lawrence River. The original computation methods developed in this work were first published in 1959. Later, refinements were reported in 1966. They were put to use immediately on a number of hydroelectric projects that Hydro-Quebec was designing at the time, as well as in laying out the land reclamation limits for the Expo 67 Islands in the St. Lawrence River. Since that time, the LaSalle Consulting Group has been continuously involved in ice studies, for the most part in connection with hydroelectric developments. The original methodology has been refined over the years, and analytical studies, backed up by model studies or field observations, have been checked for accuracy often enough to offer a high degree of confidence in their use.

The LaSalle Consulting Group is regularly involved in project related to ice mechanics and estimation of loads: design and certification of ice bridges for winter operation of heavy equipment (Hydro-Quebec, SEBJ), ice loads on temporary bridges for the Rupert and Romaine hydroelectric project (Hydro-Quebec), ice loads on wharves (Alcoa wharf in Baie-Comeau).

9.1.5 Environnement illimité Inc.

Since the mid-1970s, EI has assembled a multidisciplinary team specializing in data acquisition in aquatic environments (lakes, rivers, estuaries, oceans). Over the years, this team has grown and diversified, and now consists of nearly one hundred employees who, through their expertise and creativity, play an integral part in the firm's outstanding reputation.

Today, EI has teams deployed across Canada and in the United States, Africa and Australia. The flexibility of our workforce and our extensive array of equipment allow us to mobilize within very short timeframes. An additional hallmark of all our operations is our utmost concern for quality.

Precise hydrological data are essential in designing any hydroelectric structure, bridge, water intake or outlet, and any other project calling for effective water management (flood risks, irrigation, etc.). EI has solid expertise in surveys specific to hydrology, such as water level and flow measurements, establishment of limnimetric stations, and sampling of suspended sediment and bed load. The quality of data collected by EI's technical teams enables engineering firms to plan with confidence the design, construction and operation of infrastructures in aquatic environments.

EI's clients include some of the largest hydropower producers in the world. As a result, its professionals and technicians are accustomed to working on major projects, particularly in challenging environments. EI team members are fully aware of the importance of the accuracy of their measurements to ensure that the surveys are carried out with the highest regard for quality.

9.2 ENVIRONMENTAL ASSESSMENT AND POST EA EXPERIENCE

GENIVAR has a wealth of experience in the area of Environmental Assessment and Post Environmental Assessment work, which is detailed more specifically below.

9.2.1 Environmental Assessment Experience Overview

The GENIVAR team's collective EA experience covers a wide range of projects including electrical transmission lines and stations, linear infrastructure, water and wastewater treatment plants and pumping stations, local and arterial roads and highways (both new construction and road improvements) and transit development. In addition, this experience has involved projects that were subject to Class EA and Individual EA processes as well as federal (CEAA) and provincial EA requirements.

Staff members of GENIVAR are intimately familiar with several of the existing Class EA processes in Ontario (which all abide by the requirements of the Ontario Environmental Assessment Act), including the process for Minor Transmission facilities, Municipal Engineers Association (MEA), Ministry of Energy and Infrastructure (MEI), GO Transit, Ministry of Transportation, Ministry of Natural Resources, and the Waste Management Environmental Screening Process. **In fact, GENIVAR is currently retained by MEI/ORC to assist in amending their Class EA document for major amendments as part of the Ministry's five year review process.**

Having numerous offices across Canada, GENIVAR has professionals who have completed EAs for various projects in almost all Canadian provinces and territories, and hence have an appreciation for the various EA processes that are utilized.

As a result of significant expertise in this discipline, GENIVAR's team fully understands the importance of key EA stages, including the determination and evaluation of alternative solutions/route selection as well as the critical nature and need for stakeholder and public consultation (including First Nations). Furthermore, our team recognizes both; the inherent value of often going beyond the prescribed EA process requirements, as well as the benefit of truly understanding the entire project, from planning to the design, implementation, and post construction considerations.

We are members of the following industry associations: Ontario Energy Association, Ontario Water Power Association, Canadian Wind Energy Association, Canadian Solar Industry Association, Association of Power Producers of Ontario. In addition, our staff are members of a number of other industry environmental associations.

9.2.1.1 Renewable Energy Permitting

GENIVAR has a long experience permitting renewable energy projects in Ontario. GENIVAR has completed the EA for one of the first large wind power projects in Ontario, The AIM-PowerGen Erie Shores project. Further EA work in the Wind Industry include the Spring Bay Wind Farm EA (Schneider Power), the Renewable Energy Approvals (REA) work for NextEra Energy Canada (Bornish and Conestogo Wind Farm REAs). GENIVAR is also undertaking REA approvals for the Rutley Solar Farm (SunEdison) and the Dryden Solar Park (City of Dryden). GENIVAR has also been retained to do early REA work on an additional two wind power projects and six ground mounted solar farms.

GENIVAR has been active working with government agencies (MOE, MNR, MEI and MTC) through the development and implementation of the REA process. We are currently permitting several wind and solar projects through this project and have a clear understanding of the process and potential road blocks..

9.2.1.2 Environmental Assessments of Power Transmission Lines and Power Substations

The GENIVAR team combines more than 30 years of experience in the field of environmental impact assessments for power transmission lines. GENIVAR's personnel has produced more than 30 major environmental studies which have covered all aspects of environmental assessments, from preliminary studies to public hearings, and including environmental impact studies.

More specifically, GENIVAR has developed significant expertise in transportation corridor studies, line alignment studies, line dismantling and replacement studies, substation dismantling, positioning and enlargement studies, environmental monitoring guides and vegetation control in line right-of-ways.

Corridor Studies

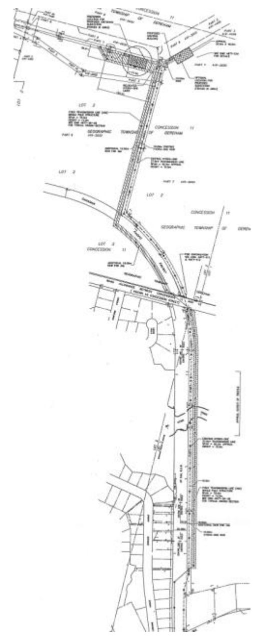
Between 1979 and 1981, GENIVAR's personnel produced, for the *Société d'énergie de la Baie James* account, two corridor optimization studies, one for the power transmission lines and one for the access roads that would eventually service the Nottaway-Broadback-Rupert hydroelectric project. These projects included a 1:50,000 scale study of 3,000 km of corridors spread over approximately 120,000 km^2.

In 1986-1987, GENIVAR produced the scoping study of the supply variants for the Hydro-Québec-Central Maine Power interconnection project. This study involved the analysis of more than 300 km of electric power transport corridor. It covered an area encompassing the Beauce, Bois-Francs and Estrie regions. This was followed by a study of corridors connecting the Des Cantons substation and Maine.

In 1989, GENIVAR produced the corridor study on the 12th 735 kV Chibougamau-Chamouchouane-Jacques-Cartier line. This phase of the preliminary project covered the inventory of 465 km of corridor. Finally, a similar study was conducted for the section of the 14th 735 kV line south of the 49th parallel.

In 1998, GENIVAR participated in the inventorying of the Moyenne-Côte-Nord and Basse-Côte-Nord territories, within the framework of the corridor study on the connection of the Montagnais and Micoua substations at the Churchill project. More recently, GENIVAR produced all the line corridor studies for the de la Romaine project in the Côte-Nord region.

Representation, Communication and Public Participation



The GENIVAR team includes many different specialists in the following domains: sociology, anthropology, human and historical geography, as well as urban planning. Our specialists are utilize various data acquisition tools such as individual interviews, group interviews, focus groups, postal surveys, phone surveys, field surveys, etc.

Most of the projects have required an in-depth knowledge of the population at hand. This planning and evaluation has oriented communications between the local population and the promoter, which has greatly enhanced the social acceptability of the projects. Depending on the project, the general knowledge of an area has been gathered by completing social, political, cultural and economic profiles of the local population. These can include demographic characteristics, socio-political context, definition of the social fabric, lifestyle, local culture and health determinants, knowledge and valorization of the local environment, etc. Usually, this characterisation of the local population has also taken into account the preoccupations, fears, opinions and reactions with regards to the project. In dealing with the social acceptability specifically for energy projects, social and psychosocial impact studies of the risk perception and environmental nuisances have been completed. These are growing concerns in local public health authorities.

GENIVAR has accomplished many mandates that have required representations and interactions with various levels of government: federal, provincial, regional, municipal, local organisations as well as with the promoters. These mandates demand a strong and continuous communication with all the parties involved. Additionally, the company has participated in many projects that involved preparing documents that communicate technical information (e.g. summaries, information leaflets, presentations, posters).

The following table lists some of the main power transmission projects that GENIVAR has completed in Quebec.

Table 9-1 Main Power Transmission Line Projects Carried Out by GENIVAR in Quebec

Projects
Connection of the Romaine complex − Corridor and line alignment study;
315 kV line between the SM-3 powerhouse and the Arnaud substation;
Toulnustouc-Micoua 315 kV line − Environmental Monitoring Guide;
Addition of de-icing equipment at the Bergeronnes substation and the Bergeronnes-Lévis line − Mechanical strengthening of lines and other related works − Environmental monitoring guide;
Corridor study for the Micoua-Montagnais line project − Lower Churchill Development;
Manic-5 project additional capacity − Environmental impact assessment for the positioning of the substation at the

Table 9-1 Main Power Transmission Line Projects Carried Out by GENIVAR in Quebec

Projects
powerhouse and alignment for 315 kV line;
Grand-Brûlé−Vignan 315 kV double-circuit line, modifications to the 735-120 kV Grand-Brûlé substation and 315-230 kV Outaouais permanent substation, outaouaise ring circuit project. Hydro-Québec;
14th 735 kV line, segment on the southernmost part of the territory under the jurisdiction of the James Bay and Northern Quebec Agreement (JBNQA) – Chénier. Hydro-Québec;
315 kV power transmission line between the Abitibi and Lebel substations, environmental and social impact assessment report. Hydro-Québec;
James Bay grid, 735 kV power transmission lines between the Chibougamau, Albanel and Nemiscau substations. Hydro-Québec;
Alignment study and environmental summary report for the 735 kV Lemoyne-Tilly line. Hydro-Québec
120 kV Grand-Pré−Shawinigan 3 double-circuit line. Hydro-Québec;
230 kV supply for Kruger (Trois-Rivières). Hydro-Québec;
Des Chenaux−Trois-Rivières 230 kV double-circuit line and Des Chenaux 230-25 kV substation. Hydro-Québec;
Replacement of an overhead ground wire with an optical fibre ground wire (OFGW) on sections of lines connecting the Mauricie, Jacques-Cartier, Laurentides, Lévis, Boucherville, Nicolet, Duvernay, Chénier, Lanaudière and La Gabelle substations. Hydro-Québec;
Hydro-Québec/Ontario Hydro interconnection. Hydro-Québec;
120-25 kV Dostaler substation. Hydro-Québec;
Relocation of the 120-25 kV St-Alexandre-de-Kamouraska electrical substation. Hydro-Québec;
New 315-25 kV substation and 315 kV connecting line in Saint-Augustin-de-Desmaures. Hydro-Québec;
Construction of the Anne-Hébert 315-25 kV substation and the 315 kV connecting line in Québec. Hydro-Québec;
120 kV Grand-Brulé-Mont-Tremblant line project and Mont-Tremblant 120-25 kV substation. Hydro-Québec;
Electrical power transmission line project between the INGA dam, in the Democratic Republic of Congo, and Pointe-Noire, in the Republic of Congo;

9.3 EXPERIENCE – SIMILAR PROJECTS

The following project summaries demonstrate our team's experience similar to the contract services requested in the RFP.

NextEra Energy Canada – Wind Power Project Permitting

GENVIVAR has been completing the permitting for three wind power projects in southern Ontario under the new Province of Ontario's Renewable Energy Approvals process. Tasks completed to date include: completion of supporting studies (natural heritage, archaeological, noise, shadow flicker); public consultation including preliminary and final public meetings; completion of draft reports for public review; meetings and consultation with MOE, MNR, REFO and Conservation Authorities; strategic advice; and aboriginal consultation. Filing of the formal REA application is anticipated shortly.

Erie Shores Wind Farm

GENIVAR completed the EA and the preliminary engineering for the project (99 MW – Phase I). This included electrical design, access road layout, obtaining geotechnical information, preliminary foundation design and preparation of EPC tender documents. GENIVAR completed the EA and the preliminary engineering for the project (99 MW – Phase I) in south-western Ontario. This included design of 34.5 kV electrical collector system, substation, transmission line and SCADA system, access road layout, preparation of EPC tender documents, and interface with IESO/HONI.

Hydro-Québec & Hydro One: Chenier–Outaouais Line & Ontario Interconnection

An EA study was completed for 114 km 315 kV transmission line. It linked the Chenier and Outaouais sub-stations. An additional 15 km line of 230 kV was needed to link the Ontario and Québec sides. The main constraint of this project was that most of the line was located in agricultural land. A parallel and existing transmission line was already in place. There was a need to coordinate the position of the pylons to minimise the visual impact.

DURHAM-YORK RESIDUAL WASTE STUDY EA

GENIVAR was part of an environmental consulting team undertaking the Durham York Residual Waste Study Environmental Assessment. This initiative involved the examination of alternative means for the management of post-diversion residuals from the two municipalities. The work included:

- **Environmental Assessment Terms of Reference (EA ToR)**. The EA Terms of Reference were prepared and an extensive consultative process was employed at various stages of development of the EA ToR to solicit feedback from interested parties including the: Need and Purpose of the Undertaking; The alternative waste disposal methods; process for selecting preferred method; The process that would be used to select a site and the competitive process used to implement the preferred system; and the consultative process that would be implemented during the EA Study. The proposed EA Terms of Reference were approved.
- **Evaluation of "Alternative Methods"** involved development of a work plan, which provided: a systematic process for identifying and evaluating potential sites for the preferred Thermal Treatment system, with a focus on publicly owned lands and sites offered by 'willing sellers' within areas such as industrial lands that are suitable for the development of such facilities; a consultative process to support the evaluation of potential sites; and equipment procurement process.

Spring Bay Wind Farm

GENIVAR completed Provincial and Federal Environmental Assessments for this 15 MW wind farm, which is now in operation. The scope included public consultation, management of all field surveys, receptor groundtruthing, agency consultation and preparation of reports.

SunEdison – Solar Farm Renewable Energy Approval

GENIVAR is in the process of completing the Renewable Energy Approvals for a 10 MW groundmounted PV solar project located in Eastern Ontario. Tasks completed to date include: completion of supporting studies (natural heritage, archaeological and noise); public consultation including preliminary public meeting; meetings and consultation with MOE, MNR, REFO and Conservation Authorities; strategic advice; and aboriginal consultation. Filing of the formal REA application is anticipated in early 2011.

City of Dryden – Solar Farm Renewable Energy Approval

GENIVAR is undertaking the Renewable Energy Approvals for a 5 MW groundmounted PV solar project located near the City of Dryden in North-western Ontario. Tasks completed to date include: completion of supporting natural heritage and archaeological studies; the preliminary public meeting; consultation with MOE, MNR, REFO and Conservation Authorities and strategic advice. Filing of the formal REA application is anticipated in Q2 of 2011.

Hydro-Québec: La Romaine Project

Hydro-Québec plans to construct four power houses on the Romaine River. Transmission lines must be built to link the new infrastructure with the existing distribution system. Two different lines were identified: the first one links the Romaine-1 and Romaine-2 power houses with the Arnaud sub-station. It totals 289 km and is of 315 kV. The second transmission line represents 207 km of transmission lines and links the Romaine-3 and Romaine-4 power houses with the des Montagnais sub-station. This project was mainly in forested lands. However, major issues with regards to topography, wetlands and accessibility needed to be addressed.

Hydro-Québec: Waskaganish

Hydro-Québec wanted to integrate the Cree Nation of Waskaganish in its distribution. A 208 km transmission line of 69 kV was needed between the Waskaganish and de la Nemiscau sub-stations. This transmission line was mainly in forested lands. Interviews were conducted with the aboriginal Tallymen that were affected by this transmission line. Surveys and public consultations were key issues with regards to this project.

Western Beaches Watercourse Facility

The City of Toronto was selected as the host city for the International Dragon Boat Federation (IDBF) Club Crew World Championships (CCWC) in 2006. Several conditions were attached to the bid award. The first condition was that a new watercourse facility be provided in the Western Beaches, located west of Ontario Place. Another condition was that the watercourse be ready for use by June 1, 2006.

Following the bid award, the TWRC retained GENIVAR (MacViro) to undertake a Feasibility Study. The Study concluded that a new multi-sport watercourse facility meeting international paddling and rowing standards could be constructed in time for the 2006 CCWC event. However, the schedule for obtaining all environmental approvals, designing and constructing the watercourse would be extremely tight and would pose a major challenge. Based on the outcome of the Feasibility Study, the federal, provincial and municipal governments committed funding in the amount of $23 million in order to construct the new watercourse facility.

GENIVAR (MacViro) was subsequently retained by TWRC to lead the multi-disciplinary team to undertake the Environmental Assessment and Facility Design for the Western Beaches Watercourse. Given the short available schedule for completing the assignment, the environmental assessment process and detailed design work were accomplished coincidently. The TWRC and the City of Toronto acted as co-proponents for the Coordinated EA Report, involving both federal and provincial EA processes.

The main components of the project that were subject to the EA were:

- Removal of approximately 600 m of existing breakwater
- Construction of a new breakwater
- Diversion of the Jameson Avenue Storm Sewer Outfall
- Construction of aquatic habitat (fisheries compensation)

Within seven months of the commencement of work on the EA process, the Canadian Environmental Assessment Agency (CEAA) and the responsible authorities (Department of Fisheries and Oceans, Transport Canada and Citizenship and Immigration Canada) made a determination that the Western Beaches Watercourse Facility could proceed. One month later final designs were completed and all permits were obtained in order to allow tendering of the project and award of construction.

At the conclusion of the 2006 CCWC competition event, the facility will remain as a permanent training and competition venue for Toronto's paddling and rowing community.

9.4 ORGANIZATION STRUCTURE

An organizational chart for our team is found in Appendix D. The boxes highlighted in red are key team members not proposed to be part of the GENIVAR team. The EA/REA Project Manager is to facilitate communication between the GENIVAR team leads and other members of the Windstream Team. She will work closely with the Back-up PM so there is seamless communication should the EA/REA PM not be available.

APPENDIX A – SCOPE DESCRIPTION SUMMARY TABLE

Task	Major Tasks	Deliverables
OPTION 1 - Permitting		
Permitting	• Determine which permits are required • Determine scope of studies required for permits • Fill out permit applications • Follow-up with agencies to determine permit application status • Report on permitting progress	• REA Application Package • EA report • DFO permits (as required) • Aeronautical Obstruction Clearance Form • NavCanada Land Use form • SARA Permit (if required) • Species at Risk Permit (if required) • CRCA permits (if required) • Building Land Use Permit (if required) • Permit to Take Water (if required)
Stakeholder Consultation	• Initial meetings with provincial agencies • Initial meetings with federal agencies • Develop and obtain approval of work plans • Prepare, update and maintain communication plan • Develop CEAA schedule	• Communications plan • Consultation report
Public Consultation	• Develop notice of project • Develop and arrange publication of public meeting notices • Design presentation boards for public meetings • Participate in public meetings • Summarize and respond to public comments and questions	• Notice of Project • Public meeting notices for PIC 1 and PIC 2 • Presentation Boards • Response letters • Consultation Report
Reporting	• Develop draft REA component reports • Revise and update component reports as necessary • Develop EA report	• Project Description Report • Construction Plan Report • Design and Operations Report • Offshore Wind Facility Report • Wind Turbine Specifications Report • Decommissioning Report • Consultation Report • EA Report
Noise	• Identify noise receptors	• Noise report

Task	Major Tasks	Deliverables
	• Ground truth noise receptors • Noise modeling for wind farm using CADNA based model • Construction noise modeling not included	
Shadow Flicker	• Model shadow flicker in project area	• Shadow flicker report
Visual Simulation	• Take pictures for visual simulation • Create photomontages	• 15 photomontages
Telecommunications	• Obtain list of telecommunication systems in and near the project areas • Identify consultation zones and potential conflicts	• Telecommunications interference study
Option 2 - Ecological Field Work		
Avian Surveys	• One year of avian surveys • Spring Migration surveys (radar and visual) • Fall Migration surveys (radar and visual) • Breeding bird surveys (automatic call recorders, radar and visual) • Resident bird surveys (radar and visual) • Assessment of weather radar data to identify migratory pathways	• Avian study report
Bat Surveys	• One year of bat surveys • Radar and acoustic surveys • Migrating bat surveys • Maternal colony surveys	• Bat habitat report • Bat study report
Fisheries Study	• Review of background data • Aquatic habitat, fisheries and spawning surveys • Benthos sampling	• Existing conditions report • ESIA report
Natural Heritage Evaluation	• Records review • Biological Inventories (terrestrial) • Assessment of impacts and mitigation measures	• Natural heritage report • EIS report, if required
Option 3 - Technical Field Work		•
Hydrology	• Obtain historical water level data	• Hydrology report covering water levels

Task	Major Tasks	Deliverables
	• Hourly monitoring of water level, current velocities and waves through the installation of two ADCP units and 3 months of data collection • Modeling of the hydrological regime	and current velocities
Wave Studies	• Obtain wind and wave data from existing data sets • Numerical modeling of wave propagation	• Wave report documenting the historic and anticipated wave regime and impacts of the project
Sediment Transfer	• Modeling of existing sedimentation regime • Impact assessment of the installation • pre-construction, post-construction and plume transport from construction scenarios • sediment sampling	• Sedimentation report illustrating existing conditions and predicted conditions during and after construction
Icing Studies	• Analysis of historical ice conditions in eastern Lake Ontario • Lake surface icing conditions analysis • Blade icing potential	• Surface icing report documenting historical and anticipated freezing, break-up, pill-up and thickness
Coastal Engineering	• Assessment of static and dynamic forces (wind, wave, icing, etc.) • Potential failure mechanisms such as scour • Mitigation options to combat potential failure mechanisms	• Coastal engineering report
Option 4 - Cultural Heritage & Archaeology Study		
Stage 1 Study	• Examination of historical maps and documents • Obtain land registry information • Review aerial photos • Review wreck lists, harbour plans, shipping information, sessional Papers, newspaper accounts, existing reports and research • Site visit	• Stage 1 archaeological report
Stage 2 Marine	• A thorough underwater survey including the use of a Side Scan Sonar, Multi-Beam Sonar, Sub-bottom profiling, magnetometer and a	• Stage 2 marine archaeological report

Task	Major Tasks	Deliverables
	Remotely operated Vehicle (ROV) • Mitigation recommendations of any find sites	
Stage 2 Terrestrial	• 5 m interval surveys for areas of high archaeological potential • 10 m interval surveys for areas of low to medium archaeological potential	• Stage 2 terrestrial archaeological report
Cultural Heritage Study	• Inventory of heritage resources • Assessment of potential impacts	• Cultural heritage report

APPENDIX B – SELECTED CVS

ASSOCIATE CONSULTANT

PATRICIA BECKER, M.E.S.

ENVIRONMENTAL ASSESSMENT/PLANNING

AREAS OF PRACTICE

Environmental Assessment & Planning

Public/Agency Consultation

PROFILE

Patricia has over 20 years of experience in environmental planning and public/agency consultation. Areas of expertise include, environmental assessments (provincial and federal) for individual and class Environmental Assessment (EA) projects for both the municipal and private sectors, municipal master plans for water, wastewater and waste, public consultation, aboriginal consultation and government/agency consultation.

EDUCATION

Master's of Environmental Studies, York University	1987
Bachelor's of Arts Honours (Geography & Environmental Studies), Carleton University	1984

PROFESSIONAL EXPERIENCE

Renewable Energy / Consultation Programs

- **Private Client (Southwestern Ontario for 3 projects)**: undertaking Renewable Energy Approvals (REA) for three private sector wind turbine projects located in southwestern Ontario. The three projects are located northwest of London (Bornish project), near Arthur (Conestogo project) and near East Durham (East Durham project). The REA process requirements for these projects involves the development of consultation programs and undertaking public, aboriginal, government and agency consultation activities.
- **Private Client (Southwestern Ontario for 3 projects)**: undertaking Renewable Energy Approvals (REA) for four private sector wind turbine projects located in southwestern Ontario. The three renewable energy projects are meeting the REA process. The REA process involves the development of consultation programs and undertaking public, aboriginal, government and agency consultation activities.
- **Private Client (Southwestern Ontario for 9 projects):** completed nine environmental screening for private sector wind turbine projects located in communities in southwestern Ontario (specifically the Municipality of Chatham-Kent and County of Essex). The screening process (under the Electricity Regulation 116) involved the development of consultation programs and undertaking public, aboriginal, government and agency consultation activities. In addition, SARA requirements were identified and met as part of the EA process.
- **Private Client (Lake Erie shores near Port Burwell):** completed an environmental screening (under the Electricity Regulation 116) for a private sector wind turbine project, including developing a consultation program and undertaking the public, aboriginal, government and agency consultation activities.
- **Private Client (Spring Bay/Providence Bay):** completed an environmental screening (under the Electricity Regulation 116) for a private sector wind turbine

project, including developing a consultation program and undertaking the public, aboriginal, government and agency consultation activities.

- **Durham/York Residual Waste Study:** assisted in technical review of EA work for study to process (physically, biologically, and/or thermally) the waste remaining after the at source waste diversion programs to recover resources (both material and energy - and to minimize the amount of material requiring landfill disposal).
- **Niagara-Hamilton Waste Plan:** assisted in development of the alternative methods and siting criteria to meet the EAA requirements for a waste disposal facility to handle the long term waste management needs of the area. This included examining waste-to-energy facilities (i.e., incineration) and disposal (i.e., landfill).

Federal Environmental Assessments (CEAA) – includes Joint Provincial/Federal EA Projects

- **Private Client (Southwestern Ontario):** completed nine (9) environmental screening (meeting both federal (CEAA) and provincial (EAA) EA requirements) for private sector wind turbine projects located in communities in southwestern Ontario (specifically the Municipality of Chatham-Kent and County of Essex). The screening process involves the development of consultation programs and undertaking public, aboriginal, government and agency consultation activities. In addition, SARA requirements were identified and met as part of the EA process.
- **Private Client (Spring Bay/Providence Bay):** completed an environmental screening (meeting provincial EA requirements) for a private sector wind turbine project, including developing a consultation program and undertaking the public, aboriginal, government and agency consultation activities.
- **Private Client (Lake Erie Shores near Port Burwell):** completed an environmental screening (meeting both federal (CEAA) and provincial (EAA) EA requirements) for a private sector wind turbine project, including developing a consultation program and undertaking the public, aboriginal, government and agency consultation activities.
- **Durham Region:** undertaking environmental screening to meet CEAA requirements with Transport Canada for the siting of water storage facilities on federal lands and construction of 9 bridges for Regional level roads. This is combined with the Municipal Class EA process (including developing and undertaking public, aboriginal, government and agency consultation activities) for the sustainable community of the Central Pickering Development Plan. The class EAs are for the provision of regional services (water, wastewater, transportation and transit services) throughout the sustainable community of the Central Pickering Development Plan.
- **York Region – York-Peel Feedermain:** completed the CEAA report to address federal EA requirements for a watermain in York Region and Peel Region that triggered CEAA. Included working with the applicable agencies (DFO and Transport Canada) to ensure the additional requirements (including cumulative effects analysis) was completed.
- **Department of Fisheries & Oceans:** completed property transfer assessments and federal environmental assessments (under the Canadian Environmental Assessment Act) for the divestiture of approximately 45 federal harbours located throughout Ontario.

Provincial Class Environmental Assessments (EAs) / Consultation Programs

- **Region of York Infrastructure:** completed Schedule B, Class EAs for numerous water and wastewater projects throughout York Region. This included developing consultation programs and undertaking the public, aboriginal, government and agency consultation activities. The following is a list of some of the key Schedule B projects that have been undertaken:
  - York Region – undertaking EA for determining preferred water storage facility (elevated tank or in-ground reservoir) and siting of the facility for the east end of Aurora
  - York Region & City of Toronto – completed EA for preferred route for trunk watermain from Kennedy pumping station to connection on Major Mackenzie Drive
  - Aurora-Newmarket Water – completed EA for a preferred route for new water supply from Maple Reservoir to Aurora
  - Stouffville Elevated Tank – completed EA for preferred sties for new pumping station and elevated tank and preferred alignment for trunk watermain
  - Stouffville Water Supply – completed EA for preferred option for additional long term water supply for Stouffville
  - Pressure District 7 – completed EA for preferred route for watermain connecting Maple and Richmond Hill Pressure District 7
- **Durham Region:** undertaking Schedule B and C, Class EAs (including developing and undertaking public, aboriginal, government and agency consultation activities) for the sustainable community of the Central Pickering Development Plan. The class EAs are for the provision of regional services (water, wastewater, transportation and transit services) throughout the sustainable community of the Central Pickering Development Plan.
- **Durham Region:** completed a Schedule C, Class Environmental Assessment for the provision of additional water pollution control plant capacity for the Bowmanville urban area. Class EA involved evaluation of the siting process and designs for the existing Port Darlington WPCP to meet the additional needs from growth in the Bowmanville urban area. EA process includes undertaking public, aboriginal, government and agency consultation activities.
- **City of Timmins:** undertaking Schedule A+/B, Class EA (including developing and undertaking public, aboriginal, government and agency consultation activities) for upgrades to the Mattagami Water Pollution Control Plant within the Green Infrastructure Funding program. The project also includes development of a Community Liaison Committee to assist in dealing with community concerns related to the updgrades.
- **City of Toronto:** completed Schedule B, Class EA (including developing and undertaking public, aboriginal, government and agency consultation activities) on a route study to define the location and conceptual design for twinning of the existing trunk watermains east of Highway 427 to increase security of supply and improve system hydraulic performance. The Class EA involved evaluation of the routes for the trunk watermain. EA process includes undertaking public, government and agency consultation activities.

- **City of Toronto:** completed a Schedule C, Class EA for the Eastern Beaches Shoreline Stabilization, including undertaking public, government and agency consultation activities.
- **City of Hamilton:** completed Schedule B, Class EA (including developing and undertaking public, aboriginal, government and agency consultation activities) for upgrading the Ferguson Avenue water pumping station. Class EA involved evaluation of the siting process.
- **Peel Region:** completed Schedule B, Class EA (including developing and undertaking public, aboriginal, government and agency consultation activities) for intersection improvements on Steeles Avenue at Finch Avenue and at Highway 50. The Class EA study reviewed and evaluated current and future levels of service at the two intersections in order to recommend a strategy to improve intersection operations. EA process includes undertaking public, government and agency consultation activities.
- **Peel Region:** undertaking Schedule C, Class EA (including developing and undertaking public, aboriginal, government and agency consultation activities) for the preferred wastewater solution to increase capacity to the West Trunk Sewer in Mississauga. Class EA involves evaluation of the siting process and designs for the trunk sewer. EA process includes undertaking public, government and agency consultation activities.
- **Peel Region:** completed Schedule C, Class EA (including developing and undertaking public, aboriginal, government and agency consultation activities) for the preferred water storage solution to service the Mayfield West area of the Town of Caledon. Class EA involved evaluation of the siting process and designs for an elevated tank and the connecting feedermain. EA process includes undertaking public, government and agency consultation activities.
- **Peel Region:** completed an addendum to the Schedule C, Class EA for the preferred water storage solution to service the Mayfield West area of the Town of Caledon. Class EA involved evaluation of the siting process and designs for an elevated tank and the connecting feedermain. EA process includes undertaking public, government and agency consultation activities.
- **Peel Region:** completed an addendum to the Schedule C, Class EA for the Credit Valley Sanitary Trunk Sewer project to revise a portion of the route due to technical issues and easement opportunities. Class EA involved evaluation of the siting process and designs for a sanitary sewer through the Credit Valley area. EA process includes undertaking public, government and agency consultation activities.
- **Town of Blue Mountains:** completed a Schedule C class EA to produce a comprehensive environmental study report for the supply and distribution of water and the collection and treatment of wastewater (including conducting extensive stakeholder consultation).
- **Lake Simcoe Water Treatment Facility Schedule C, Class Environmental Assessment (EA) for York Region:** completed Phases 3 and 4 of the Class EAs process, including assisting on developing and undertaking the public, government and agency consultation activities. Included integration of the York Region Long Term Water Supply Master Plan and Georgina Class EA. Preferred solution included intake, water treatment, transmission and infrastructure.

SUNIL KUMAR, M.B.A., P.Eng.

DIRECTOR, ENERGY

AREAS OF PRACTICE

Wind Energy
Renewable Energy
Cogeneration
Energy Management

LANGUAGES

English

PROFILE

Sunil has over 28 years of experience in the energy and environmental fields. His areas of expertise include planning, renewable energy projects, energy audits, feasibility studies, economic evaluations, technology transfer, design of energy and cogeneration plants, due diligence reviews and management of energy projects.

EDUCATION

M.B.A., York University	1986
B.A.Sc. (Hons.) Mechanical Engineering, University of Toronto	1981

ADDITIONAL TRAINING

Retscreen Renewable Technologies Software Training	2002

PROFESSIONAL AFFILIATIONS

Professional Engineers of Ontario	PEO
Ontario Energy Association	
Canadian Wind Energy Association	
Canadian District Energy Association	

PROFESSIONAL EXPERIENCE

Wind Projects

- **FPLE Canada Wind:** Project Manager for the development of several projects in Ontario. The scope of work included installation of wind monitoring towers, wind resource assessment, municipal approvals support, electrical studies and engineering including interface with Hydro One and IESO, environmental assessment process, direction of field bird and bat surveys, natural heritage surveys, and overall project management.
- **Horizon Wind:** Preliminary electrical engineering and preparation of electrical interconnection applications for 4 sites.
- **City of Barrie:** Installation of wind monitoring tower.
- **Erie Shores Wind Farm (Ph I - 99 MW):** Project Manager as the Owner's Engineer. This included completion of federal and provincial environmental assessments, preliminary electrical design including co-ordination with IESO and Hydro One for impact assessment studies, preliminary foundation design, turbine technology assessments, municipal approvals, stakeholder consultation, and preparation of tender documents for design/build contract.
- **Windstream Energy:** Project Manager for preliminary electrical engineering for 5 sites and for Provincial EA for a large scale wind farm in Ontario.

- **Providence Bay/Spring Bay Wind Farm (15 MW):** Project Manager for the federal and provincial environmental assessments.
- **Lakewind (20 MW):** Project Manager for preliminary engineering phase.
- **GO Transit:** Project Manager for evaluation of sites for potential installation of wind turbines, electrical interconnection preliminary design, turbine technology review and financial analysis. This led to an assignment for preliminary engineering and tender documents preparation for a project at Lisgar Station.
- **Town of Richmond Hill:** Project Manager for pre-feasibility study for a small scale wind farm on municipal property. This included techno-economic evaluation and wind resource monitoring.
- **Northumberland Hills Hospital/Lakeside Utilities:** Feasibility study for potential applications of wind, solar photovoltaic and solar thermal technologies.
- **Windfall Energy Centre:** Project Manager for electrical preliminary engineering. This included interfacing with the utility and preparation of capital cost.
- **Regional Municipality of Niagara:** Project Manager for pre-feasibility study.
- **Vector Wind Energy:** Project Manager for preliminary engineering for three wind sites in Ontario.

Cogeneration/Power Generation

- **Markham District Energy:** Project Manager for several projects including site plan development and preliminary engineering for a $20 million facility; chiller plant expansion; owner's engineer for a 5 MW cogeneration plant.
- **Toronto Community Housing Corporation:** Technical and economic evaluation of the interconnection of the TCHC and TWRC district energy systems.
- Cogeneration feasibility study for an industrial facility for load displacement (2-4 MW). The study included review of biomass and natural gas fuel options, estimates of capital and operating costs, and financial modelling.
- Studies for cogeneration/power generation projects. This included preparation of feasibility studies, heat balances, examination of alternative configurations, system optimization, capital and operating cost estimates, financial evaluations and environmental impact. This covered a wide range of technologies and steam hosts ranging from less than 1 MW using reciprocating engines to over 100 MW using gas turbines.
- **Public Works and Government Services Canada:** Conceptual engineering for a 2-4 MW cogeneration facility for the RCMP Vanier Complex (Ottawa). It included load analysis, energy balance, equipment sizing and layout, and financial analysis.
- **Due Diligence for TransCanada Power:** This involved three cogeneration plants then owned by Westcoast Power in the size range of 50 to 115 MW. The role involved review of BOP mechanical systems, heat balances, technical review of project agreements, assisting in review of O&M costs and coordinating the preparation of the report.
- **Due Diligence for Corpfinance:** This involved two biomass plants (7.5 MW and 12.5 MW) then owned by Drayton Valley. The role involved review of BOP mechanical systems, environmental issues, O&M practices and costs, capital

expenditure program, technical review of project agreements, and overall financial evaluation.

- Mechanical engineering for an international combined cycle power plant. It involved system design, preparation of equipment specifications, bid analysis, vendor information review, work planning, design coordination and client interface. Played a key role in plant heat balances, coordination of noise study and mitigation plan, steam and water system design.
- Involved in several aspects of detailed engineering for the Meridian Combined Cycle Cogeneration plant at a refinery (jointly owned by Transalta & Husky Oil) including preparation of PIDs, mechanical, piping and controls equipment sizing.

Energy Efficiency

- **Region of Durham:** Project Manager for Energy Studies at 9 facilities covering water plants, wastewater plants, pumping stations, office buildings and nursing homes. The scope included field visits, analysis of opportunities, cost-benefit analysis, and training workshop for Region staff.
- **Region of Halton:** Project Manager for Energy Audits at 6 wastewater treatment plants (in progress). Scope includes baseline use analysis, VFDs, cogeneration, process modifications and controls, and metering systems.
- **Region of Niagara:** Project Manager for an energy study of 6 water treatment plants, 9 wastewater treatment plants and remote sites. Scope included analysis of energy bills, variable frequency drives, process controls, cogeneration, pump selection, new technologies and benchmarking parameters.
- **Region of Durham:** Lead for preparation of an Energy Management Plan for the Courtice WPCP.
- Responsible for the development and implementation of the industrial Demand Side Management program at an energy utility. This included a program for boiler and steam system auditing of facilities. Energy audits were conducted at over 40 facilities identifying potential savings in excess of $4 million per year.
- **Union Gas Energy Efficiency Program:** Audit of 12 facilities in the industrial, institutional and commercial sectors to determine actual savings as a result of implementing energy efficiency projects.

PUBLICATIONS AND PRESENTATIONS

Publications

- “Combustion Control Techniques to Reduce NO_x Emissions from Industrial Boilers” published in *Pulp & Paper Canada Journal*, 1995.

Presentations

- “Industrial Natural Gas Technologies for the Mining and Metallurgy Industry” presented at the Canadian Institute of Mining and Metallurgy Conference, 1993.
- “A Utility’s Role in the Development and Marketing of Industrial Gas Technologies” presented at The International Gas Union Conference, 1995.
- “Challenges of Natural Gas Combustion” presented at Combustion Canada Conference, 1996.

- "The Meridian Cogeneration Project" presented at the Power Generation International Conference, 1999.
- "Emissions Trading Overview" presented at Low NO_x Boilers and Energy Efficiency Workshop, 2003.

TERENCE RASMUSSEN, M.B.A., M.A.Sc.

PROJECT MANAGER - ENERGY

AREAS OF PRACTICE

Wind Energy

Renewable Energy

Financial Analysis

Site Assessment and Remediation

PROFILE

Terence has over 8 years of experience in the energy and environmental fields. His areas of expertise include project management, renewable energy projects, feasibility studies, financial evaluations, environmental assessments and permitting, sustainability studies and site assessment and remediation.

He is currently the Project Manager for all aspects of the environmental work related four Ontario wind projects including the submission of Renewable Energy Approvals documents. He has also completed numerous feasibility studies for wind and solar projects in Ontario including fatal flaw analyses.

Mr. Rasmussen has extensive experience interpreting and applying the Renewable Energy Approvals Regulation to wind and solar projects in Ontario. He frequently consults with and provides feedback to both the MOE and MNR on new and existing regulations applying to renewable energy projects.

EDUCATION

B.Sc. (Hons.) Biology, McMaster University	1996
M.A.Sc. Applied Chemistry, University of Toronto,	2000
M.B.A., Schulich School of Business, York University	2009

PROFESSIONAL AFFILIATIONS

Ontario Energy Association

Canadian Wind Energy Association

Canadian Solar Industries Association

CAREER

Project Manager, Energy, GENIVAR	2009 - Present
Team Leader, Environmental Site Assessment & Remediation, Jacques Whitford, Markham, ON	2005 - 2008
Project Manager, Environmental Site Assessment & Remediation, Jacques Whitford, Markham, ON	2003 - 2005
Project Scientist, Site Assessment & Remediation, AMEC, Calgary, AB	2001 - 2003

PROFESSIONAL EXPERIENCE

Wind Projects

→ **NextEra Energy Canada Wind:** Project Manager for the development of four wind projects in Ontario with a combined proposed nameplate capacity of over 300 MW. The scope of work included managing all aspects of obtaining a

Renewable Energy Approval including: public notifications; public meetings; co-ordination of bird, bat, natural heritage and archaeological studies; meetings with governmental agencies; noise ground-truthing and impact studies; shadow flicker studies; and completion of reports and mapping.

- **SunEdison Canada**: Project Manager for the Renewable Energy Approvals permitting of a proposed 10 MW solar farm in Eastern Ontario. The scope of work included managing all aspects of obtaining a Renewable Energy Approval including: public notifications; aboriginal consultation; public meetings; co-ordination of natural heritage and archaeological studies; meetings with governmental agencies; noise impact studies; and completion of reports and mapping
- **City of Dryden:** Project Manager for the Renewable Energy Approvals permitting of a proposed 5 MW solar farm in Dryden, Ontario. The scope of work included managing all aspects of obtaining a Renewable Energy Approval including: public notifications; MTO permitting; public meetings; co-ordination of natural heritage and archaeological studies; meetings with governmental agencies; noise impact studies; and completion of reports and mapping
- **City of Barrie:** Installation of wind monitoring tower, analysis of wind resource availability and site constraint analysis.
- **Regional Municipality of Durham**: Wind Power Pre-Feasibility Study including wind resource analysis and site constraint analysis.

Solar Projects

- **EDF-Enexco:** Project Manager for the development of several projects in eastern Ontario. The scope of work included site plan approvals and permitting support.

Renewable Energy Studies

- **Ontario Realty Corporation:** Completed a report detailing the Renewable Energy Approvals process and project development steps for large scale wind and solar projects. This report also provided a summary of common lease terms used for renewable energy projects and a survey of lease rates for land used for wind and solar projects.

Financial Analysis

- **Confidential Client:** Provided financial analysis as a part of a feasibility study for a proposed Energy to Waste Facility.
- **Confidential Client**: Market analysis of the wind power industry to determine points of entry and financial attractiveness for a Fortune 500 company.

Environmental Studies

- **Ontario Ministry of the Environment:** Project Manager for Regulatory and Best Practices Review of industry and government standards, regulations and guidelines for the protection of source water.
- **Petro-Canada:** Project Manager for the assessment and remediation of soil and groundwater contamination on numerous sites across Ontario.
- **Toronto Transit Commission:** Project Manager for the assessment of chlorinated solvent groundwater contamination.

- **Sobeys**: Project Manager for the assessment and remediation of a brownfields redevelopment project including construction support and post construction monitoring.
- **Various Clients**: Project Manager / Project Scientist for the assessment and remediation of soil and groundwater at numerous sites across Ontario, Alberta, British Columbia and the Northwest Territories.

GENIVAR

ENVIRONMENT

CRAIG S. WOOD, Environmental Scientist, B.Sc.

SENIOR PROJECT MANAGER

AREAS OF PRACTICE

Environmental Impact Assessments

Environmental Permitting

Environmental Effects Monitoring

Restoration

Site closure

Sediment characterization

Process water reduction and effluent treatment

Biodiversity

Environmental audits

Process optimization

Contaminated soil management

Mine closure plans

LANGUAGES

English

French

PROFILE

Craig Wood is an environmental scientist with over thirty years experience in the mining and pulp and paper sectors of Noranda Inc. before joining GENIVAR. Mr. Wood holds a BSC in Biology and has extensive knowledge of base metal exploration, mining and mineral processing sectors. Mr Wood has been involved in evaluating the environmental impacts associated with all aspects of the mining cycle from the exploration phase through construction, operation and closure and post closure monitoring including permitting. In addition, Mr Wood is a well-respected researcher who has conducted numerous research projects with Environment Canada on the effects of mining and pulp and paper effluents on the receiving environment. Mr. Wood has a solid expertise in a variety of different fields, e.g. environmental impact assessments, site closures, restoration, sediment characterization, environmental audits, process water reduction and effluent treatment.

EDUCATION

B. Sc., Biological Sciences, Concordia University, Montreal	1977

ADDITIONAL TRAINING

Noranda 6-Sigma Brown Belt Project on (5 weeks training) Thiosalt Oxidation Optimization at Brunswick Mining, NB	2002
Air and Waste Management Association National PM2.5 Monitoring Program Short Course, Florida	2002
Noranda Auditor Training Workshop – Environmental Management Framework, Bathurst, NB	2000
Establishing Effective Work Teams, Total Quality, Noranda Technology Center	1997
Milling College on Environmental Controls, Noranda Technology Center	1997
Minimum Effluent Mill Symposium, The Technical Association of the Pulp and Paper Industry, Atlanta, Georgia	1996
Activated Sludge Plant Operations Short Course, The Technical Association of the Pulp and Paper Industry, Atlanta, Georgia	1995
Creating and Using Wetlands for Wastewater disposal and Water Quality Improvement, University of Wisconsin-Madison, College of Engineering, Madison, Wisconsin	1994
Managing Time, IBM Education and Training Services, Noranda Technology Center	1994
The Leadership Challenge – Working With Others, Niagara Institute, Niagara, Ontario	1991
Project Leadership Seminar, Queen’s University School of Business, Noranda Technology Center	1991

Noranda Inc. – Environmental Audit Training Course, Toronto, Ontario	1991
Effective Presentation – Greta Berlin – Noranda Technology Center	1989

CAREER

Senior Project Manager, Environmental Studies, GENIVAR	2003 to date
Principal Scientist, Environment, Noranda Inc. – Technology	2000-2002
Principal Scientist, Environment, Noranda Forest/Nexfor Technology	1997-2000
Senior Scientist, Environment, Noranda Forest Inc.	1995-1997
Environmental Scientist, Noranda Forest Laboratory	1990-1995

PROFESSIONAL EXPERIENCE

Environmental Monitoring

- Prepared the Permitting and Environmental Assessment sections for the 5 different options of the rehabilitation feasibility study for the Cliff Central Heating and Cooling Plant (CHCP), located in Ottawa, for Public Works Government Services Canada (Jan-May 2010)
- Revised the Technical Specifications and scope of work for both the Asbestos Abatement and selective demolition of Boiler No. 1 and for the complete demolition of the interior of the Boiler plant in the Cliff Central Heating and Cooling Plant located in Ottawa for Public Works Government Services Canada (Dec 2009 - April 2010)
- Environmental and Arsenic specialist in the Value Engineering Services provided the Ontario Ministry of Environment for the Deloro Mine Site Cleanup Project (Dec 2009)
- Prepared an internal Environmental Impact Assessment Study for Alcoa Corporate on the modernization of the Baie Comeau Aluminum smelter (2009)
- In collaboration with the Grand Counsel of the Cree, Cree Regional Authority, developed and implemented the Opemiska Mine Tailings Dam Failure environmental monitoring program and geotechnical review of the restoration plans (2009 – ongoing)
- Completed an evaluation of the options for remediating HAP, PBC and metal contaminated marine sediments including the dredging method and treatment option including an option of storing the sediments in waterproof cells, Baie Comeau (2008). Client: Alcoa
- Gaspé Mine Closure project, Murdochville, Quebec: Management of hazardous substances (asbestos, lead, arsenic, beryllium, etc) and working with large scale decommissioning reams and remediation contractors. Senior Environmental consultant (Since 2007) . Client: Xstrata Copper Canada
- In collaboration with the Alcoa Remediation Workgroup characterized the marine sediments (PAH, PCB and metals) and determined the sedimentation rates in the Baie des Anglais (Since 2005)

- Prepared the mine closure plan for the mining permit for the advanced exploration project at the Dianor Leadbetter project site
- Developed a action plan for arsenic emissions for GBDC's silver-based metal Refinery in response to a Provincial Officer Report
- Optimized the Restigouche Mine Water treatment plant and dewatered the open pit mine. Negotiated new temporary effluent discharge limits with the New Brunswick DOE
- Prepared the Federal Environmental Screening Assessment and permit applications for the Trent University Stanley Adamson Powerhouse re-development
- Managing the environmental component of the BHP-Billiton- Selbaie Mine and LaSarre concentrate loading facility restoration (2005 – ongoing)
- Prepared the Provincial and federal environmental screening assessments and the permit applications for the new Domtar hydroelectric power plant in Ottawa (2004 – ongoing)
- Conducted a second aquatic environmental baseline survey for Quinto Technology's graphite deposit (2005)
- Transport Quebec. Conducted the environmental monitoring of the dredging of the Hudson-Oka ferry channel (2005)
- Prepared the federal Environmental Evaluation including the permitting for Agriculture Canada for the Expansion and re-modelling of the Small Animal Hospital, University of Montreal, Saint-Hyacinthe Campus (2005)
- Prepared the federal Environmental Evaluation and permitting for the Agro-environmental research facility for funding under the Canada Development Economic for Quebec Region, University of Montreal, Sainte-Hyacinthe Campus (2005)
- Developed a sediment characterization program and permit applications for the proposed dredging of the Hudson-Oka ferry channel (2004)
- Conducted an aquatic baseline environmental survey for Quinto Technology's graphite deposit (2004)
- Designed and conducted lake habitat characterization programs for Matagami and Mont Wright mines for the loss of fisheries habitat under the Fisheries Act (2004)
- Baseline environmental studies and operational management plans for three military manoeuvre corridors on CFB Petawawa
- Aquatic Environmental Effects Monitoring, Study design for Noranda Inc. Matagami Division (ongoing)
- Aquatic Environmental Effects Monitoring, Study designs for McWaters Mines Inc, Kiena, Sigma and East Malartic mines (2003)
- Aquatic Environmental Effects Monitoring, Study design for Quebec Cartier Mining, Mont Wright Mine (2003)
- Aquatic Environmental Effects Monitoring, Historical data report for Noranda Inc. Matagami Division (2003)
- Aquatic Environmental Effects Monitoring, Historical data report for Inmet Mining Corporation, Troilus Mine (2003)

- Aquatic Environmental Effects Monitoring, Historical data report for Agnico-Eagle Mines Limited, Laronde Division (2003)
- Developed and implemented a joint Noranda Forest Inc./Environment Canada research program at the three pulp and paper operations to assess the potential of pulp and paper mill effluents to cause reproductive impairment in wild fish
- Demonstrated the effectiveness of mini-mesocosm as a viable alternative to a benthic survey for the National Environment Effects Monitoring program in collaboration with Environment Canada's National Water Research Institute in a two-year study
- Initiated and implemented a two-year research program with Environment Canada to assess the suitability of using forage fish in the EEM program to monitor impacts from pulp and paper effluents at the Thurso and Masson operations
- Designed and built a state-of-the-art mobile toxicity laboratory to conduct on-site fathead minnow life cycle bioassays to assess the endocrine disrupting effects of pulp mill effluents
- Developed and implemented the Forest Laboratory environmental program including toxicity evaluations, solid waste management, effluent minimization, novel treatment technologies, and forestry issues with annual budgets in excess of $1 million/year in order to meet present and future environmental regulations and issues
- Evaluated the use of chemical tracers in pulp and paper mill effluents as one of two industry members of Environment Canada's Ontario Region Environmental effects Monitoring Tracer Working Group, and presented the results at an International conference on the Environmental Fate and Effects of pulp mill effluent
- Conducted a technical evaluation of a novel carbon sequestration technique Joint Venture opportunity and recommended funding
- Complied and edited a Biologically Supported Water Covers Manual for tailings and sludge ponds for use by mill personnel
- Provided on-site environmental expertise to Ontario Northern Railways on behalf of Noranda/Falconbridge after the sulphuric acid train derailment in Temagami
- Designed and conducted a toxicity identification program that identified biocides and a floor cleaner as the causative agents of sub-lethal toxicity in a 1200 ton per day fine paper mill
- Determined that a toxicity failure at a calcium bi-sulphite pulp and paper mill was due to excess chlorine used to reduce filamentous bacteria in the treatment plant mill
- Represented Noranda Forest Inc. (Nexfor Inc.) on the Canadian Pulp and Paper Association (CPPA) Environmental Effects Monitoring (EEM) committee from 1990 to 2000 in developing and implementing a cost effective and scientifically sound EEM program with Environment Canada
- Promoted and influenced cooperation between industry and government on the National EEM Technical Management and EEM Research committees
- Coordinated the implementation of the EEM program for the Atlantic Region pulp and paper industry

- Achieved high quality Cycle 1 EEM final reports for 5 Nexfor pulp and paper mills in NB, Quebec, Ontario and BC, by selecting, supervising, auditing and editing consultant's work. Cycle 2 EEM reports also achieved the same high quality
- Acted as the scientific expert for Brunswick Mining on the Daly Pointe Reserve and the Nepisiguit River fisheries management committees
- Designed and conducted in-plant toxicity and BOD balances and flow programs at 5 pulp and paper mills to fulfill remedial action plans as required in the Federal Pulp and Paper effluent regulations
- Designed, developed, piloted and implemented forestland management audits, five audits conducted
- Developed and implemented a long-term watershed monitoring program using benthic invertebrates to evaluate effects of summer and winter clear-cutting on water quality in Northern Quebec
- Catalogued wood waste inventories and potential environmental liabilities at 18 forestry operations (pulp and paper, OSB, and sawmills, closed sawmills) in North America
- Conducted a preliminary environmental and health risk assessment for a lead and cadmium contaminated concentrate loading facility and recommended soil replacement as a permanent solution
- Represented Noranda at three international workshops on Biodiversity and Mining and achieved common ground on Mining and Biodiversity with international non-government organizations (World Wildlife Fund, IUCN, Friends of the Earth, etc.) while acting as an Industry member on two international Mining and Biodiversity committee

Water Treatment

- Completed 6-Sigma brown belt training and initiated a 6-Sigma project on thiosalt oxidation optimization at Brunswick Mining to avoid a $1.5 M dollar capital and a $0.5 M operating cost
- Used hydraulic retention time studies in an aerated lagoon to identify short-circuiting and total oxygen requirements for complete BOD oxidation for 600 ton per day sulphite mill
- Developed an experimental protocol to evaluate the organochlorine emissions from the Magnola process water pond
- Designed and implemented water minimization programs at 5 pulp and paper mills
- Developed and implemented an odor control strategy for pulp mill wastewater treatment plant sludge
- Identified urea as the cadmium source in 600 ton per day hardwood Kraft mill secondary treatment plant sludge compliance issue. Developed and communicated cadmium specifications for urea to supplier, no further cadmium compliance issues
- Prepared mercury reporting requirements and prepared Hg specifications for chemical suppliers

Air Emissions

- Prepared the atmospheric emission environmental specifications for the Basis of Design specifications for a new boiler and two fluidized beds for a pharmaceutical company
- Evaluated the applicability of Oriented Strand Board fluidized bed continuous dryer temperature monitoring equipment for Noranda inc.'s Magnola's serpentine fluidized bed to improve drying efficiency.
- Designed and implemented a 6-month $PM_{2.5}$ ambient air monitoring program at a primary lead smelter to establish a baseline $PM_{2.5}$ database
- Evaluated the use of SO_2 as a catalyst to improve organochlorine destruction efficiencies in the Bio-Thermica units at Noranda Inc., Magnola plant (2002)
- Demonstrated the efficiency of portable and cost effective US EPA approved MiniVol $PM_{2.5}$ ambient air sampler against the industry standard model Teom 1400a continuous $PM_{2.5}$ monitor in monitoring ambient air $PM_{2.5}$ levels
- Designed and conducted a comprehensive Volatile Organic Carbon (VOC) monitoring program for a new Oriented Strand Board product and determined that the additional VOC loading could be treated in the current air emission treatment system
- Conducted an audit of an out-of-compliance air washer/biofilter unit at an Oriented Strand Board (OSB) plant. Prepared action plan for unit to meet compliance by upgrading the air-washer and piloting the biofilter to determine number of units and operating conditions

Other Studies

- One of fifteen members of the Noranda Inc. Scenario planning team responsible for researching and construction four plausible scenarios of the world twenty years in the future. Provided recommendations on how Noranda could survive in any one of the four scenarios. As a result, Noranda divested its forestry, oil and gas interest to focus on mining
- Solicited, reviewed and selected new ideas across the company for further funding as one of three Innovation Core Team members responsible for a $1 M annual budget
- Conducted two Environmental Management framework audits at Aluminum rolling mills

Environmental Scientist and Ecology Group Leader, Mining Division

- Directed a staff of two permanent employees and contract workers
- Defined the terms of reference for environmental studies covering new and existing mines, selected contractors, and managed programs to ensure that set standards were adhered to
- Conducted detailed biological monitoring of terrestrial and aquatic habitats in mining, smelting, and/or manufacturing sectors, which involved planning, conducting fieldwork, sample preparation, sending and receiving samples, analysis and quality control, data analysis, interpretation and report writing
- Handled the technical revisions of the Noranda Technology Center water quality criteria review document, a summary of Provincial, Federal and US water quality objectives for heavy metals, and updated the manual on a regular basis

- Implemented the rebuilding of Atlantic salmon and brook trout stocks in the Nepisiguit River, New Brunswick, the establishment of walleye populations in Lac Dufault, Northern Quebec, using new enhancement techniques (upwelling incubation boxes, reconditioning of black salmon and aquaculture cages)
- Modified and implemented west coast salmon incubation box technology, for use with Atlantic salmon eggs, to the Nepisiguit Salmon Association, a local non-profit group. Over 8 million fry have been released since 1985 from the incubation boxes
- Created and implemented a brook trout rehabilitation program on the Nepisiguit River in collaboration with the Nepisiguit Trout Association and New Brunswick Department of Natural Resources
- Prepared annual project plans, budgets, liaised with operations, and managed resources through project completion
- Required to be constantly up-to-date on the status of government environmental regulations, especially the Ontario MISA program, Quebec Directive 19, as well as the CCREM water quality objectives and the Fisheries Act
- Participated in preparation and implementation of mine closure plans
- Collaborated in the development of a resources management plan for the Fraser Inc. New Brunswick freehold land
- Developed and implemented two-5 year management plans for Brunswick Mining's Daly Reserve, a 100-hectare nature reserve that included flora and fauna identification. The Maritime Ringlet butterfly was found on-site and listed as an endangered species and a recovery plan currently being developed
- Designed, developed and implemented a lobster larvae and gammerid bioassay methodology to evaluate the toxicity of a phosphate fertilizer plant final effluent
- Developed and conducted moss bag surveys to determine the metal contributions from a metallurgical plant to the surrounding vegetation

New technology applications

- Developed and/or applied the following new technologies that reduced cost or provided a competitive advantage and achieved an improvement in environmental performance:
  - Designed and constructed a peat moss cover to eliminate waste water treatment plant sludge and landfill odor at James Maclaren Industries, Thurso hardwood Kraft mill with no further odor complaints from the town
  - Demonstrated the feasibility of Dissolved Air Flotation (DAF) to remove BOD, COD and toxicity from the bleachery sewer to reduce loading to the treatment plant including endocrine disrupting chemicals and to provide opportunities to burn the DAF sludge in the boiler and re-use the treated bleachery water back in the mill
  - Evaluated the use of Semi-permeable Membrane Devices (SPMD) an artificial fish liver to monitor the health St. John River fish health in collaboration with Environment Canada and Fraser Papers Inc, Edmundston
  - Demonstrated wetland technology as a low capital cost treatment alternative for wood waste leachate and metal removal from mine effluent

- Demonstrated trickling filter technology to treat acid condensate to reduce COD/BOD loading to the treatment plant at Edmundston. 30% COD/BOD reduction achieved
- Demonstrated that ozone, as an alternative to secondary treatment, removed sub-lethal toxicity and color in the Madawaska, Maine, 1200 tons per day fine paper mill's final effluent
- Applied a new Microtox® chronic toxicity test as surrogate to *Ceriodaphnia* for Toxicity Reduction Evaluations in a paper mill in collaboration with the Maine Department of the Environment
- Developed a final effluent odor removal strategy for a 100,000-ton per day copper mine in Peru
- Conducted in-plant piloting of high-pressure filter technology to clean vacuum pump seal water for re-use on paper machines to reduce freshwater use
- Evaluated the use of spruce and aspen bark leachate to control hemlock loper and/or spruce budworm damage to NFI forest in collaboration with the University of New Brunswick

GENIVAR **ENVIRONMENT**

RICHARD BRUNET, Ph.D, biologist

ENVIRONMENT DIRECTOR, ESTRIE

AREAS OF PRACTICE

Wildlife inventories, monitoring and management

Detection of rare and endangered species

Wildlife habitat characterization

Evaluation of human impacts on ecosystems

Development of specialized protocols and monitoring tools

LANGUAGES

French

English

PROFILE

Richard Brunet, senior biologist, has a PhD degree in ornithology and faunal toxicology from the University of Sherbrooke. However, he has developed, through more than 20 years of experience, a solid expertise in many other fields including fish and bat populations monitoring. Expert in identifying its client's needs, he is behind the development of specialized methodologies and technological tools serving the joint management of human and natural environments. Issued from a longstanding collaboration, his close contacts within departments and universities are a major asset for the management of sensitive projects. These last 20 years, he led hundreds of projects in environment, for public and private clients, throughout Quebec, the Maritimes, Ontario and Alberta.

EDUCATION

Doctoral degree in Biology (Avian toxicology), Université de Sherbrooke	1996
Master degree in Biology (Avian behavior), Université de Sherbrooke	1990
Bachelor degree in Biology, specialization in ecology, Université de Sherbrooke	1987

PROFESSIONAL EXPERIENCE

Environment director, Estrie, GENIVAR, Sherbrooke	2009-…
General director, Envirotel 3000 inc., who became part of GENIVAR in 2009, Sherbrooke	2002-2009
Part-time lecturer for the « Environmental research seminar » of the Environmental management master degree, Université de Sherbrooke	1998-1999
Vice-president, Envirotel inc.	1989-2001
Laboratory teaching assistant, Université de Sherbrooke	1994-1995
Part-time lecturer for ornithology courses, Université de Sherbrooke	1993
Research assistant, GREBE inc. and Université de Sherbrooke	1989-1990
Teaching assistant, Université de Sherbrooke	1987-1996
Research assistant, Université de Sherbrooke	1985-1986

OTHERS

Regional vice-director of the Québec association of Biologist (Association des biologiste du Québec)	2005 - 2008
Radio speaker on environment and wildlife issues	2001 - 2008
Member of follow-up groups of the Sectorial committee of environmental labour (Membre des groupes de suivi de projet du Comité sectoriel de main-d'œuvre de l'environnement)	2000 - 2002
Organisation of a conference on genetically modified organism	2000
Member of the board of directors of the Wildlife and environment research institute (Institut de Recherche en Environnement et Faune (IREF))	1998-2001
Organisation of a conference on private land management	1998
Regional director of the Québec association of Biologist (Association des biologistes du Québec)	1996-2002
NSERC scholarship	1991-1994

PROFESSIONAL ASSOCIATION

Member of the Québec association of Biologist (Association des biologistes du Québec)	ABQ

PUBLICATIONS

Technical Reports – Chiropteras

- Brunet, R. (2003). Mine Ascot (Estrie) : fermeture d'un puits incliné, Envirotel 3000: 10 p.
- Brunet, R. (2005). Expertise sur la présence de chiroptères au 20, route des Mésanges, St-Christophe d'Arthabaska, Envirotel 3000: 21 p.
- Brunet, R. (2007). Expertise sur la présence de chiroptères au 2350, chemin des Bouleaux, St-Boniface de Shawinigan, Envirotel 3000: 20 p.
- Brunet, R. (2008). Expertise sur la présence de chiroptères au 12, rue Jordi-Bonet, Granby, Envirotel 3000: 18 p.
- Brunet, R. et V. Bouffard (2003). Expertise sur la présence de chiroptères dans l'habitation du 4381, boulevard Lasalle, Verdun, Envirotel 3000: 20 p.
- Brunet, R. et R. Duhamel (2002). Aménagement de la mine Bruneau (Nord-du-Québec), Envirotel 3000: 9 p.
- Brunet, R. et R. Duhamel (2002). Mine Acton (Acton Vale, Montérégie) : fermeture de deux puits de mine. Rapport de fin des travaux, Envirotel 3000: 7 p.
- Brunet, R. et R. Duhamel (2002). Mine Yves (Eastman, Estrie) : fermeture de deux ouvertures minières, Envirotel 3000: 7 p.
- Brunet, R. et R. Duhamel (2002). Aménagement de la mine Bruneau (Nord-du-Québec), Envirotel 3000: 9 p.

- Brunet, R. et R. Duhamel (2002). Aménagements d'hibernacles de chauves-souris: Mine Acton (Montérégie), Mine Petit Pré (Région de Québec), Mine Saint-Robert Métals (Estrie), Mine Saint-Fabien (Bas-du-Fleuve). Envirotel 3000**:** 22 p.
- Brunet, R. et R. Duhamel (2002). Évaluation préliminaire de la mine Opémiska comme hibernacle à chiroptères (Nord-du-Québec), Envirotel 3000**:** 16 p.
- Brunet, R. et R. Duhamel (2003). Aménagement et suivi des hibernacles de chiroptères au Québec. Rapport synthèse, Envirotel 3000**:** 20 p.
- Brunet, R. et R. Duhamel (2003). Évaluation détaillée de la mine Opémiska comme hibernacle à chiroptères (Nord-du-Québec), Envirotel 3000**:** 22 p.
- Brunet, R. et R. Duhamel (2003). Mine Halifax (Estrie) : installation et suivi d'un compteur automatisé à chiroptères, Envirotel 3000**:** 9 p.
- Brunet, R. et R. Duhamel (2004). Réserve écologique de la Mine-aux-Pipistrelles: intervention d'urgence, Envirotel 3000**:** 8 p.
- Brunet, R. et R. Duhamel (2004). Sauvetage de la mine Opémiska comme hibernacle à chiroptères (Nord-du-Québec), Envirotel 3000**:** 13 p.
- Brunet, R. et R. Duhamel (2005). Échantillonnage 2005: herpétofaune, micromammifères et chiroptères (LabMag Iron Ore Projet - contrat LGP-08-108), Envirotel 3000**:** 51 p.
- Brunet, R. et R. Duhamel (2005). Plan d'échantillonnage 2005: insectes, herpétofaune, micromammifères et chiroptères (LabMag Iron Ore Project), Envirotel 3000**:** 14 p.
- Brunet, R. et R. Duhamel (2005). Revue de littérature et plan d'échantillonnage: insectes, herpétofaune, micromammifères, et chiroptères (LabMag Iron Ore Project), Envirotel 3000**:** 46 p.
- Brunet, R. et R. Duhamel (2007). Suivi des conditions abiotiques dans l'hibernacle à chiroptères de la caverne du « Trou de la Fée », Envirotel 3000**:** 19 p.
- Brunet, R. et R. Duhamel (2009). Inventaire des chiroptères du Bois Beckett (Sherbrooke) – saison 2008, Envirotel 3000 : 19 p.
- Brunet, R. et R. Duhamel (2010). Inventaire des chiroptères : secteur de la Tour Daigle (Sept-Îles), Envirotel 3000 : 16 p.
- Brunet, R. et M. Gauthier (1996). Réparation et installation de deux sections de clôture à l'ancienne mine Québec Copper (canton de Bolton), Envirotel**:** 5 p.
- Brunet, R. et M. Gauthier (1996). Fabrication et installation d'une dalle de béton pour sécuriser une ouverture de l'ancienne mine Québec Copper (canton de Bolton), Envirotel**:** 5 p.
- Brunet, R. et M. Gauthier (1997). Aménagement de la mine Western Ashley (région de la Mauricie) en vue d'en protéger l'accessibilité pour les chauves-souris, Envirotel**:** 14 p.
- Brunet, R. et M. Gauthier (1999). Évaluation, aménagement et suivi des hibernacles de chauves-souris au Québec. Rapport quinquennal, 1994-1999, Envirotel**:** 32 p.
- Brunet, R. et M. Gauthier (2000). Aménagement de la caverne 'Le trou-de-la-fée' en vue d'y protéger la population de chauves-souris hibernantes, Envirotel**:** 17 p.

- Brunet, R. et M. Gauthier (2000). Évaluation, aménagement et suivi des hibernacles de chauves-souris au Québec, Envirotel: 37 p.
- Brunet, R., M. Gauthier, et al. (1998). Inventaire acoustique des chauves-souris du Parc de la Gaspésie - été 1997, Envirotel: 29 p.
- Brunet, R., M. Gauthier, et al. (1998). Inventaire acoustique des chauves-souris du Parc du Mont Orford, Envirotel: 29 p.
- Brunet, R., M. Gauthier, et al. (1999). Évaluation du potentiel des mines désaffectées comme habitat hivernal des chauves-souris cavernicoles au Québec : Travaux réalisés en 1998-1999, Envirotel: 37 p.
- Brunet, R., J.-F. Masson, et al. (2000). Évaluation, aménagement et suivi des hibernacles de chauves-souris au Québec, Envirotel: 16 p.
- Brunet, R., J. Mc Duff, et al. (1997). Évaluation du potentiel des mines désaffectées comme habitat hivernal des chauves-souris cavernicoles au Québec (Phase 2). Deuxième année, Envirotel: 38 p.
- Brunet, R., J. Mc Duff, et al. (1997). Évaluation hivernale de l'hibernacle de la mine Candego (Réserve Faunique des Chics-Chocs). Rapport de la visite du 4 février 1997, Envirotel: 8 p.
- Brunet, R., J. Mc Duff, et al. (1998). Évaluation sommaire du potentiel de la mine Bruneau comme hibernacle de chauves-souris, Envirotel: 11 p.
- Brunet, R., J. Mc Duff, et al. (1999). Restauration de l'hibernacle de la mine Candego, (Réserve Faunique des Chic-Chocs). Compte rendu des travaux d'octobre 1998, Envirotel: 9 p.
- Brunet, R., J. Mc Duff, et al. (2003). Conception et construction d'un compteur à chiroptères automatisé et économique pour les ouvertures minières. Rapport recherche et développement, Envirotel 3000: 12 p.
- Brunet, R., J. Mc Duff, et al. (2006). Inventaire des chiroptères - domaine du parc éolien de la Matapédia, Envirotel 3000: 23 p.
- Brunet, R., J. Mc Duff, et al. (2006). Inventaire des chiroptères - domaine du parc éolien de Saint-Hubert / Saint-Honoré, Envirotel 3000: 26 p.
- Brunet, R., J. Mc Duff, et al. (2006). Inventaire des chiroptères - domaine du parc éolien du Granit, Envirotel 3000: 25 p.
- Brunet, R., J. Mc Duff, et al. (2006). Inventaire des chiroptères - domaine du parc éolien Roussillon, période de migration 2006, Envirotel 3000: 23 p.
- Brunet, R., J. Mc Duff, et al. (2006). Inventaire des chiroptères - domaine du parc éolien Saint-Constant, période de migration 2006, Envirotel 3000: 23 p.
- Brunet, R., J. Mc Duff, et al. (2007). Inventaire des chiroptères - domaine du parc éolien de Cacouna, Envirotel 3000: 22 p.
- Brunet, R., J. Mc Duff, et al. (2007). Inventaire des chiroptères - domaine du parc éolien de Chaudière-Appalaches, période de reproduction 2006, Envirotel 3000: 23 p.
- Brunet, R., J. Mc Duff, et al. (2007). Inventaire des chiroptères - domaine du parc éolien de Mont-Louis, Envirotel 3000: 22 p.
- Brunet, R., J. Mc Duff, et al. (2007). Inventaire des chiroptères - domaine du parc éolien de St-Ulric / St-Léandre, Envirotel 3000: 22 p.

- Brunet, R., J. Mc Duff, et al. (2007). Inventaire des chiroptères - domaine du parc éolien de Vaudreuil-Soulanges, période de reproduction 2006, Envirotel 3000: 23 p.
- Brunet, R., J. Mc Duff, et al. (2007). Inventaire des chiroptères - domaine du parc éolien des Terres du Séminaire, Envirotel 3000: 22 p.
- Brunet, R., J. Mc Duff, et al. (2007). Inventaire automnal des chiroptères - domaines des parcs éolien d'Amqui, Patapédia et Témiscouata, Envirotel 3000.
- Brunet, R., J. Mc Duff, et al. (2008). Fall Bat Inventory: Ft. Lawrence Wind Farm Project, Envirotel 3000: 14 p.
- Brunet, R., J. Mc Duff, et al. (2008). Inspection de 5 hibernacles à chiroptères à la recherche de signes du « White Nose Syndrome », Envirotel 3000.
- Brunet, R., J. Mc Duff, et al. (2008). Évaluation sur dossier du potentiel des mines d'Abitibi en tant qu'hibernacles à chiroptères, Envirotel 3000.
- Duhamel, R. et R. Brunet (en cours). Pyramid Mountains Park Project – Small mammal and bat surveys. Envirotel 3000 / Genivar sec.
- Envirotel 3000 (2001). Problématique et écologie des chauves-souris au Québec: 56 p.
- Envirotel 3000 (2002). Problématique et écologie des chauves-souris au Québec: 57 p.
- Envirotel 3000 / Genivar sec (2010). Mise en place et suivi de compteurs automatisés à chiroptères (SEDChiros) dans des hibernacles aménagés au Québec depuis 2000, Envirotel 3000 / Genivar sec.
- Envirotel 3000 / Genivar sec (2010). Mise en place et suivi de compteurs automatisés à chiroptères (SEDChiros) dans l'hibernacle de la Mine du Lac-Rose. Envirotel 3000 / Genivar sec.
- Gauthier, M. et R. Brunet (1994). Évaluation du potentiel des mines Candego et Federal comme habitat d'hiver des chauves-souris cavernicoles : Rapport de la visite du 20 et 21 juillet 1994, Envirotel: 13 p. + annexes.
- Gauthier, M. et R. Brunet (1994). Installation de grilles permettant l'accès de la mine Candego (réserve des Chic-Chocs), aux chauves-souris. Rapport de fin des travaux, Envirotel: 17 p.
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- Gauthier, M. et R. Brunet (1997). Aménagement de la mine Emerald en vue d'en protéger l'accessibilité pour les chauves-souris hibernantes, Envirotel: 14 p.
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- Gauthier, M., R. Brunet, et al. (1997). Inventaire acoustique des chauves-souris du Parc du Mont Orford - été 1996, Envirotel: 21 p.
- Gauthier, M., R. Brunet, et al. (1997). Inventaire acoustique des chauves-souris du Parc du Mont Saint-Bruno - été 1996. Rapport final, Envirotel: 18 p.
- Gauthier, M., R. Brunet, et al. (1997). Inventaire acoustique des chiroptères du parc national de la Mauricie - été 1996. Rapport final, Envirotel: 36 p.
- Gauthier, M., R. Brunet, et al. (1998). Inventaire acoustique des chauves-souris du Parc du Mont-Saint-Bruno - été 1997, Envirotel: 30 p.
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- Mc Duff, J., C. Bouchard, et al. (2001). Inventaire acoustique des chauves-souris dans la région de Sept-Iles, Côte-Nord - été 2000, Envirotel: 40 p.
- Mc Duff, J., C. Bouchard, et al. (2001). Inventaire acoustique des chauves-souris dans la région du Nord-du-Québec - été 2000, Envirotel: 35 p.
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- Mc Duff, J., R. Brunet, et al. (1998). Évaluation de la problématique entourant la présence de chauves-souris dans la mine Bruneau, Envirotel: 9 p.
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- Mc Duff, J., R. Brunet, et al. (2000). Développement d'un outil de suivi acoustique des populations de chauves-souris, Envirotel: 86 p.
- Mc Duff, J., R. Brunet, et al. (2001). Inventaire acoustique des chauves-souris dans la région de l'Abitibi-Témiscamingue - été 2000, Envirotel: 40 p.
- Mc Duff, J., R. Brunet, et al. (2001). Suivi de l'effectif de la population de chauves-souris hibernantes dans la mine Bruneau, Envirotel: 43 p.
- Rioux, J., J.-F. Poulin et al. (2010). Étude sur le péril aviaire à l'aéroport de Sept-Îles, Génivar sec. : 158 p.

Technical Reports – Wind farms

- Brunet, R., R. Duhamel, et al. (2008). Biological Features & Impact Assessment – Fermeuse Wind Farm Project, Envirotel 3000.
- Brunet, R., R. Duhamel, et al. (2009). Biological Features – Survey Methodology & Raw Data, Walters Wind Farm Project, Alberta, Envirotel 3000.
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- Brunet, R., R. Duhamel, et al. (2009). Inventaire radar et acoustique des chiroptères : Projet de parc éolien de St-Rémi (Montérégie), Envirotel 3000/Genivar sec.
- Brunet, R., J. McDuff, et al. (2006). Inventaire des chiroptères - domaine du parc éolien de la Matapédia, Envirotel 3000.
- Brunet, R., J. McDuff, et al. (2006). Inventaire des chiroptères - domaine du parc éolien de Saint-Hubert / Saint-Honoré, Envirotel 3000.
- Brunet, R., J. McDuff, et al. (2006). Inventaire des chiroptères - domaine du parc éolien du Granit, Envirotel 3000.
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- Brunet, R., J. McDuff, et al. (2007). Inventaire des chiroptères - domaine du parc éolien des Terres du Séminaire, Envirotel 3000.
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- Envirotel 3000 (2008). Inventaire des chiroptères - domaine du parc éolien de Grand-Métis, Envirotel 3000.

Technical Reports – Avifauna

- Brunet, R., R. Duhamel, et al. (2008). Biological Features & Impact Assessment – Fermeuse Wind Farm Project, Envirotel 3000.
- Brunet, R., R. Duhamel, et al. (2003). Inventaire aviaire du Parc écoforestier de Johnville, Envirotel 3000 : 7 p. + annexes.
- Brunet, R., R. Duhamel, et al. (2006). Inventaires fauniques Garnisson Valcartier, Envirotel 3000 : 314 p.
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- Brunet, R., R. Duhamel, et al. (2009). Biological Features – Survey Methodology & Raw Data, McLaughlin Wind Farm Project, Alberta, Envirotel 3000.

PUBLICATIONS

Scientific articles

- BRUNET, R. et J. Mc Duff. 1996. Impact of dimethoate on the circadian cycle of body temperature of european starling (Sturnus vulgaris). Archives of Environmental Contamination and Toxicology.
- BRUNET, R. et J. Mc Duff. 1996. Time-course study of the impact of dimethoate on the circadians cycles of body temperature and activity of rock dove (Columbia livia). Biological Rhythm Research.
- BRUNET, R. et J. Mc Duff. 1997. Recovery of Brain Cholinesterases of Brown-headed Cowbirds from Organophosphate Intoxication: Effect of Environmental Temperature. Bulletin of Environmental contamination and toxicology. 59:285-291

REMI DUHAMEL, biologiste, M.Sc.

BIOLOGIST

AREAS OF PRACTICE

Small mammal ecology

Wildlife surveys, monitoring and management

Rare and endangered species

Wildlife habitat assessment and management

Environmental impact studies

LANGUAGES

French

English

PROFILE

Rémi Duhamel, M.Sc., is a senior biologist and small mammal specialist with GENIVAR. Mr. Duhamel has devoted his post-graduate studies to the study of small mammals. In 1999, he was in charge of training professionals from Quebec ministry of natural resources and wildlife (MRNF) regarding the biology and survey techniques of small mammals. In 2006, he was retained by the MRNF to write a report on the situation of Rock vole (*Microtus chrotorrhinus*), a species of concern, in Quebec. In the past 20 years, Rémi Duhamel has conducted numerous wildlife surveys (small mammals, big game, herpetofauna, bats, etc.). Among those surveys, about a hundred focused specifically on small mammals in France, Quebec and other Canadian provinces (Maritimes and Alberta). Within GENIVAR, Mr. Duhamel is also in charge of projects in other fields, including wildlife habitat assessment and management as well as environmental impact studies.

EDUCATION

1994	D.E.A. in Evolution and Ecology Université de Montpellier II
1992	Maîtrise in Biology of Organisms and Populations Université d'Orléans
1991	Licence in Biology of Organisms and Populations Université d'Orléans
1990	D.E.U.G. série B – Natural Sciences Université d'Orléans

Study equivalence notice certifying that this education corresponds to a M.Sc. in Pure and Applied Sciences / specialisation in Ecology. Has also completed schooling for a PhD in Biology at University of Sherbrooke (1995-1999).

ADDITIONAL TRAINING

→ First Aid for the Workplace

PROFESSIONAL AFFILIATIONS

1997 - Present	Quebec Association of Biologists

CAREER

2009 - Present	Biologist, GENIVAR
2002-2009	Biologist, Envirotel 3000 inc. *(GENIVAR acquisition)*
2001	Biologist, Club Cap Natashquan inc., Québec Biologist, ZIP Comittee of Îles de la Madeleine

REMI DUHAMEL, biologiste, M.Sc.

	Biologist, Envirotel inc., Sherbrooke
2000	Lecturer, University of Sherbrooke, Biology department Biologist, Groupe HBA Experts-Conseils S.E.N.C.
1999-2000	Teaching Assistant, University of Sherbrooke, Biology department
1999	Lecturer: Faune et Parcs Québec (FAPAQ) Biologist, Envirotel inc., Sherbrooke Teaching Assistant, University of Sherbrooke, Biology dept.
1998	Biologist, RAPPEL, Sherbrooke

PROFESSIONAL EXPERIENCE

- GENIVAR and Envirotel 3000 inc. – Biologist : Project manager of environmental impact studies (wind farms, mines, etc.), specialist in small mammals, evaluation and conservation of Chiropteran habitats, animal surveys (herpetofauna, small mammals, mammals), population monitoring, environmental management of construction sites, habitat diagnosis and restoration, environmental emergencies management, evaluation of mitigation measures, management development projects.
- Club Cap Natashquan inc. – Biologist : Completion of a development and integrated resource management plan for the Club Cap Natashquan Outfitter, faunal surveys, identification of habitats and sites of ecotouristic interest, monitoring of Salmonidae populations. Determination of management orientations and priorities.
- ZIP Comittee of Îles de la Madeleine – Biologist: Elaboration of a Plan of Action and Ecological Rehabilitation, intake with local interveners in the environmental field, targeting of environmental problems in the archipelago.
- Groupe HBA Experts-Conseils S.E.N.C., Department of Environment – Biologist: Environmental evaluations, in particular for Public Works and Government Services Canada (PWGSC), evaluation of site contamination potential for Hydro-Quebec and many other projects, international or not, including habitat description and preliminary impact study along a new hydroelectrical line for Hydro-Quebec.

PUBLICATIONS

- Duhamel R., Delattre P., Quéré J.-P. & Giraudoux P. (2000): Landscape effects on the population dynamics of the fossorial form of the water vole (*Arvicola terrestris* sherman). *Landscape Ecology* **15**: 89-98
- Giraudoux P., Delattre P., Habert M., Quéré J.-P., Deblay S., Defaut R., Duhamel R., Moissenet M.-F., Salvi D. & Truchetet D. (1997): Population

dynamics of fossorial water vole (*Arvicola terrestris* sherman): a land use and landscape perspective. *Agriculture, Ecosystems & Environment* **66**: 47-60

- Berteaux D., Duhamel R. & Bergeron J.-M. (1994): Can radio collars affect dominance relationships in *Microtus*? *Canadian journal of Zoology* **72**:785-789

TECHNICAL REPORTS

Technical reports – Chiropteras

- Brunet, R. (2003). Mine Ascot (Estrie) : fermeture d'un puits incliné, Envirotel 3000: 10 p.
- Brunet, R. (2005). Expertise sur la présence de chiroptères au 20, route des Mésanges, St-Christophe d'Arthabaska, Envirotel 3000: 21 p.
- Brunet, R. (2007). Expertise sur la présence de chiroptères au 2350, chemin des Bouleaux, St-Boniface de Shawinigan, Envirotel 3000: 20 p.
- Brunet, R. and V. Bouffard (2003). Expertise sur la présence de chiroptères dans l'habitation du 4381, boulevard Lasalle, Verdun, Envirotel 3000: 20 p.
- Brunet, R. et R. Duhamel (2002). Aménagement de la mine Bruneau (Nord-du Québec), Envirotel 3000**:** 9 p.
- Brunet, R. et R. Duhamel (2002). Mine Acton (Acton Vale, Montérégie) : fermeture de deux puits de mine. Rapport de fin des travaux, Envirotel 3000**:** 7 p.
- Brunet, R. et R. Duhamel (2002). Mine Yves (Eastman, Estrie) : fermeture de deux ouvertures minières, Envirotel 3000**:** 7 p.
- Brunet, R. et R. Duhamel (2002). Aménagement de la mine Bruneau (Nord-du-Québec), Envirotel 3000**:** 9 p.
- Brunet, R. et R. Duhamel (2002). Aménagements d'hibernacles de chauves-souris: Mine Acton (Montérégie), Mine Petit Pré (Région de Québec), Mine Saint-Robert Métals (Estrie), Mine Saint-Fabien (Bas-du-Fleuve). Envirotel 3000**:** 22 p.
- Brunet, R. et R. Duhamel (2002). Évaluation préliminaire de la mine Opémiska comme hibernacle à chiroptères (Nord-du-Québec), Envirotel 3000**:** 16 p.
- Brunet, R. et R. Duhamel (2003). Aménagement et suivi des hibernacles de chiroptères au Québec. Rapport synthèse, Envirotel 3000**:** 20 p.
- Brunet, R. et R. Duhamel (2003). Évaluation détaillée de la mine Opémiska comme hibernacle à chiroptères (Nord-du-Québec), Envirotel 3000**:** 22 p.
- Brunet, R. et R. Duhamel (2003). Mine Halifax (Estrie) : installation et suivi d'un compteur automatisé à chiroptères, Envirotel 3000**:** 9 p.
- Brunet, R. et R. Duhamel (2004). Réserve écologique de la Mine-aux-Pipistrelles: intervention d'urgence, Envirotel 3000**:** 8 p.

REMI DUHAMEL, biologiste, M.Sc.

- Brunet, R. et R. Duhamel (2004). Sauvetage de la mine Opémiska comme hibernacle à chiroptères (Nord-du-Québec), Envirotel 3000**:** 13 p.
- Brunet, R. et R. Duhamel (2005). Échantillonnage 2005: herpétofaune, micromammifères et chiroptères (LabMag Iron Ore Projet - contrat LGP-08-108), Envirotel 3000**:** 51 p.
- Brunet, R. et R. Duhamel (2005). Plan d'échantillonnage 2005: insectes, herpétofaune, micromammifères et chiroptères (LabMag Iron Ore Project), Envirotel 3000**:** 14 p.
- Brunet, R. et R. Duhamel (2005). Revue de littérature et plan d'échantillonnage: insectes, herpétofaune, micromammifères, et chiroptères (LabMag Iron Ore Project), Envirotel 3000**:** 46 p.
- Brunet, R. et R. Duhamel (2007). Suivi des conditions abiotiques dans l'hibernacle à chiroptères de la caverne du « Trou de la Fée », Envirotel 3000**:** 19 p.
- Brunet, R. et R. Duhamel (2009). Inventaire des chiroptères du Bois Beckett (Sherbrooke) – saison 2008, Envirotel 3000 : 19 p.
- Brunet, R. et R. Duhamel (2010). Inventaire des chiroptères : secteur de la Tour Daigle (Sept-Îles), Envirotel 3000 : 16 p.
- Brunet, R., R. Duhamel, et al. (2006). Inventaires fauniques Garnison Valcartier: recueil cartographique, Envirotel 3000: 53 p.
- Brunet, R., J. Mc Duff, et al. (2008). Évaluation sur dossier du potentiel des mines d'Abitibi en tant qu'hibernacles à chiroptères, Envirotel 3000.
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- Envirotel 3000 (2001). Problématique et écologie des chauves-souris au Québec**:** 56 p.
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Technical reports – Wind farms

- Brunet, R., J. Mc Duff, et al. (2006). Inventaire des chiroptères - domaine du parc éolien de la Matapédia, Envirotel 3000: 23 p.
- Brunet, R., J. Mc Duff, et al. (2006). Inventaire des chiroptères - domaine du parc éolien de Saint-Hubert / Saint-Honoré, Envirotel 3000: 26 p.

REMI DUHAMEL, biologiste, M.Sc.

- Brunet, R., J. Mc Duff, et al. (2006). Inventaire des chiroptères - domaine du parc éolien du Granit, Envirotel 3000: 25 p.
- Brunet, R., J. Mc Duff, et al. (2006). Inventaire des chiroptères - domaine du parc éolien Roussillon, période de migration 2006, Envirotel 3000: 23 p.
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- Brunet, R., J. Mc Duff, et al. (2007). Inventaire des chiroptères - domaine du parc éolien de Mont-Louis, Envirotel 3000: 22 p.
- Brunet, R., J. Mc Duff, et al. (2007). Inventaire des chiroptères - domaine du parc éolien de St-Ulric / St-Léandre, Envirotel 3000: 22 p.
- Brunet, R., J. Mc Duff, et al. (2007). Inventaire des chiroptères - domaine du parc éolien de Vaudreuil-Soulanges, période de reproduction 2006, Envirotel 3000: 23 p.
- Brunet, R., J. Mc Duff, et al. (2007). Inventaire des chiroptères - domaine du parc éolien des Terres du Séminaire, Envirotel 3000: 22 p.
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- Duhamel, R. et R. Brunet (2010). Wolfe Island Shoals Wind Project – Bat and bird study. Scope of work, Envirotel 3000 / Genivar sec : 28 p.
- Envirotel 3000 (2008). Inventaire des chiroptères - domaine du parc éolien de Grand-Métis, Envirotel 3000.

GENIVAR | E N V I R O N N E M E N T

JULIE MC DUFF, biologiste, M.Sc.

BIOLOGIST

AREAS OF PRACTICE

Bat inventories and management

Habitat assessment

Vegetation surveys

Environmental impact studies

LANGUAGES

French

English

PROFILE

Julie Mc Duff, senior M.Sc. biologist, is a Project director with GENIVAR. Ms. Mc Duff is one of the very few recognized bat experts in Quebec with respect to the evaluation and management of their wintering habitats, the establishment of inventory techniques and the identification of species based on sonograms. For more than 15 years working in environment, Ms. Mc Duff has also developed a strong expertise in plant ecology, from vegetation surveys to habitat delineation and habitat quality assessments. She has also built a reliable knowledge of ArcGIS and its applications to environmental projects. Her great organisational and communication skills help her to efficiently lead multi-disciplinary teams.

EDUCATION

1995	M.Sc. Biology (Avian toxicology), University of Sherbrooke
1993	B.Sc. Biology, specialization in Ecology, University of Sherbrooke

ADDITIONAL TRAINING

- First Aid for the Workplace
- Vertical rope training

DISTINCTIONS

1993-1995	Recipient of a research scholarship from the Fonds pour la Formation de Chercheurs et Aide à la Recherche (FCAR).
1990-1993	Recipient of a Canada Scholarship

PROFESSIONAL AFFILIATIONS

1993 - Present	Quebec Association of Biologists

CAREER

2009 - Present	Biologist, Project Director, GENIVAR
2001-2009	Biologist, Envirotel 3000 inc.*(GENIVAR acquisition)*
1992-2001	Biologist, Envirotel inc.
1993-1995	Teaching Assistant, University of Sherbrooke
1992-1993	Research Assistant, University of Sherbrooke

JULIE MC DUFF, biologiste, M.Sc.

PROFESSIONAL EXPERIENCE

- GENIVAR and Envirotel 3000 inc. – Senior Biologist – Project Director : In charge of the development and operation of bat acoustic surveys, bat identification, bat winter surveys in hibernaculum (mining galleries) and maternities, bat capture with diverse techniques (Japonese net, harp trap, barrel net), use of the software "Anabat 54" for the production of bat sonograms, bat identification from sonograms, environmental impact studies, survey and identification of plants, birds, small mammals and herpetofauna, animal tracks identification, bird capture with Japonese net, bird banding, use of telemetry techniques, capture (seine, hoop-net, line fishing) and identification of fish, mapping of faunal resources. (2001-Present)
- Envirotel inc. - Biologist and Research Assistant : Evaluation of the potential of abandoned mines in Quebec as bat hibernation sites, bat identification, bat winter surveys in hibernaculum (mining galleries) and maternities, bat capture with diverse techniques (Japonese net, harp trap, barrel net), bat acoustic surveys, use of the software "Anabat 54" for the production of bat sonograms, bat identification from sonograms, environmental impact studies, aquatic plant survey, plant community study (population density, abundance, dominance, etc.), survey and identification of birds, mammals, small mammals and herpetofauna, animal tracks identification, benthic macro-invertebrate identification, evaluation of the impact of chloropyrifos on American Robin (Turdus migratorius) in natural habitats, bird capture with Japonese net and barrel net, bird banding, use of telemetry techniques, study on gulls' population dynamics, evaluation of bird colony productivity, creation of a fish collection, capture (seine, hoop-net, electric fishing, line fishing) and identification of fish, mapping of faunal resources. (1992-2001)
- University of Sherbrooke, Biology Department - Teaching Assistant : Assist the professor for the « Biostatistics 1 », « Biostatistics 2 » and « Plant Biogeography » courses. (1993-1995)
- University of Sherbrooke, Chronobiology laboratory - Research Assistant : Scientific literature review and update, coordination of research activities and project management, bird capture (Japonese net), help in the conception of controlled temperature chambers and electronic scales, manipulation, preparation and maintenance of laboratory animals. (1992-1993)

PUBLICATIONS

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- Brunet, R., J. Mc Duff, et al. (2003). Conception et construction d'un compteur à chiroptères automatisé et économique pour les ouvertures minières. Rapport recherche et développement, Envirotel 3000: 12 p.
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- Brunet, R., J. Mc Duff, et al. (2008). Fall Bat Inventory: Ft. Lawrence Wind Farm Project, Envirotel 3000: 14 p.
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- Brunet, R., J. Mc Duff, et al. (2008). Évaluation sur dossier du potentiel des mines d'Abitibi en tant qu'hibernacles à chiroptères, Envirotel 3000.
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- Mc Duff, J. (2002). Identification de chauves-souris enregistrées au Parc de la rivière des Mille-Iles - étté 2001., Envirotel 3000: 13 p. + 12 annexes.
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- Mc Duff, J., C. Bouchard, et al. (2001). Inventaire acoustique des chauves-souris dans la région de Sept-Iles, Côte-Nord - été 2000, Envirotel: 40 p.
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- Mc Duff, J. et V. Bouffard (2002). Rapport d'identification des enregistrements de chauves-souris réalisés au lac à Poléon (Ville de la Baie) à l'été 2002, Envirotel 3000: 4 p.
- Mc Duff, J. et V. Bouffard (2003). Rapport d'identification des enregistrements de chauves-souris réalisés au site Bon Pasteur (Québec) à l'été 2002, Envirotel 3000: 4 p.

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- Mc Duff, J. et V. Bouffard (2004). Identification des chauves-souris enregistrées dans le cadre du Réseau québécois d'inventaires acoustiques des chauves-souris - saison 2003. Annexe, Envirotel 3000.
- Mc Duff, J. et V. Bouffard (2004). Rapport d'identification des enregistrements de chauves-souris réalisés aux lacs Nérée et à Poléon (Usine Alcan Grande-Baie) à l'été 2003, Envirotel 3000: 5 p.
- Mc Duff, J. et V. Bouffard (2004). Rapport d'identification des enregistrements de chauves-souris réalisés dans la région du Nord-du-Québec au cours de la saison 2004, Envirotel 3000
- Mc Duff, J. et V. Bouffard (2004). Rapport d'identification des enregistrements de chauves-souris réalisés dans la région du Nord-du-Québec au cours des étés 2001 et 2003, Envirotel 3000
- Mc Duff, J. et V. Bouffard (2005). Identification des chauves-souris enregistrées dans le cadre du Réseau québécois d'inventaires acoustiques de chauves-souris - saison 2004, Envirotel 3000.
- Mc Duff, J. et V. Bouffard (2005). Rapport d'identification des enregistrements de chauves-souris réalisés au Parc national des Monts-Valin, secteur Ste-Marguerite, au cours de l'été 2003, Envirotel 3000.
- Mc Duff, J., V. Bouffard, et al. (2003). Identification des chauves-souris enregistrées dans le cadre du Réseau Québécois d'inventaires acoustiques des chauves-souris - saison 2002, Envirotel 3000: 126 p. + annexes.
- Mc Duff, J., V. Bouffard, et al. (2003). Inventaire acoustique des chauves-souris dans le Parc écoforestier de Johnville - été 2002, Envirotel 3000: 40 p.
- Mc Duff, J. et R. Brunet (2000). Réseau québécois d'inventaires acoustiques de chauves-souris. Guide du participant - saison 2000, Envirotel: 35 p. + annexes.
- Mc Duff, J. et R. Brunet (2000). Réseau québécois d'inventaires acoustiques des chauves-souris. Manuel du formateur, Envirotel: 78 p.
- Mc Duff, J. et R. Brunet (2001). Identification des chauves-souris enregistrées dans le cadre du Réseau québécois d'inventaires acoustiques des chauves-souris - saison 2000. Annexe, Envirotel: 41 p. + 1 annexe (document séparé).
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Waste Management

PROFILE

Mr. Reeves, B.Sc., M.Sc. is a biologist with GENIVAR who has a diverse background in environmental sciences, ecology, and biology gained through experience in academia, and work experience in both the private and public sectors. He has conducted multi-scale vegetation assessments and worked on a variety of long-term abundance and diversity indices. Dan has extensive experience collecting, analyzing, and reporting publication quality scientific data through experiences at several institutions. Work history paired with educational background has given him a well rounded knowledge of scientific methods, an understanding of the scientific process from concept to publication, and solid scientific communication skills.

EDUCATION

M.Sc., Biology, Laurentian University	2007
B.Sc., Biology, Nipissing University	2004

ADDITIONAL TRAINING

Levels 1, 2 and 3 WSIB Training	2010
WHMIS	2009
OSHA	2009
MTO/DFO/OMNR Fisheries Protocol Training Course, Ministry of Transportation	2009
Managed Forest Plan Approver	2008
Ontario Benthos Biomonitoring Network Course	2008
Ontario Stream Assessment Protocol Course	2008
Hazwoper 24 Hour Training Course	2008
Class 2 Backpack Crew Leader Electrofishing Course	2008

PROFESSIONAL AFFILIATIONS

Environmental Protection and Compliance Program Advisory Committee Board Member, Canadore College	
Managed Forest Plan Approver	MFPA
Ontario Benthos Biomonitoring Network	OBBN
Ontario Stream Assessment Network	OSAP
Society for the Study of Amphibians and Reptiles	SSAR
Canadian Association of Herpetologists	CAH
American Society of Ichyologists and Herpetologists	ASIH

CAREER

Biologist, GENIVAR	2009 - Present
Biologist, Jagger Hims Limited *(GENIVAR acquisition)*	2008 - 2009
Lab Instructor, Laurentian University	2005 - 2007
Wildlife Technician (Level 2), Ontario Ministry of Natural Resources	2003 - 2004
Lab Assistant, Ontario Clean Water Agency	2002

PROFESSIONAL EXPERIENCE

Natural Sciences

- **Phytoremediation Planning, Installation, and Monitoring**, Burlington, Ontario (2008 - Present): An Industrial producer of plastics had contaminated lands on and adjacent to their production site. A phytoremediation plan was submitted as an alternative containment and remediation on the site. The project was approved by the MOE, constructed and is monitored on an on-going basis to ensure efficacy. Client: Confidential.
- **Ravenshoe Road Residential Development**, Udora, Ontario (2010). An Environmental Impact Study was required for the approval of a proposed residential development within the Greenbelt. GENIVAR was retained to conduct surveys of sensitive wildlife and habitat and to develop measures to eliminate or mitigate environmental impacts. Client : iPLANcorp.
- **Solar Project Natural Heritage Assessments**, Various Locations (2010). Ontario Regulation 359/09 requires proposed alternative energy projects to complete Natural Heritage Assessments investigating Significant Wildlife and their habitats, and the potential for project impacts. Along with GENIVAR's Energy Group, Natural Heritage Assessments have been prepared for a variety of sites throughout Ontario. Client: Various.
- **23196 Warden Avenue, Environmental Impact Study**, East Gwillimbury, Ontario (2008): An Environmental Impact Study with an emphasis on a Provincially Significant Wetland was conducted for the client in order to determine what portion of the property could potentially be developed and to identify environmental concerns for the proposed uses. Client: Anne McKeown.
- **243 Rhodes Circle**, Newmarket, Ontario (2008): Through consultation with the client and the local Conservation Authority, it was found that while within the boundaries of the Oak Ridges Moraine, the development proposed by the landowner did not need a full Natural Heritage Evaluation. A scoped Natural Heritage Report was created based on the specific requirements of the site, saving the client time and money. Client: John Charbonneau.
- **Part Lot 24, Concession 8,** Muskoka Lakes, Ontario (2008): A 20 year managed forest plan was created for inclusion into the Managed Forest Tax Incentive Program, saving the landowner 75% on their taxes for the eligible areas for a period of 10 years. The plan was created using good forestry practices with an emphasis on the short and long-term goals of the landowner. Client: Patrick Mann.

- **4233 10th Sideroad**, Bradford West Gwillimbury, Ontario (2008): A 20 year managed forest plan was created for inclusion into the Managed Forest Tax Incentive Program, saving the landowner 75% on their taxes for the eligible areas for a period of 10 years. The plan was created using good forestry practices with emphasis on the short and long-term goals of the landowner. Client: Lillian Montgomery.
- **16255 Keele St.,** King City, Ontario, (2009): Through consultation with the client and the local Conservation Authority, a Natural Heritage Evaluation was prepared to satisfy the requirements of the Oak Ridge's Moraine Act. Client: Yong Seung Kim & Yun Hwa Kim.
- **Foxbridge Residential Development**, Uxbridge, Ontario (2009): The owner of a golf course required an Environmental Impact Study on the proposed severance of a piece of their property to develop a small community of single-family dwellings. Emphasis was on the potential impacts to the nearby Provincially Significant Wetland and how to incorporate the community and the associated stormwater retention pond into the existing golf course. Client: Miller Golf Design Group.
- **206 Churchill Avenue**, King City, Ontario, (2009): Through consultation with the client and the local Conservation Authority, a Natural Heritage Evaluation was prepared to satisfy the requirements of the Oak Ridges Moraine Conservation Act. Client: Catrina Jankowski.
- **17165 Jane Street**, King City, Ontario (2009): A scoped Natural Heritage Report was created based on the specific requirements of the site. Client: Ted Barron.
- **625 Wagg Street**, Uxbridge, Ontario (2009): A scoped Natural Heritage Report was created based on the specific requirements of the site. Client: Josh Henderson.
- **Closed Ancaster Landfill Site**, Hamilton, Ontario (2009): The City of Hamilton was concerned that a closed landfill site was leaking leachate and negatively impacting an off-site pond. Through field examinations, benthic communities were collected to determine if the landfill site was affecting the pond and to what degree. Client: City of Hamilton.
- **Sporting Clay Club**, Kawartha Lakes, Ontario (2009): The Municipality approached us to Peer Review another firm's Environmental Impact Statement to ensure that it conformed to local and Provincial legislation. Client: City of Kawartha Lakes.
- **Durham Pit**, Durham Region, Ontario (2008): Conducted a field sampling protocol to capture and identify benthic invertebrates. The identified benthos were used to determine the degree to which the water body was impacted by the existing rock quarry and to develop a baseline for future operations. Client: Regional Municipality of Durham.
- **Ministry of Transportation**
  - **Natural Environment Study – Aggregates**, Parry Sound, Sudbury, North Bay, Kirkland Lake, and Renfrew Districts, Ontario (2008): Conducted Level 1 and 2 Natural Environmental Study to determine the impacts of the proposed granite quarries at 17 different locations. Emphasis was taken to determine if any rare or threatened species existed on or within 120 m of the sites, and to map their locations. It was found that a river system adjacent to one property would be affected by the proposed works, and

specific mitigative measures were developed to ensure that the negative effects on the site and the surrounding areas were minimized.

Geotechnical

- **Minthorn Park**, Richmond Hill, Ontario (2009): On site testing of concrete was performed to determine if the concrete being poured was of adequate quality for the application. Client: Town of Richmond Hill.

Aggregates and Industrial Minerals

- **Quarry Application and Agricultural Irrigation Investigation**, Melancthon Township, Ontario (2008-2009): Groundwater and surface water sampling as part of a protocol to ensure conformity with the Certificate of Approval.

Waste Management

- **County of Simcoe**
  - **Various Landfills**, Elmvale, Oro, Bradford West Gwillimbury, and Medonte, Ontario (2009): Water sampling as part of a sampling protocol to ensure conformity with the Certificate of Approval.

PUBLICATIONS AND PRESENTATIONS

Publications

- Reeves, D.J. and Litgus, J.D. "Using morphometrics to investigate sexual size dimorphism in spotted turtles (Clemmys guttata"). Copeia (in review). 2009.
- Reeves, D.J. and Litzgus, J.D. "Demography of an island population of spotted turtles (Clemmys guttata) at the species' northern range limit". Northeastern Naturalist, 2008, 15(3): 417-430.
- Reeves, D.J. and Litzgus, J. D. "Modelling the critical habitat use of spotted turtles (Clemmys guttata) at the northern extreme of the species range" (in prep. for submission to Journal of Herpetology) 2008.

Presentations

- Reeves, D. J.. "Spotted Turtles (Clemmys guttata) at the northern extreme of their range: Habitat Quantification, General Ecology, and Population Dynamics". Guest Speaker, Nipissing Naturalists, North Bay, Ontario (1 hour oral presentation), 2009.
- Reeves. D. J. "Careers in the Environmental Services". Presented to Environmental Success and Environmental Business Management first and second year Technician/Technologist students. Canadore College, North Bay, Ontario (2 hour oral presentation), 2008 and 2009.
- Reeves. D. J. and J. D. Litzgus. "Demography of an island population of spotted turtles (Clemmys guttata) at the species' northern range limit". The Canadian Amphibian and Reptile Conservation Network, Kingston, Ontario (poster presentation in absentia), 2007.
- Reeves, D. J. and J. D. Litzgus. "Using morphometrics to investigate body size dimorphism in spotted turtles (Clemmys guttata)". Joint meeting of Ichthyologists and Herpetologists, St. Louis, MO (oral presentation), 2007.
- Reeves, D. J. and J. D. Litzgus. "Demography of an island population of spotted turtles (Clemmys guttata) at the species' northern range limit". Joint

meeting of Ichthyologists and Herpetologists, St. Louis, MO (poster presentation), 2007.

- Reeves, D. J. and J. D. Litzgus. "Using morphometrics to investigate body size dimorphism in spotted turtles (Clemmys guttata"). First annual Canadian Society for Ecology and Evolution, University of Toronto, Toronto, Ontario (oral presentation), 2007.
- Reeves, D. J. and J. D. Litzgus. "Using morphometrics to investigate body size dimorphism in spotted turtles (Clemmys guttata)". Biology symposium, Laurentian University, Sudbury, Ontario (oral presentation), 2007.
- Reeves, D. J. and J. D. Litzgus. "Modeling the critical habitat use of spotted turtles (Clemmys guttata) at the northern extreme of the species range". Joint Meeting of Ichthyologists and Herpetologists, New Orleans, LA (poster presentation), 2006.
- Reeves, D. J. and J. D. Litzgus. 2006. "Modelling the critical habitat use of spotted turtles (Clemmys guttata) at the northern extreme of the species range". Biology symposium, Laurentian University, Sudbury, Ontario (oral presentation), 2006.
- Reeves, D. J., J. D. Litzgus and D. Hackett. "Effect of temperature on physiology and behavior in two colour morphs of the red-backed salamander (Plethodon cinereus". The Canadian Amphibian and Reptile Conservation Network, Kingston, Ontario (oral presentation), 2005.

ANN ROCCHI, M.Sc.

AQUATIC BIOLOGIST

AREAS OF PRACTICE

Fish Compensation Design & Implementation

Transportation

Industrial

Urban Development

Stormwater Management

Water Supply & Sewage Disposal

Municipal Solid Waste

Fisheries Resource Planning

Comparative Freshwater Community Studies

Fish Population Monitoring

Terrestrial Ecological Surveys

Species at Risk Reviews

First Nations Training

International Training & Consulting

PROFILE

Ann Rocchi, M.Sc., has over 17 years of experience in fish and wildlife studies in both Canada and abroad. Ms. Rocchi's experience includes launching detailed bio-inventories and environmental impact assessments as both project manager and as part of a multi-disciplinary team. Collective work in lake and river systems includes: fish inventories, habitat assessment, fish habitat compensation design, implementation and monitoring, comparative community studies, age and diet analysis, and zooplankton, benthos and water chemistry collection. She has designed sampling programs, supervised installation works and monitored post-construction success of numerous fish habitat compensation projects throughout Ontario, Quebec and British Columbia. She has also worked closely with First Nations and remote communities in northern Canada to co-operatively develop fisheries projects, including consultation and the collection and interpretation of baseline data.

In addition, Ms. Rocchi is a Fisheries Assessment Specialist under the MTO/DFO/MNR Fisheries Protocol. She is thereby qualified to identify the sensitivity of fish and fish habitat to the potential impacts of proposed construction projects, recommend mitigation and compensation methods and provide all aspects of reporting and auditing with minimum guidance from the federal Department of Fisheries and Oceans.

EDUCATION

M.Sc. in Fisheries Biology, York University, Toronto, ON	1993
B.Sc. in Biological Sciences, University of Guelph, Guelph, ON	1988

ADDITIONAL TRAINING

Chimney Swift Monitoring Workshop, Bird Studies Canada, Lindsay, ON	2010
Level II Electrofishing Certification, Guelph, ON	2009
Species at Risk Fish Identification Workshop, Royal Ontario Museum, Toronto, ON	2007
Fisheries Assessment Specialist ranking, MTO/DFO/OMNR Protocol for Protecting Fish and Fish Habitat on Provincial Transportation Undertakings Training, Toronto, ON	2006
Data Sensitivity Training Course, Natural Heritage Information Centre, Peterborough, ON	2003

PROFESSIONAL AFFILIATIONS

American Fisheries Society, Ontario Chapter Member	2004

CAREER

Aquatic Biologist, Environment, GENIVAR	2010 - Present
Project Biologist, McIntosh Perry Consulting Engineers Ltd.	2010
Project Biologist / Project Manager, Jacques Whitford/Stantec Consulting Ltd.	2008 - 2010
Project Biologist / Project Manager, Niblett Environmental Associates	2002 - 2008
Project Biologist/Environmental Team Lead, AGRA/AMEC Earth and Environmental Ltd.	1997 - 2002

PROFESSIONAL EXPERIENCE

Municipal and Class Environmental Assessment and Remediation Projects

- Environmental Assessments incorporating historical research, documentation, fisheries, water quality, socio-economic, vegetation, terrestrial and aquatic analysis and wildlife and resources enhancement recommendations. Remediation projects including the analysis

Fish Compensation Design and Implementation

- **Fish Compensation Packages (Aquatic Lead on Design Team):** Prepared numerous fish compensation packages in Ontario and BC. Specifically, these packages involved plans for realigning streams, enhancing instream habitat such as spawning beds or cover pools, improving fish passage, restricting livestock access, and stabilizing banks. Negotiations were successfully conducted with the federal Department of Fisheries and Oceans (DFO) when works resulted in the Harmful Alteration, Disruption or Destruction of fish habitat (HADD). Ann has designed and monitored fish compensation works on the following watercourses:
  - Thompson Creek, Peterborough, ON (rock vortex weirs, rock deflectors, boulder clusters, sweeper logs and native plantings);
  - the Mississippi River, Almonte, ON (walleye spawning bed enhancement and submerged crib structures);
  - the Tay River, Perth, ON (cattle exclusion, alternative watering methods and native plantings); T
  - the Indian River in Tatlock (walleye spawning bed enhancement, removal of log jams and native riparian plantings),
  - Lavallee Creek, Carleton Place, ON (riffle/pool sequences, native plantings),
  - Poole Creek, Stittsville, ON (rock vortex weirs);
  - the York River, Bancroft, ON (creation of an off-channel spawning bay;
  - Sawmill Creek, McKinnons Creek, Mosquito Creek and the Jock River in Ottawa, ON (enhanced habitat complexity, and creation of pike spawning habitat), and;
  - the Halfway River, BC (erosion spurs, rootwad installation and native plantings).

- She has also acted as the Environmental Monitor during construction of the proposed works, and provided post-construction assessment of the success of the compensation measures.

Transportation

- **Baseline Aquatic Surveys and Impact Assessments** (Project Manger and Biologist): Conducted baseline aquatic surveys and completed impact assessments for new roads and improvements to existing roads. These assessments included the crossing of both small streams and large rivers with culverts or bridges. Ann most recently acted as Field Coordinator for the assessment of 90 proposed stream crossings between Montreal and Oshawa for Canadian National Railway. Other recent projects included spawning and fish habitat surveys for the realignment of Bowmanville Creek, the realignment of County Road 9 near Perth, several road extensions in Renfrew County and the City of Ottawa-Carleton, and Ministry of Transportation projects near Peterborough, Whitney, Deseronto and Cameron, Ontario, and Highway 97 North, Prince George, BC. Two major ferry projects included a multi-year impact assessment at ferry crossings on the Mackenzie and Eight Mile Rivers, NWT, and a fish and fish habitat assessment at an existing ferry crossing in Cumberland, on the Ontario/Quebec border. Ann also conducted a fish and fish habitat assessment of the Racing River, BC, for a major bridge replacement and federal CEEA project at km 431 on the Alaska Highway.

Industrial Development

- **Baseline Aquatic Surveys and Impact Assessments** (Project Manger and Biologist): Conducted water quality and fisheries impact assessments for an operating pit in Hearst and a marble quarry expansion near Perth, Ontario. Conducted baseline fisheries assessments for: exposed pipeline on a coldwater stream in Cavan North Monaghan Township near Peterborough, a microhydro project involving Blue-listed bull trout (Salvelinus confluentus) habitat near McBride, BC, walleye spawning surveys for two separate hydro developments on the Otonabee River in Peterborough, and a study of Species at Risk, the threatened river redhorse (Moxostoma carinatum) and endangered American eel (Anguila rostrata), for the expansion of the Almonte hydroelectric generating facility.

Urban Development

- **Baseline Aquatic Surveys and Impact Assessments** (Project Manger and Biologist): Responsible for aquatic impact assessments of urban developments in Peterborough, Lindsay, Uxbridge, Wasaga Beach, Cobourg, Courtice, Brooklin, Bowmanville, Ottawa, Carleton Place and Stittsville, as well as the development of educational facilities in Orillia, East Gwillimbury and Belleville, and a retirement home in Gananoque. She has conducted fisheries assessments for property severances for waterfront lots in Almonte, Sharbot Lake, on Georgian Bay, Lake Scugog, Pigeon and Stony Lakes in the Kawarthas, and in Gatineau Park, Quebec. The impacts of proposed golf courses on water quality and fisheries were evaluated in Bancroft, Buckhorn, Warsaw, Courtice and the Municipality of Clarington. She designed fish compensation measures and provided construction monitoring for stream alignment work in association with the construction of a SmartCentres shopping development in Carleton Place.

Stormwater Management

- **Baseline Aquatic Inventories and Impact Assessments:** Conducted baseline aquatic inventories and impact assessments for stormwater management ponds in Peterborough, Whitby and Ottawa. These projects involved pre-construction, during construction, and post-construction evaluation and monitoring.

Water Supply and Sewage Disposal

- **Fisheries Impact Assessments:** Conducted fisheries impact assessments for proposed extensions and upgrading of communal water supply facilities and sewage disposal facilities in the Courtice and Peterborough areas, as well as a proposed feedermain in Lindsay and Ottawa. Also conducted fisheries assessment for proposed water intake structures to service a popular resort on Stony Lake, outside of Peterborough.

Municipal Solid Waste

- **Aquatic Ecosystem Impact Assessments (Biologist):** Conducted aquatic ecosystem impact assessments for the expansion of the existing landfills site near Sault Ste Marie, North Lancaster and Greely, Ontario. Conducted sampling of fish community to obtain a composite sample of fish flesh for baseline conditions of a human health risk assessment supporting an energy from waste project for the York and Durham Regions.

Fisheries Resource Planning

- **Reconnaissance Level Inventories (Project Manager and Biologist):** Managed large-scale reconnaissance level inventories of fish and fish habitat for major forestry companies operating in watersheds of the upper Fraser River, BC. The distribution of salmonids, gamefish, and endangered fish were documented and fish streams were classified following the standards of the BC Ministry of Environment, Lands and Parks. This information allowed forest licensees to set suitable buffer zones to protect crucial fish habitat.

Comparative Freshwater Community Studies

- **Whole Lake Community Study, Ministry of the Environment and York University (Researcher):** A whole-lake community study conducted by the Ministry of the Environment and York University in Dorset, Ontario. This multi-year project involved a detailed comparison of two oligotrophic lake ecosystems in central Ontario and consisted of limnological, benthos and zooplankton collection, water chemistry analysis and macrophyte identification.

Fish Population Monitoring

- Ms. Rocchi is skilled in mark-recapture population estimate methods and has applied population information to community interaction and diet requirement studies. She is also adept at age determination by scale reading and has used age information to determine year class composition of fish populations. Ms. Rocchi has conducted extensive diet studies on several fish species and has experience in stomach content analysis. Ms. Rocchi was also part of a field team collecting data for Lake Ontario fish population surveys.

Terrestrial Ecological Surveys

- **Vegetation and Bird Surveys:** Performed vegetation and bird surveys in both urban and bush settings, supervised a University of Guelph radio telemetry project to measure juvenile dispersal of beavers, and collected red-winged blackbird eggs for organo-contaminant analysis for the Canadian Wildlife Service. Also conducted an assessment of a proposed retention dam on the beaver community at a busy recreational facility in the City of Prince George, BC and supervised a team literature review of the effects of prescribed burning on vegetation, target ungulate species and non-target species such as songbirds and herptiles for the Ministry of Water, Land and Air Protection, Fort St. John, BC. Participated in raptor and winter bird surveys for potential wind energy sites in rural south-central Ontario.

Species at Risk Reviews

- Conducted baseline fisheries assessments for: a microhydro project involving Blue-listed bull trout (Salvelinus confluentus) habitat near McBride, BC, and a field assessment of suitable habitat requirements for potential Species at Risk, namely, the threatened river redhorse (Moxostoma carinatum) and endangered American eel (Anguila rostrata), for the expansion of the Almonte hydroelectric generating facility. She has participated in the Lake Ontario Atlantic Salmon Restoration program in Cobourg Creek as a parent volunteer.
- Ms. Rocchi also compiled information and geographic locations of documented endangered, threatened or species of special concern within 30 m of the Trent Severn Waterway and co-produced an education package developed to inform shoreline residents of potential Species At Risk on their properties.

First Nations Training and Consulting

- **Environmental Monitoring Training (Instructor):** Facilitated Environmental Monitoring Training for two mature students from the Alderville and Hiawatha First Nations, Rice Lake, Ontario. Participants were instructed in fish habitat compensation and design, water quality monitoring and well monitoring.
- **Baseline Fisheries and Water Quality Assessment Training (Lead Biologist and Instructor):** Ms. Rocchi worked with the people of Tshiigehtchic and Fort McPherson, NWT, to investigate the aquatic effects of ferry operations at the MacKenzie and Peel River crossings. Both rivers have strong social, cultural and economic value to the Gwich'in communities and fish harvesting is still actively practiced. Ann was lead biologist and instructor for water quality sampling, fish sampling and a fish habitat assessment for local coregonid (whitefish) populations as well as other sustenance fish species over a 2 year period.
- **Baseline Fisheries Assessment Training (Instructor):** Supervised and trained First Nations youth from Prince George, Fort St. John, and Smithers, BC, in baseline fisheries assessment for forestry operations. Training included fish sampling techniques, fish habitat assessment and accurate data entry methods.
- **Environmental Monitoring (Fisheries Biologist and Environmental Monitor):** Provided environmental monitoring, reporting and government liaison during the construction of erosion spurs on the Halfway River I.R., Halfway River, BC. The spurs were constructed to prevent further erosion of the band's property, as well as to protect the local drinking water source.

International Training and Consulting

- Acting as the Provincial Information Coordinator for the WWF Irian Jaya Programme, Ms. Rocchi improved information flow between resources, field teams and outside agencies, resulting in increased professional capabilities of Indonesian staff. Ms. Rocchi also directed intensive training to increase computer and library management skills. She was responsible for all written representation of the program and handled information requests from domestic and visiting experts, media and university staff. She fostered cooperative efforts between government, academic and special interest groups, often creating international liaisons.

- **Environmental Baseline Study:** Collected marsupials, lizards and invertebrates for baseline information in Cradle Mountain World Heritage Site, Tasmania, Australia.

PUBLICATIONS AND PRESENTATIONS

Publications

- Photo Credit. Atlantic Salmon Fact Sheet. Ontario Ministry of Natural Resources, 2009.
- Contributor. Oldham, M.J. and W.F. Weller. 2000. Ontario Herpetofaunal Atlas. Natural Heritage Information Centre, Ontario Ministry of Natural Resources.
- Moore, John M., A. Rocchi and S.J. Renyaan. 1996. The Background of Lake Sentani. Prepared for the Department of Forestry of Indonesia and the WWF Irian Jaya Programme. Poster presentation at the Bi-nation Biologists Meeting, Papua New Guinea, 1996.
- Contributions to the updated Irian Jaya chapters in *Irian Jaya: Journey into the Stone Age* (Periplus Editions, 1996) and the *Lonely Planet Guide to Indonesia (*Lonely Planet Publications, 1995).
- Rocchi, A. 1995. The Amazon of Southeast Asia. Working for Wildlife, Fall 1995, WWF Canada.
- Ramcharan, C.W., D.J. McQueen, E. Demers, S. Popiel, A.M. Rocchi, .D. Yan, A. Wong and K.D. Hughes. 1995. A comparative approach to determining the role of fish predation in structuring limnetic ecosystems. Arch.Hydrobiol. 133:389-416.
- Rocchi, A. 1993. Population Structure, Size and Age of Yellow Perch (*Perca flavescens*) in Predator-rich and Predator–free Lakes. M.Sc. Thesis, York University.

Presentations

- Last Name, First Name. “Presentation Title.” Conference or Event, City, State/Province Abbreviation. Month Day, Year

JEAN-LUC DAVIAU, M.A.Sc., P.Eng.

MANAGER, ENVIRONMENTAL HYDRAULICS

AREAS OF PRACTICE

Hydraulic Transients
Network Modeling
Pump & System Tests
GIS-linked Models
Training

LANGUAGES

English
French

PROFILE

Jean-Luc has 20 years of multi-disciplinary experience in the investigation and control of flow or surges (hydraulic transients). An expert in GIS-SCADA-model integration for high-capacity systems, he has developed models or techniques for master plans, treatment plants, break or legal cases, pressure & flow monitoring and pump station (PS) tests. He leads the Centre of Excellence in Hydraulics.

Jean-Luc has helped to develop or test the models: HAMMER, OTTHYMO/VO2/ SWMHYMO & CFA/LFA. He has trained over 200 engineers on Bentley Systems' HAMMER transient software – first created by the Environmental Hydraulics Group (EHG) he has led at GENIVAR for over 5 years. He is fluently bilingual.

EDUCATION

Master's of Applied Science (Civil Eng., GIS & Statistics), University of Ottawa	1998
Bachelor's of Applied Science (Civil Eng., Water Option), University of Waterloo	1992

PROFESSIONAL AFFILIATIONS

Professional Engineers of Ontario (PEO) and Ontario Society of Professional Engineers (OSPE)

American Water Works Association (OWWA/AWWA) and its Research Foundation (WRF)

Water Environment Association Ontario (WEAO), part of Water Environment Federation (WEF)

CAREER

Manager, Environmental Hydraulics, GENIVAR	2005 - Present
Senior Hydraulic Engineer, Environmental Hydraulics Group (EHG)	1996 - 2005
Consultant to EHG, Greenland Engineering Group and JFSA	1995 - 1996
University of Ottawa, Research Associate under NSERC Strategic Grant	1993 - 1995
Engineer-in-Training, Paul Wisner & Associates	1989 - 1992

PROFESSIONAL EXPERIENCE

Wastewater Collection Systems and Forcemains

→ **Dynamic Models & Pre-design for 12 Sewage Collection Systems in Trinidad & Tobago** (2009): Route, build and load 1,000+ pipe models using

GIS. Dynamic simulations with pump start/stop level controls. Sized trunk sewers and forcemains (single model).

- **City of Ottawa Sanitary and Storm Sewer Monitoring (**1990-1992): Installed, calibrated & operated several depth-velocity and insertable flumes as part of assessment of infiltration/inflow (I/I) at 28 sites for 7 years. Also, network of 3 rain gauges, 3 ISCO automatic water quality samplers and 3 floats at 3 SWM ponds.
- **Woodward WWTP Head Works**, Hamilton, ON (2001): Complete hydraulic model of gravity head works from lift station to 2 primary influent channels, 4 screens and 6 Pista-grit vortex tanks with channels from 1.7 to 3.7 m wide. Hydraulic integration removed bottlenecks to pass more flow at less head.
- **Contract Research, Zenon Environmental** (2001): HAMMER model for dynamic simulations of 6 and 8 membrane tank trains to obtain valve and pump times. Effect of bottom-draining tanks (during backwash) on the efficiency of this batch ultra-filtration process. Process innovation is now used widely.
- **City of Toronto Humber Sewage Treatment Plant – 4 Projects** (1999-2004): Modelled entire plant HGL from raw sewage intake channel, primary and secondary plants and the effluent pumping station. Considered various treatment rates (up to 1450 ML/d) and design alternatives. Identified and resolved constraints including: flow imbalances, bottlenecks, submerged weirs, uncontrolled overflows and minor inefficiencies. Hydraulic transients for LLPS and (separately) investigation of transients in blended natural and digester gas.
- **Greenhill Drop Shaft and Tunnel – 1:12 Scale Model,** Hamilton, ON (2005): Combined sewer system has collector 20 m underground that drops 45 m under the Niagara escarpment. Hydraulic analysis showed that existing plunge inlet and air handling limited capacity and caused surges. Field inspections and hydraulic problem definition (surcharge, surges, venting); public meeting for Class EA and conceptual-level designs for alternatives; preliminary design (to scale) to guide physical model building; coordinated tests at Canada's NWRI-CCIW laboratory in Burlington at 1:15 scale (model is 30 x 4 m). Retained again to twin the design: vortex-inlet shaft and tunnel, tested in the lab.
- **Greenhill CSO Tank Retrofit, with New Primary Inlet and Tank**, Hamilton, ON (2003): Hydraulic review and HGL analysis showed flight sewer into existing CSO tank caused surges. Hydro-dynamic design for deflector gate into new 65 ML CSO tank and connecting passages to existing CSO tank, complete with overflow weirs, outlets, bends. Complete hydraulic integration.
- **Western Beaches Tunnel – Hydraulic Transients,** Toronto, ON (2002): Tunnel filling hydraulics, from gradually-varied to unsteady flow for input into preliminary design and transitions. Retained again as part of the review team: identified risk of shaft oscillations/choking and surcharge to ground in the time it takes to accelerate flow in submerged outfall pipes.
- **Scale Model of Gravity Sewer,** Waterloo, ON (1992): Designed and tested 10 m long, 1:10 scale model of gravity sewer to study transitions from open channel to pressure flow. Real-time level and flow logging.
- **City of Mobile Area Wastewater Sewerage System (MAWSS),** AL (2005): Led a team to investigate and resolve issues in a 14 mile long, 48 in sewer forcemain system with 4 PS: collapsed SCAV float; condition assessment; built a hydraulic model from drawings in HAMMER (steady + transient); visited to pump stations; simulated normal starts/stops and power failures; and, stand-alone report and operator training. Retained again to update model with a new PS.

- **Leslie Street Sewage Pumping Station,** Region of York, ON (2009): Field and facility inspections to investigate repeated and severe (hydraulic) check valve slam and thrust block damage. High-speed pressure monitoring to catch 1 and 2-pump power failure events. Calibrated HAMMER transient model to reproduce slam. Pump and surge control system upgrade strategy based on model results. Fill/drain/inspect procedures for twin 1200 mm forcemains, 3 km long. Assessed impact of grease issue for sewage combination air valves.
- **Orleans-Cumberland Collector (OCC) and ROPEC SPS,** Ottawa, ON (2002): Field investigation of air handling, surcharge and sedimentation (with divers) for regional 1200 mm trunk sewer operating under surcharge near the 20 MLD PS. Hydraulic analysis for two tributary gravity sewers. Identified causes of surcharge and surface spills (to environmentally sensitive area) – mostly reversals from IOS up OCC upon power failure. Solution involved an engineered 48” duckbill valve to allow forward flows with minimal head loss while preventing reversals (high-rate, low-lift SPS also provided as backup). Three projects from environmental assessment to pre-design, detailed design and construction.
- **Richmond Sewage Lift Station**, Ottawa, ON (2003): Break Investigation for fatigued PVC 20” forcemain conveying 20 MLD. Site visit and operator interviews. Formulation and analysis of break theories, leading to field-checks and finding ‘proof’: an eroded crack that resulted in uncontrolled air expulsion transients, leading to fatigue and eventual rupture. Provided normal start/stop ramp times to keep transients within working pressure to extend remaining service life. Hydraulic models of steady-state and transients for entire forcemain.
- A dozen SPS and forcemain studies each year, one or two due to a break (investigation): lengths from 300 m to 15 km, diameters from 300 to 750 mm.

River and Coastal Engineering

- **Mattamy-on-the-Lake Shoreline Protection and Self-scouring Storm Sewer Outfall (SSO),** Hamilton, ON (2008, 2009): Led 3 technical teams to review Lake Ontario water levels, wave, ice and erosion regimes at property shoreline; wave height, set-up and frequency analyses using LITPACK and NOAA data; and, detailed design (including approvals), tendering; and, rock selection, coordination and inspections during construction. Narrow hazard block required cross-section with sheet piles fronted by armour stones and beach. Expert witness for (successful) Arbitration regarding cost-sharing for the $1.6 M works.
- **Self-Scouring Storm Sewer Outfall (SSO) to Lake Ontario**, Hamilton, ON (2006, 2007): Led 2 teams to obtain and analyse sediment and bathymetric survey to characterise site; then build a 9x12 m, 1:15 scale model of the near-shore, beach, armour stones and sheet-pile wall with slot for outfall inserts. Tested and refined two SSO designs that re-direct wave energy to scour sediments away. Retained again to assist the City’s designer with armour stone placement near the outfall. City built the $0.5M works and outfall has operated without blockage.
- **Hydraulic Design for Lawrie Road Storm Inlet,** Ajax, ON (2006, 2009): Led hydraulic analysis, design and inspections during construction for the $0.6M works built by Durham Region. Took flow from across a street and swale with a 90^o turn onto a new inlet structure, retrofitted atop an existing box culvert. Inlet takes 20 m^3/s via four gratings (bottom withdrawal). Emergency overflow, 2 air shafts and two downstream vents also provided. Works withstood a 1:100 year

storm the following year, draining it to Lake Ontario. Retained again to advise on scope of watershed and sewershed drainage study.

- **Hawkesbury Creek Relocation Study**, Ottawa, ON: Worked with the biologists on relocation study.
- **Carp Road Flow Restoration Study**, Thunder Bay, ON: worked with biologists on restoration study. Detailed geomorphology and hydraulic survey with walk-through and helicopter overflight.
- **Long-term Hydrology and Hydraulic Models**. Markham, ON: With limnologist, worked on several continuous models for urban SWM ponds.

Watershed Studies and Urban or Highway Drainage

- **Hydrology, Flooding and Erosion Models**, ON: Deterministic and stochastic models of hydrology, flooding and erosion for 2 legal cases in relation to Etobicoke Creek (for MTO) and Black Creek (for Plaintiff).
- **Rapid evaluation of Lawrence Ave. E. crossing of Wilkett Creek**, Toronto. ON (2004):
- **West Extension of HWY 407 ETR**, Halton, ON (2004): Led 3 jobs to: review over 50 culverts; study median drainage and new grating alternatives; and, review the impact of 16 Mile Ck. bridge piers on backwater levels.
- SWM pond retrofit to treat road pollutants (STORM).
- **Revision of Dyment Ck. model (OTTHYMO, 556 ha)**: Revision and sensitivity analysis of Cardinal Ck. MDP (3,276 ha). Avalon subdivision (656 ha). Post-construction monitoring plan for 9th line SWM pond, for water quality retrofit.

Hydropower Systems and Transients

- **Hydraulics for Synchronous Bypass and Stilling Basin** (2009): Reviewed a 16 m^3/s bypass system with vibration and high losses for Algonquin Power Systems (APS). Conceptual design and capital cost estimate for improvements.
- **Hydropower Transients at Pit River #5, #1 & #3 (2006-2007):** Consisted of two projects. Calibrated and validated transient model for 5 types of events: load acceptance, load rejection (global or single-unit), synchronous-no-load and load variation. Client: Pacific Gas & Electric.
- **Failure investigation for 14' Johnson Valve** (2001): Sir Adam Beck hydropower complex. Client: Ontario Power Generation. Confidential.

Federal Government / Military Systems

- **USAF Military Cooling System**, TN (2006): Built and ran a 1500-pipe model using HAMMER to simulate flow and surge control for four 1000^+ MLD pump stations and pipe network from 300 to 3000 mm at the Arnold Engineering Development Centre (AEDC). Details are confidential. References available.
- **Two Pipe Breaks at Correctional Institution**, ON (1999, 2004): Two water systems. Client: Corrections Canada.
- **Water Supply and Fire Loops for Downsview AFB**, ON (2001): Project included Secondary Plan Area, pressure zone re-definition and check valves for fire flow.

Mining Systems and Surge Control

- **4 Projects for QIT Fer et Titane's UGS-ALP** (2002-2006): Plant-wide thermal-hydraulic transient pressures and forces for 3D liquid and steam piping systems

(Québec). Explained and reduced the frequency of equipment breaks, then improved process inefficiencies. Interfaced with dynamic pipe stress analyses. Specified high-speed transient sensing system. Tests and operator training.

- **Algoma Steel, Descaling System (**2001): Calibrated transient pressure and force analysis to improve process for 265 bar system with 20 m^3 accumulator. Matched de-scaling cycle compared to 5 ms pressure records for several minutes.
- **Newmont Gold, Reclaim Line**, NV (2004): Design & operation review.
- **4 Projects for Barrick Gold (2001-2005)**: Analyses included: surge for slurry lines, mix/thicken, gravity lines, dynamic plant model. Boulder mine dewatering WTP and Roaster slurry and reclaim lines (Nevada). Plant-wide hydraulic review and models for water & slurry systems during basic engineering for Pascua Lama (Argentina/Peru). Bulyanhulu water transmission line review (Tanzania).

Water Supply Systems and Surge Control

- **Transmission & Distribution from Peel to York Region** (2001-2010): Project manager and lead for hydraulic tests and models of Peel's water transmission system. Many new 2100 mm feedermains linking 12 PS on the east and west ends for a total lift of 200 m over 40 km. Over 15 projects including:
  - **Hanlan Transfer HL PS** (2008): A 4 ML storage and six 100 MLD pumps, all connected to the existing Hanlan PS and reservoir. Sized four pressure vessels (total 1200 m^3) to control transients in the 2100 mm line.
  - **High-lift Pump Tests at Hanlan, Herridge and East Brampton PS (**2007): Tested all HL pumps to identify the existing pump to be replaced at each PS. Suction system evaluated for $NPSH_A$.
  - **Hanlan HL & LL PS Upgrade and Proposed 2100 mm Peel/York Feedermain, (**2002-2007): Steady-state and transient models of PS and all-pipe Zone 3 network for pump selection and surge protection, including existing 14 km 1200, 1500 and proposed 2100 mm. Identified the need to move-up construction of the 2100 mm to meet York-Peel commitments.
  - **Airport Road HL & LL PS** (2005): Award-winning design-build project. Mixing analysis for 35 ML Airport Rd. reservoir. Surge control: two 225 m^3 (each) gas vessels based on steady and transient models for:
    - Three 46 MLD (533 L/s) pumps to Zone 4E
    - Three 46 MLD pumps to Zone 5E and Tullamore (E4) reservoir
    - Four 55 MLD pumps for 25 km, 1800 mm to Maple reservoir (York PD 6)
  - **Route Hydraulics for E4 Class EA** (2005): for feedermain to Tullamore E4 reservoir, including transient model for alternate routes and profiles.
  - **Maple HL & LL PS and Reservoir** (2007): steady and transient analysis for detailed design of PS and surge control to supply PD7 & PD8 mains.
  - **Lorne Park Transfer HL PS and Surge Tanks** (2007): steady and transient analysis to support detailed design of 606 MLD PS to supply Streetsville directly (transfer) or via the Herridge LL PS, with connection to Zone 2 and existing feedermains. Sized three pressure vessels (total 675 m^3) to control hydraulic transients in the new 2100 mm line.
  - **Herridge LL PS Upgrade including Suction Headers and NPSH** (2003): Steady-state model of 700-pipe Zone 2 network and transient analysis of 345 MLD LLPS and 7 km long 1050 and 1500 mm lines to the Streetsville reservoir. Tested suction system NPSHA and six pumps' NPSHR in-situ based on ANSI 1.6 standard to select correct piping and pump upgrades.

- **Streetsville HL and LL PS Upgrade** (2003): Hydraulic model of Zones 3 and 4 for transient analysis, including 10 km 900 and 1200 mm lines to the Meadowvale North reservoir. Field tests of NPSHA to calibrate suction and discharge piping & improve pump upgrade decisions.
- **Streetsville Shaft Break and Impeller Wear Investigation** (2004).
- **West Brampton HL & LL PS** (2006): Steady and transient analysis to support detailed design of PS and surge control for existing feedermains.
- **23 Pump Curves & $NPSH_A$ at 5 Peel PS** (2006-2009): Tests for power draw and team operations to provide input to pump upgrade at each PS.
- **Shaft Break and Impeller Wear at Streetsville PS** (2003): Field calibration of suction ($NPSH_A$) & discharge models to explain break, pump upgrades.

→ **Toronto and York Region Transmission Operation Optimizer** (TOO) (2004): Evaluated risk of water shortage during extended power outage. Coordinated hydraulic analysis for pump scheduling at the City of Toronto and York Region.

→ **City of Toronto's Ellesmere PS to PD2E and PD4 up to York Region** (2005): Assessment of this PS and reservoir. Developed 3-year, $500,000 Capital Plan for pump and surge control upgrades. Steady & transient analyses:

- Hydraulic Grade Line (HGL) to identify bottlenecks at reservoir inlets, partition wall, suction & discharge headers, and yard piping up to Neilson.
- Pump & piping tests including $NPSH_A$ (suction header) and $NPSH_R$ for 2 pumps. Provided input to selection and design a replacement impeller.
- Gas vessel (closed surge tanks) simulation and forecast to Year 2011.

→ **Trinidad & Tobago Water and Wastewater Master Plan & Policy** (2008): Led a team of 12 GIS and hydraulic modeling professionals to complete:

- A nation-wide 1:10,000 infrastructure atlas for water & wastewater systems.
- Condition assessment for 800 km of watermains up to 150 yrs old.
- Re-definition of 100 water supply areas into 6 zones (50,000 pipes).
- Hydraulic modelling to the preliminary design level of detail, e.g. 100 m long pipes, for all trunk sewers, water transmission and distribution systems.
- Transmission optimisation model for energy use and age (10,000 pipes).
- 3D visualisations and thematic maps for all aspects of these systems.

→ **Transmission from Lake Huron to London & Branch Systems** (1997-2009): Project manager for several steady-state and transient model studies of this 40 km, 1200 mm (partially-twinned) pipeline to London, ON, including:

- Review and tests for the entire system, including the Grand Bend PS and the Ausable booster PS with two 425 m^3 gas vessels.
- Flow and surge control for 600 mm line to Strathroy (2005).
- Flow and surge control for the line to Exeter-Hensall (2007).
- Break investigation, flow and surge control and shop drawing review for the new connection to the Lambton Shores B-Line (2009).
- EPCM for compressor and level gauge retrofits at both PS (2010 ongoing)

→ **Transmission from Collingwood to Alliston & Beeton Networks** (1999-2006): Transient analysis of 57 km, 600 mm line to Alliston from a 13 MLD PS to four 60 MLD PS for OCWA (1999). Alliston model calibration and transients for 10 km line to Beeton (2001). Calibration for master plan update (2006).

→ **Ottawa South PS: Optimal Supply for the South Urban Community** (2009-2010): Project manager for a hydraulic modeling and (pumping) optimisation from the Lemieux and Brittania WTP to the SUC. Direct input to the Functional Design of the pump and reservoir upgrades at the Ottawa South PS.

- **Ottawa Water Supply, Transmission & Distribution** (2006): Project manager for hydraulic model of steady and transient pressures and forces (to size thrust chambers). Twin 1200 mm LPTM to 340 MLD Fleet St. booster PS, 1930 mm HPTM to Zone 1W (800-pipe model). Year 2005 to Year 2031 modeled to:
  - Determine the number, types, sizes and settings for surge control valves at the WTP HLPS and LLPS, as well as pipe class for the LPTM and HPTM.
  - Map areas with high steady or transient pressures, sub-atmospheric pressures (e.g. intrusion risk), or changes in velocities for Zone 1W.
  - Compute 3D steady and transient thrust forces on soil and piping anchors at major bends. HPTM and LPTM cross Ottawa River on pipe rack.
- **City Hamilton – West Dundas Water Supply Investigation** (2008): Project manager for condition assessments and hydraulic tests at 2 PS: Osler PS and Glancaster PS. Calibrated EPS using SCADA for 5 pressure zones.
- **Dedicated Fill Line to Airport Reservoir and Zone 1B Limits, Grande Prairie**, AB (2010): Combine 3 models for entire City including 4 zones plus one reduced-pressure "trickle feed" for rural area. Update to 24/7 simulation in WaterGEMS and evaluate two fill-line alternatives with pump rules. Transients and costs for selected alternative. Pressure contours for expanded Zone 1B.
- **Paintearth Regional Water Distribution and Reservoir Study**, AB (2009): Preliminary design, modeling and analysis of a rural water distribution system servicing an area of 340,000 ha. The 960km system was modeled to support the Town of Castor, the Town of Coronation, the Village of Halkirk, four Hamlets, 700 rural residences and a major power generating station.
- **Hydraulic Model Review for Kneehill Water Distribution System**, AB (2009): Model runs for reliability and energy efficiency on this branched rural system.

Hydraulic Evaluations for Class EA, Route Selection

- **City of Toronto, Central PS to Eglinton** (2005-2009): PM for transient evaluation of 4 alignments and profiles for 2 Class EAs: Avenue Rd & Rosehill.
- **Peel Region, East Brampton PS to Wildfield Reservoir** (2005): Transient evaluation of 4 alignments and profiles for Class EA: "Countryside".

Pump Station Tests and Pipe Break Investigations

- **7 Pump Curves at 2 LHPWSS PS** (2008), c/w air valves at key chambers along the 1200 mm transmission line. PS-wide hydraulic condition assessment including steady-state, surge control and operations.
- **6 Pump Curves at Osler and Garner Road PS** (2008): Including power monitoring and wire-to-water evaluation for 4 pumps. PS-wide hydraulic condition assessment including steady-state, surge control and operations.
- **12 Pump Curves & NPSHA at 3 Peel PS** (2006): Tests included power and team operations to provide input to pump upgrade at each PS. Many earlier pump (including NPSHR) and suction tests in Toronto, Peel and Chatham.
- **Shaft Break and Impeller Wear** (2003): Field calibration of suction (NPSHA) and discharge models to explain break, inform pump upgrade at Streetsville PS.

Geographic Information Systems (GIS) and Model Integration

- HAMMER specification and links to use Access database for linking to GIS data.
- Trinidad & Tobago water transmission and distribution using ArcGIS linked to WaterGEMS. Trunk sewers using ArcGIS linked to SewerGEMS. GIS report.

- Analysis of floods at 189 flow measurement stations in Ontario and Quebec using SPANS GIS, L-moments and geostatistical methods (thesis).

Hydraulic Evaluations for Class EA, Route Selection

- **City of Toronto, Central PS to Eglinton** (2005-2009): Project manager for transient evaluation of 4 alignments and profiles parallel to Avenue Rd. for Class EA: “Rosehill”.
- **Peel Region, East Brampton PS to Wildfield Reservoir** (2005): Project manager for transient evaluation of 4 alignments and profiles for Class EA: “Countryside”.

REFERENCES

- Anthony Parente, P.Eng., Manager of Capital Works, Region of Peel, 10 Peel Centre Drive, 4th floor Brampton Ontario Canada L6T 5M8, Tel: (905) 791-7800 Ext. 4989, Fax: (905)791-0728. *Hydraulic Transient Analysis or Pump Tests.*
- Henry Polvi, P. Eng., Sr. Project Manager, City of Toronto, Metro Hall Station 1170 16th Floor 55 John Street Toronto Ontario Canada M5V 3C6, Tel: (416) 392-8887, Fax: (416) 392-3639. *Hydraulic Assessment for Ellesmere PS.*
- Harold Baker, P. E., Sr. Project Manager, Volkert & Associates Inc., 3809 Moffett Road, Mobile AL 36618, Tel: (251) 342-1070, Fax: (251) 342-7962, *Break Investigation & Transient Models for 5 Sewage Forcemains, Mobile, AL.*

PUBLICATIONS AND PRESENTATIONS

Selected Publications

- *Wastewater Models for Trinidad & Tobago’s Master Plan*, in “WEF Influents”, Spring 2009 by Jean-Luc Daviau, GENIVAR.
- *Impact of Skeletonization on Hydraulic Transients*, at EWRI conference: “Water Distribution System Analysis Symposium”, Salt Lake City, UT, 2004, (Walski, T., Coran, S., and Daviau, J.-L.)
- *User's Manual: HAMMER Hydraulic Transient Software*, Haestad Methods Press (now Bentley Systems), 2003 (Daviau, J.-L., Fok, A.)
- *Regional Flood Frequency Analysis using GIS, L-moment & Geostatistical Methods*, Hydrol. Proc. 14, 2731-2753 (Daviau, J.-L., Adamowski, K. & Patry, G.G.)
- *Introduction to Applied Hydrology - A Practical Manual*, Department of Civil Engineering and Centre for University Teaching, University of Ottawa, Ottawa, 1995 (used in third year course). 120 pp (Daviau, J.-L., and Adamowski, K.)
- *Regional Analysis of Annual Maximum (AM) Floods and of Partial Duration Series (PD) data by L-Moments,* presented in French during Workshop on Regional Estimation of Floods (GREYHIS - NSERC), CAWQ & AQTE conference, Montréal, 15-17 November 1994 (Daviau, J.-L., Gingras, D., Adamowski, K., Pilon, P.)

Presentations/Seminars

- “Modeling Growth and Change”. Overview of key issues faced by owners and operators. Problem-solving using integrated GIS-SCADA-Model technologies.

- "Hydraulic Transient Analysis featuring HAMMER Software". As Lead Instructor for Bentley/Haestad, delivered this training in 25 cities around the world since 2003 in English and in French (including WaterGEMS).
- "Thermal-Hydraulic Transients in QIT's UGS-ALP Fluid and Steam Piping", presented to the engineering and operations staff of QIT Fer et Titane's UGS-ALP plant, Three sessions in French and English, May 2002.
- "Surge and Waterhammer in Water and Sewer Networks", presented to staff of the Region of Ottawa-Carleton (ROC) on July 10-11, 2000 (Daviau, J.-L. and Fok, A.)

GENIVAR

HYDROPOWER AND HYDRAULIC

STEVE RENAUD, Eng., M.Sc.

Engineer – P.E.O. n° 121069

HYDRAULIC

FIELDS OF ACTIVITIES

River Hydraulic

Coastal Engineering

Environment

EDUCATION AND DEGREES

2009 (in progress)	Coastal Engineering Certificat - Old Dominium University
2000	M. Sc., Water Sciences – Water Resource Management, Institut national de recherche scientifique (INRS-EAU)
1998	B. Sc. Civil Engineering, Université de Sherbrooke

ADDITIONAL TRAINING

2009	Flow-3D Training Class
2003	Conference of the users of SonTek YSI hydro-acoustic instruments
2001	Three day training on Ensim-TELEMAC-2D software, given by the Canadian Hydraulic Centre (CHC)

COMPUTER EXPERTISE

SMS (STWAVE, CGWAVE), TELEMAC-2D, Flow-3D, Mike 21, HEC-RAS, HYFRAN (frequency analysis in hydrology), MapInfo, Modflow, Fortran, Matlab, Visual Basic, MS Project, Visio Technical, Excel, Word

SCHOLARSHIPS

1993	Canada scholarship, Pure and Applied Sciences
1993-1994	Entreprise scholarship (Mines Seleine)

MEMBERSHIPS

2010	American Shore and Beach Preservation Association (ASBPA)

STEVE RENAUD, Eng., M.Sc.

CAREER

2001 to date	Project director, Hydraulics and hydropower works, GENIVAR
2001	Trainee in hydrology and hydraulics, Ministry of the Environment, Hydraulics and Hydrology Branch
2000	Technical support, G.P.R. Geophysics
1998	In charge of work schedule and technical support, JANIN (construction of the TQM Waterloo – USA gas pipeline.)
1997	Assistant to the expert in water and water treatment, General Policy Branch (Environment Division), Canadian International Development Agency (CIDA)
1996	Trainee in engineering, Centre canadien d'étude et de coopération internationale (CECI, Guatemala)
1996	Technical support, Rock mechanics laboratory, Université de Sherbrooke
1995	In charge of updating the road network database, Department of Transport of Québec (Baie-Comeau)

PROFESSIONNAL ASSOCIATION

Ordre des ingénieurs du Québec

PROFESSIONNAL EXPERIENCE

Major Projects, Coastal Engineering

- Port-Cartier Harbour Environmental Impact Study and Technical Field Work Study - Arcelor Mittal Mines Canada
- Shoreline Protection Alternatives Study – Beach nourishment, riprap (Tadoussac Bay, Canada)
- Shoreline Protection Alternatives Study – Beach nourishment, riprap, seawall (Sainte-Luce Waterfront, Canada)
- Blanc Sablon, New harbour agitation study and Wave analysis, Public Works Canada
- Pigeon Hill Harbour and inlet - Shoaling and navigation enhancement study, Public Works Canada
- Rio Tinto –IOC Wharf – Shoaling and sediment transport analysis

STEVE RENAUD, Eng., M.Sc.

- Alternatives to riprap for Newport Shoreline Protection and for Fish Habitat Enhancement – Beach nourishment and groins (Ministry of Transport of Quebec, Canada)
- Brine Plume diffusion study, Pointe-Noire, Congo (Mag Minerals)
- Preliminary Study for the Sillery Marina Restoration (Department of Fisheries and Oceans, Canada)
- Preliminary Study for the Grande-Rivière Restoration (Department of Fisheries and Oceans, Canada)
- Plans and specifications for shore protection, Bonaventure (Ministry of Transport of Quebec, Canada)
- Plans and specifications for riprap rehabilitation, Promenade Samuel de Champlain, Québec City's 400th Anniversary Waterfront (Commission de la Capitale nationale - Québec)
- Hydraulic Study and Bridge Design over the Saint-Augustin Estuary, Basse Côte-Nord, Canada (Pakatan Meskanau)
- 2D Modeling of the sediment behavior in the Sainte-Anne River Estuary and effects on the Atlantic Tomcod, Canada (CAPSA)
- Plume diffusion study of the fine screening station effluent, Des Chaleurs Bay, Canada (City of Newport)

Major Projects, Hydrodynamics Modeling

- 2D modeling of the propagation of the LG-4 dam break wave in the Robert-Bourassa Reservoir (Hydro-Québec)
- Hydrodynamics and habitat modeling at the Farmers Rapids, Gatineau River, Outaouais (Hydro-Québec)
- Simulations of the flooding wave of dam breaks on the Saint-Maurice River and analysis of the effects on the St. Lawrence River water levels (Hydro-Québec)
- Hydrodynamics simulations for the conservation flow study (instream flow need) of the partial diversion project on the Rupert River (Hydro-Québec)
- Expertise for shore stabilization at the road rest area, by reinforcing sills at site 202, Anse Saint-Jean, Ministry of Transport (MTQ)

STEVE RENAUD, Eng., M.Sc.

- Hydrodynamics simulations for the study on whitefish spawning in the tailrace of the Outardes 3 power plant (Hydro-Québec)
- Hydrodynamics simulations for fish habitat studies in the Pikauba River (Hydro-Québec)

Major Projects, Hydraulics Studies

- Dam Safety of 4 dams – hydraulic study (Algonquin Power)
- Development of guidelines for the data acquisition and monitoring around hydropower station (H-Q)
- Impact Assessment for beaver dam break along Port-Cartier railway –Mont Wright Mine (CMQC)
- Hydro-sedimentary analysis of the Romaine River and feasibility evaluation of flushing-flow for salmon habitat enhancement (Hydro-Québec)
- Evaluation of the hydrodynamic conditions in the spillways of the Pointe-des-Cascades dam in order to assess the migration possibilities of Lake Sturgeon (Hydro-Québec)
- Monitoring of the Atlantic Salmon spawning habitat in the Petit-Saguenay River
- Study of the sand silting problems in the Sainte-Anne River estuary and the impacts on the Atlantic Tomcod river run
- Hydraulics study for the bridges on the Pabos Ouest and Grand Pabos rivers (MTQ)
- Hydraulics study for the construction of a new bridge on the Grande Décharge River in Alma (MTQ)
- Physical monitoring study at the Saint-Ours fish ladder (2001)
- Determination of the floodplains of the Terrebonne Brook, Saint-Nicolas
- Hydraulics studies for river regulation works and dam reconditioning, Ministry of the Environment.

Major Projects, River Regulation Works

- Plans and specifications for 11 spawning habitat, Rupert River Diversion Project (Hydro-Québec)
- Plans and specifications for Beloeil Dam, Parc des Laurentides (MTQ)

STEVE RENAUD, Eng., M.Sc.

- Plans et specifications for the improvement of the Katchapahun fish lader (APRM)
- Plans et specifications for the improvement of Rivière-à-Mars fish lader (Ministère du Développement durable, de l'Environnement et des Parcs)
- Plans et specifications for the dredging of the intake of the Saint-Raphaël Hydro-power Station, (Algonquin Power System inc.)
- Plans and specifications for shore stabilization, rivière Portneuf, (Usine MPI)
- Plans and specifications for shore stabilization, Saint-Jean River, La Pocatière (Cégep de La Pocatière)
- Plans and specifications for various environmental compensation projects (MTQ)
- Plans and specifications for wildlife habitat development in the Lake Daran outlet in the Parc des Laurentides, compensation project for Highway 175 (MTQ)
- Plans for shore rehabilitation at Listuguj

Major Projects in Hydrology

- Hydroclimatological Report for the Canadian Malartic Gold Mine (OSISKO Mining)
- Hydroclimatological Report for the Raglan South Nickel Mine (Canadian Royalties)
- Coordination and data processing for three bathymetry and gauging surveys in the Manic 5 area (Hydro-Québec)
- Hydrological regime monitoring (low water) in the Saint-Charles River from 1999 to 2002 (Quebec City)
- Hydrological analyses to asses the production potential of the Angliers power plant
- Hydrology and hydraulics studies for more than 200 dams in the course of the creation of the Répertoire des barrages du Québec (Dam Safety Act), Ministry of the Environment
- Complementary hydrological analyses in the course of the conservation flow study (instream flow need) for the partial diversion project of the Rupert River (Hydro-Québec)

STEVE RENAUD, Eng., M.Sc.

- Hydrology studies for most of the regulated river projects and hydraulics study projects listed below

Other Major Projects

- Work site surveys to update the construction schedule and development of a Visual Basic program to draw graphic work schedules, JANIN
- Financial study of CIDA's investments over ten (10) years in water studies and water treatment
- Feasibility study for the construction of two new roads, Centre canadien d'étude et de coopération internationale (Guatemala)

Cirriculum Vitae

Leon Boegman, Ph.D.
Assistant Professor
Department of Civil Engineering
Queen's University
Kingston, Ontario, Canada K7L 3N6
Phone: (613) 533-6717
Fax: (613) 533-2128
Email: leon.boegman@civil.queensu.ca

1. PROFESSIONAL INTERESTS

My engineering activities focus on transport and mixing processes in the aquatic environment and their impact upon water quality. Recently, I have been applying laboratory and field techniques to quantify the energy flux between the various internal wave groups in lakes, with an ultimate goal of understanding how this energy is irreversibly lost to dissipation and mixing upon sloping topography. I have continuing research activities in hydrodynamic and water-quality modelling, bio-physical coupling, boundary layer dynamics, hydrodynamic stability and open channel hydraulics.

2. EMPLOYMENT HISTORY

Assistant Professor 09/2005-present
Department of Civil Engineering
Queen's University
Kingston, Ontario, Canada

Engineering Consultant 09/2005-present
Boegman & Associates
16 Hill St.
Kingston, Ontario, Canada

Visiting Scientist 08/2010-present
National Water Research Institute
Environment Canada
Burlington, Ontario, Canada

Special Graduate Faculty (Adjunct) 03/2009-present
Department of Integrative Biology
University of Guelph
Guelph, Ontario, Canada

Visiting Research Scientist 01/2009 to 03/2009
Geophysical Fluid Dynamics Laboratory
School of Environmental Systems Engineering
University of Western Australia
Perth, Western Australia, Australia

Post-Doctoral Fellow 03/2005 to 08/2005
Computational Fluid Dynamics and Ocean Process Modeling
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, California, USA

Post-Doctoral Fellow 05/2004 to 02/2005
Geophysical Fluid Dynamics Laboratory
School of Environmental Systems Engineering
University of Western Australia
Perth, Western Australia, Australia

Research Associate 09/1999 to 02/2000
Environmental Fluid Dynamics Laboratory
Department of Mechanical and Industrial Engineering
University of Toronto
Toronto, Ontario, Canada

Research Assistant 07/1997 to 08/1997
Environmental Hydraulics
Department of Civil Engineering and Applied Mechanics
McGill University
Montreal, Quebec, Canada

3. EDUCATION

Doctor of Philosophy (Ph.D.) 03/2000-04/2004
The degeneration of internal waves in lakes with sloping topography
Centre for Water Research, Department of Environmental Engineering
University of Western Australia
Perth, Western Australia, Australia
Thesis supervisors: G.N. Ivey and J. Imberger

Master of Applied Science (M.A.Sc.) 09/1997-08/1999
Application of a two-dimensional hydrodynamic and water quality model to Lake Erie
Department of Mechanical and Industrial Engineering
University of Toronto
Toronto, Ontario, Canada
Thesis supervisors: M.R. Loewen and P.F. Hamblin

Bachelor of Engineering (B.Eng.) 09/1992-04/1997
Department of Civil Engineering and Applied Mechanics
Minor in Environmental Engineering
McGill University
Montreal, Quebec, Canada
Thesis supervisor: J.A. Nicell

4. ENGINEERING CONSULTING: (Major Consulting Projects)

Eastern Lake Ontario/St. Lawrence River Intake Protection Zone Study: Delineation of IPZ-1 and 2 $127,500
Role: Principal Engineer
Client: Ontario Ministry of the Environment & Cataraqui Region Conservation Authority
Dates: 2007

Eastern Lake Ontario/St. Lawrence River Intake Protection Zone Study: Delineation of IPZ-3 $100,300
Role: Principal Engineer
Client: Ontario Ministry of the Environment & Cataraqui Region Conservation Authority
Dates: 2008

Modeling of transport and mixing for IPZ-3 delineation for Port Hope and Wellington intakes $44,000
Role: Principal Engineer
Client: Region of Peel
Dates: 2009-2011

Application of a two-dimensional hydrodynamic and water quality model for Lake Winnipeg eutrophication management $10,000
Role: Principal Engineer
Client: Environment Canada
Dates: 2009-2010

5. ENGINEERING RESEARCH: (Major Research Projects)

Research initiation grant $65,000
Role: Principal Investigator
Funding Agency: Queen's University
Dates: 2005

Flow visualization for environmental fluid dynamics $143,984
Role: Principal Investigator with A. da Silva and K. Hall
Funding Agency: NSERC Research Tools and Instruments
Dates: 2006

Acoustic Doppler system for experimental research on river and coastal processes $34,597
Role: Co-Investigator with A. da Silva (P.I.) and K. Hall
Funding Agency: NSERC Research Tools and Instruments
Dates: 2006

Field instrumentation for source water protection $71,695
Role: Principal Investigator with K. Hall and K. Lamb
Funding Agency: NSERC Research Tools and Instruments
Dates: 2007

Aquatic Eddy Covariance System for Ecological and Environmental Research $46,361
Role: Co-Investigator with J. Ackerman (P.I.)
Funding Agency: NSERC Research Tools and Instruments
Dates: 2008

The turbulent dynamics of shoaling internal waves $100,000
Role: Principal Investigator
Funding Agency: NSERC Discovery Grants
Dates: 2006 - 2010

An integrated approach to lake dynamics: Protecting Canada's aquatic resources $625,000
Role: Principal Investigator
Funding Agency: Canada Foundation for Innovation & Government of Ontario Leaders Opportunity Fund & Ontario Research Fund
Dates: 2007

Three dimensional hydrodynamic and ecological models for water quality problems in Lake Erie $284,070 (2008) $240,500 (2009) $175,500 (2010)
Role: Co-Investigator with K. Lamb (PI), R. Smith and J.D. Ackerman
Funding Agency: NSERC Strategic Projects
Dates: 2008-2010

Impacts of climate change on water quality and hydrodynamics in Ontario Lakes $150,000
Role: Principal Investigator with R. Smith, R. Yerubandi and K. Lamb
Funding Agency: Ontario Ministry of the Environment, Best in Science
Dates: 2008-2011

Predicting the influence of mixing hydrodynamics and food web structure on spatial variability of phosphorus concentrations in Lake Simcoe with a 3-D model $291,080 (2009) $226,190 (2010) $226,190 (2011)
Role: Co-Investigator with L. Molot (PI), R. Smith, P. Dillon, D. Evans, D. Barton, B. Ginn, J. Winter
Funding Agency: Lake Simcoe Cleanup Fund, Environment Canada
Dates: 2009-2011

Characterization of turbulent mixing dynamics in large lakes $150,000
Role: Principal Investigator
Funding Agency: Early Researcher Award, Ontario Ministry of Research and Innovation
Dates: 2010-2015

6. ENGINEERING PUBLICATIONS

For long term consistency publications have been numbered in reverse chronological order.

(a) Invited refereed book chapters

1. Boegman, L. Currents in Stratified Water Bodies 2: Internal Waves. *Hydrodynamics and Mixing in Rivers, Reservoirs, and Lakes.*, Encyclopedia of Inland Waters (Editor-in-Chief G. E. Likens), Elsevier Academic Press.

(b) Refereed journal publications: published, in press or accepted

11. Zhang, H., Culver, D. and Boegman, L. Dreissenids in Lake Erie: an algal filter or a fertilizer? *Aquatic Invasions.*(In press).
10. Conroy, J.D., Boegman, L., Zhang, H., Edwards, W.J. and Culver, D.A. 2010. "Dead Zone" dynamics: the importance of weather and sampling intensity on calculated hypolimnetic oxygen depletion rates. *Aquat. Sci.* (In press).
9. Aghsaee, P., Boegman, L., and Lamb, K.G. 2010. Breaking of shoaling internal solitary waves. *J. Fluid Mech.* doi:10.1017/S002211201000248X
8. Boegman, L., and Ivey, G.N. 2009. Flow separation and resuspension beneath shoaling nonlinear internal waves. *J. Geophys. Res*. 114. C02018, doi:10.1029/2007JC004411.
7. Zhang, H., Culver, D.A. and Boegman, L. 2008. A two-dimensional ecological model of Lake Erie: Application to estimate dreissenid impacts on large lake plankton populations. *Ecol. Model*. 214: 219-241.
6. Boegman, L., M. R. Loewen, P. F. Hamblin, and D. A. Culver. 2008. Vertical mixing and weak stratification over zebra mussel colonies in western Lake Erie. *Limnol. Oceanogr*. 53: 1093-1110.
5. Boegman, L., Loewen, M.R., Culver, D.A., Hamblin, P.F. and Charlton, M.N. 2008. Spatial-dynamic modelling of algal biomass in Lake Erie: Relative impacts of Dreissenid mussels and nutrient loads. *J. Environmental Eng. ASCE*. 134(6): 456-468.
4. Boegman, L., Ivey, G.N. and Imberger, J. 2005. The degeneration of internal waves in lakes with sloping topography. *Limnol. Oceanogr.* 50: 1620-1637.
3. Boegman, L., Ivey, G.N., and Imberger, J. 2005. The energetics of large-scale internal wave degeneration in lakes. *J. Fluid Mech*. 531: 159-180.
2. Boegman, L., Imberger, J., Ivey, G.N. and Antenucci, J.P. 2003. High-frequency internal waves in large stratified lakes. *Limnol. Oceanogr*. 48: 895-919.
1. Boegman, L., Loewen, M.R., Hamblin, P.F. and Culver, D.A. 2001. Application of a two-dimensional hydrodynamic reservoir model to Lake Erie. *Can. J. Fish. Aquat. Sci.* 58: 858-869.

(c) Refereed journal publications under review

5. Aghsaee, P., Boegman, L., Diamessis, P.J. and Lamb, K.G. Boundary layer separation and vortex shedding beneath internal solitary waves. *J. Fluid Mech.*
4. Dorostkar, A., Boegman L., Diamessis P.J. and Pollard A. Three-dimensional numerical simulation of internal wave dynamics in a long narrow lake. *J. Geophys. Res.*
3. Sleep, S., and Boegman, L. Feasibility of bubble plume destratification of central Lake Erie. *J. Hydraul. Eng. ASCE.*

2. Zhang, H., Culver, D.A. and Boegman, L. Application of a two-dimensional ecological model to evaluate the effects of external phosphorus loading on Lake Erie's lower trophic levels. *Ecol. Model.*
1. Boegman, L., and Ivey, G.N. The dynamics of internal wave resonance in periodically forced lakes. *J. Fluid Mech.*

(d) Invited refereed conference publications

1. Culver, D., Li, H., Edwards, W., Babcock-Jackson, L., Weisgerber, K., Loewen, M., Boegman, L., Hamblin, P., Charlton, M., Coakley, J. 1999. Ecological modeling of Lake Erie trophic dynamics – 1999. Proc. *42nd Annual Conference on Great Lake Research. IAGLR*, May 24-28, Cleveland, Ohio. 8 pp.

(e) Refereed conference publications (presenter underlined)

5. Dorostkar, A., Boegman, L., Diamessis, P., Pollard, A. 2010. Sensitivity of MITgcm in application to Cayuga Lake. Proc. *6th Int. Symposium on Environmental Hydraulics*, Jun. 23-5, Athens. 6 pp.
4. Boegman, L. and Yerubandi, R. 2010. Process oriented modelling of Lake Ontario hydrodynamics. Proc. *6th Int. Symposium on Environmental Hydraulics*, Jun. 23-25, Athens. 6 pp.
3. Boegman, L. and Ivey, G.N. 2007. Experiments on internal wave resonance in periodically forced lakes. Proc. *5th Int. Symposium on Environmental Hydraulics*, Dec. 4-7, Tempe, Arizona. 6 pp.
2. Boegman, L. 2006. A model of the stratification and hypoxia in central Lake Erie. Proc. *6^{th} Int. Symposium on Stratified Flows.*, Perth, Australia, Dec. 11-14, 608-613.
1. Boegman, L., Ivey, G.N. and Imberger, J. 2004. An internal solitary wave parameterization for hydrodynamic lake models. Proc. *15th Australasian Fluid Mechanics Conference*, University of Sydney, CD Rom: AFMC00098. 4 pp.

(f) Invited conference publications (presenter underlined)

3. Boegman, L. 2010. Nonlinear internal waves in long narrow lakes: evolution, propagation and topographic interaction. 2^{nd} Norway-Scotland Internal Waves Symposium, Nov. 1-2, Edinburgh.
2. Boegman, L. and Ivey, G.N. 2009. Flow separation and resuspension beneath shoaling nonlinear internal waves. Proc. *Workshop on Dynamics in Environ. and Geophysical Flows*. Jul. 27-29. Waterloo.
1. Boegman, L. Intake Protection Zone Modeling - Lake Ontario and the Cataraqui Region. 2007. *A.D. Latornell Conservation Symposium*. Nov. 14-16. Alliston, Ontario.

(g) Non-refereed conference publications (presenter underlined)

38. Scalo, C., Piomelli, U. and Boegman, L. 2010. Large-eddy simulation of oxygen transport and depletion in waterbodies. Proc. *63rd Annual Meeting of the American Physical Society's Division of Fluid Dynamics*, Nov. 21-23 Long Beach, California.
37. Bouffard, D., Boegman, L. and Yerubandi, R.R. 2010. Spatial and temporal variability of turbulent hot spots in a large stratified lake. Proc. *14th International Workshop on Physical Processes in Natural Waters*. Jun. 28 – Jly.1, Reykjavík, Iceland, 2 pp.
36. Boegman, L. and Yerubandi, R.R. 2010. Process oriented modeling of Lake Ontario hydrodynamics. Proc. *14th Int. Workshop on Physical Processes in Natural Waters*. Jun. 28 – Jly.1, Reykjavik, 2 pp.

35. Aghsaee, P., Boegman, L. and K. Lamb. 2010. Instability mechanisms and reflection of internal solitary waves shoaling upon coastal boundaries of lakes and oceans. Proc. *Congress of the Canadian Meteorological and Oceanographic Society* May 31—Jun. 4, Ottawa.
34. Boegman, L. and Yerubandi, R.R. 2010. Hydrodynamic modelling of seiches and Kelvin and Poincaré waves in Lake Ontario. Proc. *Annual Congress of the Canadian Meteorological and Oceanographic Society* May 31—June 4, Ottawa, Ontario.
33. Bouffard, D., Boegman, L. and Yerubandi, R.R. 2010. Spatial and temporal variability of turbulent hot spots in Lake Erie, Proc. *53rd Int. Conference on Great Lakes Research,* May 17-21, Toronto.
32. Oveisy, A., Boegman L., and Imberger J. 2010. Simulation of ice formation on Lake Ontario, Proc. *53rd International Conference on Great Lakes Research*, May 17-21, U. Toronto.
31. Boegman, L. and Yerubandi, R.R. 2010. Process oriented modeling of Lake Ontario hydrodynamics. Proc. *53rd International Conference on Great Lakes Research*, May 17-21, University of Toronto.
30. Sonekan, C., Boegman, L. and Yerubandi, R.R. 2010. Application of a one-dimensional hydrodynamic model to Hamilton Harbour and Lake Simcoe. Proc. *53rd International Conference on Great Lakes Research*, May 17-21, University of Toronto.
29. Dorostkar A., Boegman L., Diamessis P.J. and Pollard A. 2010. *Comparison of hydrostatic and non-hydrostatic modeling of internal wave fields in Cayuga Lake*. Proc. *53rd International Conference on Great Lakes Research*, May 17-21, University of Toronto.
28. Aghsaee, P., Boegman, L. and K. Lamb. 2010. Instability mechanisms and reflection of internal solitary waves shoaling upon coastal boundaries of lakes and oceans. Proc. *53rd International Conference on Great Lakes Research*, May 17-21, University of Toronto.
27. Paturi, S., Boegman, L. Yerubandi, R.R. 2010. Near –shore hydrodynamics and tracer modeling of Upper St. Lawrence River using ELCOM model. Proc. *53rd International Conference on Great Lakes Research,* May 17-21, University of Toronto.
26. Valipour, R., Boegman, L. Bouffard, D. and Yerubandi, R. 2010. *Large scale internal waves in the central basin of Lake Erie.* Proc. *53rd Int. Conf. on Great Lakes Research*, May 17-21, Toronto.
25. Bouffard, D., and Boegman, L. 2010. Validation of a vertical turbulent diffusivity parameterization at the field scale. Proc. *2010 Ocean Sciences Meeting,* Feb. 22-26, Portland, Oregon.
24. Boegman, L., Bouffard, D., and Yerubandi, R.R. 2010. Spatial and temporal variability of turbulent hot spots in a large stratified lake. Proc. *2010 Ocean Sciences Meeting,* Feb. 22-26, Portland, Oregon.
23. Boegman, L. and Ivey, G. 2009. The dynamics of internal wave resonance in periodically forced lakes. Proc. *13th Int. Workshop on Physical Processes in Natural Waters.* Sept. 1-4, Palermo, 2 pp.
22. Aghsaee, P., Boegman, L. and K. Lamb. 2009. Breaking of shoaling internal solitary waves. Proc. *Dynamics in Environmental and Geophysical Flows.* Jul. 27-29. Waterloo, ON.
21. Dorostkar, A., Boegman, L, Pollard, A. and Diamessis, P. 2009. Three dimensional modeling of internal waves in a medium sized lake. Proc. *Workshop on the Dynamics in Environmental and Geophysical Flows*. Jul. 27-29. Waterloo, ON.
20. Boegman, L., and Pichette, M. 2008. Modelling the impacts of climate change on Lake Erie hypoxia. Proc. *Physical Processes in Natural Waters XII.* Lake Tahoe, NV.
19. Hall, E.A., Paturi, S., Boegman, L., Yerubandi, R.R., Hall, K. 2008. A hydrodynamics study of Lake Ontario and the upper St Lawrence River. Proc. *Annual Congress of the Canadian Meteorological and Oceanographic Society*. May 25 – 28, Kelowna BC.
18. Hall, E.A., Boegman, L., Yerubandi, R.R., and Paturi, S. 2008. Modeling Lake Ontario hydrodynamics: performance of basin-scale and nearshore simulations. Proc. *51st Annual Conference on Great Lakes Research,* IAGLR, May 19 - 2, Peterborough, ON.

17. Boegman, L. Loewen, M.R., Culver, D.A. and Hamblin P.F. 2008. Coupling between Stratification, mixing and *Dreissenid* grazing impacts in western Lake Erie. Proc. *51st Annual Conference on Great Lakes Research*, IAGLR, May 19 - 2, Peterborough, ON.
16. Boegman, L. and Ivey, G.N. 2007. Experiments on internal wave resonance in periodically forced lakes. Proc. *30th Congress of the Int. Assoc. of Theoretical and Applied Limnology*, Aug. 12-18, Montreal 15. Hall, E.A., Boegman, L, Yerubandi, R.R. and Hall, K.R. 2007. A hydrodynamics study of Lake Ontario and the upper St. Lawrence River. Proc. 14th Annual International Conference on the Great Lakes / St. Lawrence River Ecosystem. May 15-17, Cornwall, ON.
14. Boegman, L., 2007. A stratification criterion for hypoxia formation in central Lake Erie 2007. Proc. *50th Conference on Great Lakes Research*, May 28 – Jun.1, University Park, PA.
13. Culver, D.A., Zhang, H., Conroy, J.D., Boegman, L. and Edwards, W.J. 2007. Process oriented approaches to determining hypoxia impacts in large lakes. Proc. *50th Annual Conference on Great Lakes Research,* IAGLR, May 28 - June 1, University Park, PA.
12. Zhang, H., Culver, D.A. and Boegman, L. 2007. Dreissenids in Lake Erie: an Algal Filter or a Fertilizer? Proc. *50th Annual Conference on Great Lakes Research.* May 28-Jun.University Park, PA
11. Zhang, H., Culver, D.A. and Boegman, L. 2007. Impacts of phosphorus loading on the lower trophic levels of Lake Erie during the growing season – Application of an ecological model. Proc. *50th Annual Conference on Great Lakes Research*, IAGLR, May 28 - June 1, University Park, PA
10. Culver, D.A., Zhang, H., Conroy, J., Boegman, L. and Edwards, W. 2007. Hydromechanics and the Impact on Lake Erie Plankton, Benthos, and Fish. Proc. Ecological impacts of hypoxia on living resources, NOAA Workshop, March 26-27, St. Louis MS.
9. Boegman, L., 2006. The degeneration of internal waves in lakes with sloping topography. Proc. *Annual Congress of the Canadian Meteorological and Oceanographic Society*. May 29 to June 1, Toronto, Canada.
8. Boegman, L. and Loewen, M.R. 2006. The Role of Weak Stratification in Controlling Vertical Plankton Flux over Zebra Mussel Colonies in Western Lake Erie. Proc. *49th Annual Conference on Great Lakes Research*, IAGLR, May 22-26, Windsor, Canada.
7. Boegman, L., Lamb, K.G., and Ivey, G.N. 2006. Flow separation and resuspension beneath shoaling internal solitary waves. Proc. *13th Ocean Sciences Meeting,* Feb. 20-24, Honolulu.
6. Boegman, L., Ivey, G.N. and Imberger, J. 2004. Classification of shoaling internal solitary waves. Proc. *IAPSO Ocean mixing conference*. Oct. 11–14, Victoria, Canada.
5. Lamb, K.., Boegman, L. and Ivey, G. 2005. Numerical simulations of shoaling internal solitary waves in tilting tank experiments. Proc. *9th European Workshop on Phys. Processes in Natural Waters*, Lancaster, 31-38.
4. Boegman, L., Imberger, J. and Ivey, G.N. 2004. An internal solitary wave parameterization for hydrodynamic lake models. Proc. *IAPSO Scientific committee on oceanic research: Ocean mixing conference*. October 11 – 14, Victoria, Canada.
3. Boegman, L., Ivey, G.N. and Imberger, J. 2003. The degeneration of internal waves in lakes with sloping topography. Proc. *IUGG General Assembly,* June 30 - July 11, Sapporo.
2. Boegman, L., Loewen, M.R., Hamblin, P.F. and Culver, D.A. 2000. Application of a two-dimensional hydrodynamic and water quality model to Lake Erie. Proc. *10th Ocean Sciences Meeting,* Jan. 24-28, San Antonio, Texas.
1. Boegman, L., Hamblin, P.F. and Loewen, M.R. 1999. Two-Dimensional Modelling of Zebra Mussel Effects in Lake Erie, Stage One: Validation of Temperature, Currents and Water Levels. Proc. *42nd Annual Conference on Great Lake Research. IAGLR,* May 24-28, Cleveland, Ohio.

(h) Consulting reports

2. Boegman, L and Rao, Y.R. 2010. Application of a two-dimensional hydrodynamic and water quality model for Lake Winnipeg eutrophication management. Prepared for Environment Canada.
1. Boegman, L. (Ed.) 2008. Delineation of Intake Protection Zones in eastern Lake Ontario and the upper St. Lawrence River. Prepared for Ontario Ministry of the Environment Source Protection Technical Studies Program for Municipalities.

(i) Invited scholarly presentations

11. Boegman, L. 2009. Forty years of water quality change in Lake Erie: Modelling eutrophication, hypoxia and invasive mussel impacts. Centre for Water Research. University of Western Australia.
10. Boegman L. 2009. Shoaling of nonlinear internal waves in coastal environments. School of Environmental Systems Engineering. University of Western Australia
9. Boegman, L. 2009. Spatial-dynamic modelling of eutrophication, hyopxia and invasive mussel impacts in Lake Erie. Department of Physical and Environmental Sciences. University of Toronto.
8. Boegman, L. 2007. Nonlinear internal waves in lakes: Tales from Australia to Ithaca. Department of Civil & Environmental Engineering, Cornell University, Ithaca, USA.
7. Boegman, L. 2007. Lake hydrodynamics and implications for water quality. Biology, Dept.. Queen's.
6. Boegman, L., Imberger, J. and Ivey, G.N. 2004. Internal solitary wave parameterization for hydrodynamic lake models. Dept. of Applied Mathematics, University of Waterloo, Canada.
5. Boegman, L. Control points in open channel flow. 2004. Department of Civil Engineering, Queen's University, Kingston, Canada.
4. Boegman, L., Ivey, G.N. and Imberger, J. 2004. The degeneration of internal waves in lakes with sloping topography. Department of Civil Engineering, Queen's University, Kingston.
3. Boegman, L., Ivey, G.N. and Imberger, J. 2004. The degeneration of internal waves in lakes with sloping topography. Centre for Water Research, University of Western Australia, Perth, Australia.
2. Boegman, L., Ivey, G.N. and Imberger, J. 2003. The degeneration of internal waves in lakes with sloping topography. Department of Applied Mathematics, University of Waterloo, Canada.
1. Boegman, L., Ivey, G.N. and Imberger, J. 2003. The degeneration of internal waves in lakes with sloping topography. National Water Research Institute, Canada Centre for Inland Waters, Canada.

Pierre Dupuis, ing. M.Sc.

Vice-President

Aquapraxis inc.

M. Dupuis is a civil engineer who is specialized in hydraulics and hydrology, with 30 years of experience in the fields of numerical modeling, data acquisition campaigns and data analysis. He was involved in major environmental projects, where his expertise in computing sciences was put to contribution to solve specific and often unusual problems. He uses object oriented programming (C++ language) to create specific software suited for solving these problems.

When working at "La Société d'Énergie de la Baie James (SEBJ)", he was involved in acquisition and treatment of data in the rugged climate of Northern Québec. He was in charge of wind, waves measurements and analyses in order to assess damages that occurred to dams and dikes riprap under wave attack. He created software to quickly analyze and visualize the data gathered and predict the wave climate on large reservoirs.

As a member of Dessau-Soprin, he worked on network analysis (stormwater, aqueduct and water hammer studies) and he developed specialized software to quickly evaluate the strength and weaknesses of storm water networks. He went to Africa to work on water allocation schemes for the Government of Sénégal and on road rehabilitation in Sénégal and Burkina Faso.

He his currently working with major engineering firms on hydrological and hydraulic studies for freeway implementation in both Africa (Algeria) and in the West Indies(Grenada and Trinidad-Tobago). He worked on river training in Grenada. His expertise in 2D modeling and tidal analysis is sought by Hydro-Québec and SEBJ.

Recently, the Hydraulic Service of Hydro-Quebec sought his services to work on the hydrodynamics of Rupert Bay, a large bay in Northern Québec which is partly fresh and brakish water. He developped special software applications to synthetise the output information from the Mike21 software in order to facilitate dissemination of information to non specialists.

He specializes in tidal data treatment, wave climate analyses, and ripap size evaluation.

Author of several important papers in different fields of hydraulics, he attended many conferences in the United States and Canada. He his co-founder and now acting as vice-president of Aquapraxis Inc, a consulting firm that specializes in water resources analyses, software development and formation in hydrology and hydraulics.

Academics

M. Sc., Université Laval (Québec), 1984

B.Sc.A. Université Laval Civil engineering, (Québec), 1981

Expertise

- Software development
- Specialized software
- 2D hydraulic modeling
- Road hydrology
- Water resources analyses
- Tidal hydraulics
- Wind and wave hindcast

CARREER

Since November 2010	GENIVAR	Research and development Hydrology and hydraulics
Since October 2000	Aquapraxis inc.	Vice-President Research and development Hydrology and hydraulics
1997 - 2000	Dessau-Soprin inc	Hydraulic Engineer
1989 - 1996	Société d'énergie de la Baie James	Hydraulic Engineer
1987 - 1989	TAO Simulations inc	Infography specialist
1986 - 1987	Hydro-Québec, Direction Environnement	Research counselor - Hydrology
1984 - 1986	Université Laval	Doctoral studies - Projects Research assistant - Crani
1981 - 1983	Université Laval	Master studies Research assitant - Centreau

PROFESSIONAL ASSOCIATIONS

Ordre des ingénieurs du Québec (OIQ)

Canadian society of civil Engineers (CSCE)

International Association for Hydraulic Research (IARH)

Canadian Dam Association (CDA)

UPDATED 2009-05-23

Languages : French and English

PROFESSIONAL EXPERIENCE

INTERNATIONAL

Hydraulic study for oued El Kebir (Algeria). For Tecsult (2007).

Hydraulic study for river training of Guayanapa River. Trinidad and Tobago. For Dessau-Soprin International (2006).

Hydrological study for the Prince-Town to Mayaro freeway, Trinidad et Tobago. For Dessau-Soprin International (2005).

Water network study for le Servicios de Agua y drenaje de Monterrey , Mexico. For IMS Experts, Trois-Rivières (2005).

Hydrological study for the second Rocade freeway in Alger, Algeria. For Dessau-Soprin International (2005) ;

Hired as a Specialist by l'Agence Canadienne de Développement International (ACDI) to evaluate a Canadian-Burkina Faso project on Climatic Changes. Niamey, Niger. (2004);

Hydraulic studies for bridges, river training and implementation of Early Warning Systems in Grenada, West Indies. For Dessau-Soprin International and the Ministry of Public Works, Grenada, West Indies (2002-2003);

Hydrological studies to retrofit 20 bridges in Grenada, West Indies. For Dessau Soprin International (2002);

Hydraulic study for Batié-Ghana border and Batié-Ivory Coast border (Burkina-Faso). For Dessau Soprin International (2001);

Hydraulic study for the Ouahigouya-Séguénéga road (Burkina-Faso). For Dessau Soprin International(2000);

Hydraulic study for the Kaya-Piaboré road (Burkina-Faso). For Dessau Soprin International (1999);

Hydrological and hydraulic study for the water resource allocation for the revitalization of fossil valleys in Senegal. For SNC-Lavalin – Dessau consortium (1997).

URBAN AND NETWORKS

Water hammer analysis for the Aqueduct network of Quebec City. For Dessau (May 2009)

Aqueduct network analyses for 9 Cree community of Northern Quebec. Supervisor for Dessau (October 2009).

Pond network analysis for Development « Au cœur du Monde » in St-Alexis. For Dessau (July 2008).

Update of Aqueduct network plan of North-Hatley, Quebec. For Génipur, (August 2008).

Impacts of climatic changes on the St-Lawrence river hydrology and on the Montreal water intakes (April 2006). For the city of Montreal;

Water supply network for the ciment plant sector of Beauport , Québec (May 2005);

Creation of storm water drainage networks from GIS databases for cities of Laval and Ste-Foy , Québec (August 2002);

Water supply network for the city of North Hatley. Analysis performed for Genipur inc (March 2002).

Storm water source control analysis for the Champigny Basin; city of Sainte-Foy (March 2001) ;

Creation of SWMM and SWMM et XP-SWMM models from a SIRDU model (Data treatment). For the city of Sainte-Foy (August 2001);

Water hammer analysis for a pumping station in Saint-Calixte. For SNC-Lavalin inc (July 2001);

Impacts of storm water modifications on the St-Regis river hydraulics. For the city of St-Constant. For Dessau-Soprin (2000).

Flow and pressure analysis in the water distribution network of Saint-Léonard and potential gain in implementing pressure reducing valves at the boundary with Montreal. For the city of Saint-Léonard (Dessau).

Study on the use of a main interceptor as a storm water catchbasin for the city of Saint-Jerôme. For Dessau (1997);

Stormwater network analysis for the following cities: Saint-Hubert, Laval, Ste-Foy, Cap-de-la-Madeleine ;

Source control criteria in a urban setting using real rain data.

HYDROLOGICAL AND HYDRAULIC STUDIES FOR ROAD WORKS

Hydraulic studies for Corte-Real and Anse-au-Griffon crossings (Gaspésie). For the town of Gaspé and the « ministère de la sécurité publique du Québec » (November 2007).

Hydraulic study for the Kinebic stream (Québec). For Environnement Illimité and the Canadien National Railroad (September 2007).

Hydraulic study for all river crossing of the East-West and North-South segments of the access road for Great Whale Hydroelectric Project. For SEBJ, a subsidiary of Hydro-Québec (1991).

Hydrology and hydraulic studies for bridge rehabilitation. For the Ministry of Transport, Québec.

Hydrology and hydraulic studies for the bridge on Aux Vaches River. For the Ministry of Transport, Québec.

See also InternationalExperience at the beginning of this CV

DAM BREAK ANALYSES

Dam Break Study for Lake Breeches Dam (Thetford-Mines). (July 2008).

Supervison for the dam break analysis for barrage Boischatel . For Roche (November 2007).

Dam Break Study for Wayagamac dam. For IMS and the town of La Tuque. (August 2006).

BANK EROSION

Responsible for the maritime aspect of a cost-benefit study for the protection of banks against erosion for Pointe-aux-Outardes (Quebec North Shore) Fro the town of Pointe-aux-Outardes and « le ministère de la sécurité publique du Québec » (2008).

Hydraulic study for bank protection of Maria (Gaspésie). For Roche ltee (December 2006).

Evaluation of hydraulic solicitations on the south bank of La Grande River, James Bay Region. For Hydro-Québec. (July 2006);

Evaluation of hydraulic solicitations on the banks of Rivière-Ouelle, Lower St-Lawrence region. For le Groupe Sohier inc (March 2006).

MARITIME

Sainte-Marguerite River. Environmental follow-up. Creation of a tidal signal transfer function fromSept-Îles signal toward the signal at two sites nt Sainte-Marguerite estuary. Generation of the wave climate near the Sainte-Marguerite outlet. Natural flow reconstitution without the effect of the SM-3 dam (January 2009).

Analysis of the sand filling phenomenom at the Chandler Marina, Gaspésie. (October 2008)

Tidal analysis at Ivujivik, Northern Quebec. For CIMA+. (July 2008)

Wave climate generation at Baie Ste-Catherine, Québec. For Génivar (June 2008).

Tidal and wave climate analyses for the future Marina of Chisasibi. For Dessau (July 2007).

Creation of the transfer function between Rimouski tidal signal and the PK 3,6 site of the Portneuf river estuary. For Environnement Illimité and Hydro-Québec, North Shore Region (October 2005).

Tidal Signal analyses at Tasiujaq et Akulivik, Nunavik and evaluation of different datum elevations. For Environnement Illimité inc (September 2004);

Wind and waves analyses on large reservoirs. For la Société d'Énergie de la Baie James (subsidiary of Hydro-Québec) (1991-1996);

Tidal analyses for sites located on the La Grande Rivière, James Bay. For the « Société d'Énergie de la Baie James, SEBJ »;

HYDRAULIC WORKS

Site selection for a water intake for the Niobec Mine. For Roche. (May 2009).

Low stage flows for the Jacques Cartier River. For Dessau (November 2008).

The Atwater Intake Canal. Hydraulic capacity of the channel. For the consortium SNC_Lavalin - Dessau-Soprin and the city of Montréal. (February 2007).

Hydrological study of the St-Lawrence River at Montreal. Climatic changes and potential impacts on the hydrological regime of the Saint-Lawrence River and the intake performance on the water treatment plant of Atwater and Charles-J. Des Baillets. For SNC-Lavalin and Dessau-Soprint and the city of Montréal (April 2006).

Hydraulic study to establish design water levels for the design of a cofferdam on the Jacques-Cartier River. For Dessau-Soprin inc.

Analyses and modifications to formulas used for the design of riprap for large dams and dikes. For SEBJ (1993-1996)

Analyses of results from large scale modeling of riprap protection submitted to irregular wave trains. For SEBJ (1993-1996).

1 AND 2D MODELING

2D numerical modeling to correct the velocity field near an articial spawning site for yellow sturgeon specie (Mike 21 HD). For Hydro-Québec Équipement (2006).

2D numerical modeling to obtain velocity fields upstream of the proposed La Sarcelle powerhouse (Mike 21 HD).   For Hydro-Québec Équipement (2005).

1D (Hec-Ras) and 2D (Mike 21 HD) hydraulic analyses of the dowstream reach of Romaine1 futur powerhouse. Pour Hydro-Québec (2006);

1D Hydraulic study (Hec-Ras) to obtain design water elevation for construction of a coffer dam on Jacques-Cartier River. For Dessau-Soprin inc (2006).

1D numerical analyses (Hec-Ras) of the hydraulic regime of Romaine-4 futur reservoir. For Hydro-Québec (2005);

2D numerical modeling of an artifical spawning site for the yellow sturgeon fish specie on the Eastmain river (Mike 21 HD).   For Hydro-Québec (2006);

Hydrodynamic study of Rupert Bay estuary using Mike21 HD and Ad modules. For Hydro-Québec (September 2004).

Numerical simulation of tidal propagation within the Eastmain River estuary, before and after river diversion. For Hydro-Québec (1984).

SPECIAL STUDIES – HYDRAULICS AND HYDROLOGY

Stability analysis of a buoy to be installed on an ice cover. For Environnement Illimité and Manitoba Hydro (February 2009).

Hydrology of the des Mille Îles River and the Montreal Archipelargo. For Ville de Laval (2007-2009)

Hydraulic analysis of Rivière Serpent. For Environnement Illimité (December 2006).

Hydrological study of Lac à la Pêche. For IMS Experts-Conseils. (September 2006).

Over land and over water wind speed analysis (1991-1996).

Analysis of a large submersion wave triggered by a major landslide on the La Grande River (James Bay) (1989);

Scale modeling of a fish latter to enhance the flow pattern. For Hydro-Québec.

Analysis of year round thermal behaviour of northern reservoirs. For SEBJ.

Analysis of the thermal response of La Grande Rivière (Baie James). For SEBJ (1991);

Collaborator for the numerical modeling of the reach of La Grande Rivière downstream of LG2.

Hydrology and hydraulic of the Cheval-Blanc Rapid related to dredging of a channel. For Dessau, Ville de Laval (Québec), 1997.

Hydraulic study of Chicoutimi marina using a 2D finite element model;

Hydrological and hydraulic regime of Rivière-à-Mars (Saguenay) to minimize dredging. For SECAL (Alcan) (1982) ;

Collaborator for the study "Methodology for the study of physical impacts on northern estuary following hydroelectric powerhouse implantation". For Centreau and Hydro-Québec.

Collaborator for the hydraulic study of Archipel faisability project. For Hydro-Québec;

DATA ACQUISITION

Supervision of a water survey on the Archipelargo of Montreal during the spring freshet of 2008. With Hydro-Québec, Environnement Québec, Environnement Canada and Environnement Illimité. For Ville de Laval (Spring and summer of 2008).

Supervisionof a water survey on the Mille Îles River. With Environnement Illimité. For Ville de Laval (November 2007).

Supervision of the installation of electronic instruments (limnimetry, thermometry et meteorology) for all major powerhouse projects (LG1, LA1, Fontanges, Brisay) and reservoirs LG2, LG3, LG4 and Caniapiscau for la Société d'Énergie de la Baie James (SEBJ) a subsidiary of Hydro-Québec;

Supervision of hydraulic surveys for all major river crossings for the Great Whale access road in northern Quebec. For la Société d'Énergie de la Baie James (SEBJ) a subsidiary of Hydro-Québec;

Supervision of the installation of accelerometric buoys and meteorological stations on all large reservoirs within the La Grande Hydroelectric Complex. For la Société d'Énergie de la Baie James (SEBJ) a subsidiary of Hydro-Québec;

Supervision of water temperature measurements in all large reservoirs in the La Grande Hydroelectric Complex. For la Société d'Énergie de la Baie James (SEBJ) a subsidiary of Hydro-Québec;

SOFTWARE

Development of AquaWave, a software for the analyis of tidal signals, creation of tidal transfert function, propagation of waves in shallow water, and maritime related functions.

Development of AquaShore. Maritime data analyses. Design of beach in equilibrium according to the Coastal Engineering Manual of the US Army Corps of Engineers.

Development of AquaSignal, a software to visualize and correct temporal data vectors. For the Geomatic unity of Hydro-Québec.

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Supervision of 2D numerical modeling of the St-Lawrence flow in the vicinity of Grondine, Québec, for the implementation of a power line crossing. Study performed by TAO Simulations inc.

PUBLICATIONS / CONFERENCES

Sept. 2006. « Impacts assesment of the Rupert River Diversion on Rupert Bay Hydrodynamics », Pierre Dupuis et Al. Oral presentation at the 7th International Conference on Hydroinformatics, Nice, France, 2006.

Sept. 2002. «*Tools for Analysis and Decision Support for Sewer Networks : Assessment of Needs and Interface Integration*», G. Rivard et Pierre Dupuis, Oral presentation at the 9th international Conference on Urban Drainage, Portland, Orégon.

Feb. 2002. «*Integrating Floodplain and Stormwater Management : Historical Perspective, Concepts and Case Studies*», G. Rivard, S. Bélanger et P. Dupuis. Oral presentation by G. Rivard at the International Stormwater Modeling Conference, Toronto.

2000. *« Évaluation du comportement hydraulique d'un réseau d'égout existant : paramètres et critères d'analyse pour la réhabilitation »*, G. Rivard et Pierre Dupuis. Oral presentation by G. Rivard at INFRA 2000 Conference, Laval (Québec).

1999. *« Criteria for surface on-site detention systems : a reality check »*, G. Rivard et Pierre Dupuis. Oral presentation by G. Rivard at the 8th International Conference on Urban Drainage, Sydney, Australia.

1996. *« Wave Climate of Large Reservoirs and Revised Wave Hindcast Formula »*, Pierre Dupuis, Jean-Pierre Tournier et Octave Caron. Oral presentation by P.Dupuis at the 25th International Conference on Coastal Engineering. Orlando, Fl. September 1996.

1996. *« An Improved Design Method for the Riprap of Earthfill Dams of Large Reservoirs ».* J.P. Tournier, Pierre Dupuis et Raymond Arès. Oral presentation by

J.P.Tournier at the 5th International Conference on Coastal Engineering, Orlando, Fl..

1993. *« On the use of van der Meer and Hudson formulae for the riprap design of large dams ».* Pierre Dupuis. Discussion at the International Riprap Workshop 1993. Fort Collins, Colorado.

1993. *« The Hydraulics of Riprap Design Applied to the Repairs of Dams and Dikes of the La Grande Hydroelectric Complex. »* O. Caron, P.Dupuis and T.T.Van. 5th CDSA Annual Conference and CANCOLD Annual Meeting, St-John's, Newfoundland.

1992. *« Winter Thermal Regime of a Nordic Reservoir, the LG-2 Reservoir (James Bay). »* P. Dupuis, O. Caron and P. Pelletier. IAHR, 11th International Symposium on Ice, Banff, 1992.

1987. *« A modified method for pipe network analysis. »* Pierre Dupuis, Jean-Loup Robert et Yvon Ouellet . Journal of Hydraulic Research, Vol. 25, no 1, 1987, pp. 27 - 40.

1987. *« Modélisation des écoulements de l'archipel de Montréal par éléments finis: aspects divers de l'application. »* Michel Leclerc, Gouri Dhatt, Jean-Loup Robert, Jean-Claude Tessier, Azzedine Soulaïmani, Pierre Dupuis et Yves Matte. Revue internationale des sciences de l'eau, Vol. 20 no 2, mai 1987.

1986. *« Influence du choix du niveau d'eau sur le dimensionnement des ouvrages maritimes. »*Yvon Ouellet et Pierre Dupuis. International Symposium « Périls et catastrophes », Rimouski, Québec, 1986.

1986. *« Modélisation d'un écoulement tourbillonnaire en régime permanent. »*Yvon Ouellet, Pierre Dupuis et Azzedine Soulaïmani. Revue canadienne de génie civil, Vol. 13, no 3, 1986, pp. 310-318.

1986. *« Effets de la coupure de la rivière Eastmain (Baie James) sur son régime hydrodynamique estuarien. »* Pierre Dupuis et Yvon Ouellet. Le Naturaliste canadien, Vol. 113, no 4, 1986.

1986. *« Finite-Element Modelling of the Montréal Archipel : a Case Study »* Leclerc, M, G. Dhatt, J.L. Robert, A. Soulaïmani et P. Dupuis. Proceedings of the VIth International Conference on Finite Elements in Water Resources. Lisbonne. June 1986.

1985. *« Méthode modifiée des tronçons pour le balancement des réseaux d'aqueduc.* Pierre Dupuis, Jean-Loup Robert et Yvon Ouellet. Hydrotechnical Conference, Canadian Society of Civil Engineering, Saskatoon, 1985.

1985. *« La propagation de la marée dans le fjord du Saguenay. »* Yvon Ouellet et Pierre Dupuis. Symposium on the Oceanograpy of the Saguenay River, 53th Congress of ACFAS, Chicoutimi, 1985.

GENIVAR **ENERGY**

Pierre Dupuis, Eng.

COASTAL AND RIVER HYDRAULIC

AREAS OF PRACTICE

Software development
Water resources analyses
Tidal hydraulics
Wind and wave hindcast
2D hydraulic modeling
Road hydrology

LANGUAGES

English
French

PROFILE

Pierre Dupuis is a civil engineer who is specialized in hydraulics and hydrology, with 30 years of experience in the fields of numerical modeling, data acquisition campaigns and data analysis. He was involved in major environmental projects, where his expertise in computing sciences was put to contribution to solve specific and often unusual problems. He uses object oriented programming (C++ language) to create specific software suited for solving these problems.

When working at “La Société d’Énergie de la Baie James (SEBJ)”, he was involved in acquisition and treatment of data in the rugged climate of Northern Québec. He was in charge of wind, waves measurements and analyses in order to assess damages that occurred to dams and dikes riprap under wave attack. He created software to quickly analyze and visualize the data gathered and predict the wave climate on large reservoirs.

As a member of Dessau-Soprin, he worked on network analysis (stormwater, aqueduct and water hammer studies) and he developed specialized software to quickly evaluate the strength and weaknesses of storm water networks. He went to Africa to work on water allocation schemes for the Government of Sénégal and on road rehabilitation in Sénégal and Burkina Faso.

He his currently working with major engineering firms on hydrological and hydraulic studies for freeway implementation in both Africa (Algeria) and in the West Indies(Grenada and Trinidad-Tobago). He worked on river training in Grenada. His expertise in 2D modeling and tidal analysis is sought by Hydro-Québec and SEBJ.

Recently, the Hydraulic Service of Hydro-Quebec sought his services to work on the hydrodynamics of Rupert Bay, a large bay in Northern Québec which is partly fresh and brakish water. He developped special software applications to synthetise the output information from the Mike21 software in order to facilitate dissemination of information to non specialists.

He specializes in tidal data treatment, wave climate analyses, and ripap size evaluation.

Author of several important papers in different fields of hydraulics, he attended many conferences in the United States and Canada. He his co-founder and now acting as vice-president of Aquapraxis Inc, a consulting firm that specializes in water resources analyses, software development and formation in hydrology and hydraulics.

EDUCATION

Master in hydraulic, Université Laval	1984
B.Sc.A. Civil engineering, Université Laval	1981

PROFESSIONAL AFFILIATIONS

Ordre des ingénieurs du Québec	OIQ
Canadian society of civil Engineers	CSCE

International Association for Hydraulic Research	IARH
Canadian Dam Association	CDA

CAREER

Hydraulic Engineer, Research and development, GENIVAR	2010 - Present
Vice-President, Research and development, Hydrology and hydraulics Aquapraxis inc.	Since October 2000
Hydraulic Engineer, Dessau-Soprin inc.	1997 - 2000
Hydraulic Engineer, Société d'énergie de la Baie James	1989 - 1996
Infography specialist, TAO Simulations inc.	1987 - 1989
Research counselor – Hydrology, Hydro-Québec, Direction Environnement	1986 - 1987
Doctoral studies – Projects, Research assistant – Crani, Université Laval	1984 - 1986
Master studies, Research assitant - Centreau Université Laval	1981 - 1983

PROFESSIONAL EXPERIENCE

International

- Hydraulic study for oued El Kebir (Algeria). For Tecsult (2007).
- Hydraulic study for river training of Guayanapa River. Trinidad and Tobago. For Dessau-Soprin International (2006).
- Hydrological study for the Prince-Town to Mayaro freeway, Trinidad et Tobago. For Dessau-Soprin International (2005).
- Water network study for le Servicios de Agua y drenaje de Monterrey , Mexico. For IMS Experts, Trois-Rivières (2005).
- Hydrological study for the second Rocade freeway in Alger, Algeria. For Dessau-Soprin International (2005).
- Hired as a Specialist by l'Agence Canadienne de Développement International (ACDI) to evaluate a Canadian-Burkina Faso project on Climatic Changes. Niamey, Niger. (2004).
- Hydraulic studies for bridges, river training and implementation of Early Warning Systems in Grenada, West Indies. For Dessau-Soprin International and the Ministry of Public Works, Grenada, West Indies (2002-2003).
- Hydrological studies to retrofit 20 bridges in Grenada, West Indies. For Dessau Soprin International (2002).
- Hydraulic study for Batié-Ghana border and Batié-Ivory Coast border (Burkina-Faso). For Dessau Soprin International (2001).
- Hydraulic study for the Ouahigouya-Séguénéga road (Burkina-Faso). For Dessau Soprin International (2000).
- Hydraulic study for the Kaya-Piaboré road (Burkina-Faso). For Dessau Soprin International (1999).

- Hydrological and hydraulic study for the water resource allocation for the revitalization of fossil valleys in Senegal. For SNC-Lavalin – Dessau consortium (1997).

Urban and networks

- Water hammer analysis for the Aqueduct network of Quebec City. For Dessau (May 2009).
- Aqueduct network analyses for 9 Cree community of Northern Quebec. Supervisor for Dessau (October 2009).
- Pond network analysis for Development « Au cœur du Monde » in St-Alexis. For Dessau (July 2008).
- Update of Aqueduct network plan of North-Hatley, Quebec. For Génipur, (August 2008).
- Impacts of climatic changes on the St-Lawrence river hydrology and on the Montreal water intakes (April 2006). For the city of Montreal.
- Water supply network for the ciment plant sector of Beauport , Québec (May 2005).
- Creation of storm water drainage networks from GIS databases for cities of Laval and Ste-Foy , Québec (August 2002).
- Water supply network for the city of North Hatley. Analysis performed for Genipur inc. (March 2002).
- Storm water source control analysis for the Champigny Basin; city of Sainte-Foy (March 2001).
- Creation of SWMM and SWMM et XP-SWMM models from a SIRDU model (Data treatment). For the city of Sainte-Foy (August 2001).
- Water hammer analysis for a pumping station in Saint-Calixte. For SNC-Lavalin inc. (July 2001).
- Impacts of storm water modifications on the St-Regis river hydraulics. For the city of St-Constant. For Dessau-Soprin (2000).
- Flow and pressure analysis in the water distribution network of Saint-Léonard and potential gain in implementing pressure reducing valves at the boundary with Montreal. For the city of Saint-Léonard (Dessau).
- Study on the use of a main interceptor as a storm water catchbasin for the city of Saint-Jerôme. For Dessau (1997).
- Stormwater network analysis for the following cities: Saint-Hubert, Laval, Ste-Foy, Cap-de-la-Madeleine.
- Source control criteria in a urban setting using real rain data.

Hydrological and hydraulic studies for road works

- Hydraulic studies for Corte-Real and Anse-au-Griffon crossings (Gaspésie). For the town of Gaspé and the « ministère de la sécurité publique du Québec » (November 2007).
- Hydraulic study for the Kinebic stream (Québec). For Environnement Illimité and the Canadien National Railroad (September 2007).

- Hydraulic study for all river crossing of the East-West and North-South segments of the access road for Great Whale Hydroelectric Project. For SEBJ, a subsidiary of Hydro-Québec (1991).
- Hydrology and hydraulic studies for bridge rehabilitation. For the Ministry of Transport, Québec.
- Hydrology and hydraulic studies for the bridge on Aux Vaches River. For the Ministry of Transport, Québec.

See also InternationalExperience at the beginning of this CV.

Dam break analyses

- Dam Break Study for Lake Breeches Dam (Thetford-Mines). (July 2008).
- Supervison for the dam break analysis for barrage Boischatel . For Roche (November 2007).
- Dam Break Study for Wayagamac dam. For IMS and the town of La Tuque. (August 2006).

Bank Erosion

- Responsible for the maritime aspect of a cost-benefit study for the protection of banks against erosion for Pointe-aux-Outardes (Quebec North Shore) Fro the town of Pointe-aux-Outardes and « le ministère de la sécurité publique du Québec » (2008).
- Hydraulic study for bank protection of Maria (Gaspésie). For Roche ltee (December 2006).
- Evaluation of hydraulic solicitations on the south bank of La Grande River, James Bay Region. For Hydro-Québec. (July 2006).
- Evaluation of hydraulic solicitations on the banks of Rivière-Ouelle, Lower St-Lawrence region. For le Groupe Sohier inc (March 2006).

Maritime

- Sainte-Marguerite River. Environmental follow-up. Creation of a tidal signal transfer function fromSept-Îles signal toward the signal at two sites nt Sainte-Marguerite estuary. Generation of the wave climate near the Sainte-Marguerite outlet. Natural flow reconstitution without the effect of the SM-3 dam (January 2009).
- Analysis of the sand filling phenomenom at the Chandler Marina, Gaspésie. (October 2008).
- Tidal analysis at Ivujivik, Northern Quebec. For CIMA+. (July 2008).
- Wave climate generation at Baie Ste-Catherine, Québec. For GENIVAR (June 2008).
- Tidal and wave climate analyses for the future Marina of Chisasibi. For Dessau (July 2007).
- Creation of the transfer function between Rimouski tidal signal and the PK 3,6 site of the Portneuf river estuary. For Environnement Illimité and Hydro-Québec, North Shore Region (October 2005).
- Tidal Signal analyses at Tasiujaq et Akulivik, Nunavik and evaluation of different datum elevations. For Environnement Illimité inc (September 2004).

- Wind and waves analyses on large reservoirs. For la Société d'Énergie de la Baie James (subsidiary of Hydro-Québec) (1991-1996).
- Tidal analyses for sites located on the La Grande Rivière, James Bay. For the « Société d'Énergie de la Baie James, SEBJ ».

Hydraulic works

- Site selection for a water intake for the Niobec Mine. For Roche. (May 2009).
- Low stage flows for the Jacques Cartier River. For Dessau (November 2008).
- The Atwater Intake Canal. Hydraulic capacity of the channel. For the consortium SNC_Lavalin - Dessau-Soprin and the city of Montréal. (February 2007).
- Hydrological study of the St-Lawrence River at Montreal. Climatic changes and potential impacts on the hydrological regime of the Saint-Lawrence River and the intake performance on the water treatment plant of Atwater and Charles-J. Des Baillets. For SNC-Lavalin and Dessau-Soprint and the city of Montréal (April 2006).
- Hydraulic study to establish design water levels for the design of a cofferdam on the Jacques-Cartier River. For Dessau-Soprin inc.
- Analyses and modifications to formulas used for the design of riprap for large dams and dikes. For SEBJ (1993-1996).
- Analyses of results from large scale modeling of riprap protection submitted to irregular wave trains. For SEBJ (1993-1996).

1 and 2D modeling

- 2D numerical modeling to correct the velocity field near an articial spawning site for yellow sturgeon specie (Mike 21 HD). For Hydro-Québec Équipement (2006).
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- Stability analysis of a buoy to be installed on an ice cover. For Environnement Illimité and Manitoba Hydro (February 2009).
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Data acquisition

- Supervision of a water survey on the Archipelargo of Montreal during the spring freshet of 2008. With Hydro-Québec, Environnement Québec, Environnement Canada and Environnement Illimité. For Ville de Laval (Spring and summer of 2008).
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PUBLICATIONS AND PRESENTATIONS

Publications

- Sept. 2006. « Impacts assesment of the Rupert River Diversion on Rupert Bay Hydrodynamics », Pierre Dupuis et Al. Oral presentation at the 7th International Conference on Hydroinformatics, Nice, France, 2006.
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- 1999. *« Criteria for surface on-site detention systems : a reality check »*, G. Rivard et Pierre Dupuis. Oral presentation by G. Rivard at the 8th International Conference on Urban Drainage, Sydney, Australia.
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- 1996. *« An Improved Design Method for the Riprap of Earthfill Dams of Large Reservoirs ».* J.P. Tournier, Pierre Dupuis et Raymond Arès. Oral presentation by J.P.Tournier at the 5th International Conference on Coastal Engineering, Orlando, Fl.
- 1993. *« On the use of van der Meer and Hudson formulae for the riprap design of large dams ».* Pierre Dupuis. Discussion at the International Riprap Workshop 1993. Fort Collins, Colorado.
- 1993. *« The Hydraulics of Riprap Design Applied to the Repairs of Dams and Dikes of the La Grande Hydroelectric Complex. »* O. Caron, P.Dupuis and T.T.Van. 5th CDSA Annual Conference and CANCOLD Annual Meeting, St-John's, Newfoundland.
- 1992. *« Winter Thermal Regime of a Nordic Reservoir, the LG-2 Reservoir (James Bay). »* P. Dupuis, O. Caron and P. Pelletier. IAHR, 11th International Symposium on Ice, Banff, 1992.
- 1987. *« A modified method for pipe network analysis. »* Pierre Dupuis, Jean-Loup Robert et Yvon Ouellet . Journal of Hydraulic Research, Vol. 25, no 1, 1987, pp. 27 - 40.
- 1987. *« Modélisation des écoulements de l'archipel de Montréal par éléments finis: aspects divers de l'application. »* Michel Leclerc, Gouri Dhatt, Jean-Loup

Robert, Jean-Claude Tessier, Azzedine Soulaïmani, Pierre Dupuis et Yves Matte. Revue internationale des sciences de l'eau, Vol. 20 no 2, mai 1987.

- 1986. *« Influence du choix du niveau d'eau sur le dimensionnement des ouvrages maritimes. »*Yvon Ouellet et Pierre Dupuis. International Symposium « Périls et catastrophes », Rimouski, Québec, 1986.
- 1986. *« Modélisation d'un écoulement tourbillonnaire en régime permanent. »*Yvon Ouellet, Pierre Dupuis et Azzedine Soulaïmani. Revue canadienne de génie civil, Vol. 13, no 3, 1986, pp. 310-318.
- 1986. *« Effets de la coupure de la rivière Eastmain (Baie James) sur son régime hydrodynamique estuarien. »* Pierre Dupuis et Yvon Ouellet. Le Naturaliste canadien, Vol. 113, no 4, 1986.
- 1986. *« Finite-Element Modelling of the Montréal Archipel : a Case Study »* Leclerc, M, G. Dhatt, J.L. Robert, A. Soulaïmani et P. Dupuis. Proceedings of the VIth International Conference on Finite Elements in Water Resources. Lisbonne. June 1986.
- 1985. *« Méthode modifiée des tronçons pour le balancement des réseaux d'aqueduc.* Pierre Dupuis, Jean-Loup Robert et Yvon Ouellet. Hydrotechnical Conference, Canadian Society of Civil Engineering, Saskatoon, 1985.
- 1985. *« La propagation de la marée dans le fjord du Saguenay. »* Yvon Ouellet et Pierre Dupuis. Symposium on the Oceanograpy of the Saguenay River, 53th Congress of ACFAS, Chicoutimi, 1985.

ALAN T.K. FOK, Ph.D., P.Eng.

HYDRAULIC SPECIALIST, ENVIRONMENTAL HYDRAULICS

AREAS OF PRACTICE

Hydraulic Transients
Expert Witness
Network Modeling
River & Coastal Eng.

LANGUAGES

English
Chinese

PROFILE

The Professional Engineers of Ontario (PEO) designated Alan a: "Hydraulic Specialist" in 1983 for his contributions to the field (over 30 technical papers). He later completed his Ph.D. in Civil Engineering (hydraulic transients) and founded Environmental Hydraulics Group (EHG, now a division of GENIVAR) 20 years ago.

Alan's expert opinions are backed by 30 years of consulting experience, project management and contract research. He is the original co-author of HAMMER®, the hydraulic transient software sold worldwide by Bentley Systems' Haestad Methods.

EDUCATION

Ph.D. (Civil Eng., Hydraulic Transients), University of Ottawa	1987
Master of Engineering (Civil Eng., Sediment Transport), Queen's University	1975
Bachelor of Science (Civil Engineering), Cum Laude, University of Ottawa	1972

PROFESSIONAL AFFILIATIONS

Professional Engineers of Ontario	PEO
Member, ISO Canadian Advisory Committee	

PROFESSIONAL EXPERIENCE

Managed projects for most major Canadian cities, regions and governments (Canadian and US Air Forces, Corrections Canada) and the water industry (Zenon). Multi-sector experience in mining (Barrick Gold, Newmont Gold, Algoma Steel, Inco, QIT Fer et Titane), hydropower (Ontario Power Generation, Pacific Gas & Electric, Algonquin Power), legal and insurance firms in Canada and the USA and top engineering firms (SNC-Lavalin, Hatch, CH2M Hill, Burns & McDonnell, Kimley-Horn, Volkert).

Water Supply and Distribution

- Water Supply: Hydraulic tests & analysis for Ellesmere PS upgrade in PD2 & 4. Hydraulic grade line (HGL) for R.C. Harris WTP in Toronto. Many more studies.
- Water distribution, for Toronto's largest pressure districts (PD4, PD5 and PD6), York Region, Region of Peel, Region of Waterloo (Tri-City, surface and ground water sources), City of Ottawa (entire system), City of Hamilton, Simcoe Region (transients), Niagara Region (review), New-Tecumseth (pipeline and Alliston network), Sault Ste. Marie, Town of Taber (AB), Calgary (AB), St. John (NB), Montego Bay (Jamaica) and Kabul (Afghanistan). Many more studies.
- Greater Toronto Area (GTA): Peel-York 2100 mm feedermains (and all 6 zones), Downsview Base Lands Re-development in Toronto's PD5 & 6; Block 17 in Vaughan; Oakville Zone 2; Fieldrun Phase III water system.

Hydraulic Modeling (Steady and Transient)

Project Manager for over 100 major hydraulic modeling projects, each including transient analysis for water, wastewater, oil/gas, hydro and slurry systems:

- Entire water networks such as pressure districts 4 & 5 (Toronto), Glenmore/Top Hill system (Calgary); Major LPTM and HPTM supply pipelines to Zone 1W, including 3D transient forces (Ottawa); 3 zones in Thunder Bay; Zones 2 to 6 (Peel Region) and 6 to 8 (York Region) and many others. Steady-state model calibrations for Toronto PD5, Chatham and Alliston, ON. Transient risk evaluations for DeCew Falls (Niagara); Region of Ottawa-Carleton; Aurora to Newmarket (York Region); and Keswick to Sutton (Georgina Township).
- High-energy water transmission lines including: (i) valves for Zone 5 mains (Hamilton), 15 major PS and mains in Peel and York (Ontario), LPTM and 4 zones in Ottawa, Montego Bay (Jamaica) and Kabul (Afghanistan); (ii) surge tanks for NY hydro penstock (differential), Deacon booster PS (Winnipeg) and Buffalo Pound line (Regina), and (iii) gas vessels for Lake Huron raw water (London, ON), Easterly and Humber STP (Toronto), Airport Rd line (Peel and York) and Longeuil forcemain (Montréal, QC).
- Transient analysis of surcharged trunk sewers and WWTP in Edmonton (confirmed by independent tests) and Ottawa (Orleans-Cumberland). Pre-design and review of Western Beaches CSO storage Tunnel (Toronto); and Somerset tunnel (Ottawa). Review of York-Durham Sanitary Sewer System (YDSS) and designs for many hydraulic structures.
- Hydraulic reviews and surge control for mining and industrial plants including Boulder mine dewatering WTP and Roaster slurry pumping for Barrick Gold and gravity line for Newmont Gold (all in NV); Pascua Lama mine (Argentina/Chile); Bulyanhulu water line (Tanzania); QIT Fer et Titane plant with high pressures and temperatures plus steam system (QU) and Algoma 265 bar descaling system – both with transient forces on piping for input to CAESAR II pipe stress analysis.
- Break investigations and project reviews and/or legal cases for dozens of water and sewage PS, hydropower penstocks (Adam Beck 1 & Welland canal), plants and pipelines on 4 continents.

Expert Witness and ADR

- Expert witness for insurer (Encon) for a slurry pipeline legal case in AB (ongoing).
- Expert witness for plaintiff for a cooling system break in a prison in NY (ongoing).
- Expert witness on flooding and erosion cases: Markland Woods Golf (MTO) and Oakdale Golf (plaintiff), the latter with case management and ADR (both settled).
- Confidential pre-trial investigations for 5 other cases, plus dozens of reviews and break investigations as owner's expert or through value engineering. Built an experienced field and forensic engineering team.

Environmental Assessment

- EA and site selection for several feedermains and reservoirs (Peel and York).
- Water balance and erosion potential for Carp River and basin (Thunder Bay).
- Point Lepreau nuclear plant (NB) and Lower Churchill hydro (NFLD).

- Al Masane mine (Saudi Arabia).

Dispersion Analysis

- Chlorine dispersion from a snow disposal site near Ottawa River and from petroleum plants along St. Clair River.
- Thermal discharge study by computer modeling and dye diffusion for Dalhousie power plant and Point Lepreau nuclear plant (New Brunswick).

Physical Modeling of Hydraulic Structures

- Scale models of chlorine mixing for the Glen Cairn and Ottawa South reservoirs in the City of Ottawa. Field tracer study for Brampton chlorine contact chamber.
- Conceptual and detailed design of 45 m drop shaft and 200 m tunnel system at 1:12 scale in NWRI laboratory. Tests to improve air recirculation ($200k in fees)
- Lab tests of PVC pipe under vacuum and overpressure for Ontario Ministry of Environment. Self-scouring outfall (Hamilton).
- Self-scouring storm outfall design at 1:15 scale for the City of Hamilton.

Water Pollution Control

- Pollution control studies for existing wastewater collection systems for Calgary, Edmonton, Winnipeg, St. Catharines, Toronto and St. John.
- Design and hydraulic operations for water and waste treatment plants for R.C. Harris, Humber and Dufferin (Toronto); Thunder Bay (Ontario) and Boulder Valley (Nevada).
- Technical reviews and design improvements for CSO tanks in Hamilton (Greenhill, Royal, Ewen) and for tunnels in Toronto (Western Beaches), Ottawa (SWSF), Calgary (Glencoe) and Hamilton (Greenhill).

Shoreline Protection

- Physical model studies of wave effects for site selection of point Lepreau nuclear station (New Brunswick). Analysis and design of intake and outfall alternatives.
- Shoreline protection for Lake Vista development on Lake Ontario, ON (ongoing). Includes a Self-Scouring Outfall (SSO) for storm water management pond.
- Harbour dredging, breakwaters, shoreline protection and sediment or current studies.

PUBLICATIONS AND PRESENTATIONS

- Over 30 publications and papers have been contributed to journals and conferences across North America and internationally. A complete list is available upon request.

REFERENCES

- Anthony Parente, P.Eng., Manager of Capital Works, Region of Peel, 10 Peel Centre Drive, 4th floor, Brampton, Ontario, Canada L6T 5M8, Phone: (905) 791-7800 Ext.4989, Fax: (905) 791-0728, *Steady & Transient Hydraulic Analysis or Tests.*

- Henry Polvi, P.Eng., Sr. Project Manager, City of Toronto, Metro Hall, Station 1170 16th Floor, 55 John Street, Toronto, Ontario, Canada M5V 3C6, Phone: (416) 392-8887, Fax: (416) 392-3639, *Hydraulic Assessment for Ellesmere Pumping Station.*
- Doug Scott, P.Eng., Director of Engineering, City of Thunder Bay, 410 Mountdale Avenue, P.O. Box 800, Thunder Bay, Ontario, Canada, P7C 5K4. Phone: (807) 625-2269, Fax: (807) 625-3588, *Network-wide Tests and Transient Analysis of Water System.*

GENIVAR

INDUSTRIAL AND ENERGY

NICOLAS GUILLEMETTE, P.Eng., M. Sc.

PROJECT MANAGER, HYDRAULIC, HYDROLOGY AND COASTAL ENGINEERING

AREAS OF PRACTICE

River hydraulic
Coastal Engineering
Hydrology
Modeling

LANGUAGES

French
English (Intermediate)

PROFILE

Mr Guillemette, P. Eng., holds bachelor's degree in civil engineering and a master degree in environmental hydraulic. He is specialized in the fields of hydraulic, hydrology and coastal engineering. Over the last 3 years, he carried out numerous hydrological studies, hydraulic modeling and studies on watersheds in Eastern Canada and abroad for a wide range of civil engineering works (dams, bridges and culverts, water intakes, irrigation, etc.), and of wildlife restoration works (fish habitat, stream bank restoration works, etc.). In the field of coastal projects, Mr Guillemette has been involved in different projects as technical specialist in wave propagation modeling for shoreline stabilization, beach nourishment and sediment transport.

EDUCATION

M. Sc./Environmental hydraulic, INRS-ETE, Quebec (Qc)	2009
B. A. Sc./Civil engineering, U Laval, Quebec (Qc)	2005

ADDITIONAL TRAINING

Coastal engineering course Old Dominium University, Virginia, USA	2010
Training for the use of a 3D hydrodynamic model FLOW-3D, Flow Science, New-Mexico, USA	2008

DISTINCTIONS

Scholarship from the Global Environmental and Climate Change Centre(C_3EG), McGill University, Quebec	2008

PROFESSIONAL AFFILIATIONS

Ordre des ingénieurs du Québec	OIQ
Canadian Water Ressources Association	CWRA

CARRER

Engineer, Hydropower and Hydraulic, GENIVAR, Quebec, Canada	2008 to date
Engineer, Hydraulic and Environment, BPR, Quebec, Canada	2007
Research assistant, Laval University, Quebec, Canada	2006

Research internship, Laval University, Quebec, Canada	2005
Internship in river hydraulic, Groupe-Conseil LaSalle, Quebec, Canada	2005
Internship in civil engineering, Roche ltee, Quebec, Canada	2004
Internship in civil engineering, Roche ltee, Quebec, Canada	2003

PROFESSIONAL EXPERIENCE

River development and restoration projects

- Hydrotechnical study of the Cataraqui river. Estimation of the probable maximum flood (PMF) for seven dams on the Rideau waterway, Ontario
- Feasability study for the development of the water supply reservoir of the Bissa gold mine, Burkina Faso
- Study on increasing river capacity using a 3D hydrodynamical model: case study of the Sable river. Study to optimize flow management, Quebec
- Technical expertise for stream bank protection, Noire-nord-est river, Quebec
- Hydrological and hydraulic study of the Petit Pabos river. 1D hydrodynamical modeling of the river flood, Quebec
- Feasability study for flood management at the Lac Creve-Faim lake. Hydrological modeling to design a lake outlet, Quebec
- Hydraulic study and water management plan to design a riprap weir in the Becancour river, Quebec
- Environmental impact study of the restoration of St-Joseph lake, Quebec
- Hydrological and hydraulic study of the Becancour river. 1D hydrodynamical modeling of the river flood , Quebec
- Collaboration to environmental compensation works below the 4 Miles (5 MW) and 6 Miles (11 MW) falls on the Sault-aux-Cochons River, Quebec

Coastal Projects

- Feasability study to design a river bridge on the St-Augustin river. Hydrodynamical study of the river estuary using a 2D model, Quebec
- Wave modeling in the Blanc-Sablon bay to restore a small craft harbour. Calculation of wave generation and propagation to evaluate significant wave height to design coastal structures, Quebec
- Preliminary study to restore the Portneuf sandbank. Capacity calculation of the beach nourishment with equilibrium profile, Quebec
- Wave modelling of the Chandler bay to evaluate longshore circulation induce by tides, Quebec
- Technical expertise to evaluate scour in the St-Augustin river estuary, Quebec
- Riprap calculation for shoreline protection in the St-Lawrence Gulf, Quebec

Hydropower and Dams

- Study on increasing capacity evacuation of the Sartigan dam. Calculation of the hydraulic jump position and length, Quebec
- Flood maps for preliminary emergency plans for the Riviere-du-Loup dam (Algonquin Power Systems), Quebec
- Dam Safety Review of the Jones falls dam, consequence of a dam break (Parks Canada), Ontario
- Collaboration to the feasibility study for the development of 4 Miles (5 MW) and 6 Miles (11 MW) falls on the Sault-aux-Cochons River (Betsiamites First Nation), Quebec

Municipal Projects

- Hydraulic study and design criteria of the flooding of Le Francois brook for a residential development project (village de Uashat), Quebec

Profile:

A hydraulic engineer with 30 years of experience, Mr. Saucet is a specialist in hydraulics of northern rivers, with special emphasis to thermal budget and ice generation and accumulation. As project engineer and Vice President of the LaSalle Consulting Group, Mr. Saucet has been in charge of studies in all fields of hydraulics, including field surveys as well as numerical and physical modeling. His field of expertise includes assessment of the winter regime of large hydroelectricity projects, including most of the projects by Hydro-Québec (notably the La Grande project and the Nottaway, Broadback Rupert projects in the early '80, the Great Whale Project in the early '90, and more recently the Rupert Diversion Project). Mr. Saucet is in charge of all the scientific and technical aspects of a major software development project involving the development of new modules for the MIKE 11 (Danish Hydraulics Institute) river modeling system.

Academic training:

1975: M. Sc. Applied Science, (Hydraulics, Hydrology) Ecole Polytechnique, Montreal
1973: Diploma in Engineering, Ecole Polytechnique, Paris, France

Experience:

Since 1977: The LaSalle Consulting Group

- Scientific Director (1992)
- Vice President (2000)
- President (2007)

1990-2000:
M. Saucet is in charge of graduate and undergraduate courses at Ecole Polytechnique de Montreal and Ecole de Technologie Supérieure, Montreal (general hydraulics, sediment transport, etc.)

1976-78 Montreal Engineering Company Limited

While working for Tidal Power Consultants Ltd consortium, carried out preliminary numerical studies of the operation of the proposed power scheme on the Bay of Fundy, Canada

Recent projects:

YEAR	PROJECT	CLIENT
2010	Numerical modelling of the thermal regime and frazil ice generation on the proposed intake channel of the Romaine-1 hydroelectric project.	HYDRO-QUEBEC
2010	Alcoa Wharf No 4. Baie-Commeau. Ice conditions and ice load design criteria	HATCH
2009-2010	Technical advisor for the ice management on the Rupert river, Quebec, Canada, during the winter construction of height weirs and spur dykes	SEBJ and Hydro-Quebec
2009	Member, River Ice Review Panel established by NALCOR, Newfoundland, Canada, to advise on issues related to ice management of the Churchill river during construction of the Lower Churchill Project in Labrador	NALCOR
2008-2009	Numerical Simulation of Dam Break in Winter Conditions. La Gabelle Dam on the Saint-Maurice River.	Hydro-Quebec
2008	Saugeen River at Durham, Ontario. Frazil Ice assessment	OEL - Hydrosys
2007-2008	Assessment of the ice jam and flooding risks when discharging large flow through the Saint-Timothée and Pointe du Buisson basins, (Saint-Lawrence river)	Hydro-Quebec
2007	Ice retention system for the SM-1 generating station, Sainte-Marguerite river.	HydroMega inc.
2007	Numerical modeling of the frazil ice generation and ice cover formation on the La Grande river, downstream of the LG-1 powerhouse	Hydro-Quebec
2007	Expert advice, thermal budget evaluation and numerical simulations on the winter operation of the proposed La Sarcelle powerhouse, as part of the Eastmain-1A / Rupert Diversion project	James Bay Corporation
2005-2006	Evaluation of the accessibility of the ice-covers by skidooers, as part of the Environmental	Hydro-Quebec

	Impact Assessment, Romaine Complex, Quebec	
2005	Assessment of the future winter regime of the Rupert river following proposed diversion (Eastmain-1-A / Rupert Diversion project)	James Bay Corporation
2005	Re-evaluation of the thermal regime and ice conditions at the water intake of the proposed Romaine I generating station	Hydro-Quebec
2003	Numerical modeling of ice conditions along the Boyd-Sakami derivation, as part of the EM1-Rupert project	Hydro-Quebec
2003	Assessment of the impact on the ice regime of the proposed Highway 25 bridge above the Des Prairies river.	Ministère des Transports, Québec
2002-2003	Development of a comprehensive numerical model of ice generation and accumulation, in partnership with Hydro-Quebec and DHI Water and Environment	Hydro-Quebec
2002-03	Winter reconnaissance of the Eastmain and Rupert rivers, as part of the definition of the ice survey requirements and numerical modeling of the future ice conditions	Hydro-Québec
2002	Ice conditions at the water intake of the proposed Romaine I generating station	Hydro-Quebec
2002	Ice survey on the Nelson River, northern Manitoba, and final assessment of the ice conditions during the construction of the projected Gull rapids Generating Station.	Manitoba-Hydro
2000	Granite Canal Project, Newfoundland. Preliminary Assessment of the Ice Conditions.	AGRA – BAE Newplan Joint Venture
1999	High Falls generating Station, Ontario. Winter Conditions in the Proposed Approach Channel	McNamara-AGRA-Monenco
1996-2003	New Grand-Mere Generating Station with increased capacity. Comprehensive study of the ice conditions along the Saint-Maurice river (ice covers submitted to large flow and water level variations during peaking)	Hydro-Quebec

Selected publications:

- *Full 2D Calculation of Ice Generation, Transport and Build-up in Natural Rivers* - by P. Beauchemin; J.P.Saucet and C. Marche - I.A.H.R. Ice Symposium 1994, Trondheim.
- *Effects of simulated water level management on shore erosion rates. Case study: Baskatong Reservoir, Quebec, Canada,* by D. Saint Laurent; B.N.Touileb; J.P.Saucet; A. Whalen; B. Gagnon and T. Nzakimuena. Canadian Journal of Civil Engineering, 2001
- *Chronological Reconstitution of Floods of the Saint-François Drainage Basin, Quebec* – by D. Saint-Laurent; M. Forest and JP Saucet. 3rd Canadian Conference on Geotechnic and natural Hazards, Edmonton, June 2003
- *Development of River Ice Modules for MIKE 11* – by J. -P. Saucet, M. Villeneuve, K. W. Olesen, T. S. Jensen and F. Therrien. 2nd North American DHI Software Conference, San Francisco, CA, November 2003
- *Validation of the Mike-Ice model simulating river flows in presence of ice and forecast of changes to the ice regime of the Romaine river due to hydroelectric project* – by Isabelle Thériault, Wael Taha and J.P. Saucet. 20th IAHR Ice Symposium, Lathi, Finland, June 2010

Languages:

French, written and spoken
English, written and spoken

Professional affiliations:

- Quebec Order of Engineers

Name: Sven HEINZ
Curriculum Vitae

LAHMEYER INTERNATIONAL

Position:	Senior Engineering Expert	**Nationality:**	German
Born:	1971	**With Firm since:**	2005

Key Qualifications:

Development of German Offshore Wind Farms .Technical inspection of wind turbines several manufacturers (0,5 MW – 3MW installed capacity) in several countries (approx. 100 turbine inspections); Partial experience in O&M monitoring of approx. 100 MW wind farm projects; Project manager with experience in Development of Wind Farm Project On-/Offshore, Technical Due Diligence, EPC Contract negotiation incl. FIDIC, Construction Monitoring for Turnkey and Multi contracting,

Education:

1993 - 2000	University of Applied Sciences, Aachen, Germany, Dipl.-Ing. Mechanical Engineer
1989 - 1991	Schmalbach-Lubeca AG, Weißenthurm, Germany, Skilled Worker Industrial Mechanic / Machine and System Technology

Professional Record (since 2000)**:**

Since 2005	Lahmeyer International GmbH, Bad Vilbel, Germany, Project Manager
2000 - 2004	Offshore Wind Projektentwicklung GmbH, Erkelenz, Germany, Project Engineer
1997 - 2000	Umweltkontor Group, Erkelenz, Germany, Project Engineer

Project Experience (excerpt since 2000)**:**

Since 2009	Greece, Project Manager, 18 MW EEN SKOPIES WIND FARM, Lender's Engineer, Technical Due Diligence, Construction Monitoring, Technical Inspection (before Taking Over)
2008	Ethiopia, Project Engineer, 120 MW ASHEGODA WIND FARM, EPC/Turnkey Contract negotiation (FIDIC), Technical Expertise
2007 – 2009	Greece, Project Manager, 42 MW GARBIS & SEFIROS WIND FARM, Lender's Engineer, Technical Due Diligence, Construction Monitoring, Technical Inspection (before Taking Over)
2006 – 2007	Greece, Project Manager, 16 MW ENVITEC PORTFOLIO, Lender's Engineer, Technical Due Diligence, Contract negotiation, Construction Monitoring, Technical Inspection
2006	Greece, Project Manager, 13 MW VOREAS PORTFOLIO, Lender's Engineer, Technical Due Diligence, Contract negotiation, Construction Monitoring, Technical Inspection (before Taking Over and periodic), O&M Monitoring
2005 – 2007	Greece, Project Manager, 40 MW ARKADIA WIND FARMS, Lender's Engineer, Technical Due Diligence, Contract negotiation, Construction Monitoring, Technical Inspection
2005 - 2006	Greece, Project Manager, 23 MW ZARAKES PORTFOLIO, Lender's Engineer, Technical Due Diligence, Contract negotiation
2003 - 2004	Germany, Project Engineer, 200 MW OFFSHORE WIND PORTFOLIO, Design and optimisation of the wind farm layout, Contact person for authorities, Elaboration of a feasibility study, Negotiation with sub contractors for EIA.
2004	France, Project Engineer, 100 MW OFFSHORE WIND FARM, Technical Support during preparation of application documents
2000-2004	Germany, Project Engineer, 600 MW ADLERGRUND OFFSHORE WIND FARM, Project development, Contract negotiation, Tender procedure EIA, Budget planning
2000-2004	Germany, Project Engineer, SEVERAL WIND FARM PROJECTS IN CENTRAL PART OF GERMANY, Wind potential analysis, Development and optimisation of wind farm layout, Calculation of noise emissions, Calculations of shade emissions, Basic Infrastructure Design

Languages:

	speaking	reading	writing
German	mother tongue	mother tongue	mother tongue
English	good	good	good

Name: Matthias HENKE
Curriculum Vitae

Position:	Senior Engineering Expert	**Nationality:**	German
Born:	1974	**With Firm since:**	2006

Key Qualifications:

Industrial Engineer with both Electrical and Economical Degree. In addition to the technical background, completed a MBA course on international management. Extensive work experience in onshore as well as offshore wind farm projects for developing companies, utilities and consulting companies including the following tasks:
Project Management: Set up and coordinate project teams for wind farm development and consulting project. Management of projects regarding time and cost schedule. Development of business plans and implementation.
Wind Energy Technologies: Wind turbine technology, Project infrastructure, Tender & Bid specifications, Construction supervision, O&M concepts, Wind farm internal and external electrical Grid design.
Wind Energy Economics: Due Diligences, Economic assessments, Feasibility studies, Cost calculations, Land lease contracts, EPC-contracts, Cash-flow models, Budget control, Maintenance and repair cost forecast, Market studies

Education:

2007 - 2009	Institute for Economics and Management, Frankfurt a.M., Germany MBA: Master of Business Administration
2001 – 2003	University of Applied Sciences, Bielefeld, Germany 2003: Graduation as Dipl. Wirt.-Ing. in Economics
1996 – 2000	University of Applied Sciences, Bielefeld, Germany 2000: Graduation as Dipl.-Ing. in Electrical Engineering

Professional Record (since [year])**:**

Since 2010	LAHMEYER INTERNATIONAL USA, Inc. Washington, DC, USA, Vice President Renewable energy Services in North America
2008 - 2010	LAHMEYER INTERNATIONAL GmbH, Consulting Engineers, Bad Vilbel, Germany Manager Renewable Energy Projects North America
2006 - 2008	LAHMEYER INTERNATIONAL GmbH Consulting Engineers, Bad Vilbel, Germany, Project Manager Department “Renewable Energies – Wind Energy”
2005 – 2006	MAINOVA AG, Frankfurt am Main, Germany Sales Engineer for individual electricity grid connection contracts
2099 – 2004	WINKRA ENERGIE GmbH, Hannover, Germany Project Analyst for acquiring and analysing of turn key wind energy projects

Project Experience (excerpt since [year])**:**

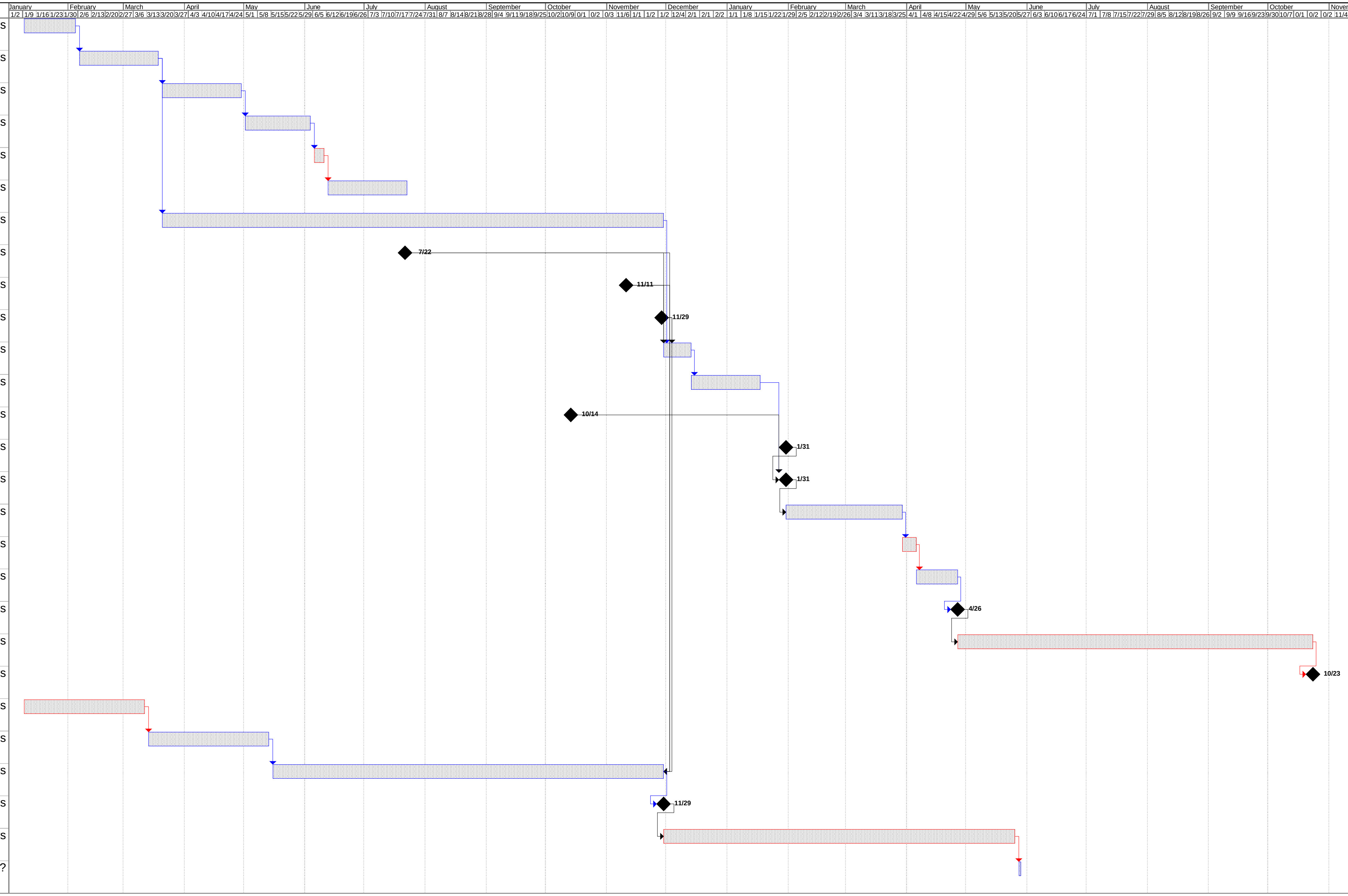
2010	USA, Project Director, Wind Farm Development (ca. 100 MW), MT
2010	Canada, Project Director, Offshore Wind Farm Pre-Feasibility Assessment (ca. 370 MW), ON
2010	USA, Project Director, 4 Wind Farm Portfolio Development (ca. 600 MW), MT; ND
2009	USA, Project Manager, 100MW Wind Farm, MT,
2009	USA, Project Manager, Wind Farm Portfolio
2009	USA, Project Manager, Wind Turbine Technology
2009	World Wide, Project Manager, World Wide Wind Farm Portfolio (ca. 4300MW)
2008	Europe, Project Manager, 37 Wind Farms Portfolio (ca. 800 MW)
2008	USA, Project Manager, 1 Wind Farm Project (ca. 66 MW)
2007	Germany, Project Manager, 1 Offshore Wind Farm Project (ca. 400 MW)

Languages:

	speaking	reading	writing
German	mother tongue	mother tongue	mother tongue
English	excellent	excellent	excellent
Spanish	fair	fair	fair

APPENDIX C – GANTT CHARTS

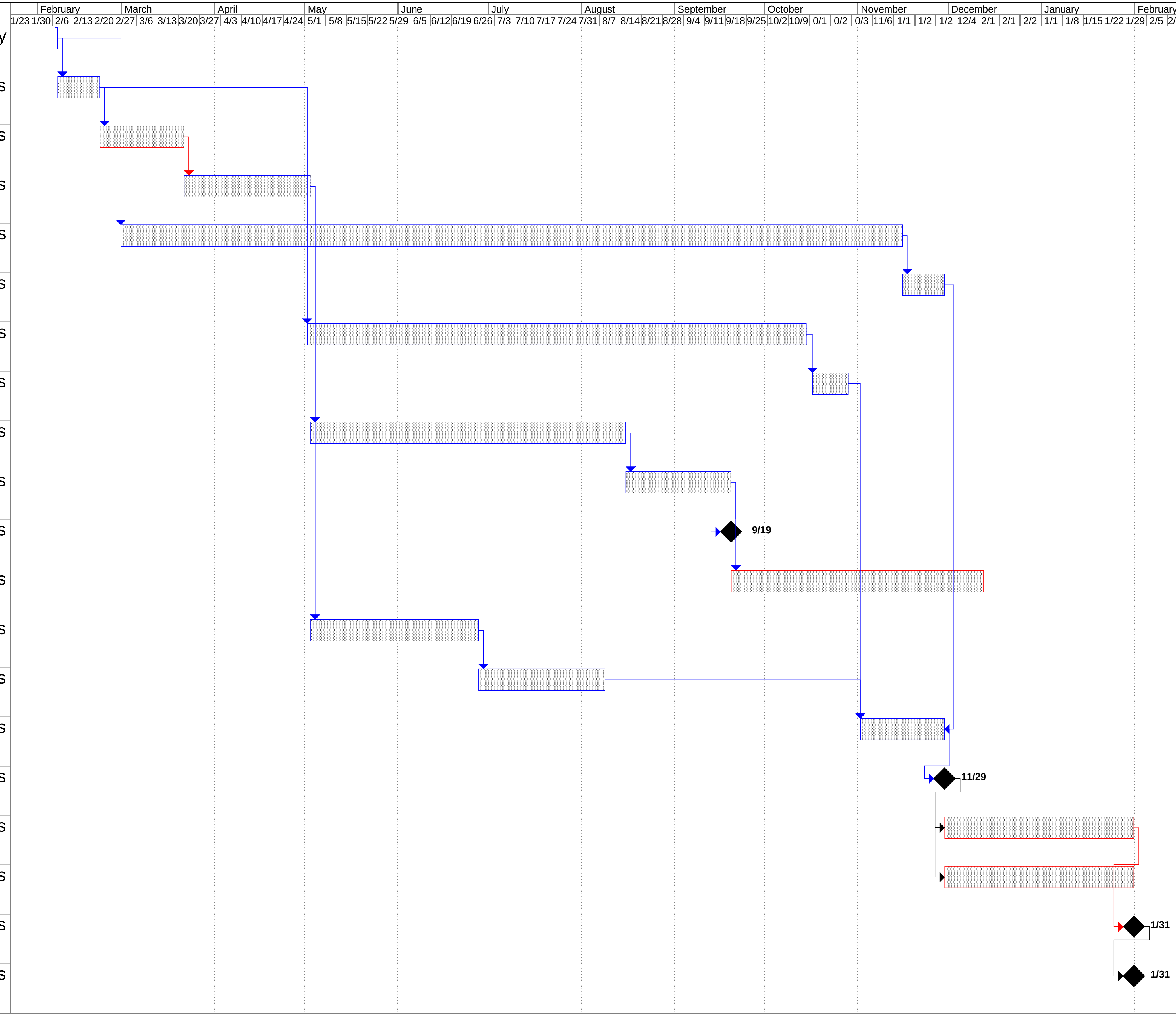
ID	Task Name	Duration
1	Develop Consultation Plan	20 days
2	Scoping Meetings with Stakeholders	30 days
3	Development of Project Description Report	30 days
4	Publish Notice of Project and Notice of Public Meeting # 1	25 days
5	Public Meeting #1 (minimum 3 meetings)	5 days
6	Public Comment Response Development	30 days
7	Development of Required Reports	182 days
8	Archaeological Reports Completed	0 days
9	Technical Reports Completed	0 days
10	Ecological Reports Completed	0 days
11	Finalization of REA Component Reports	10 days
12	Submission of Municipal Consultation Form	25 days
13	Receipt of MTC Final Sign-Off	0 days
14	Receipt of MNR Final Sign-Off	0 days
15	Publish Notice of Public Meeting #2	0 days
16	Public Review of Reports	43 days
17	Public Meeting # 2 (minimum 3 meetings)	5 days
18	Finalization of Reports	15 days
19	SUBMISSION OF REA	0 days
20	MOE Review of REA Application	128 days
21	Receipt of REA	0 days
22	Identification of Responsible Authority (by CEAA)	45 days
23	Establish timeline of project	45 days
24	Create EA Report	142 days
25	Submission of CEAA report	0 days
26	Review of EA by Responsible Authority	128 days
27	Decision by Responsible Authority	1 day?



Project: Permitting Timeline
Date: Thu 11/25/10

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

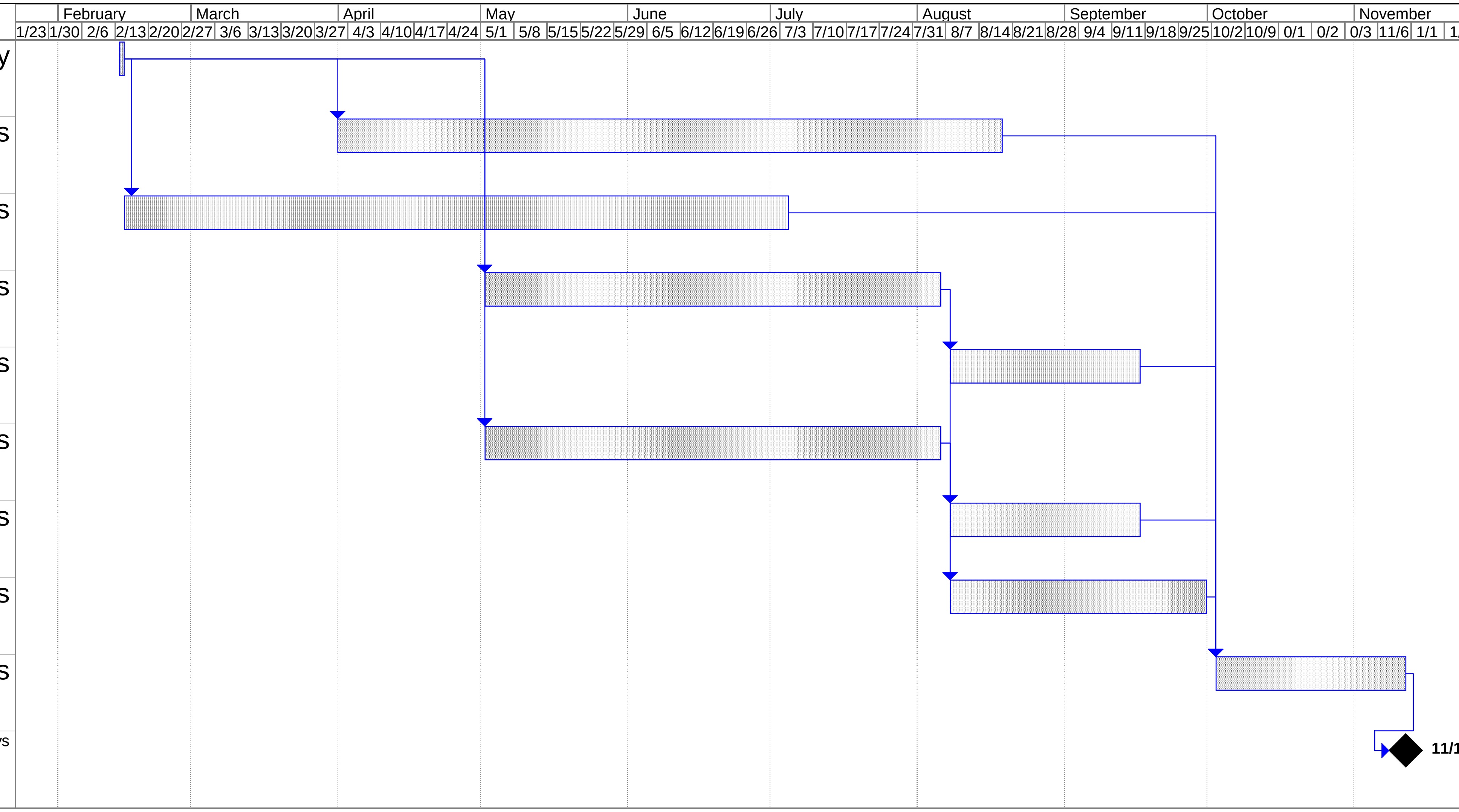
ID	Task Name	Duration
1	Scoping Meeting(s) with MNR, CWS and DFO	1 day
2	Work plan Development	10 days
3	Work plan review and approval	20 days
4	Background Studies	30 days
5	Avian Field Surveys	186 days
6	Avian Reporting	10 days
7	Bat Field Surveys	120 days
8	Bat Reporting	10 days
9	Aquatic Field Surveys	75 days
10	Aquatic Reporting	25 days
11	Submission of Aquatic Report to DFO and CRCA	0 days
12	Review of Aquatic Reports	60 days
13	Terrestrial Field Work	40 days
14	Terrestrial Reporting	30 days
15	EIS Development	20 days
16	Submission of Reports to MNR and EC	0 days
17	MNR Review	45 days
18	EC Review	45 days
19	MNR Letter of Acceptance	0 days
20	End of Ecological Field Work	0 days



Project: Ecological Fieldwork Timeline
Date: Thu 11/25/10

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

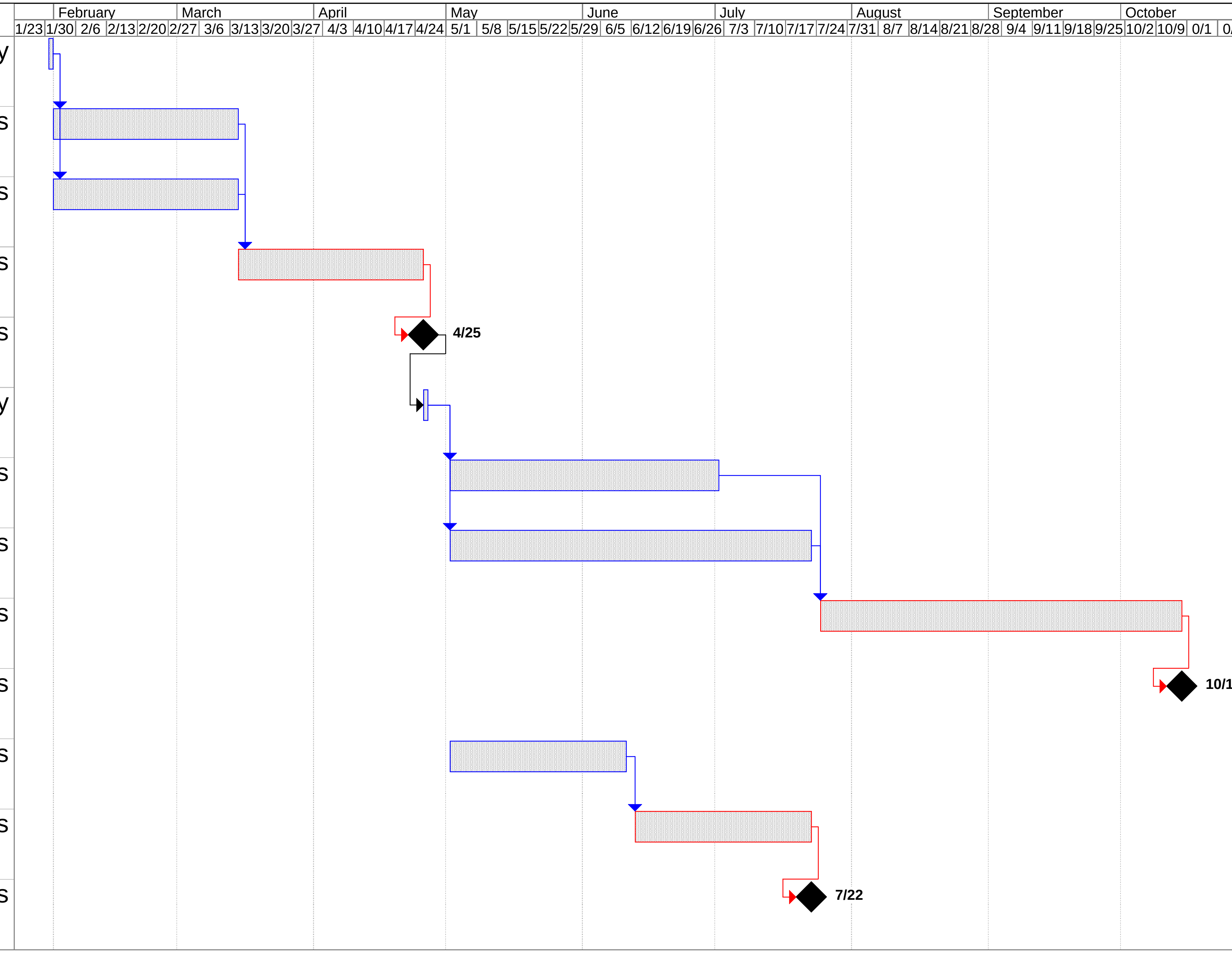
ID	Task Name	Duration
1	Team Scoping Meeting with Laymeyer	1 day
2	Sediment Transfer Study	100 days
3	Icing Studies	100 days
4	Hydrology Field Study	70 days
5	Hydrology Reporting	30 days
6	Wave Studies Field Study	70 days
7	Wave Studies Reporting	30 days
8	Coastal Engineering Study	40 days
9	Laymeyer Peer Review and Study Revisions	30 days
10	End of Technical Field Work	0 days



Project: Technical Fieldwork Timeline
Date: Thu 11/25/10

Task		Progress		Summary		External Tasks		Deadline	
Split		Milestone		Project Summary		External Milestone			

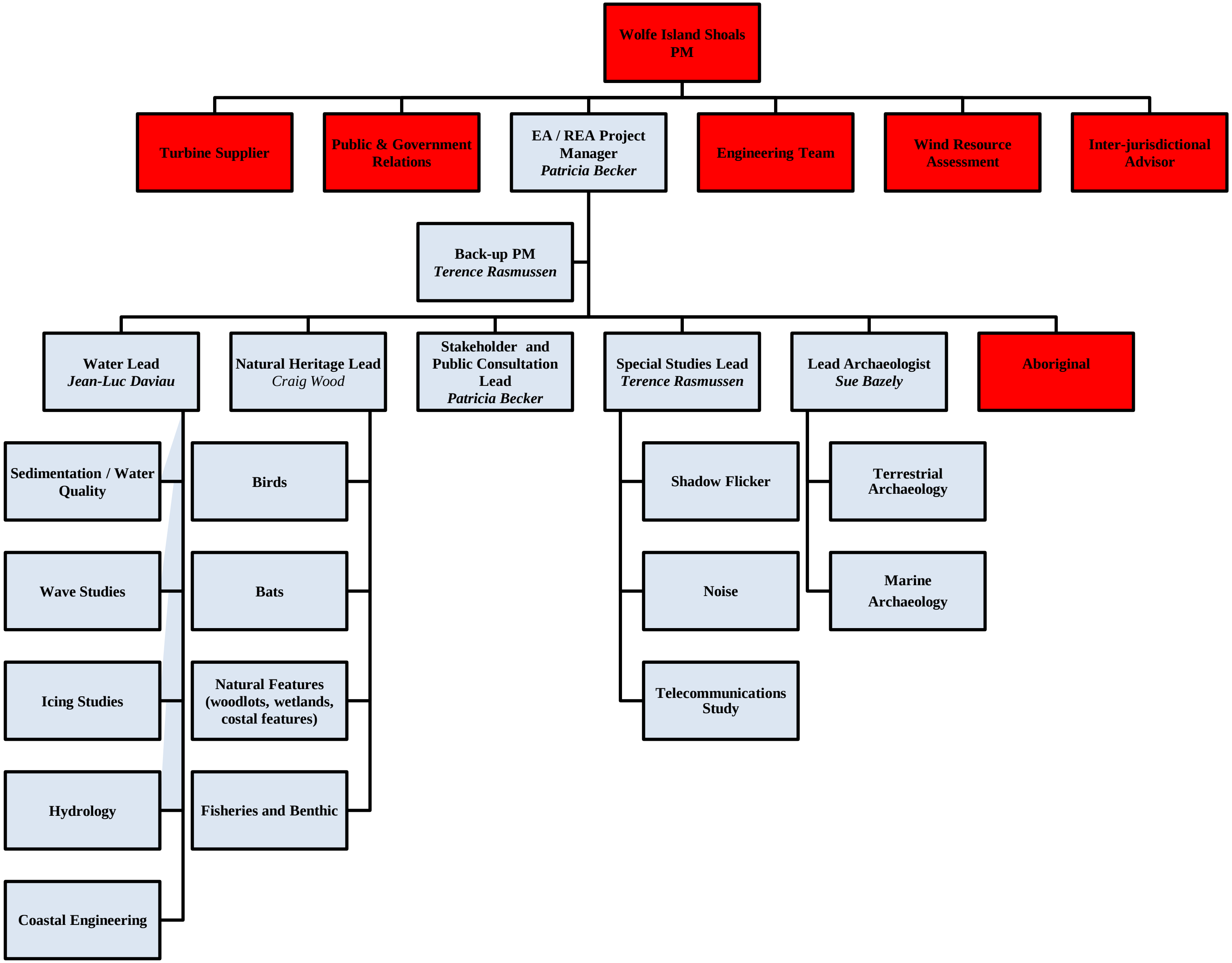
ID	Task Name	Duration
1	Scoping Meeting with MTC	1 day
2	Stage 1 Terrestrial Study	30 days
3	Stage 1 Marine	30 days
4	MTC Review of Stage 1 Study	30 days
5	Receipt of Stage 1 Confirmation Letter	0 days
6	Stage 1 Follow up and scope confirmation meeting	1 day
7	Stage 2 Terrestrial Study	45 days
8	Stage 2 Marine Study	60 days
9	MTC Review of Stage 2 Studies	60 days
10	Receipt of Stage 2 Confirmation Letter	0 days
11	Cultural Heritage Study	30 days
12	MTC Review of Cultural Heritage Study	30 days
13	Receipt of Cultural Heritage Confirmation Letter	0 days



Project: Archaeological Timeline
Date: Thu 11/25/10

Task	Progress	Summary	External Tasks	Deadline
Split	Milestone	Project Summary	External Milestone	

APPENDIX D – ORGANIZATIONAL CHART


Wolfe Island Shoals PM
Turbine Supplier
Public & Government Relations
EA / REA Project Manager
Patricia Becker
Engineering Team
Wind Resource Assessment
Inter-jurisdictional Advisor
Back-up PM
Terence Rasmussen
Water Lead
Jean-Luc Daviau
Natural Heritage Lead
Craig Wood
Stakeholder and Public Consultation Lead
Patricia Becker
Special Studies Lead
Terence Rasmussen
Lead Archaeologist
Sue Bazely
Aboriginal
Sedimentation / Water Quality
Wave Studies
Icing Studies
Hydrology
Coastal Engineering
Birds
Bats
Natural Features (woodlots, wetlands, costal features)
Fisheries and Benthic
Shadow Flicker
Noise
Telecommunications Study
Terrestrial Archaeology
Marine Archaeology

TAB 6

Windstream Wolfe Island Offshore Wind Energy Project

NAFTA2 - Lake Ontario Context

February 18, 2022 | 13513.101.R1.Rev0_WIS_Lake Ontario

Baird.

Innovation Engineered.

baird.com

Windstream Wolfe Island Offshore Wind Energy Project

NAFTA2 - Lake Ontario Context

Prepared for:	Prepared by:
Windstream Energy	W.F. Baird & Associates Coastal Engineers Ltd

For further information, please contact
Mark Kolberg, P.Eng. at +1 905 845 5385
mkolberg@baird.com
www.baird.com

13513.101.R1.Rev0_WIS_Lake Ontario

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Revision	Date	Status	Comments	Prepared	Reviewed	Approved
0	2022-02-18	Final	Issued	MOK/DS	MOK/DS	MOK

Executive Summary

Windstream Energy Inc. (Windstream) proposed development of the Wolfe Island Shoals Offshore Wind Project (the Project, WIS). The Project has a capacity of 300 MW comprised of 66 wind turbine generators (WTGs), located in Canadian waters in the northeastern part of Lake Ontario, approximately 10 km southwest of Wolfe Island. Details of the Project are provided in Wood (2022)[1].

W.F. Baird & Associates Coastal Engineers Ltd. (Baird) in association with Beacon Environmental Ltd. (Beacon), G. Comfort Ice Engineering Ltd. (Comfort), and Scarlett Janusas Archaeology Inc. (SJAI) previously conducted studies for Windstream in support of the NAFTA arbitration proceedings held in 2014-2016 (NAFTA1) related to the WIS Project. At that time the Project consisted of 130 wind turbine generators. Baird was responsible for addressing matters related to Lake Ontario lakebed sediments and drinking water protection, shipping and navigation, coastal processes, wind, wave, and ice conditions, and demonstrating that the various in-water components of the WIS Project do not differ in any substantive manner than numerous other constructed in-water projects. Comfort provided expert input on the ice conditions and ice design approach. Beacon was responsible for considerations of regulatory permitting related to fisheries. SJAI addressed marine archaeological aspects of the Project. The previous studies were presented in two reports, Baird 2014[2] and Baird 2015[3]. The Baird reports did not identify any material impacts or impediments with respect to the matters reviewed that would preclude the proposed WIS Project from proceeding to design development and the regulatory permitting processes.

It is our understanding that on February 18, 2020, the government notified Windstream that the power purchase agreement (Feed-in-Tariff contract) issued for the Project had been cancelled. In response, Windstream submitted a Notice of Intent (February 2020) and Notice of Arbitration (November 2020), as the initial steps in a second round of NAFTA arbitration proceedings (referred to in this report as NAFTA2).

Baird, in association with Beacon and Comfort, and added expert team members SLR Consulting (Canada) Ltd. (SLR) and Ventolines, was retained by Windstream to update the reports it provided in NAFTA1 for NAFTA2. Our findings are presented in this Report. The Baird team is well qualified to undertake this review based on our expertise and experience with in-water projects on the Great Lakes and particularly projects on Lake Ontario.

The previous studies and Baird reports (2014 and 2015) have been recently reviewed by the relevant Baird team members and, in our opinion, the accuracy and conclusions of the studies reports were valid at the time of preparation. The findings of the previous studies are summarized in this Report. To the extent that facts or conclusions contained the previous reports have changed since they were published, we have indicated so in this Report.

Based on our independent review of the technical and permitting feasibility, the Baird team has not identified any material impacts or impediments with respect to the lakebed sediments and protection of drinking water, physical coastal processes, aquatic resources, shipping and navigation, and underwater noise in Lake Ontario that would preclude the proposed WIS Project from proceeding to design development and the regulatory

[1] **CER-Wood**. Wood, 2022. Wolfe Island Shoals Offshore Wind Farm Technical Expert Report, 6.20.247560.CAN.R.001, Prepared for Windstream Energy Inc., February 18.

[2] **CER-Baird**. Baird, 2014. Wolfe Island Shoals Offshore Wind Energy Project, Lake Ontario Context. Prepared for Torys LLP. Project No. 12021.103. August 13, 2014.

[3] **CER-Baird-2**. Baird, 2015. Wolfe Island Shoals Offshore Wind Energy Project, Response to URS Technical Report, January 20, 2015. Report prepared for Torys LLP, June 16.

permitting processes. We have reconfirmed that various in-water components of the WIS Project do not differ in any substantive manner than numerous other constructed in-water projects. There is a reasonable expectation that approval for the WIS Project turbine structures could be obtained under regulations related to lakebed sediments and protection of drinking water, physical coastal processes, aquatic resources, shipping and navigation, and underwater noise present in 2021. The permitting process would be subject to detailed engineering and scientific studies using accepted practices, codes and guidelines and implementation of appropriate mitigation measures during construction and through the operational life of the structures and decommissioning.

Comparable Freshwater Offshore Projects and Other Marine and Offshore Projects

There are many marine and offshore projects comparable to the WIS Project. Baird (2014, 2015) previously concluded that the various in-water components of the WIS Project do not differ in any substantive manner from the numerous in-water projects constructed and planned on the Great Lakes. The design, impact assessment, permitting, scheduling and construction of marine elements like the various components of the Project are not "*first of kind*" and have been successfully undertaken many times before for comparable marine projects on the Great Lakes.

This present report confirms that proven marine design and construction techniques applicable to the marine elements of the WIS Project continue to be applied to other marine projects, such as the Champlain Bridge over the St. Lawrence River, Montreal, Quebec, which was completed in 2019, and the Ashbridge's Bay Wastewater Treatment Plant outfall risers presently under construction in Lake Ontario (Figure ES.3). A further review of freshwater offshore wind projects was completed for this report by Wagner and Slooff (2021)[4].

Offshore wind turbine projects have been successfully constructed in freshwater in Europe for almost 30 years (Figure ES.1, Figure ES.2). Some of these projects are exposed to ice; the foundations are designed to accommodate ice loads, which is a standard design practice that is guided by international standards. The LEEDCo Icebreaker offshore wind turbine project is to be the first freshwater offshore wind project in North America. The Icebreaker turbines will be constructed in Lake Erie and are designed to resist heavy ice loads and wave forces. Sediment contaminant concentration levels at the Icebreaker site are like those at the WIS site; regulatory agencies reviewed the sediment information and approved the project. The Icebreaker project has successfully received all regulatory and environmental permits and approvals required to proceed.

Disturbance of Lakebed Sediments at WIS Project will not Pose a Risk to Drinking Water

Baird (2015) demonstrated that the levels of contaminants in the existing lakebed sediments in the WIS Project area are relatively low and could be readily and safely managed within established Ontario Ministry of the Environment and Climate Change (MOE) criteria and guidelines[5]. As shown in Baird (2015), and as further supported by additional findings in this report, any shifting or disturbance of the lakebed sediments during installation of the turbine foundations would not pose a threat to drinking water. To our knowledge, the province has not undertaken any further studies since 2015 that address the potential for disturbance of the lakebed sediments to pose a threat to drinking water sources or studies that refute the conclusions of Baird (2015). To our knowledge no regulatory changes related to sediments and drinking water protection have been made which would preclude the Project.

[4] **C-2385**. Wager, L. and Slooff, D., 2021. Subtask 01.01 – Detailed Document Review & Gap Analysis, Memo prepared by Ventolines for Windstream Energy LLC, August 13.
[5] **C-1570**. MOE, 2011. Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario, revised in 2011 by M. Gordon and T. Fletcher, Standards Development Branch, Ontario Ministry of the Environment, March.

Figure ES.1: Freshwater offshore wind project Vindpark Vänern, Sweden (Wager, L. and Slooff, D., 2021)

Figure ES.2: Wind Farm Fryslân, Lake Ijssel, the Netherlands (Wager, L. and Slooff, D., 2021)

https://toronto.ctvnews.ca/gta-from-above-the-ashbridges-bay-outfall-project-1.5136435

Figure ES.3: Marine construction of in-lake risers for Ashbridge's Bay Treatment Plant Outfall Project, Lake Ontario

Since 2015, lakebed sediment disturbance has been extensively studied for two projects on Lake Erie, the LEEDCo Icebreaker offshore wind project (Figure ES.4) and the ITC Lake Erie Connector cross lake transmission cable project (Figure ES.5). The LEEDCo Icebreaker turbines will be founded on the lakebed of Lake Erie. The ITC Lake Erie Connector Project is a 104 km long underwater high-voltage electric transmission cable across Lake Erie between Canada and the United States. The transmission line will be buried to a depth of 2 to 3 metres in the sediment of Lake Erie using a towed jet-plow installation method. The LEEDCo and ITC projects have similar concerns with respect to lakebed sediments as the WIS Project. Both the LEEDCo and ITC projects were subject to environmental assessments and the studies concluded that disturbance of the lakebed sediments did not pose an unacceptable risk to drinking water; both have received approvals.

Other comparable in-water projects have advanced to construction since 2015, including the temporary causeway for the Third Crossing, Kingston (Figure ES.6), the Ashbridge's Bay Erosion and Sediment Control Project, Toronto and the Jim Tovey Conservation Area, Mississauga. Notably, construction of the temporary causeway for the Third Crossing project, which is less than 20 km from the WIS Project site involves the dumping of substantial amount of fill into a provincially significant wetland less than 5 km directly upstream of a drinking water intake (Figure ES.6).

Therefore, in Baird's opinion, the presence of low levels of contaminants in the lakebed sediments does not have the potential to contaminate drinking water and the Project would meet MOE criteria for the protection of drinking water.

http://www.leedco.org/index.php/about-icebreaker

Figure ES.4: Approved LEEDCo Icebreaker offshore wind project plan, Lake Erie

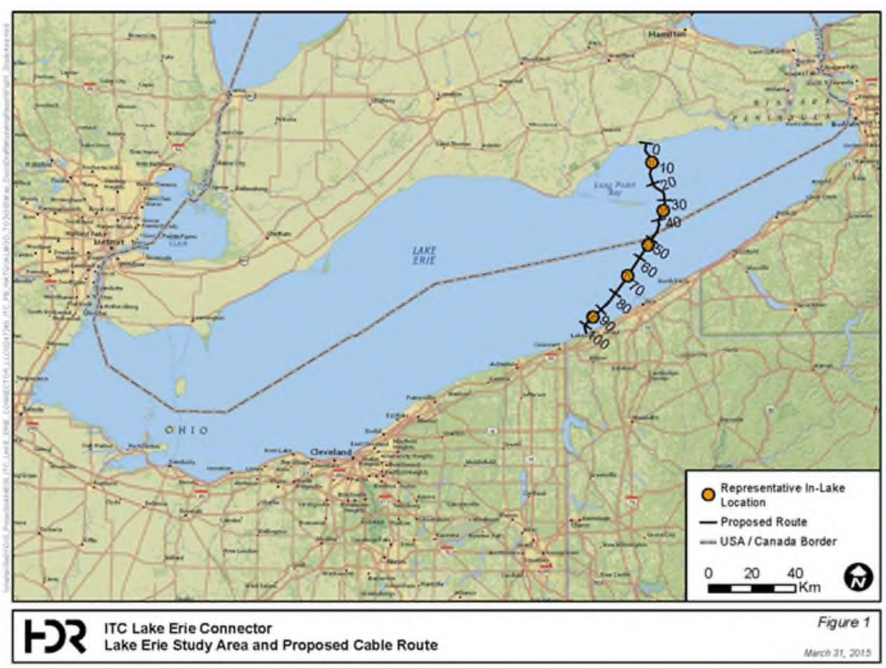


Figure ES.5: ITC Connector Project, Lake Erie (HDR, 2015) - cross-lake electricity transmission cable installed by plowing a cable trench through the existing lakebed sediments

https://thirdcrossing.cityofkingston.ca/photos-videos/photo-gallery

Figure ES.6: Third Crossing construction causeway across the Cataraqui River, Kingston, involves dumping fill material in Provincially Significant Wetland 5 km directly upstream of water intake

Shipping and Navigation Risk Acceptable

The evidence presented in Baird (2015) demonstrated that the WIS Project could safely be located adjacent to the existing upbound Great Lakes – St. Lawrence Seaway navigation route. As a result of the reduced number of turbines, the revised turbine layout, and the updated shipping and navigation risk analysis completed for this report, the Project has increased the navigation allowance. The WIS Project now proposes a 2450 m wide navigation allowance adjacent to the WTG field for a length of approximately 10 km (Figure ES.7). The proposed navigation allowance includes a defined 600 m wide upbound channel for one-way vessel traffic plus a further 1850 m (1 nautical mile) wide separation between the northern edge of a defined upbound channel and the wind turbine generator (WTG) field.

The 600 m wide upbound channel for one-way traffic follows the existing, established upbound navigation route and will be defined by the placement of new navigational buoys and aids. The 600 m width for one-way traffic is more than two times wider than existing channel segments for two-way vessel traffic at many other locations along the Great Lakes - St. Lawrence Seaway system. The channel width for two-way traffic at these other segments is often less than 250 m and the Seaway has been safely operating in this manner for over 50 years, with mandatory pilotage[6] minimizing risk of collisions. The proposed 600 m width for one-way traffic is more than sufficient based on both Canadian and International navigational guidance. Considering the much wider channel proposed for one-way traffic only, the limited volume of traffic on the Seaway in this area (only about six vessels per day in the peak months), and with mandatory pilotage on the Seaway, the risk of vessel collisions is minimized.

[6] **C-1840**. Minister of Justice, 2011. Great Lakes Pilotage Regulations, C.R.C., c. 1266. Last amended on July 1, 2011. Pp2-4; http://laws-lois.justice.gc.ca. Accessed May 21, 2015.

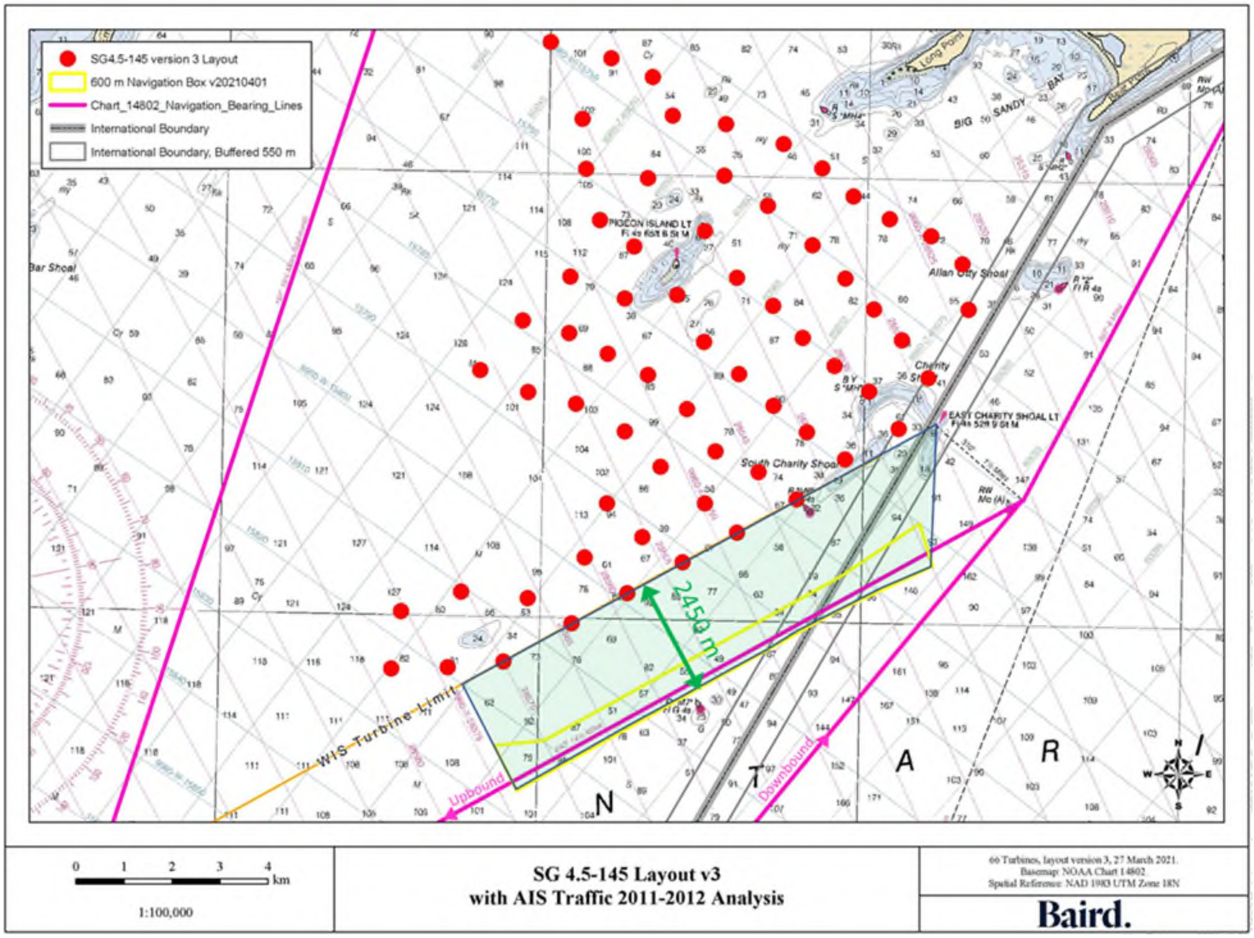


Figure ES.7: 2450 metre wide navigation allowance for one-way vessel traffic adjacent to WIS Project, including 600 m wide channel and additional 1850 m separation allowance

The proposed 1850 m (1 nm) separation beyond the 600 m upbound channel is compatible with the Seawaymax vessels that operate adjacent to the WIS Project. So-called Seawaymax vessels are the largest vessels that can access the channel adjacent to the Project because vessels entering the Seaway are constrained in size due to the dimensions of the locks at Montreal and the Welland Canal. Seawaymax vessels have a maximum length overall of 225.5 m, a beam of 23.8 m, and a draft of 8.1 m. The 1 nm (1.85 km) separation provided allows for a course deviation width of 0.3 nm (0.556 km) and an emergency turn diameter of 0.73 nm (1.35 km), which is 6 times the length of a Seawaymax vessel. It is important to recognize that the potential for collision with another large commercial vessel is extremely low due to the Seaway traffic separation in this area as a downbound vessel should not be expected in the upbound channel. This collision potential could, however, arise with a disabled or inattentive small craft vessel. The 1 nm (1.85 km) separation distance also allows for sufficient distance for a vessel emerging from the wind farm area to be readily identified on marine radar systems.

Potential navigational risks will be mitigated by marking and lighting WTGs in accordance with regulations, providing Automatic Identification System (AIS) transponders on selected WTGs, providing aviation obstruction lighting, and implementing WTG rotor braking systems to allow access by marine search and rescue (SAR) helicopters.

The proposed 600 m wide navigation channel plus the additional 1 nm (1.85 km) wide separation allowance adjacent to the WIS Project is reasonable and in accordance with both Canadian and International navigational guidance. The Project Schedule has made appropriate allowances for consultation and approvals with respect to navigation. To our knowledge no regulatory changes related to navigation or shipping have been made which would preclude the Project.

Waves, Coastal Processes and Ice Conditions Well Understood and Quantifiable

Baird reports (2014 and 2015) demonstrated that, based on the available evidence of the site conditions, Baird's extensive experience with Lake Ontario coastal conditions, as well as analysis completed by others for similar conditions in peer-reviewed literature, the physical coastal processes at the Project site, including wind, wave, scour, and ice conditions were well understood and that they do not pose any unmanageable impediments to the design of the WIS turbine structures. The reports also concluded with a good level of certainty that the WIS turbine field is not likely to cause material impacts to the coastal processes and adjacent shorelines.

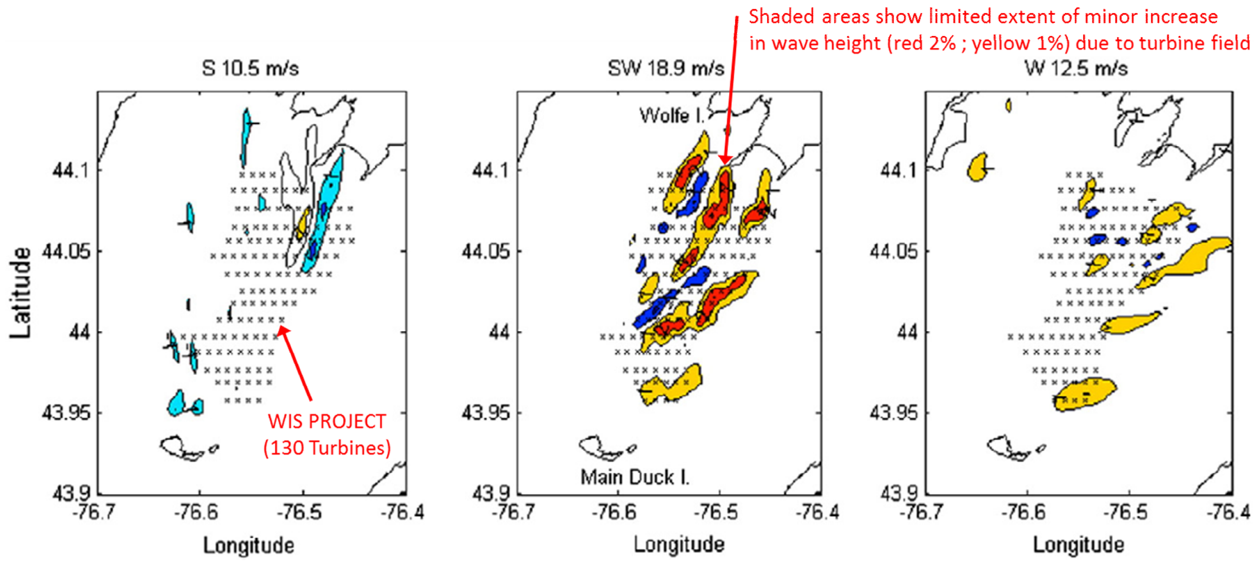
A review of other relevant reports and literature completed since 2015 supports the conclusions of the earlier Baird reports. Using advanced numerical modelling, McCombs et al. (2014)[7] assessed the impacts of a 130-turbine offshore wind farm at Wolfe Island shoal on surface waves. Overall, the model results indicated that the wave height in coastal areas will be minimally affected with slight far-field changes in significant wave height of less than 2% and near-field changes of less than 3% (Figure ES.8).

Ice conditions were studied in the early design phases of the WIS Project (Baird, 2012; Baird 2014; Baird 2015) and were incorporated into the preliminary design of the turbine foundations. The previous reports demonstrated that ice conditions at the Project location were understood and reasonably well quantified and that the state-of-the-art engineering knowledge, design procedures and accepted codes of practice surrounding ice-structure interactions were advanced enough to implement a safe turbine foundation design.

Subsequent additional expert assessment of the ice conditions (Comfort, 2022[8]) prepared for this report, using advances in practice codes and guidelines, has confirmed that ice conditions at the WIS Project area and the ice design process are sufficiently understood to allow for the detail design development of the wind turbine foundations. The relevant updated ice design codes have been identified and have been included in the assessment. Further, Comfort (2022) demonstrates that the ice design loads identified in Baird 2012 for the proposed down-breaking gravity-based foundation structure are, in all probability, conservative and could most likely be reduced with further analysis, which would be done in the normal course of detailed design.

Based on the available data and our experience, we are of the opinion that the in-water environment could be adequately characterized with reasonable accuracy and reliability using existing data, additional data gathered through site-specific studies, and field investigations of a nature typically required for a project of this magnitude using accepted engineering and scientific practices. The Baird team has not identified any material impacts or impediments with respect to the waves, coastal processes and ice conditions that would preclude the proposed WIS Project from proceeding to design development and the regulatory permitting processes.

[7] **C-2231**. McCombs, M. P., Mulligan, R. P., & Boegman, L. (2014). Offshore wind farm impacts on surface waves and circulation in Eastern Lake Ontario. Coastal Engineering, 93, 32–39. https://doi.org/10.1016/j.coastaleng.2014.08.001.
[8] **C-2487**. G. Comfort Ice Engineering Ltd., 2022. Wolfe Island Shoals Wind Farm: Preliminary Assessment of Ice Design Criteria, Final Report prepared for Baird & Associates, February 2.



Each contour line unit is in % and a positive value (yellow; 1%, red; 2%) represents an increase in significant wave height and a negative value (light blue; −1%, dark blue; −2%) represents a decrease. Wind direction and speed for each plot are indicated.

McCombs, M. P., Mulligan, R. P., & Boegman, L. (2014). Offshore wind farm impacts on surface waves and circulation in Eastern Lake Ontario. Coastal Engineering, 93, 32–39. https://doi.org/10.1016/j.coastaleng.2014.08.001

Figure ES.8: Minor impact of wind farm on wave height for three wind directions

Fisheries Permitting Achievable

Beacon Environmental Limited (Beacon) previously assessed fisheries permitting for Windstream in support of the NAFTA arbitration proceedings held in 2014-2016 (NAFTA1) related to the WIS Project (Baird, 2014; Baird, 2015). Beacon concluded that fisheries permitting was achievable within the Project Schedule timeline.

In support of NAFTA2, Beacon has updated its previous fisheries permitting assessment with a review of the key conclusions related to the feasibility of the Project from a technical and scheduling perspective. This current study considers changes to legislation, policy, and species status since NAFTA1 in 2015. In Beacon's expert opinion, none of these changes are likely to have a significant negative impact on the Project Schedule, particularly considering that the number of turbines has almost been cut in half, from 130 to 66.

Underwater Noise Effects Likely Not Significant

Underwater noise (hydroacoustic) effects were not identified as a significant concern in Baird (2014) and based on the further analysis completed for this report, there is no basis to change this conclusion at this time. Baird commissioned SLR Consulting Canada Ltd (SLR) to conduct additional technical study of underwater noise issues relevant to the Project[9]. SLR concluded that Project noise sources during construction are comparable to or less than some of the commercial vessels using the existing shipping lane. While there is likely to be

[9] **C-2366**. SLR, 2021. Technical Advice on Underwater Noise Wolfe Island Shoals Offshore Wind Project, SLR Project No: 201.38265.00000. Prepared by SLR Consulting (Canada) Ltd. Prepared for Baird & Associates, May.

some potential for masking and behavioral effects in fish, these will be temporary (during construction only) and localized to the immediate vicinity of construction activity. To our knowledge no regulatory changes related to underwater noise have been made which would preclude the Project. We have not identified any material impacts or impediments with respect to underwater noise that would preclude the proposed WIS Project from proceeding to design development and the regulatory permitting processes.

Table of Contents

Tables

Figures

LIST OF ACRONYMS

3D	Three Dimensional
AIS	Automatic Identification System
ASA	American Standards Association
AtoN	Aid to Navigation
CEAA	Canadian Environmental Assessment Agency
CEFAS	Centre of Environmental Fisheries and Aquaculture
CER	Claimant's Expert Report
CHIA	Cultural Heritage Impact Assessment
CSPA	Cataraqui Source Protection Area
CSR	Canadian Seabed Research
DDT	Dichlorodiphenyltrichloroethane
DFO	Department Fisheries and Oceans
EA	Environmental Assessment
ESA	Endangered Species Act
FA	Fisheries Act
FFA	Federal Fisheries Act
GLOFS	Great Lakes Operational Forecast System
IJC	International Joint Commission
IPZ	Intake Protection Zone
km	Kilometres
LEL	Lowest Effects Level
m	Metres
m^2	Square metres
m^3	Cubic metres
MMS	Minerals Management Service
MNRF	Ministry of Natural Resources and Forestry

MOE	Ontario Ministry of Environment
MTCS	Ministry of Tourism Culture and Sport
MW	Megawatts
nm	Nautical mile (equals 1.85 kilometre)
NOAA	National Oceanic and Atmospheric Agency
NPA	Navigation Protection Act
NPP	Navigation Protection Program
OMNR	Ontario Ministry of Natural Resources
OMOE	Ontario Ministry of Environment
OPG	Ontario Power Generation
PCB	Polychlorinated Biphenyls
PEL	Probable Effects Level
PUC	Public Utilities Commission
REA	Renewable Energy Approval
s	Seconds
SAR	Search and Rescue
SAR	Species at Risk
SEL	Severe Effects Level
SJAI	Scarlett Janusas Archaeology Inc.
TEL	Threshold Effect Level
U.S.	United States
USACE	US Army Corps of Engineers
WIS	Wolfe Island Shoals
WTG	Wind Turbine Generator

1. Introduction

Windstream Energy Inc. proposed development of the Wolfe Island Shoals Offshore Wind Project (the Project, WIS) located in Canadian waters in the northeastern part of Lake Ontario, approximately 10 km southwest of Wolfe Island. The Project has a capacity of 300 MW, comprised of 66 wind turbine generators (WTGs). Details of the Project are provided in Wood (2022)[10].

W.F. Baird & Associates Coastal Engineers (Baird) previously conducted studies (Baird, 2014[11]; Baird, 2015[12]) for Torys LLP on behalf of Windstream Energy Inc. in support of the NAFTA arbitration proceedings held in 2014-2016 (NAFTA1) related to the WIS Project. Baird was retained by Torys LLP to conduct an independent review of the technical and permitting feasibility of the Project within the context of the Lake Ontario marine environment and permitting requirements. Baird was assisted by various experts including Beacon Environmental Ltd. (Beacon), who evaluated the aquatic resources, including fish and fish habitat, and Mr. George Comfort, P.Eng., who prepared a detailed ice study. The review was primarily based on the team's collective expertise and experience with in-water projects in Lake Ontario (Baird, 2014[13]).

Subsequently, Baird, in association with Beacon Environmental Ltd. (Beacon) and Scarlett Janusas Archaeology Inc. (SJAI), was retained by Torys LLP to respond to comments provided by the *URS Windstream Arbitration, Technical Report*[14] ("URS" or "URS Report") regarding the NAFTA arbitration proceedings held in 2014-2016 (NAFTA1). The URS Report was commissioned by the Government of Canada in relation to the Project. Baird responded to the URS Report in Baird (2015)[15].

It is our understanding that on February 18, 2020, the government notified Windstream Energy Inc. that the power purchase agreement (Feed-in-Tariff contract) issued for the Project had been cancelled. In response, Windstream submitted a *Notice of Intent* (February 2020) and *Notice of Arbitration* (November 2020), as the initial steps in a second round of NAFTA arbitration proceedings (referred to in this report as NAFTA2).

W.F. Baird & Associates Coastal Engineers Ltd. (Baird), in association with Beacon Environmental Ltd. (Beacon), G. Comfort Ice Engineering Ltd. (Comfort), SLR Consulting (Canada) Ltd. (SLR) and Ventolines was retained by Windstream Energy Inc. to update the reports it provided in NAFTA1 for NAFTA2. Baird and members of the Baird team are independent from the parties to this arbitration, their legal advisors, and the Tribunal.

The previous Baird reports (2014 and 2015) have been recently reviewed by the relevant Baird team members and, in our opinion, the accuracy and conclusions of the reports were valid at the time of preparation. To the extent that facts or conclusions contained the previous reports have changed since they were published, we have indicated so in this Report.

[10] **CER-Wood**. Wood, 2022. Wolfe Island Shoals Offshore Wind Farm Technical Expert Report, 6.20.247560.CAN.R.001, Prepared for Windstream Energy Inc., February 18.
[11] **CER-Baird**. Baird, 2014. Wolfe Island Shoals Offshore Wind Energy Project, Lake Ontario Context. Prepared for Torys LLP. Project No. 12021.103. August 13, 2014.
[12] **CER-Baird-2**. Baird, 2015. Wolfe Island Shoals Offshore Wind Energy Project, Response to URS Technical Report, January 20, 2015. Report prepared for Torys LLP, June 16.
[13] **CER-Baird**. Baird, 2014. *op. cit*.
[14] **RER-URS**. URS, 2015. Windstream Arbitration. URS Second Technical Report Relating to the Claimant's Reply Memorial.
[15] **CER-Baird-2**. Baird, 2015. *op. cit*.

The objectives of this current Report are to consider recent information and experience since NAFTA1, complete an expert review of the key conclusions related to the feasibility of the Project from a technical and scheduling perspective and provide an opinion on the feasibility of the Project should it have been allowed to re-start the development process in February 2020 and to progress in the absence of ("but for") restrictions imposed and uncertainty created by various government agencies.

Based on our independent review of the technical and permitting feasibility, the Baird team has not identified any material impacts or impediments with respect to the lakebed sediments and protection of drinking water, physical coastal processes, aquatic resources, shipping and navigation, and underwater noise in Lake Ontario that would preclude the proposed WIS Project from proceeding to design development and the regulatory permitting processes. There is a reasonable expectation that approval for the WIS Project turbine structures could be obtained under regulations related to lakebed sediments and protection of drinking water, physical coastal processes, aquatic resources, shipping and navigation, and underwater noise present in 2021. The permitting process would be subject to detailed engineering and scientific studies using accepted practices, codes and guidelines and implementation of appropriate mitigation measures during construction and through the operational life of the structures and decommissioning.

The qualifications the Baird team are presented in Section 2.

Baird was primarily responsible for the following components of this current study:

- Section 3 - Comparable Offshore Projects, with support from Ventolines for Sections 3.1 and 3.2.
- Section 4 - Lakebed Sediments and Drinking Water Protection
- Section 5 - Shipping and Navigation Risk
- Section 6, Coastal Processes and Wind, Wave, and Ice Conditions, with support from George Comfort who completed an updated evaluation of the ice conditions (summarized in Section 6.2).

Beacon prepared Section 7 – Fisheries Permitting.

SLR completed a technical advice report for Baird; the report is summarized in Section 8 – Underwater Noise.

It is our genuine belief that all the facts and opinions in this report are true.

2. Baird Team Qualifications and Experience

The Baird team is well qualified to undertake this review based on our expertise and experience with in-water projects on the Great Lakes and particularly projects on Lake Ontario.

2.1 Baird

2.1.1 Baird

W.F. Baird & Associates Coastal Engineers Limited (Baird) is a leading authority on coastal processes and engineering on the Great Lakes and as such is highly qualified to undertake this independent review of the WIS Project within the context of Lake Ontario. For example, Baird, in association with Beacon Environmental, was commissioned by the Ontario Ministry of Natural Resources to prepare the *Offshore Wind Power Coastal Engineering Report: Synthesis of Current Knowledge & Coastal Engineering Study Recommendations*[16]. Baird, established in 1981, is a Canadian firm specializing in marine and coastal engineering on the Great Lakes and around the world. With eight offices in Canada, United States, Barbados, Chile, and Australia. Baird provides services for all stages of marine and coastal engineering projects, including field data collection, planning and feasibility studies, numerical and physical modelling, environmental impact assessments, regulatory approvals and permitting, stakeholder consultation, preliminary and detail final designs, preparation of construction plans, specifications and documents, cost estimating, construction observation and administration, post-construction monitoring and peer review.

2.1.2 Baird Key Personnel

Mark Kolberg, P.Eng., is a Principal with Baird & Associates with over 35 years of experience. He specializes in marine and coastal engineering planning, design, contract documents and specifications, construction review, project management, regulatory issues and approvals, environmental assessments, and stakeholder consultation, particularly on the Great Lakes. He was instrumental in the development of the Ontario Ministry of Natural Resources Natural Hazards *Technical Guide for Great Lakes – St. Lawrence River Shorelines*[17]. Mr. Kolberg was a lead author of the *Technical Guide* and the primary coastal engineering consultant for OMNR. The shoreline policies and guidelines, which address flooding, erosion, and dynamic beaches, are applicable to 11,500 km of shoreline within Ontario.

Doug Scott, Ph.D., P.Eng., a Principal and Director of Baird & Associates with over 35 years of experience, has specialized in the management and high-level technical direction of complex investigations and projects in the coastal and port engineering fields. He has successfully managed teams supporting the design and assessment of large-scale dry and liquid bulk cargo facilities. In the last several years, Dr. Scott has focused on navigational risk management in port and offshore wind developments. Recent projects have included navigational risk assessments for almost 280 ports across Canada and for the proposed Vineyard Wind and Atlantic Shore offshore wind fields in the northeast U.S. He also led the development of revised vessel towing strategies and a ship under keel clearance forecasting system for an LNG terminal located in Peru.

[16] **C-0530**. Baird, 2011. Offshore Wind Power Coastal Engineering Report: Synthesis of Current Knowledge & Coastal Engineering Study Recommendations, Prepared for the Ontario Ministry of Natural Resources, May.
[17] **C-1309**. Ministry of Natural Resources (MNR), 2001. Great Lakes – St. Lawrence River System and Large Inland Lakes. Technical Guides. Published by Watershed Science Centre, Trent University, Peterborough, Ontario, Canada.

2.2 Beacon

2.2.1 Beacon

Beacon Environmental Limited (Beacon) specializes in all aspects of terrestrial and aquatic ecology, with offices in Markham, Bracebridge, Guelph and Ottawa, Ontario. Beacon's Lake Ontario experience ranges from Niagara-on-the-Lake through the Greater Toronto Area and east through to the Bay of Quinte. This experience has included environmental assessments, design/build projects, monitoring and feasibility studies. Staff at Beacon provided the natural environment component for the federal Environmental Assessment (EA) that was conducted for the New Nuclear Build at Darlington. The terrestrial component included baseline data collection and impact assessment. Beacon's role in the aquatic component focused on identifying impacts to fish and fish habitat for up to 40 ha of infill and working with Fisheries and Oceans Canada to identify suitable compensation. This project also required senior staff at Beacon to testify at the Federal Review Panel. Other projects along the lake shore have included: the Pickering Nuclear Station Refurbishment, collaboration with Baird & Associates on the feasibility study, Class EA, design and construction of the Western Beaches Watercourse Facility, various authorizations under Section 35 of the federal *Fisheries Act*, as well as collaboration with Baird & Associates on the *Offshore Wind Power Coastal Engineering Report*[18] completed for MNR. Beacon completed the fisheries permitting components of the Baird (2014) report and the Baird (2015) report.

2.2.2 Beacon Key Personnel

Ms. Jo-Anne Lane is a Principal and Senior Ecologist with Beacon Environmental. Ms. Lane has over 30 years of experience that commenced with aquatic ecology and has specialized in aquatic habitat assessment, the effects of land use activities on fisheries, recreational fisheries development and habitat enhancement or creation techniques. Her experience has included projects for both the public and private sector. These projects have ranged from provincial and federal Environmental Assessments to detailed design for infrastructure projects, watershed plans, environmental impact studies and restoration projects. Through her involvement with these projects, Ms. Lane has worked closely with staff from regulatory agencies at the municipal, provincial, and federal levels.

2.3 G. Comfort Ice Engineering Inc.

George Comfort graduated in civil engineering in 1975 from Queen's University, at Kingston ON. Since graduation (45 years of experience) he has worked exclusively in the field of ice engineering for structures, pipelines, and ships. He has experience in defining ice design criteria and specifying ice loads for a wide range of structures including wind platforms for the Great Lakes, drilling structures in the Beaufort Sea, the Caspian Sea and elsewhere, bridges, structures for use in ponds in the Oil Sands in Alberta, and hydro-electric dams. He has worked on projects related to most regions of the world where ice problems are present including the Great Lakes, the St. Lawrence River system, the US and Canadian Beaufort Seas, Sakhalin Island, and the Caspian Sea. His experience includes field measurements, laboratory testing, and analytical investigations. He was a member of the Ice Engineering Group that contributed to both the recent ISO 19906 code for offshore structures (2010); and updates to it (2018) which are at the FDIS stage.

[18] **C-0530.** Baird, 2011. *op. cit.*

Of direct relevance to this study, George Comfort has conducted two previous ice investigations for Baird for wind farms in the vicinity of Kingston, ON. He was the ice engineer for the proposed Wind One wind farm (2010) which was to be located near Kingston, Ontario. Following that, he was the ice engineer for the proposed Wolfe Island Shoals Wind Farm (2012). As a result, he is familiar with the area and site; as well as the issues of concern for offshore wind farms exposed to ice.

2.4 SLR Consulting (Canada) Ltd.

2.4.1 SLR

SLR Consulting (Canada) Ltd., combines extensive experience in underwater acoustics and signal processing with in-house ecological expertise. SLR has extensive experience in propagation modelling of underwater noise and comprehensive environmental impact assessments, mooring and hydrophone array design, deploying and recovering acoustic and environmental instrumentation/sensors in challenging environments (deep-water, high current, cold water, coral reef, full or partial ice cover), signal processing of acoustical and oceanographic data in-house algorithms that can be customized for cetacean localization and vessel or source noise analysis.

2.4.2 SLR Key Personnel

Briony Croft, Ph.D., P.Eng. has expertise in underwater noise and vibration impact assessment, including the prediction of underwater construction noise propagation and impacts of piling, blasting and other construction activities on marine fauna. Her project experience includes underwater noise assessment, modelling and mitigation recommendations for marine projects in British Columbia, the USA, Australia, New Zealand, and South Africa. In addition to identifying project impacts, Briony's role on these projects commonly involves liaising with regulatory authorities, interpreting technical underwater noise reports, and producing plain language summaries and presentations to communicate impacts to a wider audience.

Jonathan Vallarta, Ph.D. has years of experience in underwater acoustics in a wide range of positions, including teaching, design, project management, acoustic consulting, and collaborative research. Jonathan has supported projects in the Arctic, Canada, Caribbean Islands, Mexico, and the USA. He also specializes in the design and deployment of novel hydrophone array configurations and the development and implementation of localization algorithms. In 2018, his expertise was recognized at the 19th UNICPOLOS meeting as a Mexican advisor and invited panelist on 'Anthropogenic Underwater Noise' at the United Nations headquarters in New York.

2.5 Ventolines

With a staff of over one hundred experts, Ventolines has played a lead role in the development and operation of many sustainable energy projects, with national, European, and U.S. prominence. Ventolines' offshore wind advisory services encompass development, contracting, contract due diligence, system integration, construction, and asset management as well as Power Purchase Agreements. Ventolines has extensive knowledge and hands-on experience in the development of offshore wind lake projects, including Westermeerwind (144 MW, 48x SGRE 3.0-108 turbines, successfully completed in 2016) and Windpark Fryslân (383 MW, 89x SGRE 4.3-130 turbines, under construction).

2.5.1 Lorry Wagner, Ph.D.

Lorry Wagner, Ph.D., has a wide range of experience in offshore and onshore wind development, certification and verification, supply chain development, environmental and regulatory permitting," first of a kind" solutions, and defensive engineering. Since 2020, Dr. Wagner has been the USA Director of Ventolines, where he leads all Ventolines' activities in the USA. He is co-chair of Committee #25, American Clean Power Association (formerly AWEA) Standards and board member of the Business Network for Offshore Wind. Dr. Wagner is the team leader for the development of a U.S. nearshore wind farm project under development.

Dr. Wagner was president of Lake Erie Energy Development Corp. from 2010 to 2019. He led the project development for Icebreaker, the first freshwater offshore wind project in North America, which included: the first submerged lands lease in the Great Lakes; receiving one of two U.S. Department of Energy $60 million Advanced Technology Demonstrations Projects; CVA certificate of compliance; sourcing the domestic supply chain and local content; receiving fourteen federal and state permits for construction.

From 2006 to 2010, Dr. Wagner was president of Azure Energy where he led the installation of a waterfront urban turbine and provided complete project management including permitting, foundation design, construction, installation, and operation and maintenance. He is experienced as Owner's Engineer and as Banker's Third-Party Representative.

3. Comparable Marine and Offshore Projects

There are many marine and offshore projects comparable to the WIS Project. Baird (2014, 2015) previously concluded that the various in-water components of the WIS Project do not differ in any substantive manner from the numerous in-water projects constructed and planned on the Great Lakes. The design, impact assessment, permitting, scheduling and construction of marine elements like the various components of the Project are not "*first of kind*" and have been successfully undertaken many times before for comparable marine projects on the Great Lakes.

Proven marine design and construction techniques applicable to the marine elements of the WIS Project continue to be applied to other marine projects, such as the Champlain Bridge over the St. Lawrence River, Montreal, Quebec, which was completed in 2019 and the Ashbridge's Bay Wastewater Treatment Plant outfall risers presently under construction in Lake Ontario. A further review of freshwater offshore wind projects was completed for this report by Wagner and Slooff (2021)[19].

Offshore wind turbine projects have been successfully constructed in freshwater in Europe for almost 30 years. The LEEDCo Icebreaker offshore wind turbine project is to be the first freshwater offshore wind project in North America. The Icebreaker turbines will be constructed in Lake Erie and are designed to resist heavy ice loads and wave forces. Sediment contaminant concentration levels at the Icebreaker site are like those at the WIS site; regulatory agencies reviewed the sediment information and approved the project. The LEEDCo Icebreaker project has successfully received all regulatory and environmental permits and approvals required to proceed.

3.1 Freshwater Offshore Wind Projects

Wind turbines have been successfully constructed in freshwater in Europe (e.g., a 30 MW wind energy project in operation on Sweden's Lake Vänern since late 2009, Figure 3.1) and many more in salt-water environments (Wagner and Slooff, 2021). Freshwater wind projects are nearshore, but they specifically refer to wind farms that are realized in lakes. In many ways freshwater conditions pose fewer challenges than saltwater, including: less corrosion than in salt water, custom lifting solutions that offer more efficient solutions (and lower cost), a higher energy yield than comparable onshore windfarms, lower wind/wave fatigue loads, and less extreme metocean conditions.

Table 3.1 provides an overview of all freshwater wind projects in the world, indicating almost 30 years of experience and knowledge that has been acquired. The world's largest freshwater wind farm is currently Windpark Fryslân in Lake Ijssel (Ijsselmeer), the Netherlands (Figure 3.2).

Freshwater ice conditions and the corresponding loads are important factors for assessing the dynamic and ultimate forces on the foundation, although wind loads are still the predominant foundation design driver. The climatic conditions that produce freshwater ice are quite varied and are not exclusive to inland lakes, such as the U.S. and Canadian Great Lakes, but additionally in Bohai Bay and the Baltic Sea. Therefore, in all these locations, the foundation is designed to accommodate ice loads, which is a standard design practice that is guided by international standards.

[19] **C-2385**. Wager, L. and Slooff, D., 2021. Subtask 01.01 – Detailed Document Review & Gap Analysis, Memo prepared by Ventolines for Windstream Energy LLC, August 13.

One common design feature that has been used on these foundations is the ice-breaking cone. As the ice encounters this cone, it is forced up (or down) and subsequently breaks in flexure thereby releasing the pressure on the foundation. This has been used quite frequently in gravity base concrete foundations such as, Tunø Knob, Nysted, Vindpark Vänern, and Lillgrund (see Figure 3.3). Although, in both of Finland's demonstration projects, Pori I and Tahkoluoto, the gravity base is a steel structure with an ice cone. It is worth pointing out that the Finnish ice conditions are among the most severe of any freshwater ice in the world and the foundations have performed exactly as designed. Lake Vänern freezes solid during the winter and its gravity base foundation has performed well.

Table 3.1: Overview of Freshwater Wind Projects in the World (Wagner and Slooff, 2021)

Location	Project	Size MW	WTG Details	COD	Phase
Lake IJssel (NL)	Windpark Lely	2	4x NedWind 500	1994	Decommissioned
Lake IJssel (NL)	Irene Vorrink	16.8	28x NTK 600	1997	Operational
Lake IJssel (NL)	Westermeerwind	144	48x SGRE 3.0-108	2016	Operational
Lake IJssel (NL)	Windpark Fryslân	383	89x SGRE 4.3-130	2021	Construction
Lake IJssel (NL)	Windplan Blauw	TBD	24x max tip 213 m	TBD	Development
Vänern (SE)	Vindpark Vänern	30	10x WinWinD 3	2010	Operational
Vänern (SE)	Rewind Vänern	100	TBD	2024	Development
Lake Erie (US)	Icebreaker Wind	20.7	6x V126-3.45	2023	Development

Figure 3.1: Freshwater offshore wind project Vindpark Vänern, Sweden (Wagner and Slooff, 2021)

Figure 3.2: Wind Farm Fryslân, Lake Ijssel, the Netherlands (Wagner and Slooff, 2021)

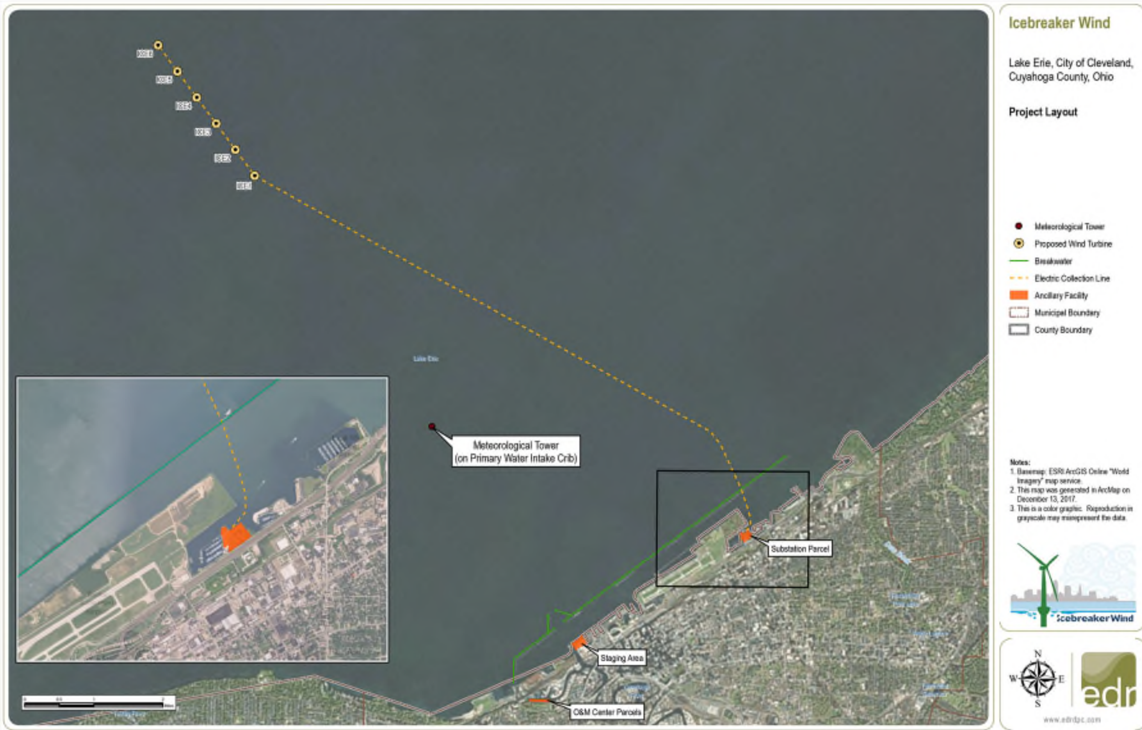
Figure 3.3: Tahkoluoto (t-l), Tunø Knob (t-m) and Nysted (t-r), Vindpark Vänern (b -l), Lillgrund (b-r) with ice-breaking cones (Wagner and Slooff, 2021)

The engineering team working for Baird on Wolfe Island Shoals has first-hand experience developing turbine installation solutions where industry standard jack-up vessels cannot be utilized. In the case of the Westermeerwind project, the challenge was solved by utilizing an existing barge that was converted into a self-elevating platform (stabilized but not lifted out of the water) with the addition of a hydraulic spud system that maintained even pressure between the legs (see Figure 3.4). This vessel was then fitted with a crawler crane that could perform all the turbine erection lift operations. In the case of Wind Farm Fryslân, where the turbine and hub height are larger, a similar concept was used, but a custom design was required for the higher crane capacity. The vessel is essentially 4 barges connected by a topside superstructure that also acts as the crane platform. A similar, although larger, hydraulic spud system acts as the stabilizing and positioning system during lifts.

Figure 3.4: Westermeerwind project turbine installation (Wagner and Slooff, 2021)

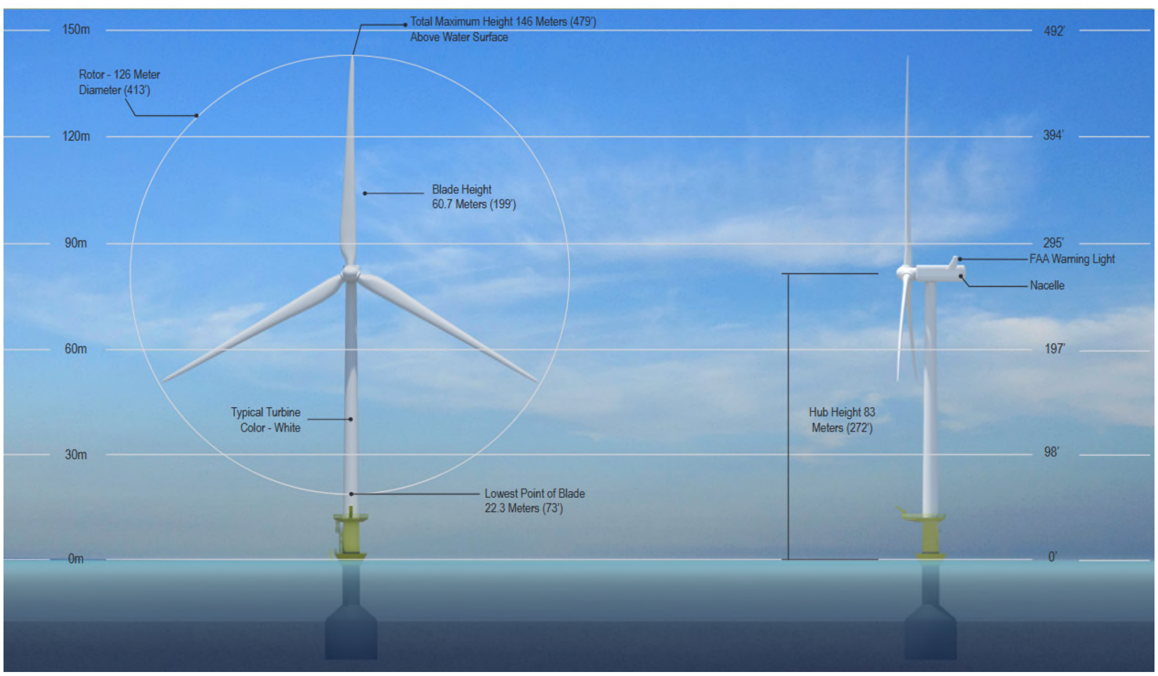
3.2 LEEDCo Icebreaker Offshore Wind Farm, Lake Erie

LEEDCo has developed Icebreaker Wind, the first freshwater offshore wind project in North America, located in Lake Erie approximately 10 miles off the coast of Cleveland, Ohio (Figure 3.5). Icebreaker is a six turbine, 20.7-megawatt offshore wind project (Figure 3.6).



http://www.leedco.org/index.php/about-icebreaker

Figure 3.5: Approved LEEDCo Icebreaker offshore wind project plan, Lake Erie



http://www.leedco.org/index.php/70-resources/156-technical

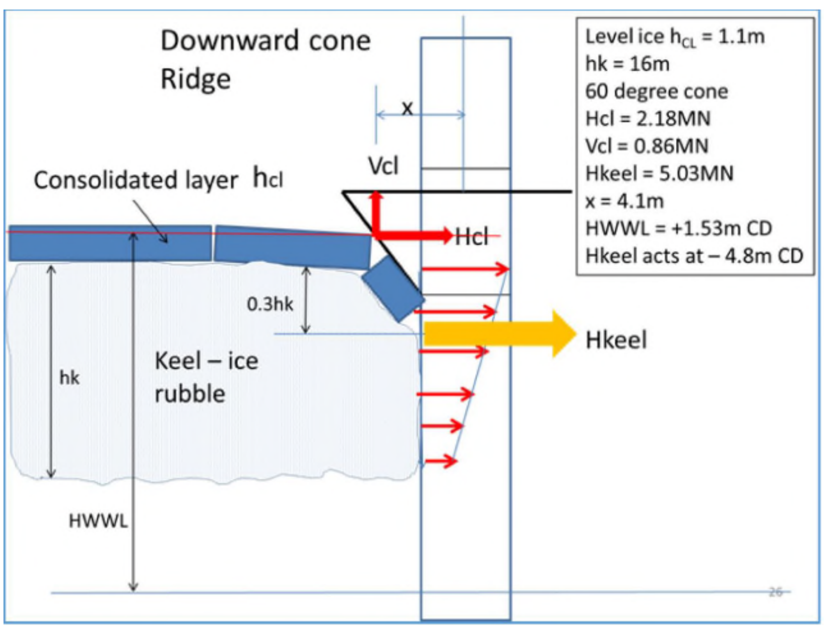
Figure 3.6: LEEDCo Icebreaker offshore wind turbine, Lake Erie

During design and development of the project, multiple federal and state permits, as well as environmental studies, were required to be completed before construction could commence. As of 2020, all permits, and approvals have been received by Icebreaker. A comprehensive list of the Icebreaker studies and permits required for construction are summarized below:

1. National Environmental Policy Act – Environmental Assessment (EA)
2. Finding of No Significant Impact (FONSI)
3. Final EA
4. Appendix A-1 Public Scoping Documents
5. Appendix A-2 Public Comments
6. Appendix B Substation Layout Plan
7. Appendix C Favorability Analysis Map
8. Appendix D Substation and Cable Route Design Report
9. Appendix E-1 2016 Aquatic Sampling Report
10. Appendix E-2 2017 Aquatic Sampling Report
11. Appendix F-1 Geophysical Survey Report
12. Appendix F-2 Windfarm Lake Bottom Ground Conditions Report
13. Appendix F-3 Harbor & Nearshore Lake Bottom Ground Conditions Report
14. Appendix G-1 Sediment Quality Evaluation Technical Memorandum
15. Appendix G-2 Inadvertent Return Contingency Plan 080718
16. Appendix H Substation Geotechnical and Subsurface Exploration Report
17. Appendix I Aquatic Ecological Resource Characterization and Impact Assessment
18. Appendix J Avian NEXRAD Analysis
19. Appendix K Avian Radar Survey Report
20. Appendix L-1 Summary of Risks to Birds and Bats
21. Appendix L-2 Bird & Bat Annual Report 2018
22. Appendix M-1 Biological Assessment of Endangered Species
23. Appendix M-2 USFWS Biological Assessment Concurrence 2017
24. Appendix N ODNR Division of Wildlife Letter for No Endangered Species
25. Appendix O Summary of Cable EMF Impacts on Fish
26. Appendix P Recreational Boat Survey
27. Appendix Q Characterization Lake Erie Ice
28. Appendix R Navigational Risk Assessment
29. Appendix S Cultural Resources Report
30. Appendix T-1 Section 106 Geophysical Cultural Resources Survey Review
31. Appendix T-2 Addendum Sect.106 Geophysical Cultural Resources Survey
32. Appendix U Visual Impact Assessment
33. Appendix V-1 Cultural Resources Effects Analysis
34. Appendix V-2 Ohio Historic Preservation Office-ACHP Correspondence
35. Appendix W Socioeconomic Report January 2017
36. Appendix X Memoranda of Understanding - Fisheries, Aquatics, Avian & Bat

37. Ohio Power Siting Board – Certificate of Environmental Compatibility & Need
38. U.S. Army Corps of Engineers; Validated Permit Clean Water & Rivers & Harbors Acts
39. Ohio Water Quality Certificate
40. U.S. Army Corps of Engineers Permit for Temporary Alteration of Civil Works
41. FAA No Hazard to Aviation
42. Ohio Aviation Administration Concurrence with FAA
43. International Joint Commission - Approval Not Required for Boundary Waters Treaty
44. U.S. Coast Guard Approval for Private Aid to Navigation
45. Submerged Lands Lease from Ohio Coastal Zone Management
46. Aerial Survey Waterbird Assessment
47. National Telecommunications & Information Administration – No Radar Interference
48. Cleveland Water Department - No Sediment Transport Impact to Drinking Water
49. Cuyahoga County major component transport route approval

Keel ice loads were a significant consideration for the Icebreaker turbine design. The keel ice loads are summarized in Figure 3. The methodology to develop the ice loads was based on design code ISO 19906 - Petroleum and Natural Gas Industries – Arctic Offshore Structures in which the load from the ridge keel is added to the load from the consolidated layer of the ridge. In the Icebreaker turbine design case, the critical ridge load occurs from a ridge with a keel depth of 16 m and a consolidated later thickness of 1.1 m. The total load was calculated to be 7.2 MN of which the largest component is from the keel (over 5 MN). The ice analysis and design were thoroughly reviewed by the permitting agencies and accepted as reasonable. Discussion of ice design for the WIS Project is provided in Section 6.2.



http://www.leedco.org/index.php/70-resources/156-technical

Figure 3.7: LEEDCo Icebreaker ice loading on turbine foundation, Lake Erie (Wagner and Slooff, 2021)

3.3 Comparable Marine Projects

3.3.1 WIS Project is not a "*First of Kind*" Project

Baird (2014, 2015) concluded that the various in-water components of the WIS Project do not differ in any substantive manner from the numerous in-water projects constructed and planned on the Great Lakes. The design, impact assessment, permitting, scheduling and construction of marine elements like the various components of the Project are not "*first of kind*" and have been successfully undertaken many times before for comparable marine projects on the Great Lakes.

Below water, the marine components of the Project, such as dredging, stone bedding, concrete pier foundations and electrical cables, are like other marine projects that have been safely permitted and constructed in freshwater Lake Ontario and other Great Lakes for over a century. The turbine foundation structures are relatively slender structures and are similar in form and function to bridge piers, piles, lighthouses, and navigation towers. Such structures have been designed, permitted, and constructed throughout the freshwater Great Lakes and connecting channels and elsewhere in Canada for over a century in accordance with accepted scientific and engineering practices with respect to coastal processes, including wind, waves, and ice.

Numerous examples of projects with features comparable to the WIS Project turbine foundations were presented in Baird (2015). Examples of structures with similar conditions to the Project (i.e., ice, waves, wind and/or freshwater) include the Yamachiche Light Pier, St. Lawrence Seaway (Figure 3.8) and the Confederation Bridge with 62 concrete piers in the water between New Brunswick and Prince Edward Island, Canada (Figure 3.9). Section 3.1 described many wind energy project turbine foundations that have successfully been designed and constructed in Europe and in fresh water. Therefore, Baird does not consider wind turbine foundations in the Great Lakes as "*first of kind*" structures with respect to coastal processes, wind, waves, ice conditions and installation.

Figure 3.8: Ice action at Yamachiche Light Pier, St. Lawrence Seaway, Canada[20]

[20] **C-1375**. Barker, A., and Timco, G., 2005. Ice Rubble Generation for Offshore Production Structures: Current Practices Overview, Technical Report CHC-TR-030, February.

Figure 3.9: Confederation Bridge, Northumberland Strait, New Brunswick-PEI, Canada showing ice action on piers

3.3.2 Other Comparable Marine Projects Since 2015

Proven marine design and construction techniques applicable to the marine elements of the WIS Project continue to be applied to marine projects on the Great Lakes – St. Lawrence River, such as the Champlain Bridge over the St. Lawrence River, Montreal, Quebec, which was completed in 2019, and the Ashbridge's Bay Treatment Plant Outfall risers, presently under construction in Lake Ontario. This further demonstrates that the coastal processes can be reasonably quantified, and that accepted engineering design codes, guidelines and methodologies can be applied to successfully implement projects in ice prone marine environments.

3.3.2.1 Champlain Bridge

The Champlain Bridge is a cable-stayed bridge constructed in 2019 to replace the original Champlain Bridge over the Saint Lawrence River in Montreal, Quebec (Figure 3.10). The 2,044-metre (6,706 ft) west approach structure has 26 spans that are typically 80.4 metres (264 ft) long. The east approach is 780 metres (2,560 ft) long. Another example of a marine structure subjected to ice loads is the Champlain Bridge Ice Control Structure (called the "Estacade"). It runs parallel to the Champlain Bridge, about 300 metres upriver and was built between 1964 and 1965 to control ice jams and ice flow. Floating booms and stop logs originally used to hold back ice are no longer in operation as ice breakers are now used. The multiple piers continue to protect the Champlain Bridge against damage from large pieces of ice during spring break up.

Credit: INFC https://www.canambridges.com/projects/new-champlain-bridge-corridor-project/

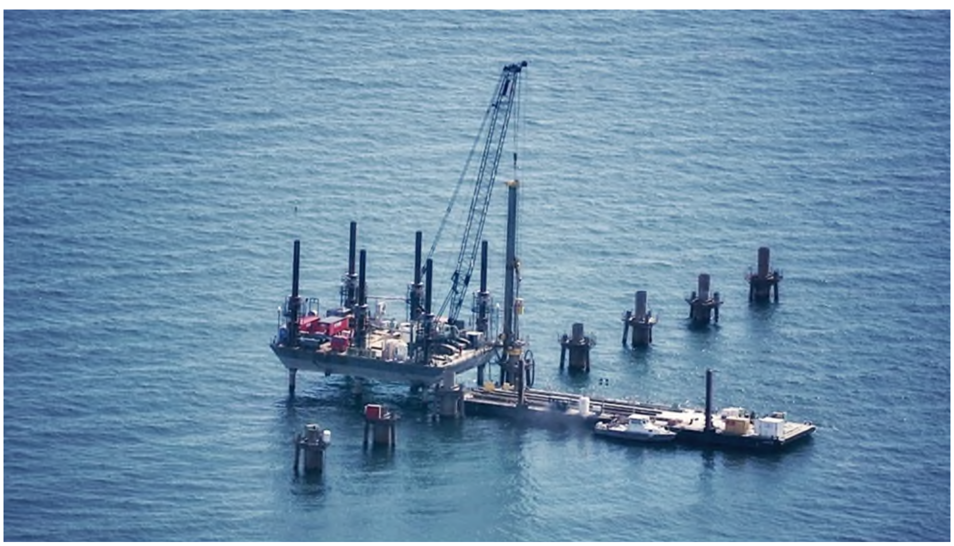
Figure 3.10: Marine construction of Champlain Bridge over St. Lawrence River, Montreal, Quebec

https://www.infrastructure.gc.ca/nbsl-npsl/architecture-eng.html

Figure 3.11: Champlain Bridge Ice Control Structure (called the "Estacade") approximately 300 m upriver from the Champlain Bridge

3.3.2.2 Ashbridge's Bay Wastewater Treatment Plant Outfall

The Ashbridge's Bay Wastewater Treatment Plant expansion includes boring of a seven-metre-diameter, 3.5-kilometre-long tunnel outfall underneath Lake Ontario. The tunnelling contractor is Southland Mole of Canada/Astaldi Canada Joint Venture, and the consulting engineering team is comprised of lead consultant Hatch and Jacobs (formerly CH2M) and Baird. Last summer the phased installation of fifty in-lake risers by Southland Mole of Canada/Johnson Bros Corporation, the Joint Venture marine contractor, also got underway using barge mounted equipment (Figure 3.12). The risers are vertical stainless-steel pipes along the last kilometre of the tunnel which will diffuse the treated effluent.



https://toronto.ctvnews.ca/gta-from-above-the-ashbridges-bay-outfall-project-1.5136435

Figure 3.12: Marine construction of in-lake risers for Ashbridge's Bay Treatment Plant Outfall Project, Lake Ontario

4. Lakebed Sediments and Drinking Water Protection

Disturbance of Lakebed Sediments at WIS Project will not Pose a Risk to Drinking Water

Baird (2015) clearly demonstrated that the levels of contaminants in the existing lakebed sediments in the WIS Project area are relatively low and could be readily and safely managed within established Ontario Ministry of the Environment and Climate Change (MOE) criteria and guidelines[21]. As shown in Baird (2015), and as further supported by additional findings in this study, the shifting or disturbance of the lakebed sediments during installation of the turbine foundations would not pose a threat to drinking water.

This report confirms that the analysis completed by Baird (2015) regarding the potential contaminant concentration in the water because of disturbance to the lakebed sediment was safely conservative. To our knowledge, the province has not undertaken any further studies since 2015 that address the potential for disturbance of the lakebed sediments to pose a threat to drinking water sources or studies that refute the conclusions of Baird (2015). To our knowledge no regulatory changes related to lakebed sediments and drinking water protection have been made which would preclude the Project.

Since 2015, lakebed sediment disturbance has been extensively studied for two projects on Lake Erie, the LEEDCo Icebreaker offshore wind project and the ITC Lake Erie Connector cross lake transmission cable project. The LEEDCo and ITC projects have similar sediment contaminant characteristics as the WIS Project and similar concerns with respect to the potential impacts of disturbing the lakebed sediments. Both the LEEDCo and ITC projects were subject to environmental assessments and studies and in both instances, it was concluded that disturbance of the lakebed sediments did not pose an unacceptable risk to drinking water; both projects have received approvals.

In Baird's opinion, it is reasonable to expect that the presence of low levels of contaminants in the lakebed sediments does not have the potential to contaminate the drinking water intakes and that the Project would meet MOE criteria for the protection of drinking water.

Based on our independent review of the technical and permitting feasibility, the Baird team has not identified any material impacts or impediments with respect to the lakebed sediments and protection of drinking water in Lake Ontario that would preclude the proposed WIS Project from proceeding to design development and the regulatory permitting processes. There is a reasonable expectation that approval for the WIS Project turbine structures could be obtained under regulations related to lakebed sediments and protection of drinking water present in 2021. The permitting process would be subject to detailed engineering and scientific studies using accepted practices, codes and guidelines and implementation of appropriate mitigation measures during construction and through the operational life of the structures and decommissioning.

4.1 Baird (2015) Analysis of Potential Contaminant Concentration in Water

Baird's 2015 analysis indicated that the level of contaminants in the existing lakebed sediments of Lake Ontario in the area of the Project would be safely manageable within established Ontario Ministry of Environment (MOE) criteria and guidelines[22]. The preliminary analysis (Baird, 2015) also indicated that shifting of those

[21] **C-1570**. MOE, 2011. Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario, revised in 2011 by M. Gordon and T. Fletcher, Standards Development Branch, Ontario Ministry of the Environment, March.
[22] **C-1570**. MOE, 2011. *op. cit.*

sediments during installation of the turbine foundations would pose no threat to drinking water and the Project would meet MOE criteria[23] and as such would not create significant scheduling delays.

At the WIS Project site, a limited number of contaminants exceed the lowest effects level (LEL) thresholds established by MOE[24] and the Canadian Council of Ministers of the Environment,[25] and none of the parameters tested exceed the severe effects level (SEL) threshold (Baird, 2015). Contaminants are present at various concentration levels in sediments throughout the Great Lakes, with many of these occurring naturally at "background" levels. The important issue is not that contaminants exist, but that the contaminant concentration levels in the existing lakebed sediments are within accepted, safe and manageable levels.

The analysis completed by Baird (2015) very conservatively assumed that 100% of the mass of the contaminants in the volume of lakebed sediment resuspended during installation of the turbine foundations dissolved into the water column. This was a very conservative, safe assumption because a significant portion of the contaminants do not dissolve but remain bound to the sediment. The actual mass of contaminants dissolved into the water is much less than the 100% assumed for the purposes of Baird (2015). The metal partition coefficient (Kd, also known as the sorption distribution coefficient) is the ratio of sorbed metal concentration (expressed in mg metal per kg sorbing material) to the dissolved metal concentration (expressed in mg metal per L of solution) at equilibrium, expressed in the following equation:

$$K_d = \frac{\text{sorbed metal concentration } (mg/kg)}{\text{dissolved metal concentration } (mg/L)}$$

Metal partition coefficients are presented in units of log-Kd (e.g., a log-Kd coefficient of 2 is equal to a Kd coefficient of 100 and a log-Kd coefficient of 3 is equal to a Kd coefficient of 1000). Using appropriate median values of metal partition coefficients would result in much lower concentration of dissolved metals in the water than the 100% assumed in the conservative analysis. For example, using the median partition coefficients (log Kd in L/kg) for arsenic (As) of 2.5 for sediment/water or 4.0 for suspended matter/water[26], would result in dissolved As concentrations two orders of magnitude less than used in Baird (2015), i.e., less than 1% of the As would be dissolved into the water column. Nevertheless, even using the very conservative assumption of 100%, Baird (2015) demonstrated that the concentration of contaminants in the sediment disturbed during the installation of each turbine would be readily diluted to MOE drinking water quality standards[27] within a very short distance of each turbine and that the dissolved contaminant concentrations were no threat to drinking water sources.

The Kingston drinking water intake is 12 km from the closest WIS turbine. Computer numerical modelling (Baird, 2015) that simulates the movement of the sediments (i.e., "particle tracking") indicates that the sediments disturbed during dredging for the turbine GBF closest to the water intake would still be approximately 5 km away from the designated intake protection zone (IPZ), and therefore would not threaten drinking water (Figure 4.1).

[23] **C-1408**. MOE, 2006. Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines, Ontario Ministry of Environment, Revised June 2006.*op. cit.*
[24] **C-1570**. MOE, 2011. *op. cit.* pp. 36-37.
[25] **C-1291**. Canadian Council of Ministers of the Environment. 1999. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, Polychlorinated Biphenyls. Canadian Environmental Quality Guidelines, updated 2001. p. 1. http://ceqg-rcqe.ccme.ca/download/en/244 accessed May 21, 2015.
[26] **C-1628**. Allison, J.D., Allison, T., 2005. Partition Coefficients for Metals in Surface Water, Soil, and Waste. Report EPA/600/R-05/074, U.S. Environmental Protection Agency, July.
[27] **C-1408**. MOE, 2006. *op cit.*

An internal MOE email[28] was consistent with Baird's opinion that the Project would not likely pose a risk to drinking water. The email noted: "…*point a consultant at some Environment Canada sediment data…suggesting reviewing the Source Water Protection Modelling might be a fast way to demonstrate why re-suspended sediments from >5km offshore in depths of >100m cannot pose a significant threat to drinking water intakes located only ~0.5km to 2km offshore in depths of <20m*".

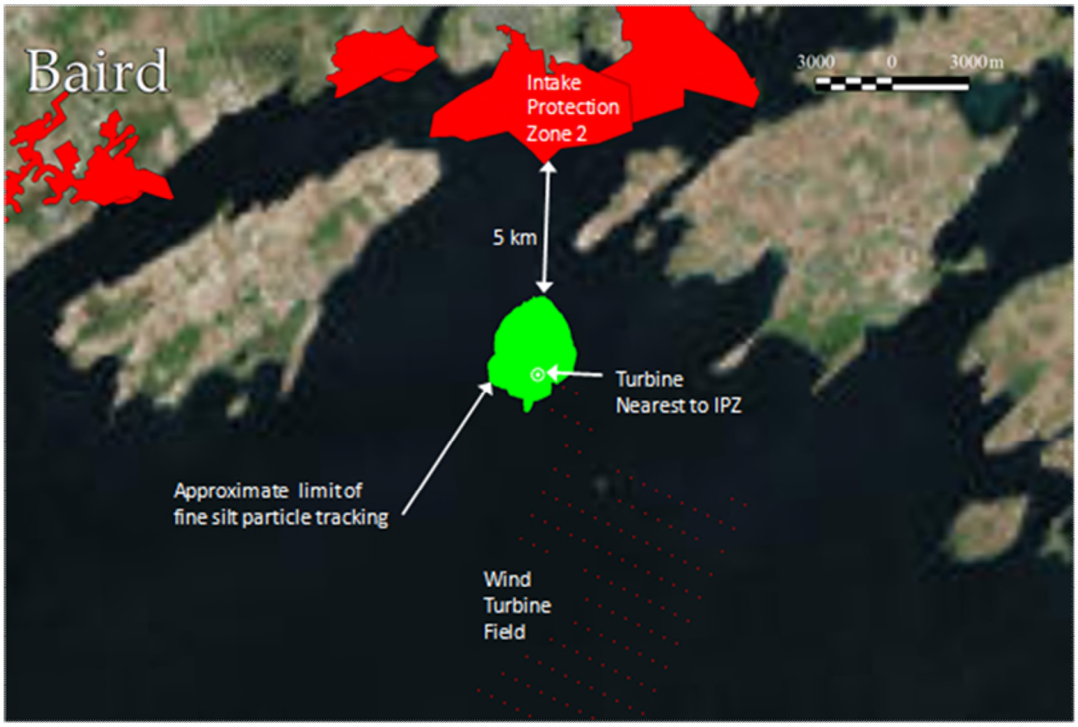


Figure 4.1: Limit of movement of disturbed sediment modelled by particle tracking and proximity to drinking water intake protection zone (IPZ) (Baird, 2015)

4.2 No Further Sediment Studies by Province

To our knowledge, the province has not undertaken any further studies since 2015 that address the potential for disturbance of the lakebed sediments to pose a threat to drinking water sources or studies that refute the conclusions of Baird (2015). The provinces own experts from the Environmental Monitoring and Reporting Branch, Ontario Ministry of the Environment concluded: "*Based on the results of this assessment, it was concluded that any impacts from construction of an offshore windmill would be quite small*."[29] To our knowledge no regulatory changes related to sediments and drinking water protection have been made which would preclude the development Project.

[28] **R-0306**. Boyd, Duncan (ENE) email to Radcliffe, Steve (ENE) (November 5, 2012).
[29] **C-0637**. Nettleton, P., 2012. Application of the MIKE3 model to examine water quality impacts within the Lake Ontario nearshore in 2008, Great Lakes Unit, Water Monitoring & Reporting Section, Environmental Monitoring & Reporting Branch (EMRB), Ontario Ministry of the Environment, draft final December 28, 2012.

As demonstrated in Baird 2015, it is not necessary for MOE to map and create a database identifying available sediment quality data throughout the Great Lakes prior to allowing the WIS Project to proceed. In fact, a suitable sediment quality database was available to the province at the time. In fact, sediment quality data from this database for two sampling stations in the WIS Project area (Location #1067 and Location #1068) was used in the analysis completed by Baird (2015). Baird (2015) concluded that the available sediment contaminant data indicated that contaminant levels were low and that disturbance of the sediment during the construction of the Project was likely not to be of concern with respect to drinking water.

Another sediment quality study was available to MOE at the time of the moratorium; the Sediment Quality Index (Marvin et al., 2004)[30] could have been used by Ontario to understand the relative risks of contaminants in the sediment. The sediment quality index (SQI) used the Canadian Sediment Quality Guidelines (CCME, 1999) and an equation incorporating three elements; scope – the percent (%) of variables that did not meet guidelines; area frequency – the percent (%) of failed tests divided by the total number of tests in a group of sites; and amplitude – the magnitude by which failed variables exceeded guidelines. The Canadian Sediment Quality Guidelines were selected for application to the SQI because of their applicability to a broad suite of contaminants, and because they represent a conservative approach to the evaluation of sediment quality (Rheaume et al., 2000). The SQI calculation produces a numerical score with a maximum value of 100 representing the highest sediment quality. The area of the WIS site had basin sediment quality index values rated as “excellent” (+95) (Figure 4.2). An index value of 95 to 100 is classified as sediment that is devoid of any contaminant related impairment and is indicative of ambient environmental background conditions. Index values within this range are achieved when practically all measurements fall within the guideline values (Marvin et al., 2004).

Rather than undertaking a Great Lakes wide sediment sampling campaign prior to even considering the merits of the WIS Project (which Ontario stated was required), the most informative manner to further confirm that shifting of the lakebed sediments during the installation of the turbine foundations for the Project would not pose a threat to drinking water would have been to undertake a detailed, site specific study of the Project site, using accepted scientific and engineering principles, as part of the design development process. As detailed in Baird (2015), the Project Schedule allowed sufficient time for these site- specific studies to be undertaken, as would have been the normal procedure for any major infrastructure project. But for the Moratorium, WIS would have completed these studies. MOE has well-established guidelines and procedures to review the Project for the protection of drinking water[31] [32] [33]. The Project Schedule allows for these studies to be completed and for the review by MOE. Section 4.3 demonstrates two comparable projects on the Great Lakes that were successfully assessed and approved in similar manner as outlined in Baird (2015).

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[30] **C-2523**. Marvin, C., Grapentine, L, and Painter, S., 2004. Application of a Sediment Quality Index to the Lower Laurentian Great Lakes, Environmental Monitoring and Assessment 91: 1–16, 2004.
[31] **C-1408.** MOE, 2006. *op. cit.*
[32] **C-1499**. MOE, 2009. Technical Rules: Assessment Report. Clean Water Act, 2006. Ontario Ministry of the Environment, Dated November 16, 2009.
[33] **C-1819**. Cataraqui Source Protection Area (CSPA). 2014. Cataraqui Source Protection Plan. Dated November 2014. accessed 21/05/2014, http://www.cleanwatercataraqui.ca/sourceProtectionPlan.html.

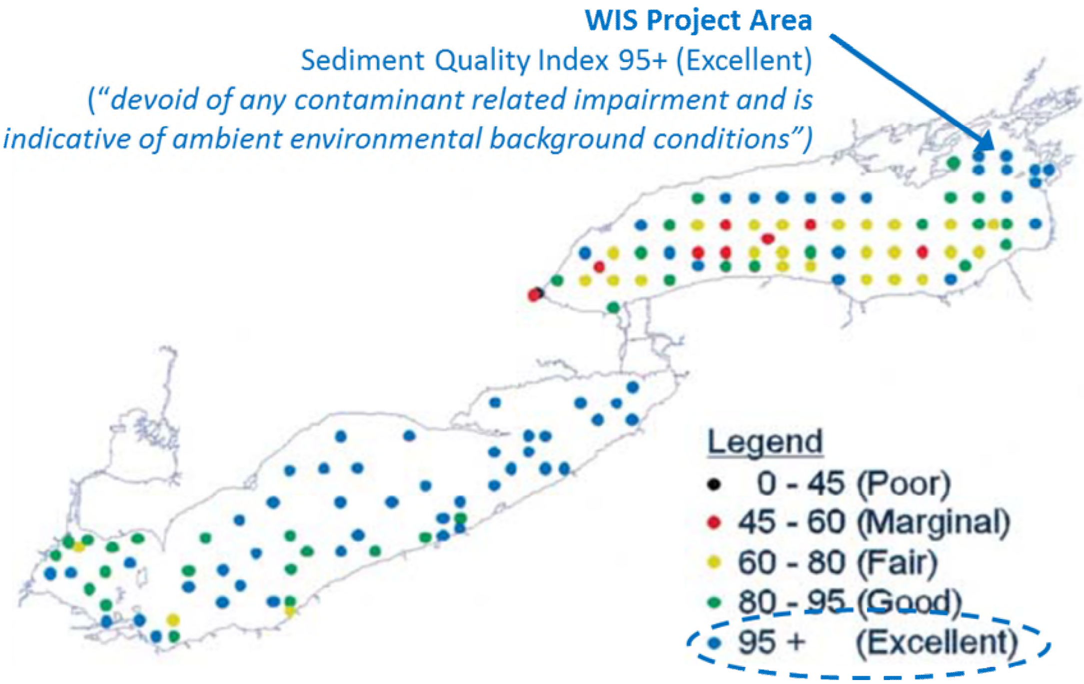


Figure 4.2: Distribution of individual lake basin sediment quality index values for Lakes Erie and Ontario (Marvin, C., Grapentine, L, and Painter, S., 2004) indicating "Excellent (95+)" sediment quality index values at WIS Project area

4.3 Comparable Great Lakes Projects Approved

Since Baird (2015), we have identified two offshore projects in Lake Erie that are comparable to the WIS project with respect to concerns regarding the disturbance lakebed sediments and the protection of drinking water; these two projects are the LEEDCo Icebreaker offshore wind project and the ITC Lake Erie Connector cross-lake electricity transmission cable project between Canada and the United States.

Detailed studies completed for the two Lake Erie projects, similar to the type and scope of studies included in the schedule for the WIS project (Baird 2015), demonstrated that disturbance of the lakebed sediments did not pose an unacceptable risk to drinking water. Both projects were evaluated and approved by the relevant regulatory agencies. The conclusions for the LEEDCo Icebreaker project and the ITC project are relevant for the WIS Project because the general characteristics of the lakebed sediments at the two Lake Erie sites are comparable to the sediments at the WIS Project site in the Kingston Basin of Lake Ontario.

4.3.1 LEEDCo Icebreaker Wind Farm, Lake Erie

LEEDCo Icebreaker is a freshwater offshore wind project with six turbines located in Lake Erie, approximately 16 km off the coast of Cleveland, Ohio (Figure 3.5). During the design and development of the Icebreaker project, multiple federal and state permits, as well as environmental studies, were required to be completed before construction could commence. As of 2020, all permits, and approvals have been received by Icebreaker. Further details of the Icebreaker project are provided in Section 3.2. The conclusions for the LEEDCo Icebreaker project are relevant for the WIS Project because the level of contaminants in the sediment at the Icebreaker project are comparable to the conditions at the WIS Project site.

The Aquatic Ecological Resource Characterization and Impact Assessment report for the Icebreaker project (LimnoTech, 2017[34]) presented the following findings:

- *"Degradation of habitat by sediment resuspension during electric cable installation is expected to only last several hours and extend no further than a few hundred meters or less beyond the point of installation.*"
- "*The area impacted by the 17 m diameter turbine foundations is 0.05 acres per turbine and 0.3 acres total. Spacing between turbines is approximately 0.5 mi. Therefore, the footprint of the foundations represents an insignificant loss of habitat and juvenile and adult fish can avoid the structures easily.*"
- "*At the 2012 workshop, a number of other relatively minor potential areas of impact were discussed including sediment scour around turbines that could affect local bathymetry, local wind and wave patterns, and circulation. The workshop participants concluded no overall impact of sediment scour, wind, and waves from offshore wind development is likely and only a small impact of turbidity/sediment transport is likely during construction. The workshop participants indicated that changes in lake circulation patterns could be possible, but it would depend on the scale and location of any proposed project*."

Icebreaker Sediment Quality Evaluation

CH2M (2017)[35] completed a sediment quality evaluation for the Icebreaker project. The sediment quality evaluation was performed on four composite samples collected from the Icebreaker project area. The contaminant concentrations for eight metals are presented in Table 4.1 along with the consensus-based threshold effects concentrations (TECs) and probable effects concentrations (PECs) (MacDonald et al. 2000). Threshold effect levels (TECs) are conservative screening values that represent a level below which there would be a high confidence of no adverse effects, but above which unacceptable risk is uncertain. The probable effects concentrations (PECs) represent a level above which there is a reasonable likelihood of adverse effects.

For metals, the TEC was exceeded in one or more samples for all metals with nickel exceeding the respective TEC screening value in all four samples. None of the samples, except for nickel, exceeded their respective PEC levels; one nickel sample marginally exceed the PEC level. Overall, CH2M (2017) concluded that there was *"low potential for toxicity in the project area"* and*, "as a result, aquatic receptors will not likely be impacted by disturbed sediment during the construction activities within the project area.*" All permits, and approvals have been received for the Icebreaker project.

Comparison of Icebreaker Sediment with WIS Sediment

The level of contaminants in the lakebed sediment at the Icebreaker project area are comparable to the level of contaminants in the sediment at the WIS Project site. A comparison of the ratios of sediment contaminant concentration to pre-colonial background sediment concentration for the Icebreaker project and the WIS Project is presented in Figure 4.3. A ratio 1.0 of contaminant concentration to pre-colonial concentration indicates that the contaminant is the same as the background level. The PEL or SEL threshold values for the eight contaminants are about 4 to more than 10 times the background levels. Average contaminant levels at the WIS project locations (locations 1067 and 1068) range from less than background levels to at most 2 to 3 times background levels. Average contaminant levels at the WIS project locations (locations 1067 and 1068)

[34] **C-2068**. LimnoTech, 2017. Aquatic Ecological Resource Characterization and Impact Assessment, Prepared for Icebreaker Windpower Inc., January 24.
[35] **C-2079**. CH2M HILL, Inc., 2017. LEEDCo Sediment Evaluation, Icebreaker Demonstration Wind Project, Lake Erie near Cleveland, Ohio. Technical Memorandum prepared for: Lake Erie Energy Development Corporation, March 10.

for As, Cr, Cu, Ni and Zn were lower or the same as the four LEEDCo Icebreaker samples and all were similar or less than the lowest effects level (LEL). The concentration value for Pb for WIS was slightly higher than for the LEEDCo Icebreaker value, but still below the lowest effects level (LEL). Hg for the WIS samples was higher the LEEDCo Icebreaker samples, but still well below the probable effects level (PEL). Even though the sediment contaminant concentration for Hg at the WIS project site was three to four greater than the Hg concentrations at the LEEDCo Icebreaker and ITC Crossing sites respectively, water quality modelling for the ITC Crossing project (Section 4.3.2) shows that the dissolved Hg concentration (<0.000008 µg/L for hours only) is orders of magnitude below the Provincial Water Quality Objectives (PWQO) limit (0.2 µg/L); it is expected that the higher Hg levels at WIS would not pose a concern. This is relevant to the WIS Project, as it demonstrates that disturbance of the lakebed sediment during construction of the turbines is not reasonably expected to pose a threat to the drinking water intakes.

Table 4.1: Sediment Contaminant Concentrations, LEEDCo Icebreaker Project, Lake Erie

	Sediment Contaminant Concentration *(reported as mg/kg)*							
LeedCo Composite Samples	**As**	**Cd**	**Cr**	**Cu**	**Pb**	**Ni**	**Zn**	**Hg**
PC01R, PC02, PC03	13.1	0.17	18.6	22.6	11.8	30.3	72.7	0.0138
PC04, PC05R1, PC06R2, PC07	13.9	0.24	19	26.8	16	30.2	111	0.0173
PC09, PC10	14.6	0.51	26.1	42.4	24	34.1	116	0.0354
BC01, BC02, BC03	8.21	1.94	53.1	47.7	44.9	51.4	204	0.335
Average of 4 LeedCo Samples	12.5	0.72	29.2	34.9	24.2	36.5	126	0.10
Consensus Based TEC	*9.79*	*0.99*	*43.4*	*31.6*	*35.8*	*22.7*	*121*	*0.18*
Consensus Based PEC	*33*	*4.98*	*111*	*149*	*128*	*48.6*	*459*	*1.06*
Average WIS 1067 & 1068	12.7	0	21.9	21.6	30.1	24.2	93.2	0.28

TEC = Threshold Effects Concentration - is a conservative screening value that represents a level below which there would be a high confidence of no adverse effects.

PEC = Probable Effects Concentration - represents a level above which there is a reasonable likelihood of adverse effects.

Values of consensus based LEC and PEC from MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39, 20-31., as reported in CH2M HILL, Inc., 2017. Sediment Evaluation, Icebreaker Demonstration Wind Project, Lake Erie near Cleveland, Ohio, Appendix G-1 Sediment Quality Evaluation Technical Memorandum, Prepared for: Lake Erie Energy Development Corporation, March 10.

Contaminant concentration data from CH2M HILL, Inc., 2017. LEEDCo Sediment Evaluation, Icebreaker Demonstration Wind Project, Lake Erie near Cleveland, Ohio. Technical Memorandum prepared for: Lake Erie Energy Development Corporation, March 10.

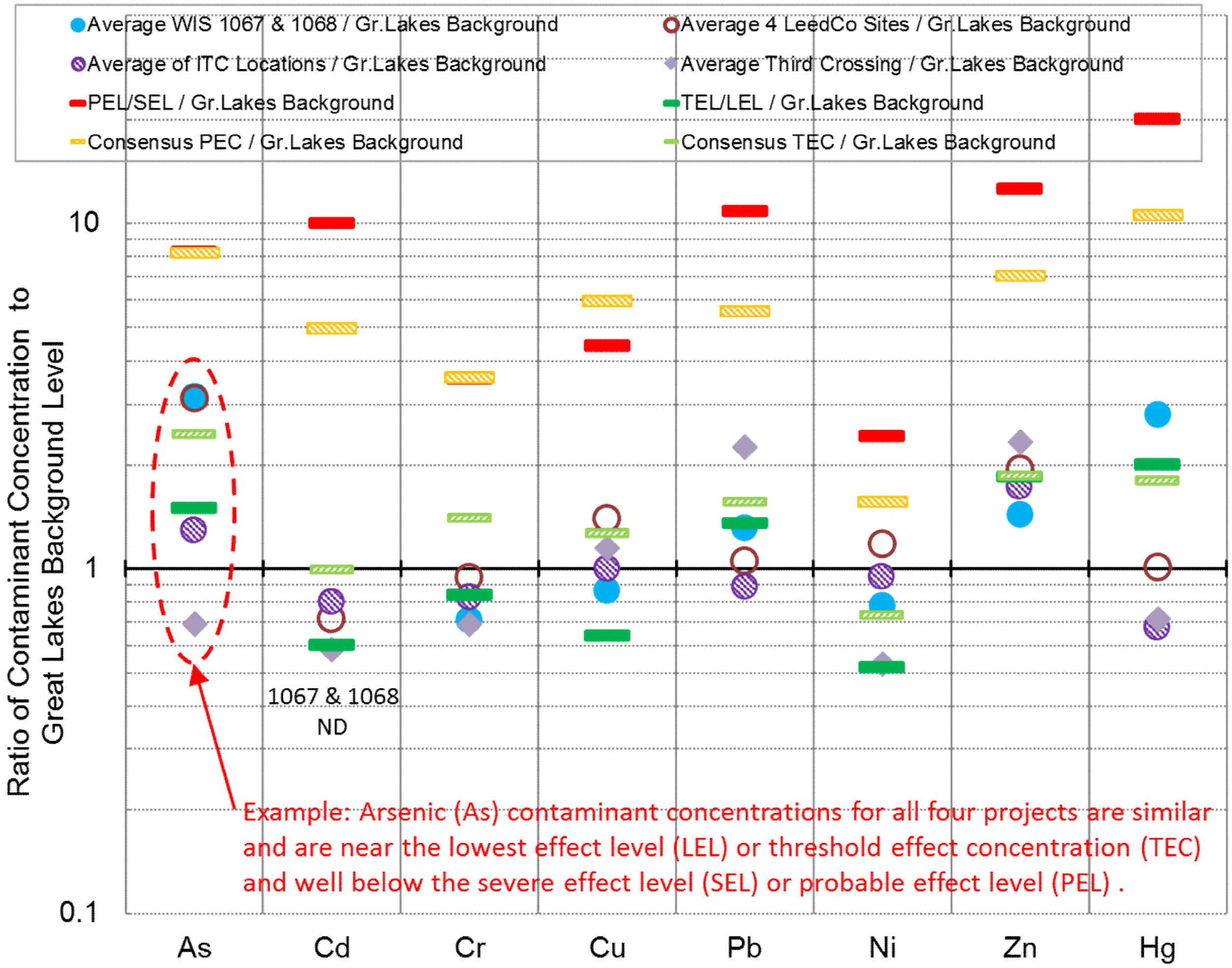


Figure 4.3: Comparison of sediment contaminant concentrations at WIS Project site with LEEDCo Icebreaker, ITC Crossing and Third Crossing project sites on the Great Lakes

Sites 1067 and 1068, WIS Project

LEL - Lowest Effect Level is the level of contamination in the sediment at which testing shows there is no toxic effect on the majority of sediment dwelling organisms (Ontario Ministry of the Environment, 2008. Guidelines for Identifying, Assessing and Managing Contaminated Sediment in Ontario, May).

SEL - Severe Effects Level indicates a level of contamination that is expected to be detrimental to the majority of sediment-dwelling organisms. Sediments exceeding the SEL are considered heavily contaminated (OMOE, 2008).

TEL - Threshold Effect Level is concentration below which adverse biological effects are expected to occur rarely. (Canadian Council of Ministers of the Environment (CCME). 1999. Canadian Environmental Quality Guidelines).

PEL - Probable Effect Level is the level above which adverse effects are expected to occur frequently. (Canadian Council of Ministers of the Environment (CCME). 1999. Canadian Environmental Quality Guidelines).

TEC - Threshold Effects Concentration (MacDonald et al., 2000).

PEC - Probable Effects Concentration (MacDonald et al., 2000).

Background level is the quality of the sediment in pre-colonial Great Lakes.

4.3.2 ITC Lake Erie Connector

The ITC Lake Erie Connector Project is 116 km long high-voltage electric transmission cable across Lake Erie between Canada and the United States (Figure 4.4). The proposed underwater portion of the transmission line is approximately 104 km long and will be buried to a depth of 2 to 3 meters in the sediment of Lake Erie using a towed jet-plow installation method. The jet-plow creates a trench to lay the cable by fluidizing the sediment in front of the installation plow using water jets and then the cable slips into the trench from the back of the plow. The cable settles to the bottom of the trench and is buried with the resuspended sediment (HDR, 2015[36]).

The ITC Lake Erie Connector project did a comprehensive study of sediment resuspension potential during the installation of the proposed cable causing localized migration of heavy metals in the basin or water column. Numerical modelling (HDR, 2015) showed that the cable installation is expected to have minimal impacts on water quality because the impacts are temporary and would occur locally within a four-hour timeframe.

Following a review of the project, the National Energy Board (2017[37]) determined that adverse effects of the ITC Lake Erie Connector were not likely to be significant for the following reasons:

- magnitude of the effects was low
- temporal extent was short to medium term
- effects were reversible
- geographical extent was limited to the local study area.

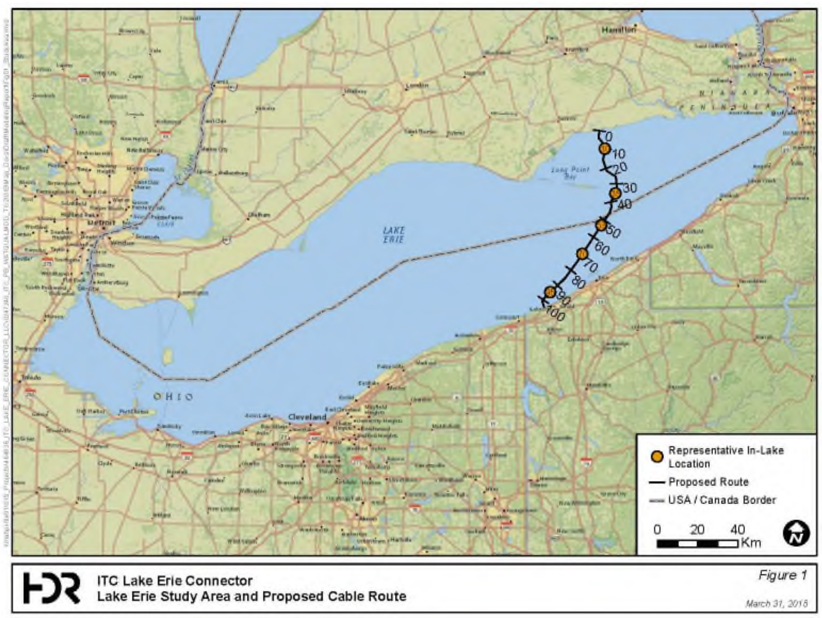


Figure 4.4: ITC Connector Project, Lake Erie (HDR, 2015) - cross-lake electricity transmission cable installed by plowing a cable trench through the existing lakebed sediments

36 **C-2016**. HDR, 2015. Lake Erie Connector Project Environmental Report – Appendix E Lake Erie Water Quality Modeling Report, ITC Lake Erie Connector, prepared for ITC Lake Erie Connector, LLC, May 4. .

37 **C-2066**. National Energy Board, 2017. Reasons for Decision ITC Lake Erie Connector LLC, Lake Erie Connector International Power Line Project, EH-001-2015, January.

Water Quality Assessment for ITC Lake Erie Connector Project

The conclusions for the ITC Lake Erie Connector Project are relevant for the WIS Project because the level of contaminants in the sediment along the route of the ITC project are comparable to the conditions at the WIS Project site. Sediment samples were collected and analyzed at five locations along the route of the ITC Connector Project. The contaminant concentrations for eight metals at the five locations are presented in Table 4.2 along with the consensus-based threshold effects concentrations (TECs) and probable effects concentrations (PECs); only nickel (Ni) shows a slight exceedance of the threshold effects concentration. The level of contaminants in the sediment at the ITC site are comparable to the conditions at the WIS Project site. A comparison of the ratios of sample sediment contaminant concentration to Lake background sediment concentration for ITC and WIS is presented in Figure 4.3. Average contaminant levels at the WIS project locations (1067 and 1068) for Cr, Cu, Pb, Ni and Zn are similar to the ITC samples and also similar to or less than the lowest effects level (LEL). The WIS concentrations for As and Pb are higher than the values for ITC, but both are only slightly higher that the TEC levels, but well below the PEC levels.

Table 4.2: Sediment Contaminant Concentrations along ITC Lake Erie Connector Crossing Route

	Sediment Contaminant Concentration *(reported as mg/kg)*							
ITC Location (depth)	**As**	**Cd**	**Cr**	**Cu**	**Pb**	**Ni**	**Zn**	**Hg**
KM10 (20.4m)	2.8	0.8	19.35	20.95	8.5	23.05	69.6	0.031
KM35 (61.1 m)	2.4	0.8	32	32.6	25.5	39	130.9	0.072
KM53 (36.9 m)	7.7	0.8	28.2	29.75	16.75	34.95	106.7	0.051
KM70 (23.2 m)	6.87	0.8	25.43	23.64	22.61	27.99	120.48	0.078
KM95 (13.4 m)	6.03	0.8	22.67	17.53	28.47	21.03	134.27	0.105
Average of ITC Locations	**5.16**	**0.8**	**25.53**	**24.894**	**20.366**	**29.204**	**112.39**	**0.0674**
Consensus Based TEC	*9.79*	*0.99*	*43.4*	*31.6*	*35.8*	*22.7*	*121*	*0.18*
Consensus Based PEC	*33*	*4.98*	*111*	*149*	*128*	*48.6*	*459*	*1.06*
Average WIS 1067 & 1068	12.7	0	21.9	21.6	30.1	24.2	93.2	0.28

Data from HDR (2015) Lake Erie Water Quality Modeling Report, May

As described in the Lake Erie Water Quality Modeling Report (HDR, 2015), a water quality model of Lake Erie was developed to assess the potential water quality impacts associated with the temporary resuspension of lake sediments during ITC Lake Erie Connector cable installation. Like the WIS project where existing sediment would be shifted on the lakebed for the installation of the turbine foundation, the potential water quality impacts due to the ITC Connector project are associated with the temporary re-introduction of existing sediments to the water column during cable installation and do not represent a new pollution source to the lake. The water quality modeling was completed to show the concentration increases associated with the cable installation at five representative locations for the following parameters: total suspended solids (TSS); total phosphorus (TP); dissolved phosphorus (DP); arsenic; cadmium; chromium; copper; lead; nickel; zinc; and mercury. The intent of the assessment was to provide sufficient information for regulatory agency review, including compliance with applicable Pennsylvania Department of Environmental Protection (PADEP) Water Quality Standards (WQS) and Ontario Ministry of Environment and Energy (MOEE) Provincial Water Quality Objectives (PWQO)[38].

[38] **C-2518**. Ontario Ministry of Environment and Energy (MOEE). 1994. Policies Guidelines Provincial Water Quality Objectives, July.

HDR (2015) concluded that the cable installation in the lakebed sediments of Lake Erie would have minimal impact on water quality. The water quality modelling demonstrated that the impacts are temporary, occurring within a four-hour timeframe, and localized. At all five of the representative locations, the model calculated TSS concentration increases due to the cable installation are less than 3 mg/L above observed background lake TSS levels at 100 m from the cable installation and within 5 m to 11 m of the lake bottom. The model calculated TSS concentration increases reach a temporary peak concentration at the point of installation and then decrease rapidly. The time to reach a TSS concentration increase of less than 100 mg/L is on the order of one hour and to reach less than 3 mg/L above background TSS levels is on the order of one to four hours. Figure 4.5 shows the TSS mode results for Station KM95 at a depth of 13.4 m, which is like depths for the WIS Project (10-30 m). This is relevant to the WIS Project, as it demonstrates that the expected impact of the disturbance of the lakebed sediment has a very limited spatial extent and is of very limited duration.

HDR (2015) reported that all model calculated dissolved metals concentration increases were less than the associated method detection limits (MDL) and much less than applicable acute and chronic dissolved WQS and PWQO. Figure 4.6 presents the modelled concentrations of dissolved metals As, Cd and Hg at sample station KM95. HRD (2015) concluded that water quality impacts associated with the eight metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc, and mercury) due to the installation of the cable in the lakebed sediments of Lake Erie are expected to be in compliance with applicable water quality standard (WQS) and Provincial Water Quality Objectives (PWQO) (MOEE, 1994). This is relevant to the WIS Project, as it demonstrates that disturbance of the lakebed sediment during construction of the turbines is not reasonably expected to pose a threat to the drinking water intakes.

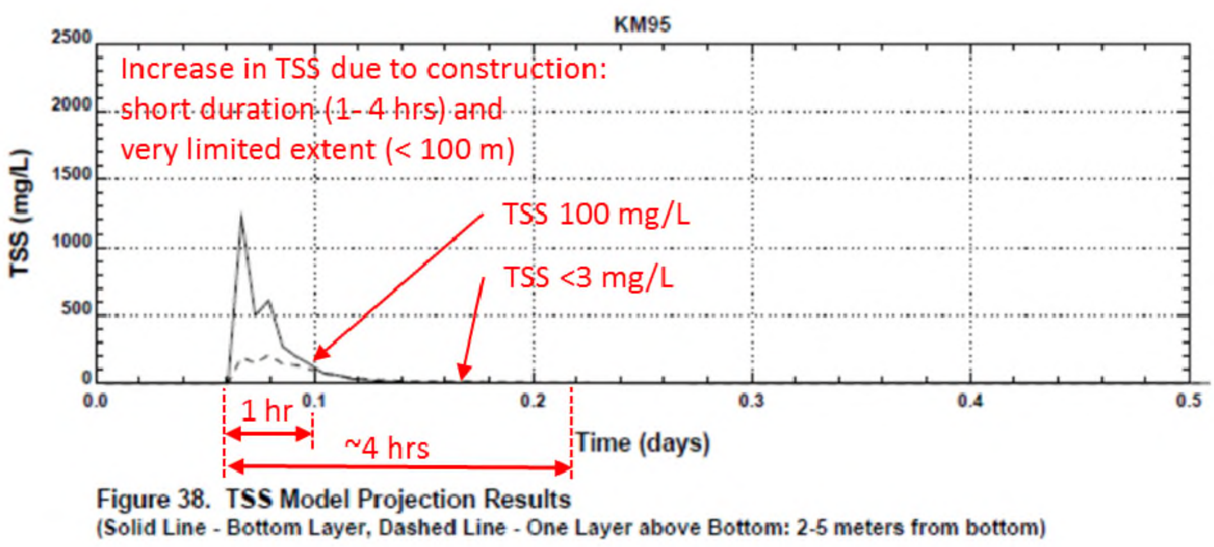


Figure 4.5: Water quality modelling of total suspended solids (TSS) modelling at sample station KM95 (depth = 13.4 m) during construction of ITC Lake Erie Connector (HDR, 2015)

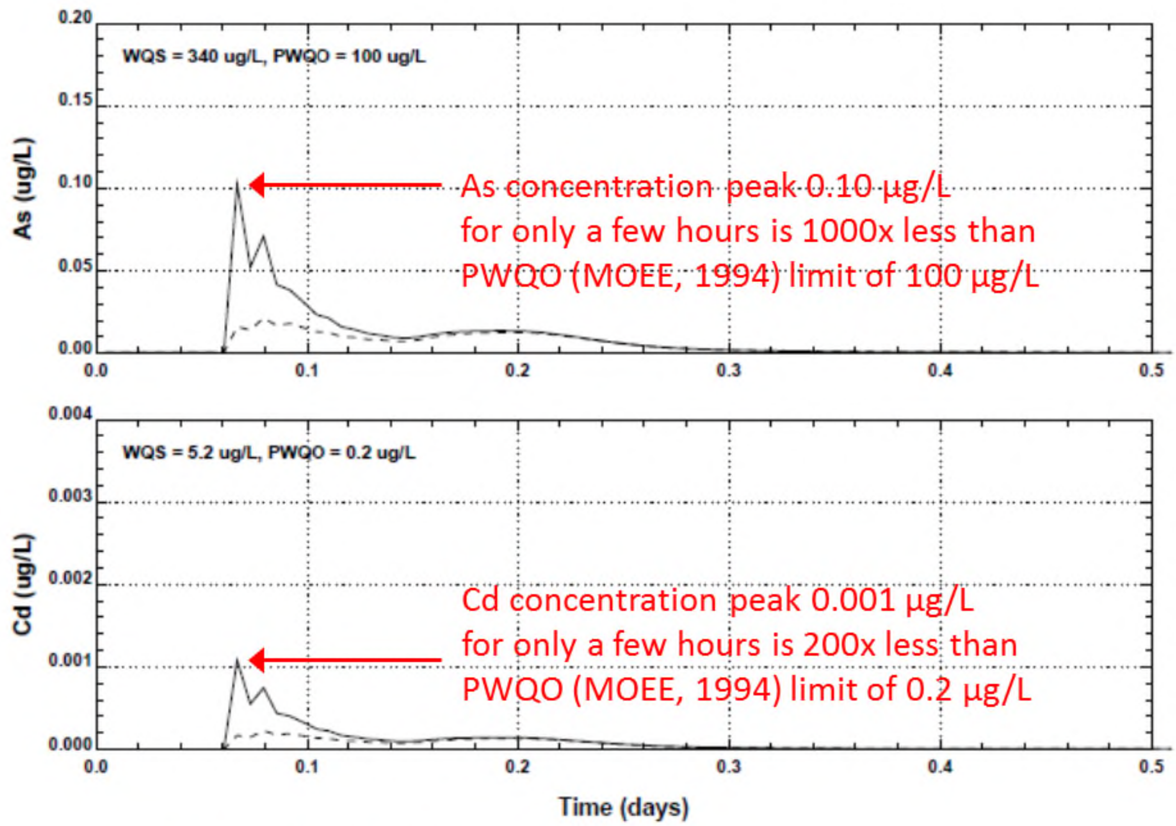


Figure 71. As and Cd Model Projection Results at KM95
(Solid Line - Bottom Layer, Dashed Line - One Layer above Bottom: 2-5 meters from bottom)

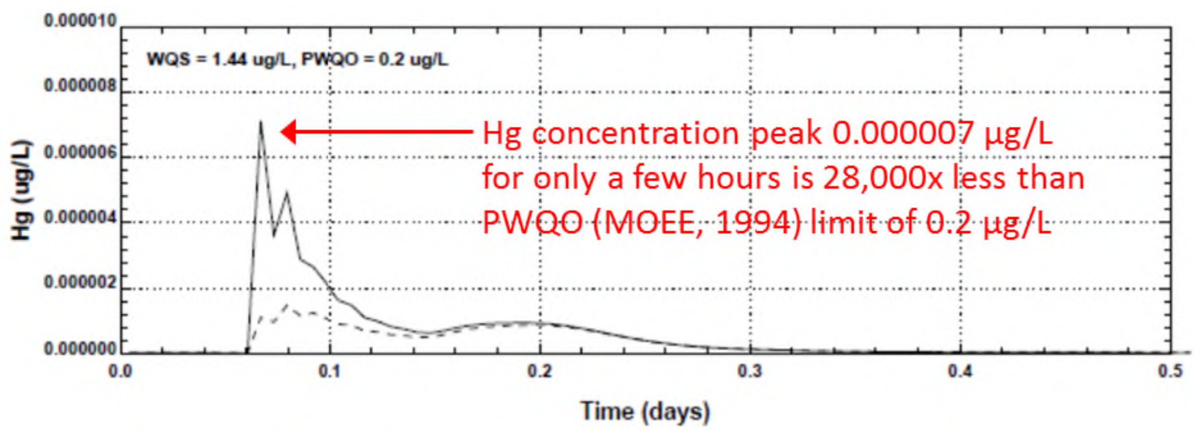


Figure 74. Zn and Hg Model Projection Results at KM95
(Solid Line - Bottom Layer, Dashed Line - One Layer above Bottom: 2-5 meters from bottom)

Figure 4.6: Water quality modelling of dissolved metals (arsenic (As), cadmium (Cd) and mercury (Hg)) at sample location KM95 (depth = 13.4 m) during construction of ITC Lake Erie Connector Project (HDR, 2015)

National Energy Board Review of ITC Connector Project

The National Energy Board determined that the ITC Connector project was subject to an environmental assessment under the NEB Act (2017)[39]. Following a review of the project, the National Energy Board determined that adverse effects of the ITC Lake Erie Connector were not likely to be significant. In the NEB Reasons for Decision, the relevant views of the Board are provided as follows:

- *"Given the mitigation to be implemented, direct mortality, if any, associated with these activities would likely be limited to a few individuals; therefore, the magnitude of residual effects is anticipated to be low and the Project is not expected to result in effects to aquatic Species At Risk. Any aquatic resources impacted by the Project would likely resemble pre-construction conditions in the short to medium term*."
- *"Any fish habitat impacted by the Project is low-quality fish habitat, and the alteration of such habitat would be of low magnitude, temporary (i.e., medium/short-term) in nature, and reversible*."
- *"Decreased water quality is likely to result from increased suspended sediment resulting from construction of the three Project activities outlined above, and that such increased sediment could result in temporary, short-term, reversible impacts to fish and fish habitat. Once construction activities cease, water quality would return to background levels within the short term (i.e., hours). Given the mitigation and the Board's conditions, Project effects on water quality would be low in magnitude*."
- *"The Board is of the view that overall, with the implementation of ITC Lake Erie's environmental protection procedures and mitigation and the Board's conditions, the Project is not likely to cause significant adverse environmental effects*."

4.4 Other Approved Lake Ontario Projects Close to Drinking Water Intakes Now Under Construction

The potential for impacts during construction, operation and decommissioning of the WIS Project are like impacts that might be expected from other in-water construction projects such as pipelines, channel dredging, bridge piers or lakefills. Baird (2014) and Baird (2015) outlined numerous marine projects of the scale of the WIS Project that were approved and constructed in closer proximity to drinking water intakes than the proposed WIS project. In the case of the proposed WIS Project, the potential for impacts to water quality is in many ways more limited than the projects identified in Baird (2014, 2015), as the Project is located 12 km to 24 km from the nearest water intake, in depths of about 10 m to 30 m. In contrast, lakefill projects and other nearshore construction projects are located at the shoreline where wave-induced currents are much higher and can result greater movement of turbidity plumes and contaminants.

This report presents several marine projects that are now under construction in Lake Ontario near drinking water intakes; these projects involve dumping hundreds of thousands of cubic metres of fill directly into the lake. The projects include the temporary causeway for the Third Crossing, Kingston, the Ashbridge's Bay Erosion and Sediment Control Project, Toronto, the Jim Tovey Conservation Area, Mississauga, and the Gibraltar Point Erosion Control Project, Toronto Islands. These projects were not blocked by a moratorium, even though they also involved work in the water environment and had the potential to disturb lakebed sediments in very close proximity to drinking water intakes. The projects were allowed to advance through established environmental assessment processes and in accordance with existing procedures, practices, and

[39] **C-2066**. National Energy Board, 2017. Reasons for Decision ITC Lake Erie Connector LLC, Lake Erie Connector International Power Line Project, EH-001-2015, January.

guidelines. The necessary field work, studies and evaluation were undertaken, and the projects were assessed based on the facts and their merits. The projects were all approved and permitted. The four projects, along with the WIS Project are summarized in Table 4.3 and include:

- Third Crossing, Kingston
- Ashbridge's Bay Erosion and Sediment Control Project, Toronto
- Jim Tovey Conservation Area, Mississauga
- Gibraltar Point Erosion Control Project, Toronto Islands.

The locations of these projects and the WIS Project relative to the nearest drinking water intakes are shown in Figure 4.3.

Table 4.3: Lakefill Projects Approved for Construction Near Water Intakes

Project	Status	Fill Placement in Water	Proximity to Drinking Water Intake
Third Crossing, Kingston	Under construction	Temporary causeway across river with wetted area loss of 32,475 m^2	Located within a provincially significant wetland (PSW) about 5 km immediately upriver of water intakes.
Ashbridge's Bay Erosion and Sediment Control Project, Toronto	Under construction	270,000 m^2 of lakefill (1.11 million m^3 of material)	4 km from RC Harris Water Treatment Plant.
Jim Tovey Lakeview Conservation Area, Mississauga	Under construction	About 1.5 million m^3 of soil and concrete rubble dumped (as of April 2020)	1 km from Arthur P. Kennedy Water Treatment Plant.
Gibraltar Point Erosion Control, Toronto	Constructed 2019-2020	37,000 m^3 of stones placed in lake to create 7,000 m^2 submerged reef	1 km of from City of Toronto Island water intake.
WIS Project	Proposed	66 GBFs; 110,000 m^3 existing lakebed material shifted and replaced with clean granular bedding stone[40]	Nearest drinking water intake is 12 km away.

These projects were not blocked by a moratorium, even though they also involved work in the water environment and had the potential to disturb lakebed sediments in closer proximity to drinking water intakes than the WIS Project. The projects were permitted to advance through the established environmental assessment processes and in accordance with existing procedures, practices, and guidelines. The necessary field work, studies and evaluation were undertaken, and the projects were assessed based on the facts and their merits. The projects were all approved and permitted and are presently under construction or completed.

[40] **CER-COWI (Wind Turbine Gravity Base Foundation Design)**. COWI North America, Inc., 2022. Windstream Energy, Inc., Wolfe Island Shoals, NAFTA 2 Wind Turbine Gravity Base Foundation Design Expert Witness Report, February 18.

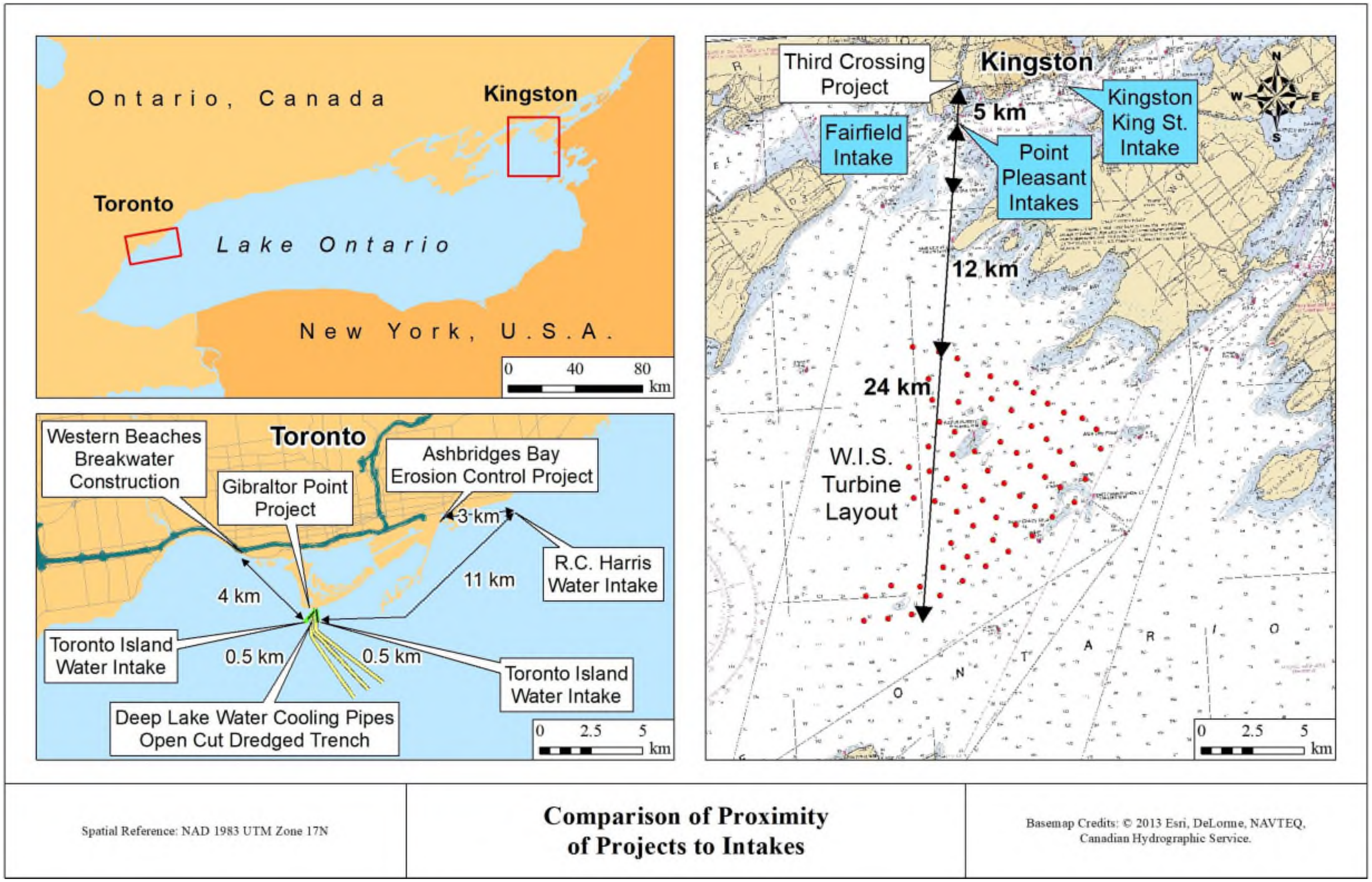


Figure 4.7: Comparison of proximity of the WIS Project and various other in-water Lake Ontario projects to drinking water intakes

4.4.1 Third Crossing, Kingston

The Third Crossing in Kingston, Ontario is a new 1.2 km long bridge with 21 piers spanning the Cataraqui River. The bridge is being constructed using a temporary causeway that extends across the river (Figure 4.8). The causeway was created by dumping fill material directly into the water and disturbs 32,475 m² of wetted area within the Greater Cataraqui Marsh Provincially Significant Wetland (Hatch, 2019). A second disturbance will be created when the temporary causeway is excavated from the river. The Greater Cataraqui Marsh PSW provides habitat for a wide range of terrestrial and aquatic wildlife species.

https://thirdcrossing.cityofkingston.ca/photos-videos/photo-gallery

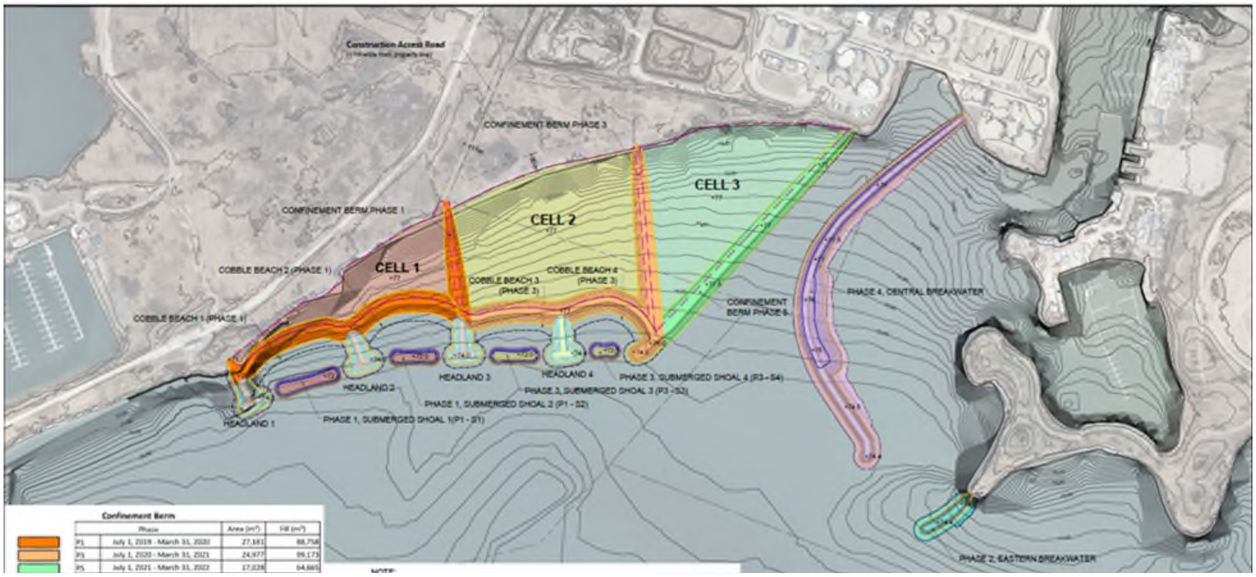
Figure 4.8: Third Crossing construction using a temporary causeway across the Cataraqui River, involves dumping fill material in Provincially Significant Wetland, 5 km directly upstream of water intake

Within the riverbed sediment, most parameters in exceedance of the sediment quality guidelines were heavy metals such as lead, copper, chromium, and zinc (Hatch, 2019)[41]. Elevated levels of PAHs are also found within the sediment. Construction activities will disturb the sediment resulting in sediment resuspension within the water column. In addition, increased levels of total suspended sediments can have detrimental effects on vegetation, fish, aquatic wildlife, and users. The project was approved to proceed even though it is within the Cataraqui Source Protection Area, and only about 5 km directly upstream of Point Pleasant and Kingston Central Intake Protection Zones.

[41] **C-2252**. Hatch, 2019. City of Kingston - Third Crossing of the Cataraqui River - Parks Canada Environmental Impact Analysis Detailed Impact Analysis Report, December 2.

4.4.2 Ashbridge’s Bay Erosion and Sediment Control Project, Toronto

The Ashbridge’s Bay Erosion and Sediment Control project (TRCA, 2014) was described in Baird (2014). The final design consists of approximately 27 ha of new land created by dumping 1.1 million m^3 of lakefill material into the water (Figure 4.9). Figure 4.10 shows progress of the lakefilling. The project is located about 4 km from the R.C. Harris water treatment plant (Figure 4.7). The exterior berms for Cell 1 (the southernmost cell) and Cell 2 were closed in June and October 2020, respectively, and Cell 1 filling activities are currently underway. The project was subject to an environmental assessment and was approved by the regulatory agencies.



Ashbridges Bay Landform Project Construction Phase Plan C01, 2019-04-12 (TRCA, 2019)

Figure 4.9: Ashbridge’s Bay Erosion and Sediment Control project lakefilling plan

https://trca.ca/conservation/green-infrastructure/ashbridges-bay-erosion-sediment-control-project/#status

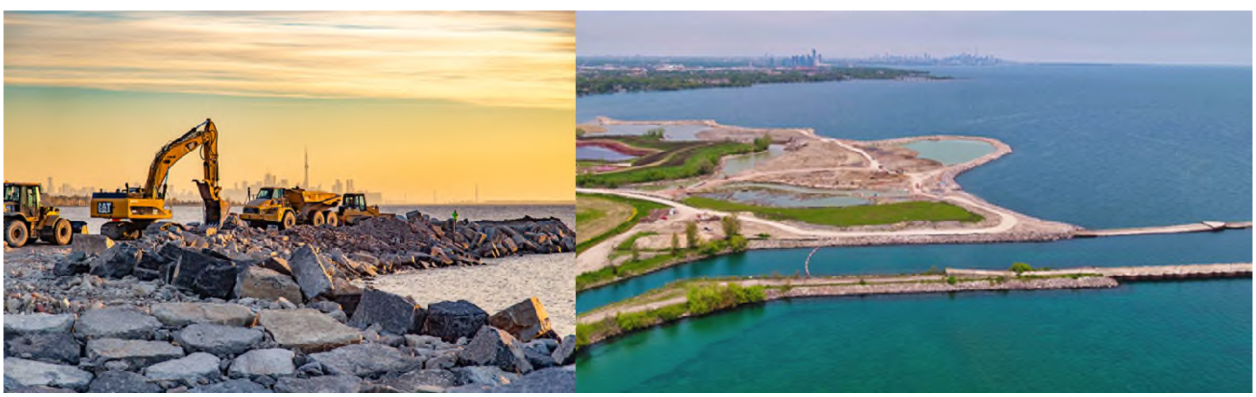
Figure 4.10: Ashbridge’s Bay Erosion and Sediment Control project progress of lakefilling

4.4.3 Jim Tovey Lakeview Conservation Area, Mississauga

The Jim Tovey Lakeview Conservation Area lakefill project (formerly named Lakeview Waterfront Connection Project) was described in Baird (2014) (Figure 4.11). As of April 2020, approximately 1.5 million m^3 of excess soil and concrete rubble have been diverted from landfill for sustainable reuse as lakefill at the project[42], including 200,000 m^3 of concrete from demolition of former Ontario Power Generation coal fired plant located on the adjacent west property. Figure 4.12 shows progress of the lakefilling. The project is located approximately 1 km from the Arthur P. Kennedy Water Treatment Plant which is one of the world's largest water treatment facilities with a capacity to produce 1200 million litres of clean water every day. The project was subject to an environmental assessment and was approved by the regulatory agencies.

https://cvc.ca/jimtoveylakeviewca/about/ accessed March 22, 2021

Figure 4.11: Plan of Jim Tovey Lakeview Conservation Area lakefill project, Mississauga



https://mylakeviewvillage.com/conservation/

Figure 4.12: Placement of fill material into Lake Ontario at Jim Tovey Lakeview Conservation Area lakefill project

[42] **C-2331**. Region of Peel Meeting Date: 2020-09-10 https://pub-peelregion.escribemeetings.com/filestream.ashx?DocumentId=4309.

4.4.4 Gibraltar Point Erosion Control

The Gibraltar Point Erosion Control Project included the placement of 35,000 m^3 of stone to create a submerged reef (Figure 4.13). Construction of the reef was completed in 2019-2020 (Figure 4.14). The reef construction is located about 1 km from the Toronto Island water treatment plant (Figure 4.7).

Figure 4.13: Gibraltar Point submerged reef at Toronto Islands created by dumping stone material into Lake Ontario

Figure 4.14: Placing stone into Lake Ontario at Gibraltar Point, Toronto Islands

5. Shipping and Navigation Risk

This section addresses an updated analysis of the shipping and navigation risks of the WIS Project.

The evidence presented in Baird (2015) demonstrated that the WIS Project could safely be located adjacent to the existing upbound Great Lakes – St. Lawrence Seaway navigation route. The upbound route is limited to one-way vessel traffic. To our knowledge no regulatory changes related to navigation or shipping have been made which would preclude the Project. As a result of the revised turbine layout and the updated shipping and navigation risk analysis, the Project has increased the navigation allowance and now proposes a 2450 m wide navigation allowance adjacent to the wind turbine generator (WTG) field for a length of approximately 10 km (Figure 5.1). The navigation allowance includes a defined 600 m wide upbound channel for one-way vessel traffic plus a further 1850 m (1 nautical mile) wide separation between the northern edge of a defined upbound channel and the WTG field.

The 600 m wide upbound channel follows the existing, established navigation route and will be defined by the placement of new navigational buoys (red starboard marks). The 600 m width is more than sufficient for one-way traffic based on both Canadian and International navigational guidance. The proposed 600 m wide upbound navigation channel for one-way traffic is more than two times wider than existing two-way vessel traffic channel segments at many other locations along the Great Lakes - St. Lawrence Seaway system; the channel width for two-way traffic at these other segments is often less than 250 m and the Seaway has been safely operating in this manner for over 50 years, with mandatory pilotage[43] minimizing risk of collisions. Considering the much wider channel proposed for one-way traffic only, the limited volume of traffic on the Seaway in this area (only about 6 vessels per day in the peak months), and with mandatory pilotage on the Seaway, the risk of vessel collisions is minimized.

The proposed 1850 m (1 nm) separation beyond the 600 m upbound channel is compatible with the Seawaymax vessels which are the largest vessels that can access the channel adjacent to the Project. Vessels entering the Seaway are constrained in size due to the dimensions of the locks at Montreal and the Welland Canal. So-called Seawaymax vessels have a maximum length overall of 225.5 m, a beam of 23.8 m, and a draft of 8.1 m. The 1 nm (1.85 km) separation allows for a course deviation width of 0.3 nm (0.556 km) and an emergency turn diameter of 0.73 nm (1.35 km), which is 6 times the maximum length overall of a Seawaymax vessel. It is important to recognize that the potential for collision with another large commercial vessel is extremely low due to the Seaway traffic separation in this area as a downbound vessel should not be expected in the upbound channel. This collision potential could, however, arise with a disabled or inattentive small craft vessel. The 1 nm (1.85 km) separation distance also allows for sufficient distance for a vessel emerging from the wind farm area to be readily identified on marine radar systems.

Potential navigational risks will be mitigated by marking and lighting WTGs in accordance with regulations, providing Automatic Identification System (AIS) transponders on selected WTGs, providing aviation obstruction lighting, and implementing WTG rotor braking systems to allow access by marine search and rescue (SAR) helicopters.

The Project Schedule has made appropriate allowances for consultation and approvals with respect to navigation.

[43] **C-1840**. Minister of Justice, 2011. Great Lakes Pilotage Regulations, C.R.C., c. 1266. Last amended on July 1, 2011. pp2-4; http://laws-lois.justice.gc.ca. Accessed May 21, 2015.

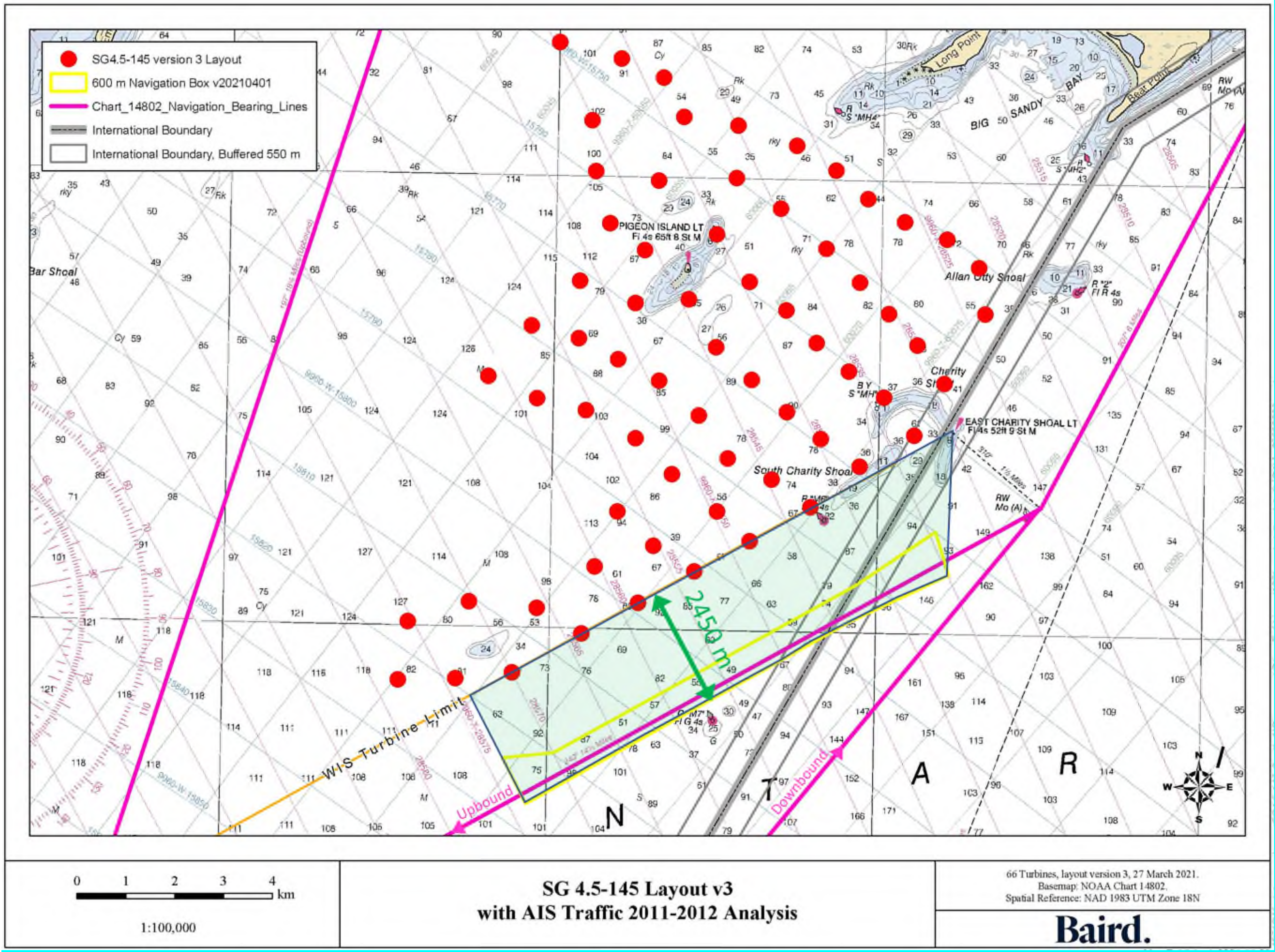


Figure 5.1: 2450 metre wide navigation allowance for one-way vessel traffic adjacent to WIS Project, including 600 m wide upbound channel and additional 1850 m separation allowance

5.1 Background

Baird (2015) previously conducted a shipping and navigation study for Windstream Energy Inc. (Windstream) in support of the NAFTA arbitration proceedings held in 2014-2016 (NAFTA1) related to the Wolfe Island Shoals (WIS) offshore wind power project (the Project). This previous study has been recently reviewed by Baird and, in our opinion, the accuracy and overall conclusions of the shipping and navigation study were valid at the time of preparation.

Since the last report was prepared (Baird, 2015), there has been a large increase in the number of offshore wind farms globally with over 23 Gigawatts of power installed in the last six years. Commensurate with this growth in wind power, there has been an increase in the knowledge and technical guidance on the effects of offshore wind turbine generators (WTGs) on vessel navigation. Much of this guidance arises from the United States and Europe but is generally considered relevant to the construction of a wind farm in Canadian waters. There are presently no offshore wind facilities installed in Canada, and the regulatory and technical guidance for such facilities is very limited.

In this report section, a review of the previous reports and documents has been carried out considering the above changes in technical guidance and the regulatory framework. Sections 5.2 and 5.3 provide a summary of the waterway characteristics and vessel traffic in the Project area, while Section 5.4 gives a summary of the previous reports. Section 5.5 summarizes the various technical guidance associated with the assessment of navigational risk in wind farms. The remainder of the section addresses various items including development impacts on navigation, communications, radar and positioning systems, and search and rescue missions.

5.2 Review of Waterway Characteristics

The proposed 66-turbine WTG layout is in an area of relatively shallow water to the southwest of Wolfe Island with the WTGs placed in water ranging from approximately 10 m to 30 m. As shown in Figure 5.1, the eastern most part of the facility is located to the north of the primary shipping lane in Lake Ontario and is setback 550 m from the international boundary. At East Charity Shoal, the shipping lane splits into separate one-way upbound and one-way downbound lanes, or routes. In one-way lanes, the ship traffic proceeds in one direction only. The upbound lane extends westward from East Charity shoal to Pysche Shoal along a 240° true north (TN) alignment before swinging to 249° TN headed towards Point Petre Light. The southern end of the Windstream wind farm is located approximately 2.3 km north of the upbound shipping lane alignment.

The shipping lanes, or channels are unbounded (i.e., no defined limits) except for various aids to navigation (AtoNs) marking shoals in the region. These AtoNs include a light marking East Charity Shoal that has a least depth in the order of 2.4 m, and the following lateral marks (red-green light buoy pairs):

- The red (starboard) light buoy “2” marking Allan Otty Shoal.
- The red (starboard) light buoy “M6” marking the western edge of South Charity Shoal.
- The green (port) light buoy “M7” that marks shoal with a least depth in the order of 7.6 m.

About 2.4 km southeast of the East Charity Shoal light is the East Charity Shoal Traffic Lighted Buoy that defines the split between the upbound and downbound lanes.

The next set of red and green buoys in the upbound direction are located just to the west of Main Duck Island (buoy “M9”) and adjacent to Psyche Shoal (buoy “M10”). Main Duck Island is also marked by a light.

There is a buoy marking the eastern portion of Wolfe Island, called Long Point, and a light located at the western end of Simcoe Island to the north of the Project area.

There is also a vessel bearing route from the Kingston area that joins up to the upbound Seaway vessel lane, as may be noted on Figure 5.1. This route is located to the west of the proposed Project and would not be affected by the presence of the WTGs.

Vessel pilotage is compulsory everywhere on the Great Lakes – St. Lawrence Seaway system for most vessels, including all foreign flagged vessels. Large commercial vessels are subject to Vessel Traffic Control to provide safe and efficient scheduling of vessel traffic, efficient search and rescue coverage, pilotage requirements, marine weather broadcasts and information on vessel location to all interested parties. The WIS Project is in Lake Ontario Vessel Traffic Control Sector 4, which extends from Crossover Island in the St. Lawrence River to the middle of Lake Ontario as per the Seaway Handbook (St. Lawrence Seaway Management Corporation and St. Lawrence Seaway Development Corporation, 2021).

Vessels entering the Seaway are constrained in size due to the dimensions of the locks at Montreal and the Welland Canal. Seawaymax vessels, as they are referred to, have a maximum length overall of 225.5 m, a beam of 23.8 m, a draft of 8.1 m and a height (i.e., air draft) of 35.5 m.

Large commercial vessels of this type are required to carry Automatic Identification System (AIS) transponders that broadcast vessel details (position, speed, heading, dimensions, etc.) every few seconds and receive similar information from nearby vessels that is displayed on an electronic chart. AIS is intended, primarily, as a safety precaution to allow ships to view marine traffic in their area and to be seen by that traffic. It has also become increasingly common for small craft to also utilize AIS.

5.3 Vessel Traffic

5.3.1 Large Commercial Shipping Traffic

Annual vessel traffic reports for large commercial vessels utilizing the St. Lawrence Seaway system are produced by the St. Lawrence Seaway Management Corporation (2020).

Table 5.1 provides a summary of the upbound transits by year in the Montreal to Lake Ontario section of the Seaway. Most, if not all, of these vessels would pass through the upbound traffic lane adjacent to the Project area, primarily bound for the ports of Toronto, Hamilton, or the Welland Canal for transit into the other lakes. Vessel traffic has remained relatively consistent over the past 10 years with an average of 1,402 upbound transits per year. Approximately two-thirds of these vessels are laden, with the dominant cargos transported being grain, corn and soyabeans.

Figure 5.2 shows a summary of average daily upbound vessel transits. There are on average five to six vessel transits per day during much of the navigational season. This Montreal to Lake Ontario portion of the Seaway typically has a navigational season from late March until end of December and occasionally into early January of the following year.

Table 5.1: Upbound Transits by Year in the Montreal to Lake Ontario Section of the Seaway

Year	Upbound Transits
2010	1,353
2011	1,499
2012	1,484
2013	1,376
2014	1,334
2015	1,272
2016	1,271
2017	1,412
2018	1,561
2019	1,459
Average	1,402
Maximum	1,561

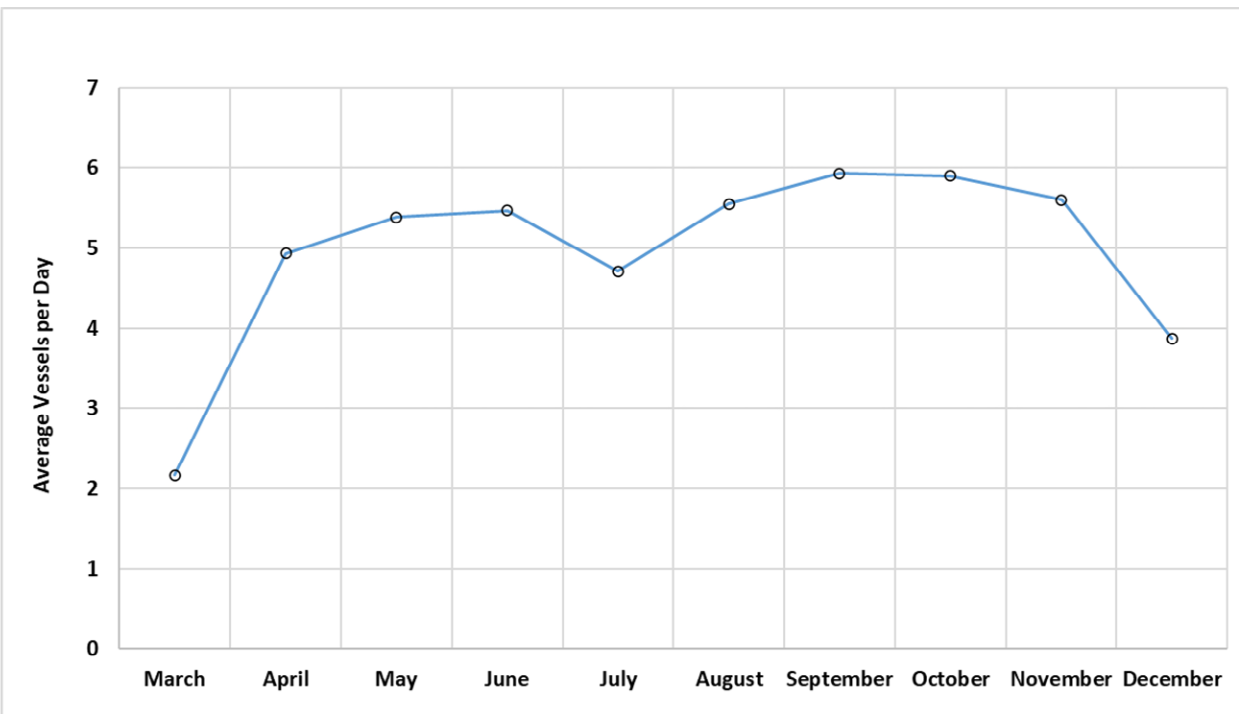


Figure 5.2: Average upbound vessel transits per day in Lake Ontario section of the Seaway

AIS transmission data is archived by shore-based and satellite stations and historical data for Lake Ontario were obtained for the years 2011 and 2012. Figure 5.3 shows a plot of AIS transmission (“pings”), represented by grey dots, for the Project area. The concentration of the vessel traffic within the upbound and downbound vessel lanes may be readily identified. In Figure 5.4, the percentage of traffic by distance from the bearing line across the upbound lane is shown for a transect located near WTG No. 16 (see Figure 5.3). In the portion of the upbound lane immediately adjacent to the proposed WTG locations, 90% of the vessel traffic transits in a channel width of approximately 925 m. As part of this project, it is proposed that the traffic be confined to a 600 m wide channel to achieve adequate separation from the WTGs; approximately 74% of all upbound traffic in this area currently passes through a channel width of 600 m. Given the limited volume of traffic on the Seaway in the Project area (only about 6 vessels per day in the peak months), there would be no significant impact on traffic congestion by limiting the channel width to 600 m and as will be shown in Section 5.4, there are many areas on the Seaway system where channel widths are much narrower.

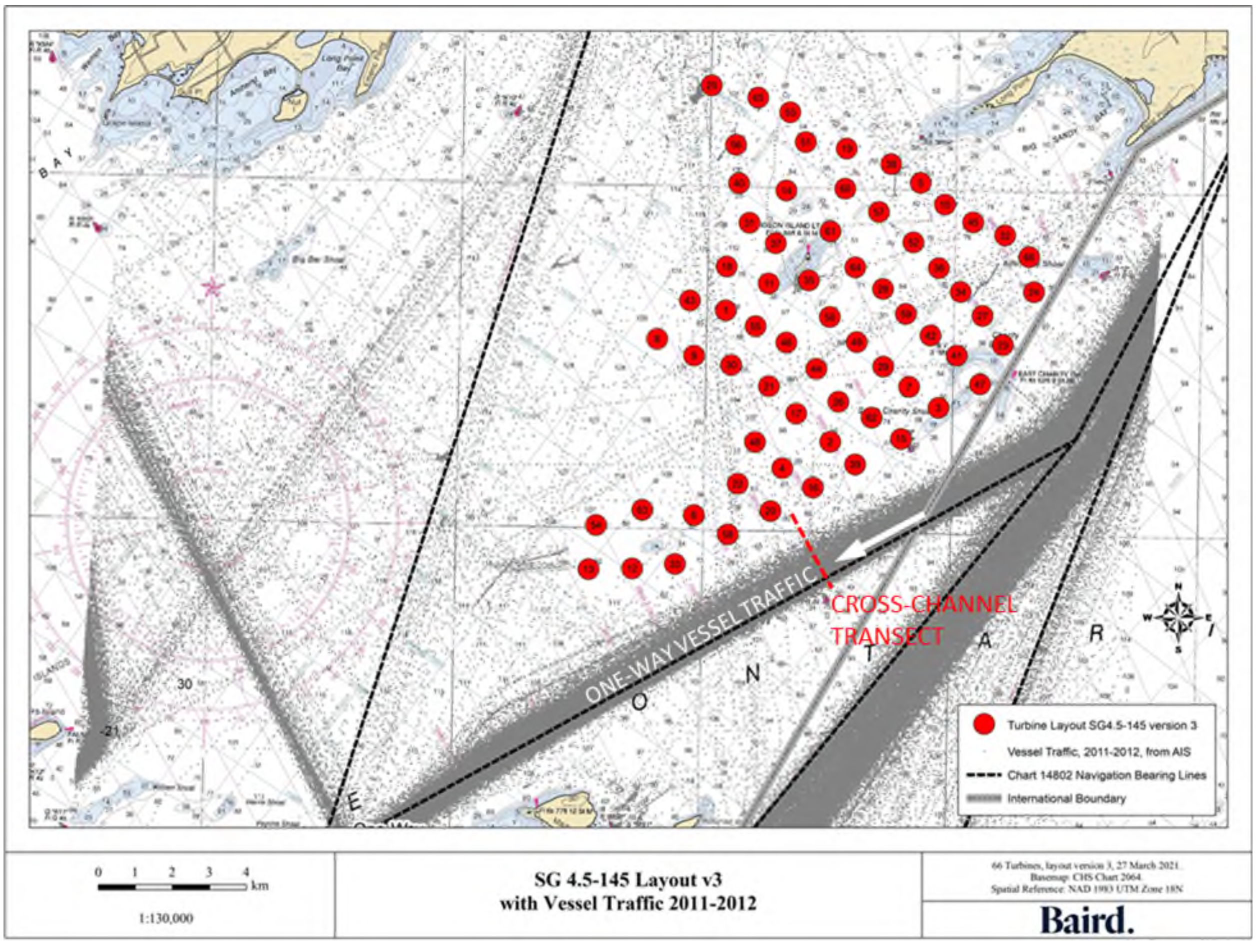


Figure 5.3: AIS vessel traffic tracking (2011-12) at WIS Project area

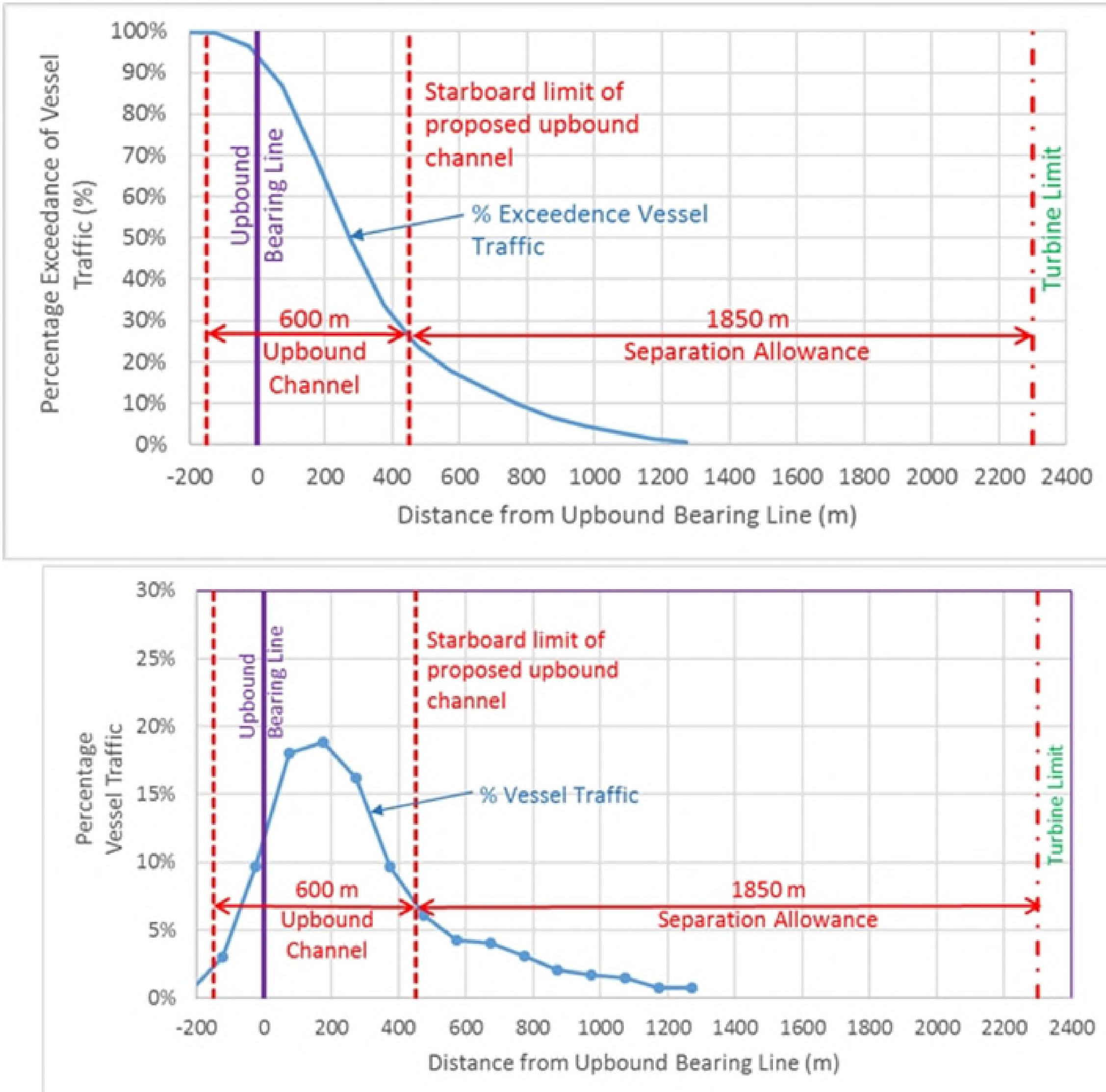


Figure 5.4: Percentage exceedance (top) and percentage (bottom) of vessel traffic by distance across proposed upbound channel and separation allowance (transect shown in Figure 5.3)

5.3.2 Small Craft Traffic

Small craft are not required to carry AIS, so it is difficult to assess the volume and patterns of vessel traffic. On the Canadian side of the border, there are several marinas within approximately 35 km from the Project, including:

- Portsmouth Olympic Harbour Marina, Kingston with 250 slips for vessels up to 30 m in length
- Kingston Yacht Club with approximately 70 slips for sailing vessels
- Confederation Basin, Kingston with 350 slips for vessels up to 30 m in length
- Collins Bay Marina with 350 slips for vessels up to 15 m in length

- Loyalist Cove Marina, Bath with 85 slips for vessels up to 15 m in length
- Waupoos Marina in Prince Edward County with 186 slips.

There are also several small marinas in US waters.

The small craft traffic would be highly seasonal with peak traffic occurring on weekends during the summer months from May to September.

A Recreational Boating Feasibility and Capacity Study conducted by the Town of Oakville in 2014 (Touristics, 2014) examined the sizes of recreational vessels registered in the Province of Ontario. In 2012, there were 1.1 million recreational vessels, with 90% of these smaller than 6 m in length. Vessels over 14 m in length represented only 0.5% of all vessels and only 5.5% of all vessels greater than 6 m in length.

5.4 Summary of Previous Reports

Baird has previously prepared reports on the WIS Project in 2014 and 2015, both of which have addressed navigational issues. The 2015 report provided a detailed review of shipping and navigation in the Project area in comparison to other locations along the Great Lakes – St. Lawrence Seaway system. It was identified that the historical traffic patterns for the upbound route adjacent to the proposed WTG array was in the order of 1200 to 1500 m wide although, as shown in Section 5.3.1, most of the traffic transits within a relatively narrow corridor. The minimum acceptable channel width for Seawaymax vessels was estimated to be in the order of 225 m to 240 m (approximately 10 times the vessel beam) for two-way traffic based on Canadian and international technical guidance for the safe design of channels and harbour approaches. Channel width for one-way traffic can be considerably smaller.

In the Baird (2015), numerous locations on the Seaway system were identified where channel widths are relatively narrow, as summarized in Table 5.2. The channel width for two-way traffic is often less than 250 m and the Livingstone channel on the Detroit River has a width of 115 m to 130 m for one-way traffic.

Also identified in Baird (2015) were two narrow channel sections leading up to the Project area through which two-way traffic must navigate: (1) the Brockville Narrows that has a 4 km length of channel with a width of about 140 m; and (2) the American Narrows that has a length of 9 km with a width of about approximately 150 m; portions of the hydrographic charts showing these locations are given in Figure 5.5 and Figure 5.6 respectively. Figure 5.7 shows a vessel transiting upbound in the existing 150 m wide, two-way channel at the American Narrows. Figure 5.8 shows a vessel upbound through the 150 m wide, two-way channel in the American Narrows. Figure 5.9, reproduced from Baird (2015), shows an oblique view of two vessels passing in the St. Clair River where the channel width is approximately 300 m. The Seaway has been safely operating in this manner for over 50 years.

The Project layout proposes a defined upbound channel width of 600 m for one-way vessel traffic, considerably larger than the various two-way vessel traffic channel segments identified above and in Baird (2015) (see Figure 5.1). In addition to the 600 m wide defined upbound channel, a further 1850 m (1 nautical mile) wide separation allowance has been provided between the northern edge of the 600 m wide upbound channel and the WTG field. With the much wider channel and the separation allowance, only one-way traffic adjacent to the Project, and with mandatory pilotage on the Seaway, the risk of vessel collisions is minimized.

Table 5.2: Examples of Channel Dimensions on the Great Lakes – St. Lawrence Seaway*

Channel Location	Vessel Traffic	Channel Width and Length	Reference/Comment
St. Lawrence River American Narrows	Two-way	~150 m wide for ~9 km	NOAA Chart 14772 &14773
St. Lawrence River Brockville Narrows	Two-way	~140 m wide for ~4 km	NOAA Chart 14770
St. Lawrence River Below Iroquois Lock to Ogdensburg-Prescott Bridge	Two-way	Less than 200 m wide for approximately 13 km	CHS Chart 1416 (April 27,1990)
St. Lawrence River Lac Saint-Pierre	Two-way	~250 m wide for ~ 45 km	CHS Chart 1312 (June 6, 2007)
St. Lawrence River Sorel-Tracy to Varennes	Two-way	~250 m wide for ~35 km	CHS Chart 1311 (March 21, 2008)
Detroit River (Amherstburg, Ballards Reef and Fighting Island)	Two-way	150 – 180 m (500 – 600 ft) wide for 22 km	NOAA Chart 14853 (10th Ed.)
Detroit River (Livingstone)	One-way	115 – 130 m (375 – 425 ft) wide for 10 km	NOAA Chart 14853 (10th Ed.)
Detroit River (at Windsor/Detroit)	Two-way	500 – 1000 m wide	NOAA Chart 14853 (10th Ed.) See Figures 5.2 and 5.3
Lake St. Clair	Two-way	213 – 243 m wide (700 – 800 ft) for approximately 23 km	NOAA Chart 14853 (10th Ed.) See Figure 5.4
St. Clair River and approaches	Two-way	200-300 m wide for approximately 70 km	NOAA Chart 14853 (10th Ed.) See Figure 5.5

** Reproduced from Baird (2015)*

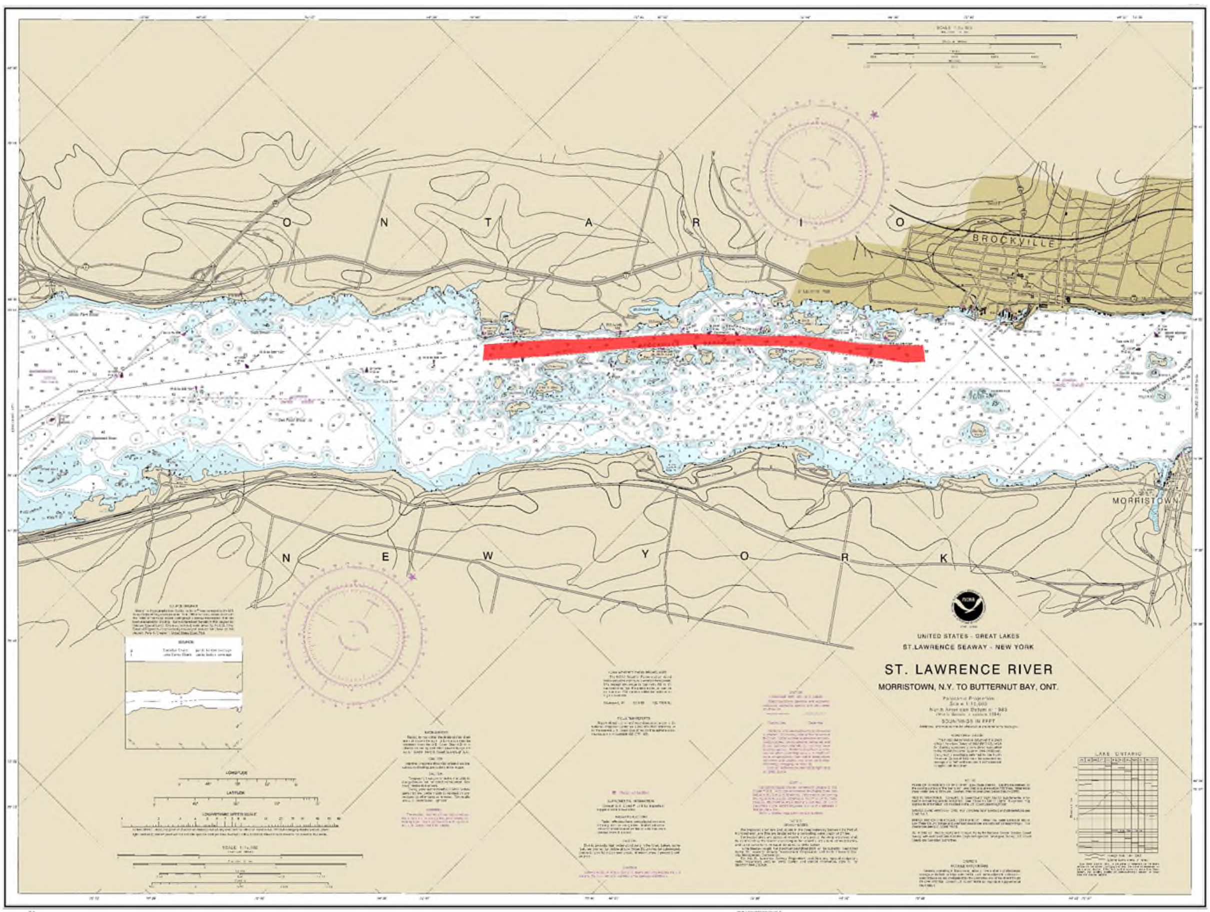


Figure 5.5: Brockville Narrows (from NOAA Chart 14770) consists of 140 m wide channel (red shading) for two-way vessel traffic

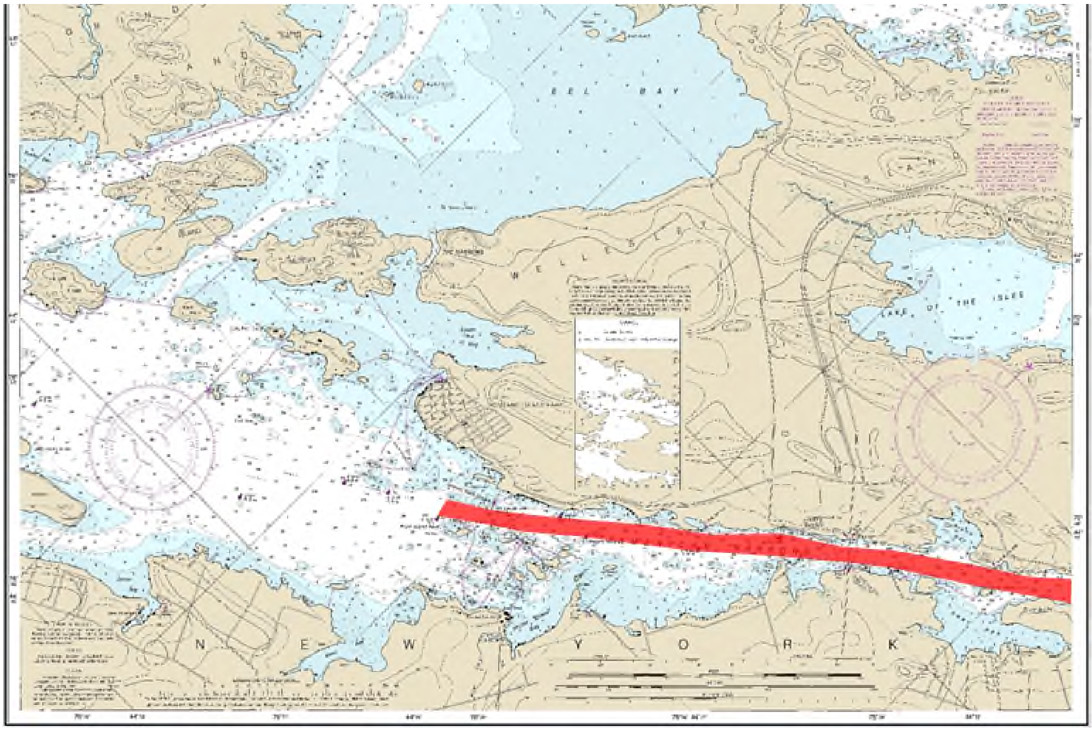


Figure 5.6: Portion of American Narrows (from NOAA Chart 14773) consists of 150 m wide channel (red shading) for two-way vessel traffic

Figure 5.7: Vessel transiting the American Narrows, St. Lawrence Seaway (image Google Earth)

https://www.facebook.com/spliethoffofficial/photos/a.991047904242200/3928251723855122/?type=3

Figure 5.8: Vessel carrying wind turbine blades passing through existing American Narrows Channel for two-way traffic

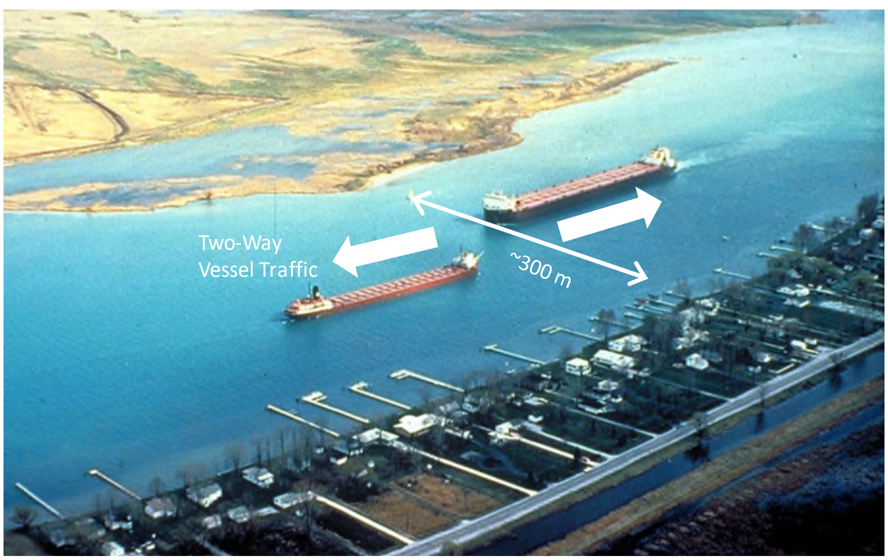


Figure 5.9: St. Clair River Channel, showing two-way vessel traffic in 300 m wide channel

5.5 Relevant Technical Guidance and Regulations

As noted previously, since the preparation of Baird's last report in 2015, the numbers of installed offshore wind farms has expanded significantly globally and there has been an increase in international technical guidance on the effects of offshore wind turbines on vessel navigation. Much of this guidance arises from Europe and the US but is generally considered relevant to the construction of a wind farm in Canadian waters. This guidance addresses such issues as separations from shipping traffic, corridor widths for small craft passage, effects on marine radar and communication systems, lighting and marking, and use of AIS.

5.5.1 Canada

Presently there are no offshore wind installations in Canada, and regulations and guidance have lagged other jurisdictions, particularly Europe and the U.S. The Government has established a legislative framework for offshore renewable energy projects under Part 5 of the Canadian Energy Regulator Act (CER Act). The CER Act came into force in August 2019 and provides the CER with legislative authority to review applications for proposed Offshore Renewable Energy (ORE) projects and their associated offshore power lines in Canada's offshore areas, as well as oversee these facilities throughout their lifecycle. The CER Act also provides the authority to make regulations respecting safety and environmental protection, as it pertains to these projects.

An Offshore Renewable Energy Regulations (ORER) initiative is presently being led by Natural Resources Canada (NRCan) to develop modern safety and environmental protection regulations that will ultimately apply to exploration, construction, operation, and decommissioning activities related to renewable energy projects and power lines in Canada's offshore areas. These regulations will support CER. The ORER initiative is still in the pre-engagement phase and a final publication of regulations is not expected until late 2023. It is expected that the WIS Project would be able to satisfy these regulations as the project development has been in accordance with generally accepted international practices and guidelines. To our knowledge no regulatory changes related to navigation or shipping have been made which would preclude the Project.

5.5.1.1 Navigation Protection Program

The Navigation Protection Program (NPP) of Transport Canada administers the *Canadian Navigable Waters Act (CNWA)*, the *Canada Shipping Act, 2001* and the *Wrecked, Abandoned or Hazardous Vessels Act* to keep Canadian waters open for safe navigation and recreational use. The NPP's main responsibilities are to:

- approve and set terms and conditions for works in navigable waters
- assess navigable waters for additions to the schedule of the CNWA
- manage obstructions in all navigable waters
- enforce the regulations for private buoys
- address irresponsible vessel management
- provide authorization to people to salvage, remove or dispose of abandoned boats
- enforce rules against dewatering (removing water from) or depositing materials into navigable waters.

The Canadian Navigable Waters Act (R.S.C., 1985, c. N-22) was last amended in October 2019.

The WIS Project will need to comply with the requirements of the NPP.

5.5.1.2 Safe Waterway Guidelines

The Canadian Coast Guard is a special operating agency within Fisheries and Oceans Canada that works to ensure the safety of mariners in Canadian waters and protect Canada's marine environment. Key areas of responsibility include:

- aids to navigation
- channel maintenance
- marine search and rescue
- marine pollution response
- icebreaking and ice-management services
- marine communications and traffic management services
- support of other government departments and agencies by providing ships, aircraft, and other services.

The Coast Guard do not have any specific guidance or regulations related to offshore wind facilities but does publish the Safe Waterway Guidelines (Canadian Coast Guard, 2001) that provide guidance on navigable waterway dimensions; these guidelines have relevance to the proposed width of the upbound lane of the Seaway adjacent to the Project.

5.5.2 United States

5.5.2.1 U.S. Coast Guard NVIC 01-19

The United States has many wind farms in the planning and development stage along its coastlines. Navigational impacts and risk fall under the auspices of the US Coast Guard (USCG), who have published *Guidance on the Coast Guard's Roles and Responsibilities for Offshore Renewable Energy Installations (OREI)* in Navigation and Vessel Inspection Circular (NVIC) 01-19 (US Coast Guard. This circular provides technical guidance on the information and factors that the USCG will consider when reviewing an application for a permit to build and operate an OREI, such as a wind farm.

Enclosure (2) of NVIC 01-19 identifies the type of information that should be included in a navigation risk assessment, including:

- Site and installation coordinates
- Details of the installation characteristics, such as marking and lighting
- Completion of a recent marine vessel traffic survey
- Details of the offshore above and under water structures, and whether these structures can impinge on vessel movements and emergency response
- Assessment of navigation within and nearby the structures
- Effects of meteorological and oceanographic conditions (tides, currents, winds, etc.)
- Potential hinderance to visual navigation, such as structural blockage of the view of other vessels or navigational aids
- Impacts on communications, radar, and positioning systems
- Evaluation of the risk of collision, allision, or grounding
- Assessment of the potential impact on emergency response such as Search and Rescue (SAR), and marine environmental protection
- Description of facility characteristics and design requirements

- Operational requirements and procedures.

5.5.2.2 Offshore Wind Lighting and Marking

Various regional districts of the USCG have issued guidance on the marking and lighting of offshore wind facilities in the US (e.g., USCG District 5 Local Notice to Mariners (LNM) 45/20, USCG, 2020a). Key aspects of this guidance included:

- Tower Identification: Unique lettering and numbering in an organized pattern as near to rows and columns as possible that are visible above any servicing platform and, if feasible, below. The letters/numbers are to be as near to three meters high as possible, visible throughout a 360-degree arc at the water's surface, and visible at night through use of retro-reflective paint/materials.
- Lighting: Lighting is to be located on all structures, preferably on the servicing platform, and visible throughout a 360-degree arc at the water's surface. The lighting is differentiated between significant peripheral structures (SPSs), other outer boundary towers, and interior towers in terms of range and flash sequence. Corner towers/SPS must contain quick flashing yellow (QY) lights energized at a 5 nm range, other outer boundary towers must contain yellow 2.5 seconds (FL Y 2.5s) lights energized at a 3 nm range, and interior towers must contain yellow 6 seconds or yellow 10 seconds (FL Y 6/FL Y 10) lights energized at a 2 nm range. Temporary lights (during construction) must be QY obstruction lights visible at 5 nm.
- Sound Signals: Mariner Radio Activated Sound Signal (MRASS) are required on corner structures/SPSs that sound every 30 seconds (4s Blast, 26s off) to a range of 2 nm. Spacing between MRASS should not exceed 3 nm. MRASS must be activated by keying VHF Radio frequency 83A five times within 10 seconds and be energized for 45 minutes from the last VHF activation.
- AIS Transponder Signals: AIS transponder signals must be transmitted at all corner structures/SPSs and capable of transmitting signals to mark all locations of all structures throughout the turbine field.

5.5.3 International Guidelines

The following sub-sections summarize a few of the key international guidance documents.

5.5.3.1 PIANC (2018) – Interaction Between Offshore Wind Farms and Maritime Navigation

The World Association for Waterborne Transport Infrastructure (PIANC) issued a report in 2018 giving an approach, guidelines, and recommendations to assess the required manoeuvering space for ships in the vicinity of offshore wind farms. This report recommended minimum distances between shipping lanes and sea areas for offshore wind farms to ensure minimal risk to navigation. The report touches on international regulations, general navigational guidelines, the effect of WTGs on radar and radio communications, mitigating measures, and emergency situations.

5.5.3.2 PIANC (2014) – Harbour Approach Channels Design Guidelines

PIANC also published guidelines for the design of vertical and horizontal dimensions of harbor approach channels, the maneuvering and anchorage areas within harbors, and defines restrictions to operations within channels. Although not strictly applicable to offshore wind farms, the basic principles of estimating required channel widths and maneuvering areas outlined in the report are relevant.

5.5.3.3 International Maritime Organization (IMO)

The International Maritime Organization (IMO) is the United Nations' specialized agency responsible for the safety and security of shipping and the prevention of marine and atmospheric pollution by ships. Its main role is to create a regulatory framework for the shipping industry that is fair and effective, universally adopted, and universally implemented. There are various aspects of the IMO regulations that can apply to offshore wind farms, including:

- The Convention on the International Regulations for Preventing Collisions at Sea, commonly referred to as COLREGs, set out the navigational rules to be followed by vessels to avoid collisions.
- The General Provisions on Ships' Routing (GSPR) apply in areas where vessel traffic is expected to be heavier or where there is restricted room to navigate or the presence of obstacles.
- The Standards for Ship Manoeuvrability (MSC 137[76]) are used to evaluate the manoeuvering performance of vessels in support of the design, construction, repair, and operation of vessels. The concepts outlined in these standards, particularly related to vessel turning, are used to define safe distances for manoeuvering.

5.5.3.4 UK Maritime & Coastguard Agency

The UK Maritime & Coastguard Agency has released several guidance documents related to navigation in the vicinity of OREIs, including:

- Marine Guidance Note (MGN) 543 on Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response
- MGN 372 – OREIs: Guidance to Mariners Operating in the Vicinity of UK OREIs
- OREIs: Requirements, Guidance and Operational Considerations for Search and Rescue and Emergency Response.

5.5.3.5 Netherlands White Paper on Offshore Wind Energy (2014)

Appendix 6 of the Government of the Netherlands White Paper on Offshore Wind Energy (2014) provides an assessment framework for defining safe distances between shipping lanes and offshore wind farms.

5.6 Navigational Impacts of the Proposed WTG Layout

In the absence of Canadian guidance or regulation regarding vessel navigation, international technical guidance has been relied upon to evaluate the potential effects of the WIS development on vessel navigation.

5.6.1 Commercial Shipping Lanes

Offshore wind facilities should not interfere with safe vessel navigation, and typically there is a safe separation distance between any shipping channels and the WTGs. This physical separation is necessary for several reasons, including:

- Room for a vessel to make an emergency turn for collision avoidance. To avoid collision, vessels as a last resort would conduct a full round turn to starboard (IMO COLREG 8, IMO COLREGS, 1972). Vessels are designed to turn within five ship lengths with application of full rudder. PIANC (2018) recommends that six ship lengths be allowed to compensate for the vessel's officers not being prepared for such a maneuver. Further, a 0.3 nm (556 m) allowance for vessel deviation to starboard is sometimes assumed as the first step in collision avoidance is change course.
- Reduction of risk for allision with a turbine in the case of navigational errors or vessel breakdown (i.e., a drifting vessel). Physical separation would allow time and distance for the disabled vessel to anchor.
- Safe distance to permit identification of small craft by radar when the small craft are travelling out of the WTG field. Offshore wind farms can interfere with marine radar signals making it difficult to identify vessels that are transiting within the wind farm. The safe distance to avoid interference with a small craft exiting the WTG field has been estimated as 0.8 nm (PIANC, 2018).

- Separation to allow for possible ice throw from the turbine blades. The blades can accumulate ice in certain conditions (high humidity and low air temperature) that may be thrown up to a few hundred metres.

With respect to the nearby shipping lanes, the proposed Project WTG layout has a 1 nm (1.85 km) separation between the northern edge of a defined upbound channel. Presently, the navigated upbound route is approximately 1200 m to 1500 m wide as it is only constrained by shoals; however, much of the traffic transits within a few hundred metres of the navigation bearing line, as described in Section 5.3.1. It is proposed that an upbound channel of 600 m width be defined adjacent to the WIS WTG field for approximately 10 km by placement of one or two new navigational buoys (red starboard marks). This channel width is more than sufficient for one-way traffic based on both Canadian and International navigational guidance (CCG, undated[44]; PIANC, 2014) and is considerably wider than at many other locations along the Seaway as discussed previously in Section 5.4.

The 1 nm (1.85 km) separation will allow for a course deviation width of 0.3 nm (0.556 km) and an emergency turn diameter of 0.73 nm (1.35 km), which is 6 times the maximum length overall of a Seawaymax vessel. It is important to recognize that the potential for collision with another large commercial vessel is extremely low due to the Seaway traffic separation in this area as a downbound vessel should not be expected in the upbound channel. This collision potential could, however, arise with a disabled or inattentive small craft vessel.

The 1 nm separation distance also allows for sufficient distance for a vessel emerging from the wind farm area to be readily identified on marine radar systems.

Although certain guidelines (e.g., Government of Netherlands, 2014) cite a fixed separation distance of 2 nm (3.7 km) from shipping lanes, it is important to recognize that these guidelines are associated with channels designed to accommodate much larger vessels (greater than 400 m in length) and in situations with much greater numbers of vessel transits. The Seawaymax vessels have a maximum length of 225 m, and the proposed 1 nm separation is compatible with this length and with the small number of vessel transits.

The U.S. guidelines (NVIC 01-19, U.S. Coast Guard, 2019) note the lack of an international standard with respect to specifying the minimum distance between shipping routes and fixed structures. A 2 nm (3.9 km) separation is identified for separation from a traffic separation scheme (TSS) but again this assumes the transit of very large vessels with lengths of 300 m to 400 m.

In certain jurisdictions (e.g., Government of Netherlands, 2014), an additional safety zone of 500 m is defined around WTGs. This zone was based on the United Nations Convention on the Law of the Sea (UNCLOS)[45] for safety considerations for passage of large commercial vessels around hazardous offshore structures such as drilling platforms and oil production platforms. Other jurisdictions, such as in the UK (UKMCGA, MGN 543), consider that this safety zone should not be applied to wind farms. A further safety zone is not proposed at the WIS site.

5.6.2 Small Craft

The proposed WTG layout does not restrict the entry and passage of smaller vessels, such as recreational craft. The WTGs have been located on a semi-regular spacing driven by water depth requirements with spacing between WTGs varying from 0.9 km to 1.6 km, depending on location. Other than Pigeon Island and the Charity Shoals, water depths are sufficient that grounding of small craft vessels would not occur.

[44] **C-2514**. Canadian Coast Guard Safe Waterways, undated. https://www.ccg-gcc.gc.ca/publications/waterways-voies-navigables/safe-waterways/index-eng.html
[45] **C-2515**. UNCLOS United Nations Convention on the Law of the Sea Part V, Article 60, clause 5.

The recent US Coast Guard MARIPARS study (USCG, 2020b) put forward a methodology for calculating the required size of internal transit corridors within wind farms, based in part on the Government of Netherlands White Paper on Offshore Wind Energy (2014). This methodology assumes the possible passage of four vessels side-by-side and incorporates a traffic lane width of eight times the vessel length (L), starboard and port collision avoidance zones of width of 1.5L each and starboard and port safety margins (emergency turn zones) of 6L each. If a 14 m long vessel is assumed at the Project, the required corridor width would be 322 m; even the smallest spacing between Project turbines is considerably greater than the minimum required corridor width.

As the WTGs are placed in a semi-regular grid spacing and due to the hazard created by the presence of the natural shoals and Pigeon Island, small craft may choose to transit around the wind farm at night and during adverse weather conditions.

5.6.3 Air Draft Restrictions

The proposed WTG has an anticipated hub height of 100 m above mean water level on Lake Ontario with a rotor diameter in the range of 145 m. Assuming the largest rotor, the rotor blade tip will be at a minimum approximately 27.5 m above the water level. It is not anticipated that any small craft in the area will have air drafts exceeding this height. There are infrequent visits of tall ships to the Kingston area; such vessels would likely choose to navigate around the wind farm.

5.6.4 Visual Blockage

The WTGs will result in a degree of visual blockage for objects or vessels that lie directly beyond and opposite (i.e., behind) the structure from the viewer. The size of object or vessel fully obscured depends on the relative distance between the visual obstruction and both the viewing vessel and the obscured vessel. For this Project, the WTG towers will be supported by a gravity base foundation (GBF), which will extend to approximately 10 m above the water's surface. The visible portion of this GBF has a diameter of approximately 8 m. Based on this diameter, Table 5.3 below provides a summary of the estimated length of an object that would be "hidden" in the visual shadow of a WTG based on the proximity of the sighting vessel and the object being sighted from the WTG. For example, someone standing on a vessel 250 m from a WTG would not be able to visually detect an 11 m long vessel 100 m away from the WTG on the opposite side of the WTG.

Table 5.3: Visual Blockage Length (m) Created by the WTG Foundation

	Distance of the Object Being Sighted from the WTG (m)		
Distance of Sighting Vessel from the WTG (m)	100	250	500
100	16	28	48
250	11	16	24
500	10	12	16

Thus, small craft navigating amongst the WTGs could potentially briefly lose sight of another small craft vessel also within the turbine field, but the time of visual loss would be very short (typically 2 to 3 seconds at typical vessel speeds) and would be acceptable. Most importantly, a vessel within the turbine field closest to the upbound channel would not lose sight of a large commercial vessel sailing within the channel.

There is one AtoN, the Pigeon Island light, that falls within the confines of the wind farm. This light might be very briefly visually obscured by the WTG foundations when a vessel is transiting through the turbine field.

5.6.5 Anchorage

As it is planned to rest the inter-array cables and the export cable to shore directly on the seabed, the area enclosed by the wind farm should be considered a no-anchorage area.

5.7 Marine Radar, Communications, and Positioning Systems

Wind turbines may theoretically distort various types of electromagnetic signals (PIANC, 2018) potentially impacting systems such as radar, radio communications, AIS, global navigation satellite systems (GNSS) and vessel compasses. The following provides a brief overview of these issues with relevance to the WIS wind farm and demonstrates that it is not expected that the WIS turbine field will not create significant adverse impacts.

- *Marine Radar:* Studies (e.g., as summarized in PIANC, 2018) have shown that wind turbines have very strong radar reflection characteristics that at short distances can result in the display of false targets, clutter, and shadowing. There have been various investigations (e.g., BWEA, 2007) of this effect performed in Europe and some have shown that through adjustment of the radar system by skilled operators these spurious effects can be minimized. In the case of the WIS wind farm, one of the primary concerns would be the ability of large commercial vessels in the Seaway channel to detect moving small craft emerging from the wind farm and travelling towards the channel. Adequate separation (1 nm) has been provided that would allow for the detection of such vessels.
- *VHF Radio and AIS Communications:* Marine vessels communicate by means of VHF radio and AIS systems operate in VHF frequencies. Review of various European studies at sites such as the Horns Rev 3 Wind Farm (Orbicon, 2014) and the North Hoyle Wind Farm (Howard and Brown, 2004) have indicated that WTGs did not have any significant impact on VHF communications.
- *Compasses:* Compasses may be theoretically affected by electromagnetic fields generated around turbine generators and/or submarine cables. The electromagnetic fields around turbine generators are located at a sufficient height above the water surface that there will be no appreciable effect on compasses used for surface navigation. Similarly, the electromagnetic fields around the interarray cables decrease in strength rapidly with increasing distance from the cable. Given the site water depths, in the range of 10 m to 30 m, there will be no appreciable effect on compasses by the cable systems.

It is not expected that the WIS turbine field will have significant effects on radar, communications, and positioning systems.

5.8 Search and Rescue Missions

The nearest Canadian Coast Guard (CCG) station is in Kingston at Portsmouth Harbour, approximately 14 km from the northernmost WTG, and marine search and rescue (SAR) would likely be initiated from this site. The presence of the WTGs will not restrict marine SAR activity.

Aerial SAR missions are led by the Joint Rescue Coordination Centre (JRCC) located at Canadian Forces Base Trenton. SAR within the wind farm may be restricted by the height of the WTGs. Mitigations are proposed to address this as discussed in Section 5.9.

5.9 Navigational Risk Mitigations

To mitigate potential navigational risks, the Project is considering a number of additional actions as follows:

- The WTGs will be marked and lit in accordance with International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA, 2021) requirements, including alphanumeric tower designation and distinct lighting on corner towers/significant peripheral structures (SPSs), outer boundary towers, and interior towers. Mariner Radio Activated Sound Signals (MRASS) on corner towers/SPSs and perimeter structures may be provided.
- The provision of AIS transponders on selected WTGs to mark and broadcast all WTG locations.
- Aviation obstruction lighting and marking to be provided in accordance Transport Canada's Standard 621 - Obstruction Marking and Lighting - Canadian Aviation Regulations (CARs).
- Windstream will coordinate with Transport Canada and the Canadian Hydrographic Service on navigational chart updates showing positions of constructed WTGs and the issuance of Notices to Mariners (NOTMARs).
- Implementation of WTGs' rotor emergency braking systems to stop and maintain the position of the WTG blades, nacelles, and other appropriate moving parts to allow access by helicopters during SAR missions. The Windstream operations team will coordinate with the CCG, DND and other stakeholders as required during such missions.
- The possible provision of access ladders on the WTG foundations to allow distressed mariners access to an open refuge area on top of the ladder.

6. Coastal Processes, Wind, Wave, and Ice Conditions

Baird (2014[46] and 2015[47]) demonstrated that, based on the available evidence of the site conditions, Baird's extensive experience with Lake Ontario coastal conditions, as well as analysis completed by others for similar conditions in peer-reviewed literature, the physical coastal processes at the Project site, including wind, wave, scour and ice conditions were well understood and that they do not pose any onerous impediments to the design of the WIS turbine structures. The reports also concluded with a good level of certainty that the WIS turbine field is not likely to cause material impacts to the coastal processes and adjacent shorelines.

A review of other relevant reports and literature completed since 2015 supports the conclusions of the earlier Baird reports. Using advanced numerical modelling, McCombs et al. (2014[48]) assessed the impacts of a 130-turbine offshore wind farm at Wolfe Island shoal on surface waves. Overall, the model results indicated that the wave height in coastal areas will be minimally affected with slight far-field changes in significant wave height of less than 2% and near-field changes of less than 3%.

Ice conditions were studied in the early design phases of the WIS Project (Baird, 2012[49]; Baird 2014; Baird 2015) and were incorporated into the preliminary design of the turbine foundations. The previous reports demonstrated that ice conditions at the Project location were understood and reasonably well quantified and that the state-of-the-art engineering knowledge, design procedures and accepted codes of practice surrounding ice-structure interactions were advanced enough to implement a safe turbine foundation design.

Subsequent additional expert assessment of the ice conditions (Comfort, 2022[50]) prepared for this report, using advances in practice codes and guidelines, has confirmed that ice conditions at the WIS Project area and the ice design process are sufficiently understood to allow for the detail design development of the wind turbine foundations. In fact, Comfort (2022) demonstrates that the ice design loads identified in Baird 2012 for the down-breaking gravity-based foundation structure are, in all probability, conservative and could most likely be reduced with further analysis, which would done in the normal course of detailed design.

Based on our independent review of the technical and permitting feasibility, the Baird team has not identified any material impacts or impediments with respect to the physical coastal processes and ice conditions in Lake Ontario that would preclude the proposed WIS Project from proceeding to design development and the regulatory permitting processes. There is a reasonable expectation that approval for the WIS Project turbine structures could be obtained under regulations related to physical coastal processes and ice conditions present in 2021. The permitting process would be subject to detailed engineering and scientific studies using accepted practices, codes and guidelines and implementation of appropriate mitigation measures during construction and through the operational life of the structures and decommissioning.

[46] **CER-Baird.** Baird, 2014. Wolfe Island Shoals Offshore Wind Energy Project, Lake Ontario Context. Prepared for Torys LLP. Project No. 12021.103. August 13, 2014.
[47] **CER-Baird-2**. Baird, 2015. Wolfe Island Shoals Offshore Wind Energy Project, Response to URS Technical Report, January 20, 2015. Report prepared for Torys LLP, June 16.
[48] **C-2231**. McCombs, M. P., Mulligan, R. P., & Boegman, L. (2014). Offshore wind farm impacts on surface waves and circulation in Eastern Lake Ontario. Coastal Engineering, 93, 32–39. https://doi.org/10.1016/j.coastaleng.2014.08.001
[49] **C-0635**. Baird. 2012. Wolfe Island Shoals Ice Study. Report prepared by W.F. Baird & Associates Coastal Engineers Ltd. for Windstream Energy Inc. December 21, 2012.
[50] **C-2487**. G. Comfort Ice Engineering Ltd., 2022. Wolfe Island Shoals Wind Farm: Preliminary Assessment of Ice Design Criteria, Final Report prepared for Baird & Associates, February 2.

6.1 Wave Conditions

6.1.1 Wave Conditions Well Defined at WIS Project Site

Baird (2015) clearly documented that the wave conditions on Lake Ontario are well defined and understood. Baird is recognized as expert in wave modelling, and we are very experienced in defining wave conditions in the Great Lakes. We have completed numerous wave models on the Great Lakes and world-wide and are well-versed in the different characteristics of wave conditions on the Great Lakes (e.g., “seas”) and the oceans (e.g., combination of “seas” and “swells”). As presented in Baird (2015), the Baird wave model[51] to be used for the WIS Project was validated against two multi-year sets of wave buoy measurements, as well as data from various shorter-term buoy deployments. The model was vetted by the US Army Corp of Engineers (USACE) and was used as a standard Lake Ontario wave data source by the USACE. Baird has also deployed instruments and measured waves in vicinity of the Project site from November 2009 to April 2010. Additional field studies to validate the wave conditions at exact Project site are not required for the development of the detail design.

Claims of “*a frequency and build-up of wave peaks often resulting in confusing seas with rogue waves frequently recorded”* (URS Rejoinder #393) are unsubstantiated with no supporting documentation or references. In fact, a catalogue prepared by Liu (NOAA, GLERL, 2007[52]) of 51 freak wave events world-wide dating to the late 15th century included only three events on the Great Lakes. The term “*confusing seas”* is not defined or described. It possibly is a reference to directional wave spreading, which is no more than at other places with a limited quadrant for wave generating fetch.

Baird is confident that our state-of-the-art knowledge of wave conditions for the WIS Project allows for the proper Project design in accordance with good engineering practices. Based on our independent review of the technical and permitting feasibility, the Baird team has not identified any material impacts or impediments with respect to the wave conditions in Lake Ontario that would preclude the proposed WIS Project from proceeding to design development and the regulatory permitting processes. There is a reasonable expectation that approval for the WIS Project turbine structures could be obtained under regulations related to wave conditions present in 2021. The permitting process would be subject to detailed engineering and scientific studies using accepted practices, codes and guidelines and implementation of appropriate mitigation measures during construction and through the operational life of the structures and decommissioning.

6.1.2 Impact of WIS Turbine Array on Far-Field Waves Inconsequential

Baird (2014 and 2015) demonstrated that the impacts of the WIS Project turbine array on wave conditions beyond the turbine array are expected to be inconsequential. Baird (2015) summarized other studies and research in the literature and concluded that changes to the wave field due to offshore wind farms in various locations are unlikely to be significant in the far-field and are small in the near-field. The effects of the Project on shoreline processes at the U.S. shore were shown to negligible (Baird, 2015). With the new 66 turbine layout, the WIS Project turbine field will be further from the U.S. shore, further diminishing the effects.

[51] **C-1348**. Baird. 2003. Lake Ontario WAVAD Hindcast for IJC Study. Report prepared for US Army Corps of Engineers and the International Joint Commission by W.F. Baird & Associates. October 2003.
[52] **C-2527**. Liu, Paul, 2007. A chronology of freauqe wave encounters, Geofizika (geofizika-journal@gfz.hr); Vol.24 No.1.

A review of other relevant reports since 2015 (e.g., McCombs, 2013[53]; McCombs, M. P., Mulligan, R. P., and Boegman, L., 2014[54]; Christensen, E. D., Johnson, M., Sørensen, O. R., Hasager, C. B., Badger, M., and Larsen, S. E., 2013[55]; Sismani, G., Babarit, A., and Loukogeorgaki, E., 2017[56]) supports the previous conclusions in Baird (2015). In addition, the reduction in the number of turbines from 130 to 66 will even further reduce the already expected minimal impact.

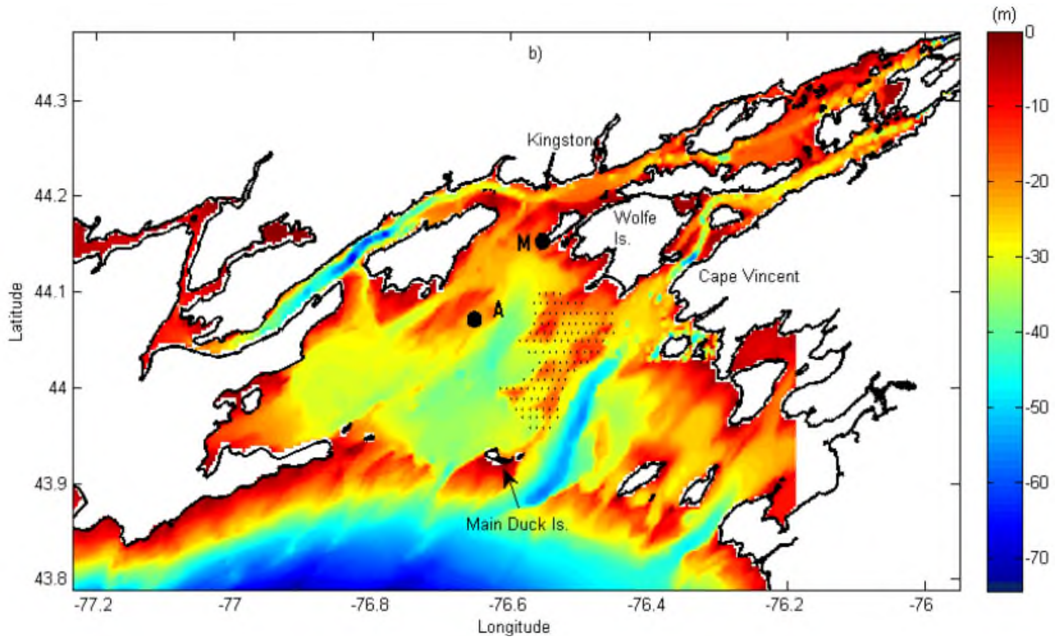
McCombs (2013) used a hydrodynamic model (Delft3D and SWAN) to assess the impacts of a 130-turbine offshore wind farm at Wolfe Island shoal on surface waves (Figure 6.1). The diameter of the modelled monopole turbine foundation was 7 m. Overall, the model results indicate that the wave height in coastal areas will be minimally affected with slight far-field changes in significant wave height of less than 2% and near-field changes of less than 3% (Figure 6.2). The largest far-field impacts occur during winds from the southwest (longest fetch) as waves are influenced by the entire length of the windfarm. Due to the large pile spacing (1 km) and low wave periods (6-7 seconds) the wave energy changes by less than 5% in the near field and is negligible in the far field.

Christensen et al. (2013)[57] evaluated the transmission of wave energy through an offshore wind farm. They analysed three effects: energy dissipation due to drag resistance; wave reflection/diffraction from structures; and modified wind field inside and on the lee side of the wind farm. The analyses showed that for shorter period waves, up to 70% of the incoming wave energy integrated over a frontal area of a circular cylinder is reflected. For diameters less than one tenth of the wavelength the reflected energy is negligible. Christensen et al. (2013) reported:

- The dissipation of wave energy due surface friction and vortex shedding is negligible.
- The reflection/diffraction of waves by the structures has some effect on the wave height upwind of the wind farm. In the cases analysed here the effect can be up to 2 to 3%.
- For moderate wind speed (U10 = 10 m/s), the local reduction of wave height, i.e., 2 km downwind, comes 1/3 from reflection/ diffraction and 2/3 from the reduced wind shear.
- From 15 km downwind (3 times the extent of the offshore wind farm) the effect of reduced wind shear controls a major part of the wave height reduction.
- The maximum reduction of wave height downwind the offshore wind farm is in the order of 5%. This means that the reduction in wave energy is reduced up to around 10%.
- 20 km downwind of the wind farm the reduction of wave height is up to around 1%.
- The offshore wind farm only had little influence on the wave period. But for large fetches the wave period was increased in the order of 1% downwind of the offshore wind farm.

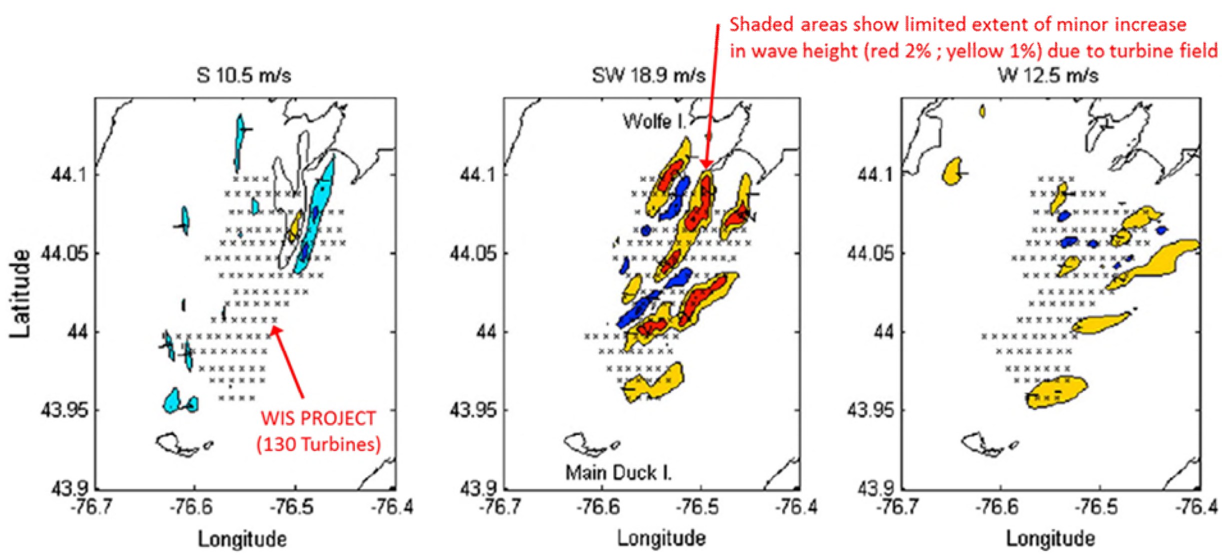
Of relevance to the WIS Project with the reduction in the number of turbines from 130 to 66, Christensen et al. (2013) also noted that “The trend in offshore wind farms is towards larger but fewer wind turbines in the same area. This means that the effect of the reflection/diffraction from structures in general will be smaller while the effect of reduced wind shear will be of the same order of magnitude.”

[53] **C-1989**. McCombs, M. (2013). Modelling Waves and Currents in Northeastern Lake Ontario to Assess the Impacts of a Proposed Offshore Wind Farm.
[54] **C-2231**. McCombs, M. P., Mulligan, R. P., & Boegman, L. (2014). Offshore wind farm impacts on surface waves and circulation in Eastern Lake Ontario. Coastal Engineering, 93, 32–39. https://doi.org/10.1016/j.coastaleng.2014.08.001.
[55] **C-1990**. Christensen, E. D., Johnson, M., Sørensen, O. R., Hasager, C. B., Badger, M., & Larsen, S. E. (2013). Transmission of wave energy through an offshore wind turbine farm. Coastal Engineering, 82, 25–46. https://doi.org/10.1016/j.coastaleng.2013.08.004.
[56] **C-2214**. Sismani, G., Babarit, A., & Loukogeorgaki, E. (2017). Impact of fixed-bottom offshore wind farms on the surrounding wave field. International Journal of Offshore and Polar Engineering, 27(04), 357–365.
[57] **C-1990**. Christensen, E. D., Johnson, M., Sørensen, O. R., Hasager, C. B., Badger, M., & Larsen, S. E. (2013). *op. cit.*



McCombs, M. P., Mulligan, R. P., & Boegman, L. (2014). Offshore wind farm impacts on surface waves and circulation in Eastern Lake Ontario. Coastal Engineering, 93, 32–39. https://doi.org/10.1016/j.coastaleng.2014.08.001

Figure 6.1: Wind farm turbine locations shown on 20–30 m deep shoal between Wolfe Island and Main Duck Island (Location A denotes the ADCP and M denotes location of meteorological station deployed during winter months 2011–12; depths shown in metres – red shallower, blue deeper)



Each contour line unit is in %. Increase in significant wave height: yellow, +1%; red, +2%. Decrease in significant wave height: light blue, −1%; dark blue, −2%. Wind direction & speed for each plot are indicated.

McCombs, M. P., Mulligan, R. P., & Boegman, L. (2014). Offshore wind farm impacts on surface waves and circulation in Eastern Lake Ontario. Coastal Engineering, 93, 32–39. https://doi.org/10.1016/j.coastaleng.2014.08.001

Figure 6.2: Minor impact of wind farm on wave height for three wind directions

Sismani et al. (2017)[58] reported on the impact of fixed-bottom offshore wind farms on the surrounding wave field. They used a numerical model of an offshore wind farm with 12 fixed bottom monopile structures with a diameter of 8 m diameter. The turbines were in a 4 x 3 grid pattern with spacing of 1000 m between piles. Various wave periods (3-10 s) and significant wave heights (1.5 m to 4 m) (regular and irregular waves) were modelled. Sismani et al (2017) concluded that for irregular waves smaller period leads to more intense variation of the diffracted wave field. The existence of the offshore wind farm leads to limited shadowing in the area behind the offshore wind farm, while significant scattering effects occur only in the wave field upstream. The impact of the offshore wind farm is more pronounced in the near field. The study did not extend for far-field effects.

The LEEDCo Icebreaker offshore wind project on Lake Erie project (see Section 3.2) was subject to an extensive environmental review and permitting process. The review concluded that because of the small scale of the proposed project, and circular shape of the turbine foundations, currents, and waves were not anticipated to be affected during construction, operations, maintenance, or decommissioning. Therefore, this resource was not carried forward for further analysis.

6.2 Ice Conditions and Design

Ice conditions were studied in the early design phases of the WIS Project (Baird, 2012; Baird 2014; Baird 2015) and were incorporated into the preliminary design of the turbine foundations. The previous reports demonstrated that ice conditions at the Project location are understood and quantified and that the state-of-the-art engineering knowledge, design procedures and accepted codes of practice surrounding ice-structure interactions were advanced enough to implement a safe turbine foundation design.

Subsequent additional expert assessment (Comfort, 2022[59]) prepared for this report, using advances in practice codes and guidelines, has confirmed that ice conditions at the Project area and the ice design process are sufficiently understood to allow for the detail design development of the wind turbine foundations. In fact, Comfort (2022) demonstrates that the ice design loads identified in Baird (2012) for the down-breaking gravity-based foundation structure are, in all probability, conservative and could be reduced with further analysis, which would normally be done during detailed design.

Since NAFTA1, ice conditions and design loads were identified and resolved for the LEEDCo Icebreaker wind farm project on Lake Erie. The state-of-the-art ice design procedures and codes were applied in the design development and regulatory permitting for the Icebreaker structures. The Icebreaker project was subjected to intensive scrutiny and review and has been approved.

Consideration has also been given to the potential effects of climate change on the ice conditions. Available evidence indicates that Lake Ontario ice cover has been declining over time. Over the period of comparison from 1983 to 2018, ice cover has been decreasing by about 5% per decade[60]. Decreasing ice cover could result in lower ice loads on the WGT foundations.

Based on our independent review of the technical and permitting feasibility, the Baird team has not identified any material impacts or impediments with respect to the ice conditions in Lake Ontario that would preclude the proposed WIS Project from proceeding to design development and the regulatory permitting processes. There

[58] **C-2214**. Sismani, G., Babarit, A., & Loukogeorgaki, E. (2017). Impact of fixed-bottom offshore wind farms on the surrounding wave field. International Journal of Offshore and Polar Engineering, 27(04), 357–365.
[59] **C-2487**. G. Comfort Ice Engineering Ltd., 2022. Wolfe Island Shoals Wind Farm: Preliminary Assessment of Ice Design Criteria, Final Report prepared for Baird & Associates, February 2.
[60] **C-2344**. NOAA, 2021. https://research.noaa.gov/article/ArtMID/587/ArticleID/2706/NOAA-projects-30-percent-average-Great-Lakes-ice-cover-for-2021-winter.

is a reasonable expectation that approval for the WIS Project turbine structures could be obtained under regulations related to ice conditions present in 2021. The permitting process would be subject to detailed engineering and scientific studies using accepted practices, codes and guidelines and implementation of appropriate mitigation measures during construction and through the operational life of the structures and decommissioning.

6.2.1 Additional Expert Assessment of Ice Design Conditions

G. Comfort Ice Engineering Ltd. (Comfort) conducted an ice investigation on behalf of Baird & Associates Ltd. for the proposed Wolfe Island Shoals (WIS) Wind Farm in 2012 (termed the 2012 Ice Report herein (Baird, 2012[61])), during which preliminary ice design criteria were established. An additional assessment of the ice design conditions was conducted by Comfort (2022) for Baird; the findings are summarized in the following subsections.

6.2.1.1 Objective and Scope of Additional Assessment

The objective of the additional ice condition assessment was to examine the ice design criteria originally established for the 2012 Ice Report. The work was focussed on items such as:

a) New developments since the 2012 Ice Report was prepared, including ice design codes, ice data and information, the turbine layout, and structural design concept for the GBF platforms for the WIS Project.
b) A general assessment of the conservatism in the 2012 Ice Report.

The work scope included the following: (a) investigation of the ice conditions, leading to the development of ice design criteria; (b) evaluation of the ice-structure interaction scenarios of concern, followed by evaluations of the ice loads; and (c) assessment of the potential for ice contact with the submarine cables that are part of the WIS Wind Farm.

6.2.1.2 Assessment of the Effect of Design Code and Potential Regulatory Regime

In the 2012 Ice Study, the preliminary ice loads were determined using various available methods and experienced engineering judgement. These assumptions have been reconsidered because there have been several changes since 2012. For example, CSA S471[62] (General requirements, design criteria, the environment, and loads in connection with the design, construction, transportation, installation, and decommissioning of offshore structures) is no longer in force, and it has been replaced by CSA ISO 19906:20 Petroleum and natural gas industries - Arctic offshore structures [63], which is an adoption without modification of the identically titled ISO (International Organization for Standardization) Standard 19906 (second edition, 2019-07). ISO 19906:2019-07 Petroleum and natural gas industries - Arctic offshore structures (ISO, 2019)[64] is an updated version of the “original” International Organization for Standardization (ISO) ISO 19906:2010 (ISO 2010) [65]. Comfort (2022) concludes that the governing code for the WIS Wind Farm would likely be IEC 61400-3 - International Standard, Wind Turbines – Part 3: Design Requirements for Offshore Wind Turbines (IEC, 2009) (now replaced by IEC 61400-3-1:2019-04 Wind energy generation systems – Part 3-1: Design requirements for fixed offshore wind turbines[66]).

[61] **C-0635**. Baird. 2012. Wolfe Island Shoals Ice Study. Report prepared by W.F. Baird & Associates Coastal Engineers Ltd. for Windstream Energy Inc. December 21, 2012.
[62] **C-1942**. CSA S471, 4th Edition, December 2008 - General requirements, design criteria, the environment, and loads.
[63] **C-2488**. CSA ISO 19906:20. Petroleum and natural gas industries — Arctic offshore structures.
[64] **C-2222**. ISO, 19906:2019, Petroleum and Natural Gas Industries – Arctic Offshore Structures.
[65] ISO 19906:2010 Petroleum and natural gas industries — Arctic offshore structures.
[66] **C-2215**. IEC, 2019. IEC 61400-3-1:2019-04 Wind energy generation systems – Part 3-1: Design requirements for fixed offshore wind turbines.

Assessment of Likely Effect of Using IEC 61400

The likely effect of adopting IEC 61400 as the governing code for the WIS Wind Farm is as follows: (a) Ultimate Limit State (ULS) design – the ice design criteria would be unchanged should IEC 61400 be specified as the governing code. (b) Fatigue Limit State (FLS) design – this type of loading has not been evaluated to date; and IEC 61400 would impose a requirement for this. It is our opinion that this would not affect the overall feasibility of the WIS Wind Farm. However, it might affect the structural details for the wind platforms; and the degree of optimization that is possible. For example, this may impose limits on the slenderness of the GBSs.

6.2.1.3 Overview of Conservatism in the Ridged Ice Loads in 2012 Ice Report (Baird, 2012)

The conservatism inherent in the ridged ice loads in the 2012 Ice Report (Baird, 2012) are described in detail in Comfort (2022) and summarized in Table 6.1 (from Table 5.1 with additional text from Table 5.2, Comfort, 2021).

On balance, it is believed that the preliminary ridged ice loads in the 2012 Ice Report (Baird, 2012) are conservative; and that further analyses or refinements during detailed final design would lead to a reduction in the ice loads. Any refinements in ice design criteria must be done taking the level ice loads into account as they might then become the governing load case. Refinements at the final design stage would be done for both ice loading scenarios.

6.2.1.4 Overview of Conservatism in Level Ice Load in 2012 Ice Report (Baird, 2012)

Because the “down-breaking gravity structure” has a sloped face, the ice will fail in multi-modal process that includes flexure, ride-up and clearing. The limit-stress loads (which are based on the force to fail the ice) were evaluated using the FDIS (Final Draft International Standard) (2018) version of ISO 19906 which is the updated version of ISO 19906:2010 (ISO/DIS 19906:2019-07, 2nd Edition. Petroleum and Natural Gas Industries – Arctic Offshore Structures, International Standards Organization has been released). Note that although IEC 61400 is the most likely governing code, Comfort (2022) states that it would be advisable to refer to other approaches for calculating level ice sheet ice loads on a down-breaking structure. IEC 61400 only provides the guidance that Ralston’s (1980) plastic method for cones can be used for this case; and it is believed that other methods (such as the one in the FDIS (2018) version of ISO 19906) would be more accurate.

Comfort (2022) concluded that the level ice loads presented in the 2012 Ice Report (Baird, 2012) are likely conservative. Table 6.2 summarizes the various factors and processes that add conservatism to the level ice load. The turbine foundation would be optimized during the detailed design phase. The downward refinements for the level ice loads are not likely to be particularly large compared to those expected from optimization of the ridged ice loads, except for shielding of the interior platforms which applies to both load-generating scenarios. Thus, the refinements may cause impacts by level ice sheets to become the governing load case; this would be evaluated at the detailed design stage.

Table 6.1: Overview of Conservatism in Ridged Ice Loads in 2012 Ice Report (Baird, 2012)

Process or Factor	Effect on Conservatism
Probability that ice ridges may not be created in a given winter – the environmental prerequisites for ridge formation include: (a) high ice concentration, and (b) ice thick enough to transmit ridge-building loads without failing elsewhere in the ice pack.	Adds major conservatism – this combination only occurred in about 50% of the winters; and other factors would also limit the formation of ridges.
Energy limits not included – ice loads were calculated presuming that sufficient driving forces are available to allow the ice loads to build up to the force to fail the ice at the platform (termed "limit-stress"). The ice loads may be limited by the available kinetic energy in the drifting ice mass, or by the acting environmental drag forces.	Adds major conservatism – this has the potential to greatly lower the ridge ice loads.
Shielding of the interior platforms against ridged ice loads by the outer ones in the WIS Wind Farm – the platforms inside the perimeter of the wind farm will be protected against ice loads by the exterior ones.	Adds major conservatism – More than 60 % of the platforms are shielded from ridged ice loads; so, the interior ones will "see" lower ice forces.
Ridge may have more consolidation than assumed – over time and with exposure to Freezing Degree Days, the ice blocks in the ridge will consolidate, leading to a solid consolidated layer in the middle of the ridge. In the 2012 Ice Report, the consolidated layer was assumed to be only 0.1 m thick, based on judgement recognizing that the site is in a temperate area; and likely there would be little time for ridges to consolidate before being moved against the platform. Also, ridges with low consolidation would likely disintegrate when moved.	Reduces conservatism, but probably only a small effect – calculations showed that the effect is small as the ridge loads are dominated by those to fail the unconsolidated portion of the ridge. *No further analysis, because load increases (due to thicker consolidated layer) would make it more likely that energy limits govern*.
Ridge keel draft may be deeper than 12 m, which was the maximum assumed in the 2012 Ice Report.	Reduces conservatism, but probably only a small effect – deeper ridges may occur. For example, grounded ridges have occurred in Lake Erie at depths exceeding 20 m. This would increase the load to fail a single ridge; But this would be balanced by other load limits (e.g., energy) which become more significant. *No further analysis, because load increases (due to deeper draft ridges) would make it more likely that energy limits govern*.

Table 6.2: Overview of Conservatism in Level Ice Load in 2012 Ice Report (Baird, 2012)

Factor or Process	Likely Effect
Design level ice sheet (with the 50-year ice thickness) may not contact the GBS's in the WIS Wind Farm. Also, the design level ice sheet may be significantly deteriorated.	Adds major conservatism. This effect can be quantified effectively. This would be investigated further as part of an optimization process carried out during detailed design. The work would start with an assessment of the probability of contact. Next, the timing of the events would be evaluated as ice movements may occur before the peak ice thickness has been reached. As well, the expected reduction in ice strength at breakup would be investigated and factored into the ice load calculations.
Level ice load on a single, isolated platform may be limited by the kinetic energy of the drifting ice mass.	Adds major conservatism for a single GBS. This effect can be quantified effectively.
Interior platforms in the WIS Wind Farm will be shielded from ice loads by the exterior ones.	Adds major conservatism for the whole wind farm. Further analysis recommended - This effect can be quantified effectively. Note that this item is present for both ice loading scenarios (i.e., a level ice sheet and an ice ridge).

6.2.1.5 Ice-Related Risks for Submarine Cables for the WIS Wind Farm

It is understood that the current design basis presumes that the cables in the vicinity of the wind farm and its approaches to shore will be unburied. This approach is likely to be successful as there are several unburied existing submarine cables in the general vicinity, which have performed in an acceptable manner (Baird, 2014). Site-specific geophysical surveys were completed in 2011 by Canadian Seabed Research (CSR) (Burton, 2011). These geophysical lakebed surveys did not show any ice scours in the vicinity of the WIS Wind Farm or its cable approach to shore. Hence, the submarine cables for the WIS Wind Farm are not likely to be prone to unmanageable ice-related issues, and it is expected that this would be confirmed following further analysis normally completed at the detailed design phase.

Ice push events and pileups can occur at the shoreline. Locating the cable landfall in a trench or advancing the cable below the surface by directional drilling are common measures used to mitigate risks to cable crossings at the shoreline.

7. Fisheries Permitting

Beacon Environmental Limited (Beacon) previously assessed fisheries permitting for Windstream Energy Inc. (Windstream) in support of the NAFTA arbitration proceedings held in 2014-2016 (NAFTA1) related to the WIS Project (Baird, 2014; Baird, 2015). Beacon concluded that fisheries permitting was achievable within the Project Schedule timeline.

In support of NAFTA2, Beacon has updated its previous fisheries permitting assessment with a review of the key conclusions related to the feasibility of the Project from a technical and scheduling perspective. This current study considers changes to legislation, policy, and species status since NAFTA1 in 2015 (Beacon, 2021). In Beacon's expert opinion, none of these changes are likely to have a significant negative impact on the Project Schedule, particularly considering that the number of turbines has almost been cut in half, from 130 to 66.

Based on our independent review of the technical and permitting feasibility, the Baird team has not identified any material impacts or impediments with respect to the fisheries in Lake Ontario that would preclude the proposed WIS Project from proceeding to design development and the regulatory permitting processes. There is a reasonable expectation that approval for the WIS Project turbine structures could be obtained under regulations related to fisheries present in 2021. The permitting process would be subject to detailed engineering and scientific studies using accepted practices, codes and guidelines and implementation of appropriate mitigation measures during construction and through the operational life of the structures and decommissioning.

7.1 Summary and Conclusions of Updated Assessment

For this updated study, Beacon reviewed changes in legislation, policy and species status as they relate to fisheries. These include changes to the federal *Fisheries Act* and provincial *Endangered Species Act* (ESA) and changes to listed species. We have also reviewed changes to the Project. These include the number and configuration of wind turbine generators (WTGs), footprint, timing, and construction methodology. We have assessed these changes in relation to their impact on the field schedule, permitting timelines and mitigation measures with respect to the fisheries, as well as the implications any of these changes would have on the overall Project schedule.

In Beacon's opinion, none of these changes are likely to have a significant negative impact on the Project Schedule for the following reasons:

- Number of Wind Turbine Generators (WTGs) has been reduced by close to half – from 130 to 66 - which substantially reduces the physical footprint, construction timing and subsequent impacts to the fisheries of the study area.
- Species at Risk fish identified in previous report have not changed. No new species have been added and none have been removed. In this regard, the worst-case scenario would be the original permitting timeline and would remain so, but in all likelihood, the schedule would be accelerated based on the anticipated reduction in impacts due to reduced number of WTGs.
- Changes to the federal *Fisheries Act* that came into force in August 2019 have restored fish habitat protection for smaller projects but the offsetting priorities of the 2019 *Act* are similar to the priorities in the 2013 *Act*.

Further, we continue to conclude that:

- The Project Schedule allows the appropriate time for field work, analysis, consultation and permitting.

- Permits would be obtainable under both federal and provincial legislation and processes.
- The timing windows as they relate to fish can be managed and have been considered in the Project Schedule.

7.2 Previous Fisheries Permitting Assessment

Beacon Environmental Limited (Beacon) previously conducted a fisheries permitting assessment related to the WIS Project (Baird, 2014; Baird, 2015). The previous assessment reviewed the Permitting Schedule to determine if sufficient time had been included in the Project Schedule to accommodate the activities necessary to procure the required permits. The potential for Species-at-Risk (SAR) habitat in the Project Area was assessed and determined to be low. Nevertheless, the Project Schedule allowed for permitting under both the federal *Species at Risk Act (SARA)* and the provincial *Endangered Species Act (*ESA*)*. The Project Schedule also allowed sufficient time to procure an authorization under the federal *Fisheries Act*. These timelines included allotments for field work, agency discussions, application preparation and any other activities necessary to procure the final permit.

The previous assessment concluded that the Project Schedule allowed sufficient time for the necessary tasks to be completed with respect to fisheries permitting. The previous assessment also determined that the fisheries timing restrictions that would be imposed during construction of the Project could be managed and had been considered in the Project Schedule.

These previous studies were included in Baird (2014 and 2015) and have been recently reviewed by Beacon and, in Beacon's opinion, the accuracy and conclusions of the studies were valid at the time of preparation.

7.3 Changes to Legislation, Policy and Species Status Since 2015

In support of NAFTA2, Beacon has updated its previous fisheries permitting studies with a detailed review of the key conclusions related to the feasibility of the Project from a technical and scheduling perspective. This current study considers recent information and experience since NAFTA1 in 2015 and provides an opinion on the feasibility of the Project should it have been allowed to re-start the development process in February 2020. The objective of this current study is to assess the feasibility of the Project should it have been allowed to progress in the absence of the Ontario Government's moratorium.

Changes to legislation, policy and species status since the previous assessment were investigated to determine any implications to permitting requirements, permitting processes and potentially, the need for additional permits.

7.3.1 Federal Fisheries Act

On June 21,2019, a new *Fisheries Act* (*FFA*) received royal assent (*Canadian Fisheries Act*, 2019). It became law in August 2019. The new FFA includes new provisions and stronger protections to support the sustainability of marine and freshwater ecosystems and resources. The changes that are relevant to the Project include:

- New protection of all fish and fish habitat where previously protection was provided only to commercial, recreational, or Aboriginal fisheries and only to the permanent alteration of fish habitat; and
- Protection against the "death of fish, other than by fishing" and the 'harmful alteration, disruption or destruction (HADD) of fish habitat' where previously "serious harm" was prohibited.

The same measures that were applied to the original Project are still valid with respect to these changes and no additional measures need to be considered in the context of these changes. Also, offsetting priorities remain essentially unchanged, therefore we anticipate that discussions with the Department of Fisheries and Oceans (DFO) regarding same would follow the same format and schedule.

7.3.2 Provincial Endangered Species Act

The Ministry of Environment, Conservation and Parks (MECP) now oversees the provincial ESA, whereas for NAFTA1, the Ministry of Natural Resources and Forestry (MNRF) had oversight. The Act itself has not undergone any revisions that are relevant to the Project.

7.3.3 Changes to Species Status

None of the species identified in NAFTA1 have had their status changed, nor have any new species been added to the Species at Risk list. Also, no new invasive species have been identified within the Project Area since NAFTA1.

7.4 Changes to Project

Changes to the Project including timing, construction, footprint and number and configuration of WTGs are discussed in detail in other sections of this report.

7.5 Implications as a Result of Changes

The proposed changes in the timing, construction methodology and cumulative size of the footprint of all Gravity Based Foundations (GBFs) have certain implications on the fisheries permitting process.

7.5.1 Reduced Footprint

The number of WTGs has been reduced from 130 to 66. An obvious implication of this change is the subsequent reduction in loss of fish habitat since less of the lakebed will be occupied by GBFs. As a result of this reduction, the magnitude of the HADD to fish habitat will also be reduced and consequently the amount of offsetting required for the permit will be reduced. The same process for procuring the FFA permit will need to be completed, but a reduction in footprint will be received favourably by DFO since part of their hierarchy of measures requires investigating means to avoid impacts. Also, the reduced magnitude of the offsetting requirement will make an offsetting project easier to find and implement. In this regard, the permitting process with the DFO could be shortened substantially. Lakefilling for the Pigeon Island substation will still need to be incorporated into the offsetting project if this option is selected.

7.5.2 Construction Methodology

Construction methodology remains unchanged from that proposed in 2014. The only substantial difference is the approximately 50% reduction in number of WTGs, which will result in less disturbance to the aquatic environment. All other parameters remain the same as outlined in the previous assessment.

7.6 Timing Windows

Further to the Baird Final Report (2015) and notwithstanding additional commentary on Fish and Fish Habitat in the URS Expert Rejoinder Report (Section 4.3.2.5), Beacon continues to be of the opinion that timing windows with respect to fish can be managed. Per Beacon’s earlier observations, which were based on experience with large projects in the Great Lakes, timing windows for these large projects are typically negotiated through agency discussion and are based on the results of site-specific fish community and habitat assessments. Agencies are known not to apply “default” timing windows for projects of this scope contrary to the position stated in the URS Rejoinder Report (2015). Each component of the project would be assessed separately. Discussion is provided in the following sub-sections.

7.6.1 Installation of GBFs

Preparation of the lakebed is scheduled to commence in April 2023 and continue through October including both mechanical dredge and installation of bedding stone. This construction window coincides with the “default” warmwater timing window of approximately April 1 – June 30 in which in-water work is prohibited because of the spawning season of warmwater species. The GBFs will be situated at water depths between 10 and 30 m and on average about 20 m. Warmwater spawners would simply not be present in this type of environment. Water temperature would be far too low, and substrate would not be suitable, nor would oxygen content of the water. In this regard, it is very likely that the default warmwater spawning window would not apply to the GBF installation.

The coldwater timing window extends from approximately October through May 31. Salmonids and other coldwater species including Whitefish species and Burbot are the most typical fall spawners in the Great Lakes. Although primarily stocked in the Great Lakes, the Pacific Salmon species (*Oncorhynchus spp.*) are riverine spawners, and their spawning attempts are in the rivers that are tributary to the lakes. Lake Trout (*Salvelinus namaycush*) spawning in the Great Lakes has been recorded in water depths similar to the depths at which the GBFs will be installed, but the more consistent requirement appears to be the presence of clean cobble shoals and orientation of the shoals downward and away from fall winds (Fitzsimons, 1994). The substrate of the turbine layout will be confirmed through field investigations, but cobble shoals are not typically located in depths at which the turbines are proposed. Also, Lake Trout are known to readily accept alternate spawning habitat if previous habitat becomes unavailable. Lake Trout spawning habitat is not limited in Lake Ontario.

Burbot (*Lota lota*) and Whitefish (*Coregonus spp.*) are also fall spawners. Burbot migrate to nearshore reefs and shoals to spawn. Whitefish species also spawn in shallow water over shoals one to three meters deep. Neither of these species would spawn in the area of the GBF installations.

Beacon’s experience with large construction projects in the Great Lakes is that MNRF would consider the characteristics of the fish habitat to be impacted by the construction schedule and would apply appropriate timing windows on a site-specific basis. It is not uncommon for timing windows to be waived or extended to accommodate construction timing in non-sensitive fish habitat.

7.6.2 Transmission Cable Installation and Pigeon Island Substation Construction

Export cable and interconnecting cables will likely be laid directly on the lakebed. They will occupy a minimal amount of the lakebed, which will become unavailable to fish and the installation will be minimally invasive. Timing window restrictions in deep water will certainly be the same as the GBF installation. At the shore landing zones, the cables will be trenched and buried. This construction methodology will be more invasive to fish habitat, but the impacts will be temporary and localized. For the shore construction, the warmwater timing window will be in effect prohibiting in-water work from approximately April 1 to June 30. Considering the brief period required for laying the cable, we would anticipate a shift in the construction schedule or a refinement of the timing window. This would be undertaken following field studies to determine the presence/absence of fish spawning habitat in the vicinity of Pigeon Island and at the landfall location at the mainland shore. In any case, this timing is the least restrictive and we do not anticipate a problem.

Similarly, cable landfall at the Pigeon Island substation, including lakefilling would be undertaken according to the relevant timing windows and original schedule. It is noted that substantial lakefilling to create the substantial construction causeway for the Third Crossing project (refer to Section 4.4.1) was permitted in a provincially significant wetland.

7.7 Monitoring and Mitigation Measures

Monitoring and mitigation measures will be necessary for several phases of the project including:

- GBF and WTG installation
- Cable installation and Pigeon Island Substation construction
- Offsetting project(s).

These activities will require monitoring through the construction phases to identify and mitigate short-term impacts as well as through post-construction to identify any long-term effects.

7.7.1 GBF and WTG Installation

Monitoring for the installation of GBFs and WTGs will focus primarily on sediment control. This responsibility will likely fall to the contractors that will be installing the structures. A fisheries biologist could visit the site weekly to ensure all measures are in place and functioning as intended.

7.7.2 Cable Installation and Pigeon Island Substation Construction

Like GBF and WTG installation, cable installation will focus on sediment control. The risk of sedimentation is lower for the cable installation as the cables will likely be laid directly on the lakebed. Temporary sediment disturbance is likely, but any major or long-term disturbance is highly unlikely.

The Pigeon Island substation construction has an increased potential for impacts because of the lakefill required to expand the footprint of the island. Also, the fish habitat that will be impacted is higher functioning than the deeper lake water habitat that is part of the GBF construction work. However, considering the numerous other lakefill projects constructed on the Great Lakes (e.g., see Section 4.4), it is reasonable to expect that permitting of the substation would be achievable, possibly through offsetting projects as mitigation.

7.7.3 Offsetting Projects

Offsetting projects for the FFA authorization will be determined through discussions with DFO. Offsetting projects can be implemented during construction or after construction.

7.8 Consideration of LEEDCo Icebreaker Project

The fisheries work completed for the LEEDCo Lake Erie Connector Project (Icebreaker) extended from May through October of a calendar year. The work was undertaken in US waters. If Canadian agencies required the same level of field investigations, the submission timeline of the report would likely be impacted as field investigations would need to extend into the fall, however sufficient flexibility has been built into the schedule to accommodate this extra effort and sufficient time for review and discussion with the agencies is provided. In Beacon's opinion, such an extensive field program is not warranted. Per our earlier comments, the water depth and substrate, as detailed in the previous assessment are clear indicators of the low productivity of fish habitat in the proposed locations of the WTGs. This position is supported by the results of the Icebreaker study which confirmed the low productivity and the potential for benefits to fish habitat because of the project.

8. Underwater Noise

Underwater noise (hydroacoustic) effects were not identified as a significant concern in Baird (2014). Baird commissioned SLR Consulting Canada Ltd (SLR) to conduct additional technical study of underwater noise issues relevant to the Project (SLR, 2021)[67] for this report. SLR concluded that Project noise sources during construction are comparable to or less than some of the commercial vessels using the existing shipping lane adjacent to the WIS Project site. While there is likely to be some potential for masking and behavioral effects in fish, these will be temporary (during construction only) and localized to the immediate vicinity of construction activity. To our knowledge no regulatory changes related to underwater noise have been made which would preclude the Project.

Based on our independent review of the technical and permitting feasibility, the Baird team has not identified any material impacts or impediments with respect to underwater noise in Lake Ontario that would preclude the proposed WIS Project from proceeding to design development and the regulatory permitting processes. There is a reasonable expectation that approval for the WIS Project turbine structures could be obtained under regulations related to underwater noise present in 2021. The permitting process would be subject to detailed engineering and scientific studies using accepted practices, codes and guidelines and implementation of appropriate mitigation measures during construction and through the operational life of the structures and decommissioning.

8.1 Key Findings of Underwater Noise Technical Advice Report

SLR's key findings are summarized in this section.

Project Noise Sources are Comparable to or Less Than Non-Project Noise Sources

The WIS Project is located adjacent to a commercial shipping lane. Although no measurements of existing ambient noise are available, it is expected that noise from non-project vessel movements would dominate the existing noise environment in this area of Lake Ontario. The Project turbines would be installed on gravity-based foundations, which are installed without requiring pile driving. Four Project construction activities generating underwater noise in the frequency range of fish sensitivity have been identified:

- Dredging using a grab or bucket dredge
- Tugs transiting through the project area
- Tugs using dynamic position during placement of foundations at the turbine locations
- Side-scan sonar used to survey the lakebed at several stages during construction.

Figure 8.1 shows the noise emissions of expected Project dredging and tug noise sources relative to existing non-project noise sources in the vicinity of the Project. The Project noise sources are comparable to or less than some of the commercial vessels using the existing shipping lane (e.g., bulk carriers, vehicle carriers). Figure 8.2 summarizes the extents of noise impact from various noise sources and project activities in terms of the distance from the source relative to the temporary hearing impairment threshold (temporary threshold shift or TTS) for fish species with swim bladder involved in hearing. The highest project-related noise levels are due to transiting tugboats. Tugboats also use the commercial shipping lanes, and other commercial vessels

[67] **C-2366**. SLR, 2021. Technical Advice on Underwater Noise Wolfe Island Shoals Offshore Wind Project, SLR Project No: 201.38265.00000. Prepared by SLR Consulting (Canada) Ltd. Prepared for Baird & Associates, May.

operating in the vicinity of the project are expected to produce higher noise levels. Of these sources, side scan sonar has no impact on fish behavior as it operates at frequencies much higher than the range of sensitivity of fish.

Likely Effects of Project Noise Not Significant

While there is likely to be some potential for project activity to cause masking and behavioral effects in fish, these will be temporary (during construction only) and localized to the immediate vicinity of construction activity. Project-related exposure of aquatic species to noise levels with potential for impacts such as temporary (recoverable) hearing damage is unlikely, although theoretically possible if a fish remains within 10 m of tugs using dynamic positioning systems over extended periods of the order of 12 hours.

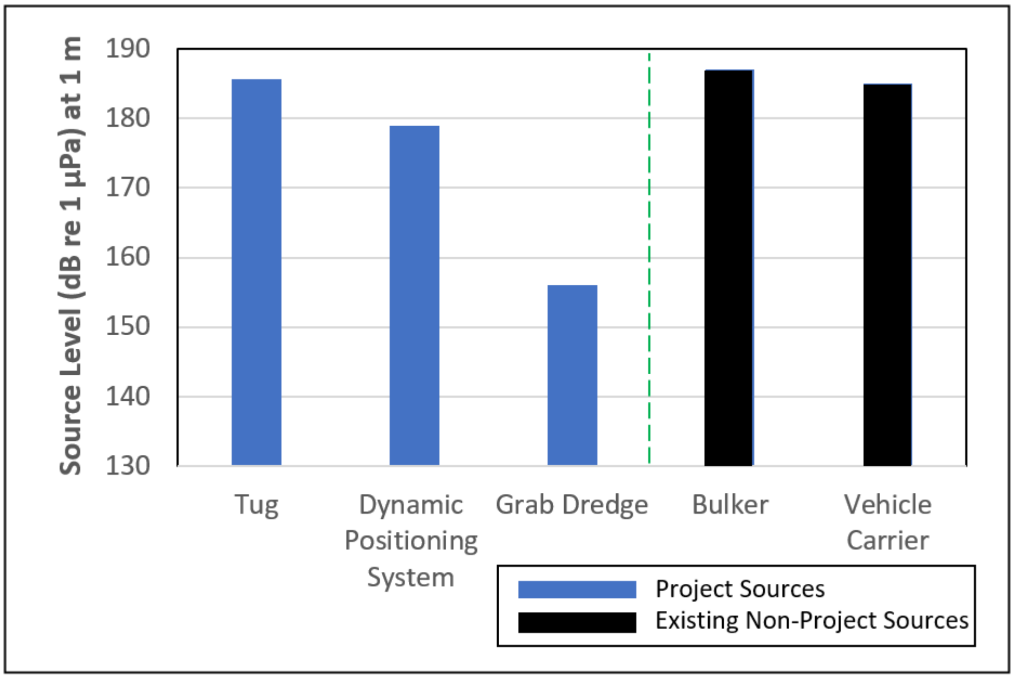


Figure 8.1: Noise emissions of the various project noise sources relative to existing non-project noise sources in the vicinity (SLR, 2021)

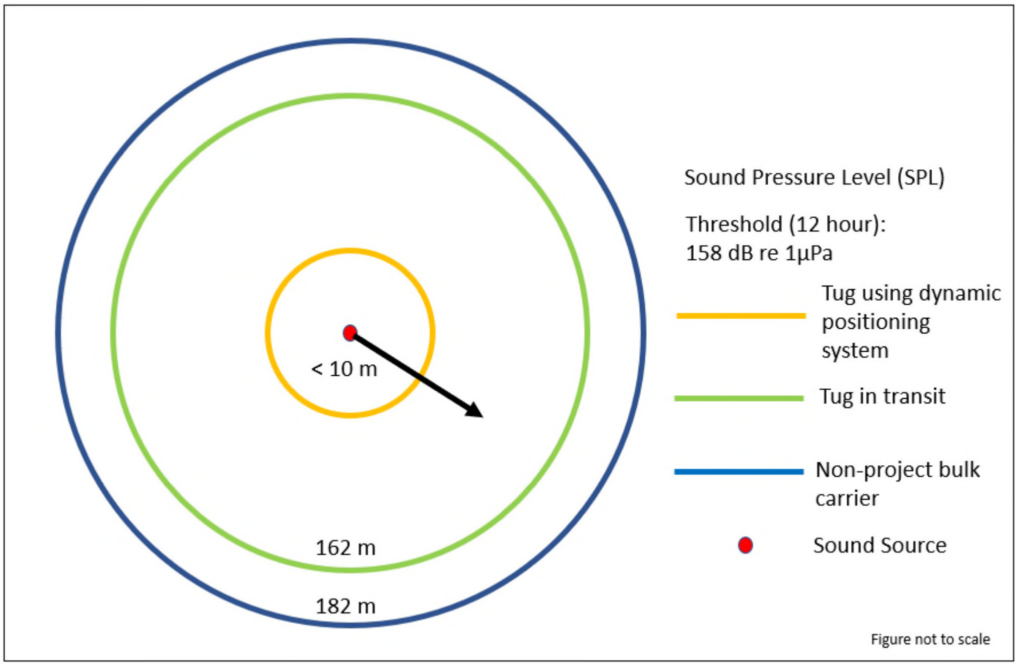


Figure 8.2: Relative distances to fish temporary hearing impairment threshold (temporary threshold shift or TTS) for various noise sources (SLR, 2021)

8.2 Summary of Underwater Noise Technical Advice Report

SLR (2021)[68] describes underwater noise issues relevant to the project, identifies relevant regulations and criteria, and provides an assessment of potential project underwater noise impacts. The primary objective of the technical advice report is to provide information identifying relevant underwater noise thresholds/criteria, assessing project impacts relative to thresholds, and providing background context. Reference is made to comparison projects and the relative impacts of different construction techniques and noise sources.

For activities generating impulsive noise (e.g., impact pile driving) DFO provides guidance on the peak underwater sound pressure levels (peak SPL) that are likely to adversely affect fish. For non-impulsive sounds (e.g., shipping, dredging noise), safe pressure levels are normally expressed in terms of root mean square pressure (RMS SPL) of the steady noise level or by using dose-response relationships to account for cumulative noise exposure effects over time.

For shipping noise and other continuous sounds (RMS SPL) such as would be generated by construction of the WIS offshore wind project, there is no direct evidence of mortality or potentially fatal damage to fish. However, extended duration noise exposure can have adverse effects. There is evidence of recoverable physical injury and temporary hearing impairment in fish with swim bladder involved in hearing exposed to noise long term. Popper et al. (2014) describe recoverable injury to fish exposed to noise at 170 dB re 1 µPa RMS SPL over 48 hours. They also identify that temporary hearing impairment (temporary threshold shift or TTS) in fish can occur with 12 hours of exposure to noise at 158 dB re 1 µPa RMS SPL after 12 hrs.

[68] **C-2366**. SLR, 2021. Technical Advice on Underwater Noise Wolfe Island Shoals Offshore Wind Project, SLR Project No: 201.38265.00000. Prepared by SLR Consulting (Canada) Ltd. Prepared for Baird & Associates, May.

This study identifies the distances from the various project noise sources at which aquatic life may suffer recoverable injury or temporary hearing impairment if they remain in proximity to the noise source for extended periods of the order of 12 hours. The relative noise emissions from project construction are also contrasted to the noise emissions from normal vessel traffic past the project area, to provide context on the magnitude of project underwater noise impacts.

Using the dBSea software package (SLR, 2021), a site-specific model was developed to calculate the distance from each noise source to the identified criteria representing temporary hearing damage (TTS) for fish with swim bladder involved in hearing, taken to be exposure above 158 dB re 1 µPa RMS SPL for an extended period. Figure 8.3 shows a sample output from the modelling.

There is no measured data available on the existing ambient underwater noise environment to enable an assessment of potential masking effects or behavioral disturbance to aquatic life due to the WIS project. While there is likely to be some potential for masking and behavioral effects in fish, these will be temporary (during construction only) and localized to the immediate vicinity of construction activity.

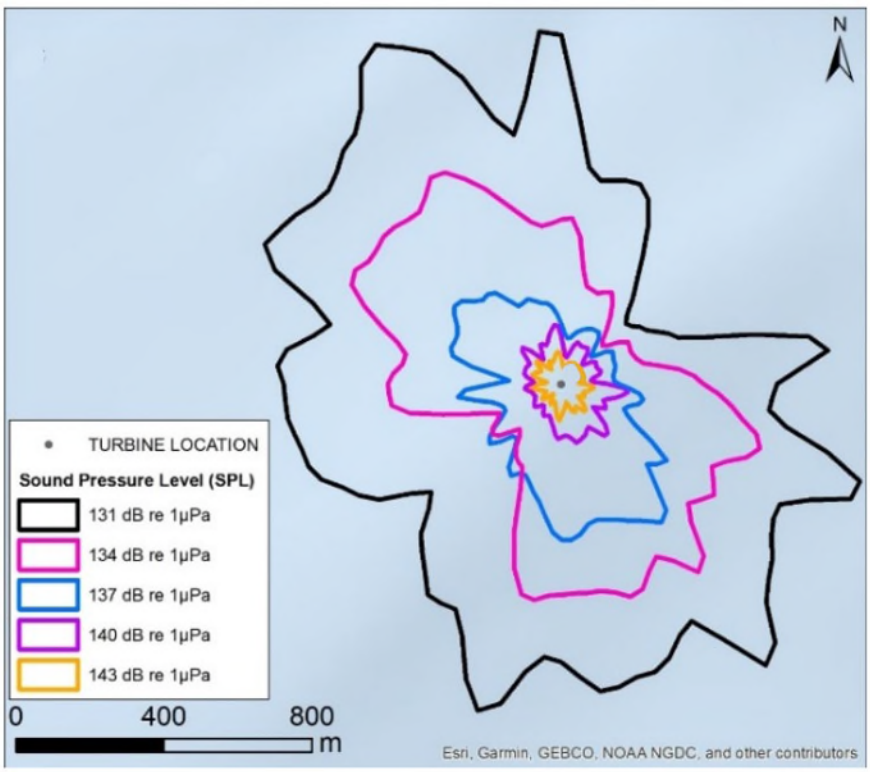


Figure 8.3: Example of detailed noise modelling for tug with dynamic positioning (shallow water 10 m) (SLR, 2021)

This assessment indicates that exposure of aquatic species to noise levels with potential for more serious impacts such as temporary hearing damage is unlikely, although theoretically possible if a fish remains within 10 m of tugs using dynamic positioning systems over extended periods of the order of 12 hours.

An assessment has been undertaken of the potential underwater noise impacts of the WIS project. In comparison to alternative construction approaches, the gravity-based foundations proposed by the WIS Project will result in considerably lower underwater noise emissions. The assessment considers impacts to aquatic species, in particular fish.

The project is located adjacent to a commercial shipping lane. Although no measurements of existing ambient noise are available, it is expected that noise from non-project vessel movements would dominate the existing noise environment in this area of Lake Ontario.

Four project construction activities with the potential to generate underwater noise have been identified:

- Dredging using a grab or bucket dredge
- Tugs transiting through the project area
- Tugs using dynamic position during placement of foundations at the turbine locations
- Side-scan sonar used to survey the lakebed at several stages during construction.

Of these sources, side scan sonar has no impact on fish behavior as it operates at frequencies much higher than the range of sensitivity of fish. The dredging equipment proposed produces noise at levels that are below the thresholds for temporary hearing damage to fish. The project noise source with the loudest underwater noise levels are tugboats. Tugboats also use the commercial shipping lanes, and other commercial vessels operating in the vicinity of the project are expected to produce higher noise levels than tugboats.

While there is likely to be some potential for project activity to cause masking and behavioral effects in fish, these will be temporary (during construction only) and localized to the immediate vicinity of construction activity.

Project-related exposure of aquatic species to noise levels with potential for more serious impacts such as temporary hearing damage is unlikely, although theoretically possible if a fish remains within 10 m of tugs using dynamic positioning systems over extended periods of the order of 12 hours.

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TAB 7

Aercoustics Engineering Ltd.
50 Ronson Drive, Suite 165
Toronto, ON M9W 1B3

Tel: 416-249-3361
Fax 416-249-3613
aercoustics.com

ACOUSTIC STUDY - **Project: 14399.01**

Wolfe Island Shoals Sound Study

Prepared for:

Windstream Energy Inc.
33 Faircrest Blvd.
Kingston, ON
K7L4V1

Prepared by:

Payam Ashtiani, B.A.Sc., P. Eng

Allan Munro, B.A.Sc., P. Eng

18 February 2022

Table of Contents

Executive Summary

Aercoustics Engineering Limited ("Aercoustics") has been contracted by Windstream Energy LLC ("Windstream") to update studies conducted in relation to the 300 MW Wolfe Island Shoals ("WIS") Offshore Wind Energy Project (the "Project") in 2015. The work entails updating the noise modelling of the proposed project with modern turbines in a new layout, and conducting a literature review to evaluate any advancements in the scientific knowledge base about sound propagation over water. Based on this work, we have concluded that the noise modelling parameters and methodology are still valid, and that the expected noise impact from the updated project would be far below the Sound Level Limit at land based receptors.

The work involved two parts:

1. Noise modelling for the Project with new turbine models and related layout (specifically 66 x SG 4.5-145).

2. Literature review related to new research on long distance sound propagation over water.

The 2021 acoustic model uses modelling parameters conforming to updated noise modelling guidelines (MECP Noise Guidelines for wind farms [last revised: May 2016]). The updated guidelines prescribe additional conservative modelling procedures including lower ground absorption factor (G=0.5) over land and the inclusion of uncertainty (2dB) to the modelled turbine maximum sound power level.

The results show that the proposed Project is expected to have a very small noise impact at any of the land-based noise receptors near the project area. The analysis also shows that the noise impact from the Project is expected to be far below the 40 dBA sound level limit requirements specified by the Ontario Ministry of Environment Conservation of Parks ("MECP").

If receptors are within 1.5km of a turbine, the existing noise modelling guideline would trigger the need to also assess cumulative impacts at those receptors. There would not be any receptors within 1.5km of the Project. However, at the request of Windstream, the noise impact analysis considered the cumulative impact at all the receptors up to at least 10km from the closest wind turbine, as well as the existing onshore wind energy Project. The analysis has shown that for all the receptors within 1.5km from an existing TransAlta wind turbine, the contribution from the Project would be less than 30dBA. This noise level is more than 10 dBA below the 40 dBA noise limit, and is therefore not expected to have any cumulative effect beyond the existing wind energy Project (TransAlta).

Aercoustics is independent from the Parties to this arbitration, their legal advisors and the Tribunal. We believe that all of the facts and opinions set out in this report are true.

1 Introduction

In 2015, Aercoustics Engineering Limited was contracted by Windstream to investigate noise propagation characteristics over water and ice. This work was specific to the Project and was meant to enhance the understanding of how noise propagates over water in the project area. A series of tests were conducted in winter 2014/spring 2015 during which noise propagation characteristics of an elevated source over water were measured. The noise propagation characteristics were then compared to those predicted by land based noise models. The findings of the noise propagation measurement work were then used to inform noise modelling of the proposed Project. Noise modelling was conducted for the proposed layouts on the Wolfe Island Shoals project.

Currently, Aercoustics has been contracted to revisit the scientific literature in relation to long distance sound propagation over water, and to update the noise studies with a new Layout of the proposed project (specifically 66 x SG 4.5-145 wind turbines). Noise impacts from the Project were evaluated at the most impacted onshore points of reception.

1.1 Firm experience

Aercoustics Engineering Limited is a wholly owned, privately held Canadian corporation that has dedicated itself to providing high quality consulting services in the science and engineering of acoustics, noise and vibration since its inception in 1971.

Aercoustics has had extensive experience and exposure to the challenge of quantifying the noise impact of wind turbines on residential receptors. Since the advent of wind energy projects within Ontario, Aercoustics has been at the vanguard of noise and vibration related issues with regards to wind turbines. Aercoustics has worked for many different stakeholders in relation to wind generation, including wind developers, regulatory bodies and government agencies, manufacturers and residents affected by wind turbine noise. Aercoustics also regularly publishes scientific research on wind turbine noise, and often participates in the organizing committees for the bi-annual International Conference on Wind Turbine Noise. Aercoustics is also accredited by the Standards Council of Canada to perform Acoustic Noise measurements of Wind Turbine noise in accordance with IEC 61400-11 and serves as the only Canadian representation on the TC 88's IEC 61400-11 working group on wind turbine noise standards. CVs for key project staff involved in this project have been included in the Appendix.

2 Background and Purpose

Sound propagation over water has continued to be a subject of interest with the advent of extensive offshore wind energy development in Europe, and more recently in the Eastern United States. Offshore wind is now the fastest growing source of wind energy. With many offshore wind energy projects being installed near shore, there has been development and refinement work examining the characteristics of sound propagation over water, with a specific focus on differences to propagation over land.

A number of models have been developed and used in Europe that are specific to sound propagation over water. The purpose of the work originally undertaken on behalf of Windstream was to investigate the real-world sound propagation as compared to what the leading models suggest. That work was used as a basis for conducting noise predictions of the proposed wind farm in 2015. As part of the 2021 update, a literature review has been conducted in order to determine if there have been any advancements in the knowledge base that would influence the findings of our 2015 work.

3 Project Noise modelling

Aercoustics has modelled the noise impact of the Project turbines on all surrounding receptors within a 10km radius. Three (3) layouts have to date been considered in this modelling as follows:

- The original (2014) Layout: including 130 x 2.3MW turbines and a minimum 5 km shoreline setback
- A slightly revised (2015) Layout: also including 130 x 2.3MW turbines and a minimum 5 km mean setback (excluding uninhabited or uninhabitable points) with a 1.5 km wide shipping lane buffer included.
- An updated (2021) Layout: including 66 x 4.5MW turbines to reflect more modern machines available in the market since the last iteration of the study, a minimum 5 km mean setback (excluding uninhabited or uninhabitable points) and even wider shipping lane buffer.

Noise contours of the latest (2021) layout are provided in Appendix 2.

3.1 Acoustic Modelling Method

Based on the measurements of sound propagation, and their decay, it was determined that the ISO 9613-2 model could reasonably predict sound propagation at the Project site. This ISO model is an algorithm for outdoor sound propagation that makes provisions for various sound propagation phenomena such as: geometrical spreading of sound, ground and air absorption of noise, acoustic reflection from surfaces, and shielding of noise sources. The model assumes a spherical geometric divergence, which has an effective decay rate of 6dB per doubling of distance. The model assumes downwind conditions from all sources. The ISO standard reports a model accuracy of within ±3dB for source heights up to 30m and source-receiver distances up to 1km; no claims are made for models that are outside of these bounds. The ISO standard is the model required by the MECP when evaluating the impact of land-based wind energy projects at distances up to and beyond 1 km.

In practice the ISO 9613-2 outdoor sound propagation standard is the most prolific model used to predict outdoor sound propagation of wind turbine noise, which made it a suitable choice as a baseline for evaluating offshore noise propagation. There are other noise models used such as Harmonoise, and Nord2000. Either of these models could have been used as baseline models, however, the main benefit of using Harmonoise or Nord2000 would have been the ability to make predictions based on mixed atmospheric conditions. This would not be of use in the case of this study, as the Ontario Ministry's methodologies are based on predictble worst case downwind conditions only.

3.2 Updated Acoustic Modelling Method (2021 Layout)

The noise impact assessment for the 2021 Layout is conducted in accordance with the 2016 Noise Guidelines for Wind Farms [last revised: May 2016]. The updated guidelines prescribe additional conservative modelling procedures including lower ground absorption factor (G=0.5) over land and the inclusion of uncertainty (2dB) to the modelled turbine maximum sound power level.

The calculations for the 2021 layout acoustical noise prediction model were performed using DataKustik's CadnaA environmental noise prediction software. The calculations are based on established prediction methods including the standard ISO 9613-2 "A Standard for Outdoor Noise Propagation".

Noise impacts of the 2021 Layout were predicted based on the following noise modelling parameters:

- Temperature = 10^{o}C
- Humidity = 70%
- G = 0.5 global ground attenuation factor over land. This is a change compared to the previous study to align with Ontario Ministry's 2016 guidelines.
- G = 0 ground attenuation factor over water.
- Sound Level Limit = 40.0 dBA at ≤6m/s wind at 10m agl
- Turbine noise emission corresponding to the manufacturer's worst-case sound power level for each turbine at 10m agl. The spectrum used was that of 9m/s wind bin as it provides the worst-case noise propagation. A conservative fixed value of 2dB has been added to the selected manufacturer's worst case sound power spectrum to account for the overall uncertainty in sound power value as per section 6.2.4 of the 2016 Noise Guidelines for Wind Farms.
- Analysis to include turbines within 10 km of a receptor.
- Receptor heights and coordinates provided by ORTECH.
- Topography included in model.

The parameter changes to the ground factor and the sound power uncertainty adjustment to align with the Ontario Ministry's 2016 guidelines are estimated to add roughly 2.5 dBA to the predicted levels depending on individual receptor positions.

3.3 **Project Acoustic Modelling**

The turbine layouts (2014 and 2015) comprise 130 Siemens SWT-113 turbines, each having 90m hub heights and an overall sound power of 105dBA.

The turbine layout (2021) comprises 66 Siemens Gamesa SG4.5-145 turbines, each having 100m hub heights and overall sound power of 108dBA.

The turbines are located based on a setback of 5km. The layouts represent a minimum 5 km setback from all receptors. The nearest receptors are 5.2km away, located near the base of Long Point / Simcoe Island. The octave band sound power used for the turbines is provided in Table 1.

Table 1: A-weighted wind turbine sound power used for modelling

A-weighted Octave Band Centre Frequency [Hz]	63	125	250	500	1000	2000	4000	8000	dBA
Sound Power Level [dB]	79	92	98	99	99	98	91	74	105
2021 Sound Power Level [dB]*	90	96	99	100	102	102	96	82	110

*+2dB uncertainty added to overall sound power level

The noise impact of each turbine was modelled at all receptors that were within 10km of each source. The results of the model are summarized be in Table 3. The predicted impact of the Project at the nearest receptors is significantly below the MECP criteria of 40 dBA.

Table 2: Summary of Noise Impact from Project

WIS Layout	Distance to Nearest Receptor	Location of Nearest Receptor	Noise Impact at Worst case Receptor [ISO 9613-2]
Original (2014) Layout	5.4km	Simcoe Island	22 dBA
(2015) Layout	5.5km	Base of Long Point	26 dBA
(2021) Layout	5.2km	Base of Long Point	29 dBA

3.4 **Cumulative Impacts**

MECP noise regulation for onshore wind projects requires the project to consider cumulative noise impacts of other nearby wind energy projects based on the following criteria:

- The onshore wind project to identify all noise sensitive receptors within 1500m of any of the projects turbines (called Receptors of Interest)

- All turbines from the project and turbines from any nearby wind energy projects (existing or proposed) within 5000m of the Receptors of Interest are to be included when evaluating the cumulative impact at each Receptor of Interest

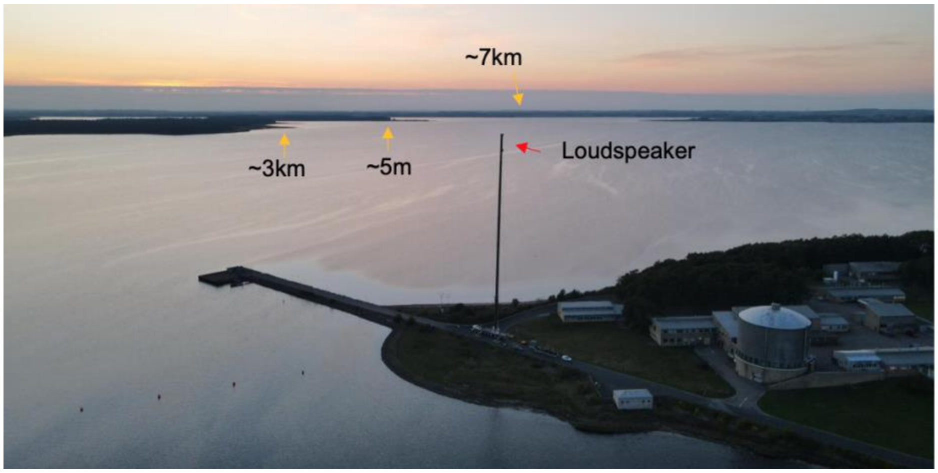
Based on the existing noise modelling guideline for onshore wind projects, the Project would not have any receptors within 1500m as all receptors are further than 5km from the nearest Project turbine and thus would not be required to evaluate cumulative impacts. However, at the request of Windstream, the noise impact analysis considered the cumulative impact at all the receptors up to at least 10km from the closest Project wind turbine, as well as the existing Trans Alta wind project on Wolfe Island.

Since the closest receptors to the Project are on Wolfe Island, the existing TransAlta onshore turbines dominate the noise impact at most of the receptors in the noise study. The analysis has shown that for all the receptors within 1.5km from an existing TransAlta wind turbine, the contribution from the Project would be 29 dBA or less. This sound level is more than 10 dB below the MECP noise limit and is therefore not expected to have any cumulative effect beyond the existing Trans Alta project.

4 Literature Review update

Published literature on the topic of sound propagation over water was researched in order to determine if there had been any relevant further studies on the matter since the 2015 sound study. Very few relevant publications were identified that focused on sound propagation over water in the context of offshore wind farms. The most relevant study was that of L. Sondegaard [2] published as part of the proceedings of the 9th International Conference on Wind Turbine Noise in May of 2021. The study was jointly carried out by FORCE Technology and DTU Wind Energy (Danish Technical University), and involved placing sound sources at various heights, and measuring sound propagation across a bay at different available distances. The test was carried out on two attempts. The first attempt did not yield any detectable signal beyond 2km despite emitting sound at 115-130 dBA Sound Power (much higher than expected sound power from individual wind turbines)

Figure 1: Drone photo showing the area of the measurement campaign. Taken from Figure 4 in [2]



The second measurement campaign focused on capturing a time with very calm water conditions in order to minimize ambient (wave) noise, and propagation in the downwind direction. The measurements were carried out on one evening roughly between 9 pm and midnight in order to minimize background noise. The goal of the measurements was to evaluate whether multiple reflections and downward refraction were detectable and at what distance such a phenomenom would occur. If such a phenomenon occurred it would be an indication that sound *could* travel more efficiently than is accounted for in the ISO 9613-2 standard.

Their results were mixed in that at most frequencies (125Hz and above) they were not able to detect any multiple reflection scenarios – similar to the results found by Aercoustics during the 2015 measurement campaign. For lower frequencies such as 63Hz evidence of multiple reflections and downward refraction was found. However, this was for noise sources closer to the ground than wind turbines (50m or less) making the findings not applicable to the Wolfe Island Shoals project. The study also outlines that long term measurements would be required to ascertain the statistical significance of how often such conditions occur, and what their strength would be.

The study aimed to verify if the multiple reflection scenario, required by danish standard BEK 135 could in fact be measured. For context, in the BEK 135 standard, the threshold distance before multiple reflections become applicable is a function of source height, and that for a source height of 100m (as is the case for the WIS project) the threshold would be over 5 km. This means that because the sources are located at a higher elevation, the model would predict spherical spreading (similar to ISO 9613-2) for the entire propagation path of the noise onto shore. This is consistent with the way noise was modelled in Aercoustics' 2015 study as well as in this study, and consistent with the measurement findings. To summarize, the only measurements based study conducted since Aercoustics' 2015 study serves to further confirm that for the WIS project, no modifications to the propagation conditions need to be made in order to adequately model the noise propagation.

5 Conclusion

Aercoustics Engineering Limited was contracted by Windstream to update previous noise modelling conducted for a proposed 100MW project in Lake Ontario. Noise modelling was conducted for a new proposed layout, and noise impacts from the Project were evaluated at the most impacted onshore points of reception. This modelling process is part of the permitting requirements for a wind energy project.

Previous work had shown sound propagation consistent with spherical spreading of sound, similar to over land. As such, noise modelling using existing Ontario Ministry's applicable standards (ISO 9613-2) was deemed suitable for this analysis. An updated literature review shows that a limited number of additional studies have been performed, and in the only case that focuses on potential multiple reflections over water, the effect would not be applicable for turbines with hub heights and distances seen at the WIS project. Thus, no changes to the modelling methodology is warranted.

Based on the previous modelling methodology implemented, with relevant updates to Ontario Minisitry of Environment Conservation and Parks guidelines (2016) applied, the greatest noise impact of the Project for the 2021 layout was 29 dBA at the most impacted receptor which is well below the Sound Level Limit of 40 dBA.

The results of the analysis also indicate that the Project has a negligible contribution to the cumulative impacts at the sensitive receptors and would meet the Ontario Ministry's 40 dBA sound level limits.

6 References

[1] **C-1276**, ISO 9613-2:1996 - Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation

[2] **C-2370,** Søndergaard "Long distance noise propagation over water for an elevated height-adjustable sound source" Proceedings of the 9th International Conference of Wind Turbine Noise, Remote from Europe, May 2021 (Confidential)

Aercoustics Engineering Ltd.
50 Ronson Drive, Suite 165
Toronto, ON M9W 1B3

Tel: 416-249-3361
Fax 416-249-3613
aercoustics.com

Appendix 1

Experience and CVs

aercoustics

Aercoustics Engineering Ltd.
1004 Middlegate Road, Suite 1100
Mississauga, ON L4Y 0G1

Tel: 416-249-3361
Fax 416-249-3613
aercoustics.com

payam ashtiani

BASc PEng ASA

profile

Payam Ashtiani is a Principal Acoustic Engineer at Aercoustics, with a Bachelor's degree in Mechanical Engineering from the University of Toronto. He has over 13 years of experience in the field of Acoustics with a specific focus on noise from wind turbines.

Apart from completing numerous noise assessments for wind projects, and extensive wind turbine noise measurement campaigns, he has authored multiple research papers on the topic and presented at international technical conferences.

His experience has included providing expert advice to regulatory bodies such as the Ontario Ministry of Environment, and the Vermont Public Service Department on the topic of wind turbine noise, and has appeared as expert witness in cases such as the Kent Breeze Environmental Review Tribunal in Ontario, and the Alberta Utilities Commission Hearing for the Bull Creek Wind Farm, and the Grizzly Bear Creek Wind Farm.

Payam also oversees the technical group responsible for carrying out IEC 61400-11 measurements – the first such group accredited to ISO 17025 in Canada. He is also the only Canadian member of the international IEC Technical Committee 88 Working Group on IEC 61400-11 standard.

education + career milestones

B.A.Sc., Mechanical Engineering, University of Toronto, 2005
joined aercoustics in 2006 as a noise and vibration consultant.
Member of

Canadian Acoustical Association,
Professional Engineers of Ontario, Alberta, BC
Acoustical Society of America

publications

Using Measured Sound Power Inputs for Comparison of Measured Immission Noise Levels and Sound Levels Predicted with ISO 9613-2 for Various Ground Factors. Clark K., **Ashtiani P**, 8th International Conference on Wind Turbine Noise, Lisbon, Portugal, June 2019

An Investigation into correlation between strong wind turbine amplitude modulation and environmental conditions, Halstead, D, Suban-Loewen A, **Ashtiani P**, 7th international Conference of Wind Turbine Noise, Rotterdam, Netherlands, 2-5 May 2017

An investigation into the effect of wind shear on the sound emission of wind turbines, **Ashtiani P**, Halstead, D, , 7th international Conference of Wind Turbine Noise, Rotterdam, Netherlands, 2-5 May 2017

Detection of Amplitude Modulation in Southern Ontario Wind Farms, Halstead, D., Suban-Loewen, S, **Ashtiani P**, 6th international Conference of Wind Turbine Noise, Glasgow, Scotland, 20-23 April 2015

Spectral discrete probability density function of measured wind turbine noise in the far field, **Ashtiani P** and Denison A (2015). Front. Public Health 3:52. doi: 10.3389/fpubh.2015.00052

Health-based audible noise guidelines account for infrasound and low-frequency noise produced by wind turbines. Berger RG, **Ashtiani P**, Ollson CA, Whitfield Aslund M, McCallum LC, Leventhall G and Knopper LD (2015) Front. Public Health 3:31. doi: 10.3389/fpubh.2015.00031

Generating a better picture of noise immissions in post construction monitoring using statistical analysis, **Ashtiani, P**., 5th international Conference of Wind Turbine Noise, Denver, Colorado, 28 - 30 August 2013

A new software tool to facilitate NURB based geometries in acoustic design, O'Keefe J., **Ashtiani, P**., Grant D., International Symposium on Room Acoustics, Toronto, Canada, 9 June 2013

Analysis of noise immission levels measured from wind turbines, **Ashtiani, P.,** Titus, S, Wind Turbine Noise 2011, Rome, Italy, 11-14 April 2011

Improved noise audit technique for wind farms, Titus S., **Ashtiani P.**, INTER-NOISE 2010, Lisbon, Portugal, 13-16 June 2010

Concerns with using simplified wind profiles in determining noise impacts of wind turbines, Gambino, V., **Ashtiani, P**., Preager, T., Ramakrishnan, R., INTER-NOISE 2009, Ottawa, Canada, August 23-26, 2009

Acoustic Performance Considerations For A "Once Through Steam Generator", Gambino, V., **Ashtiani, P**., 2006.

selected projects

Noise modelling and assessment

Wolfe Island EcoPower Centre	Wolfe Island, ON
McLeans Mountain Wind Farm	Manitoulin Island, ON
Grand Bend Wind Farm	Grand Bend, ON
Bull Creek Wind Farm	Provost, AB
Ingredion (formerly CASCO) facility NIA	Cardinal, ON
Q9 Networks data centres	Various locations within ON, AB, BC

Wind Turbine noise measurements and compliance verification

Kingsbridge wind plant (K1)	Goderich, ON
Melancthon EcoPower Centre	Melancthon, ON
Wolfe Island EcoPower Centre	Wolfe Island, ON
Gosfield Wind Project	Essex County, ON
Comber Wind Project	Essex County, ON
South Kent Wind Project	Chatham-Kent, ON
Port Dover Nanticoke Wind Project	Nanticoke, ON
South Dundas Wind Project	South Dundas, ON
HAF Wind Energy Project	West Lincoln, ON
Wainfleet Wind Energy Project	Wainfleet, ON
K2 Wind Project	Kincardine, ON

Bull Creek Wind Power Project	Provost, AB
Vestas R&D Acoustics Testing	Undisclosed locations
GE R&D Acoustic Testing	Undisclosed locations
Hybridyne wind Systems	Various locations with Ontario

Peer Review, expert witness, and expert advice

Various Wind Turbine Noise submissions to Public Service Board	Montpellier, VT
Ontario Ministry of Environment wind turbine noise measurement protocol	Ontario
Dufferin Wind Power project noise study peer review	Dufferin County, ON
Kent Breeze ERT (Erickson vs. Director)	Chatham-Kent, ON
Bull Creek Wind Power Project Proceeding 2999	Provost, AB
Grizzly Bear Creek Wind Power Project Proceeding 3329	Vermillion, AB
Vermont Wind Sound level investigation Docket 8653	Sheffield, VT

aercoustics

Aercoustics Engineering Ltd.
1004 Middlegate Road, Suite 1100
Mississauga, ON L4Y 0G1

Tel: 416-249-3361
Fax 416-249-3613
aercoustics.com

Allan Munro

BEng PEng

profile

Allan holds an Engineering Physics degree and is a member of the Professional Engineers of Ontario. Since starting with Aercoustics in 2009, he has become a fundamental part of the wind and renewables team. Specific experience for wind turbine noise includes noise modelling and assessment of wind projects, detailed noise immission measurements and turbine noise emission performance verification measurements (per IEC 61400-11). Allan is known in the industry for his diligence and level-headed project approach.

education + career milestones

- B.Eng., Engineering Physics/Applied Physics, Queen's University, 2008
- joined Aercoustics full time in 2009 as a noise and vibration consultant.
- Member of Professional Engineers of Ontario.

publications

Field Comparison of IEC 61400-11 Wind Turbines – Part11: Acoustic Noise Measurement Techniques: Edition 3.0 and Edition 2.1,

Jozwiak, R., **Munro, A.**, Halstead, D., Denison, A., 6th international Conference of Wind Turbine Noise, Glasgow, Scotland, 20-23 April 2015

selected projects

Noise modelling and assessment

Bull Creek Wind Farm	Provost, AB
Triple M Metal Recycling Facility	Brampton, ON
Labatt Brewery	London, ON
St. Joseph's Health Centre	Toronto, ON
Grand Bend Wind Farm	Grand Bend, ON

Wind Turbine noise measurements and compliance verification

Henvey Inlet Wind Farm	Henvey Inlet First Nation, ON
Armow Wind Project	Bruce, ON
Grand Renewable Wind Project	Haldimand, ON
K2 Wind Farm	Huron, ON
South Kent Wind Project	Chatham-Kent, ON
Springwood Wind Project	Wellington, ON
Suncor Adelaide Wind Power Project	Strathroy, ON
Summerhaven Wind Energy Centre	Haldimand, ON
Port Ryerse Wind Farm	Port Ryerse, ON
Oxley Wind Farm	Harrow, ON
Cedar Point Project	Sarnia, ON
Niagara Region Wind	Farm Niagara, ON
Bull Creek Wind Farm	Provost, AB
McLeans Mountain	Little Current, ON
Goshen Wind	Huron County, ON
East Durham Wind	Grey County, ON
Conestogo Wind	Wellington County, ON
Bow Lake Wind	Algoma District, ON
Bornish Wind Energy Centre	Middlesex County, ON
Bluewater Wind Energy Centre	Bluewater, ON

Wind Turbine vibration research and development testing

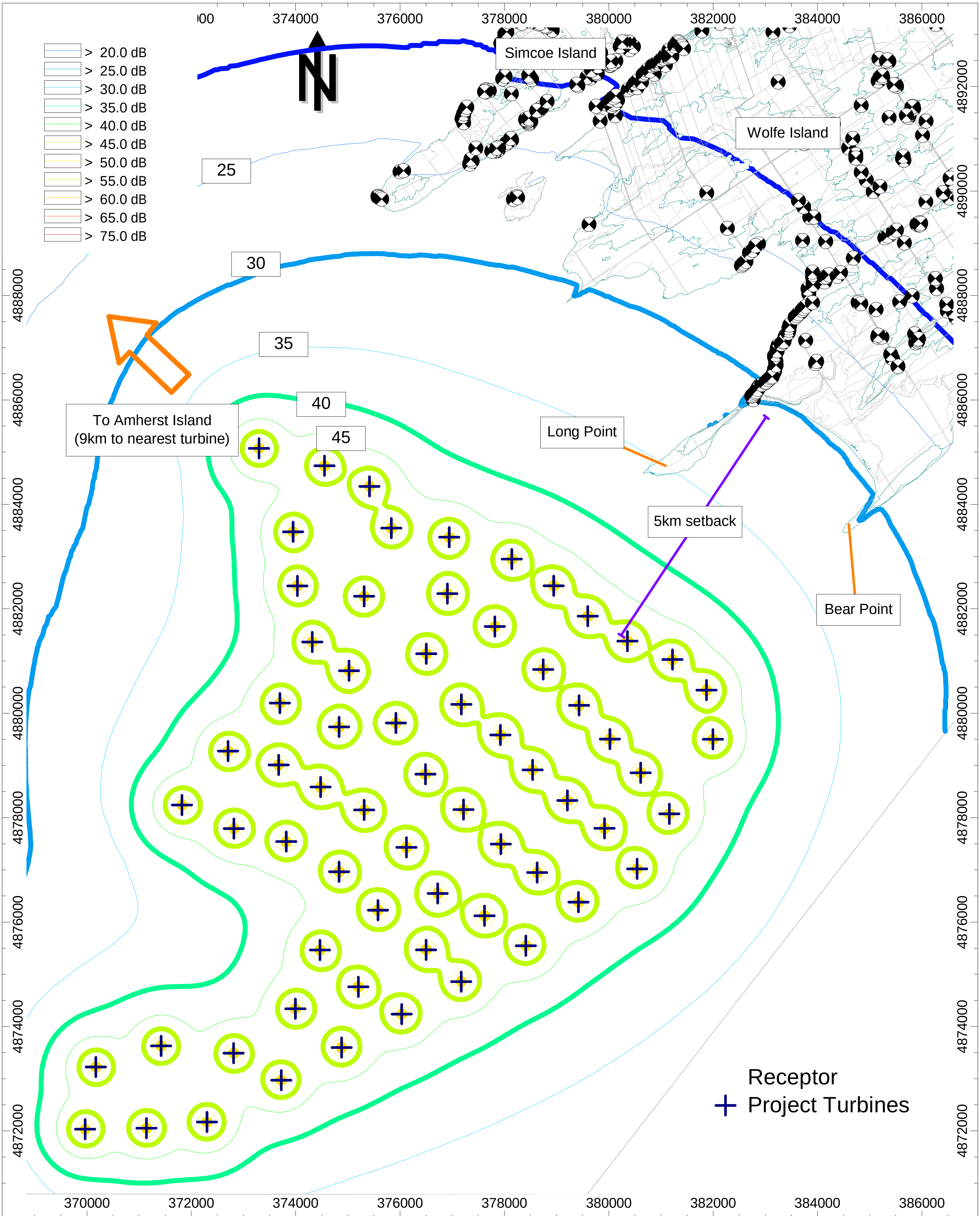
Provided acoustics and vibration testing services for the following manufacturers:

Siemens	Canada
Senvion	Canada

Aercoustics Engineering Ltd.
50 Ronson Drive, Suite 165
Toronto, ON M9W 1B3
Tel: 416-249-3361
Fax 416-249-3613
aercoustics.com

Appendix 2

Noise Contours



aercoustics

1004 Middlegate Rd Suite 1100,
Mississauga, ON L4Y 0G1
P: 416 249 3361 F: 416 249 9813

Scale: NTS
Drawn: AM
Eng: PA
Date: May 2021

The scope of the work outlined in this document is limited to the acoustic, noise, and/or vibration control aspects of the design. Contractors to verify all dimensions

Project Name:
Wolfe Island Shoals - Sound Study (2021)

AEL Project Number 14399.02

Figure Title:
Noise Contours - Revised (2021) Layout
Project Turbines Only

Figure A1