APPENDIX N: EMI

September 23, 2022

Mr. Dan MacEachern
Fire Chief
Auld's Cove Fire Hall
NS-104
Aulds Cove, NS B0H 1K0
Email: auldscovefire3053@gmail.com

Dear Mr. MacEachern,

Re: Port Hawkesbury Paper Wind Farm Project
Mulgrave, Nova Scotia

Strum Consulting, a Nova Scotia-based environmental and engineering consulting firm, has been retained by Port Hawkesbury Paper (our client) to support with the proposed Port Hawkesbury Paper Wind Farm (the "Project") within Guysborough County, Nova Scotia.

On behalf of our client, Strum is conducting an electromagnetic interference ("EMI") study on the placement of 29 wind turbines near the community of Mulgrave, Nova Scotia.

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A map showing the proposed locations of the turbines is attached (Drawing 1); and a summary of the proposed turbine details, including coordinates and elevations, is provided in Table 1, below.

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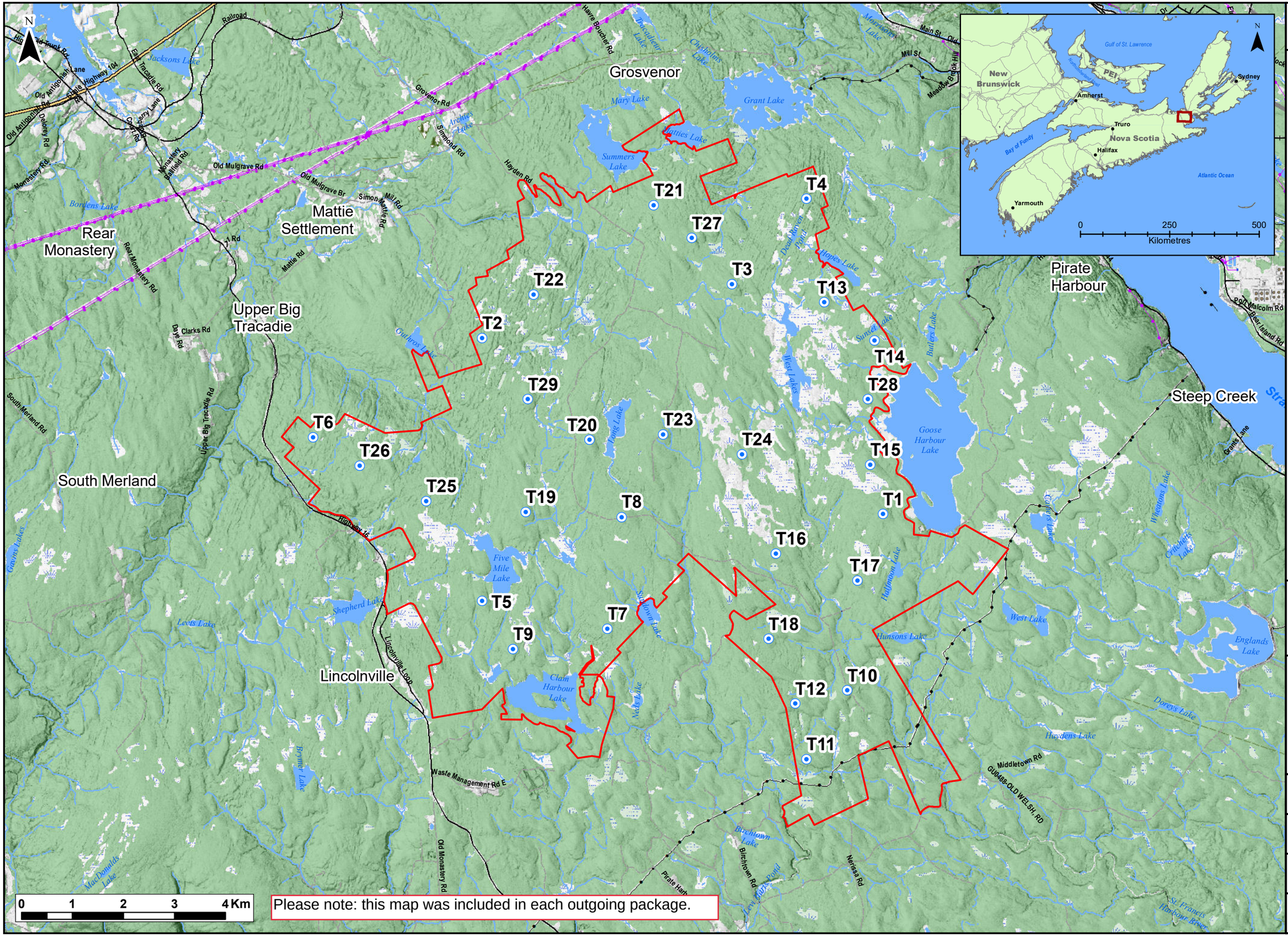
Thank you for your time and consideration of this Project. Upon review, should you have any questions, concerns, or identify a need for additional information, please do not hesitate to contact a member of our team and we will follow up with you directly. Your feedback and support in this matter is most appreciated.

Thank you,

Shawn Duncan, BSc.
President
sduncan@strum.com

Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com



Notes:

1. Data Sources: GeoNOVA. NSTD, NSTIR.
2. Projection: NAD83 UTM Zone 20 North.

Legend:

- Proposed Turbine Location
- Proposed Project Boundary

Transportation

- Trans-Canada Highway
- Highway
- Road
- Unpaved Road

Utilities (line)

- Existing Pipeline
- Existing Transmission Lines

Water Features

- Mapped Stream
- Mapped Indefinite Stream
- Mapped Wet
- Mapped Lakes and Rivers

Port Hawkesbury Paper Wind Site Overview

Strum CONSULTING
*Engineering * Surveying * Environmental*
*Bedford * Antigonish * Moncton * St. John's*

Date: Sept 2022	Project #: 21-7890
Scale: 1:70,000	Drawing #: 1
Drawn By: M. Savelle	
Checked By: S. Duncan	

September 23, 2022

Mr. Brad Wells, CET
Senior Manager, NS Zone Leader
Access Engineering
Bell Aliant
Email: Brad.Wells@bellaliant.ca

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President
sduncan@strum.com

Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

September 23, 2022

Mr. Joel Butler
Bell (BCE Corporate Headquarters)
1 Carrefour Alexander-Graham-Bell
Building A, 4th Floor
Verdun, QC H3E 3B3
Email: Joel.Butler@bellaliant.ca

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Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

Subject: RE: [EXT]Port Hawkesbury Paper Wind Farm Project

Saini, Sunny <sunny.saini@bell.ca> Wed, Sep 28, 6:04 PM
to Butler, Joel

You are viewing an attached message. Strum Consulting Mail can't verify the authenticity of attached messages.

Hello Joel,

Team reviewed various parameters regarding Electromagnetic Interference Study. As per internal discussions, this will not affect the function of our communications equipment. No issues from our end.

Hope this is helpful!

Thank you!

Best Regards,
--

Sunny Saini
Project Manager
M: (587) 229-9812
RAN Support and Solution

September 23, 2022

Canadian Coast Guard
Vessel Traffic Systems Radars
Email: windfarm.coordinator@dfo-mpo.gc.ca

To Whom it may concern,

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Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
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Courtney Morrison <cmorrison@strum.com>

RE: Port Hawkesbury Paper Wind Farm Project

Grégoire, Martin <Martin.Gregoire@dfo-mpo.gc.ca> Mon, Oct 3, 2022 at 4:22 PM
To: Courtney Morrison <cmorrison@strum.com>, General Mailbox <general@strum.com>, Scott Dickey <sdickey@strum.com>, Matthew Savelle <msavelle@strum.com>

Thanks for the files, they work fine with Google Earth.

The proposed wind farm (Port Hawkesbury Paper) is located 14 km away from the Eddy Point radar site. Even though it is located within the 60 km consultation zone, it is located beyond the area covered by the radar. Therefore no interference issues are anticipated.

Regards / Salutations,

Martin Grégoire

Canadian Coast Guard

Garde côtière canadienne

From: Courtney Morrison <cmorrison@strum.com>
Sent: Monday, 3 October, 2022 2:08 PM
To: Grégoire, Martin <Martin.Gregoire@dfo-mpo.gc.ca>
Cc: General Mailbox <general@strum.com>; Scott Dickey <sdickey@strum.com>; Matthew Savelle <msavelle@strum.com>
Subject: Re: Port Hawkesbury Paper Wind Farm Project

Hi Martin,

Thanks for your email. I've attached a zip folder of the shapefiles for this project, which should work for Google Earth. I've cc'd our Geomatics Manager, Matt Savelle, in case you have any issues.

Best,

Courtney Morrison, MREM (she/her)

Community Engagement Coordinator

Note: Out of Office Oct 8 - 16

September 23, 2022

Department of National Defence (DND)
Military Air Defence and Air Traffic Control Radars
Wind Turbines
D Aero Rdns
1 Canadian Air Division
PO Box 17000 Station Forces
Winnipeg MB R3J 3Y5
Email: +WindTurbines@forces.gc.ca

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Thank you for your time and consideration of this Project. Upon review, should you have any questions, concerns, or identify a need for additional information, please do not hesitate to contact a member of our team and we will follow up with you directly. Your feedback and support in this matter is most appreciated.

Thank you,

Shawn Duncan, BSc.
President
sduncan@strum.com

Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

Wind Turbine Submission Form

Turbine information						
Turbine Number	**LAT dd mm ss.ss**	**LONG -ddd mm ss.ss**	**Ground Elevation (meters)**	**Nacelle Height (meters)**	**Rotor Diameter (meters)**	**Total Height (meters)**
Example 1	*60 39 16.59*	*-110 36 14.01*	*126.00*	*100.00*	*96*	*274*
1	45 32 14.456	-61 25 37.703	152	120	150	347
2	45 34 11.101	-61 31 36.663	157	120	150	352
3	45 34 42.075	-61 27 50.028	172	120	150	367
4	45 35 35.422	-61 26 41.37	177	120	150	372
5	45 31 23.953	-61 31 41.028	165.6	120	150	361
6	45 33 9.845	-61 34 11.16	132	120	150	327
7	45 31 5.152	-61 29 48.588	163	120	150	358
8	45 32 15.761	-61 29 33.888	168	120	150	363
9	45 30 53.275	-61 31 14.128	157.1	120	150	353
10	45 30 22.986	-61 26 13.114	133	120	150	328
11	45 29 39.857	-61 26 51.26	138	120	150	333
12	45 30 15.203	-61 27 0.288	143	120	150	338
13	45 34 29.512	-61 26 27.041	160	120	150	355
14	45 34 13.568	-61 25 42.084	163	120	150	358
15	45 32 45.938	-61 25 48.4	151	120	150	346
16	45 31 50.739	-61 27 15.23	159	120	150	354
17	45 31 32.599	-61 26 1.966	142	120	150	337
18	45 30 56.602	-61 27 23.211	156	120	150	351
19	45 32 20.005	-61 31 0.418	173.9	120	150	369
20	45 33 4.991	-61 30 1.583	183	120	150	378
21	45 35 33.229	-61 28 59.48	160	120	150	355
22	45 34 37.936	-61 30 49.496	159	120	150	354
23	45 33 7.741	-61 28 55.048	173	120	150	368
24	45 32 54.09	-61 27 44.07	176	120	150	371
25	45 32 28.159	-61 32 30.077	160.5	120	150	356
26	45 32 51.368	-61 33 29.43	159.8	120	150	355
27	45 35 11.847	-61 28 25.767	172	120	150	367
28	45 33 27.56	-61 25 49.501	150	120	150	345
29	45 33 31.631	-61 30 56.411	162	120	150	357

General Mailbox <general@strum.com>

NAVCAN File #22-4067

1 message

+WindTurbines@forces.gc.ca <+WindTurbines@forces.gc.ca> Tue, Nov 22, 2022 at 2:32 PM
To: general@strum.com

Good day,

We have completed the detailed analysis of your proposed site, referenced in NAVCAN Land Use file# 22-4067 Port Hawkesbury Paper Wind Farm Project near Mulgrave NS. The results of the detailed analysis and subsequent technical and operational impact assessments have confirmed there is likely to be minimal or no interference with DND radar, flight operations, and radio-communication systems.

Therefore, as a result of these findings we have no objections with your project as submitted. Please find the attached Letter of Non-Objection for your records.

Thank you again for your patience during this process.

MWO / Adjum Jeff Bateman, CD

Staff Officer Aerospace Systems 3, 1 Canadian Air Division/Canadian NORAD Region Headquarters

Canadian Armed Forces

jeffrey.bateman2@forces.gc.ca / Tel.: 204-833-2500 ext 2257 / CSN: 257-2257

Officier d'État Major Systèmes Aérospatiales 3, 1re Division Aéreienne du Canada/Région Canadienne du NORAD

Forces armées canadiennes

jeffrey.bateman2@forces.gc.ca / Tel.: 204-833-2500 ext 2257 / CSN: 257-2257

CANR Letter NON Objection 22-4067 Port Hawkesbury.pdf
36K

National Defence / Défense nationale

1 Canadian Air Division HQ
PO BOX 17000 STN Forces
Winnipeg, MB R3J 3Y5

Date of Electronic Signature

Shawn Duncan
President
Strum Consulting
1355 Bedford Highway,
Bedford, Nova Scotia B4A 1C5

LETTER OF NON-OBJECTION FOR STRUM CONSULTING

Dear Mr. Duncan

Thank you for your patience on this matter and for considering DND radar, airport facilities, and radio-communication systems in your project development process. We have completed the detailed analysis of your proposed site, referenced in NAVCAN Land Use file# 22-4067 Port Hawkesbury Paper Wind Farm Project near Mulgrave, NS. The results of the detailed analysis and subsequent technical and operational impact assessments have confirmed there is likely to be minimal or no interference with DND radar, flight operations, and radio-communication systems. Therefore, as a result of these findings we have no objections with your project as submitted. If however, the layout were to change/move, please re-submit that proposal for another assessment.

The concurrence for this site is valid for 24 months from date of this correspondence. If the project should be cancelled or delayed during this timeframe please advise the point of contact. It should be noted that each submission is assessed on a case by case basis and as such, concurrence on this submission in no way constitutes a concurrence for similar projects in the same area, nor does it indicate that similar concurrence might be offered in another region. The issuance of this Letter of Non-Objection shall not constitute a waiver or alienation of any existing or future legal rights of the DND/CAF nor shall it be construed to create any exemptions, indemnification, approvals, rights, acceptances in favour of Strum Consulting.

DND/CAF expressly reserves its rights to take legal action or seek remedy for any and all liability, loss, harm, degradation of services or equipment, litigation costs, damages, judgements or expenses that arise from the adverse effects, whether incidental, indirect or causal, of the referenced NAVCAN Land Use file# 22-4067 Port Hawkesbury Paper Wind Farm Project near Mulgrave, NS. upon the DND/CAF radars, equipment and its provision of Air Traffic Services.

Canada

At present DND is working with Transport Canada to make obstruction lighting compliance with Night Vision Goggles (NVG) mandatory. At present DND cannot stipulate that proponents of wind turbine farms utilize NVG compliant lighting. However, as you can imagine, the safety of our aircrews is a top priority, and as such, we ask that you consider lighting your turbines with NVG compliant lighting so that they are visible to pilots during NVG operations.

I trust that you will find this satisfactory. If you have any technical questions or concerns regarding any aspect of this investigation, please contact the undersigned.

Kind regards.

A.A. Lockerby
Lieutenant-Colonel
Senior Staff Officer Aerospace
Capabilities and Readiness

September 23, 2022

Mr. Andrew MacVicar
Eastlink Inc.
P.O. Box 8660, Station "A"
Halifax, NS B3K 5M3
Email: CEO@corp.eastlink.ca

Dear Mr. MacVicar,

Re: Port Hawkesbury Paper Wind Farm Project
Mulgrave, Nova Scotia

Strum Consulting, a Nova Scotia-based environmental and engineering consulting firm, has been retained by Port Hawkesbury Paper (our client) to support with the proposed Port Hawkesbury Paper Wind Farm (the "Project") within Guysborough County, Nova Scotia.

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4	621300	5050024	45.59317279	-61.44482503	177	120	75	372
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6	611635	5045350	45.5527347	-61.56976655	132	120	75	327
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11	621298	5039047	45.49440482	-61.44757214	138	120	75	333
12	621081	5040134	45.50422318	-61.45008	143	120	75	338
13	621650	5047996	45.57486436	-61.44084471	160	120	75	355
14	622634	5047253	45.57043568	-61.42835655	163	120	75	358
15	622550	5044816	45.54609383	-61.43011124	151	120	75	346
16	620700	5043076	45.53076085	-61.45423048	159	120	75	354
17	622300	5042547	45.52572198	-61.43387953	142	120	75	337
18	620559	5041402	45.51572291	-61.45644761	156	120	75	351
19	615799	5043887	45.53889028	-61.51678265	174	120	75	369
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Thank you,

Shawn Duncan, BSc.
President
sduncan@strum.com

Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

September 23, 2022

Environment Canada
Weather Radars
Email: weatherradars@ec.gc.ca

To Whom it may concern,

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Mulgrave, Nova Scotia

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Thank you for your time and consideration of this Project. Upon review, should you have any questions, concerns, or identify a need for additional information, please do not hesitate to contact a member of our team and we will follow up with you directly. Your feedback and support in this matter is most appreciated.

Thank you,

Shawn Duncan, BSc.
President
sduncan@strum.com

Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

Meteorological Service of Canada
Service météorologique du Canada

Oct. 7th, 2022

Courtney Morrison
Strum Consulting

Subject: Port Hawkesbury Paper Wind Farm Project – Updated Preliminary Analysis of Impacts on ECCC Radars (Marion Bridge Radar) – no *objections to the current proposal.*

Dear Ms. Morrison,

Thank you for contacting the Meteorological Service of Canada, a branch of Environment and Climate Change Canada (ECCC), regarding your wind energy intentions.

When assessing the potential impact of all new wind farm projects, ECCC's main goal is to avoid significant interference that would hinder the timely and accurate production of watches and warnings of significant weather.

We have reviewed the information you have provided to us via email on Sept. 26, 2022, for the proposed Port Hawkesbury Paper Wind Farm Project (located 104 km away from ECCC's Marion Bridge Radar - Marion Bridge, NS). Our preliminary assessment of the proposed project indicates that any potential interference that may be created, should not be severe for our radar operations. Consequently, *we do not have objections to the current proposal*.

If your plans are modified in any manner (e.g. number of turbines, height, placement or materials) this analysis would no longer be valid and an updated analysis must be conducted. Please contact us at: radarsmeteo-weatherradars@ec.gc.ca

Thank you for your ongoing cooperation and we wish you success with your wind energy project.

Sincerely,

Robert Daigle
Directeur, Surveillance atmosphérique et services de données
Service Météorologique du Canada, Environnement et Changement Climatique Canada
Director, Atmospheric Monitoring and Data Services
Meteorological Service of Canada, Environment and Climate Change Canada

September 23, 2022

Guysborough Police
55 Queen Street
Guysborough, NS B0H 1N0

To Whom it may concern,

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Mulgrave, Nova Scotia

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President
sduncan@strum.com

Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

September 23, 2022

Industry Canada
Email: ic.spectrumnsd-spectredne.ic@canada.ca

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Mulgrave, Nova Scotia

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22	615957	5048148	45.57720452	-61.51374893	159	120	75	354
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24	620037	5045019	45.5483582	-61.46224163	176	120	75	371
25	613850	5044103	45.54115525	-61.54168805	161	120	75	356
26	612550	5044796	45.54760235	-61.55817506	160	120	75	355
27	619052	5049253	45.58662417	-61.47382408	172	120	75	367
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Thank you for your time and consideration of this Project. Upon review, should you have any questions, concerns, or identify a need for additional information, please do not hesitate to contact a member of our team and we will follow up with you directly. Your feedback and support in this matter is most appreciated.

Thank you,

Shawn Duncan, BSc.
President
sduncan@strum.com

Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

General Mailbox <general@strum.com>

RE: Port Hawkesbury Paper Wind Farm Project

1 message

DuChene, Bethany (ISED/ISDE) <bethany.duchene@ised-isde.gc.ca> Tue, Oct 25, 2022 at 3:52 PM
To: "general@strum.com" <general@strum.com>

Good afternoon,

I have reviewed the details of this proposal. My comments are as follows:

- The proposed turbines are within 15km of an analog TV station in Port Hawkesbury, and are located within the station's secondary service contour. As per section 3.2 of the RABC/CanWEA guidelines document, it is recommended that a reception analysis is performed as new turbines may affect reception in the area.
- Please ensure all agencies listed in Table 1 are consulted with - several are operating in the area of the proposed wind farm.

Regards,

Bethany DuChene

Spectrum Management Officer, STS-Atlantic and Ontario Regions
Innovation, Science and Economic Development Canada / Government of Canada
bethany.duchene@ised-isde.gc.ca / Tel: 902-499-9258 / TTY: 1-866-694-8389

Agente de gestion du spectre, SST-Regions de l'Atlantique et de l'Ontario
Innovation, Sciences et Développement économique Canada / Gouvernement du Canada
bethany.duchene@ised-isde.gc.ca / Tél. : 902-499-9258 / ATS : 1-866-694-8389

From: General Mailbox <general@strum.com>
Sent: September 26, 2022 9:48 AM
To: ic.spectrumnsd-spectredne.ic@canada.ca
Cc: Scott Dickey <sdickey@strum.com>
Subject: Port Hawkesbury Paper Wind Farm Project

Good morning,

Please find attached a notification letter for the proposed Port Hawkesbury Paper Wind Farm development located near the community of Lincolnville within Guysborough County, Nova Scotia. A confirmation of receipt would be greatly appreciated. For questions or comments, kindly contact the undersigned.

Thank you,

Courtney Morrison (she/her)

Community Engagement Coordinator

Strum CONSULTING

Engineering • Surveying • Environmental

Bedford • Antigonish • Moncton • St. John's

Email: general@strum.com

Tel: 902.835.5560 (24/7)
Fax: 902.835.5574

Cell: 902.293.4914 (call/text)

www.strum.com

September 23, 2022

Mulgrave Volunteer Fire Department
385 Murray Street
Mulgrave, NS B0E 2G0

To whom it may concern,

Re: Port Hawkesbury Paper Wind Farm Project
Mulgrave, Nova Scotia

Strum Consulting, a Nova Scotia-based environmental and engineering consulting firm, has been retained by Port Hawkesbury Paper (our client) to support with the proposed Port Hawkesbury Paper Wind Farm (the "Project") within Guysborough County, Nova Scotia.

On behalf of our client, Strum is conducting an electromagnetic interference ("EMI") study on the placement of 29 wind turbines near the community of Mulgrave, Nova Scotia.

As an aspect of our investigation, we would like to formally consult with you on the Project and provide a discussion opportunity with respect to the proposed turbine layout.

More specifically, Strum is soliciting feedback, details, and specifications of existing operations from stakeholders to determine if there would be any potential interference with your existing operations as a result of the proposed wind turbine installations. The turbine specifications are as follows:

- Total of 29 turbines
- Tip height of each turbine is 195 metres
- Hub height of each turbine is 120 metres
- 3-blade rotor; turbine blade sweep diameter is 150 metres (blade length is 75 metres)

A map showing the proposed locations of the turbines is attached (Drawing 1); and a summary of the proposed turbine details, including coordinates and elevations, is provided in Table 1, below.

Table 1: Proposed Turbine Locations & Specifications

Turbine ID	Easting (UTM Z20)	Northing (UTM Z20)	Latitude	Longitude	Base of Turbine Elevation (m)	Turbine Hub Height (m)	Blade Length (m)	Total Elevation (m)
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Thank you,

Shawn Duncan, BSc.
President
sduncan@strum.com

Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

NAV CANADA
Serving a world in motion
Au service d'un monde en mouvement
navcanada.ca

Land Use Proposal Submission Form – General

NAV CANADA file N°./ Ref N°	Transport Canada File N° / Ref N°

General Information

Company/Owner Name: Port Hawkesbury Paper Wind		Contact Person: Mark Savory	
Address: 120 Pulp Mill Rd		City: Port Hawkesbury	Prov: NS	Postal Code: B9A 1A1
Tel: 902 237 7321	Cell:	Email: mark.savory@porthawkesburypaper.com	
Applicant: Strum Consulting		Contact Person: Scott Dickey	
Address: Railside, 1355 Bedford Highway		City: Bedford	Prov: NS	Postal Code: B4A 1C5
Tel: 902-835-5560	Cell:	Email: sdickey@strum.com	

Details of Proposal

- Please provide the data in the highest degree of accuracy available.
- For geographic coordinates, provide up to four (4) decimal places of a second.
- For ground elevation and tower height, provide up to four (4) decimal places.

Additional document(s) to be submitted:

- **Map:** either 1:50,000 Topographical map (http://atlas.gc.ca/site/english/toporama/index.html) or a Google Earth map/kmz location of the proposed structure needs to be clearly marked; paper or digital surveys are always welcomed.

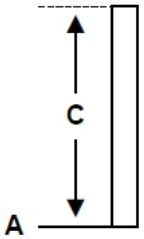
Project Identification: Port Hawkesbury Wind Project Street Address, etc.: See attached for location details	Nearest Town: Lincolnville Province: NS

Geographic Coordinates of Site in NAD 83: Lat. N 45 (Degrees) / 33 (Minutes) / 7.741 (Seconds) Long. W -61 (Degrees) / 28 (Minutes) / 55.048 (Seconds) **For submissions containing more than one set of coordinates, please complete the *Multiple Obstacle Template* and return in Excel format.**
(Examples: Linear Structures, Wind Farms, Building Corner Coordinates, etc.)

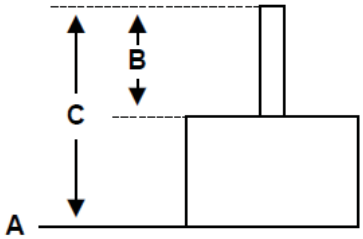
Type of Structure: Wind Farm

New Structure? ☒Yes ☐No

Structure alone



Structure with an addition



A. Ground Elevation (Above Sea Level)	132 - 183	☐ft ☒m
B. Structure Height Addition	120	☐ft ☒m
C. Structure Total Height (Above Ground Level) **Include all appurtenances**	195	☐ft ☒m
Total Height (Above Sea Level) (**A** + **C**)	327- 378	☐ft ☒m

Cranes to be used? ☒Yes ☐ No
If Yes: Crane details shall be submitted separately using the Land Use Proposal Submission Form – Crane(s).

Approximate Duration of Construction: 12 Months

Proposed Construction Start Date: 15-Jan-23

If Temporary Structure, indicate Removal Date: 15-Jan-48

Comments: See attached letter and drawing for additional details. Once transmission line and crane data known, details will be submitted separately. 1:70,000 scale drawing provided to detail Project boundary.

Known co-location with/on NAV CANADA Site: ☐Yes ☒No

A Third-Party Submission Form may be required for complex applications, fee applicable.

Applicant/Representative Signature	**Print Name**	**Date**
	Scott Dickey	11-Oct-22

Acknowledgement of reading *Detailed Land Use Proposal Guidelines* (Submitter's Initials) SD

For a detailed description on NAV CANADA's requirements and additional information, refer to the NAV CANADA website at www.navcanada.ca > Aeronautical Information > Land Use Program.

NAV CANADA's land use evaluation is based on information known as of the date of this letter and is valid for a period of up to 18 months, subject to any legislative changes impacting land use submissions. Our assessment is limited to the impact of the proposed physical structure on the air navigation system and installations; it neither constitutes nor replaces any approvals or permits required by Transport Canada, other Federal Government departments, Provincial or Municipal land use authorities or any other agency from which approval is required. Innovation, Science and Economic Development Canada addresses any spectrum management issues that may arise from your proposal and consults with NAV CANADA Engineering as deemed necessary.

Please submit by email to landuse@navcanada.ca

October 11, 2022

NAV CANADA
Email: landuse@navcanada.ca

To Whom it may concern,

Re: Port Hawkesbury Paper Wind Farm Project
Mulgrave, Nova Scotia

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Thank you,

Shawn Duncan, BSc.
President
sduncan@strum.com

Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

Courtney Morrison <cmorrison@strum.com>

22-4067 Port Hawkesbury Paper Wind Farm Project

1 message

Land Use <LandUse@navcanada.ca> Thu, Nov 3, 2022 at 3:28 PM
To: General Mailbox <general@strum.com>

Hi / Bonjour

La version française figure ci-dessous / French Text Follows

Thank you for your submission, your Land Use file number is 22-4067. Please reference this number for all transactions on this submission.

At NAV CANADA, we are currently working on different ways to diminish our turnaround times. Please note that we currently have the following time frame published on our website:

Processing times vary, but NAV CANADA attempts to respond within 8 to 12 weeks of receiving a complete proposal. The accuracy and completeness of the initial documentation and your cooperation and promptness in remedying deficiencies or inaccuracies will help to expedite the review process.

If you have any questions or would like an update of your file, please do not hesitate to contact us.

Merci pour votre soumission. Votre numéro de dossier d'utilisation de terrain est 22-4067. Veuillez mentionner ce numéro pour toutes les transactions reliées sur cette soumission.

Chez NAV CANADA, nous travaillons actuellement sur différentes façons de réduire nos délais d'exécution. Veuillez noter que nous avons actuellement le délai suivant publié sur notre site Web:

Les délais de traitement varient selon l'exhaustivité et l'exactitude des renseignements soumis et selon la complexité du projet. En général, NAV CANADA tente de répondre dans un délai de 8 à 12 semaines.

N'hésitez pas à nous contacter si vous avez des questions ou souhaitez une mise à jour de votre dossier.

Regards / Merci,

Jean Séguin
Land Use Specialist | Spécialiste d'utilisation de terrains
NAV CANADA
Group: LandUse@navcanada.ca
www.navcanada.ca

From: General Mailbox <general@strum.com>
Sent: October 11, 2022 12:40 PM
To: Land Use <LandUse@navcanada.ca>
Subject: [EXT] Port Hawkesbury Paper Wind Farm Project

Strum CONSULTING

General Mailbox <general@strum.com>

22-4067 LUF Port Hawkesbury Wind Project

1 message

Aldana-Cameron, Natalia <Natalia.Aldana-Cameron@navcanada.ca> Fri, Dec 2, 2022 at 10:15 AM
To: "general@strum.com" <general@strum.com>

Hello,

Your Land Use file number for this project is: 22-4067 – I am the Land use specialist assessing your file.

Could you please make the necessary correction in the spreadsheet and send it back to me.

NAV CANADA Serving a world in motion / Au service d'un monde en mouvement navcanada.ca

Z-LDU-100 Version 20.5 30 July 2020

Obstacle Information for Assessment

Obstacle ID	LAT dd mm ss.ss	LONG -ddd mm ss.ss	Ground Elevation (Feet)	Structure Height (Feet)	Total Height (Feet)	Crane Swing Radius (Feet)	Upon completion: Lighted Y/N	Upon completion: Painted Y/N	Upon completion: Construction Date
Example 1	60 39 16.59	-110 36 14.01	2162.5001	463.0001	2625.5002		Y	N	15-Jun-07
1	45 32 14.456	-61 25 37.703	498.6877	639.7638	1138.4514				
2	45 34 11.101	-61 31 36.663	515.0919	639.7638	1154.8556				
3	45 34 42.075	-61 27 50.028	564.3045	639.7638	1204.0682				
4	45 35 35.422	-61 26 41.37	580.7087	639.7638	1220.4724				
5	45 31 23.953	-61 31 41.028	543.3071	639.7638	1183.0709	544.6194	166m		
6	45 33 9.845	-61 34 11.16	433.0709	639.7638	1072.8346				
7	45 31 5.152	-61 29 48.588	534.7769	639.7638	1174.5407				
8	45 32 15.761	-61 29 33.888	551.1811	639.7638	1190.9449				
9	45 30 53.275	-61 31 14.128	515.4199	639.7638	1155.1837	515.0919	157m		
10	45 30 22.986	-61 26 13.114	436.3517	639.7638	1076.1155				
11	45 29 39.857	-61 26 51.26	452.7559	639.7638	1092.5197				
12	45 30 15.203	-61 27 0.288	469.1601	639.7638	1108.9239				
13	45 34 29.512	-61 26 27.041	524.9344	639.7638	1164.6982				
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15	45 32 45.938	-61 25 48.4	495.4068	639.7638	1135.1706				
16	45 31 50.739	-61 27 15.23	521.6535	639.7638	1161.4173				
17	45 31 32.599	-61 26 1.966	465.8793	639.7638	1105.6430				
18	45 30 56.602	-61 27 23.211	511.8110	639.7638	1151.5748				
19	45 32 20.005	-61 31 0.418	570.5381	639.7638	1210.3018	570.8661	174m		
20	45 33 4.991	-61 30 1.583	600.3937	639.7638	1240.1575				
21	45 35 33.229	-61 28 59.48	524.9344	639.7638	1164.6982				
22	45 34 37.936	-61 30 49.496	521.6535	639.7638	1161.4173				
23	45 33 7.741	-61 28 55.048	567.5853	639.7638	1207.3491				
24	45 32 54.09	-61 27 44.07	577.4278	639.7638	1217.1916				
25	45 32 28.159	-61 32 30.077	526.5748	639.7638	1166.3386	528.2152	161m		
26	45 32 51.368	-61 33 29.43	524.2782	639.7638	1164.0420	524.9344	160m		
27	45 35 11.847	-61 28 25.767	564.3045	639.7638	1204.0682				
28	45 33 27.56	-61 25 49.501	492.1260	639.7638	1131.8898				
29	45 33 31.631	-61 30 56.411	531.4961	639.7638	1171.2598				

Please revise the lines that are highlighted and send a new spreadsheet to me with the new changes

please see the highlighted numbers inside the red rectangle conversion from meters to feet the correct ones.

Thank You

Best regards,

Natalia Aldana

Land Use Specialist | Spécialiste d'utilisation de terrains

AERONAUTICAL INFORMATION MANAGEMENT (AIM) NAV CANADA

Personal: Natalia.Aldana-Cameron@navcanada.ca

Group: LandUse@navcanada.ca

1601 avenue Tom Roberts Avenue Ottawa, ON K1V 1E5

T. (613) 248-3751

www.navcanada.ca

From: General Mailbox <general@strum.com>
Sent: October 11, 2022 12:40 PM
To: Land Use <LandUse@navcanada.ca>
Subject: 22-4067 LUF

Good afternoon,

Please find attached a notification letter for the proposed Port Hawkesbury Paper Wind Farm development located near the community of Lincolnville within Guysborough County, Nova Scotia. A confirmation of receipt would be greatly appreciated. For questions or comments, kindly contact the undersigned.

Thank you,

Courtney Morrison, MREM (she/her)

Community Engagement Coordinator

Engineering • Surveying • Environmental

Bedford • Antigonish • Moncton • St. John's

Head Office:
Railside, 1355 Bedford Highway
Bedford, NS B4A 1C5

Tel: 902.835.5560 (24/7)
Fax: 902.835.5574

Cell: 902.293.4914 (call/text)

www.strum.com

3 attachments

221011 EMI Study Notification PHP Wind Farm - NavCAN.pdf
1672K

Signed F-LDU-100 Land Use Proposal Submission Form - General.pdf
142K

PHPW z-ldu-100-multiple-obstacle_Wind Turbines.xlsx
85K

September 23, 2022

Ms. Heather Allen-Johnson
NCS Managed Services
Email: heather@ncsnetwork.net

Dear Ms. Allen-Johnson,

Re: Port Hawkesbury Paper Wind Farm Project
Mulgrave, Nova Scotia

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4	621300	5050024	45.59317279	-61.44482503	177	120	75	372
5	614950	5042141	45.52332024	-61.52806344	166	120	75	361
6	611635	5045350	45.5527347	-61.56976655	132	120	75	327
7	617400	5041606	45.5180978	-61.49683013	163	120	75	358
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9	615551	5041205	45.5147986	-61.52059098	157	120	75	352
10	622100	5040394	45.5063849	-61.43697621	133	120	75	328
11	621298	5039047	45.49440482	-61.44757214	138	120	75	333
12	621081	5040134	45.50422318	-61.45008	143	120	75	338
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Thank you,

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President
sduncan@strum.com

Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

September 23, 2022

Port Hawkesbury Police
8 Paint Street
Port Hawkesbury, NS B9A 3J6

To whom it may concern,

Re: Port Hawkesbury Paper Wind Farm Project
Mulgrave, Nova Scotia

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President
sduncan@strum.com

Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

September 23, 2022

Port Hawkesbury Volunteer Fire Department
309 Hiram St,
Port Hawkesbury, NS B9A 2R4

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Re: Port Hawkesbury Paper Wind Farm Project
Mulgrave, Nova Scotia

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President
sduncan@strum.com

Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

September 23, 2022

Royal Canadian Mounted Police
Email: Windfarm_Coordinator@rcmp-grc.gc.ca

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Mulgrave, Nova Scotia

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Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

Protected A

Courtney Morrison
Strum

GV 1620-7-3

October 03, 2022

SUBJECT: Port Hawkesbury Paper Wind Farm Project

Ref. # 2022-09-26_0012

Greetings,

Reference is made to your email request dated September 26, 2022, on your plans for the wind farm project called “Port Hawkesbury Paper” in the province of Nova Scotia.

According to the Radio Advisory Board of Canada (RABC) and Canadian Wind Energy Association (CanWea), the radius of the consultation zone for fixed Land Mobile Radio (LMR) sites is 1 km. The RCMP currently have no “owned” radio towers or Point-To-Point (PTP) microwave links in this area.

However, the **surrounding area is receiving radio coverage from TMR2** operated as a leased system through Bell Canada. We do recommend that you request coordination with Bell who are acting on behalf of RCMP in the province of Nova Scotia with leased towers.

Should you require additional information, please direct any questions or concerns to the undersigned.

Sincerely,

Phil Tanguay

Wind Farm Coordinator, National Radio Services
Royal Canadian Mounted Police (RCMP) / Government of Canada
windfarm_coordinator@rcmp-grc.gc.ca / Tel: 343-552-1290

Coordonnateur parc éolien, Services de radio nationaux
Gendarmerie royale du Canada (GRC) / Gouvernement du Canada
windfarm_coordinator@rcmp-grc.gc.ca / Tél: 343-552-1290

September 23, 2022

Rogers Communications Inc.
333 Bloor Street East, 10th Floor
Toronto, ON M4W 1G9

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Manager, Environmental Sciences
sdickey@strum.com

September 23, 2022

Seaside Communications
1318 Grand Lake Road
P.O. Box # 4558
Reserve Mines, NS B1E 1L2

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10	622100	5040394	45.5063849	-61.43697621	133	120	75	328
11	621298	5039047	45.49440482	-61.44757214	138	120	75	333
12	621081	5040134	45.50422318	-61.45008	143	120	75	338
13	621650	5047996	45.57486436	-61.44084471	160	120	75	355
14	622634	5047253	45.57043568	-61.42835655	163	120	75	358
15	622550	5044816	45.54609383	-61.43011124	151	120	75	346
16	620700	5043076	45.53076085	-61.45423048	159	120	75	354
17	622300	5042547	45.52572198	-61.43387953	142	120	75	337
18	620559	5041402	45.51572291	-61.45644761	156	120	75	351
19	615799	5043887	45.53889028	-61.51678265	174	120	75	369
20	617049	5045299	45.55138644	-61.50043962	183	120	75	378
21	618309	5049899	45.5925636	-61.48318893	160	120	75	355
22	615957	5048148	45.57720452	-61.51374893	159	120	75	354
23	618490	5045411	45.5521504	-61.48195776	173	120	75	368
24	620037	5045019	45.5483582	-61.46224163	176	120	75	371
25	613850	5044103	45.54115525	-61.54168805	161	120	75	356
26	612550	5044796	45.54760235	-61.55817506	160	120	75	355
27	619052	5049253	45.58662417	-61.47382408	172	120	75	367
28	622501	5046100	45.55765546	-61.43041707	150	120	75	345
29	615845	5046099	45.55878628	-61.51566976	162	120	75	357

Thank you for your time and consideration of this Project. Upon review, should you have any questions, concerns, or identify a need for additional information, please do not hesitate to contact a member of our team and we will follow up with you directly. Your feedback and support in this matter is most appreciated.

Thank you,

Shawn Duncan, BSc.
President
sduncan@strum.com

Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

September 23, 2022

Mr. Johnny Duykers
Fire Chief
Tracadie & District Volunteer Fire Department
995 NS-16
Monastery, NS B0H 1W0
Email: jduykers@ns.sympatico.ca

Dear Mr. Duykers,

Re: Port Hawkesbury Paper Wind Farm Project
Mulgrave, Nova Scotia

Strum Consulting, a Nova Scotia-based environmental and engineering consulting firm, has been retained by Port Hawkesbury Paper (our client) to support with the proposed Port Hawkesbury Paper Wind Farm (the "Project") within Guysborough County, Nova Scotia.

On behalf of our client, Strum is conducting an electromagnetic interference ("EMI") study on the placement of 29 wind turbines near the community of Mulgrave, Nova Scotia.

As an aspect of our investigation, we would like to formally consult with you on the Project and provide a discussion opportunity with respect to the proposed turbine layout.

More specifically, Strum is soliciting feedback, details, and specifications of existing operations from stakeholders to determine if there would be any potential interference with your existing operations as a result of the proposed wind turbine installations. The turbine specifications are as follows:

- Total of 29 turbines
- Tip height of each turbine is 195 metres
- Hub height of each turbine is 120 metres
- 3-blade rotor; turbine blade sweep diameter is 150 metres (blade length is 75 metres)

A map showing the proposed locations of the turbines is attached (Drawing 1); and a summary of the proposed turbine details, including coordinates and elevations, is provided in Table 1, below.

Table 1: Proposed Turbine Locations & Specifications

Turbine ID	Easting (UTM Z20)	Northing (UTM Z20)	Latitude	Longitude	Base of Turbine Elevation (m)	Turbine Hub Height (m)	Blade Length (m)	Total Elevation (m)
1	622801	5043849	45.53734885	-61.42713979	152	120	75	347
2	614950	5047301	45.56975035	-61.52685091	157	120	75	352
3	619844	5048349	45.57835411	-61.46389666	172	120	75	367
4	621300	5050024	45.59317279	-61.44482503	177	120	75	372
5	614950	5042141	45.52332024	-61.52806344	166	120	75	361
6	611635	5045350	45.5527347	-61.56976655	132	120	75	327
7	617400	5041606	45.5180978	-61.49683013	163	120	75	358
8	617678	5043791	45.53771148	-61.49274679	168	120	75	363
9	615551	5041205	45.5147986	-61.52059098	157	120	75	352
10	622100	5040394	45.5063849	-61.43697621	133	120	75	328
11	621298	5039047	45.49440482	-61.44757214	138	120	75	333
12	621081	5040134	45.50422318	-61.45008	143	120	75	338
13	621650	5047996	45.57486436	-61.44084471	160	120	75	355
14	622634	5047253	45.57043568	-61.42835655	163	120	75	358
15	622550	5044816	45.54609383	-61.43011124	151	120	75	346
16	620700	5043076	45.53076085	-61.45423048	159	120	75	354
17	622300	5042547	45.52572198	-61.43387953	142	120	75	337
18	620559	5041402	45.51572291	-61.45644761	156	120	75	351
19	615799	5043887	45.53889028	-61.51678265	174	120	75	369
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Thank you for your time and consideration of this Project. Upon review, should you have any questions, concerns, or identify a need for additional information, please do not hesitate to contact a member of our team and we will follow up with you directly. Your feedback and support in this matter is most appreciated.

Thank you,

Shawn Duncan, BSc.
President
sduncan@strum.com

Scott Dickey, BSc. (Hons), MREM
Manager, Environmental Sciences
sdickey@strum.com

APPENDIX O: SHADOW FLICKER

Licensed user:
Strum Consulting
1355 Bedford Highway
CA-BEDFORD B4A1C5
902.835.5560 (24/7)
Eric Johnson / ejohnson@strum.com
Calculated:
2023-01-16 5:05 PM/3.5.552

SHADOW - Main Result

Calculation: Vestas - Jan 2023 - Shadow - Real Case

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

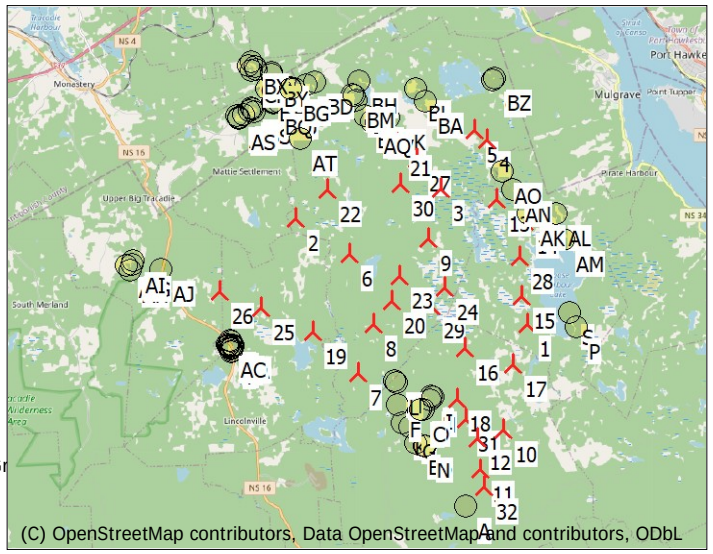
Sunshine probability S (Average daily sunshine hours) [CHARLOTTETOWN]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3.37	4.18	4.42	5.04	6.34	7.54	7.95	7.19	5.76	3.98	2.63	2.31

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Elevation Grid Data Object: Pirate Harbour - August 2022_EMDGr
Obstacles used in calculation
Receptor grid resolution: 1.0 m

All coordinates are in
UTM (north)-NAD83(NSRS/CSRS) (US+CA GPS meas. at curr. year), GRS80 Zone: 20



Scale 1:250,000

New WTG Shadow receptor

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	622,768	5,043,893	162.7	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
2	615,029	5,047,261	155.5	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
3	619,844	5,048,348	172.8	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
4	621,302	5,049,972	174.3	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
5	620,898	5,050,285	170.3	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
6	616,839	5,046,106	181.3	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
7	617,181	5,042,189	162.3	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
8	617,665	5,043,802	178.0	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
9	619,430	5,046,660	181.7	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
10	622,063	5,040,422	142.0	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
11	621,294	5,039,075	140.6	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
12	621,199	5,040,109	149.2	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
13	621,650	5,047,995	167.9	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
14	622,605	5,047,281	165.8	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
15	622,550	5,044,815	165.0	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
16	620,700	5,043,075	164.8	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
17	622,300	5,042,546	152.4	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
18	620,509	5,041,401	160.6	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
19	615,685	5,043,510	171.9	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
20	618,273	5,044,587	184.2	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
21	618,361	5,049,776	170.8	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
22	616,057	5,048,219	160.3	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
23	618,491	5,045,410	187.1	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
24	620,008	5,045,055	180.2	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
25	613,929	5,044,260	162.6	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
26	612,550	5,044,795	159.8	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
27	619,017	5,049,289	174.2	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
28	622,476	5,046,111	155.6	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
29	619,585	5,044,467	180.2	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
30	618,499	5,048,444	176.3	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
31	620,794	5,040,750	157.9	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
32	621,457	5,038,480	136.7	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0

Licensed user:
Strum Consulting
1355 Bedford Highway
CA-BEDFORD B4A1C5
902.835.5560 (24/7)
Eric Johnson / ejohnson@strum.com
Calculated:
2023-01-16 5:05 PM/3.5.552

SHADOW - Main Result

Calculation: Vestas - Jan 2023 - Shadow - Real Case

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
A	620,829	5,037,842	114.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
B	619,233	5,040,980	132.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
C	619,274	5,040,998	132.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
D	619,377	5,040,999	139.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
E	619,164	5,039,914	137.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
F	618,520	5,041,156	149.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
G	618,938	5,040,438	143.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
H	619,581	5,041,329	149.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
I	619,689	5,041,434	157.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
J	619,628	5,041,473	154.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
K	618,685	5,040,575	144.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
L	618,476	5,041,898	153.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
M	618,431	5,041,959	151.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
N	619,424	5,039,800	127.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
O	619,474	5,039,804	122.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
P	624,390	5,043,819	145.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
Q	612,949	5,043,158	135.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R	612,922	5,043,189	137.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
S	624,185	5,044,297	140.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
T	612,985	5,042,820	142.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
U	613,011	5,042,850	141.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
V	612,970	5,042,896	139.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
W	612,972	5,042,922	140.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
X	612,940	5,042,960	140.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
Y	612,885	5,042,985	143.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
Z	613,050	5,042,990	140.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AA	613,012	5,043,011	140.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AB	613,030	5,043,021	139.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AC	612,881	5,043,022	143.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AD	612,899	5,043,031	141.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AE	612,852	5,043,060	145.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AF	609,461	5,045,568	133.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AG	609,654	5,045,625	115.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AH	609,598	5,045,423	121.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AI	609,662	5,045,759	120.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AJ	610,615	5,045,497	98.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AK	622,742	5,047,563	163.1	0.5	0.5	1.5	90.0	"Green house mode"	2.0
AL	623,659	5,047,576	144.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AM	623,925	5,046,705	141.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AN	622,203	5,048,318	158.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AO	621,827	5,048,926	157.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AP	621,836	5,048,941	157.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AQ	617,498	5,050,497	137.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AR	613,104	5,050,505	66.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AS	613,082	5,050,523	68.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AT	615,138	5,049,884	124.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AU	613,049	5,050,602	64.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AV	617,662	5,050,461	139.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AW	613,427	5,050,782	0.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AX	613,538	5,050,835	0.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AY	613,509	5,050,849	0.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AZ	616,971	5,051,190	138.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BA	619,275	5,051,207	136.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BB	614,451	5,051,482	127.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BC	614,481	5,051,498	127.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BD	615,577	5,051,764	121.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BE	613,988	5,051,516	117.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BF	614,922	5,051,522	129.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BG	614,796	5,051,533	126.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BH	617,060	5,051,841	140.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BI	614,792	5,051,554	126.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BJ	613,251	5,050,644	69.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BK	618,047	5,050,653	138.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BL	618,935	5,051,599	138.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BM	616,914	5,051,363	136.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0

To be continued on next page...

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2023-01-16 5:05 PM/3.5.552

SHADOW - Main Result

Calculation: Vestas - Jan 2023 - Shadow - Real Case

...continued from previous page

No.	Easting	Northing	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
BN	617,259	5,050,682	136.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BO	614,235	5,051,042	119.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BP	616,830	5,051,368	137.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BQ	614,214	5,051,062	119.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BR	613,589	5,050,729	83.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BS	613,607	5,050,734	82.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BT	614,239	5,051,082	118.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BU	614,411	5,051,084	121.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BV	614,251	5,051,092	117.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BW	615,285	5,051,678	121.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BX	613,488	5,052,383	96.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BY	614,163	5,051,998	127.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BZ	621,520	5,052,000	125.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CA	613,601	5,052,224	95.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CB	613,605	5,052,235	95.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CC	614,170	5,052,036	127.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CD	613,385	5,052,274	90.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CE	613,465	5,052,108	92.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CF	613,490	5,052,115	92.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CG	613,474	5,052,120	92.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CH	613,616	5,052,137	97.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CI	621,476	5,051,932	123.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CJ	613,467	5,052,382	95.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0

Calculation Results

Shadow receptor

Shadow, expected values

No.	Shadow hours per year [h/year]
A	0:00
B	12:51
C	6:39
D	18:54
E	10:01
F	2:18
G	6:56
H	18:05
I	17:44
J	15:32
K	4:35
L	7:02
M	7:21
N	5:15
O	6:00
P	8:14
Q	0:00
R	0:00
S	7:28
T	0:00
U	0:00
V	0:00
W	0:00
X	0:00
Y	0:00
Z	0:00
AA	0:00
AB	0:00
AC	0:00
AD	0:00
AE	0:00
AF	0:00
AG	0:00
AH	0:00

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SHADOW - Main Result

Calculation: Vestas - Jan 2023 - Shadow - Real Case

...continued from previous page

Shadow, expected values

No.	Shadow hours per year [h/year]
AI	0:00
AJ	2:00
AK	89:41
AL	8:13
AM	16:23
AN	19:45
AO	1:14
AP	1:14
AQ	13:25
AR	0:00
AS	0:00
AT	0:00
AU	0:00
AV	15:08
AW	0:00
AX	0:00
AY	0:00
AZ	0:00
BA	3:05
BB	0:00
BC	0:00
BD	0:00
BE	0:00
BF	0:00
BG	0:00
BH	0:00
BI	0:00
BJ	0:00
BK	0:00
BL	1:42
BM	0:00
BN	8:39
BO	0:00
BP	0:00
BQ	0:00
BR	0:00
BS	0:00
BT	0:00
BU	0:00
BV	0:00
BW	0:00
BX	0:00
BY	0:00
BZ	0:00
CA	0:00
CB	0:00
CC	0:00
CD	0:00
CE	0:00
CF	0:00
CG	0:00
CH	0:00
CI	0:00
CJ	0:00

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (132)	15:52	6:11
2	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (133)	0:00	0:00
3	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (134)	3:38	1:21
4	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (135)	4:33	1:27
5	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (136)	12:58	4:14

To be continued on next page...

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SHADOW - Main Result

Calculation: Vestas - Jan 2023 - Shadow - Real Case

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
6	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (137)	0:00	0:00
7	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (138)	26:15	12:02
8	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (139)	0:00	0:00
9	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (140)	0:00	0:00
10	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (141)	0:00	0:00
11	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (142)	5:12	1:58
12	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (143)	29:17	10:35
13	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (144)	92:17	38:11
14	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (145)	268:31	92:51
15	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (146)	18:20	8:46
16	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (147)	0:00	0:00
17	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (148)	2:16	0:44
18	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (149)	100:25	44:09
19	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (150)	0:00	0:00
20	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (151)	0:00	0:00
21	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (152)	66:41	20:16
22	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (153)	0:00	0:00
23	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (154)	0:00	0:00
24	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (155)	0:00	0:00
25	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (156)	0:00	0:00
26	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (157)	5:14	2:00
27	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (158)	21:54	6:27
28	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (159)	7:57	3:02
29	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (160)	0:00	0:00
30	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (161)	0:00	0:00
31	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (162)	64:12	25:25
32	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (163)	4:50	1:33

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.

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SHADOW - Main Result

Calculation: Vestas - Jan 2023 - Shadow - Worst Case

Assumptions for shadow calculations

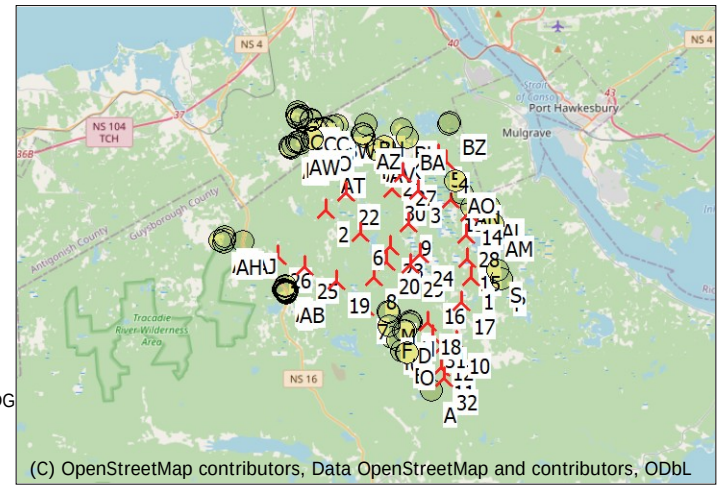
Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Elevation Grid Data Object: Pirate Harbour - August 2022_EMDG
Obstacles used in calculation
Receptor grid resolution: 1.0 m

All coordinates are in
UTM (north)-NAD83(NSRS/CSRS) (US+CA GPS meas. at curr. year), GRS80 Zone: 20



Scale 1:400,000
New WTG
Shadow receptor

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	622,768	5,043,893	162.7	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
2	615,029	5,047,261	155.5	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
3	619,844	5,048,348	172.8	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
4	621,302	5,049,972	174.3	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
5	620,898	5,050,285	170.3	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
6	616,839	5,046,106	181.3	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
7	617,181	5,042,189	162.3	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
8	617,665	5,043,802	178.0	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
9	619,430	5,046,660	181.7	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
10	622,063	5,040,422	142.0	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
11	621,294	5,039,075	140.6	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
12	621,199	5,040,109	149.2	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
13	621,650	5,047,995	167.9	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
14	622,605	5,047,281	165.8	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
15	622,550	5,044,815	165.0	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
16	620,700	5,043,075	164.8	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
17	622,300	5,042,546	152.4	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
18	620,509	5,041,401	160.6	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
19	615,685	5,043,510	171.9	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
20	618,273	5,044,587	184.2	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
21	618,361	5,049,776	170.8	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
22	616,057	5,048,219	160.3	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
23	618,491	5,045,410	187.1	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
24	620,008	5,045,055	180.2	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
25	613,929	5,044,260	162.6	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
26	612,550	5,044,795	159.8	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
27	619,017	5,049,289	174.2	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
28	622,476	5,046,111	155.6	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
29	619,585	5,044,467	180.2	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
30	618,499	5,048,444	176.3	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
31	620,794	5,040,750	157.9	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0
32	621,457	5,038,480	136.7	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT:	...Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	2,500	0.0

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
A	620,829	5,037,842	114.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
B	619,233	5,040,980	132.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
C	619,274	5,040,998	132.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0

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Calculated:
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SHADOW - Main Result

Calculation: Vestas - Jan 2023 - Shadow - Worst Case

...continued from previous page

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
D	619,377	5,040,999	139.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
E	619,164	5,039,914	137.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
F	618,520	5,041,156	149.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
G	618,938	5,040,438	143.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
H	619,581	5,041,329	149.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
I	619,689	5,041,434	157.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
J	619,628	5,041,473	154.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
K	618,685	5,040,575	144.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
L	618,476	5,041,898	153.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
M	618,431	5,041,959	151.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
N	619,424	5,039,800	127.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
O	619,474	5,039,804	122.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
P	624,390	5,043,819	145.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
Q	612,949	5,043,158	135.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
R	612,922	5,043,189	137.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
S	624,185	5,044,297	140.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
T	612,985	5,042,820	142.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
U	613,011	5,042,850	141.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
V	612,970	5,042,896	139.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
W	612,972	5,042,922	140.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
X	612,940	5,042,960	140.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
Y	612,885	5,042,985	143.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
Z	613,050	5,042,990	140.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AA	613,012	5,043,011	140.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AB	613,030	5,043,021	139.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AC	612,881	5,043,022	143.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AD	612,899	5,043,031	141.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AE	612,852	5,043,060	145.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AF	609,461	5,045,568	133.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AG	609,654	5,045,625	115.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AH	609,598	5,045,423	121.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AI	609,662	5,045,759	120.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AJ	610,615	5,045,497	98.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AK	622,742	5,047,563	163.1	0.5	0.5	1.5	90.0	"Green house mode"	2.0
AL	623,659	5,047,576	144.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AM	623,925	5,046,705	141.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AN	622,203	5,048,318	158.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AO	621,827	5,048,926	157.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AP	621,836	5,048,941	157.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AQ	617,498	5,050,497	137.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AR	613,104	5,050,505	66.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AS	613,082	5,050,523	68.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AT	615,138	5,049,884	124.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AU	613,049	5,050,602	64.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AV	617,662	5,050,461	139.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AW	613,427	5,050,782	0.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AX	613,538	5,050,835	0.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AY	613,509	5,050,849	0.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
AZ	616,971	5,051,190	138.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BA	619,275	5,051,207	136.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BB	614,451	5,051,482	127.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BC	614,481	5,051,498	127.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BD	615,577	5,051,764	121.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BE	613,988	5,051,516	117.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BF	614,922	5,051,522	129.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BG	614,796	5,051,533	126.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BH	617,060	5,051,841	140.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BI	614,792	5,051,554	126.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BJ	613,251	5,050,644	69.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BK	618,047	5,050,653	138.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BL	618,935	5,051,599	138.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BM	616,914	5,051,363	136.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BN	617,259	5,050,682	136.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BO	614,235	5,051,042	119.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BP	616,830	5,051,368	137.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0

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SHADOW - Main Result

Calculation: Vestas - Jan 2023 - Shadow - Worst Case

...continued from previous page

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
BQ	614,214	5,051,062	119.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BR	613,589	5,050,729	83.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BS	613,607	5,050,734	82.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BT	614,239	5,051,082	118.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BU	614,411	5,051,084	121.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BV	614,251	5,051,092	117.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BW	615,285	5,051,678	121.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BX	613,488	5,052,383	96.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BY	614,163	5,051,998	127.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
BZ	621,520	5,052,000	125.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CA	613,601	5,052,224	95.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CB	613,605	5,052,235	95.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CC	614,170	5,052,036	127.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CD	613,385	5,052,274	90.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CE	613,465	5,052,108	92.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CF	613,490	5,052,115	92.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CG	613,474	5,052,120	92.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CH	613,616	5,052,137	97.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CI	621,476	5,051,932	123.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
CJ	613,467	5,052,382	95.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0

Calculation Results

Shadow receptor

Shadow, worst case

No.	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
A	0:00	0	0:00
B	29:32	124	0:27
C	16:22	89	0:23
D	42:51	163	0:30
E	21:39	112	0:20
F	5:47	39	0:15
G	15:10	85	0:17
H	47:17	143	0:38
I	46:15	108	0:42
J	40:48	109	0:39
K	10:05	56	0:17
L	16:11	60	0:27
M	17:00	60	0:28
N	13:27	78	0:20
O	15:28	85	0:20
P	18:36	99	0:21
Q	0:00	0	0:00
R	0:00	0	0:00
S	17:52	67	0:24
T	0:00	0	0:00
U	0:00	0	0:00
V	0:00	0	0:00
W	0:00	0	0:00
X	0:00	0	0:00
Y	0:00	0	0:00
Z	0:00	0	0:00
AA	0:00	0	0:00
AB	0:00	0	0:00
AC	0:00	0	0:00
AD	0:00	0	0:00
AE	0:00	0	0:00
AF	0:00	0	0:00
AG	0:00	0	0:00
AH	0:00	0	0:00
AI	0:00	0	0:00
AJ	5:14	24	0:17
AK	258:34	233	1:49

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SHADOW - Main Result

Calculation: Vestas - Jan 2023 - Shadow - Worst Case

...continued from previous page

Shadow, worst case

No.	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
AL	21:03	65	0:32
AM	35:34	111	0:26
AN	53:34	76	0:54
AO	3:20	20	0:15
AP	3:18	20	0:15
AQ	44:00	82	0:38
AR	0:00	0	0:00
AS	0:00	0	0:00
AT	0:00	0	0:00
AU	0:00	0	0:00
AV	50:26	74	0:51
AW	0:00	0	0:00
AX	0:00	0	0:00
AY	0:00	0	0:00
AZ	0:00	0	0:00
BA	9:25	43	0:20
BB	0:00	0	0:00
BC	0:00	0	0:00
BD	0:00	0	0:00
BE	0:00	0	0:00
BF	0:00	0	0:00
BG	0:00	0	0:00
BH	0:00	0	0:00
BI	0:00	0	0:00
BJ	0:00	0	0:00
BK	0:00	0	0:00
BL	5:18	35	0:15
BM	0:00	0	0:00
BN	28:46	68	0:30
BO	0:00	0	0:00
BP	0:00	0	0:00
BQ	0:00	0	0:00
BR	0:00	0	0:00
BS	0:00	0	0:00
BT	0:00	0	0:00
BU	0:00	0	0:00
BV	0:00	0	0:00
BW	0:00	0	0:00
BX	0:00	0	0:00
BY	0:00	0	0:00
BZ	0:00	0	0:00
CA	0:00	0	0:00
CB	0:00	0	0:00
CC	0:00	0	0:00
CD	0:00	0	0:00
CE	0:00	0	0:00
CF	0:00	0	0:00
CG	0:00	0	0:00
CH	0:00	0	0:00
CI	0:00	0	0:00
CJ	0:00	0	0:00

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]
1	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (132)	15:52
2	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (133)	0:00
3	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (134)	3:38
4	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (135)	4:33
5	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (136)	12:58
6	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (137)	0:00
7	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (138)	26:15
8	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (139)	0:00

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SHADOW - Main Result

Calculation: Vestas - Jan 2023 - Shadow - Worst Case

...continued from previous page

No.	Name	Worst case [h/year]
9	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (140)	0:00
10	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (141)	0:00
11	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (142)	5:12
12	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (143)	29:17
13	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (144)	92:17
14	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (145)	268:31
15	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (146)	18:20
16	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (147)	0:00
17	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (148)	2:16
18	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (149)	100:25
19	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (150)	0:00
20	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (151)	0:00
21	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (152)	66:41
22	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (153)	0:00
23	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (154)	0:00
24	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (155)	0:00
25	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (156)	0:00
26	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (157)	5:14
27	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (158)	21:54
28	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (159)	7:57
29	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (160)	0:00
30	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (161)	0:00
31	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (162)	64:12
32	VESTAS V150-4.5 4500 150.0 !O! hub: 120.0 m (TOT: 195.0 m) (163)	4:50

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

APPENDIX P: SOUND

Overview of Infrasound

Infrasound is an inaudible range of low frequency sound between one and 10 Hz generated as a result of large masses/objects in motion. Infrasound is emitted from both natural sources (e.g., wind, oceans) and artificial sources such as road traffic, ventilation systems, and aircrafts (Keith, 2018). Levels of infrasound emitted from large-scale wind turbines attenuate over space as a function of site-specific characteristics (i.e., topography, structures, etc.) and climatic conditions (Rod & Heiger-Bernays, 2012; Schmidt & Klokker, 2014). Generally, frequencies below 100 Hz are attenuated by three dBA over a doubling of distance when downwind of turbines (between distances of 0.3 to 20 km) and six dBA over a doubling of distance when upwind of turbines (between distances of 0.4 to 3 km) (Shepherd & Hubbard, 1991). Health Canada reported that infrasound generated by wind turbines can be measured up to 10 km away, however, in many cases was below background levels (Health Canada, 2014; Keith, 2018).

When evaluating potential effects of infrasound, it is important that these frequencies be discussed in the context of the sound pressure levels, or in other words, the loudness of the sound. Studies show that the lower the frequency of the sound, the louder the sound needs to be in order to be audible/perceived. For instance, very loud sounds at very low frequencies (i.e., 165 dB at 2 Hz, reducing to 145 dB at 20 Hz) may result in pain (Leventhall, 2006) and infrasound has been shown to cause annoyance, when the sound level exceeds the threshold of hearing (i.e., the lowest sound levels that a listener can detect) (HGC, 2010). Further, research shows that to be physically felt, infrasound must exceed 100–110 dB (Ellenbogen et al., 2012). While there is some variation in the literature and between individual sensitivities, there is fairly good agreement on the level of the threshold of hearing among the various studies that have been completed (Figure P.1).

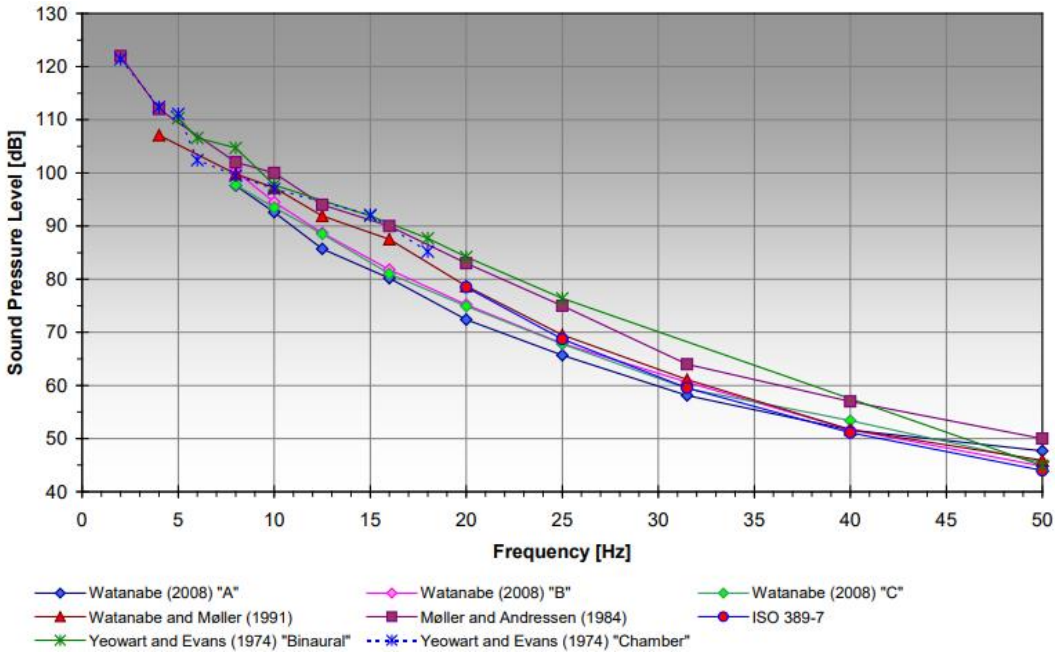

Figure P.1. Threshold of Hearing Data from Various Papers (Source: HGC, 2010)

Measuring Infrasound

In 2010, Sonus, an acoustic consulting firm based in South Australia, completed a study to measure infrasound produced by a range of natural and manmade sources using a methodology specifically designed to measure infrasound (Table P.1). Sound levels measured using the G-weighting filters, expressed as dBG. The G-weighting network was applied to the measured infrasound pressure levels as it has been standardized to determine the human perception (i.e. threshold of hearing) and annoyance due to noise that lies within the infrasound frequency range. By comparison, when measuring audible sound levels, meters are usually equipped with weighting circuits to simulate the frequency response characteristics of the human ear.

Table P.1: Measured Levels of Infrasound from Natural & Manmade Sources

Source	Infrasound Level (dBG)
Threshold of Hearing	85
Ambient Infrasound *(As measured 100 m from nearest wind turbine with negligible wind and no turbine operation)*	62
Natural Sources	
Adjacent to Beach – *25 m from high water*	75
Cliff Face – *250 m from coastline*	69
Inland Forest – *8 km from coastline*	57
Anthropogenic Sources	
Business District (70 m from two major road corridors)	76
Gas Fired Power Station (350 m away)	74
Wind Farm – *100 m downwind*	66
Wind Farm – *200 m downwind*	63
Wind Farm – *360 m downwind*	61
Outside Residence – *1.2 km from nearest wind turbine*	58

Source: Sonus 2010

The results of the study indicate that while turbines do produce infrasound, levels are well below established levels that can be perceived by humans and are comparable to natural and urban sources that are common in the environment.

Infrasound and Potential Health Concerns

Concerns about infrasound from wind turbines is thought to have originated from the experience of neighbours of early wind turbine designs with downwind rotors (rotors downwind of the tower). In contrast, all modern utility scale wind turbines have upwind rotors that produce significantly lower infrasound emissions (Bastasch et al., 2006). Several studies and panels have been assembled to evaluate the perceived health effects associated with wind turbines.

A study by Evans et al. (2013) concluded that measured infrasound levels at rural locations both near to and away from wind farms were no higher than infrasound levels measured at the urban locations. Human activity and traffic were the main sources of infrasound within urban locations, while localized wind conditions were found to be the main source of infrasound in rural locations. All measurements were below the levels that can be perceived by humans, with most by a

significant margin (Evans et al., 2013).

A scientific advisory panel with expertise in audiology, acoustics, occupational/environmental medicine, and public health was assembled by the wind industry in early 2009 to conduct a review of current literature available on the issue of perceived health effects of wind turbines (Colby et al., 2009). Following their review and analysis of the information, the panel reached consensus on the following conclusions:

- There is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects.
- The ground-borne vibrations from wind turbines are too weak to be detected by, or to affect, humans.
- Sounds emitted by wind turbines are not unique. There is no reason to believe, based on the levels and frequencies of the sounds and the panel's experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences.

The Chief Medical Officer of Health in Ontario also conducted a review of papers and reports (from 1970 to 2010) on wind turbines and health from scientific bibliographic databases, grey literature, and from a structured Internet search. The report concluded that "low frequency sound and infrasound from current generation upwind model turbines are well below the pressure sound levels at which known health effects occur. Further, there is no scientific evidence to date that vibration from low frequency wind turbine noise causes adverse health effects" (CMOH of Ontario, 2010).

The Massachusetts panel concluded that "measured levels of infrasound produced by modern upwind wind turbines at distances as close as 68 m are well below that required for non-auditory perception". Further, the panel concluded that "the weight of the evidence suggests no association between noise from wind turbines and measures of psychological distress or mental health problems" (Ellenbogan et al., 2012).

A new study found that infrasound (generated acoustically as part of the study to correspond to real world wind farms) had no influence on reported annoyance or on the measured response on the autonomic nervous system (Maijila et al., 2021). The study concluded that participants did not detect infrasonic ranges of simulated wind turbine noise.

Overall, potential impacts on nearby residents as a result of Project generated infrasound are anticipated to be negligible based on the scientific findings discussed above and distances to nearby receptors.

Project:

Goose Harbour Lake Wind Farm Project

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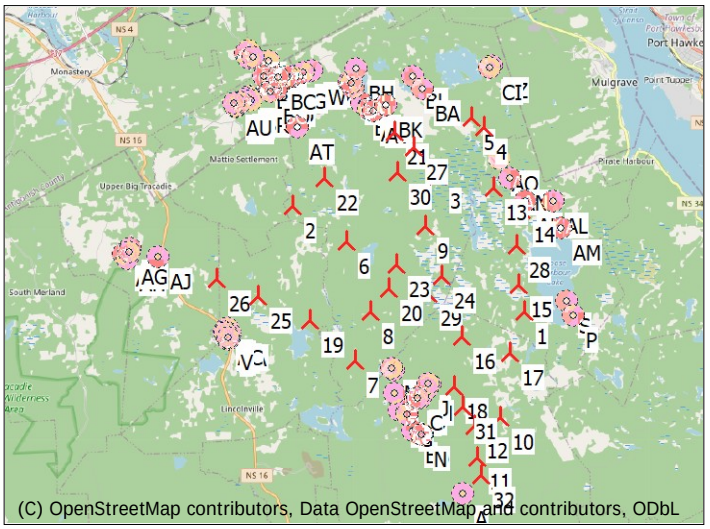
Calculated:
2023-01-13 4:08 PM/3.5.552

DECIBEL - Main Result

Calculation: Vestas - Jan 2023 - Noise

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
Loudest up to 95% rated power
Ground attenuation:
Fixed values, Agr: 0.0, Dc: 0.0
Meteorological coefficient, C0:
0.0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Fixed penalty added to source noise of WTGs with pure tones
Model: 5.0 dB(A)
Height above ground level, when no value in NSA object:
0.0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0.0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0.0 dB(A)



Scale 1:250,000
New WTG
Noise sensitive area

All coordinates are in
UTM (north)-NAD83(NSRS/CSRS) (US+CA GPS meas. at curr. year), GRS80 Zone: 20

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	Status	LwA,ref
			[m]					[kW]	[m]	[m]			[m/s]		[dB(A)]
1	622,768	5,043,893	162.7	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
2	615,029	5,047,261	155.5	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
3	619,844	5,048,348	172.8	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
4	621,302	5,049,972	174.3	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
5	620,898	5,050,285	170.3	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
6	616,839	5,046,106	181.3	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
7	617,181	5,042,189	162.3	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
8	617,665	5,043,802	178.0	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
9	619,430	5,046,660	181.7	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
10	622,063	5,040,422	142.0	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
11	621,294	5,039,075	140.6	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
12	621,199	5,040,109	149.2	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
13	621,650	5,047,995	167.9	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 - - PO4 & PO4 VTL1- 12-2021	7.0	From other hub height	105.0 f
14	622,605	5,047,281	165.8	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
15	622,550	5,044,815	165.0	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
16	620,700	5,043,075	164.8	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
17	622,300	5,042,546	152.4	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
18	620,509	5,041,401	160.6	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 - - PO4 & PO4 VTL1- 12-2021	7.0	From other hub height	105.0 f
19	615,685	5,043,510	171.9	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
20	618,273	5,044,587	184.2	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
21	618,361	5,049,776	170.8	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
22	616,057	5,048,219	160.3	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
23	618,491	5,045,410	187.1	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
24	620,008	5,045,055	180.2	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
25	613,929	5,044,260	162.6	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
26	612,550	5,044,795	159.8	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
27	619,017	5,049,289	174.2	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
28	622,476	5,046,111	155.6	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
29	619,585	5,044,467	180.2	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
30	618,499	5,048,444	176.3	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
31	620,794	5,040,750	157.9	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f
32	621,457	5,038,480	136.7	VESTAS V150-4.5 4500 150....	Yes	VESTAS	V150-4.5-4,500	4,500	150.0	120.0	EMD	Level 0 VTL1 - - PO4-0S & PO4-0S VTL1- 12-2021	7.0	From other hub height	107.6 f

f) From other hub height

Calculation Results

Sound level

Noise sensitive area No.	Name	Easting	Northing	Z [m]	Immission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Demands fulfilled ? Noise
A	Noise sensitive point: User defined (1200)	620,829	5,037,842	114.8	0.0	0.0	37.8	No
B	Noise sensitive point: User defined (1201)	619,233	5,040,980	132.4	0.0	0.0	35.5	No
C	Noise sensitive point: User defined (1202)	619,274	5,040,998	132.1	0.0	0.0	35.7	No
D	Noise sensitive point: User defined (1203)	619,377	5,040,999	139.1	0.0	0.0	36.2	No
E	Noise sensitive point: User defined (1204)	619,164	5,039,914	137.4	0.0	0.0	33.9	No
F	Noise sensitive point: User defined (1205)	618,520	5,041,156	149.0	0.0	0.0	34.0	No
G	Noise sensitive point: User defined (1206)	618,938	5,040,438	143.1	0.0	0.0	33.7	No
H	Noise sensitive point: User defined (1207)	619,581	5,041,329	149.3	0.0	0.0	37.5	No

To be continued on next page...

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DECIBEL - Main Result

Calculation: Vestas - Jan 2023 - Noise

...continued from previous page

Noise sensitive area

No.	Name	Easting	Northing	Z [m]	Immission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Demands fulfilled ? Noise
I	Noise sensitive point: User defined (1208)	619,689	5,041,434	157.9	0.0	0.0	38.2	No
J	Noise sensitive point: User defined (1209)	619,628	5,041,473	154.6	0.0	0.0	37.7	No
K	Noise sensitive point: User defined (1210)	618,685	5,040,575	144.2	0.0	0.0	33.2	No
L	Noise sensitive point: User defined (1211)	618,476	5,041,898	153.8	0.0	0.0	35.6	No
M	Noise sensitive point: User defined (1212)	618,431	5,041,959	151.3	0.0	0.0	35.9	No
N	Noise sensitive point: User defined (1213)	619,424	5,039,800	127.9	0.0	0.0	34.8	No
O	Noise sensitive point: User defined (1214)	619,474	5,039,804	122.2	0.0	0.0	35.1	No
P	Noise sensitive point: User defined (1215)	624,390	5,043,819	145.5	0.0	0.0	33.1	No
Q	Noise sensitive point: User defined (1216)	612,949	5,043,158	135.8	0.0	0.0	33.4	No
R	Noise sensitive point: User defined (1217)	612,922	5,043,189	137.3	0.0	0.0	33.5	No
S	Noise sensitive point: User defined (1218)	624,185	5,044,297	140.9	0.0	0.0	34.3	No
T	Noise sensitive point: User defined (1219)	612,985	5,042,820	142.1	0.0	0.0	31.8	No
U	Noise sensitive point: User defined (1220)	613,011	5,042,850	141.9	0.0	0.0	32.0	No
V	Noise sensitive point: User defined (1221)	612,970	5,042,896	139.6	0.0	0.0	32.1	No
W	Noise sensitive point: User defined (1222)	612,972	5,042,922	140.5	0.0	0.0	32.3	No
X	Noise sensitive point: User defined (1223)	612,940	5,042,960	140.2	0.0	0.0	32.4	No
Y	Noise sensitive point: User defined (1224)	612,885	5,042,985	143.9	0.0	0.0	32.4	No
Z	Noise sensitive point: User defined (1225)	613,050	5,042,990	140.6	0.0	0.0	32.8	No
AA	Noise sensitive point: User defined (1226)	613,012	5,043,011	140.1	0.0	0.0	32.8	No
AB	Noise sensitive point: User defined (1227)	613,030	5,043,021	139.4	0.0	0.0	32.9	No
AC	Noise sensitive point: User defined (1228)	612,881	5,043,022	143.5	0.0	0.0	32.6	No
AD	Noise sensitive point: User defined (1229)	612,899	5,043,031	141.9	0.0	0.0	32.7	No
AE	Noise sensitive point: User defined (1230)	612,852	5,043,060	145.8	0.0	0.0	32.7	No
AF	Noise sensitive point: User defined (1231)	609,461	5,045,568	133.8	0.0	0.0	22.4	No
AG	Noise sensitive point: User defined (1232)	609,654	5,045,625	115.9	0.0	0.0	23.1	No
AH	Noise sensitive point: User defined (1233)	609,598	5,045,423	121.8	0.0	0.0	23.1	No
AI	Noise sensitive point: User defined (1234)	609,662	5,045,759	120.9	0.0	0.0	23.0	No
AJ	Noise sensitive point: User defined (1235)	610,615	5,045,497	98.6	0.0	0.0	27.7	No
AK	Noise sensitive point: User defined (1237)	622,742	5,047,563	163.1	0.0	0.0	45.8	No
AL	Noise sensitive point: User defined (1238)	623,659	5,047,576	144.5	0.0	0.0	35.7	No
AM	Noise sensitive point: User defined (1239)	623,925	5,046,705	141.6	0.0	0.0	34.7	No
AN	Noise sensitive point: User defined (1240)	622,203	5,048,318	158.4	0.0	0.0	39.4	No
AO	Noise sensitive point: User defined (1241)	621,827	5,048,926	157.0	0.0	0.0	38.1	No
AP	Noise sensitive point: User defined (1242)	621,836	5,048,941	157.7	0.0	0.0	38.1	No
AQ	Noise sensitive point: User defined (1243)	617,498	5,050,497	137.8	0.0	0.0	35.6	No
AR	Noise sensitive point: User defined (1244)	613,104	5,050,505	66.8	0.0	0.0	23.4	No
AS	Noise sensitive point: User defined (1245)	613,082	5,050,523	68.1	0.0	0.0	23.3	No
AT	Noise sensitive point: User defined (1246)	615,138	5,049,884	124.2	0.0	0.0	30.6	No
AU	Noise sensitive point: User defined (1247)	613,049	5,050,602	64.5	0.0	0.0	23.0	No
AV	Noise sensitive point: User defined (1248)	617,662	5,050,461	139.1	0.0	0.0	36.8	No
AW	Noise sensitive point: User defined (1249)	613,427	5,050,782	0.0	0.0	0.0	23.5	No
AX	Noise sensitive point: User defined (1250)	613,538	5,050,835	0.0	0.0	0.0	23.6	No
AY	Noise sensitive point: User defined (1251)	613,509	5,050,849	0.0	0.0	0.0	23.5	No
AZ	Noise sensitive point: User defined (1252)	616,971	5,051,190	138.9	0.0	0.0	30.6	No
BA	Noise sensitive point: User defined (1253)	619,275	5,051,207	136.9	0.0	0.0	34.2	No
BB	Noise sensitive point: User defined (1254)	614,451	5,051,482	127.0	0.0	0.0	23.9	No
BC	Noise sensitive point: User defined (1255)	614,481	5,051,498	127.8	0.0	0.0	23.9	No
BD	Noise sensitive point: User defined (1256)	615,577	5,051,764	121.4	0.0	0.0	25.4	No
BE	Noise sensitive point: User defined (1257)	613,988	5,051,516	117.0	0.0	0.0	22.8	No
BF	Noise sensitive point: User defined (1258)	614,922	5,051,522	129.2	0.0	0.0	24.8	No
BG	Noise sensitive point: User defined (1259)	614,796	5,051,533	126.9	0.0	0.0	24.5	No
BH	Noise sensitive point: User defined (1260)	617,060	5,051,841	140.1	0.0	0.0	28.4	No
BI	Noise sensitive point: User defined (1261)	614,792	5,051,554	126.4	0.0	0.0	24.4	No
BJ	Noise sensitive point: User defined (1262)	613,251	5,050,644	69.9	0.0	0.0	23.4	No
BK	Noise sensitive point: User defined (1263)	618,047	5,050,653	138.8	0.0	0.0	37.2	No
BL	Noise sensitive point: User defined (1264)	618,935	5,051,599	138.1	0.0	0.0	32.2	No
BM	Noise sensitive point: User defined (1265)	616,914	5,051,363	136.8	0.0	0.0	29.8	No
BN	Noise sensitive point: User defined (1266)	617,259	5,050,682	136.4	0.0	0.0	33.6	No
BO	Noise sensitive point: User defined (1267)	614,235	5,051,042	119.3	0.0	0.0	24.7	No
BP	Noise sensitive point: User defined (1268)	616,830	5,051,368	137.3	0.0	0.0	29.6	No
BQ	Noise sensitive point: User defined (1269)	614,214	5,051,062	119.6	0.0	0.0	24.6	No
BR	Noise sensitive point: User defined (1270)	613,589	5,050,729	83.2	0.0	0.0	24.0	No
BS	Noise sensitive point: User defined (1271)	613,607	5,050,734	82.7	0.0	0.0	24.1	No
BT	Noise sensitive point: User defined (1272)	614,239	5,051,082	118.5	0.0	0.0	24.6	No
BU	Noise sensitive point: User defined (1273)	614,411	5,051,084	121.7	0.0	0.0	24.9	No

To be continued on next page...

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DECIBEL - Main Result

Calculation: Vestas - Jan 2023 - Noise

...continued from previous page

Noise sensitive area

No.	Name	Easting	Northing	Z [m]	Immission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Demands fulfilled ? Noise
BV	Noise sensitive point: User defined (1274)	614,251	5,051,092	117.9	0.0	0.0	24.6	No
BW	Noise sensitive point: User defined (1275)	615,285	5,051,678	121.5	0.0	0.0	25.1	No
BX	Noise sensitive point: User defined (1276)	613,488	5,052,383	96.1	0.0	0.0	19.6	No
BY	Noise sensitive point: User defined (1277)	614,163	5,051,998	127.9	0.0	0.0	21.9	No
BZ	Noise sensitive point: User defined (1278)	621,520	5,052,000	125.9	0.0	0.0	31.3	No
CA	Noise sensitive point: User defined (1279)	613,601	5,052,224	95.7	0.0	0.0	20.2	No
CB	Noise sensitive point: User defined (1280)	613,605	5,052,235	95.2	0.0	0.0	20.2	No
CC	Noise sensitive point: User defined (1281)	614,170	5,052,036	127.9	0.0	0.0	21.8	No
CD	Noise sensitive point: User defined (1282)	613,385	5,052,274	90.4	0.0	0.0	19.7	No
CE	Noise sensitive point: User defined (1283)	613,465	5,052,108	92.6	0.0	0.0	20.2	No
CF	Noise sensitive point: User defined (1284)	613,490	5,052,115	92.4	0.0	0.0	20.3	No
CG	Noise sensitive point: User defined (1285)	613,474	5,052,120	92.5	0.0	0.0	20.2	No
CH	Noise sensitive point: User defined (1286)	613,616	5,052,137	97.0	0.0	0.0	20.5	No
CI	Noise sensitive point: User defined (1287)	621,476	5,051,932	123.5	0.0	0.0	31.8	No
CJ	Noise sensitive point: User defined (1288)	613,467	5,052,382	95.9	0.0	0.0	19.6	No

Distances (m)

NSA	WTG 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
A	6354	11062	10552	12139	12443	9176	5675	6747	8928	2859	1317	2297	10186	9604	7182	5234	4928	3573	7654	7213	12186	11421
B	4581	7559	7393	9227	9453	5657	2382	3228	5684	2884	2807	2150	7420	7147	5071	2558	3444	1344	4357	3733	8840	7905
C	4538	7566	7371	9200	9427	5658	2408	3232	5664	2848	2790	2120	7389	7111	5030	2519	3399	1299	4380	3725	8825	7904
D	4458	7624	7363	9177	9409	5702	2498	3284	5661	2747	2716	2027	7356	7062	4962	2461	3307	1201	4465	3754	8836	7946
E	5369	8431	8462	10283	10515	6614	3019	4167	6751	2943	2290	2044	8455	8131	5957	3515	4095	2005	5003	4757	9895	8867
F	5053	7033	7312	9244	9433	5227	1692	2780	5578	3618	3468	2876	7521	7362	5443	2904	4027	2004	3685	3439	8621	7480
G	5158	7863	7961	9822	10040	6043	2481	3596	6241	3125	2723	2285	8029	7763	5675	3171	3968	1843	4474	4201	9356	8297
H	4091	7478	7024	8813	9052	5508	2550	3129	5333	2642	2831	2026	6980	6676	4579	2074	2979	931	4465	3511	8535	7739
I	3941	7462	6916	8689	8933	5473	2620	3116	5233	2580	2853	2008	6848	6534	4429	1928	2838	821	4510	3457	8448	7696
J	3964	7394	6878	8662	8903	5408	2551	3046	5191	2652	2920	2080	6828	6526	4439	1928	2879	884	4438	3396	8400	7633
K	5262	7621	7859	9755	9959	5831	2207	3384	6130	3382	3010	2557	7991	7768	5737	3211	4118	2003	4197	4033	9207	8083
L	4733	6376	6594	8554	8730	4515	1328	2070	4857	3879	3989	3257	6874	6784	5011	2516	3879	2093	3223	2697	7879	6768
M	4749	6300	6543	8511	8683	4441	1272	1995	4805	3944	4064	3329	6840	6763	5012	2528	3913	2152	3153	2632	7817	6694
N	5285	8660	8558	10344	10588	6815	3278	4371	6860	2711	2006	1801	8492	8129	5909	3514	3976	1934	5267	4923	10033	9067
O	5251	8681	8551	10331	10577	6830	3309	4387	6856	2662	1961	1752	8475	8106	5880	3493	3938	1903	5299	4931	10034	9081
P	1623	9974	6416	6884	7348	7889	7391	6725	5716	4118	5665	4894	4994	3894	2092	3764	2447	4573	8710	6165	8475	9423
Q	9847	4600	8630	10780	10676	4881	4341	4760	7367	9516	9291	8795	9956	10500	9743	7752	9372	7762	2759	5513	8549	5939
R	9871	4585	8633	10781	10675	4884	4374	4782	7376	9551	9328	8831	9964	10512	9764	7779	9400	7795	2782	5530	8542	5927
S	1473	9624	5938	6366	6831	7565	7314	6539	5310	4418	5969	5143	4483	3376	1715	3693	2573	4680	8536	5919	7997	9025
T	9842	4889	8809	10969	10878	5065	4243	4782	7502	9390	9114	8650	10093	10604	9771	7720	9319	7657	2787	5575	8791	6212
U	9813	4851	8771	10930	10839	5026	4222	4750	7465	9372	9103	8635	10056	10568	9740	7693	9295	7637	2755	5542	8752	6173
V	9848	4826	8773	10931	10837	5027	4269	4781	7476	9423	9159	8687	10067	10586	9770	7732	9336	7686	2784	5566	8740	6153
W	9844	4802	8756	10913	10818	5009	4272	4774	7462	9429	9168	8694	10052	10573	9763	7730	9336	7689	2776	5556	8719	6130
X	9872	4782	8758	10913	10816	5010	4310	4799	7471	9469	9213	8736	10061	10587	9787	7761	9369	7728	2800	5575	8709	6113
Y	9925	4784	8786	10939	10840	5038	4369	4849	7507	9529	9274	8797	10096	10627	9837	7816	9426	7787	2849	5621	8724	6120
Z	9760	4708	8653	10810	10715	4906	4208	4686	7361	9372	9127	8643	9951	10475	9674	7651	9261	7627	2687	5462	8618	6032
AA	9796	4704	8669	10825	10728	4922	4248	4719	7383	9414	9170	8685	9972	10500	9707	7688	9299	7668	2719	5491	8624	6033
AB	9777	4687	8649	10804	10708	4901	4233	4700	7362	9399	9158	8672	9952	10480	9687	7670	9282	7653	2700	5471	8605	6015
AC	9925	4752	8766	10918	10817	5017	4379	4846	7491	9543	9293	8813	10081	10616	9834	7819	9431	7798	2846	5614	8697	6090
AD	9907	4736	8747	10899	10798	4998	4363	4827	7472	9528	9280	8799	10061	10596	9815	7801	9414	7783	2827	5595	8679	6074
AE	9952	4732	8767	10917	10814	5018	4416	4870	7499	9582	9336	8853	10088	10628	9856	7849	9463	7835	2869	5632	8687	6074
AF	13413	5820	10749	12634	12372	7399	8427	8392	10029	13613	13498	12945	12429	13256	13111	11513	13191	11808	6556	8867	9845	7109
AG	13229	5618	10548	12433	12171	7202	8274	8216	9831	13456	13357	12795	12228	13057	12922	11337	13016	11649	6392	8682	9646	6909
AH	13258	5733	10655	12557	12301	7273	8243	8228	9909	13431	13308	12760	12323	13139	12966	11348	13024	11629	6381	8715	9784	7038
AI	13239	5573	10507	12379	12114	7186	8323	8239	9810	13501	13416	12846	12195	13033	12923	11360	13041	11690	6430	8691	9582	6853
AJ	12259	4753	9659	11586	11343	6254	7352	7251	8892	12523	12462	11876	11314	12122	11955	10372	12052	10709	5446	7712	8849	6085
AK	3670	7719	3002	2807	3288	6080	7733	6319	3433	7173	8611	7612	1174	314	2755	4931	5037	6554	8137	5369	4908	6717
AL	3789	8636	3892	3361	3868	6976	8425	7083	4327	7330	8824	7862	2052	1094	2975	5386	5210	6932	8950	6160	5737	7629
AM	3040	8914	4399	4190	4688	7111	8116	6901	4495	6553	8071	7137	2615	1440	2337	4856	4465	6309	8837	6036	6355	8012
AN	4461	7251	2359	1883	2360	5801	7923	6402	3230	7897	9288	8270	640	1113	3520	5454	5773	7121	8099	5419	4109	6146
AO	5120	7000	2066	1170	1646	5730	8184	6602	3299	8508	9866	8839	948	1820	4174	5959	6398	7640	8189	5609	3569	5813
AP	5133	7012	2078	1161	1639	5745	8201	6619	3315	8522	9881	8855	964	1830	4188	5975	6412	7656	8205	5626	3574	5824
AQ	8449	4070	3182	3840	3407	4440	8313	6697	4296	11061	12037	11028	4848	6036	7604	8084	9289	9582	7218	5961	1125	2695
AR	11709	3772	7077	8215	7797	5771	9261	8108	7403	13488	14061	13176	8907	10033	11027	10626	12162	11735	7456	7857	5307	3734
AS	11738	3799	7104	8238	7819	5800	9287	8135	7431	13517	14089	13204	8934	10060	11056	10655	12191	11764	7481	7886	5331	3763
AT	9701	2625	4951	6165	5774	4144	7961	6586	5369	11726	12440	11502	6781	7909	8980	8793	10254	10041	6397	6156	3225	1902

To be continued on next page...

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1355 Bedford Highway
CA-BEDFORD B4A1C5
902.835.5560 (24/7)
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Calculated:
2023-01-13 4:08 PM/3.5.552

DECIBEL - Main Result

Calculation: Vestas - Jan 2023 - Noise

...continued from previous page

	WTG																					
NSA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
AU	11810	3883	7160	8277	7856	5881	9372	8219	7501	13598	14173	13286	8988	10117	11125	10733	12268	11846	7566	7967	5376	3838
AV	8319	4144	3037	3673	3240	4432	8285	6659	4192	10961	11951	10939	4689	5878	7468	7986	9174	9497	7226	5906	978	2757
AW	11606	3868	6863	7916	7487	5789	9377	8166	7282	13488	14105	13203	8683	9823	10901	10597	12106	11754	7615	7865	5035	3673
AX	11549	3872	6779	7812	7380	5768	9382	8155	7221	13458	14088	13181	8595	9739	10838	10560	12062	11730	7633	7840	4938	3632
AY	11581	3897	6811	7842	7410	5796	9406	8182	7254	13487	14116	13209	8627	9771	10870	10591	12093	11759	7655	7869	4969	3663
AZ	9319	4383	4042	4499	4030	5086	9003	7421	5155	11912	12864	11860	5666	6858	8472	8931	10155	10409	7787	6730	1983	3109
BA	8105	5797	2916	2374	1867	5653	9258	7579	4550	11140	12299	11264	3995	5149	7183	8256	9175	9884	8493	6696	1698	4391
BB	11259	4260	6238	7015	6557	5883	9685	8326	6931	13427	14169	13224	7999	9173	10490	10475	11894	11762	8067	7884	4266	3637
BC	11248	4272	6220	6990	6531	5885	9692	8329	6921	13423	14169	13222	7979	9154	10477	10470	11886	11760	8078	7883	4245	3638
BD	10662	4536	5467	5999	5523	5798	9708	8232	6396	13066	13918	12940	7148	8337	9845	10087	11410	11477	8255	7667	3421	3578
BE	11627	4380	6658	7475	7018	6116	9858	8546	7294	13722	14428	13495	8432	9602	10873	10785	12229	12035	8184	8147	4706	3893
BF	10943	4262	5857	6565	6102	5746	9602	8193	6630	13199	13983	13025	7596	8776	10157	10234	11619	11561	8048	7702	3856	3493
BG	11042	4279	5969	6691	6228	5800	9643	8247	6725	13277	14052	13096	7714	8892	10260	10315	11709	11632	8073	7768	3974	3547
BH	9785	5010	4467	4635	4141	5740	9652	8062	5698	12467	13450	12441	5989	7180	8917	9492	10671	10995	8444	7355	2440	3759
BI	11059	4299	5983	6699	6236	5820	9664	8267	6742	13296	14071	13116	7726	8905	10276	10334	11727	11652	8093	7788	3987	3567
BJ	11668	3821	6982	8079	7655	5785	9323	8142	7352	13496	14090	13197	8807	9941	10975	10620	12144	11752	7538	7868	5183	3709
BK	8245	4540	2923	3325	2874	4705	8507	6862	4225	10991	12025	11005	4477	5670	7373	8029	9155	9574	7523	6070	931	3144
BL	8606	5837	3376	2872	2362	5879	9571	7900	4964	11607	12744	11711	4512	5667	7687	8705	9658	10319	8717	7043	1911	4439
BM	9490	4515	4204	4603	4127	5258	9178	7599	5334	12092	13046	12042	5812	7004	8640	9112	10332	10591	7949	6911	2147	3259
BN	8743	4084	3484	4105	3661	4596	8493	6893	4571	11330	12289	11284	5149	6337	7901	8350	9572	9834	7343	6179	1427	2741
BO	11132	3863	6222	7147	6705	5581	9330	8012	6796	13193	13894	12962	8017	9176	10388	10260	11715	11503	7670	7614	4315	3360
BP	9546	4484	4267	4684	4209	5262	9185	7612	5378	12132	13078	12076	5883	7075	8698	9151	10380	10624	7941	6933	2208	3242
BQ	11160	3887	6250	7171	6728	5608	9355	8038	6825	13222	13922	12990	8044	9203	10417	10289	11743	11531	7694	7642	4341	3388
BR	11445	3755	6693	7750	7322	5651	9264	8037	7119	13343	13971	13065	8512	9653	10737	10448	11952	11615	7517	7724	4866	3520
BS	11433	3752	6678	7733	7305	5645	9261	8032	7107	13336	13965	13058	8497	9638	10725	10439	11942	11608	7517	7717	4849	3511
BT	11155	3902	6237	7150	6706	5615	9367	8046	6819	13223	13927	12994	8029	9189	10409	10289	11741	11535	7709	7646	4324	3392
BU	11025	3872	6084	6980	6536	5539	9316	7976	6691	13124	13842	12905	7871	9034	10274	10184	11625	11444	7680	7558	4161	3305
BV	11152	3909	6230	7139	6695	5618	9372	8050	6817	13224	13929	12996	8021	9182	10406	10289	11740	11536	7717	7648	4315	3394
BW	10798	4424	5645	6254	5783	5785	9676	8228	6508	13139	13962	12992	7354	8539	9994	10165	11515	11528	8177	7695	3616	3544
BX	12578	5349	7529	8177	7701	7116	10842	9544	8250	14717	15429	14495	9267	10448	11807	11775	13207	13035	9141	9147	5526	4893
BY	11821	4815	6752	7420	6949	6471	10262	8913	7499	14015	14760	13814	8490	9670	11042	11061	12472	12352	8623	8474	4749	4227
BZ	8203	8037	4019	2040	1825	7527	10728	9060	5735	11591	12928	11896	4008	4843	7259	8963	9487	10648	10302	8093	3864	6644
CA	12387	5164	7349	8023	7550	6923	10654	9352	8059	14523	15235	14300	9093	10272	11618	11581	13013	12840	8960	8953	5352	4699
CB	12392	5174	7351	8023	7549	6931	10663	9360	8063	14529	15242	14308	9094	10274	11623	11587	13019	12847	8970	8960	5354	4706
CC	11842	4851	6768	7425	6952	6503	10296	8945	7522	14043	14790	13844	8502	9684	11062	11088	12497	12381	8659	8504	4761	4258
CD	12581	5275	7559	8245	7771	7070	10775	9492	8250	14690	15388	14458	9307	10485	11817	11753	13195	12999	9061	9110	5567	4857
CE	12411	5092	7405	8122	7653	6885	10591	9307	8078	14508	15204	14275	9160	10336	11650	11573	13019	12816	8880	8926	5422	4674
CF	12397	5092	7387	8100	7630	6880	10590	9303	8065	14499	15197	14268	9141	10318	11635	11563	13007	12809	8881	8919	5403	4666
CG	12412	5101	7403	8117	7647	6892	10600	9314	8080	14513	15209	14280	9158	10334	11651	11577	13022	12822	8889	8932	5420	4679
CH	12317	5076	7290	7985	7514	6838	10567	9266	7988	14443	15152	14218	9039	10217	11551	11502	12938	12758	8871	8871	5300	4616
CI	8142	7962	3938	1968	1746	7446	10648	8980	5655	11526	12859	11827	3941	4787	7198	8891	9423	10576	10221	8013	3789	6569
CJ	12592	5353	7546	8197	7721	7125	10848	9552	8264	14729	15438	14505	9285	10465	11822	11787	13220	13045	9145	9157	5544	4903

	WTG									
NSA	23	24	25	26	27	28	29	30	31	32
A	7921	7259	9423	10811	11589	8431	6740	10854	2908	895
B	4492	4148	6236	7695	8312	6070	3505	7500	1578	3346
C	4481	4122	6262	7721	8295	6033	3482	7485	1541	3333
D	4499	4105	6350	7811	8298	5978	3474	7496	1439	3267
E	5538	5210	6804	8220	9377	7027	4573	8556	1832	2705
F	4254	4173	5542	6992	8148	6340	3477	7287	2310	3974
G	4992	4739	6300	7732	8851	6686	4080	8017	1882	3191
H	4225	3751	6367	7839	7980	5591	3138	7197	1344	3411
I	4153	3635	6416	7891	7884	5445	3035	7110	1299	3442
J	4099	3602	6345	7819	7840	5443	2994	7062	1372	3507
K	4839	4672	6016	7446	8720	6710	3995	7871	2117	3475
L	3513	3509	5124	6596	7411	5810	2798	6546	2587	4535
M	3451	3474	5056	6529	7353	5797	2760	6485	2655	4611
N	5687	5287	7077	8497	9498	7010	4669	8693	1667	2424
O	5691	5278	7113	8534	9496	6985	4664	8694	1624	2385
P	6110	4552	10470	11880	7667	2986	4848	7489	4728	6092
Q	5982	7310	1475	1685	8626	9975	6764	7665	8207	9710
R	5995	7328	1470	1648	8623	9991	6784	7662	8241	9748
S	5802	4245	10256	11645	7186	2492	4603	7038	4907	6425
T	6085	7370	1722	2022	8845	10046	6803	7876	8079	9520
U	6049	7337	1683	1999	8805	10012	6771	7837	8062	9510
V	6066	7362	1667	1945	8799	10035	6799	7832	8113	9567

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1355 Bedford Highway
CA-BEDFORD B4A1C5
902.835.5560 (24/7)
Eric Johnson / ejohnson@strum.com
Calculated:
2023-01-13 4:08 PM/3.5.552

DECIBEL - Main Result

Calculation: Vestas - Jan 2023 - Noise

...continued from previous page

	WTG									
NSA	23	24	25	26	27	28	29	30	31	32
W	6054	7352	1645	1920	8779	10025	6791	7813	8118	9578
X	6067	7372	1633	1876	8774	10043	6814	7809	8159	9623
Y	6108	7418	1648	1841	8795	10088	6862	7831	8219	9684
Z	5955	7259	1545	1873	8677	9930	6700	7710	8062	9541
AA	5981	7288	1549	1843	8687	9959	6732	7721	8104	9584
AB	5960	7268	1530	1837	8667	9939	6712	7702	8089	9573
AC	6097	7411	1621	1803	8770	10080	6858	7807	8233	9705
AD	6077	7392	1604	1798	8752	10060	6839	7789	8218	9693
AE	6109	7430	1613	1761	8764	10097	6879	7803	8272	9749
AF	9032	10560	4656	3185	10255	13027	10184	9485	12315	13934
AG	8840	10370	4488	3013	10054	12832	9999	9284	12161	13798
AH	8893	10417	4484	3018	10181	12897	10033	9400	12132	13742
AI	8836	10371	4523	3045	9999	12820	10007	9237	12208	13861
AJ	7876	9404	3537	2059	9218	11877	9029	8417	11232	12915
AK	4765	3710	9412	10561	4106	1476	4422	4333	7086	9174
AL	5603	4436	10279	11451	4948	1882	5124	5232	7403	9359
AM	5586	4250	10291	11534	5547	1565	4883	5698	6728	8587
AN	4715	3932	9215	10275	3331	2224	4656	3706	7698	9866
AO	4847	4277	9174	10155	2834	2889	4991	3363	8241	10453
AP	4864	4294	9189	10169	2841	2901	5009	3374	8257	10468
AQ	5183	5993	7186	7549	1941	6635	6381	2284	10290	12653
AR	7414	8796	6299	5737	6036	10351	8858	5775	12422	14642
AS	7443	8825	6320	5753	6062	10379	8887	5803	12450	14670
AT	5591	6859	5752	5709	3924	8252	7009	3657	10744	13038
AU	7521	8900	6403	5828	6111	10443	8965	5862	12532	14753
AV	5118	5893	7238	7631	1791	6488	6295	2184	10204	12568
AW	7382	8724	6541	6051	5785	10184	8821	5585	12447	14691
AX	7346	8676	6587	6121	5693	10110	8782	5507	12424	14675
AY	7376	8707	6603	6130	5725	10142	8813	5540	12453	14703
AZ	5976	6846	7568	7775	2793	7490	7214	3143	11118	13479
BA	5850	6196	8766	9292	1936	6018	6748	2870	10567	12913
BB	7293	8497	7241	6952	5065	9657	8693	5062	12467	14770
BC	7290	8489	7259	6975	5045	9641	8688	5047	12465	14769
BD	6990	8041	7683	7598	4238	8920	8326	4423	12188	14528
BE	7587	8831	7257	6874	5500	10063	9001	5458	12737	15025
BF	7077	8227	7330	7133	4664	9292	8457	4719	12269	14588
BG	7152	8315	7325	7103	4780	9402	8537	4823	12340	14655
BH	6588	7399	8202	8366	3216	7885	7795	3690	11703	14066
BI	7171	8333	7345	7121	4793	9416	8556	4839	12359	14675
BJ	7406	8769	6420	5891	5923	10279	8848	5691	12442	14673
BK	5261	5931	7604	8033	1673	6344	6374	2255	10277	12642
BL	6204	6631	8884	9330	2311	6531	7162	3185	11007	13359
BM	6158	7026	7705	7886	2953	7650	7396	3322	11300	13661
BN	5414	6263	7234	7539	2243	6937	6637	2559	10543	12905
BO	7059	8317	6789	6471	5093	9604	8477	4993	12205	14490
BP	6185	7067	7677	7844	3017	7714	7430	3367	11334	13693
BQ	7087	8346	6808	6484	5119	9632	8505	5021	12232	14518
BR	7233	8567	6478	6024	5615	10015	8670	5416	12308	14558
BS	7224	8557	6482	6032	5599	10002	8661	5402	12302	14553
BT	7089	8343	6829	6510	5103	9621	8506	5011	12236	14523
BU	6988	8227	6841	6559	4943	9475	8400	4867	12147	14440
BV	7089	8342	6840	6523	5095	9616	8506	5006	12238	14526
BW	7040	8134	7541	7407	4430	9094	8396	4559	12238	14570
BX	8582	9809	8135	7646	6335	10960	9992	6374	13737	16025
BY	7882	9076	7741	7381	5558	10186	9280	5606	13057	15360
BZ	7253	7108	10841	11505	3690	5966	7778	4666	11274	13521
CA	8387	9615	7971	7503	6160	10777	9797	6187	13543	15831
CB	8394	9621	7982	7515	6162	10780	9804	6191	13550	15839
CC	7910	9101	7780	7420	5571	10203	9307	5626	13087	15391
CD	8555	9797	8033	7526	6374	10983	9970	6390	13701	15983
CE	8373	9620	7861	7370	6226	10824	9790	6226	13517	15799
CF	8364	9609	7867	7381	6207	10807	9780	6210	13510	15792
CG	8378	9623	7873	7383	6224	10823	9794	6226	13523	15805
CH	8307	9540	7883	7419	6106	10715	9719	6122	13461	15748
CI	7173	7032	10762	11429	3610	5907	7701	4586	11203	13453
CJ	8593	9822	8135	7642	6353	10977	10004	6390	13747	16035

APPENDIX Q: PROJECT TEAM CURRICULUM VITAE

Shawn Duncan, BSc.
President
Total Experience: 33 years

PROFESSIONAL ASSOCIATIONS

- Environmental Services Association of Nova Scotia (ESANS)
- Canadian Land Reclamation Association (former Board Member)
- Halifax Chamber of Commerce
- OTANS member

AREAS OF SPECIALIZATION

- Project Management
- Environmental Impact Assessment
- Public and Regulatory Consultation
- Permitting
- Infrastructure Planning and Construction
- Environmental Management System
- Natural Resource Inventories

EDUCATION

- BSc., McGill University, Montreal (1990)

TRAINING

- M.Eng. (pending), University of New Brunswick, Fredericton
- CEAA Screening Training
- Contaminated Sites Assessment and Clean-up
- EMS and Project Planning
- Conflict Management and Dispute Resolution
- Project Management Bootcamp, 2007
- ISO 14001 Orientation

RELEVANT EXPERIENCE

Mr. Duncan is the President of Strum Consulting based in Bedford Nova Scotia. Shawn has also worked for both provincial and federal government departments, as well as having senior environmental experience in the private sector for the oil and gas industry. He has worked professionally in the environmental field throughout Canada and internationally for over 30 years. His areas of specialization include project planning and management, environmental impact assessment, infrastructure planning and construction, public consultation and regulatory support.

REPRESENTATIVE PROJECTS AND ROLES

NATURAL RESOURCE INVENTORIES AND SURVEYS:

Environmental Effects Monitoring Programs, Paper Mills, NB – Project Manager: Involved in the development, design, and implementation of EEM programs for five pulp mills that were required under federal regulations. These programs where multi-year in scope and involved both freshwater and marine systems.

Assessment of Downstream Fish Migration, NB – Field Coordinator: Involved in the study of the downstream migration patterns of juvenile blue-backed herring and alewife on the St. John River.

Fish Habitat Assessments, NS, NB – Program Manager: Coordinated a fish habitat assessment program that assessed over 500 watercourses that intersected a proposed pipeline corridor, in support of the EIA and provincial and federal permitting.

Aerial Moose Survey, NB – Program Manager: Managed and conducted a provincial aerial winter survey for moose, using helicopter.

Development of Watershed Management Plan, Keswick River, NB – Program Manager: Developed a watershed management plan for the Keswick River System in conjunction with the federal Department of Fisheries and Oceans.

Numerous Fisheries and Aquatic Habitat Surveys, NS, NB – Project Manager: Coordinated a number of freshwater fisheries and aquatic habitat surveys throughout the Atlantic provinces to provide baseline and monitoring data for a number projects and developments.

Identification of Fish Habitat Improvement Opportunities, NB – Project Manager: Identified particularly beneficial opportunities for fish habitat improvement in New Brunswick, and determined strategies for project implementation.

Development of Fisheries Management Plans, Recreational Fisheries Developments, NB – Technical Support: Involved in the preparation of fisheries management plans to provide improved recreational salmonid fishing on private landholdings.

Tropical Ecology, Bellairs Institute, Barbados – Field Assistant: Attended a field course on tropical ecology and participated in research surveys of mangrove environments, reef ecosystems, and marine fisheries.

Fish Behavioural Study, St. Andrews, NB – Field Assistant: Conducted a two-month study underwater survey to observe the behaviour of juvenile Pollock under induced threat from predation.

Marine Benthic Habitat Surveys, NS, NB – Field Assistant: Conducted a number of marine benthic habitat and sampling surveys for the federal government to support dredging or wharf construction activities.

ENVIRONMENTAL ASSESSMENTS:

Sydney Tar Ponds Environmental Impact Statement, Sydney, NS – Manager: Mr. Duncan managed the EIS for the cleanup, which involved managing a large team of professionals, working closely with the proponent and their engineering consultant to prepare the 7-volume EIS for submission to federal and provincial regulators. Components included public and regulatory consultation, environmental baseline field work and human and ecological risk assessments. He also provided testimony during the three week public hearing process as part of a joint review panel.

Environmental Impact Assessment, Keltic Petrochemical and LNG Facilities, NS – Project Manager: Mr. Duncan acted as Project Manager for the preparation of a provincial EIA and a federal CSR for this combined petrochemical and LNG project. Managed a large consulting team and coordinated consultation with the public, stakeholders, and the regulatory agencies. Shawn also acted as panel lead at the 8-day provincial hearings that were part of the NS review process.

Fundy Tidal Energy Project, NB – Senior Technical Reviewer: Mr. Duncan provided senior technical input and senior review for the combined federal and provincial EA that was required as part of the Fundy Tidal Energy Project.

Environmental Assessment, NB DoT, Route #11, NB – Senior Reviewer: Mr. Duncan acted as the senior reviewer for a provincial EA for a new 4 lane highway in northern NB. This Project also included compliance with the federal CEA Act and required a number of natural resource surveys.

Federal Comprehensive Study Report, Hamilton Harbour Clean-up, ON – Project Manager: Mr. Duncan was the Project Manager and Senior Technical Reviewer for the federal CSR that was required as part of the Randle Reef Project in Hamilton Harbour.

Environmental Impact Assessment, 25 MW Windfarm, Canso, NS – Project Manager: Mr. Duncan conducted the environmental impact assessment for a windfarm and associated infrastructure. Components included public and regulatory consultation, environmental baseline field work, turbine site selection, and environmental impact assessment.

Joint Federal-Provincial Environmental Assessment (Comprehensive Study) for the Black Point Quarry Project, Erdene Resource Development Corp, NS – Project Director: Mr. Duncan was the Project Director responsible for senior review and client management for the environmental assessment project and EA scoping; scoping and coordination of field studies; regulatory and public consultation plans; and report preparation.

Environmental Impact Assessment, Power Generating Facilities, Barbados – Project Manager: Mr. Duncan was the Project Manager for the environmental impact assessment for a 250 MW power production facility and associated transmission line. Options that were considered for the facility fuel design included low-speed diesel engines and natural gas engines. Components included public and regulatory consultation, environmental baseline field work, and environmental impact assessment.

Environmental Assessment, Maritimes & Northeast Pipeline, Mainline Expansion, NS, NB – Project Manager: Mr. Duncan provided project management and development of the federal CEAA screenings for four compressor stations. This involved detailed site selection, field surveys and public, regulatory, and First Nations consultation programs.

Environmental Impact Assessment, Terminal and Pipeline Facilities, Barbados – Project Manager: Mr. Duncan prepared the EIA for a petroleum terminal facility and associated transmission pipelines. The existing bulk storage facilities were relocated from a coastal location in Oistins to a location near the airport. Components included public and regulatory consultation, environmental baseline field work, and pipeline route selection.

Environmental Impact Assessment, Windfarm, Barbados – Project Manager: Mr. Duncan conducted the Environmental Impact Assessment for a windfarm near Lamberts, Barbados. The project consisted of eleven 900 kW wind turbines. The EIA included public and regulatory consultation, environmental baseline field work, and environmental impact assessment.

Environmental Impact Assessment, Prison Facility, Barbados – Project Manager: Mr. Duncan prepared the Environmental Assessment for a new prison facility in Dodds, St. Philip. The previous prison was destroyed by fire and therefore there was an accelerated timeline to build a new facility to house the inmates. The EIA was completed ahead of schedule.

Environmental Impact Assessment, Natural Gas Pipeline Route, Country Harbour, Nova Scotia to St. Stephen, New Brunswick – Assessor: Mr. Duncan participated in the technical aspects of the corridor selection and environmental impact assessment of a 558 km pipeline, which included providing input on the definition of VECs, prediction of environmental effects, identification and analysis of design and route alternatives, socioeconomic impacts, contingency planning and compensation.

ENERGY RELATED EXPERIENCE:

Regulatory Support and Joint Public Review, Sable Offshore Energy and Maritimes & Northeast Pipeline – Technical Support: Mr. Duncan participated in, and provided environmental support to expert witness panel members testifying before a Joint Public Review Panel which included representatives of the National Energy Board.

Detailed Route Assessment and Hearings Maritimes & Northeast Pipeline – Technical Support: Mr. Duncan conducted a detailed analysis for the routing of the detailed 25 m easement for the mainline 30-inch pipeline. He also provided technical support for a detailed regulatory review of this easement through a NEB panel review process.

Environmental Protection Plan, Maritimes & Northeast Pipeline – Management/Technical Support: Mr. Duncan provided management and technical support for the development of an environmental protection plan for construction of 550 km of 30 inch natural gas transmission pipeline. Construction practices and protection measures were outlined in the EPP which would minimize potential impacts to the receiving environment.

Maritimes & Northeast Pipeline – Construction Supervisor: For the construction of the M&NP mainline and the Halifax lateral, Mr. Duncan fulfilled the role of construction supervisor. He provided supervision of a team of 20 environmental inspectors to oversee the implementation of environmental commitments and regulatory requirements during construction activities.

Duke Energy, Environment, Health and Safety Audit, Natural Gas Distribution and Processing Facilities, Fort Nelson, British Columbia, **and Northwestern Ontario – Lead Assessor:** Mr. Duncan conducted an EH&S compliance audit of distribution pipeline facilities in Ontario, and a gas processing facility in Fort Nelson. He verified compliance with applicable provincial and federal legislation and/or permits related to environmental and health and safety requirements for these types of facilities.

Comprehensive Study, Halifax Lateral, Maritimes & Northeast Pipeline – Management/Technical Reviewer: Mr. Duncan provided management support and technical review of a comprehensive EIA for the construction and operation of 120 km of 12 inch natural gas pipeline into Halifax. Shawn also acted as the construction supervisor to oversee the implementation of required environmental measures.

Pipeline Evaluation and Coastal Mapping, Orimulsion Pipeline, NB – Project Manager: Mr. Duncan was involved in the evaluation of an Orimulsion pipeline and the development of a coastal mapping for use in contingency and spill response planning for the transportation of Orimulsion. The Orimulsion was being transported to the NB Power generating station in Dalhousie New Brunswick.

ENVIRONMENTAL MANAGEMENT:

Sydney Tar Ponds Remediation – Project Director and Regulatory Manager: Mr. Duncan fulfilled these senior roles during the Detailed Design of the Sydney Tar Ponds Clean-up and for the ongoing Construction Administration and Oversight for this Project.

Inventory of Fish Processing Facilities, Environment Canada, Atlantic Provinces – Project Manager: Managed a project that compiled and evaluated data and information of fish processing facilities in the Maritimes with the intent to evaluate waste treatment procedures for these operations.

Acid Rock Mitigation and Construction Response Plan, Maritimes & Northeast Pipeline – Technical Support: Participated in the development and implementation of a unique approach to the handling of acid rock during the planning and construction of the pipeline. A construction response plan (CRP) was developed in conjunction with regulators that addressed the identification, handling, and disposal of acid rock encountered during construction. In addition, the CRP outlined mitigation and risk analysis procedures that were developed for treatment of acid rock to be left on-site.

Environmental Evaluation and Management, Canadian International Development Agency, India – Technical Support: Assisted CIDA and the government of India in identifying hazardous waste streams and developing treatment strategies.

Environmental Sensitivity Atlas, Baie de Chaleur, NB – Assessor: Collected environmental information for the Baie de Chaleur region and used it to produce environmental sensitivity mapping for the region to support spill response planning.

Inland Waters and Coastal Oceanographic Information Network, NB – Technical Support: Provided technical support for a project to develop and apply an environmental information system for the Bay of Fundy and Chaleur Bay regions. The system combines metafiles, a knowledge-based system and a geographical information system. It is used both for EIAs of proposed projects and contingency planning and to identify development opportunities.

Corporate EMS, Industrial Client – Project Manager: Developed and provided implementation guidance for a corporate environmental management system that closely followed the requirements as set out in the ISO 14001 CSA standard.

Environmental Performance Evaluation Training, India – Technical Support: Provided technical input and conducted training to environmental professionals in India to provide an overview of EPE and the requirements under the ISO 14031 CSA standard.

Wilderness Recreation Potential Assessment, Halifax, NS – Project Manager: Prepared an assessment of the potential for wilderness recreational use of a forest area that will be bisected by the proposed Highway #113.

Melanie Smith, MES
Vice President – Environmental Assessment & Approvals
Total Experience: 21 years

AREAS OF SPECIALIZATION

- Project Management
- Environmental Assessment
- Ecological Assessment
- Habitat Assessment
- Regulatory Permitting, Monitoring, and Compliance Assessments
- Environmental Protection Plans
- Wetland/Watercourse Alterations
- Wetland and Fish Habitat Compensation

EDUCATION

- MES, Dalhousie University, Halifax, NS (2004)
- BSc. (Honours), Environmental Science, Acadia University, Wolfville, NS (2001)

TRAINING

- GBA+ Micro-learning Series (2022)
- Cultural Safety (2021)
- Unconscious Bias (2021)
- Emergency First Aid (2021)
- Management Development Program (2019)
- Advanced Training, *Impact Assessment Act* (2019)
- Introduction to CEAA 2012 (November 2012)
- Water Management & Wetland Restoration Training Course, University of Guelph (2010)
- Screenings Under CEAA (2010)
- Aboriginal Relations Training (Ontario Ministry of the Environment) (2008)
- Negotiation and Mediation Training (Ontario Public Service) (2008)
- Orientation to CEAA (2007)
- Atlantic RBCA Applications (Dalhousie University) (2004)
- Management of Environmental Site Assessment (Dalhousie University) (2004)

RELEVANT EXPERIENCE

Ms. Smith is the Vice President of Environmental Assessments and Approvals. She has a strong background in a variety of environmental program and policy areas. Ms. Smith has extensive experience leading teams, as well as building relationships and communicating with the public, regulators, the Mi'kmaq of Nova Scotia, clients, experts, and other stakeholders.

Prior to her appointment as Vice President of Environmental Assessments and Approvals at Strum, Ms. Smith held a Team Lead position with the Impact Assessment Agency of Canada. That role included the following:

- Led a team of professionals in completing federal environmental and impact assessments to support the Minister in decision making.
- Managed all aspects of assembling project teams, executing priorities, performance, deliverables, and overall quality.
- Supported the team in conducting Indigenous consultation, coordinating with federal and provincial departments, communicating with proponents, and engaging with stakeholders.
- Supported the team in the technical review of regulatory submissions under the *Canadian Environmental Assessment Act, 2022* and the *Impact Assessment Act*.
- Advised senior Agency officials on complex regulatory considerations.

Ms. Smith also held multiple roles with Nova Scotia Environment which included the following responsibilities:

- Led the development, management, and implementation of the Risk-Based Audit Project. The purpose of this corporate priority project was to modernize inspection services by using risk to maximize the allocation of limited resources while fulfilling the Department's mandate.
- Conducted extensive cross-sector collaboration within the Department, including all regions, inspectorates, divisions, and staff levels to ensure the project met the needs of working level staff and the goals of senior management.
- Provided strategic policy support and analysis for departmental programs and policies using the Regulatory Management Process.
- Conducted focus group sessions, coordinated stakeholder consultation, and provided recommendations to senior management.
- Completed inspections, responded to complaints, reviewed applications, and generated approvals related to the protection and sustainable use of air, land, and water resources in NS.

At Strum, Ms. Smith previously held progressive management roles including acting as the Team Lead during a long-term secondment of a senior manager and managed all aspects of a variety of projects within the Environment Group, including environmental assessments, watercourse alteration applications, wetland alteration applications, wetland compensation, environmental protection plans, environmental monitoring, and ecological assessments. This also included successfully and simultaneously managing multiple provincial Environmental Assessments. Ms. Smith also has extensive experience creating budgets, schedules, staff resourcing and supervision, deliverables, and client communication. She has presented at public open houses, community liaison committee meetings, public hearings, and testified at a UARB hearing.

REPRESENTATIVE PROJECTS AND ROLES

Strum Consulting (current)

Wind Power Environmental Assessments, 2022-2023 – **Project Manager/Team Lead:** Providing senior review and management on several 100 MW+ wind farms in Nova Scotia.

Impact Assessment Agency

Boat Harbour Remediation Project, 2018-2022 – **Team Lead:** Team Lead for the Agency's technical review of this project, as well as associated consultation with the Mi'kmaq of Nova Scotia and public engagement. This project conducted the Agency's first external technical review as part of the process.

Beaver Dam Mine Project, Fifteen Mile Stream Project, **2017-2022**– **Team Lead:** Team Lead for the Agency's technical review of these gold mining projects, as well as associated consultation with the Mi'kmaq of Nova Scotia and public engagement.

Canso Space Port, Northern Pulp Replacement Effluent Treatment System, Touquoy Mine Expansion, Goldboro Gold Mine, 2017-2021 – **Team Lead:** Team Lead for requests to the Minister for these projects to be subject to the *Impact Assessment Act*. Review and analysis involved input from federal departments and a decision package to the Minister.

Howse Property Iron Mine Project, 2018– **Team Lead:** Team Lead for the Minister's decision package for the Howse Property Iron Mine.

Strum Consulting (past)

Wind Power Environmental Assessments, 2011-2014 – Project Manager/Team Lead: Project managed and coordinated all aspects of the provincial EA process for seven wind power projects ranging in size from 4 MW to 10 MW. Project components included wetlands, watercourses, wildlife, avifauna, bats, sound, shadow flicker, visual aesthetics, socio-economic conditions, and effects assessment. Also highly involved in public engagement activities including participation at several municipal planning meetings and project open houses, as well as the preparation of presentation materials (e.g. posters, handouts, etc.).

South Canoe Wind Project, **2011-2013 – Project Manager/Team Lead:** Project managed and coordinated the completion of numerous desktop and field studies in support of a 100 MW wind power project. Studies included exclusion mapping; a desktop review of site habitat, species at risk (including flora, fauna, and avian species), and archaeological resources; a sound and shadow flicker assessment; a visual impact assessment; and field assessment for wetlands, watercourses, wildlife, and avian species. Managed the launch of the project website and completed the effects assessment for the biophysical components of the provincial environmental assessment registration document. Also developed presentation materials for and attended three public open houses and delivered multiple technical presentations to the Community Liaison Committee and as part of the Development Agreement Public Hearing process.

CEAA Screening, Hansen Bridge Replacement, 2012 – Project Manager: Project managed field assessments (stream assessment, archaeological surveys, and habitat characterization), desktop review, and effects assessments for a bridge replacement project under CEAA. Consulted with Nova Scotia Environment, Transport Canada (TC), and DFO to ensure all regulatory requirements were met.

Scott Dickey, B.Sc. (Biology, Honours), MREM
Manager, Environmental Sciences
Total Experience: 14 years

AREAS OF SPECIALIZATION

- Project Management
- Environmental Assessment
- Technical Program Development
- Wetland and Watercourse Alteration Permitting
- HADD Projects and DFO Authorizations

EDUCATION

- Masters of Resource and Environmental Management (MREM) - Dalhousie University, Halifax, NS (2012)
- Bachelor of Science (Honours in Biology) - Mount Saint Vincent University, Halifax, NS (2009)

TRAINING

- First Aid & CPR Level A - St. John's Ambulance (2021)
- WHMIS Certification - Construction Safety Association of Nova Scotia (2018)
- Project Management for Environmental Professionals - Eco Canada (2013)
- Risk Communication and Conflict Resolution Training - Eco Canada (2013)
- Over 80 Hours of Project Management Coursework - Dalhousie University's Faculty of Management (2010 -2011)

RELEVANT EXPERIENCE

Mr. Dickey is the Manager of Environmental Sciences at Strum where he oversees the company's Environmental Science Group in conducting environmental assessments, research, and field assessment programs, as well as wetland and watercourse permitting projects.

Mr. Dickey joined the Strum team in 2012. He received his Masters of Resource and Environmental Management degree from Dalhousie University that same year. While studying at Dalhousie, Scott specialized in environmental assessment, project management, regulatory compliance management, and natural resource management. Scott also obtained a Bachelor of Science degree with Honours from Mount Saint Vincent University in 2009.

Scott is active in managing consulting projects, conducting environmental assessments, overseeing wetland and watercourse alteration applications, and Fisheries and Oceans Canada (DFO) authorizations. He is knowledgeable with provincial and federal approvals processes, as well as best industry practices for assessment and data collecting protocols. Scott is also a technical specialist in a number of specialized areas such as acoustic assessments and compliance consulting, avian radar assessments, environmental ecology, and environmental geomatics systems.

REPRESENTATIVE PROJECTS AND ROLES

Various Wind Power Projects, NS, 2020-Present, Environmental Scientist – Coordinated and led the environmental assessment of several large (> 50 MW) wind power projects. This included the development of new services such as avian radar assessments, the coordination of several environmental research and assessment programs, regulatory consultation, and the coordination of the data analysis and technical reporting programs.

L8005 Transmission Line Project, NS, 2020-2022, Environmental Scientist – Managed and conducted several component studies as part of this transmission line project's environmental assessment, including an avifauna interaction study, wetland, watercourse and rare plant studies, and a Mainland Moose study.

Chaswood Wetland Compensation Project, NS, 2020-2022, Environmental Scientist – Identified, concepted, and developed a wetland expansion and enhancement project located near Chaswood, NS.

Melford Atlantic Gateway Terminal Project, NS, 2016-2022, Environmental Scientist – Managed and conducted several component studies, permitting programs, and prepared environmental management plans for this marine terminal project. This included conducting a wetland and watercourse assessment and obtaining alteration approvals for several dozen hydraulic features; preparing environmental management plans for the Project's construction and operation; and consulting with regulators and other stakeholders on the Project's regulatory requirement.

Boat Harbor Remediation Project, NS, 2021, Environmental Scientist – Researched, designed, and installed mitigations to improve water quality and reduce fish mortalities at the Boat Harbor remediation site.

Aulds Cove Avian Assessment, NS, 2015 to 2019, Environmental Scientist – Completed pre- and post-construction avian studies and developed a risk model for the transmission line project which is located in a migratory bird flyway.

Canso Spaceport Environmental Assessment, NS, 2018, Environmental Scientist – Completed ecological assessments including avian assessments, bat assessment, flora and fauna assessments, and wetland and freshwater habitat assessments as part of the Project's Environmental Assessment.

Windsor Forks Wetland Compensation Project, NS, 2014-2018, Environmental Scientist – Contributed to the design and construction of a wetland creation project in which a wetland was created in the site of a quarry near Windsor, NS.

Various Wind Power Project, NS, 2012-2018, Environmental Scientist – Completed environmental assessments, wetland assessments, flora and fauna surveys, avian assessments, and post-construction bird and bat monitoring programs. Projects include, the CBU Wind Power Project, the North Beaverbank Community Wind Project, the Nine Mile River Community Wind Project, the Pockwock Community Wind Project, the Truro Heights / Millbrook Community Wind Project, and the Whynotts Community Wind Project.

South Canoe Wind Project, NS, 2012-2018, Environmental Scientist – Completed wetland assessments, flora and fauna surveys, ambient sound assessments, wind turbine sound warranty test, and assisted in geotechnical assessments.

Canso Causeway Avian Study, NS, 2014-2016, Environmental Scientist – Completed avian studies over several years and developed risk analysis framework and mortality prediction model.

South Canoe Wetland Compensation Research Project, NS, 2014-2016, Environmental Scientist – Completed a comprehensive research project as partial fulfillment of the wetland compensation requirement for the South Canoe Wind Project's wetland alteration. This included a comprehensive assessment and monitoring program of a number of reference wetland sites in Nova Scotia, as well as GIS analysis, vegetation, soil and hydrology data analysis, and reporting for the Project.

Maritime Link Transmission Line Watercourse Assessment, NS, 2013- 2014, Environmental Scientist – The scope of this project included the design and coordination of desktop and field programs to assess watercourse crossings and fish habitat along the footprint of transmission and grounding lines for the purpose of construction planning and permitting. This involved the identification and assessment of watercourses within the 90 km (combined) transmission and grounding line corridors in Cape Breton, as well as all associated site facilities and access roads. Responsible for completing field assessments including fish habitat and fish population assessment, preparation and maintenance of field data, and general communications.

Trenton Generating Station, Benthic and Mixing Zone Studies, NS, 2013, Environmental Scientist – An ecological assessment was completed to evaluate ecosystems in three water bodies, which receive effluents from the Trenton Generating Station's ash management facilities. The assessment incorporated an evaluation of benthic community composition (*i.e.*, benthic macro-invertebrates and macrophytes), as well as a characterization of habitat in the receiving waters. The ecological assessment was completed simultaneously with a mixing zone study, which was designed to provide guidance on determining effluent discharge limits outlined in the Operating Approval for the Trenton Generating Station, by determining concentrations of compliance parameters in the mixing zones of receiving effluent waters. Involved in all aspects of the Project including study design, the coordination and completion of the field programs, water quality sampling and sample management, data management, and reporting.

Angus Doane, MREM
Environmental Scientist
Total Experience: 6 years

AREAS OF SPECIALIZATION

- Field Program Design and Logistics Coordination
- Environmental Assessment
- Wetland Delineation and Functional Assessment
- Watercourse and Wetland Alteration Permitting
- Marine near-shore and Water Quality Monitoring
- Avian Studies
- Regulatory and Public Consultation

EDUCATION

- Master of Resource and Environmental Management (MREM) - Dalhousie University, Halifax, NS (2021)
- Bachelor of Science (Honours in Chemistry) - Mount Allison University, Sackville, NB (2019)

TRAINING

- Wetland Ecosystem Service Protocol – Atlantic Canada (WESP-AC) – Maritime College of Forest Technology (2021)
- Wetland Delineation Training – Maritime College of Forest Technology (2020)
- Small Vessel Operator Proficiency "SVOP" and Marine Emergency Duties "MED A3" - Survival Systems Training Limited (2017)
- Wilderness First Aid - St. John's Ambulance (2022)
- Backpack Electrofishing – Canadian Rivers Institute (2021)
- VHF Radio Restricted Operators Certificate – Industry Canada (2017)

RELEVANT EXPERIENCE

Mr. Doane joined the Strum team in 2020 as an Environmental Intern, while working towards his Master of Resource and Environmental Management degree at Dalhousie. While studying at Dalhousie, Angus specialized in natural resource management in Nova Scotia, especially in the coastal zone. Angus obtained his Bachelor of Science degree in 2019 from Mount Allison University, where he specialized in Environmental Chemistry and Microbiology. He completed his honours thesis in organic and inorganic synthesis of maltol-derived thiopyridinone ligands for various environmental and anti-bacterial applications. To complement the lab-based skills associated with research, Angus has experience in field-based collection and preparation of environmental samples from his academic studies.

Mr. Doane is active in conducting environmental assessments, wetland functional assessments, delineations, and compensation projects, completing radar, avian, wetland, watercourse, flora, lichen, and wildlife surveys, and other ecological studies. He has planned and coordinated multi-team fieldwork across large projects in remote locations throughout Nova Scotia. Away from the field, he is knowledgeable with Provincial and Federal approvals and permitting processes and works closely with senior staff to prepare reports and regulatory submissions, as well as prepare materials for, and participate in, public and regulator consultation components for Environmental Assessments. He complements freshwater and marine survey work with deckhand and operator experience in near-shore marine survey projects. Mr. Doane also serves on the Joint Occupational Health and Safety committee as an environmental science team representative. Also, Angus is experienced in working with multi-disciplinary teams through the Dalhousie Faculty of Management, in the Management Without Borders and Tri-Course class-structures, beyond his time with Strum.

Mr. Doane held a previous position with Environment and Climate Change Canada (ECCC) as a water quality technician. He conducted water sampling in many bays, harbours, and estuaries around Nova Scotia from Pubnico to Cape North, dealing with all matters of leading a field crew on a day-to-day basis. This included trailering, launch and recover practices, regular boat, motor, trailer and vehicle maintenance, as well as training and aiding new staff in acclimating to the work. Processing of samples was also completed on a daily basis using the modified A1 method in a level 3 CALA certified microbiology lab.

REPRESENTATIVE PROJECTS AND ROLES

Various Wind Farm Project Environmental Assessments, NS – Environmental Scientist/Field Coordinator:

- **Goose Harbour Lake Wind Farm Project, NS, (2021 – Present)**
- **Mersey River Wind Farm Project, NS, (2021 – Present)**
- **Weavers Mountain Wind Farm Project, NS, (2021 – Present)**
- **Ellershouse Wind Farm Project, NS, (2021 – Present)**
- **Apitamkiejit Windfarm, NS, (2021 – 2022)**
- **Blueberry Acres Windfarm, NS, (2021 – 2022)**
- **Panuke Lake Wind Farm, NS, (2021 – 2022)**
- **Melvin Lake Wind Farm Project, NS (2021 – Present)**
- **Sandy Point Wind Farm Project, NS (2021 – 2022)**
- **Higgins Mountain Wind Farm Project, NS, (2020 – Present)**

Coordinated and completed all aspects of field surveys for Environmental Assessments, including wetland, watercourse, fish & fish habitat, avian, avian radar, bat, wildlife, flora, and lichen surveys. Prepared, reviewed, and organized field data using several methods of collection. Prepared materials for and participated in public consultation meetings, as well as aiding in the preparation of materials for public outreach. Led regulatory meetings to brief provincial and federal agencies on project activities. Prepared EA related documents, including methodologies, effects assessments, and desktop reviews.

Avian Radar Studies for Wind Development, NL, 2022 – Present - Environmental Scientist – Aided in the design and construction of avian radar monitoring systems for 4-season deployment in harsh coastal and inland environments in Newfoundland, including siting and remote monitoring.

Ruth Falls Hydroelectric Monitoring, NS, 2021-Present - Project Coordinator/Environmental Scientist: Completed Swallow nesting/monitoring surveys during the fall 2021 migration period. Designed, coordinated, and conducted a wetland and wetland fish & fish habitat monitoring program considering wetland fish habitat functions.

Melford Atlantic Gateway Terminal Project, NS, 2020-Present – Environmental Scientist: Completed comprehensive research as partial fulfillment of the wetland compensation requirement for the Melford Terminal's wetland alteration. This has included a comprehensive search of potential sites across Antigonish and Guysborough counties based on the precedence of other wetland compensation projects, as well as aiding in the design and implementation of the engineered wetlands to be created. Supported regulatory consultation for watercourse alteration applications and impacts to fish and fish habitat, especially salmonid species.

L8001 and L8005 Transmission Line Project, NS, 2020-2022 – Environmental Scientist/Field Coordinator: Planned, coordinated and completed Wetland and watercourse assessments, wildlife surveys, and rare plant and lichen surveys, along the linear corridor spanning 100 km from the NS/NB border to Onslow, NS. These surveys involved preparing desktop and safety tools for field staff, as well as preparing reports respective to each of the surveys.

Boat Harbor Remediation Project, NS, 2021, Environmental Scientist – Monitored water quality through seasonal tide cycles, before aiding in the research and installation of mitigations to improve water quality and reduce fish mortalities at the Boat Harbor remediation site.

GWRR Watercourse Alteration Approval and Fish Surveys, NS, 2021 – Environmental Scientist: Conducted electrofishing / fish salvage for an emergency watercourse alteration along a section of railway. This involved the capture, identification, documentation, and release of fish from the impacted section of the watercourse. Conducted further watercourse assessments to aid in the alteration approval process.

Canadian Shellfish Sanitation Plan – Shellfish Water Classification Program, NS, 2017-2019 – Water Quality Technician: Completed three summers of fecal coliform testing of coastal waters around the province of Nova Scotia to aid in the classification of areas for shellfish harvesting. This involved extensive travel, sample collection, processing and overall upkeep of field equipment across a fleet of boats, vehicles, and associated gear. Lab and sample processing work included QA and QC procedures, sample reading, media production, waste management, and sample inoculation.

Lyndsay Eichinger, BSc., MREM
Environmental Scientist
Total Experience: 5 years

AREAS OF SPECIALIZATION

- Environmental Reporting and Permitting
- Wetland and Watercourse Assessment
- Wildlife Surveying and Assessment
- Remediation and Reclamation
- Environmental Emergency Response
- Dangerous Goods Assessment

EDUCATION

- Masters of Resource and Environmental Management (MREM) - Dalhousie University, Halifax, NS (2021)
- Bachelor of Science - University of British Columbia (2019

TRAINING

- ATV Certification (2022)
- RPAS Pilot Certification (2022)
- BICO – Search and Rescue Program (2022)
- Electrofishing Certification (2021)
- Standard First Aid and WHMIS (2021)
- Stream Gauging Training from UBC (2019).
- Environmental Impact Assessment Certificate received from the Centre for Environmental Assessment Research at UBC (2019).
- Derailment Response - CP Railway (2018)
- Railway Safety Training (2018) Transportation of Dangerous Goods (2018)

RELEVANT EXPERIENCE

Miss Eichinger first joined the Strum team in 2020 as an Environmental Intern, while working towards her Masters of Resource and Environmental Management degree at Dalhousie. While studying at Dalhousie, Lyndsay specialized in remediation, environmental assessment, and natural resource management in Nova Scotia. Lyndsay also obtained her Bachelor of Science degree in 2019 from the University of British Columbia where she specialized in Earth and Environmental Science with a minor in Economics.

During her graduate studies, Lyndsay conducted a desktop study on the Boat Harbor Remediation Project, producing a technical review paper evaluating the cost-effectiveness of the different remedial components and technologies considered by the project. This paper has since been published in the journal Remediation titled: Review of remedial options for the Boat Harbour remediation project in Nova Scotia, Canada.

Lyndsay is active in conducting environmental assessments, wetland delineations, watercourse assessments, bat surveys, and other ecological studies. She has conducted significant fieldwork across large projects in remote locations. She is knowledgeable with provincial and federal regulations, working closely with senior staff preparing reports and regulatory submissions. Lyndsay is experienced working with multi-disciplinary teams through the Dalhousie Faculty of Management, in the Management Without Borders and Tri-Course class-structures, beyond her time with Strum.

Lyndsay held a previous position with RAM Environmental Response as a HAZMAT Responder based in the BC interior. Her role was fast-paced and multidisciplinary, working in tandem with senior management on emergency response planning and remediation teams on site. Lyndsay has responded to an array of emergency situations involving dangerous goods, such as train derailments and fuel spills, all requiring coordination between clients, contractors, first responders, and government parties. She has a strong background in safety protocols, erosion control implementation, response tactics, and emergency remediation measures for a variety of contaminants. Lyndsay is well practiced in remote travel along with ATV, snowmobile, and 4x4 use.

REPRESENTATIVE PROJECTS AND ROLES

Environmental Assessment Registration and Environmental Protection Plan, NL, 2022 – Junior Environmental Professional: Completed reporting requirements for the submission of an EA Registration Document and associated Environmental Protection Plan for a transmission line decommissioning project located in Newfoundland and Labrador.

Ellershouse Wind Farm Environmental Risk Assessment, NS, 2022 – Junior Environmental Professional: Conducted a desktop study to characterize environmental risk, mitigation, and management measures for a wind farm located in Ellershouse, NS. This report was then used to inform constraints analysis and Project design features.

Windsor Forks Wetland Compensation Project, NS, 2021-2022 – Junior Environmental Professional: Completed reporting requirements for the final year of wetland monitoring and assessment for a constructed wetland.

Weavers Mountain Wind Farm Moose Tracking Surveys, NS, 2022 – Junior Environmental Professional: Participated in field assessments for winter wildlife, with a focus on mainland moose and other species at risk. This involved walking predetermined transects through various habitats to identify and document evidence of wildlife such as tracks, scat, and browsing.

GWRR Watercourse Alteration Approval and Fish Surveys, NS, 2021 – Junior Environmental Professional: Conducted electrofishing / fish salvage for an emergency watercourse alteration along a section of railway. This involved the capture, identification, documentation, and release of fish from the impacted section of the watercourse.

Mahone Bay Well Installation and Monitoring, NS, 2021 – Junior Environmental Professional: Groundwater well installs were completed at a construction site in Mahone Bay, NS along with vegetation transects to characterize the sites environmental features.

Pirate Harbour Wind Farm Project, NS) 2021-Present – Junior Environmental Professional: Participated in field assessments and Environmental Assessment report writing for a wind farm located in NS. Field surveys were conducted for wildlife, birds, wetlands, and watercourses. Environmental Assessment related documents such as field survey assessments, consultation, and background research were also completed.

Mersey Wind Farm Project, NS, 2021 – Junior Environmental Professional: Participated in field assessments and Environmental Assessment report writing for a wind farm located in NS. Field surveys were conducted for wildlife, birds, wetlands, and watercourses. Environmental Assessment related documents such as field survey assessments, consultation, and background research were also completed.

Melford Atlantic Gateway Project, NS, 2020-Present – Junior Environmental Professional: Completed various reporting and background research requirements such as consultation documents, engagement record keeping, and the development of a wetland compensation plan.

Higgins Mountain Wind Farm Project, NS, 2020-Present – Environmental Technician: Conducted watercourse, wetland, fish/fish habitat, wildlife and avian assessments all contributing to the environmental assessment for the establishment of a windfarm. Involved in Environmental Assessment development, planning, and finalization.

L8001 and L8005 Transmission Line, NS, 2020 – Environmental Technician: Participated in wetland and watercourse assessments, Wildlife surveys, and rare plant and lichen surveys, along the linear corridor spanning 100kms from the NS/NB border to Onslow, NS.

Shellfish Harvesting and the Persistent Threat of Sewage Pollution, NS, 2020 – MREM Tri-course project: Working in a multi-disciplinary team to assess the threat of sewage pollution on the shellfish industry of Nova Scotia, including the biophysical, socio-political, law and policy aspects of the greater issue of pollution in the near shore environment. This involved research into government programs, policies and regulations, as well as different stakeholders in the industry.

Darcy Kavanagh, BSc., MREM
Environmental Scientist
Total Experience: 3 years

AREAS OF SPECIALIZATION

- Wetland and Watercourse Assessment
- Wetland Delineation & Functional Assessment
- Wildlife Surveying and Assessment
- Environmental Reporting and Permitting
- Baseline Study Data Collection & Interpretation

EDUCATION

- Master of Resource and Environmental Management (MREM) - Dalhousie University, Halifax, NS (2022)
- Bachelor of Science (Honours in Environmental Science) - Saint Mary's University, Halifax, NS (2018)
- Diploma of Engineering - Saint Mary's University, Halifax, NS (2016)

TRAINING

- Wetland Ecosystem Services Protocol - Atlantic Canada (WESP-AC) Training – Maritime College of Forest Technology (2022)
- Wetland Delineation Training – Maritime College of Forest Technology (2022)
- Backpack Electrofishing – Canadian Rivers Institute (2022)
- Wilderness First Aid – Saint John Ambulance (2022)

RELEVANT EXPERIENCE

Mr. Kavanagh joined Strum in 2022, having just completed a master's degree in Resource and Environmental Management at Dalhousie University. While studying at Dalhousie University, Mr. Kavanagh specialized in freshwater resource management, wetland alteration/compensation, and stormwater management. He also obtained his diploma of engineering in 2016 and Bachelor of Science degree in 2018, from Saint Mary's University. While there, he completed an honours thesis focused on enhancing the effectiveness of wind power source assessment, responding to the need of having a measure of the relationship of wind speed and its consistency.

Throughout his academic career, Mr. Kavanagh has had the opportunity to partake in a number of research initiatives, including collecting and processing water chemistry data, the remediation of trampled pollinator habitat, an assessment of the carbon sequestration capabilities of species mixes within the boreal forest, and an evaluation of the acid rock drainage potential within the watersheds of Nova Scotia. Further, for the final project of his graduate studies, Darcy assessed the climate resiliency of wetland compensation projects within the province of Nova Scotia, providing a series of research-backed recommendations to continue working towards the provincial goal of no net loss of wetland structure and function, while also ensuring a net gain of climate resiliency.

Mr. Kavanagh has proven critical thinking and problem-solving skills through collaboration with multiple real-world organizations. This includes a partnership with the Atlantic First Nations Water Authority to analyze the biophysical, socio-political, and law & policy related dimensions associated with the self-determination of water resources in First Nations communities, as well as aiding the District of Argyle in their efforts to mitigate their localized mosquito problem through a series of research tactics including a literature review, policy review, jurisdictional scan, and feasibility analysis. For the internship portion of his graduate degree, Mr. Kavanagh worked with a consulting company where he was involved with various tasks including soil, sediment, and surface water sampling, wetland delineation, electrofishing, watercourse assessment, and air quality monitoring.

Mr. Kavanagh is active in conducting numerous field surveys to fulfill baseline studies, environmental permits, and conditions of approval, as well as any relative complementary desktop research. Further, Mr. Kavanagh is well practiced in working in remote areas, along with ATV, snowmobile, and 4x4 use.

REPRESENTATIVE PROJECTS AND ROLES

Various Wind Farm Project Environmental Assessments, NS – Environmental Scientist:

- **Goose Harbour Lake Wind Farm Project, NS, (2022 – Present)**
- **Mersey River Wind Farm Project, NS, (2022 – Present)**
- **Weavers Mountain Wind Farm Project, NS, (2022 – Present)**
- **Higgins Mountain Wind Farm Project, NS, (2022 – Present)**
- **Ellershouse Wind Farm Project, NS, (2022 – Present)**

Responsible for conducting field assessments and Environmental Assessment report writing for multiple prospective wind farm locations in NS. Field surveys were conducted for terrestrial flora & fauna, herpetofauna, avifauna, fish & fish habitat, wetlands, and watercourses. Other methods of data collection included snowshoe expeditions, ATV driving, and trial camera, acoustic monitor, and ultrasonic monitor deployment. Environmental Assessment documentation included field data compilation and interpretation to inform effects assessments, mitigation measures, and monitoring strategies.

Ruth Falls Wetland Monitoring, NS (2022 – Present) – Environmental Scientist: Responsible for conducting field assessments and report writing for a wetland and wetland fish & fish habitat monitoring program to be completed 2022 – 2027 to facilitate the dewatering of the reservoir necessary for capital upgrades. Field assessments included wetland delineation & functional assessment, monitor well installment, vegetation plot monitoring, and in-situ water chemistry sampling.

Nesting Bird Searches, NS (2022 – Present) – Environmental Scientist: Surveyed prospective project areas for the presence of nesting birds. Collected field data related to any observed species and reported on the findings. Flagged buffer areas for any identified species.

Wetland Delineation and Permitting, NS (2021 – Present) – Environmental Scientist: Completed wetland delineation, functional assessments, and permitting submissions at numerous sites around Nova Scotia. Projects include pre-construction and post-construction monitoring, compensation planning, contingency planning, and erosion and sedimentation control planning.

L8001 and L8005 Transmission Line, NS (2022) – Environmental Scientist: Participated in wetland and watercourse assessments, wildlife surveys, and rare plant and lichen surveys along the linear corridor spanning 100 km from the NS/NB border to Onslow, NS.

Goldboro Liquified Natural Gas (LNG) Project, NS (2021) – Environmental Scientist: Undertook soil and water sampling, stream flow monitoring, and avian surveys to satisfy conditions for environmental permits and approvals for the construction of an LNG facility. Soil samples were taken along the perimeter of the study area in order to delineate the presence of contaminants associated with historic gold mining. Water samples were analyzed in a lab for parameters including total & dissolved metals, dissolved organic carbon, and total suspended solids. Surveys included MBBA-style early morning passerine surveys, nighttime nocturnal surveys following the *Nova Scotia Nocturnal Owl Survey* sampling methodology, as well as circumnavigating multiple waterbodies and conducting waterfowl nest surveys. Other tasks included the periodic maintenance and data extraction of both acoustic avian monitors and ultrasonic bat monitors.

Highway 102 Aerotech Connector Road Project, NS (2021) – Environmental Scientist: Responsible for conducting field surveys and aiding in the reporting for birds and bats to inform science-based decision making within the project laydown area. Surveys included acoustic monitoring, point-count surveys. and nighttime nocturnal surveys. Other tasks included the periodic maintenance and data extraction of ultrasonic bat monitors, as well as aiding in the development of a wildlife crossing plan to mitigate wildlife-vehicle collisions.

Goldenville Historic Mine Remediation Project, NS (2021) – Environmental Scientist: Flow monitoring was conducted at eight locations within and around the Goldenville Gold Mine site in tandem with a surface water sampling program. A total of eight transducers were submerged (one per sample site), along with an additional datalogger nearby to measure air pressure. A discharge transect was also completed for each sample site using a handheld flow meter. Surface water samples were analyzed in a lab for parameters including total & dissolved metals, dissolved organic carbon, and total suspended solids. This program was conducted as part of an ecological risk assessment for the remediation of the contaminated tailings area.

Touquoy Gold Mine DustTrak Air Monitoring Program, NS (2021) – Environmental Scientist: Responsible for conducting direct-read real time sampling in response to periodic elevated dust levels at the Touquoy Gold Mine Site, in order to better understand the reasons for the elevated dust levels. TSI DustTrak instruments were used to strategically perform monitoring upwind and downwind of known areas of concern. During the monitoring, record was taken of any mining activities occurring, localized weather conditions, and any other potential dust sources in the area. This program was useful for providing a relative comparison of on-site dust levels, offering a good indication of whether compliance with the IA could be achieved.

Dafna Schultz, BSc., MREM, EPt
Environmental Scientist
Total Experience: 3 years

AREAS OF SPECIALIZATION

- Wetland and Watercourse Assessment
- Wildlife Surveying and Assessment
- Ecological Forestry and Agriculture
- Benthic Invertebrate Analysis

EDUCATION

- Masters of Resource and Environmental Management (MREM) - Dalhousie University, Halifax, NS (2022)
- Bachelor of Science (Hons.) - University of Manitoba, Winnipeg, MB (2019)

TRAINING

- Wetland Ecosystem Services Protocol for Atlantic Canada Training – Maritime College of Forest Technology (2022)
- Wetland Delineation Training – Maritime College of Forest Technology (2022)
- Backpack Electrofishing – Canadian Rivers Institute (2022)
- Pilot Certificate for Small Remotely Piloted Aircraft System (RPAS), Visual line-of-sight (VLOS) – Transport Canada (2022)
- Wilderness First Aid and CPR "C" – St. John's Ambulance (2022)

RELEVANT EXPERIENCE

Ms. Schultz joined the Strum team in 2022 as an Environmental Scientist upon completing her coursework for her Masters of Resource and Environmental Management degree at Dalhousie. While studying at Dalhousie, Ms. Schultz specialized in a number of different areas of natural resource management in Nova Scotia, such as forestry, agriculture, and wetlands. She obtained her Bachelor of Science degree in 2019 from the University of Manitoba in the department of biological sciences where she specialized in ecology and environmental sciences. Her honours thesis focused on the ecological application of double-stranded RNA-based pesticides to control flea beetles in canola cropping systems in Manitoba. This project incorporated both field-based sample collection and lab-based sample preparation using techniques in molecular biology.

During her graduate studies, Ms. Schultz worked on a number of large projects, collaborating with multidisciplinary teams to contribute to local issues. As her final MREM Research Project, she produced GIS and statistics-based recommendations for Nova Scotia Natural Resources and Renewables regarding identification of old-growth forest locations in the province. Through the Dalhousie Faculty of Management's 'Management Without Borders' course, Ms. Schultz helped develop recommendations for pest control in the Municipality of the District of Argyle. She also developed an understory vegetation sampling protocol to be used in the Acadia Research Forest by the Canadian Forestry Service.

Ms. Schultz's most recent work experience includes contributing to a research project on bat activity hosted by a global non-profit organization by conducting statistical analysis on acoustic data. Ms. Schultz held a previous position with Nova Scotia Department of Lands and Forestry as a summer intern while completing her graduate studies. This role required remote field work to carry out the provincial old-growth scoring protocol, and desktop GIS-based work to plan and navigate to study locations. Prior to this internship, Ms. Schultz held a position with Agriculture and Agri-Foods Canada as a Junior Policy Analyst. In this role, she focused on the development of the Clean Fuel Standard, which included significant correspondence with agricultural stakeholders and a major deliverable of a jurisdictional scan of clean fuel regulations across the world.

Ms. Schultz is active in conducting ecological studies to contribute to a variety of environmental assessments. She has conducted significant fieldwork across large projects in remote locations, in both Nova Scotia and Manitoba. She is knowledgeable with provincial and federal regulations, working closely with senior staff preparing reports and regulatory submissions.

REPRESENTATIVE PROJECTS AND ROLES

Environmental Effects Monitoring Program, Halifax International Airport Authority, NS, 2022-Present – **Environmental Scientist:** Conducting preliminary research, planning, field work, data composition, and reporting for benthic macroinvertebrate monitoring plan following CABIN protocol.

Environmental Assessment, Higgins Mountain Wind Farm, NS, 2022-Present – **Environmental Scientist:** Reporting on terrestrial habitat and flora at the Project site in support of an in-progress Environmental Assessment.

Environmental Assessment, Weavers Mountain Wind Farm, NS, 2022-Present – **Environmental Scientist**: Collecting winter and spring wildlife data and wetland and watercourse data, and reporting on various field programs for an Environmental Screening Report and in-progress Environment Assessment.

Environmental Assessment, Mersey River Wind Farm, NS, 2022-Present – Environmental Scientist: Collecting winter and spring wildlife data and wetland and watercourse data, and reporting on various field programs for an in-progress Environment Assessment.

Environmental Assessment, Goose Harbour Lake Wind Farm, NS, 2022-Present – Environmental Scientist: Collecting winter and spring wildlife data and wetland and watercourse data, and reporting on various field programs for an in-progress Environment Assessment.

Environmental Assessment, Melvin Lake, NS, 2022-Present – Environmental Scientist: Collecting winter and spring wildlife data.

Environmental Study, Apitamkiejit Wind Farm, NS, 2022 – Environmental Scientist: Reporting on winter wildlife tracking and winter avian surveys for an Environmental Screening Report.

Environmental Assessment, Blueberry Acres Wind Farm, NS, 2022 – Environmental Scientist: Reporting on winter wildlife tracking and fall and winter avian surveys for an Environmental Screening Report.

Environmental Assessment, Red Spruce Wind Farm, NS, 2022 – Environmental Scientist: Reporting on fall migration avian surveys for an Environmental Screening Report.

Environmental Study, L8005 Transmission Line, NS, 2022 – **Environmental Scientist:** Collecting winter wildlife data, reviewing a summary report of winter field work, and preparing a proposal for an old-growth forest assessment within the transmission line right-of-way.

Environmental Assessment, Ross Bay Junction, NF, 2022 – **Environmental Scientist:** Identifying previously collected benthic macroinvertebrate samples and preparing a report and data summary on the diversity and abundance of species present on the Project site.

François Gascon, EIT
Environmental Engineer
Total Experience: 4 years

PROFESSIONAL ASSOCIATIONS

- Association of Professional Engineers of Nova Scotia (Engineer-in-Training)

AREAS OF SPECIALIZATION

- Industrial Approvals
- Environmental Approvals
- Computer-Aided Design
- Hydrogeology
- Water Treatment
- Climate Change

EDUCATION

- Bachelor of Engineering (Environmental), Dalhousie University, Halifax, NS (2020)
- Civil/Mining Technician, Collège Boréal, Sudbury, ON (2010)

TRAINING

- Standard First Aid & CPR
- Excavation and Trenching
- Confined Spaces

RELEVANT EXPERIENCE

Frank Gascon is an Engineer-in-Training with a Bachelor's Degree in Environmental Engineering from Dalhousie University in Halifax, NS. Since his employment with Strum, he has been involved in project management, engineering design, environmental monitoring, groundwater assessments, hazard assessments, environmental assessments, project reporting, and regulatory compliance.

Frank has worked directly with the Mechanical Engineering group to design solid waste transfer stations, waste audits, long-term monitoring and regulatory permitting for large Solid Waste and Waste to Energy Facilities. Similarly, he has worked with the Industrial Approvals and Permitting group on various Industrial Approval applications across multiple industries; and is well-versed in the development of Environmental Management Plans. Additionally, he has gained valuable experience from Strum's Senior Hydrogeologist, concerning groundwater assessments for potable groundwater supply development, evaluation and treatment of water quality issues, and review of factors that contribute to the degradation of groundwater resources at residential sites.

Before working with Strum, Frank researched the management and disposal of municipal drinking water treatment plant waste residuals in the Northwest Territories.

REPRESENTATIVE PROJECTS AND ROLES

- **Dartmouth Municipal Compost Facility Environmental Monitoring Program, Dartmouth, NS, 2021 - Present – Intermediate Engineer:** Monitoring groundwater and surface water sampling, data compilation, data analysis, and regulatory reporting. Frank has prepared various approval amendment applications for submission to NSECC, direct correspondence with NSECC and streamlined the monitoring and reporting program.

- **Wind Turbine Environmental Assessments, Multiple Locations, NS, 2021 – Present – Intermediate Engineer**: Conducted watercourse, wetland, fish/fish habitat, wildlife and avian assessments required, and environmental assessment reporting. Developing greenhouse gas and climate change assessment criteria for quantifying effects or impacts from these and other Projects.

- **Groundwater Geothermal Heating and Cooling System Review and Permitting, Wolfville, NS, 2021 - Present – Intermediate Engineer:** Withdrawal flow monitoring, water level monitoring, equipment inspection, water quality sampling, data compilation, data analysis, and regulatory reporting.

- **Municipal Compost Facility Leachate Handling System, Dartmouth, NS, 2021 - Present – Intermediate Engineer**: Design, specification, and industrial approval amendment.

- **Level I and II Groundwater Assessments, Multiple Locations, NS, 2021 - Present – Intermediate Engineer:** Supervise well installation, pump testing (i.e., step and constant), sampling, analysis of aquifer characteristics, groundwater modelling, and regulatory reporting.

- **Groundwater Geothermal Cooling Systems, Wolfville, NS, 2021 - Present – Intermediate Engineer:** Withdrawal flow monitoring, water level monitoring, equipment inspection, water quality sampling, data compilation, data analysis, and regulatory reporting.

- **Production Field Centre Hazardous Materials Assessment, Sheet Harbour, NS, 2021 – Junior Engineer:** Hazardous Materials inventory, coordinate sampling, data analysis, and reporting.

- **Green House Gas Inventory Audit, Parrsboro, NS, 2021 – Junior Engineer:** Green House Gas auditing for Fisheries and Oceans Canada (DFO) application.

- **Air Quality Improvement Design, Labrador, NL, 2021 – Junior Engineer:** Design, specification, stack testing, data analysis, and construction of ventilation improvements.

- **Drinking and Wastewater Treatment Plant System Assessments, Baddeck, NS, 2021 – Junior Engineer:** Assess water and wastewater infrastructure, establish an asset inventory, and reporting.

- **Municipal Groundwater Withdrawal Compliance, Pictou, NS, 2021 – Junior Engineer:** Review pumping rates and withdrawal volumes, spatial interferences, sustainability concerns, data analysis, and regulatory compliance.

- **Registered Potable Groundwater Supply Assessment, Cape Breton, NS, 2021 – Junior Engineer:** Review design specifications, well logs, water quality, data compilation, data analysis, and regulatory compliance.

Matthew Savelle, BSc., Adv Dipl
Marine Surveyor and GIS Specialist
Total Experience: 13 years

AREAS OF SPECIALIZATION

- Marine Hydrographic Surveys
- Bathymetric Surveys
- Single Beam Sonar Surveys
- Multibeam Sonar Surveys
- Marine Benthic and Water Sampling
- Underwater Video
- Geographic Information Systems (GIS)

EDUCATION

- Centre of Geographic Sciences (COGS), Lawrencetown, Nova Scotia Advanced Diploma in Marine Geomatics (2010)
- Saint Mary's University, Halifax, Nova Scotia Bachelor of Science Degree (BSc) (2009), major in Biology and Minor in Geography

TRAINING

- Marine Basic First Aid
- St. John Ambulance, Level A CPR
- St. John Ambulance, Canadian East Coast Offshore Fitness Certificate
- Med A1 Offshore Survival Systems,
- WHMIS

COMPUTER EXPERIENCE

- Operating Systems: Windows, OSX, Linux
- Survey Software: HYPACK
- Seismic Software: SonarWiz, Coda
- GPS Software: Trimble Office, Waypoint GPS Processing, GravNav and GravNet
- GIS Software: ArcGIS, GRASS GIS
- CAD Software: AutoCAD Civil 3D
- Image Processing: Surfer, CARIS HIPS and SIPS
- Misc. Software: Grapher, Microsoft Office, Global Mapper, SonarPro

EQUIPMENT EXPERIENCE

- GPS Equipment: Assorted Trimble and equipment for autonomous, differential, static, and RTK surveying (Pro XR, 4600, 4800, 5700/5800), Leica RTK, differential static and total stations
- Surveying Equipment: Knudsen BP320 echosounder, SSS Klein 595 and 3000, Teledyne Reson T20P multibeam, Teledyne Reson 7125 multibeam, Odom MB1 and MB2, Integrated Marine Acoustic Profiling System, Magnetometer, and various GPR equipment.
- Misc. Equipment: RBR XR620 CTD Probe and Tide Gauge, Eckman and Van Veen Grab Samplers, Underwater Camera, CNAV 0183 NMEA GPS receivers

RELEVANT EXPERIENCE

Mr. Savelle is a Marine Surveyor and a GIS Specialist with Strum working in our Environmental Science Group. His area of speciality is in Marine Geomatics and conducting bathymetric and topographic surveys. He has extensive experience in surveying marine benthic surfaces and shorelines, obtaining overlapping hydrographic (multibeam, single beam and side scan sonar) data, data collection positioning and navigation, data processing and compilation, plotting and reporting of results. Matt also has experience collecting conventional total station data, RTK and static GPS data, and has been responsible for project set up, establishing GPS control points, and boat mobilization.

REPRESENTATIVE PROJECTS AND ROLES

EverWind Fuels Green Hydrogen Project, NS, 2022 - Present - Geomatics Specialist: Project work includes geospatial analysis, supporting external inquiries, and integrating environmental and socioeconomic factors into the assessments.

Wind Farm Projects, NS, 2022 - Present - Geomatics Specialist: Project work includes streamlining field data collection, developing in house habitat modelling, tracking applications, and performing geospatial data analysis.

Marine Survey for Offshore Oil & Gas Support Facilities, Sheet Harbour, NS, 2020 – Detailed marine surveys were conducted as part of the planning and permitting process for a marine facility used to support the offshore oil and

gas industry. Bathymetric and multibeam sonar surveys were completed to provide a detailed bottom profile and water depths in areas of Sheet Harbour that will be used for large vessel movements. This information will be used to determine proper clearances for vessels and to determine if additional dredging is required. In addition to collecting this survey information, digital video was captured to document the types of marine habitat in the area to support applications for federal approvals.

Chedabucto Bay Marine Surveys for Aquaculture Facilities, NS, 2020 – As part of the detailed siting of marine aquaculture facilities, bathymetric and single beam sonar surveys were completed to provide a detailed bottom profileand water depths in multiple areas of St. Marys Bay. In addition to collecting this survey information, digital video was captured along predetermined transects to document marine habitats, and benthic sediment samples were collected with a Van Veen grab for analysis. Marine survey data was processed to generate detailed digital bottom profiles.

St. Marys Bay Marine Surveys for Aquaculture Facilities, NS, 2019-2020 – As part of the detailed siting of marine aquaculture facilities, bathymetric and single beam sonar surveys were completed to provide a detailed bottom profile and water depths in multiple areas of St. Marys Bay. In addition to collecting this survey information, digital video was captured along predetermined transects to document marine habitats, and benthic sediment samples were collected with a Van Veen grab for analysis. Marine survey data was processed to generate detailed digital bottom profiles.

Peter Opra, MSc
GIS Specialist
Total Experience: 5 years

AREAS OF SPECIALIZATION

- Remote Sensing
- Geographic Information Systems (GIS)
- LiDAR
- Photogrammetry
- Location, spatial, and data analytics
- Geoprocessing, Model Building, and automation
- Database management
- Geomorphology

EDUCATION

- Master of Science in Applied Geomatics, Acadia University, Wolfville, NS (2021)
- Advanced Diploma in Geographic Information Systems (GIS), Centre of Geographic Sciences (COGS), Lawrencetown, NS (2020)
- Bachelor of Science, Major in Geology Saint Mary's University, Halifax, NS (2019)

TRAINING

- Standard First Aid (2022)
- WHMIS (2022)
- RPAS Pilot Certification (2021)
- Over 200 hours ESRI Academy Training (2019 – Present)

COMPUTER EXPERIENCE

- Operating Systems: Windows, macOS
- GPS Software: Garmin BaseCamp, Trimble Geospatial
- GIS Software: ArcGIS Suite, QGIS, Global Mapper
- Remote Sensing Data Processing: Trimble Inpho, POSPac MMS, LAStools
- Other Software: CorelDRAW X7
- Scripting: Python 2 & 3, SQL

RELEVANT EXPERIENCE

Mr. Opra is a GIS Specialist with Strum working in our Environmental Science Group. Mr. Opra specializes in Geomatics analysis and automation. He has extensive experience in implementing workflows for data analysis and processing. This experience includes trajectory processing, processing single and dual channel LiDAR data, photogrammetry, and automation of geospatial data analysis with both vector and raster data. In addition, Mr. Opra is experienced in operating a RPAS for data collection.

During his graduate studies, Mr. Opra focused on the application of remote sensing technologies in exploration geology. He investigated LiDAR as an effective means to visualize topography and in further detail, geomorphological features such as folds and glacial structures. He explored the advantages of both RPAS and airplane-acquired LiDAR while reviewing various software for processing and analysis. Mr. Opra helped support the project's RPAS surveys in Trafalgar, Nova Scotia and processed the data to produce high resolution terrain models.

Prior to and following his research contribution, Mr. Opra worked in academia as an advisor, then in the industry as a Geospatial Data Analyst and as a Remote Sensing Analyst. In academia, he assisted with an Honours thesis in developing a geospatial model to automatically detect sinkholes based on LiDAR data. He also assisted in a Master's thesis by mapping legacy gold mine tailings, and developing a survey grid for sampling. As a geospatial data analyst, he helped create new data products using multispectral imagery for precision agriculture. Through working on various LiDAR and Photogrammetry projects based throughout the Caribbean, USA, and Canada, Mr. Opra was able to apply automation to photogrammetry procedures and LiDAR processing. His commitment to data quality assurance and control, allowed him to develop a deeper understanding of how data is affected by environmental and human factors. His experience in both geology and environmental science allows him to have a strategic approach for geospatial analysis in environmental consulting.

Due to the multidisciplinary nature of Geomatics, Mr. Opra developed the ability to anticipate, identify, and solve diverse geospatial problems. Mr. Opra continues to research advancements in technology to build on and develop efficient procedures for data analysis and collection.

REPRESENTATIVE PROJECTS AND ROLES

EverWind Fuels Green Hydrogen Project, NS, 2022 - Present - Geomatics Specialist: Spearheaded geospatial analysis, supported external inquiries, and integrated environmental and socioeconomic factors in the assessments.

Wind Farm Projects, NS, 2022 - Present - Geomatics Specialist: Streamlining field data collection, developed in house habitat modelling, tracking applications, and performing geospatial data analysis.

Sinkhole Delineation Automation, NS, 2021 - 2022 - Advisor: Assisted in the development of a model within ArcGIS Pro for automating detection and delineation of sinkholes in the Karst prone areas.

LiDAR and Orthoimagery Data Production, Caribbean, USA, and Canada, 2021 - 2022 - Remote Sensing Analyst: Trajectory processing, LiDAR processing, automation, and creation of data products from inception to delivery.

Epiphytic Lichens as Spatial Biomonitors of Airbourne Mercury and Arsenic, 2019 - Research Intern: Used GPS to map historical mining sites and designed survey grids for Lichen collection.

Multispectral Vineyard Imagery Data Production, California, USA, 2020 - Geospatial Data Analyst: Assisted with the development of new proprietary geospatial products for precision agriculture.

Provenance and Diagenesis of Sandstones in the Deep Wells Annapolis G-24, Balvenie B-79, Crimson F-81, Weymouth A-45, and Newburn H-23, Scotian Basin, offshore NS, 2017 - 2018 - Research Assistant: Creation of graphic models and diagrams using data captured by a scanning electron microscope (SEM) to further research efforts in understanding the geology of the Scotian Basin.

Petrography of Bedrock and Ice-rafted Granules, Flemish Cap, Offshore Newfoundland and Labrador, 2017-2018, Research Assistant: Determining petrographic information of the samples using a scanning electron microscope (SEM). Energy dispersive spectroscopy (EDS) was used to determine mineral composition and backscattered electron images (BSE) were used to identify textures. Graphic design software was used to aggregate the images captured from the SEM.

Eric Johnson, BSc., Adv Dipl
Environmental Technician & GIS Technician
Total Experience: 2 years

AREAS OF SPECIALIZATION

- Geographic Information Systems (GIS)
- Field Studies
- Avian Radar Analysis
- Wind Turbine Risk Assessment (Shadow Flicker, Noise Modelling & Visual Simulations)

EDUCATION

- Centre of Geographic Sciences (COGS), Lawrencetown, Nova Scotia Advanced Diploma in Geographic Information Systems (2020)
- Saint Mary's University, Halifax, Nova Scotia Bachelor of Science Degree (BSc) (2017), major in Geography

TRAINING

- Canadian Drone Pilot Certificate (Basic)
- WHMIS
- ATV Training Course

RELEVANT EXPERIENCE

Mr. Johnson first joined Strum in 2021 as an Environmental Field Technician working in our Environmental Science Group. His area of speciality is in Geographic Information Systems and Remote Sensing. He has extensive experience in data collection in the field, installation of monitoring equipment such as groundwater wells, bird and bat monitoring systems, and working with avian radar datasets and wind turbine analysis software. He is responsible for producing concise and accurate mapping products and incorporating them into the environmental assessment.

More recently, Mr. Johnson has been responsible for the predictive modelling of multiple wind farm projects around the province. This includes the shadow flicker and noise assessment impact on receptors in nearby communities, and photo-simulations visualizing turbines in each study area.

REPRESENTATIVE PROJECTS AND ROLES

Higgins Mountain Wind Farm, NS, 2021-2022 – Junior Environmental Technician/GIS Technician: Environmental constraints were calculated and visualized using GIS software, producing mapping products to be used in the official environmental assessment. Avian radar systems were installed and used in various locations of the study area for the purpose of tracking bird activity. Detailed wind turbine risk assessment was conducted for the study area, including noise level and shadow flicker assessments, and photo-simulations visualizing turbines in each potential location.

Pirate Harbour Wind Farm Project, NS) 2021-Present – Junior Environmental Technician / GIS Technician: Responsible for the collection of field data, analysis, and production of accurate GIS mapping products to be used in the reporting process. Avian radar systems were installed and used in various locations of the study area for the purpose of tracking bird activity Detailed wind turbine risk assessment was conducted for the study area, including noise level and shadow flicker assessments, and photo-simulations visualizing turbines in each potential location.

Ellershouse Wind Farm, NS, 2022-Present – Junior Environmental Technician/GIS Technician: Responsible for the collection of field data, analysis, and production of accurate GIS mapping products to be used in the reporting process. Detailed wind turbine risk assessment was conducted for the study area, including noise level and shadow flicker assessments, and photo-simulations visualizing turbines in each potential location.

Weavers Mountain Wind Farm, NS, 2022 – Present - Junior Environmental Technician / GIS Technician: Responsible for the collection of field data, analysis, and production of accurate GIS mapping products to be used in the reporting process. Detailed wind turbine risk assessment was conducted for the study area, including noise level and shadow flicker assessments, and photo-simulations visualizing turbines in each potential location.

Mersey Wind Farm, NS, 2021 – Present - Junior Environmental Technician / GIS Technician: Responsible for the collection of field data, analysis, and production of accurate GIS mapping products to be used in the reporting process. Avian radar systems were installed and used in various locations of the study area for the purpose of tracking bird activity. Detailed wind turbine risk assessment was conducted for the study area, including noise level and shadow flicker assessments, and photo-simulations visualizing turbines in each potential location.

L8005 Transmission Line Moose Tracking Surveys, NS, 2022 – Junior Environmental Technician/GIS Technician: Participated in field assessments for winter wildlife, with a focus on mainland moose and other species at risk. This involved walking predetermined transects through various habitats to identify and document evidence of wildlife such as tracks, scat, and browsing. Additionally, responsible for the post-processing of field data and production of accurate GIS mapping products to be used in the reporting process.

Various Wetland and Watercourse Delineation Projects, NS, 2021 – Present - Junior Environmental Technician/GIS Technician: Responsible for the post-processing of field data and production of accurate GIS mapping products to be used in the reporting process.

Chris Pepper
Expert Birder
Experience: 14 years

AREAS OF SPECIALIZATION

- Avifauna Surveys
- Wetland Delineation
- Plant Identification
- Rare Lichen Assessment

TRAINING

- Wetland Plant Adaption and Identification and Wetland Delineation (2012)
- First Aid (2015)

MEMBERSHIPS AND ROLES

- Provincial Coordinator for the Nova Scotia Bird Migration Count
- Director for the Nova Scotia Birds Society

RELEVANT EXPERIENCE

Mr. Pepper has been an active member of the Nova Scotia birding community for the past 14 years, and has participated in such projects as the Maritime Breeding Bird Atlas, the Maritime Nocturnal Owl Survey and the Christmas Bird Count. Chris served as the Field Trip Coordinator for the Nova Scotia Bird Society from 2010-12 and currently sits on the Executive Committee as a Director. Other current roles include acting as the Provincial Coordinator for the Nova Scotia Spring Migration Count.

Mr. Pepper has completed over 4000 hours of avian assessment surveys in Nova Scotia, Newfoundland, and Alberta, working for various companies including Strum Consulting, McCallum Environmental, WSP ltd, CBCL Ltd., Nature Conservancy of Canada, and Canadian Wildlife Service.

Chris completed multiple avifauna surveys on a series of offshore coastal islands. The study was completed to ascertain the use of the islands by shorebirds during the breeding season, and to identify relationships between habitat and species utilization for nesting and feeding. The importance of the habitat for bird migration periods was also evaluated.

Chris has also been heavily involved in the implementation of comprehensive avifauna surveys in support of multiple wind energy developments in Nova Scotia.

In 2014 Chris completed an extensive bird interaction study at the site of a coastal vehicular causeway crossing in eastern Nova Scotia. The study was conducted to gauge bird behavioural responses to, and interaction with, electrical power line infrastructure. Situated in a marine environment, the study consisted of marine and shorebird species identification, and relationship to migratory pathways, impacts to coastal colony nesting, and access to feeding areas.

In addition to Chris's Avian Assessment experience, he has completed over 3000 hours of Boreal Felt Lichen surveys for various organizations including Stantec, McCallum Environmental, Consulting, Mersey Tobeatic Research Institute, Northern Pulp, Port Hawkesbury Paper, Nature Conservancy of Canada, Nova Scotia Nature Trust, and others.

Chris is also an experienced Wetland Delineator, completing wetland surveys for various companies including McCallum Environmental, Strum Consulting and others.

REPRESENTATIVE PROJECTS AND ROLES

Nova Scotia Wind Farm Developments, NS, Ongoing – Expert Birder: Responsible for completing seasonal avifauna surveys as part of Environmental Assessments in support of multiple proposed wind power projects.

Offshore Island Bird Surveys, NS, Ongoing – Expert Birder: Responsible for completing avifauna surveys on a series of offshore islands along the Eastern Shore of Nova Scotia.

Canso Causeway Bird Study, NS, 2014 – Expert Birder: Completion of avian abundance and species composition surveys at a marine causeway, and evaluation of potential migration pattern disturbance as a result of power line infrastructure.

Canada Warbler Study, NS, Ongoing – Expert Birder: Completion of surveys to evaluate the potential shift in presence/absence and behavioural changes of Canada Warbler, as a result of local wind farm development.

Abraham's Lake Bird Surveys, NS, 2011 – Expert Birder: Responsible for completing avifauna surveys in support of the acquisition of a parcel of land on behalf of the Nature Conservancy of Canada.

Port Hawkesbury Paper Woodlands Staff

Daniel MacKinnon

Current Job Title: Woodlands Operations Supervisor (November 2021 to present)

Previous Job Title: Silviculture Assessor and Assistant Operations Supervisor (2018 to 2021)

Educational Experience

Forest Technologist Diploma - Maritime College of Forest Technology (2016-2018)

Technical Training & Skills

WHMIS
Wilderness First Aid – CPR Level A
Firearm Safety
Silviculture assessments
NRR Old Growth surveying (2019; update training 2022)
Forestry computer applications
Data collection and analysis
Plot sampling and cruising

Megan MacInnis

Current Job Title: Woodlands Operations Supervisor (October 2021 – present)

Previous Job Title: Assistant Operations Supervisor/Old Growth Analyst (April 2019 to October 2021)

Educational Experience

Natural Resources & Environmental Technology Diploma – Nova Scotia Community College (2014 to 2016)

Technical Training & Skills

WHMIS
Wilderness First Aid – CPR Level A
Chainsaw Safety
Forest Fire Suppression
Forest Ecosystem Classification (FEC)
Pre-treatment Assessments (PTA)
NRR Old Growth surveying and aging (2019; update training 2022)
Data collection and analysis
Plot sampling and cruising
Silviculture assessments
Forestry computer applications (GIS/LRM)
Nova Forest Alliance Best Management Practices
Remote location plans

Port Hawkesbury Paper Woodlands Staff

James Duggan

Current Job Title: GIS Analyst (June 2022 to present)

Previous Job Experience:
Forestry Practitioner – Scott & Stewart Forestry Consultants (2019 to 2021)
GIS Consultant – Freelance and Exxon Mobil Research, State of Qatar (2010 to 2019)
GIS Supervisor – NewPage Port Hawkesbury (2007 to 2008)
Remote Sensing Specialist - Intermap Technologies Corp, Ontario (2006)
Physical Science Analyst – Agriculture Canada, Ontario (2006)
Research Associate – Noetix Research Inc., Ontario (2005)
Jr. Physical Scientist – Canada Centre for Mapping & Earth Observation, Ontario (2005)

Educational Experience
BSc. Forestry Management and Environmental Studies – University of New Brunswick (1997 to 2000)
International Development Certificate – Coady International Institute, St. F.X. (2001)
Geographic Information Systems Diploma – Centre of Geographic Sciences (2003)
MSc. Geographical Information Systems, Kasrst Prediction – University of Leeds (2014)

Technical Training & Skills
Geographical Information Systems
Remote sensing and digital image processing
Data management and processing
Geodatabase creation
GeoDesign
Terrain analysis mapping
Resources management principles, practices and concepts
SPASS Statistical application
Basic Life Support First Aid & Wilderness First Aid
Introduction & Advances Access Programming