HARDWOOD LANDS

COMMUNITY WIND PROJECT

ENVIRONMENTAL ASSESSMENT ADDENDUM REPORT

Proponent
Scotian WindFields Inc.
and
Scotian Wind Inc.
and
SWEB Development Inc.
and
WEB Wind Energy North America Inc.

Document Prepared By:
Strum Consulting

December 2015

Honourable Randy Delorey
Minister of the Environment
Nova Scotia Environment
PO Box 442
Halifax, NS B3J 2P8

Re: Environmental Assessment Request for Additional Information

Dear Mr. Delorey,

On behalf of Scotian WindFields Inc., Scotian Wind Inc., SWEB Development Inc. (SWEB), and WEB Wind Energy North America Inc, please find the enclosed documentation in response to the request by the Minister of the Environment on October 28th, 2015 for additional information relating to the Environmental Assessment of the Hardwood Lands Community Wind Project. The further studies relate to the five points of study the Minister requested, italicized below.

Additional information must be provided regarding traditional use of the Project by the Mi'kmaq of Nova Scotia

Over the past 18 months significant engagement effort has been undertaken with the local first nation community, the Sipekne'katik band. To ensure our engagement approach has been appropriate we have had regular updates with the Office of Aboriginal Affairs since May 2015. We sought to engage with the Sipekne'katik community as closely as possible to discern the traditional use of the land through a community open house at Sipekne'katik, a wind farm site tour with residents of Sipekne'katik, and multiple meetings with the Chief, council and staff. To gain site-specific information, we commissioned an archeological field survey and shovel test, as well we have commissioned an MEKS, which is underway and to be completed in the spring of 2016.

Information must be provided regarding the potential impacts to Mi'kmaq traditional use resulting from the undertaking

Based on the research that we have compiled, and feedback from engagement, we have identified potential impacts as well as our mitigation strategies, while offering to partner with Sipekne'katik to further their future aims toward renewable energy and energy efficiency.

Information must be provided regarding the water supply on the adjacent Indian Brook Mi'kmaq Reserve No.14

A hydrological analysis of the aquifer and the water extraction of the known wells in the Sipekne'katik community was conducted to determine if the project would impact the aquifer. Other wind projects in Nova Scotia have been co-located with municipal water supplies due to the negligible impact of operational turbines on ground or surface water quality.

The proponent must demonstrate that sound levels and shadow flicker duration are within recommended guidelines at all receptors, and at the property boundary with the Indian Brook Mi'kmaq reserve No. 14; and

The methodology for the sound and shadow models were revised to minimize the impact to the Sipekne'katik community. The proponent met with Nova Scotia Environment and Health Canada before re-running the models to confirm the methodological approach, and again afterward to verify the accuracy of the findings.

The proponent must provide archaeological shovel testing results to Communities Culture and Heritage and to Nova Scotia Environment.

Archeological field work was conducted in the summer of 2015 and the report was finished in September while the initial EA was under review. The field studies included three areas of pit testing around previously identified areas of high archeological probability in the first field survey. No items of archeological concerns were found.

It is the intention of the proponent to continue to work with the Sipekne'katik community in good faith throughout the lifecycle of the project as neighbours. Please find the enclosed information to satisfy the Minister's requests.

Best regards,

Daniel Roscoe P.Eng
Chief Operating Officer
SWEB Development Inc.

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APPENDICES

1.0 INTRODUCTION

Scotian WindFields Inc., Scotian Wind Inc., SWEB Development Inc. (SWEB), and WEB Wind Energy North America Inc. (the Proponent) have proposed the development of a 6.0 MW three turbine wind project in the community of Hardwood Lands, Nova Scotia (the Project). The proposed Study Area is approximately 6.8 km northeast of the community of Nine Mile River, Nova Scotia in the Municipality of the District of East Hants and is centered at 45º5'29.46"N, 63º31'23.50"W, on privately owned land.

The Hardwood Lands Community Wind Project Environmental Assessment (EA) document was registered on September 10, 2015. On October 28, 2015 the Minister of Environment determined that the information provided was insufficient to make a decision. Specifically, additional information was required to evaluate potential environmental effects that may be caused by the undertaking. The information requested is outlined below:

- Additional information must be provided regarding traditional use of the Project by the Mi'kmaq of Nova Scotia.
- Information must be provided regarding the potential impacts to Mi'kmaq traditional use resulting from the undertaking.
- Information must be provided regarding the water supply on the adjacent Indian Brook Mi'kmaq Reserve No.14.
- The Proponent must demonstrate that sound levels and shadow flicker duration are within recommended guidelines at all receptors, and at the property boundary with the Indian Brook Mi'kmaq reserve No. 14.
- The Proponent must provide archaeological shovel testing results to Communities Culture and Heritage and to Nova Scotia Environment.

To address the items raised in the Minister's decision, the following tasks were completed:

- Initiation and provision of preliminary results of a Mi'kmaq Ecological Knowledge Study (MEKS) to detail potential traditional use of the Project by the Mi'kmaq of Nova Scotia.
- An assessment of potential impacts on traditional use as a result of the Project.
- A review (via desktop sources) regarding the water supply to the adjacent Indian Brook Mi'kmaq Reserve No.14, (Sipekne'katik) and potential impacts to water supply as a result of the Project.
- Sound modelling including the provision of all modelling data inputs and discussion of methodology. In addition, baseline sound monitoring has been completed at the Indian Brook Mi'kmaq Reserve No.14 property boundary.
- Shadow flicker modelling was completed to ensure that applicable shadow flicker guidelines are met at the Indian Brook Mi'kmaq Reserve No.14 property boundary.
- Completion of an archaeological shovel testing program and subsequent report.

In addition to the above tasks, information regarding the re-classification of some on-site water features is also provided.

All modelling was based on the V110 turbine model, which has the following structural characteristics (Vestas 2011):

- Hub height – 95 m
- Rotor diameter – 110 m

The sections that follow present the methodology and findings of the respective assessments for the Project.

2.0 MI'KMAQ TRADITIONAL USE ASSESSMENT

2.1 Engagement with Sipekne'katik

The engagement process between the Sipekne'katik band and the Proponent has been developing for approximately 18 months. In order to ensure appropriate engagement, the Proponent has discussed the engagement strategy with the Office of Aboriginal Affairs (OAA) and updated the OAA on the engagement process since May 2015. The Proponent continued to undertake an engagement strategy to keep the community informed of the development process with as much information as possible, including multiple meetings with the chief, council, and staff and a public Open House information session at the Sipekne'katik church. In addition, the Proponent met in person and shuttled chief, council, staff, and residents to a turbine site to demonstrate a comparable project. A Mi'kmaq Ecological Knowledge Study (MEKS) was commissioned, which is currently underway, and further community meetings and council meetings were requested. The details of that correspondence are itemized in the registered Hardwood Lands Community Wind Project EA document.

Prior to the review process of the EA, the Proponent met with the Band Liaison Officer, to drop off a hard copy of the EA document with an offer to meet with the council and/or the community at large to discuss the project and the EA process. Since the EA registration on September 10, the Proponent has reached out to Sipekne'katik in an attempt to ensure that everyone in the community was aware of the Project, and to continue to develop our offer for an ongoing partnership to develop a renewable energy retrofit pilot project in the community. The Proponent was advised that the conversations to form a partnership, and the formal EA consultation process, would proceed independently.

On October 28, 2015 the EA review process yielded a 'Request for Further Information' decision from the minister, citing the potential impacts of the Project to the traditional use of the land. In a letter sent from Chief Copage to the Crown in October 2015, the Chief indicated a positive relationship with the Proponent, but a concern that the Project would result in a loss of traditional use (specifically hunting) in addition to potential noise impacts (see comment sheet from Chief Copage from bus site tour July 28, 2015 provided in Appendix A). Sipekne'katik also noted capacity issues within the band. To understand and mitigate these potential impacts, the Proponent reached out to Sipekne'katik in earnest again during the month of November 2015. In order to address the concerns, discussion and mitigation in relation to the potential impacts to hunting (as well as other traditional uses) is provided in Section 2.3 and a sound assessment has been completed, the results of which are provided in Section 3.0.

During November 2015, after the minister's decision, the Proponent reached out to Sipekne'katik on the two parallel dialogues simultaneously. Synopsise of the dialogues are listed below.

Wind Project Consultation

It is the intention of the Proponent to minimize impacts to traditional use of the land through open and ongoing dialogue.

- Sent letter to the Chief Copage requesting a meeting to discuss details regarding traditional use of land. See Appendix A.
- Regular calls/emails to Jennifer Copage, Band Liaison Officer, and to Chief Copage to set up a meeting to discuss the traditional usage of the land and the concerns voiced in the meeting with Sipekne'katik, Nova Scotia Environment (NSE), and OAA.
- Met with Jennifer Copage who delivered a letter from Sipekne'katik Council indicating that they will be kept informed of, and discuss, the activities with the Province. See Appendix A.

The above described consultation efforts are provided in Appendix A.

Pilot Project

It is the intention of the Proponent to form a lasting partnership that takes advantage of the Proponent's experience developing renewable energy projects to increase the energy independence of the Sipekne'katik community.

- Met with David Nevin, Economic Development Officer, to discuss his vision of the pilot project and next steps.
- Sent Draft Memorandum of Understanding (MOU) of project/tasks to David Nevin and Jennifer Copage. See Appendix A.
- Met with David Nevin again to review the MOU and receive feedback.

In summary, the Proponent has employed extensive engagement efforts to obtain feedback from the community on the Project, and ascertain traditional uses, which are described herein. As well, the Proponent has received positive feedback from Sipekne'katik on the concept of an MOU to build renewable energy capacity within the community. The Proponent is committed to developing a positive relationship with the community throughout the life of the Project.

2.2 Mi'kmaq Traditional Use

As previously discussed, it has been the intent of the Proponent to comprehensively engage with the Sipekne'katik band in relation to all aspects of the Project including during the early planning stages, and during the initial EA process where the Proponent initiated a formal engagement strategy, to keep the community informed of the development process. Efforts included meeting with the chief, council, and staff of the Sipekne'katik band, community meetings, and invitations to hold additional meetings and updates related to the Project. A full account of engagement efforts is listed in the EA document. More recently, concerns were raised during the review process of the 2015 EA that the Project has potential to cause effect to Mi'kmaq traditional use activities, and at the request of the Minister of Environment, additional information related to the potential impacts is required.

The Proponent has initiated background studies and consultation efforts with the Sipekne'katik band, the Kwilmu'kw Maw-klusuaqn Negotiations Office (KMKNO), and the OAA with an emphasis on better understanding traditional use in the area, and minimizing any impact to this provision through careful Project design. Additionally, the Proponent understands the Millbrook First Nation has a wind energy project adjacent to their community. The Proponent encourages the OAA and Sipekne'katik to confer with Millbrook on their experience with the adjacent wind energy project, particularly in the context of traditional use.

To date, the additional studies and background research implemented by the Proponent in order to understand traditional use in the area, has been initiated via various methods as outlined in Table 1. As highlighted in the table, a MEKS is being completed by the Confederacy of Mainland Mi'kmaq (CMM) and is due to be completed in the summer of 2016. In advance of this report, potential traditional uses in the area are discussed in Section 2.1.

Table 1: Additional Studies

Action	Main Findings/Results
Archaeological Screening and Reconnaissance, January and August 2015 (Boreas Heritage Consulting Inc. 2015)	- Three turbine locations exhibit high potential for encountering Precontact and/or early historic native archaeological resources. - Two small areas measuring 10 m x 5 m on either side of the stream bed within the proposed access road alignment exhibit high potential for encountering Precontact and/or early historic native archaeological resources. - Based on the nature of the terrain, the distance to a significant water source, and the lack of evidence indicating significant cultural modification, the remainder of the Hardwood Lands Community Wind Project Study Area is considered to exhibit low potential for encountering significant archaeological resources. - Concurrence on the archaeological study locations by the Sipekne'katik liaison officer.
Nova Scotia Communities Culture and Heritage File Review (April 2015)	- No recorded archaeology sites on file within the Project site, however the site encompasses water bodies and lies directly adjacent to the Indian Brook First Nation Reserve. - Historic maps suggest possible settlement. - Recommendation for a botanical survey to be completed to identify potential rare plants.
KMKNO Review (June 2015)	- Internal GIS database results yielded a number of traditional use locations within the general area of the Project ranging from food harvesting, forest products, encampment sites, ceremonial plant collection, and spirit beings. - The Assembly of Nova Scotia Mi'kmaq Chiefs, KMKNO and the Mi'kmaw Nation in Nova Scotia expects evidence-based decisions rooted in subsurface testing to demonstrate presence, absence, distribution, and characterization of archaeological remnants from L'nu'k ancestors.

Action	Main Findings/Results
Archaeological Shovel Testing October 2015 (Boreas Heritage Consulting Inc. 2015b)	- No archaeological resources were encountered, and no evidence of historically significant cultural modification was identified within the footprint of the proposed turbines, nor access road.
Mi'kmaq Ecological Knowledge Study (MEKS) (Commissioned October 2015)	- See discussion in section 2.1. - Final MEKS expected in the early summer of 2016.

2.3 Preliminary Findings

In advance of the completion of the MEKS study, the Proponent has utilized information obtained during the consultation and additional studies noted in Table 1 to evaluate potential traditional use in the area to which is outlined in the following section.

2.3.1 Food Harvesting

As discussed in the Archaeological Screening and Reconnaissance report issued by Boreas heritage Consulting Inc. (August 2015), the Mi'kmaq seasonally moved throughout the greater region between areas where shelter and resources, including food and medicinal plants, were available and annually migrated between hunting and fishing grounds.

Faunal

Through discussions with community members and concerns expressed by Chief Copage in his letter to the Crown during the EA consultation process, hunting has been, and continues to be, an important function of the lands adjacent to the Sipekne'katik community. Small game, such as rabbit, partridge, porcupine, pheasant, fox, beaver, and goose are typically harvested (Membertou Geomatics Solutions, 2006). A summary completed by Helldin, *et al.,* 2012 which evaluates the impacts of wind power on terrestrial animals generally suggests that disturbance of terrestrial mammals, such as deer, varies with a number of factors including:

- Species present near site
- Current use of land
- Size of wind project
- Duration of construction

In disturbed areas, such as most agricultural landscapes, wind power may not affect the occurring species to the same extent as it would in more sparsely populated forest and mountain areas (Helldin, et al., 2012).

A few studies that have been completed on wild deer, reindeer, and large carnivores during wind project construction work suggest that these animals may temporarily avoid wind farms during this period. Noise from operating turbines has been shown to have a limited impact on wildlife and livestock (Helldin, et al., 2012), however Arnett et al. (2007) proposes that the largest impact of wind power on terrestrial mammals lies in the indirect factors, mainly human disturbance. Deer, especially female deer, increase their escape and vigilance behaviour in the presence of humans, and populations that are hunted by man are more sensitive to human disturbance (Stankowich, 2008). Females are particularly vulnerable to disturbance during the reproductive phase.

Floral

A traditional use of lands that continues throughout Mi'kma'ki is the collection and harvest of medicinal plants. Many elders continue to prepare traditional medicines for their friends and relatives; however, continuous development alters the natural ecosystem and limits harvesting areas (AMEC Environment & Infrastructure, 2013).

In addition, Mi'kmaq people in Nova Scotia have traditionally utilized edible native plants as a food source, many of which are available in the Project area. A list of species identified within the Project footprint (i.e. access roads and turbine locations) is available in the 2015 EA document.

2.3.2 Ceremonial Resources

Ceremonial resources can range from physical ceremonial sites, to items (*i.e.* plants, other forest products) collected and utilized in ceremonial events and traditions. Ceremonial sites may include historical and culturally important locations that were used to acknowledge the interconnectedness of everything; ceremony is how values are taught and reinforced (Blatchford, 2012).

2.3.3 Encampment Sites

Encampments refer to historical or present locations that First Nation settlers utilized for temporary or permanent residence. The locations were likely identified based on availability of food (i.e. floral and faunal), and land conditions.

Although studies completed to date have not identified any existing encampments on, or near to the Project footprint, it is unconfirmed if any historical locations existed on the Project site.

2.3.4 Burial Sites and Spirit Beings

As discussed in the 2015 EA, during the course of the Archaeological Screening and Reconnaissance (August 2015), Boreas Heritage Consulting Inc. was informed of the reported location of a historic burial ground of European settlers, located 800 m southeast of the proposed turbine site 3 and approximately 480 m west of the proposed access road. The burial ground was not located during the field survey; however it presents a culturally significant zone and will be avoided.

The potential presence of a European village burial ground near Burma Road was suggested during the public Community Meeting held on Wednesday, July 14, 2015, in Sipkne'katik. The scope of the archeological field survey was extended, but no evidence of a burial site was found.

The existence of spirit beings on/or close to the Project site is unconfirmed, however they are known to be frequently co-located with archaeological or burial sites (MacLeod-Leslie, 2015).

2.4 Impact Discussion and Mitigation

Table 2 provides discussion of impact and mitigation methods available to prevent potential impacts to the traditional uses discussed in Section 2.1.

Table 2: Traditional Use Mitigation

Traditional Use	Discussion	Mitigation
Food Harvesting – Faunal/Fish	- Size of wind project is small, therefore decreasing potential for sensory disturbance to fauna. - Discussions with Millbrook First Nation indicate that there have been no adverse effects on hunting due to the Millbrook or Truro Heights Community Wind Projects. - Anecdotal evidence from other operational Scotian Wind turbine sites in NS indicate that noise does not negatively affect the presence of game/hunting. - The majority of land is clear cut, with only minimal clearing required for small portions of new access road and turbine locations, therefore impact to fauna habitat is low. - Species identified at the Project site during the EA studies are typical of those frequenting mainland Nova Scotia, and there is a large resource for their preferred habitat requirements in adjacent lands adjoining the Project site. - Human disturbance will be minimal (i.e. equipment maintenance visits) post construction, therefore impact to fauna via this pathway is considered low. - Impact to watercourses potentially used as a resource for harvesting fish is not expected.	- The Proponent is committed to permitting hunting and faunal food harvesting within the Project site. - The Proponent will install signage on the site to explain the project, and provide safety and emergency contact information.
Food Harvesting – Floral	- The majority of land is clear cut, with only minimal clearing required for small portions of new access road and turbine locations, therefore impact to flora is low. - The plant species identified within (and close to) the Project footprint exists in large supply within the surrounding area. Therefore, the limited removal of these species for the construction of infrastructure will not impact the availability of these species.	- Should the Project impact species of great importance to traditional use within the Project footprint (see plant list provided in the 2015 EA), the Proponent will commit to re-establish any loss of vegetation.

Traditional Use	Discussion	Mitigation
Ceremonial Resources	- Completion of the Archaeological Screening and Reconnaissance (August 2015) and Archaeological Shovel Testing (October 2015) programs, resulted in no evidence suggesting the existence of any ceremonial resources (items or sites) within the Project footprint. - The majority of land is clear cut, with only minimal clearing required for small portions of new access road and turbine locations. Much of the access road route has been designed to align with existing roads and/or clear cut areas; therefore the likelihood of impact to ceremonial items existing within the project footprint is low.	- The Proponent has committed to archaeological monitoring during the construction phase of the project to ensure that archaeological resources (including ceremonial items) are not impacted.
Current Ceremonies/present day activities	- Turbines will likely be visible from St. Catherine's Church, Sipekne'katik (See visual representations in section 11.3 and Appendix K of the Environmental Assessment document). - Sound and shadow modelling completed to assess perceived intrusiveness of turbines (Sections 3.0 and 4.0).	- Proponent commits to addressing any complaints regarding the Project through the Community Liaison Committee (CLC), who will act as intermediary. The receipt of a complaint or concern will be acknowledged in writing along with the steps the Proponent intends to take to resolve the issue. The Proponent will work with the CLC to ensure that the steps taken will address the complaint sufficiently.
Encampment Sites	- Completion of the Archaeological Screening and Reconnaissance (August 2015) and Archaeological Shovel Testing (October 2015) programs, resulted in no evidence suggesting the existence of any encampments within/or close to the Project footprint.	- While new roads and infrastructure will be present on the site, camping may still occur safely in proximity with wind turbines. There will be signage on the site to explain the project and provide safety and emergency contact information. - Should information arise prior to construction of a potential encampment location on/or close to the Project footprint, the Proponent commits to work with the community to relocate infrastructure and/or encampment sites to the greatest extent possible.
Burial Sites and Spirit Beings	- Apart from the potential burial site identified approximately 800 m southeast of proposed turbine 3, no other burial sites have been identified on/or close to the	- -The Proponent commits to archaeologist monitoring of the construction of the Project to ensure

Traditional Use	Discussion	Mitigation
	Project footprint.	that no burial sites and/or spirit being locations on/or close to the Project footprint are disturbed.

3.0 LOCAL WATER SUPPLY

3.1 Methodology

A review was completed to determine potential impacts to water supply and water quality on the adjacent Sipekne'katik community as a result of the Project. The following sources of information were utilized to gain insight into current water supply methods, from where potential risk of impact was evaluated.

- NSDNR Groundwater Atlas
- Review of available reports and mapping of surficial aquifers in proximity to the Project site and Sipekne'katik lands
- Surface water mapping

3.2 Results

According to the NSDNR Groundwater Atlas, there are three wells registered under the Indian Brook Mi'kmaq Reserve No.14 (NSDNR 2013). A Drillers Well Log was available for Well ID 440048 indicating the well was installed in 1944 to a depth of 91.5 m. Lithology data was not available for the well, however a pump test (HAN-22) was completed on the well resulting in a long term yield of 363.6 Lpm. The well is located 2.1 km east of the nearest turbine proposed for the Hardwood Lands Community Wind Project (Drawing 1, Appendix B).

Two additional wells (PW1 and PW2) located in the area near to Sandy Desert Road do not contain Well Logs, however, pump test data was available. PW1 is installed to a depth of 14.8 m and underwent a pump test (HAN-19) in May 1990 producing a long term yield of 4131.5 Lpm. PW2 was installed to a depth of 21.75 m and underwent a pump test (HAN-35) in May/June 2013. A long term safe yield was not provided for this pump test.

Relevant well data is provided below in Table 3 and well locations are illustrated on Drawing 1 (Appendix B).

Table 3. Indian Brook Mi'kmaq Reserve No. 14 Well and Pump Test Data.

Pump Test ID (Well ID)	Test For	Test Date	Well Depth (m)	Long Term Yield (Lpm)	Coordinates
HAN-19 (PW1)	Indian Brook First Nation	May 7-10, 1990	14.8	4131.5	460981E, 4991346N
HAN-22 (440048)	Shubenacadie – Indian Brook First Nation IR 14	-	91.35	363.6	460936E, 4992879N
HAN-35 (PW2)	Indian Brook First Nation	May 31-June 2, 2013	21.75	-	461278E, 4991382N

Source: NSDNR Groundwater Atlas (2013)

The Sipekne'katik band encountered significant water supply issues in 2012 after the community's well ran low. The well was recharged from a nearby spring which compromised the quality of the water supply. Sipekne'katik has since installed a second well and completed upgrades to the water treatment plant. A source water protection area has also been established for the water system.

It is believed PW1 and PW2 currently supply the Sipekne'katik community, although the status of the third well (Well ID 440048) is unknown.

A 2013 report identifying potential surficial aquifers throughout Nova Scotia references the Hardwood Lands surficial aquifer (SA-164), as supplying Sipekne'katik (Kennedy 2013). Available mapping indicates the aquifer extends from PW1/PW2 westward, approximately 3.9 km for a total area of 68.6 hectares (Drawing 1, Appendix B). This surficial aquifer is comprised of glaciofluvial deposits and has a reported mean transmissivity of 3884 m^2/d and long-term well yield of 4850 Lpm, based on pumping test results (Kennedy 2003; Kennedy 2014). Reference to Sipekne'katik being supplied via a surficial aquifer, confirms the assumption that Well 440048 is not currently utilized as its depth (91.5 m) is common of a bedrock aquifer.

3.2.1 Resulting Risk to Water Supply and Quality

The largest risk to water quality is during road and turbine pad construction, when exposed earth can wash into nearby surface water features (i.e. streams and wetlands) or an accidental spill could occur. Impacts to water quality in surface water features at source can potentially affect the water quality at down-gradient surface water locations. Tracey Brook is mapped in the northeastern portion of the site, approximately 230 m east of turbine 3 and 50 m east of the proposed access road between turbine 2 and turbine 3 (Drawing 1, Appendix B). Mapping indicates that Tracey Brook flows to the southeast where it joins Spring Brook approximately 2.8 km southeast of the Project site. Spring Brook eventually discharges into a series of small unnamed ponds south of Robinson Road in the vicinity of PW1 and PW2.

Water Quality

As well as many others, one of the functions performed by wet lands is contributing to the water balance and drinking water supply by storing and releasing surface water and recharging groundwater

reservoirs (NSE, 2011). The Project has been designed to avoid areas of wetland habitat, and as such, no wetland alterations are required on the eastern portion of the site, which drain water toward Sipekne'katik lands.

Two streams which currently drain via deteriorated culverts beneath existing woods roads were identified during the baseline field survey completed in support of the 2015 EA document submission (Drawing 1, Appendix B and Drawing 1, Appendix E). Both streams drain into Tracey Brook and are proposed to be crossed by the new access road. As part of the access road upgrade the existing deteriorated culverts will be replaced by the installation of new culverts in order to maintain hydrologic connectivity between up-gradient wetland habitat, and down-gradient Tracey Brook and its aquatic receptors.

Potential impacts to the identified streams will be easily addressed through the provincial watercourse permitting process, however the Proponent will also take the following steps to ensure water quality is not compromised for down grade aquatic receptors:

- Drainage and erosion control features will be included in the road design;
- An Environmental Protection Plan will be completed and approved prior to construction;
- An Erosion and Sedimentation Control (ESC) Plan will be completed to include:
    - A point person to review, upgrade, and maintain the ESC measures;
    - Soil stabilization and sediment controls, silt fences, berms, ponds, and check dams will be installed at the same time the road and crane pads are built;
    - No more than 1 hectare of land will be exposed without erosion controls;
    - The quality of ESC measures will be verified before and after a rainfall of more than 10 mm;
- Diversion ditches will be installed to keep clean water clean;
- Refuelling of equipment will not occur within 30 m of any watercourses/wetlands;
- Any wash water from the cleaning of construction vehicles will be disposed of on-site, using standard industry practices and following environmental regulations/guidelines for the protection of watercourses/wetlands;
- Temporary storage of waste materials on-site will be located at least 30 m from watercourses/ wetlands;
- An Environmental Monitor will be on-site to ensure;
    - The Environmental Protection Plan is adhered to;
    - The safe use of fuels and lubricants associated with construction sites;
    - Spill kits are on-site in case of an accident.

Implementation of the above-mentioned mitigation measures, best management practices, and adherence to regulatory requirements will allow for water quality up-gradient of the surficial aquifer supplying the Sipekne'katik community to be maintained and unaffected by Project activities.

Water Supply

The proposed Hardwood Lands Community Wind Project is situated approximately 2.2 km north of the surficial aquifer supplying the Sipekne'katik community. Development of the wind project will not involve blasting or require water withdrawals from the surficial or bedrock aquifer; therefore impacts to water supply are not expected as a result of the Project.

4.0 SOUND ASSESSMENT

An acoustic assessment of predicted sound pressure levels associated with the proposed turbines, in addition to the collection of baseline sound information was completed for the Project.

4.1 Sound Modelling

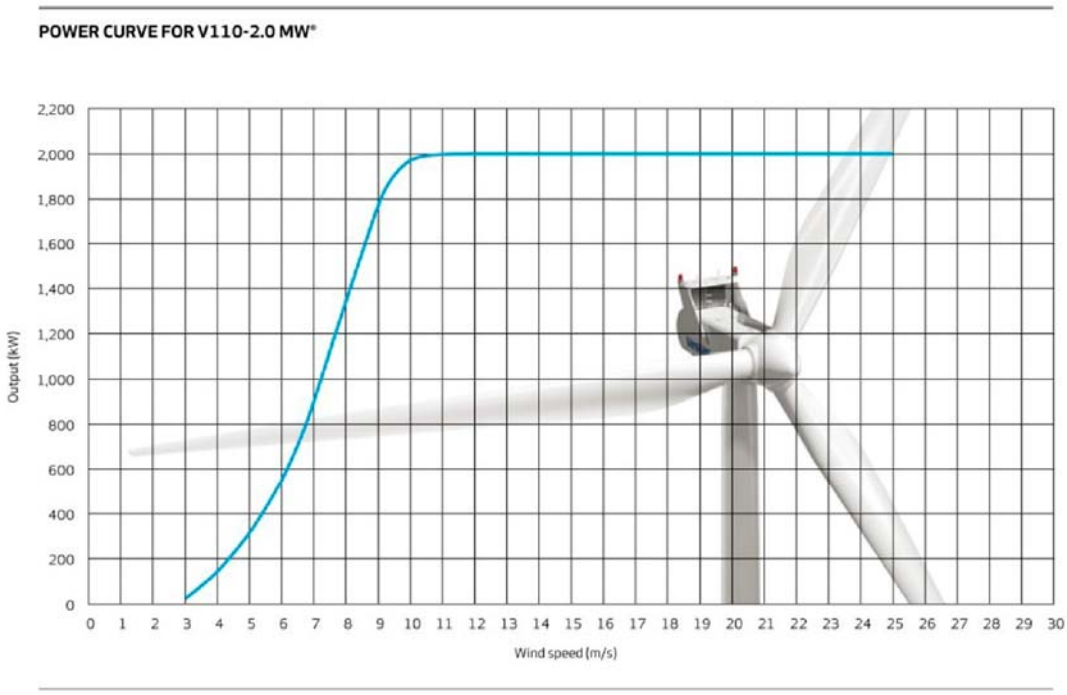
4.1.1 Assessment Methodology

An acoustic assessment was conducted for the Project to predict sound pressure levels at identified receptors within a 2 km radius of the proposed turbine locations. The assessment was completed using the "Decibel" module of the WindPro v. 3.1 software package. For the purposes of this model, receptors included all structures identified in the provincial topographic mapping, and any additional identifiable structures based on aerial imagery. No attempt to distinguish sheds and outbuildings from dwellings or cottages was made. The acoustic assessment also included two additional receptor locations, as shown in Drawing 1 (Appendix C). The two locations (R99 and R87) exist at the closest point of the adjacent Indian Sipekn'katik parcel 14 (PID 45148582) property boundary to a turbine location

The sound assessment model followed ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method and calculations, and was based on the following input information:

- UTM coordinates for the wind turbines;
- UTM coordinates for existing receptors (98) within a 2 km radius of the Project site;
- A downwind speed of 10.0 m/s, the speed at which the highest sound power level output is achieved (based on test data from the manufacturer);
- Overall sound emission data for the Vestas V110, provided by the manufacturer;
- Topographic data for the surrounding area; and
- 1/1 and 1/3 octave level data provided by the manufacturer.

The sound power curve for the V110 is provided below (Figure 1).



Source: Vestas, 2014

Figure 1: Sound Power Curve for V110

4.1.2 Sound Modelling Results

Modelling results, including the following information, is provided in Appendix C:

- Expected octave band performance for Vestas V110-2MW
- WindPro v. 3.1 modeling Assumptions Sheet
- WindPro v. 3.1 modeling Output sheet
- Drawing indicating predicted sound pressure levels (Drawing 1)

Results of the modelling indicate that predicted sound pressure levels will not exceed 40 dBA at any of the existing receptors, including the two locations (R99 and R87) modelled on the adjacent Sipekne'katik property boundary.

4.2 Baseline Sound Assessment

In order to accurately evaluate future noise levels associated with the Project, ambient pre-construction sound levels were established through the completion of ambient baseline monitoring.

4.2.1 Assessment Methodology

Ambient sound monitoring was completed from November 20 to 30, 2015 at two receptors (R87 and R99). Table 4 describes the deployment details of each receptor. Sound monitoring locations are

indicated on Drawing 1 (Appendix C). The two locations (R87 and R99) exist on the property boundary of the adjacent Indian Brook Mi'kmaq Reserve No.14 (PID 45148582).

The assessment was completed with Quest Technologies SoundPro DL-2-1/3 sound monitors. The monitors were configured to attenuate recorded sound levels every minute in A-weighted decibels (dBA). Data was then analysed using 'Detection Management Software' by the 3M Company.

At each receptor location, the monitor was kept in a locked weatherproof case, with the microphone supported by a tripod at a height of 1.5 m above the ground. The microphone was mounted inside an acoustically transparent weather resistant cage that is designed to minimize the effects of environmental noise interferences, such as wind and rain. Care was also taken to locate the equipment in areas where natural sound sources (i.e. a stream) would be minimized. The assessment was conducted during mid-fall after most of the deciduous trees had dropped their leaves, and before snow had accumulated on the ground. Under these conditions, natural noise attenuation from vegetation and accumulated snow is minimized.

Location characteristics and weather conditions for each monitoring location are provided in Table 4.

Table 4: Sound Monitoring Location Details

Monitoring Location	Dates Assessed	Location Details	Weather Conditions*
R87**	November 23 to Nov 26, 2015*	Regenerating mixedwood, adjacent to a clear cut. Logging road within 200 m.	Hourly averaged winds speeds range from 14 to 29 km/h, mostly clear skies with intermittent light rain
R99	Nov 26 to Nov 30, 2015	Mature, coniferous forest with understory canopy. Greater than 500 m from nearest logging roads.	Hourly average winds speeds range from 4 to 25 km/h, mostly clear skies with intermittent rain and drizzle.

**Source: EC 2015*

** Data from this sound monitor collected prior to 5:00 PM on November 23, 2015 was excluded from this analysis due to high wind conditions (storm event) which produced uncharacteristic sound levels.

4.2.2 Baseline Sound Results

The data was analysed to determine a number of parameters, which are described below:

- **LAS_{eq}** – This is the average noise level that contains the same amount of sound energy as the actual fluctuating sound level during the sample period. This represents the average sound level over the duration of the sampling period.
- **LAS_{mx}** – This represents the highest 'slow' time weighted sound pressure level expressed in decibels. This represents the highest sound level attenuated over 1 second recorded during the sampling period.

- **LAS_{mn}** – This represents the lowest 'slow' time weighted sound pressure level expressed in decibels. This represents the lowest sound level attenuated over 1 second recorded during the sampling period.
- **LAS_{90}** – This measurement is the sound level (in dBA) that was exceeded 90% of the time. This measurement is often used as a measurement to the background noise levels.

Results are presented in Table 5, below.

Table 5: Ambient Sound Monitoring Results

Monitoring Location ID / Parameter (Measured in dBA)	R87	R99
LAS_{eq}	37.0	44.0
LAS_{mx}	78.4	66.3
LAS_{mn}	14	43.4
LAS_{90}	18.9	43.5

5.0 SHADOW FLICKER ASSESSMENT

A shadow flicker assessment was completed for the Project as part of the original EA to assess the potential impact of shadows at identified receptors within a 2 km radius of the proposed turbine locations. The results of the study indicated that although all identified receptors were predicted to comply with the industry standard of no more than 30 minutes of shadow on the worst day and no more than 30 hours of shadow flicker per year, some exceedances in predicted shadow flicker exist at three locations within the adjacent Sipekn'katik property (known as the "exceedance zones") (PID 45148582) (Drawing 1, Appendix D).

5.1 Assessment Methodology

The methodology employed during the EA process involved the identification of receptors using the same methodology as described in the previous section for the sound assessment. The assessment was completed using the "Shadow" module of the WindPro v. 3.1 software package using worst case scenario conditions, including:

- Constant sunshine during daylight hours;
- Turbines are always operational;
- Turbine blades are oriented perpendicular to the line between the sun and all receptors;
- Receptor windows are oriented towards the turbine(s).

Other calculation variables included in the modelling are outlined in the Shadow module of the WindPro v. 3.1 software package output sheet (Appendix D)

For the purposes of the EA Addendum, modelling has been completed at eight arbitrary receptors positioned (SF1-8) within the three former "exceedance zones", to which detailed vegetation characteristics has been incorporated into the modelling inputs (Drawing 1 and 2, Appendix D).

Vegetation effects were incorporated into the model using field data collected along the property boundary of PID 45148582, at the three "exceedance zones'. Specifically, forest stand height was included to determine if the vegetation was likely to obscure the potential effect of shadow flicker. The other worst case scenario modelling conditions noted above were used for the exercise.

Vegetation height was recorded along the property boundary transect at approximately 10 m intervals. For the most part, vegetation height was very consistent within the three exceedance zones, although the northern extent of the northernmost exceedance zone comprised varying vegetation heights. In all instances, a conservative average vegetation height was used for each exceedance zone as indicated on Drawing 2 and Table D1 (Appendix D). For the purposes of the modelling, due to the future potential of the Project site undergoing tree harvesting activities, the worst case scenario approach of "no vegetation" was included as an input for the Project site lands. The NSDNR provincial forestry inventory database was used as a modelling input on the adjacent Sipekn'katik lands.

Turbine visibility was calculated at a 5 m grid resolution, and provincially available 5 m contour interval topographical data was used. Arbitrary receptor points were placed within the exceedance zones to calculate the precise incidences of shadow flicker throughout the year.

5.2 Shadow Flicker Modelling Results

Modelling results including the following information is provided in Appendix D:

- Field observed vegetation height (Table D1)
- Shadow" module of the WindPro v. 3.1 software package "without vegetation" output sheet
- Shadow" module of the WindPro v. 3.1 software package "with vegetation" output sheet
- Drawings 1 and 2 indicating predicted shadow flicker levels

The modelling results indicate that all EA receptors, and receptors modelled in the "exceedance zones" (S1-S8) are predicted to comply with the industry standard of no more than 30 minutes of shadow on the worst day and no more than 30 hours of shadow flicker per year.

6.0 ARCHEOLOGICAL SHOVEL TESTING REPORT

An Archaeological shovel testing program was completed by Boreas Heritage Consulting Inc. The Shovel testing report is provided in Appendix E.

7.0 WATER FEATURE CLASSIFICATION

As part of the baseline field data collected in support of the 2015 EA document submission, four watercourses were identified within the Project Study Area. Subsequently, NSE completed a site inspection on September 2, 2015 to review the determination of the water features identified.

As a result of the NSE inspection, Watercourse 1 and Watercourse 2 (as depicted in the 2015 EA submission) have been re-classified as drainage features. As such, the attached Drawing 1 (Appendix

F) has been updated to reflect these changes. The NSE Inspection Report is also provided in Appendix F.

8.0 SUMMARY

Through completion of the 2015 EA, in addition to findings associated with this Addendum document, it has been determined that there are no significant environmental concerns or effects that may result from the Project that cannot be effectively mitigated or monitored.

The proposed capacity of the three turbines (6 MW) will produce enough energy to power approximately 1,728 households with local, clean, renewable energy and will contribute to reaching Nova Scotia's renewable energy commitments.

9.0 REFERENCES

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APPENDIX A
CORRESPONDENCE WITH SIPEKNE'KATIK, NOV 2015

Hardwood Lands Wind Energy Project
East Hants, Nova Scotia

COMMENT SHEET
Regarding Meeting on Tuesday July 14, 2015
Katlin Mikmaw Healing Cultural Centre, Sipekne'katik, NS

Welcome to the **Hardwood Lands Wind Energy Project** open house at Sipekne'katik. Please fill out this comment sheet as it will assist us in addressing any concerns you may have, but also allow us to keep you updated on the progress of the project, environmental studies, and subsequent information sessions. When you have completed the comment sheet, please leave it in the box provided or with a member of our staff.

1. What information are you interested in learning regarding the Hardwood Lands Project or wind energy in general?
all info that can get

2. What are your impressions about wind energy in general?
I think it good clean Energy,

3. Do you have any comments or concerns regarding the Hardwood Lands project?
Noise, Hunting area

4. Would you be interested in band owned renewable energy to offset the cost of power bills?
Yes

5. How you feel about Band-owned solar panels?
Yes

6. How do you feel about Band-owned wind turbines?

Good Idea

7. Would you like us to follow up with you regarding your concerns via telephone, direct mail, or e-mail? If so, please include your contact information below:

Name: Chief Ryan Cooper
Address: 384 Robinson Rd I.R.
Postal Code: B0N 1W0
Telephone #: 902 870 5014
E-Mail: chiefcooper@SIPEKNEKATIK.CA

8. Would you like to be included on our mailing list to receive updates pertaining to this project?

☑ **YES** ☐ **NO**

Thank you for attending this Open House and for submitting your comments. We will ensure all concerns are addressed in a timely manner.

For more information about this project, please contact us at:

108F Trider Crescent
Dartmouth, Nova Scotia
Canada B3B 1R6
Toll Free: 1-877-798-5085
Direct: 902-468-3132

November 5, 2015
Chief Rufus Copage
Sipekne'katik
522 Church Street
Indian Brook, NS B0N 1W0

Dear Chief Copage,

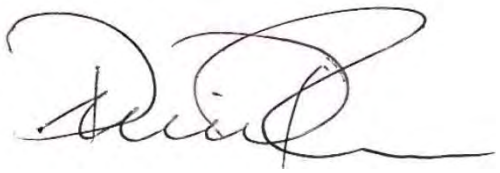
Re: Hardwood Lands Community Wind Project Environmental Assessment.

This letter is intended to acknowledge the letter dated September 29th sent from Sipekne'katik to Nova Scotia Environment in regards to the Environmental Assessment (EA) registration of the Hardwood Lands Community Wind Project. Your feedback was received as a part of the EA review documentation. We appreciate you taking the time to review and provide feedback on our project. Scotian Wind respects the formal dialogue between Sipekne'katik and the Crown regarding the proposed Hardwood Lands Project.

To continue our engagement with Sipkne'katik we would like to we would like to better understand your concerns surrounding traditional land use resulting from the Hardwood Lands project as per the above mentioned letter. With this in mind, we respectfully request a meeting with yourself, Chief Rufus Copage, to discuss this matter in further detail.

While the engagement process is ongoing, there exists an opportunity to redefine Sipekne'katik's energy independence to be cleaner and more self-reliant. We hope to continue to develop the logistics of these initiatives in a separate process, under a Memorandum of Understanding.

Sincerely,



Daniel Roscoe, P. Eng.
Chief Operating Officer
Scotian Wind Inc.

Memorandum of Understanding

Between

SIPEKNE'KATIK

And

SWEB Development Inc.

as a general partner for SCOTIAN WEB II LP ("SWEB")

This Memorandum of Understanding (MOU) describes the terms and understanding between Sipekne'katik and SWEB regarding a renewable energy partnership in good faith in relation to the Hardwood Lands Community Wind Project.

Background

SWEB, working with Scotian WEB II LP to proposes a three-turbine facility in lands adjacent to Sipekne'katik. Sipekne'katik is interested in developing ways to reduce their energy costs through home efficiency and renewable energy generation. Sipekne'katik is also interested in building the capacity to assess, install and maintain their own renewable energy generating systems. SWEB has extensive experience in small and large renewable energy projects. In anticipation of the Hardwood Lands Community Wind Project becoming operational, SWEB offers its experience and data to guide Sipekne'katik to increase their energy independence

Purpose

This MOU will describe the scope of the relationship between SWEB and Sipekne'katik and delineate the division of labour between the parties to accomplish common goals. The primary tasks of this of MOU are:

- Winter / Spring 2016: A feasibility study for the development, procurement and installation of band-owned wind turbines and/or solar panels to offset power usage.
- Spring / Summer 2016: A pilot project, involving an energy audit of a home in the community and the installation of energy efficiency a solar system and/or energy efficiency systems
    - Training of band members to work with solar team to install and maintain solar systems, if applicable
- Annually upon operation: The establishment of a Community Liaison Committee to act as communication link for project specific information and distribute funds equal to 0.75% of gross revenue from the Hardwood Lands Community Wind Project.

Tasks
The above goals will be accomplished by undertaking the following activities:

SWEB	Sipekne'katik
	Collect energy usage under the band account(s)
Conduct Band Level Review of energy consumption	
Identify potential energy efficiency and conservation strategies	
Identify potential renewable projects for wind, solar photovoltaic and solar thermal technologies	
	Council to confer on which project(s) to pursue/prioritize
	Define project development team
Work with Sipekne'katik to develop a project schedule	Work with SWEB to develop a project schedule
	Decide within community where to locate pilot project
Solar: Conduct energy audit and define scope of pilot project	Work with SWEB to decide the desired scope for
Solar: Calculate Energy savings	
Solar: Contract Solar team to install solar system and/or	
Solar: Train certain band members on auditing and/or maintenance and/or installation of solar systems	
Wind: Using proprietary local wind data, Prepare preliminary layout.	Work with SWEB on siting turbine siting.
Wind: Predict Energy Yield	
Wind: Investigate procurement options of turbines – must come with service and maintenance agreement	
Wind: Create draft financial pro forma	
Wind: Identify permitting process	
	Review layout/pro forma from SWEB
	Investigate available funding/grant options
Wind: Work with Sipekne'katik to create finance-ready project reports.	
Wind: Assist Sipekne'katik to submit all permits	
Wind: Prepare scope of construction contracts	Award contracts and manage contractors

Reporting
(Record who will evaluate effectiveness and adherence to the agreement and when evaluation will happen)

Funding
The below commitments are funded by the operating revenue of the Hardwood Lands Community Wind Project. SWEB Commits to:

- Annually contributing 0.75% of the gross revenue of the Hardwood Lands Community Wind Project,
    - To be distributed each year for the previous year,
    - to be administered by the Community Liaison Committee;
- Funding the installation of home efficiency and/or solar array to the approximate sum of $20 000;
- Working with community members to conduct training for solar system installation and maintenance.
- Waiving consulting fees regarding the above mentioned development process;

Duration
This MOU is at-will and may be modified by mutual consent of authorized officials from Sipekne'katik and SWEB. This MOU shall become effective upon signature by the authorized officials from the Sipekne'katik and SWEB and will remain in effect until modified or terminated by any one of the partners by mutual consent. In the absence of mutual agreement by the authorized officials from Sipekne'katik and SWEB, this MOU shall end upon the completion of the above mentioned tasks. The annual community contribution will continue for the duration of the 20-year Power Purchase Agreement relating to the Hardwood Lands Community Wind Project.

Contact Information

SWEB Development Inc.
108F Trider Crescent
Dartmouth, NS
B3B 1R6

902-468-3132

Daniel Roscoe
Chief Operating Officer
Dan.roscoe@swebdevelopment.ca

Rory Cantwell
Development Manager
Rory.Cantwell@swebdevelopment.ca

Gay Harley
Manager, Community Relations & Carbon Services
Gay.harley@swebdevelopment.ca

Mitchell Underhay
Project Planner
Mitch.underhay@swebdevelopment.ca

Sipekne'katik
552 Church Street
Sipekne'katik, NS
B0N 1W0

902-758-2049

Jennifer Copage,
Liaison Officer
jennifer@mikmaki.ca

Rufus Copage
Chief
chiefcopage@sipeknekatik.ca

David Nevin,
Economic Development Officer
dnevin@sipeknekatik.ca

_____ Date:_____
Rufus Copage
Chief, Sipekne'katik

_____ Date: _____
Daniel Roscoe, P. Eng.
Chief Operating Officer,
SWEB Development Inc.

SIPEKNE'KATIK
522 Church Street
Indian Brook, NS
B0N 1W0

Tel:
Fax: 902.758.2017

Scotian Wind Inc.
Daniel Roscoe, COO
108F Trider Crescent
Dartmouth, NS B3B 1R6

November 16, 2015

Dear Mr. Roscoe,

The purpose of this letter is to acknowledge receipt of your letter dated November 5, 2015 where you acknowledge Sipekne'katik's letter of September 29, 2015 sent to Nova Scotia Environment in regards to the Hardwood Lands Community Wind Project.

Sipekne'katik takes note of the five comments made by the Minister of Environment. At this time, we will be kept informed of and discuss these activities with the Province.

Sincerely yours,

Chief Rufus Copage

Chief Rufus Copage

APPENDIX B
LOCAL WATER SUPPLY

N

Indian Rd
Old Indian Rd-Tuff St
Tuff St / Old Indian Rd
Indian Rd
Blois Rd
Tracey Brook
Poplar St
Tower Rd
Burma Rd
Brown Flats Rd
Church St
Dowie Rd
Sesame St
Hollywood Dr
Meadow Dr
Spring Brook
Tracey Brook

PID 45271939
Everett & Marilyn Clarke

PID 45188810
Atlantic Star Forestry Ltd.

PID 45366630
Atlantic Star Forestry Ltd.

PID 45366648
Atlantic Star Forestry Ltd.

PID 45119344
Atlantic Star Forestry Ltd.

WTG 3
WTG 1
WTG 2

PID 45101128
Elmsdale Lumber Co. Ltd.

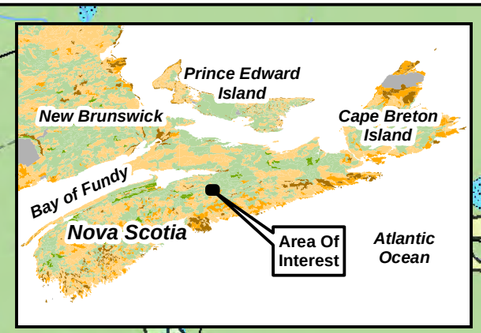
Indian Brook
Native Reserve 14

PID 45101136
Downey M Thompson
Milton Downey Thompson

PID 45289675
Brian Leahy

Well 440048
PW1
PW2

Robinson Rd
Sandy Desert Rd
Dryweather
Dryweather



Legend:

- Water Supply Wells
- Proposed Turbine
- Proposed Access Road
- Native Reserve
- Project Site
- Study Area
- Property Boundary
- Public Roads
- Access Roads / Trails
- Mapped Stream
- Mapped Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Drainage Channel
- Watercourse
- Confirmed WL Bdy
- Approximate WL Bdy
- Wetland Habitat
- Wetland: Clear Cut
- Wetland: Treed Swamp
- Potential Surficial Aquifer

NS DNR Wetland Inventory (Habitat)

- Bog or Fen
- Fen
- Marsh
- Salt Marsh
- Swamp

0 200 400 600 800 1,000 Metres

Notes:

1. Reference: Digital Topographic Mapping & Property Management Unit MU0904 by Nova Scotia Geomatics Centre. Wetland Inventory & Wet Area Mapping by Nova Scotia Department of Natural Resources (NS DNR). DP ME490, Version 1, 2014. Potential Surficial Aquifers of Nova Scotia, 2014, by Gavin Kennedy, Nova Scotia Department of Natural Resources, Minerals and Energy Branch.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Hardwood Lands Community Wind Project - Local Water Supply

Strum CONSULTING

Date: Novermber 2015	Project #: 14-5169
Scale: 1:20,000	Drawing #: 1
Drawn By: H. Serhan	
Checked By: M. Henley	

APPENDIX C
SOUND ASSESSMENT

Appendix C

Expected octave band performance for Vestas V110-2MW

Frequency	Hub height wind speeds [m/s]											
	3	4	5	6	7	8	9	10	11	12	13	14
6.3 Hz	18.6	19.0	16.3	17.5	19.7	23.2	24.5	25.1	26.0	26.6	27.1	27.5
8 Hz	23.8	23.7	22.1	24.6	27.3	30.7	31.8	32.9	33.8	34.4	34.8	35.2
10 Hz	29.1	28.4	28.1	31.5	34.3	37.6	38.8	40.0	40.7	41.2	41.5	41.8
12.5 Hz	36.9	36.2	36.9	40.0	42.1	45.5	47.0	47.8	48.4	48.8	49.0	49.3
16 Hz	42.8	41.5	41.6	46.8	47.9	51.4	52.5	53.5	54.1	54.4	54.6	54.9
20 Hz	47.0	47.2	46.5	50.7	53.8	57.2	58.0	59.1	59.4	59.6	59.8	59.9
25 Hz	52.7	53.2	52.0	55.0	58.4	62.4	63.9	65.2	65.9	66.4	66.7	67.0
31.5 Hz	56.9	56.9	56.9	59.3	62.7	66.3	67.8	69.1	69.8	70.3	70.6	71.0
40 Hz	60.9	59.5	62.7	63.3	66.5	70.4	71.7	72.8	73.4	73.7	74.0	74.3
50 Hz	66.5	65.0	68.4	68.4	71.4	74.6	76.0	76.9	77.5	77.8	78.1	78.3
63 Hz	75.3	75.8	73.5	72.1	75.0	77.9	79.2	79.1	79.8	80.3	80.6	81.0
80 Hz	77.2	76.9	77.8	75.6	78.6	80.9	82.1	82.0	82.4	82.7	83.0	83.2
100 Hz	77.7	76.1	79.8	79.5	82.5	83.8	84.2	84.9	85.1	85.2	85.3	85.4
125 Hz	80.7	79.7	83.0	82.8	85.8	86.4	86.6	87.1	87.0	87.0	86.9	87.0
160 Hz	85.0	83.6	86.9	86.3	88.6	88.6	88.4	88.6	88.5	88.5	88.4	88.4
200 Hz	84.5	85.1	87.5	87.3	90.2	90.7	90.1	89.8	89.2	88.9	88.6	88.4
250 Hz	85.7	86.7	88.1	89.2	92.4	93.3	92.6	92.3	91.6	91.2	90.8	90.5
315 Hz	87.5	88.7	89.8	90.7	93.6	94.4	93.8	93.1	92.3	91.8	91.3	91.0
400 Hz	85.6	85.9	88.8	90.8	93.3	94.1	93.7	93.4	92.6	92.1	91.6	91.3
500 Hz	85.5	86.4	88.2	91.2	94.6	96.6	96.9	96.7	96.1	95.6	95.3	95.0
630 Hz	84.3	85.8	86.8	91.2	94.2	96.7	97.5	97.0	96.3	95.8	95.4	95.1
800 Hz	83.4	84.6	86.2	89.9	93.3	96.9	98.5	98.3	97.9	97.7	97.4	97.3
1 kHz	83.7	84.6	85.8	89.1	92.4	96.6	98.6	98.4	98.3	98.2	98.1	98.1
1.25 kHz	84.8	84.7	86.2	88.5	91.2	95.2	97.8	97.6	97.9	98.0	98.1	98.3
1.6 kHz	87.4	82.7	85.1	93.7	93.9	94.0	96.9	97.8	98.4	98.8	99.1	99.4
2 kHz	82.4	81.3	82.9	86.2	90.9	94.2	94.8	96.7	97.2	97.4	97.6	97.8
2.5 kHz	82.1	80.8	82.3	83.7	86.7	90.1	93.2	94.0	95.1	95.8	96.3	96.8
3.15 kHz	78.6	76.5	79.8	82.1	85.2	87.7	90.0	91.2	91.9	92.4	92.8	93.1
4 Hz	73.9	72.2	75.9	79.3	83.3	85.7	87.1	88.5	88.9	89.1	89.3	89.5
5 kHz	73.0	71.4	74.6	76.6	80.5	82.4	83.6	84.7	85.0	85.3	85.4	85.6
6.3 kHz	67.7	65.6	68.4	73.9	78.1	78.7	79.6	81.2	81.5	81.6	81.7	81.8
8 kHz	66.7	65.6	65.3	70.5	74.5	73.5	73.8	74.9	75.1	75.2	75.3	75.4
A-wgt	96.6	96.6	98.5	101.1	103.9	105.9	107.2	107.3	107.3	107.3	107.3	107.3

Licensed user:
Strum Environmental
Railside, 1355 Bedford Highway
CA-B4A 1C5 Bedford, NS
902.835.5560 (24/7)

Calculated:
12/4/2015 11:02 AM/3.0.629

DECIBEL - Assumptions for noise calculation

Calculation: Hardwood Lands Wind Project

Noise calculation model:
ISO 9613-2 General
Wind speed:
10.0 m/s
Ground attenuation:
General, fixed, Ground factor: 0.7
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:
Pure and Impulse tone penalty are added to WTG source noise
Height above ground level, when no value in NSA object:
4.5 m Don't allow override of model height with height from NSA object
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0.0 dB(A)
Octave data required
Air absorption

63 [db/km]	125 [db/km]	250 [db/km]	500 [db/km]	1,000 [db/km]	2,000 [db/km]	4,000 [db/km]	8,000 [db/km]
0.1	0.4	1.0	1.9	3.7	9.7	32.8	117.0

WTG: VESTAS V110-2.0 2000 110.0 !O!
Noise: Strum Mode 0

Source	Source/Date	Creator	Edited
Manufacturer	8/10/2015	USER	11/30/2015 9:52 AM

Based on Document No. 0048-9642_00

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	95.0	10.0	107.3	No	84.6	91.9	96.7	100.7	102.9	101.2	93.7	82.9

NSA: R01-A
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R02-B
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R03-C
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R04-D
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

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DECIBEL - Assumptions for noise calculation

Calculation: Hardwood Lands Wind Project

NSA: R05-E
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R06-F
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R07-G
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R08-H
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R09-I
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R10-J
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R11-K
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R12-L
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R13-M
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

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DECIBEL - Assumptions for noise calculation

Calculation: Hardwood Lands Wind Project

NSA: R14-N
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R15-O
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R16-P
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R17-Q
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R18-R
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R19-S
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R20-T
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R21-U
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R22-V
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

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DECIBEL - Assumptions for noise calculation

Calculation: Hardwood Lands Wind Project

NSA: R23-W
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R24-X
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R25-Y
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R26-Z
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R27-AA
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R28-AB
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R29-AC
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R30-AD
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R31-AE
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

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DECIBEL - Assumptions for noise calculation

Calculation: Hardwood Lands Wind Project

NSA: R32-AF
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R33-AG
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R34-AH
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R35-AI
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R36-AJ
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R37-AK
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R38-AL
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R39-AM
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R40-AN
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

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DECIBEL - Assumptions for noise calculation

Calculation: Hardwood Lands Wind Project

NSA: R41-AO
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R42-AP
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R43-AQ
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R44-AR
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R45-AS
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R46-AT
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R47-AU
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R48-AV
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R49-AW
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

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DECIBEL - Assumptions for noise calculation

Calculation: Hardwood Lands Wind Project

NSA: R50-AX
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R51-AY
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R52-AZ
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R53-BA
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R54-BB
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R55-BC
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R56-BD
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R57-BE
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R58-BF
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

DECIBEL - Assumptions for noise calculation

Calculation: Hardwood Lands Wind Project

NSA: R59-BG
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R60-BH
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R61-BI
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R62-BJ
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R63-BK
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R64-BL
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R65-BM
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R66-BN
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R67-BO
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

DECIBEL - Assumptions for noise calculation

Calculation: Hardwood Lands Wind Project

NSA: R68-BP
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R69-BQ
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R70-BR
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R71-BS
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R72-BT
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R73-BU
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R74-BV
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R75-BW
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R76-BX
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

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DECIBEL - Assumptions for noise calculation

Calculation: Hardwood Lands Wind Project

NSA: R77-BY
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R78-BZ
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R79-CA
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R81-CB
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R82-CC
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R83-CD
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R84-CE
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R85-CF
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R86-CG
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

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DECIBEL - Assumptions for noise calculation

Calculation: Hardwood Lands Wind Project

NSA: R89-CH
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R90-CI
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R91-CJ
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R92-CK
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R93-CL
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R94-CM
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R95-CN
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R96-CO
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R97-CP
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

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DECIBEL - Assumptions for noise calculation

Calculation: Hardwood Lands Wind Project

NSA: R98-CQ
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R87-CR
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

NSA: R99-CS
Predefined calculation standard:
Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40.0 dB(A)
No distance demand

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Calculated:
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DECIBEL - Main Result

Calculation: Hardwood Lands Wind Project

Noise calculation model:
ISO 9613-2 General
Wind speed:
10.0 m/s
Ground attenuation:
General, fixed, Ground factor: 0.7
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:
Pure and Impulse tone penalty are added to WTG source noise
Height above ground level, when no value in NSA object:
4.5 m Don't allow override of model height with height from NSA object
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0.0 dB(A)

WTGs

					WTG type						Noise data				
	Easting	Northing	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
1	458,350	4,993,141	85.0	Wind Turbine	Yes	VESTAS	V110-2.0-2,000	2,000	110.0	95.0	USER	Strum Mode 0	10.0	107.3	No
2	458,899	4,992,845	75.3	Wind Turbine	Yes	VESTAS	V110-2.0-2,000	2,000	110.0	95.0	USER	Strum Mode 0	10.0	107.3	No
3	458,897	4,993,684	85.0	Wind Turbine	Yes	VESTAS	V110-2.0-2,000	2,000	110.0	95.0	USER	Strum Mode 0	10.0	107.3	No

Calculation Results

Sound Level

Noise sensitive area						Demands	Sound Level		Demands fulfilled ?
No.	Name	Easting	Northing	Z [m]	Imission height [m]	Noise [dB(A)]	From WTGs [dB(A)]	Distance to noise demand [m]	Noise
A	R01	460,598	4,994,046	66.6	4.5	40.0	29.4	1,137	Yes
B	R02	459,929	4,994,753	72.8	4.5	40.0	30.6	903	Yes
C	R03	460,486	4,993,998	70.0	4.5	40.0	30.2	1,016	Yes
D	R04	460,428	4,994,137	75.0	4.5	40.0	30.3	999	Yes
E	R05	460,541	4,994,622	65.0	4.5	40.0	28.0	1,305	Yes
F	R06	460,145	4,994,860	75.0	4.5	40.0	29.0	1,131	Yes
G	R07	460,126	4,994,882	75.0	4.5	40.0	29.0	1,133	Yes
H	R08	460,805	4,994,218	60.7	4.5	40.0	27.8	1,382	Yes
I	R09	460,525	4,994,085	70.8	4.5	40.0	29.8	1,076	Yes
J	R10	459,990	4,994,681	70.0	4.5	40.0	30.6	896	Yes
K	R11	460,479	4,994,480	65.0	4.5	40.0	28.9	1,181	Yes
L	R12	460,445	4,994,470	65.0	4.5	40.0	29.1	1,146	Yes
M	R13	459,879	4,995,022	84.3	4.5	40.0	29.3	1,079	Yes
N	R14	460,516	4,994,281	74.1	4.5	40.0	29.3	1,131	Yes
O	R15	460,598	4,994,279	68.7	4.5	40.0	28.8	1,207	Yes
P	R16	460,502	4,994,659	65.0	4.5	40.0	28.1	1,291	Yes
Q	R17	460,519	4,994,564	65.0	4.5	40.0	28.4	1,257	Yes
R	R18	456,478	4,992,857	69.3	4.5	40.0	28.1	1,294	Yes
S	R19	460,768	4,994,260	60.7	4.5	40.0	27.9	1,360	Yes
T	R20	460,616	4,994,042	65.5	4.5	40.0	29.3	1,153	Yes
U	R21	460,660	4,994,114	62.4	4.5	40.0	28.9	1,214	Yes
V	R22	460,187	4,994,706	71.8	4.5	40.0	29.5	1,061	Yes
W	R23	460,129	4,994,805	75.0	4.5	40.0	29.3	1,083	Yes
X	R24	460,494	4,994,266	75.0	4.5	40.0	29.5	1,105	Yes
Y	R25	460,569	4,994,238	71.5	4.5	40.0	29.1	1,166	Yes
Z	R26	460,098	4,994,764	75.0	4.5	40.0	29.7	1,032	Yes
AA	R27	459,237	4,995,608	84.1	4.5	40.0	27.4	1,373	Yes

To be continued on next page...

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DECIBEL - Main Result

Calculation: Hardwood Lands Wind Project

...continued from previous page

Noise sensitive area						Demands	Sound Level		Demands fulfilled ?
No.	Name	Easting	Northing	Z [m]	Imission height [m]	Noise [dB(A)]	From WTGs [dB(A)]	Distance to noise demand [m]	Noise
AB	R28	460,699	4,994,502	65.0	4.5	40.0	27.6	1,388	Yes
AC	R29	460,484	4,994,076	72.7	4.5	40.0	30.1	1,035	Yes
AD	R30	460,446	4,994,715	63.5	4.5	40.0	28.2	1,275	Yes
AE	R31	459,523	4,995,146	82.0	4.5	40.0	29.7	1,010	Yes
AF	R32	460,466	4,993,985	70.0	4.5	40.0	30.4	994	Yes
AG	R33	460,527	4,994,203	74.2	4.5	40.0	29.5	1,114	Yes
AH	R34	460,498	4,994,182	74.7	4.5	40.0	29.7	1,080	Yes
AI	R35	460,408	4,994,509	65.0	4.5	40.0	29.1	1,133	Yes
AJ	R36	460,301	4,994,612	66.6	4.5	40.0	29.3	1,097	Yes
AK	R37	460,400	4,994,004	71.1	4.5	40.0	30.8	934	Yes
AL	R38	460,311	4,994,760	70.9	4.5	40.0	28.7	1,192	Yes
AM	R39	460,168	4,994,752	73.7	4.5	40.0	29.4	1,077	Yes
AN	R40	460,590	4,994,518	65.0	4.5	40.0	28.1	1,297	Yes
AO	R41	460,553	4,994,110	70.0	4.5	40.0	29.5	1,110	Yes
AP	R42	460,213	4,994,641	69.7	4.5	40.0	29.7	1,043	Yes
AQ	R43	460,398	4,994,184	75.0	4.5	40.0	30.3	986	Yes
AR	R44	460,422	4,994,017	71.3	4.5	40.0	30.6	959	Yes
AS	R45	460,421	4,994,578	65.0	4.5	40.0	28.8	1,179	Yes
AT	R46	460,594	4,994,577	65.0	4.5	40.0	27.9	1,328	Yes
AU	R47	459,936	4,994,986	79.2	4.5	40.0	29.3	1,084	Yes
AV	R48	460,451	4,994,030	71.4	4.5	40.0	30.4	990	Yes
AW	R49	460,147	4,994,722	73.5	4.5	40.0	29.6	1,041	Yes
AX	R50	460,631	4,994,547	65.0	4.5	40.0	27.8	1,347	Yes
AY	R51	460,084	4,994,663	70.4	4.5	40.0	30.2	955	Yes
AZ	R52	460,152	4,994,649	70.0	4.5	40.0	30.0	999	Yes
BA	R53	460,266	4,994,798	72.9	4.5	40.0	28.7	1,181	Yes
BB	R54	460,228	4,994,822	74.4	4.5	40.0	28.8	1,168	Yes
BC	R55	460,725	4,994,424	65.0	4.5	40.0	27.7	1,379	Yes
BD	R56	460,242	4,994,633	68.7	4.5	40.0	29.6	1,061	Yes
BE	R57	460,772	4,994,174	60.0	4.5	40.0	28.1	1,339	Yes
BF	R58	460,328	4,994,591	65.9	4.5	40.0	29.3	1,108	Yes
BG	R59	460,424	4,994,665	65.0	4.5	40.0	28.5	1,228	Yes
BH	R60	460,578	4,994,148	69.8	4.5	40.0	29.3	1,145	Yes
BI	R61	460,371	4,994,629	66.0	4.5	40.0	28.9	1,164	Yes
BJ	R62	460,568	4,994,594	65.0	4.5	40.0	28.0	1,314	Yes
BK	R63	460,093	4,994,733	74.5	4.5	40.0	29.9	1,007	Yes
BL	R64	458,498	4,995,587	100.0	4.5	40.0	27.7	1,356	Yes
BM	R65	460,453	4,994,151	75.0	4.5	40.0	30.1	1,027	Yes
BN	R66	460,544	4,994,312	70.6	4.5	40.0	29.0	1,168	Yes
BO	R67	460,636	4,994,091	64.1	4.5	40.0	29.1	1,185	Yes
BP	R68	460,052	4,994,670	70.0	4.5	40.0	30.4	935	Yes
BQ	R69	456,466	4,992,841	68.6	4.5	40.0	28.1	1,309	Yes
BR	R70	460,698	4,994,449	65.0	4.5	40.0	27.8	1,365	Yes
BS	R71	460,125	4,994,656	70.0	4.5	40.0	30.1	982	Yes
BT	R72	456,739	4,992,260	70.0	4.5	40.0	28.6	1,231	Yes
BU	R73	460,420	4,993,956	70.0	4.5	40.0	30.8	943	Yes
BV	R74	460,188	4,994,645	70.0	4.5	40.0	29.8	1,025	Yes
BW	R75	460,339	4,994,653	67.9	4.5	40.0	29.0	1,151	Yes
BX	R76	460,297	4,994,849	71.6	4.5	40.0	28.3	1,238	Yes
BY	R77	460,268	4,994,623	67.7	4.5	40.0	29.5	1,076	Yes
BZ	R78	460,568	4,994,044	68.5	4.5	40.0	29.6	1,107	Yes
CA	R79	460,620	4,994,489	65.0	4.5	40.0	28.1	1,311	Yes
CB	R81	460,359	4,994,718	68.8	4.5	40.0	28.6	1,205	Yes
CC	R82	460,468	4,994,613	65.0	4.5	40.0	28.5	1,238	Yes
CD	R83	460,472	4,994,520	65.0	4.5	40.0	28.8	1,194	Yes
CE	R84	460,444	4,994,549	65.0	4.5	40.0	28.8	1,184	Yes
CF	R85	460,361	4,994,564	65.0	4.5	40.0	29.2	1,121	Yes
CG	R86	460,386	4,994,543	65.0	4.5	40.0	29.1	1,131	Yes
CH	R89	460,384	4,993,983	70.6	4.5	40.0	31.0	914	Yes

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DECIBEL - Main Result

Calculation: Hardwood Lands Wind Project

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Noise sensitive area						Demands	Sound Level		Demands fulfilled ?
No.	Name	Easting	Northing	Z [m]	Imission height [m]	Noise [dB(A)]	From WTGs [dB(A)]	Distance to noise demand [m]	Noise
CI	R90	460,453	4,993,975	70.0	4.5	40.0	30.5	979	Yes
CJ	R91	460,515	4,994,028	70.4	4.5	40.0	30.0	1,052	Yes
CK	R92	460,469	4,994,166	75.0	4.5	40.0	29.9	1,048	Yes
CL	R93	460,288	4,994,696	70.0	4.5	40.0	29.0	1,136	Yes
CM	R94	460,230	4,994,692	70.0	4.5	40.0	29.4	1,086	Yes
CN	R95	460,178	4,994,782	74.1	4.5	40.0	29.2	1,104	Yes
CO	R96	460,003	4,994,749	73.3	4.5	40.0	30.2	952	Yes
CP	R97	459,346	4,995,619	86.4	4.5	40.0	27.2	1,406	Yes
CQ	R98	460,391	4,994,626	65.1	4.5	40.0	28.8	1,179	Yes
CR	R87	459,473	4,992,646	64.5	4.5	40.0	39.9	4	Yes
CS	R99	459,499	4,993,906	65.9	4.5	40.0	39.3	48	Yes

Distances (m)

	WTG		
NSA	1	2	3
A	2424	2080	1739
B	2257	2168	1486
C	2302	1961	1620
D	2305	2001	1597
E	2646	2420	1893
F	2486	2369	1715
G	2488	2378	1717
H	2681	2349	1981
I	2371	2044	1676
J	2250	2135	1479
K	2515	2273	1771
L	2481	2243	1736
M	2424	2387	1660
N	2448	2162	1725
O	2520	2223	1802
P	2634	2421	1878
Q	2595	2362	1846
R	1893	2421	2556
S	2665	2344	1958
T	2439	2093	1756
U	2507	2170	1815
V	2414	2263	1646
W	2437	2314	1666
X	2422	2136	1700
Y	2476	2175	1761
Z	2386	2262	1615
AA	2622	2784	1954
AB	2716	2447	1979
AC	2330	2007	1635
AD	2622	2427	1861
AE	2324	2385	1591
AF	2278	1937	1597
AG	2422	2119	1710
AH	2387	2084	1677
AI	2472	2246	1722
AJ	2444	2256	1683
AK	2225	1896	1537
AL	2543	2379	1777
AM	2430	2291	1660
AN	2630	2379	1887
AO	2407	2082	1710
AP	2392	2226	1627

To be continued on next page...

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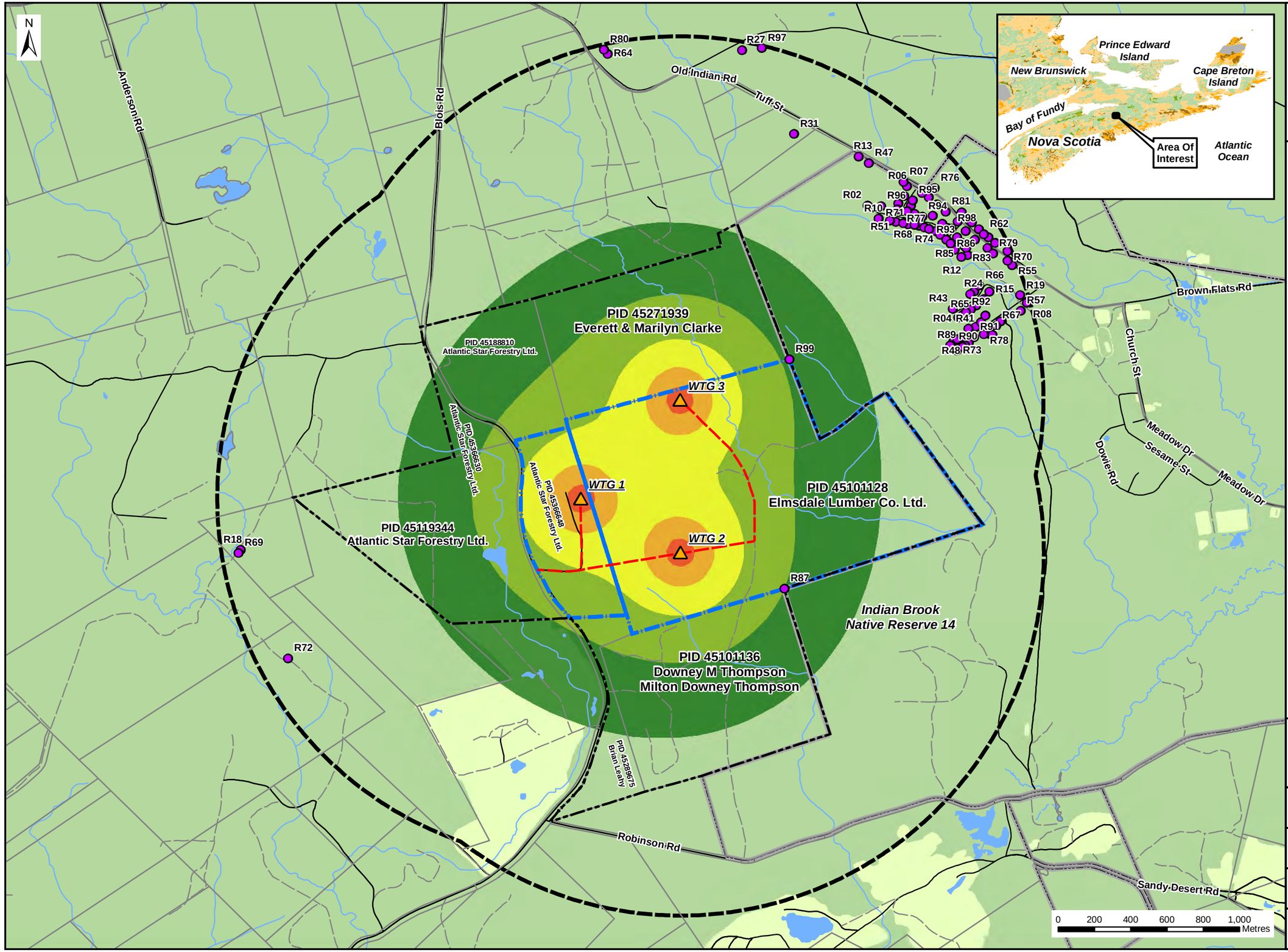
DECIBEL - Main Result

Calculation: Hardwood Lands Wind Project

...continued from previous page

	WTG		
NSA	1	2	3
AQ	2298	2010	1582
AR	2250	1922	1561
AS	2521	2306	1767
AT	2665	2423	1918
AU	2434	2379	1666
AV	2281	1952	1592
AW	2394	2254	1625
AX	2680	2428	1937
AY	2308	2170	1539
AZ	2350	2196	1583
BA	2534	2384	1765
BB	2521	2382	1752
BC	2700	2414	1972
BD	2410	2236	1646
BE	2634	2297	1938
BF	2453	2257	1695
BG	2574	2374	1815
BH	2445	2125	1744
BI	2510	2312	1751
BJ	2652	2418	1903
BK	2361	2233	1591
BL	2451	2772	1945
BM	2334	2030	1625
BN	2487	2204	1762
BO	2476	2137	1786
BP	2288	2159	1519
BQ	1907	2433	2573
BR	2689	2411	1957
BS	2334	2187	1566
BT	1835	2238	2585
BU	2225	1883	1547
BV	2375	2214	1610
BW	2499	2312	1738
BX	2591	2443	1822
BY	2424	2244	1662
BZ	2395	2055	1709
CA	2641	2380	1902
CB	2555	2375	1791
CC	2580	2364	1825
CD	2532	2298	1784
CE	2524	2301	1773
CF	2464	2257	1708
CG	2472	2256	1719
CH	2202	1871	1517
CI	2263	1921	1583
CJ	2340	2003	1654
CK	2355	2052	1645
CL	2485	2314	1721
CM	2437	2276	1671
CN	2457	2321	1687
CO	2307	2201	1536
CP	2671	2810	1987
CQ	2524	2323	1766
CR	1228	607	1187
CS	1381	1219	641



Notes:

1. Reference: Digital Topographic Mapping & Property Management Unit MU0904 by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. Noise Calculation Model was done in Accordance with ISO 96313-2 General Guidelines and Using Wind Turbine Data Supplied by Client.

Legend:

- Existing Receptors
- Proposed Turbine
- Proposed Access Road
- Study Area
- Project Site
- 2km Buffer
- Property Boundary
- Native Reserve
- Public Roads
- Access Roads / Trails
- Mapped Stream
- Mapped Indefinite Stream
- Water Bodies
- Cleared Area

Sound Modeling Results

Predicted Sound Level [dB(A)]

- 35-40
- 40-45
- 45-50
- 50-55
- 55 +

Hardwood Lands Community Wind Project - Sound Modeling Results

Strum Consulting

Date: November 2015	Project #: 14-5169
Scale: 1:20,000	Drawing #: 1
Drawn By: H. Serhan	
Checked By: A. Walter	

APPENDIX D
SHADOW FLICKER ASSESSMENT

Table D1: Field Observed Vegetation Height

Project# 14-5169

Veg Zone	Total Tree Height (m)	Tree Type	Notes
1	12.03	H	For this section habitat observed was represented by alternating taller hardwoods (~14-16m) and shorter softwood (~7m). We modelled based on this alternating arrangement along the transect (which was aligned along the property line).
	7.46	H	
	13.50	H	
	~7m dense stand	S	
	21.52	H	
	~7m dense stand	S	
	16.29	H	
	~7m dense stand	S	
	14.07	H	
	~7m dense stand	S	
	14.18	H	
	~7m dense stand	S	
	13.35	H	
	5.63	S	
	14.34	H	
	8.45	H	
	5.68	S	
	4.94	S	
	23.95	H	
	7.45	S	
2	6.78	S	An average of 13m tree height was used to model this section.
	11.20	S	
	11.81	S	
	16.74	S	
	8.95	S	
	13.68	S	
	13.44	S	
	13.88	S	
	9.10	S	
	15.56	S	
	10.01	S	
3	12.46	S	An average of 13m tree height was used to model this section.
	13.56	S	
	9.34	S	
	13.71	S	
	13.82	S	
	14.54	S	
	14.99	S	
	10.40	H	
4	14.84	S	An average of 13.5m tree height was used to model this section.
	14.53	S	
	15.18	S	
	12.67	S	
	13.11	H	
	14.54	S	
	13.54	H	
	14.04	S	

Veg Zone	Total Tree Height (m)	Tree Type	Notes
5	12.82	S	An average of 12 m tree height was used to model this section.
	12.55	S	
	8.37	S	
	11.40	S	
	12.47	S	
	10.67	S	
	12.67	S	
6	20.80	S	An average of 17.5 m tree height was used to model this section.
	16.36	S	
	16.32	S	
	26.84	H	
	18.30	H	
	19.86	H	
	16.82	H	
	19.11	H	
	17.27	H	
	13.24	H	
	16.68	S	
	11.38	S	
	15.31	S	
	18.30	S	
	19.54	S	
7	12.72	S	An average of 11 m tree height was used to model this section.
	13.85	H	
	9.13	S	
	12.79	S	
	10.74	H	
	11.27	S	
	16.07	H	
	12.87	S	
	10.11	S	
	11.40	S	
	13.25	S	
	12.14	S	

Project:
Hardwood Lands Sound & Shadow Modeling

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Calculated:
12/4/2015 11:59 AM/3.0.629

SHADOW - Main Result

Calculation: Hardwood Lands Wind Project - Without Vegetation

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: Height Contours: Contours.wpo (1)
Obstacles used in calculation
Eye height: 1.5 m
Grid resolution: 10.0 m

All coordinates are in
UTM (north)-NAD83(NSRS/CSRS) (US+CA), geocentric, GRS80 Zone: 20

WTGs

					WTG type						Shadow data	
	Easting	Northing	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	458,350	4,993,141	85.0	Wind Turbine	Yes	VESTAS	V110-2.0-2,000	2,000	110.0	95.0	1,513	0.0
2	458,899	4,992,845	75.3	Wind Turbine	Yes	VESTAS	V110-2.0-2,000	2,000	110.0	95.0	1,513	0.0
3	458,897	4,993,684	85.0	Wind Turbine	Yes	VESTAS	V110-2.0-2,000	2,000	110.0	95.0	1,513	0.0

Shadow receptor-Input

No.	Name	Easting	Northing	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
A	R01	460,598	4,994,046	66.6	1.0	1.0	1.0	53.6	90.0	Fixed direction
B	R02	459,929	4,994,753	72.8	1.0	1.0	1.0	52.3	90.0	Fixed direction
C	R03	460,486	4,993,998	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
D	R04	460,428	4,994,137	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
E	R05	460,541	4,994,622	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
F	R06	460,145	4,994,860	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
G	R07	460,126	4,994,882	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
H	R08	460,805	4,994,218	60.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
I	R09	460,525	4,994,085	70.8	1.0	1.0	1.0	53.6	90.0	Fixed direction
J	R10	459,990	4,994,681	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
K	R11	460,479	4,994,480	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
L	R12	460,445	4,994,470	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
M	R13	459,879	4,995,022	84.3	1.0	1.0	1.0	30.7	90.0	Fixed direction
N	R14	460,516	4,994,281	74.1	1.0	1.0	1.0	53.6	90.0	Fixed direction
O	R15	460,598	4,994,279	68.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
P	R16	460,502	4,994,659	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
Q	R17	460,519	4,994,564	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
R	R18	456,478	4,992,857	69.3	1.0	1.0	1.0	-99.9	90.0	Fixed direction
S	R19	460,768	4,994,260	60.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
T	R20	460,616	4,994,042	65.5	1.0	1.0	1.0	53.6	90.0	Fixed direction
U	R21	460,660	4,994,114	62.4	1.0	1.0	1.0	53.6	90.0	Fixed direction
V	R22	460,187	4,994,706	71.8	1.0	1.0	1.0	53.6	90.0	Fixed direction
W	R23	460,129	4,994,805	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction

To be continued on next page...

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902.835.5560 (24/7)

SHADOW - Main Result

Calculation: Hardwood Lands Wind Project - Without Vegetation

...continued from previous page

No.	Name	Easting	Northing	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
X	R24	460,494	4,994,266	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
Y	R25	460,569	4,994,238	71.5	1.0	1.0	1.0	53.6	90.0	Fixed direction
Z	R26	460,098	4,994,764	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AA	R27	459,237	4,995,608	84.1	1.0	1.0	1.0	14.0	90.0	Fixed direction
AB	R28	460,699	4,994,502	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AC	R29	460,484	4,994,076	72.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
AD	R30	460,446	4,994,715	63.5	1.0	1.0	1.0	53.6	90.0	Fixed direction
AE	R31	459,523	4,995,146	82.0	1.0	1.0	1.0	23.0	90.0	Fixed direction
AF	R32	460,466	4,993,985	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AG	R33	460,527	4,994,203	74.2	1.0	1.0	1.0	53.6	90.0	Fixed direction
AH	R34	460,498	4,994,182	74.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
AI	R35	460,408	4,994,509	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AJ	R36	460,301	4,994,612	66.6	1.0	1.0	1.0	53.6	90.0	Fixed direction
AK	R37	460,400	4,994,004	71.1	1.0	1.0	1.0	53.6	90.0	Fixed direction
AL	R38	460,311	4,994,760	70.9	1.0	1.0	1.0	53.6	90.0	Fixed direction
AM	R39	460,168	4,994,752	73.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
AN	R40	460,590	4,994,518	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AO	R41	460,553	4,994,110	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AP	R42	460,213	4,994,641	69.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
AQ	R43	460,398	4,994,184	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AR	R44	460,422	4,994,017	71.3	1.0	1.0	1.0	53.6	90.0	Fixed direction
AS	R45	460,421	4,994,578	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AT	R46	460,594	4,994,577	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AU	R47	459,936	4,994,986	79.2	1.0	1.0	1.0	44.7	90.0	Fixed direction
AV	R48	460,451	4,994,030	71.4	1.0	1.0	1.0	53.6	90.0	Fixed direction
AW	R49	460,147	4,994,722	73.5	1.0	1.0	1.0	53.6	90.0	Fixed direction
AX	R50	460,631	4,994,547	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AY	R51	460,084	4,994,663	70.4	1.0	1.0	1.0	53.6	90.0	Fixed direction
AZ	R52	460,152	4,994,649	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BA	R53	460,266	4,994,798	72.9	1.0	1.0	1.0	53.6	90.0	Fixed direction
BB	R54	460,228	4,994,822	74.4	1.0	1.0	1.0	53.6	90.0	Fixed direction
BC	R55	460,725	4,994,424	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BD	R56	460,242	4,994,633	68.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
BE	R57	460,772	4,994,174	60.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BF	R58	460,328	4,994,591	65.9	1.0	1.0	1.0	53.6	90.0	Fixed direction
BG	R59	460,424	4,994,665	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BH	R60	460,578	4,994,148	69.8	1.0	1.0	1.0	53.6	90.0	Fixed direction
BI	R61	460,371	4,994,629	66.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BJ	R62	460,568	4,994,594	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BK	R63	460,093	4,994,733	74.5	1.0	1.0	1.0	53.6	90.0	Fixed direction
BL	R64	458,498	4,995,587	100.0	1.0	1.0	1.0	-10.2	90.0	Fixed direction
BM	R65	460,453	4,994,151	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BN	R66	460,544	4,994,312	70.6	1.0	1.0	1.0	53.6	90.0	Fixed direction
BO	R67	460,636	4,994,091	64.1	1.0	1.0	1.0	53.6	90.0	Fixed direction
BP	R68	460,052	4,994,670	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BQ	R69	456,466	4,992,841	68.6	1.0	1.0	1.0	-100.9	90.0	Fixed direction
BR	R70	460,698	4,994,449	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BS	R71	460,125	4,994,656	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BT	R72	456,739	4,992,260	70.0	1.0	1.0	1.0	-118.5	90.0	Fixed direction
BU	R73	460,420	4,993,956	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BV	R74	460,188	4,994,645	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BW	R75	460,339	4,994,653	67.9	1.0	1.0	1.0	53.6	90.0	Fixed direction
BX	R76	460,297	4,994,849	71.6	1.0	1.0	1.0	53.6	90.0	Fixed direction
BY	R77	460,268	4,994,623	67.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
BZ	R78	460,568	4,994,044	68.5	1.0	1.0	1.0	53.6	90.0	Fixed direction
CA	R79	460,620	4,994,489	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CB	R80	458,478	4,995,611	100.0	1.0	1.0	1.0	-16.5	90.0	Fixed direction
CC	R81	460,359	4,994,718	68.8	1.0	1.0	1.0	53.6	90.0	Fixed direction
CD	R82	460,468	4,994,613	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction

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SHADOW - Main Result

Calculation: Hardwood Lands Wind Project - Without Vegetation

...continued from previous page

No.	Name	Easting	Northing	Z [m]	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
CE	R83	460,472	4,994,520	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CF	R84	460,444	4,994,549	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CG	R85	460,361	4,994,564	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CH	R86	460,386	4,994,543	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CI	R89	460,384	4,993,983	70.6	1.0	1.0	1.0	53.6	90.0	Fixed direction
CJ	R90	460,453	4,993,975	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CK	R91	460,515	4,994,028	70.4	1.0	1.0	1.0	53.6	90.0	Fixed direction
CL	R92	460,469	4,994,166	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CM	R93	460,288	4,994,696	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CN	R94	460,230	4,994,692	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CO	R95	460,178	4,994,782	74.1	1.0	1.0	1.0	53.6	90.0	Fixed direction
CP	R96	460,003	4,994,749	73.3	1.0	1.0	1.0	53.6	90.0	Fixed direction
CQ	R97	459,346	4,995,619	86.4	1.0	1.0	1.0	20.8	90.0	Fixed direction
CR	R98	460,391	4,994,626	65.1	1.0	1.0	1.0	53.6	90.0	Fixed direction
CS	R87	459,471	4,992,644	64.5	1.0	1.0	1.0	-245.3	90.0	Fixed direction
CT	R99	459,499	4,993,906	65.9	1.0	1.0	1.0	61.7	90.0	Fixed direction
CU	S1	459,607	4,994,258	73.6	1.0	1.0	1.0	61.7	90.0	Fixed direction
CV	S2	459,415	4,994,130	70.0	1.0	1.0	1.0	61.7	90.0	Fixed direction
CW	S3	459,499	4,993,906	65.9	1.0	1.0	1.0	61.7	90.0	Fixed direction
CX	S4	459,766	4,993,621	70.0	1.0	1.0	1.0	74.5	90.0	Fixed direction
CY	S5	459,667	4,993,470	0.0	1.0	1.0	1.0	79.4	90.0	Fixed direction
CZ	S6	459,605	4,992,688	62.6	1.0	1.0	1.0	-245.3	90.0	Fixed direction
DA	S7	459,471	4,992,644	64.5	1.0	1.0	1.0	-245.3	90.0	Fixed direction
DB	S8	459,716	4,992,475	62.5	1.0	1.0	1.0	-245.3	90.0	Fixed direction

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case: Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
A	R01	0:00	0	0:00
B	R02	0:00	0	0:00
C	R03	0:00	0	0:00
D	R04	0:00	0	0:00
E	R05	0:00	0	0:00
F	R06	0:00	0	0:00
G	R07	0:00	0	0:00
H	R08	0:00	0	0:00
I	R09	0:00	0	0:00
J	R10	2:39	19	0:10
K	R11	0:00	0	0:00
L	R12	0:00	0	0:00
M	R13	0:00	0	0:00
N	R14	0:00	0	0:00
O	R15	0:00	0	0:00
P	R16	0:00	0	0:00
Q	R17	0:00	0	0:00
R	R18	0:00	0	0:00
S	R19	0:00	0	0:00
T	R20	0:00	0	0:00
U	R21	0:00	0	0:00
V	R22	0:00	0	0:00
W	R23	0:00	0	0:00
X	R24	0:00	0	0:00
Y	R25	0:00	0	0:00
Z	R26	0:00	0	0:00
AA	R27	0:00	0	0:00

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SHADOW - Main Result

Calculation: Hardwood Lands Wind Project - Without Vegetation

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Shadow, worst case

No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
AB	R28	0:00	0	0:00
AC	R29	0:00	0	0:00
AD	R30	0:00	0	0:00
AE	R31	0:00	0	0:00
AF	R32	0:00	0	0:00
AG	R33	0:00	0	0:00
AH	R34	0:00	0	0:00
AI	R35	0:00	0	0:00
AJ	R36	0:00	0	0:00
AK	R37	0:00	0	0:00
AL	R38	0:00	0	0:00
AM	R39	0:00	0	0:00
AN	R40	0:00	0	0:00
AO	R41	0:00	0	0:00
AP	R42	0:00	0	0:00
AQ	R43	0:00	0	0:00
AR	R44	0:00	0	0:00
AS	R45	0:00	0	0:00
AT	R46	0:00	0	0:00
AU	R47	0:00	0	0:00
AV	R48	0:00	0	0:00
AW	R49	0:00	0	0:00
AX	R50	0:00	0	0:00
AY	R51	0:00	0	0:00
AZ	R52	0:00	0	0:00
BA	R53	0:00	0	0:00
BB	R54	0:00	0	0:00
BC	R55	0:00	0	0:00
BD	R56	0:00	0	0:00
BE	R57	0:00	0	0:00
BF	R58	0:00	0	0:00
BG	R59	0:00	0	0:00
BH	R60	0:00	0	0:00
BI	R61	0:00	0	0:00
BJ	R62	0:00	0	0:00
BK	R63	0:00	0	0:00
BL	R64	0:00	0	0:00
BM	R65	0:00	0	0:00
BN	R66	0:00	0	0:00
BO	R67	0:00	0	0:00
BP	R68	0:00	0	0:00
BQ	R69	0:00	0	0:00
BR	R70	0:00	0	0:00
BS	R71	0:00	0	0:00
BT	R72	0:00	0	0:00
BU	R73	0:00	0	0:00
BV	R74	0:00	0	0:00
BW	R75	0:00	0	0:00
BX	R76	0:00	0	0:00
BY	R77	0:00	0	0:00
BZ	R78	0:00	0	0:00
CA	R79	0:00	0	0:00
CB	R80	0:00	0	0:00
CC	R81	0:00	0	0:00
CD	R82	0:00	0	0:00
CE	R83	0:00	0	0:00
CF	R84	0:00	0	0:00
CG	R85	0:00	0	0:00

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SHADOW - Main Result

Calculation: Hardwood Lands Wind Project - Without Vegetation

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Shadow, worst case

No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
CH	R86	0:00	0	0:00
CI	R89	0:00	0	0:00
CJ	R90	0:00	0	0:00
CK	R91	0:00	0	0:00
CL	R92	0:00	0	0:00
CM	R93	0:00	0	0:00
CN	R94	0:00	0	0:00
CO	R95	0:00	0	0:00
CP	R96	0:00	0	0:00
CQ	R97	0:00	0	0:00
CR	R98	0:00	0	0:00
CS	R87	77:13	103	1:00
CT	R99	35:45	93	0:39
CU	S1	33:00	77	0:30
CV	S2	50:44	92	0:40
CW	S3	35:45	93	0:39
CX	S4	32:30	107	0:30
CY	S5	59:38	168	0:33
CZ	S6	35:48	64	0:49
DA	S7	77:12	103	1:00
DB	S8	35:42	81	0:31

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	Wind Turbine	44:09	
2	Wind Turbine	139:36	
3	Wind Turbine	137:08	

Project:
Hardwood Lands Sound & Shadow Modeling

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SHADOW - Main Result

Calculation: Hardwood Lands Wind Project - With Vegetation

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: Height Contours: Contours.wpo (1)
Area object(s) used in calculation:
Strum Field Observations: REGIONS_Hardwood Lands Wind Project_Nov2015_3.w2r (20)
Sipekne'katik Forestry: ZVI_REGIONS_Hardwood Lands Wind Project_Nov2015_0.w2r (26)
Obstacles used in calculation
Eye height: 1.5 m
Grid resolution: 5.0 m
Topographic shadow included in calculation

All coordinates are in
UTM (north)-NAD83(NSRS/CSRS) (US+CA), geocentric, GRS80 Zone: 20

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	458,350	4,993,141	85.0	Wind Turbine	Yes	VESTAS	V110-2.0-2,000	2,000	110.0	95.0	1,513	0.0
2	458,899	4,992,845	75.3	Wind Turbine	Yes	VESTAS	V110-2.0-2,000	2,000	110.0	95.0	1,513	0.0
3	458,897	4,993,684	85.0	Wind Turbine	Yes	VESTAS	V110-2.0-2,000	2,000	110.0	95.0	1,513	0.0

Shadow receptor-Input

No.	Name	Easting	Northing	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
A	R01	460,598	4,994,046	66.6	1.0	1.0	1.0	53.6	90.0	Fixed direction
B	R02	459,929	4,994,753	72.8	1.0	1.0	1.0	52.3	90.0	Fixed direction
C	R03	460,486	4,993,998	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
D	R04	460,428	4,994,137	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
E	R05	460,541	4,994,622	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
F	R06	460,145	4,994,860	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
G	R07	460,126	4,994,882	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
H	R08	460,805	4,994,218	60.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
I	R09	460,525	4,994,085	70.8	1.0	1.0	1.0	53.6	90.0	Fixed direction
J	R10	459,990	4,994,681	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
K	R11	460,479	4,994,480	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
L	R12	460,445	4,994,470	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
M	R13	459,879	4,995,022	84.3	1.0	1.0	1.0	30.7	90.0	Fixed direction
N	R14	460,516	4,994,281	74.1	1.0	1.0	1.0	53.6	90.0	Fixed direction
O	R15	460,598	4,994,279	68.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
P	R16	460,502	4,994,659	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
Q	R17	460,519	4,994,564	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
R	R18	456,478	4,992,857	69.3	1.0	1.0	1.0	-99.9	90.0	Fixed direction
S	R19	460,768	4,994,260	60.7	1.0	1.0	1.0	53.6	90.0	Fixed direction

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SHADOW - Main Result

Calculation: Hardwood Lands Wind Project - With Vegetation

...continued from previous page

No.	Name	Easting	Northing	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
T	R20	460,616	4,994,042	65.5	1.0	1.0	1.0	53.6	90.0	Fixed direction
U	R21	460,660	4,994,114	62.4	1.0	1.0	1.0	53.6	90.0	Fixed direction
V	R22	460,187	4,994,706	71.8	1.0	1.0	1.0	53.6	90.0	Fixed direction
W	R23	460,129	4,994,805	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
X	R24	460,494	4,994,266	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
Y	R25	460,569	4,994,238	71.5	1.0	1.0	1.0	53.6	90.0	Fixed direction
Z	R26	460,098	4,994,764	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AA	R27	459,237	4,995,608	84.1	1.0	1.0	1.0	14.0	90.0	Fixed direction
AB	R28	460,699	4,994,502	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AC	R29	460,484	4,994,076	72.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
AD	R30	460,446	4,994,715	63.5	1.0	1.0	1.0	53.6	90.0	Fixed direction
AE	R31	459,523	4,995,146	82.0	1.0	1.0	1.0	23.0	90.0	Fixed direction
AF	R32	460,466	4,993,985	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AG	R33	460,527	4,994,203	74.2	1.0	1.0	1.0	53.6	90.0	Fixed direction
AH	R34	460,498	4,994,182	74.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
AI	R35	460,408	4,994,509	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AJ	R36	460,301	4,994,612	66.6	1.0	1.0	1.0	53.6	90.0	Fixed direction
AK	R37	460,400	4,994,004	71.1	1.0	1.0	1.0	53.6	90.0	Fixed direction
AL	R38	460,311	4,994,760	70.9	1.0	1.0	1.0	53.6	90.0	Fixed direction
AM	R39	460,168	4,994,752	73.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
AN	R40	460,590	4,994,518	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AO	R41	460,553	4,994,110	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AP	R42	460,213	4,994,641	69.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
AQ	R43	460,398	4,994,184	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AR	R44	460,422	4,994,017	71.3	1.0	1.0	1.0	53.6	90.0	Fixed direction
AS	R45	460,421	4,994,578	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AT	R46	460,594	4,994,577	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AU	R47	459,936	4,994,986	79.2	1.0	1.0	1.0	44.7	90.0	Fixed direction
AV	R48	460,451	4,994,030	71.4	1.0	1.0	1.0	53.6	90.0	Fixed direction
AW	R49	460,147	4,994,722	73.5	1.0	1.0	1.0	53.6	90.0	Fixed direction
AX	R50	460,631	4,994,547	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
AY	R51	460,084	4,994,663	70.4	1.0	1.0	1.0	53.6	90.0	Fixed direction
AZ	R52	460,152	4,994,649	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BA	R53	460,266	4,994,798	72.9	1.0	1.0	1.0	53.6	90.0	Fixed direction
BB	R54	460,228	4,994,822	74.4	1.0	1.0	1.0	53.6	90.0	Fixed direction
BC	R55	460,725	4,994,424	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BD	R56	460,242	4,994,633	68.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
BE	R57	460,772	4,994,174	60.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BF	R58	460,328	4,994,591	65.9	1.0	1.0	1.0	53.6	90.0	Fixed direction
BG	R59	460,424	4,994,665	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BH	R60	460,578	4,994,148	69.8	1.0	1.0	1.0	53.6	90.0	Fixed direction
BI	R61	460,371	4,994,629	66.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BJ	R62	460,568	4,994,594	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BK	R63	460,093	4,994,733	74.5	1.0	1.0	1.0	53.6	90.0	Fixed direction
BL	R64	458,498	4,995,587	100.0	1.0	1.0	1.0	-10.2	90.0	Fixed direction
BM	R65	460,453	4,994,151	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BN	R66	460,544	4,994,312	70.6	1.0	1.0	1.0	53.6	90.0	Fixed direction
BO	R67	460,636	4,994,091	64.1	1.0	1.0	1.0	53.6	90.0	Fixed direction
BP	R68	460,052	4,994,670	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BQ	R69	456,466	4,992,841	68.6	1.0	1.0	1.0	-100.9	90.0	Fixed direction
BR	R70	460,698	4,994,449	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BS	R71	460,125	4,994,656	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BT	R72	456,739	4,992,260	70.0	1.0	1.0	1.0	-118.5	90.0	Fixed direction
BU	R73	460,420	4,993,956	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BV	R74	460,188	4,994,645	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
BW	R75	460,339	4,994,653	67.9	1.0	1.0	1.0	53.6	90.0	Fixed direction
BX	R76	460,297	4,994,849	71.6	1.0	1.0	1.0	53.6	90.0	Fixed direction
BY	R77	460,268	4,994,623	67.7	1.0	1.0	1.0	53.6	90.0	Fixed direction
BZ	R78	460,568	4,994,044	68.5	1.0	1.0	1.0	53.6	90.0	Fixed direction

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SHADOW - Main Result

Calculation: Hardwood Lands Wind Project - With Vegetation

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No.	Name	Easting	Northing	Z [m]	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
CA	R79	460,620	4,994,489	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CB	R80	458,478	4,995,611	100.0	1.0	1.0	1.0	-16.5	90.0	Fixed direction
CC	R81	460,359	4,994,718	68.8	1.0	1.0	1.0	53.6	90.0	Fixed direction
CD	R82	460,468	4,994,613	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CE	R83	460,472	4,994,520	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CF	R84	460,444	4,994,549	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CG	R85	460,361	4,994,564	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CH	R86	460,386	4,994,543	65.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CI	R89	460,384	4,993,983	70.6	1.0	1.0	1.0	53.6	90.0	Fixed direction
CJ	R90	460,453	4,993,975	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CK	R91	460,515	4,994,028	70.4	1.0	1.0	1.0	53.6	90.0	Fixed direction
CL	R92	460,469	4,994,166	75.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CM	R93	460,288	4,994,696	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CN	R94	460,230	4,994,692	70.0	1.0	1.0	1.0	53.6	90.0	Fixed direction
CO	R95	460,178	4,994,782	74.1	1.0	1.0	1.0	53.6	90.0	Fixed direction
CP	R96	460,003	4,994,749	73.3	1.0	1.0	1.0	53.6	90.0	Fixed direction
CQ	R97	459,346	4,995,619	86.4	1.0	1.0	1.0	20.8	90.0	Fixed direction
CR	R98	460,391	4,994,626	65.1	1.0	1.0	1.0	53.6	90.0	Fixed direction
CS	R87	459,471	4,992,644	64.5	1.0	1.0	1.0	-245.3	90.0	Fixed direction
CT	R99	459,499	4,993,906	65.9	1.0	1.0	1.0	61.7	90.0	Fixed direction
CU	S1	459,607	4,994,258	73.6	1.0	1.0	1.0	61.7	90.0	Fixed direction
CV	S2	459,415	4,994,130	70.0	1.0	1.0	1.0	61.7	90.0	Fixed direction
CW	S3	459,499	4,993,906	65.9	1.0	1.0	1.0	61.7	90.0	Fixed direction
CX	S4	459,766	4,993,621	70.0	1.0	1.0	1.0	74.5	90.0	Fixed direction
CY	S5	459,667	4,993,470	0.0	1.0	1.0	1.0	79.4	90.0	Fixed direction
CZ	S6	459,605	4,992,688	62.6	1.0	1.0	1.0	-245.3	90.0	Fixed direction
DA	S7	459,471	4,992,644	64.5	1.0	1.0	1.0	-245.3	90.0	Fixed direction
DB	S8	459,716	4,992,475	62.5	1.0	1.0	1.0	-245.3	90.0	Fixed direction

Calculation Results

Shadow receptor

		Shadow, worst case		
No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
A	R01	0:00	0	0:00
B	R02	0:00	0	0:00
C	R03	0:00	0	0:00
D	R04	0:00	0	0:00
E	R05	0:00	0	0:00
F	R06	0:00	0	0:00
G	R07	0:00	0	0:00
H	R08	0:00	0	0:00
I	R09	0:00	0	0:00
J	R10	0:00	0	0:00
K	R11	0:00	0	0:00
L	R12	0:00	0	0:00
M	R13	0:00	0	0:00
N	R14	0:00	0	0:00
O	R15	0:00	0	0:00
P	R16	0:00	0	0:00
Q	R17	0:00	0	0:00
R	R18	0:00	0	0:00
S	R19	0:00	0	0:00
T	R20	0:00	0	0:00
U	R21	0:00	0	0:00
V	R22	0:00	0	0:00
W	R23	0:00	0	0:00

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SHADOW - Main Result

Calculation: Hardwood Lands Wind Project - With Vegetation

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Shadow, worst case

No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
X	R24	0:00	0	0:00
Y	R25	0:00	0	0:00
Z	R26	0:00	0	0:00
AA	R27	0:00	0	0:00
AB	R28	0:00	0	0:00
AC	R29	0:00	0	0:00
AD	R30	0:00	0	0:00
AE	R31	0:00	0	0:00
AF	R32	0:00	0	0:00
AG	R33	0:00	0	0:00
AH	R34	0:00	0	0:00
AI	R35	0:00	0	0:00
AJ	R36	0:00	0	0:00
AK	R37	0:00	0	0:00
AL	R38	0:00	0	0:00
AM	R39	0:00	0	0:00
AN	R40	0:00	0	0:00
AO	R41	0:00	0	0:00
AP	R42	0:00	0	0:00
AQ	R43	0:00	0	0:00
AR	R44	0:00	0	0:00
AS	R45	0:00	0	0:00
AT	R46	0:00	0	0:00
AU	R47	0:00	0	0:00
AV	R48	0:00	0	0:00
AW	R49	0:00	0	0:00
AX	R50	0:00	0	0:00
AY	R51	0:00	0	0:00
AZ	R52	0:00	0	0:00
BA	R53	0:00	0	0:00
BB	R54	0:00	0	0:00
BC	R55	0:00	0	0:00
BD	R56	0:00	0	0:00
BE	R57	0:00	0	0:00
BF	R58	0:00	0	0:00
BG	R59	0:00	0	0:00
BH	R60	0:00	0	0:00
BI	R61	0:00	0	0:00
BJ	R62	0:00	0	0:00
BK	R63	0:00	0	0:00
BL	R64	0:00	0	0:00
BM	R65	0:00	0	0:00
BN	R66	0:00	0	0:00
BO	R67	0:00	0	0:00
BP	R68	0:00	0	0:00
BQ	R69	0:00	0	0:00
BR	R70	0:00	0	0:00
BS	R71	0:00	0	0:00
BT	R72	0:00	0	0:00
BU	R73	0:00	0	0:00
BV	R74	0:00	0	0:00
BW	R75	0:00	0	0:00
BX	R76	0:00	0	0:00
BY	R77	0:00	0	0:00
BZ	R78	0:00	0	0:00
CA	R79	0:00	0	0:00
CB	R80	0:00	0	0:00
CC	R81	0:00	0	0:00

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SHADOW - Main Result

Calculation: Hardwood Lands Wind Project - With Vegetation

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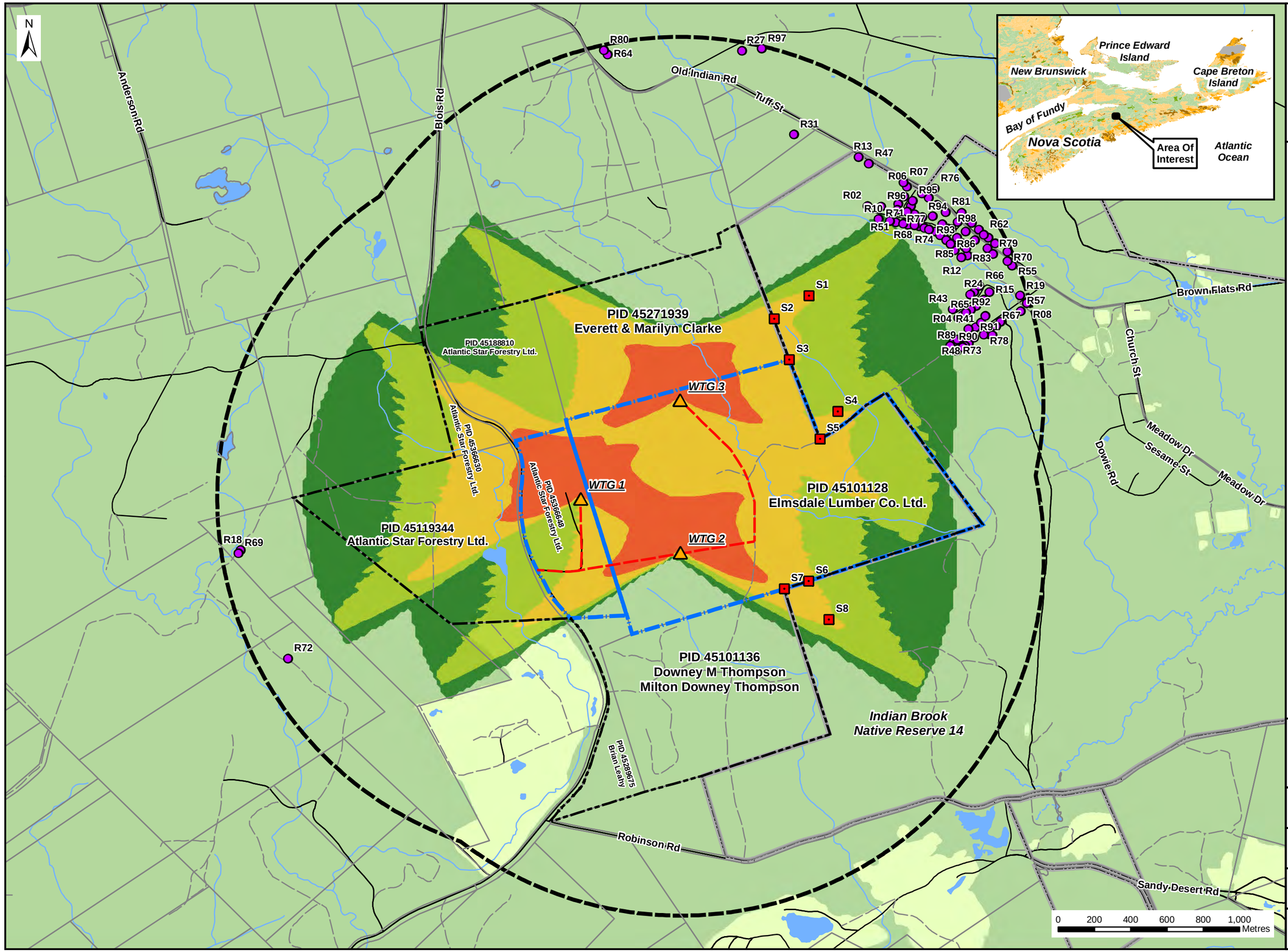
Shadow, worst case

No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
CD	R82	0:00	0	0:00
CE	R83	0:00	0	0:00
CF	R84	0:00	0	0:00
CG	R85	0:00	0	0:00
CH	R86	0:00	0	0:00
CI	R89	0:00	0	0:00
CJ	R90	0:00	0	0:00
CK	R91	0:00	0	0:00
CL	R92	0:00	0	0:00
CM	R93	0:00	0	0:00
CN	R94	0:00	0	0:00
CO	R95	0:00	0	0:00
CP	R96	0:00	0	0:00
CQ	R97	0:00	0	0:00
CR	R98	0:00	0	0:00
CS	R87	0:00	0	0:00
CT	R99	0:00	0	0:00
CU	S1	0:00	0	0:00
CV	S2	0:00	0	0:00
CW	S3	0:00	0	0:00
CX	S4	0:00	0	0:00
CY	S5	0:00	0	0:00
CZ	S6	0:00	0	0:00
DA	S7	0:00	0	0:00
DB	S8	0:00	0	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	Wind Turbine	0:00	
2	Wind Turbine	0:00	
3	Wind Turbine	0:00	



Notes:

1. Reference: Digital Topographic Mapping & Property Management Unit MU0904 by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. Shadow Calculation Model was done Using Wind Turbine Data Supplied by Client.

Legend:

- Existing Receptors
- Arbitrary Receptors
- Proposed Turbine
- Proposed Access Road
- Study Area
- Project Site
- 2km Buffer
- Property Boundary
- Native Reserve
- Public Roads
- Access Roads / Trails
- Mapped Stream
- Mapped Indefinite Stream
- Water Bodies
- Cleared Area

Shadow Flicket Modeling Results
Predicted Shadow (Hrs/Yr)

- 0-10
- 10-30
- 30-100
- 100 +

Hardwood Lands Community Wind Project - Shadow Flicker Modeling Results Without Vegetation

Strum CONSULTING

Date: August 2015	Project #: 14-5169
Scale: 1:20,000	Drawing #: 1
Drawn By: H. Serhan	
Checked By: A. Walter	

N

Blois Rd

Old Indian Rd

Tuff St

Indian Rd

R80 R64 R27 R97 R31 R13 R47 R06 R07 R76 R95 R02 R96 R81 R10 R71 R77 R94 R98 R51 R68 R74 R93 R62 R86 R79 R85 R83 R70 R12 R66 R55 R24 R15 R19 R43 R65 R92 R57 R04 R41 R67 R08 R89 R90 R91 R78 R48 R73

See Detail A

S1 S2 S3 S4 S5 S6 S7 S8

17.5m

11.0m

WTG 1

WTG 2

WTG 3

PID 45271939
Everett & Marilyn Clarke

PID 45188810
Atlantic Star Forestry Ltd.

PID 45366630
Atlantic Star Forestry Ltd.

PID 45366648
Atlantic Star Forestry Ltd.

PID 45119344
Atlantic Star Forestry Ltd.

PID 45101128
Elmsdale Lumber Co. Ltd.

PID 45101136
Downey M Thompson
Milton Downey Thompson

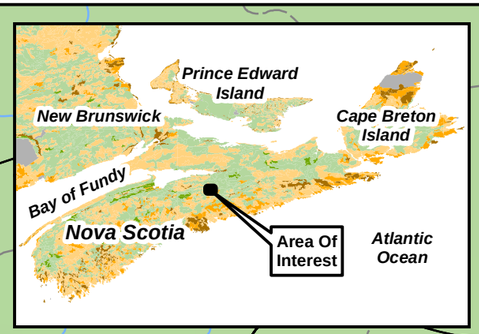
PID 45289675
Brian Leahy

Indian Brook
Native Reserve 14

R18 R69 R72

Robinson Rd

Sandy Desert Rd



0 200 400 600 800 1,000 Metres

Notes:

1. Reference: Digital Topographic Mapping & Property Management Unit MU0904 by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. Shadow Calculation Model was done Using Wind Turbine Data Supplied by Client.

Legend:

- Existing Receptors
- Arbitrary Receptors
- Proposed Turbine
- Proposed Access Road
- Study Area
- Project Site
- 2km Buffer
- Property Boundary
- Native Reserve
- Public Roads
- Access Roads / Trails
- Mapped Stream
- Mapped Indefinite Stream
- Water Bodies
- Cleared Area

Shadow Flicket Modeling Results
Predicted Shadow (Hrs/Yr)

- 0-10
- 10-30
- 30-100
- 100 +

Hardwood Lands Community Wind Project - Shadow Flicker Modeling Results With Vegetation

Strum CONSULTING

Date: August 2015	Project #: 14-5169
Scale: 1:20,000	Drawing #: 2
Drawn By: H. Serhan	
Checked By: A. Walter	

APPENDIX E
ARCHAEOLOGICAL SHOVEL TESTING REPORT

HARDWOOD LANDS COMMUNITY WIND PROJECT
ARCHAEOLOGICAL SHOVEL TESTING
EAST HANTS, NOVA SCOTIA

ARCHAEOLOGICAL SHOVEL TESTING REPORT

Submitted to:

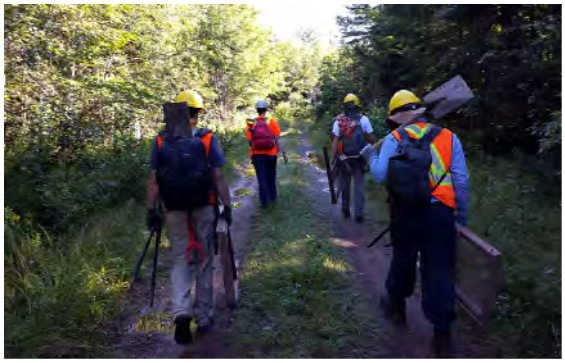
Scotian WindFields
and the
Special Places Program

Submitted by:

Boreas Heritage Consulting Inc.
and
Strum Consulting

October 2015

HERITAGE RESEARCH PERMIT: A2015NS081



Strum CONSULTING

BOREAS Heritage Consulting Inc.

PROJECT PERSONNEL

PRINCIPAL INVESTIGATOR:	Stephen G. Garcin, M.A.
PROJECT MANAGEMENT:	Sara J. Beanlands, M.A. Stephen G. Garcin, M.A.
FIELD STUDY:	Stephen G. Garcin, M.A. Andrea Richardson, M.A. Mikael Basque Riley Clark David Jones
REPORT PREPARATION:	Stephen G. Garcin, M.A. Sara J. Beanlands, M.A.
GIS/DRAFTING:	Stephen G. Garcin, M.A.

EXECUTIVE SUMMARY

Scotian WindFields Inc. is proposing to develop a three-turbine wind energy project located approximately 5 kilometres north of the community of Hardwood Lands in the District of the Municipality of East Hants. In order to evaluate the potential for encountering archeological resources on the property, Strum Consulting retained Boreas Heritage Consulting Inc. (BHCI), on behalf of Scotian WindFields Inc., in the Spring of 2015, to undertake archaeological screening and reconnaissance of the study area, conducted according to the terms of Heritage Research Permit A2015NS044. The 2015 archaeological screening and reconnaissance consisted of a background study and visual assessment of the property. BHCI determined that all three proposed turbine locations exhibited high potential for encountering Precontact and/or early historic Native archaeological resources. In addition, two small areas measuring 10 metres by 5 metres situated on either side of a stream bed located within the proposed access road alignment to Turbine Site 3 were also considered to exhibit high potential. It was therefore recommended that a 15 metre by 15 metre area within the centre of proposed footprints of Turbine Sites 1 and 3 be subjected to a strategic programme of shovel testing in order to identify any significant deposits or features associated with the Precontact or early historic occupation of the study area. It was further recommended that a 10 metre by 5 metre area on both sides of the stream bed located within the proposed access road to Turbine Site 3 be subjected to a strategic programme of shovel testing.

In May 2015, Strum Consulting retained BHCI, on behalf of Scotian WindFields Inc., to undertake the recommended shovel testing, conducted according to the terms of Heritage Research Permit A2015NS081. The 2015 shovel testing of the Hardwood Lands study area consisted of a total of 44 shovel tests excavated within three separate areas of the greater study area. No archaeological resources were encountered and no evidence of historically significant cultural modification was identified. Based on the results of the shovel testing programme, the potential for encountering significant, intact archaeological resources within the study area is considered to be low. As a result, it is recommended that these areas be cleared of any requirement for further archaeological investigation and that development may proceed as planned.

It is important to note that BHCI previously recommended (Heritage Research Permit A2015NS044) that any mechanical excavation and/or construction activity within the proposed Turbine Site 2 footprint that may have an impact on potential archaeological resources be monitored by an archaeologist to identify any significant deposits or features associated with the Precontact or early historic occupation of the study area. In addition, it was recommended that the area in the vicinity of a reported burial ground must be avoided to prevent accidental impact during construction activities related to the development of the wind project.

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LIST OF FIGURES

LIST OF PLATES

1.0 INTRODUCTION

Scotian WindFields Inc. is proposing to develop a three-turbine wind energy project located approximately 5 kilometres north of the community of Hardwood Lands in the District of the Municipality of East Hants. An initial archaeological assessment was conducted by Boreas Heritage Consulting Inc. (BHCI) in July 2014 under Heritage Research Permit A2014NS055. Scotian WindFields Inc. subsequently moved the proposed development to a new location from its previous configuration, which was situated approximately 2 kilometres to the southeast. Archaeological assessment of the revised study area was conducted in December 2014 under Heritage Research Permit A2014NS117. In the spring of 2015, the proposed development location shifted again and Strum Consulting retained BHCI, on behalf of Scotian WindFields Inc., to conduct archaeological screening and reconnaissance of the revised study area, situated approximately 1.5 kilometres to the north. The archaeological assessment was directed by BHCI Principal and Senior Archaeologist Sara Beanlands and conducted according to the terms of Heritage Research Permit A2015NS044.

The 2015 archaeological screening and reconnaissance consisted of a background study and visual assessment of the property. BHCI determined that all three proposed turbine locations exhibited high potential for encountering Precontact and/or early historic Native archaeological resources. In addition, two small areas measuring 10 metres by 5 metres situated on either side of a stream bed located within the proposed access road alignment to Turbine Site 3 were also considered to exhibit high potential for encountering Precontact and/or early historic Native archaeological resources. Based on the nature of the terrain, the distance to a significant water source, and the lack of evidence indicating significant cultural modification, the remainder of the Hardwood Lands Community Wind Project study area was considered to exhibit low potential for encountering significant archaeological resources.

It was therefore recommended that a 15 metre by 15 metre area within the centre of proposed footprints of Turbine Sites 1 and 3 be subjected to a strategic programme of shovel testing in order to identify any significant deposits or features associated with the Precontact or early historic occupation of the study area. It was further recommended that a 10 metre by 5 metre area on both sides of the stream bed located within the proposed access road to Turbine Site 3 be subjected to a strategic programme of shovel testing.

It was also recommended that any mechanical excavation and/or construction activity within the proposed Turbine Site 2 footprint that may have an impact on potential archaeological resources be monitored by an archaeologist to identify any significant deposits or features associated with

the Precontact or early historic occupation of the study area. In addition, it was recommended that the area in the vicinity of a reported burial ground must be avoided to prevent accidental impact during construction activities related to the development of the wind project.

In May 2015, Strum Consulting retained BHCI, on behalf of Scotian WindFields Inc., to undertake the recommended shovel testing (***Plate 1***). The archaeological assessment was directed by Senior Archaeologist Stephen Garcin and conducted according to the terms of Heritage Research Permit A2015NS081, issued by the Nova Scotia Department of Communities, Culture and Heritage - Special Places Program (SPP). Technical support was provided by Andrea Richardson, with the assistance of Mikael Basque, Riley Clark and David Jones. The archaeological assessment was carried out on August 27 and 28, 2015.

This report describes the programme of archaeological shovel testing, presents the results of this investigation and offers cultural resource management recommendations.

2.0 STUDY AREA

The Hardwood Lands study area, comprising a total area of approximately 6.75 hectares, is located in the District of the Municipality of East Hants, approximately 5 kilometres north of the community of Hardwood Lands. Situated within portions of two properties identified as PID 45366648 and PID 45101128, the study area includes three wind turbine footprints, each measuring approximately 100 metres by 100 metres, as well as an adjacent access road, measuring approximately 2.5 kilometres, of which 1.8 kilometres will be new construction (***Figures 1 & 2***). Located approximately 1 kilometre west of the Indian Brook Reserve (IR 14), one of the largest Mi'kmaw communities in the province, the study area can be accessed from Blois Road, situated approximately 6 kilometres northeast of Nine Mile River.

Two 15 metre by 15 metre areas within the centre of proposed footprints of Turbine Sites 1 and 3 and a 10 metre by 5 metre area on both sides of the stream bed located within the proposed access road to Turbine Site 3 are considered to exhibit high potential for encountering Precontact and/or early historic Native archaeological resources (***Figure 2***).

PLATE 1: Shovel testing programme at Hardwood Lands.

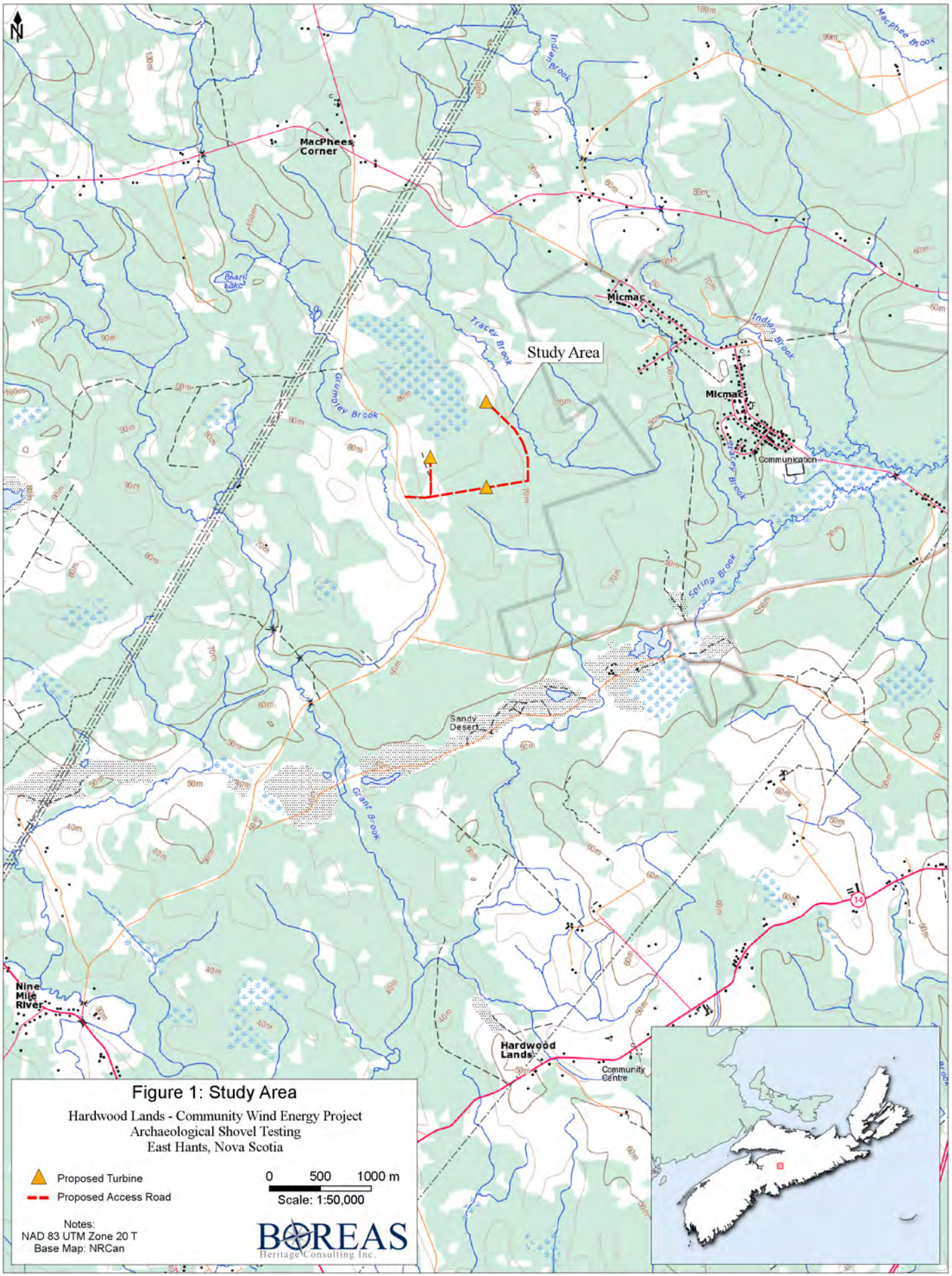
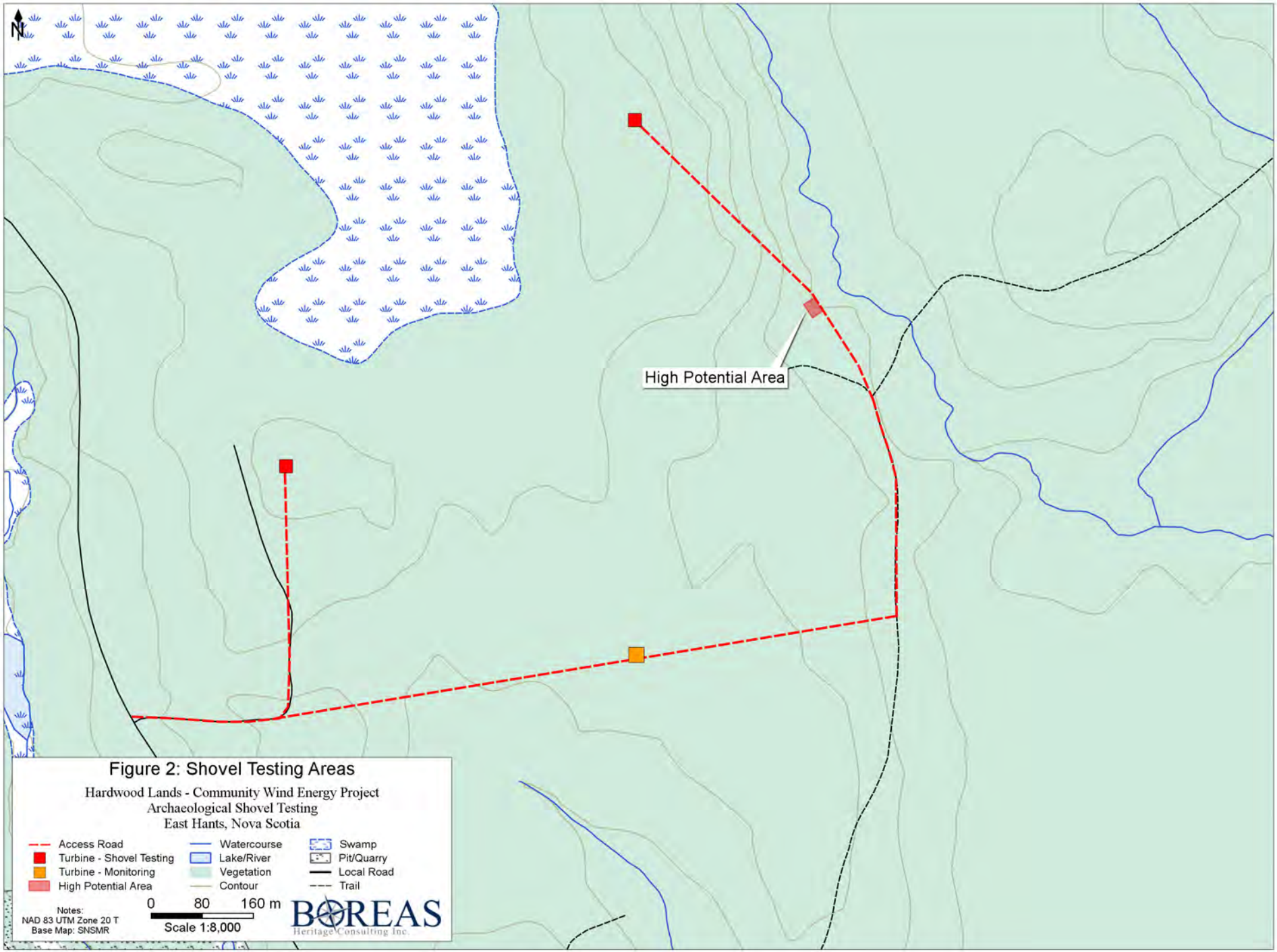


Figure 1: Study Area

Hardwood Lands - Community Wind Energy Project
Archaeological Shovel Testing
East Hants, Nova Scotia


High Potential Area
Figure 2: Shovel Testing Areas
Hardwood Lands - Community Wind Energy Project
Archaeological Shovel Testing
East Hants, Nova Scotia
Access Road
Turbine - Shovel Testing
Turbine - Monitoring
High Potential Area
Watercourse
Lake/River
Vegetation
Contour
Swamp
Pit/Quarry
Local Road
Trail
Notes:
NAD 83 UTM Zone 20 T
Base Map: SNSMR
0 80 160 m
Scale 1:8,000
BOREAS
Heritage Consulting Inc.

3.0 METHODOLOGY

The objectives of the archaeological assessment are to conduct a systematic subsurface survey (shovel testing) within the previously identified areas of high archaeological potential in order to search for and evaluate buried archaeological resources, and to provide the most comprehensive information possible so that appropriate management strategies can be devised in light of the proposed development and before project implementation.

Subsurface Survey

The objective of the subsurface survey is to determine whether or not buried archaeological resources are present within the areas of high archaeological potential identified during the archaeological screening and reconnaissance. A baseline is established across each testing area to standardize and document the location of shovel tests and to facilitate detailed recording of any resources encountered.

Shovel test pits, averaging 40 centimetres by 40 centimetres, are dug through the topsoil into subsoil at 5 metre intervals. Due to the nature of the terrain, it was not necessary or possible to test all areas on a formal 5 metre grid. All soil removed from the test pits is screened through 6 millimetre wire mesh to facilitate the recovery of artifacts within the excavated soil.

Details of the testing programme are documented in field notes, site plans, stratigraphic drawings and photographs. A hand-held Global Positioning System (GPS) unit is used to record UTM coordinates within the study area. All coordinates are UTM projection with NAD 83 as datum. Any archaeological resources encountered during the course of the shovel testing programme will be evaluated and sufficiently documented for registration within the Maritime Archaeological Resource Inventory, a provincial archaeological site database maintained by the Nova Scotia Museum. All artifacts recovered are processed and catalogued in accordance with standards set by the SPP.

As per Heritage Research Permit requirements, the Kwilmu’kw Maw-klusuaqn Negotiation Office (KMKNO) was contacted and advised of the proposed archaeological investigation.

4.0 RESULTS

Shovel Testing

Archaeological shovel testing of the study area was conducted on August 27 & 28, 2015, under overcast, warm conditions. The study area consisted of three distinct high potential areas, each of which will be discussed separately below.

Area 1

Turbine Site 1, located in the eastern portion of PID 45366648 (***Figure 2***), is situated approximately 85 metres above sea level. The area is characterised by undulating to gently sloping terrain, which has been subjected to previous clearing and tree-harvesting activity, as indicated by the young, regenerated forest growth, primarily consisting of spruce, fir and birch. A number of areas indicating modern land use and disturbance were also observed during the course of the initial assessment, including ruts and berms caused by heavy machinery, likely associated with past tree-harvesting activity. Nevertheless, given the long-standing and intensive traditional use of the greater area, Turbine Site 1 was considered to exhibit high potential for encountering Precontact and/or historic Native archaeological resources. As a result, it was recommended that a 15 metre by 15 metre area within the centre of the proposed Turbine Site 1 footprint be subjected to a strategic programme of shovel testing in order to identify any significant deposits or features associated with the Precontact or early historic occupation of the study area.

A total of 16 shovel tests were manually excavated across Area 1 (***Figure 3; Plate 2***). The general soil profile observed within Area 1 consisted of approximately 3 centimetres of leaf litter and forest duff overlying approximately 3 - 5 centimetres of dark brown organic silty clay, which overlay approximately 5 - 20 centimetres of light gray silty clay, interpreted as the “Ae” horizon, which, in turn, overlay reddish-brown sterile subsoil (***Plate 3***). Excavation of this layer typically continued to a depth of approximately 20 centimetres in order to confirm the sterile nature of the soil and to ensure that there were no underlying deposits. None of the test pits in Area 1 yielded archaeological material.

Area 2

Turbine Site 3, located in the northern portion of PID 45101128 (***Figure 2***), is characterised by generally level and undulating terrain, the majority of which has been previously subjected to clearing. The vegetation is dominated by fern growth. Given the long-standing and intensive traditional use of the greater area, Turbine Site 3 was considered to exhibit high potential for

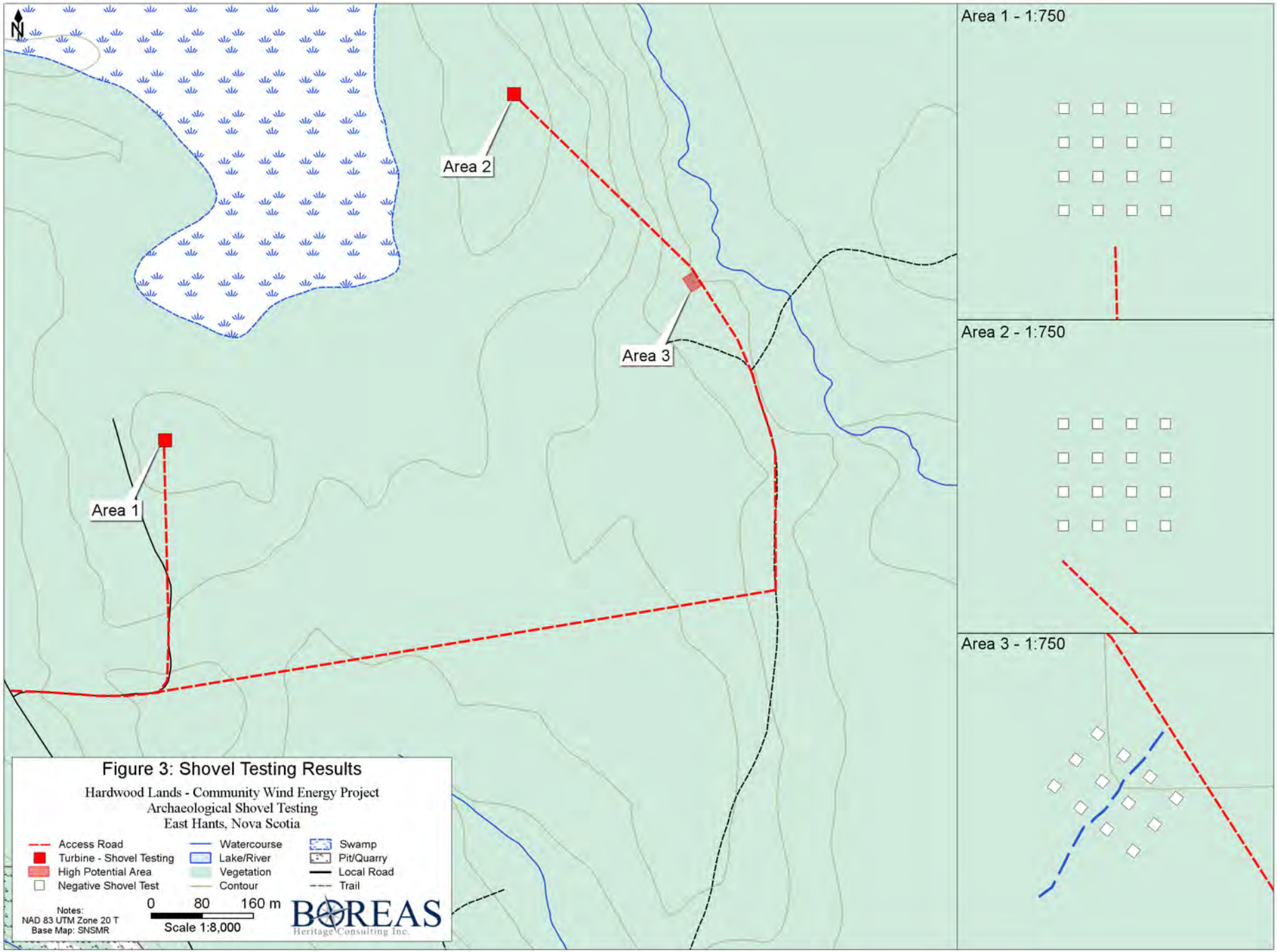

Area 1
Area 2
Area 3
Area 1 - 1:750
Area 2 - 1:750
Area 3 - 1:750
Figure 3: Shovel Testing Results
Hardwood Lands - Community Wind Energy Project
Archaeological Shovel Testing
East Hants, Nova Scotia
Access Road
Turbine - Shovel Testing
High Potential Area
Negative Shovel Test
Watercourse
Lake/River
Vegetation
Contour
Swamp
Pit/Quarry
Local Road
Trail
Notes:
NAD 83 UTM Zone 20 T
Base Map: SNSMR
0 80 160 m
Scale 1:8,000
BOREAS
Heritage Consulting Inc.

PLATE 2: **Shovel testing Area 1; facing northeast.**

PLATE 3: **Typical soil profile within Area 1; facing north.**

encountering Precontact and/or historic Native archaeological resources. As a result, it was recommended that a 15 metre by 15 metre area within the centre of the proposed Turbine Site 3 footprint be subjected to a strategic programme of shovel testing in order to identify any significant deposits or features associated with the Precontact or early historic occupation of the study area (***Figure 3***).

A total of 16 shovel tests were manually excavated across Area 2 (***Figure 3***; ***Plates 4 & 5***). The general soil profile observed within Area 2 consisted of approximately 7 centimetres of leaf litter and forest duff overlying approximately 7 - 9 centimetres of dark brown organic silty clay, which overlay approximately 9 - 35 centimetres of gray silty clay, which, in turn, overlay reddish-brown sterile subsoil. Excavation of this layer typically continued to a depth of approximately 20 centimetres in order to confirm the sterile nature of the soil and to ensure that there were no underlying deposits. None of the test pits in Area 2 yielded archaeological material.

Area 3

Within the area of proposed new access road to Turbine 3, a small dry stream bed was encountered approximately 400 metres southeast of the proposed turbine location, with generally level terrain observed on either side (***Plate 6***). Although this small unnamed feature likely had minimal influence on the suitability of the area for settlement, it may have provided a water source for those engaged in hunting, plant collection and/or ceremonial activities. As a result the proposed access road footprint in this immediate area was considered to exhibit high potential for encountering Precontact and/or historic Native archaeological resources. It was recommended that a 10 metre by 5 metre area on both sides of the stream bed be subjected to a strategic programme of shovel testing in order to identify any significant deposits or features associated with the Precontact or early historic occupation of the study area. Visual assessment of the area around the stream bed also revealed a midden of metal containers, tin cans and glass bottles on the ground surface, as well as other twentieth-century debris (***Plate 7***). While this midden is not considered to be archaeologically significant, it does indicate a historic utilization of the area, likely associated with twentieth-century logging activities and/or camp site.

A total of 12 shovel tests were manually excavated on either side of the stream bed within Area 3 (***Figure 3***; ***Plate 8***). The general soil profile observed within Area 3 consisted of approximately 2 centimetres of moss and leaf litter overlying approximately 2 - 3 centimetres of dark brown silty clay, which overlay approximately 3 - 49 centimetres of brown silty clay with small pebble inclusions, which, in turn, overlay reddish-brown sterile subsoil (***Plate 9***). Excavation of this layer typically continued to a depth of approximately 10 - 15 centimetres in order to confirm the sterile nature of the soil and to ensure that there were no underlying deposits. None of the test pits in Area 3 yielded archaeological material, although some twentieth-century debris was recovered.

PLATE 4: **Shovel testing Area 2; facing west.**

PLATE 5: **Shovel testing Area 2; facing west.**

PLATE 6: Stream bed within Area 3; facing west.

PLATE 7: Surface midden within Area 3; facing west.

PLATE 8: **Shovel testing Area 3; facing west.**

PLATE 9: **Typical soil profile within Area 3; facing north.**

Archaeological Potential

In total, 44 shovel tests were excavated within the greater study area (***Figure 3***). No archaeological resources were encountered and no evidence of historically significant cultural modification was identified during the course of the shovel testing programme. Based on the results of the shovel testing, the potential for encountering significant, intact archaeological resources within the study area is considered to be low.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The 2015 archaeological shovel testing of the Hardwood Lands study area consisted of a total of 44 shovel tests excavated within three separate areas of the greater study area. No archaeological resources were encountered and no evidence of historically significant cultural modification was identified during the course of the shovel testing programme. Based on the results of the 2015 shovel testing programme, the potential for encountering significant, intact archaeological resources within the study area is considered to be low.

Based on the above results, Boreas Heritage Consulting Inc. offers the following management recommendations:

1. It is recommended that Areas 1, 2 and 3, as described in this report, be cleared of any requirement for further archaeological investigation and that development within these areas may proceed as planned.

2. In the event that archaeological resources are encountered during development activities, immediate contact should be made with the Co-ordinator of Special Places Program, Sean Weseloh McKeane.

APPENDIX F
WATER FEATURE CLASSIFICATION

NOVA SCOTIA
Environment

30 Damascus Road, Suite 115
Bedford, N.S.B4A 0C1

Phone: (902) 424-7773
Fax: (902) 424-0597

Process RSN Number: 9161190

INSPECTION REPORT

ISSUED TO:	Mitchell Underhay, Scotian Windfields Inc.
INSPECTION DATE:	September 02, 2015
MAILING ADDRESS:	108F Trider Crescent, Dartmouth, Nova Scotia B3B 1R6
SITE NAME:	PID #s 45366648 & 45101128, Blois Road, Hants County, NS - Watercourse IDs
SITE ADDRESS:	BLOIS RD. MACPHEES CORNER NS

OVERVIEW OF INSPECTION

Nova Scotia Environment (NSE) Inspectors Grant and Robertson were on site September 2, 2015 at the proposed Hardwood Lands Community Wind Energy Project site (PID #s 45366648 and 45101128) off Blois Road in Hants County, NS to complete watercourse identification evaluations for four water conveyances (NSE File #95100-01-3116672). The watercourse identification was requested by Mitchell Underhay from Scotian Windfields Inc.

OBSERVATIONS:

Water Conveyance #1 (UTM coordinates: 458578 E and 4992780 N (Zone 20T))

The water conveyance originates from, and runs, under tree roots and vegetation mat on PID # 45101128. The channel was flagged by others and is in a forested area; no headwaters were observed and there was no flowing water at the time of the inspection. The portion of the channel inspected does not have a well defined bed or bank, and has a mud bottom.

Water Conveyance #2 (UTM coordinates: 458713 E and 4992760 N (Zone 20T))

This water conveyance appeared to originate from an upland, clear cut area adjacent to or within a defined wetland area on PID # 45101128. The water conveyance is heavily obscured by tree/wood debris and regrown machinery tracks. No headwaters were observed and there was no flowing water at the time of the inspection. Some standing water was present and an amphibian species (i.e., a frog) was observed in an area of standing water. The visible portion of the conveyance that was inspected does not have a well defined bed, bank or stream system.

Water Conveyance #3 (UTM coordinates: 459310 E and 4993039 N (Zone 20T))

The conveyance has a well defined bed and bank, but is obscured by heavy underbrush and vegetation. The channel runs through an existing road cross culvert on PID # 45101128. No headwaters were observed during the inspection. There was minimal to no water flowing in the channel at the time of the inspection and the channel appeared to be seasonally influenced. The portion of the channel observed was predominately linear with minor slope from east to west under the road. From available mapping it

appears that this water conveyance may be a tributary to Tracey Brook farther west.

Water Conveyance #4 (UTM coordinates: 459177 E and 4993400 N (Zone 20T))

The water conveyance (flagged by others) has a well defined cobble bed and vegetated bank, and is in a wooded area on PID # 45101128. No headwaters were observed and based on available mapping may be another tributary to Tracey Brook. There was no water flowing at the time of the inspection and the channel appeared to be seasonally influenced. The portion of the channel observed was not linear, runs east to west, and was moderately sloped.

WATERCOURSE IDENTIFICATION:

Based on review of 1:10,000 electronic mapping, internal databases, property mapping, available aerial photography and the September 2, 2015 site visit, Nova Scotia Environment is of the position that Water Conveyances #1 and #2 are drainage channels and do not meet Nova Scotia Environment's definition of a watercourse. However, NSE is of the position that Water Conveyances #3 and #4 meet NSE's definition of a watercourse and are identified thusly.

Inspector Signature: H. Grant.

Date: Sept. 11, 2015

This inspection report was prepared by Heather M Grant, Inspector Specialist III with Nova Scotia Environment who may be contacted at:

Nova Scotia Environment
30 Damascus Road, Suite 115
Bedford, N.S. B4A 0C1
Phone:(902) 424-7773
Fax: (902) 424-0597
http://www.gov.ns.ca/nse

N

PID 45271939
Everett & Marilyn Clarke

PID 45188810
Atlantic Star Forestry Ltd.

PID 45366648
Atlantic Star Forestry Ltd.

WTG 3

Watercourse 4

WTG 1

PID 45101128
Elmsdale Lumber Co. Ltd.

Watercourse 3

WTG 2

Former
Watercourse 1

Former
Watercourse 2

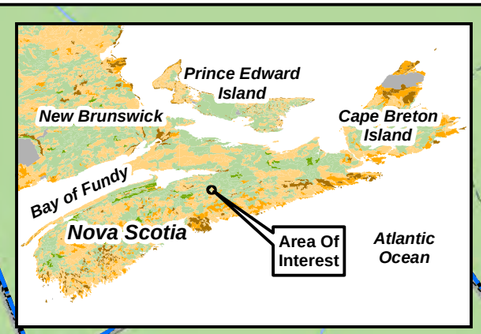
Blois Rd

PID 45119344
Atlantic Star Forestry Ltd.

PID 45289675
Brian Leahy

PID 45101136
Downey M Thompson
Milton Downey Thompson

Shubenacadie
Native Reserve 14
(Indian Brook)



0 100 200 300 400 500 Metres

Notes:

1. Reference: Digital Topographic Mapping & Property Management Unit MU0904 by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. GPS Data Collected is Typically to +/-5m Accuracy.

Legend:

- Proposed Turbine
- Proposed Access Road

Field Identified Watercourses (Type)

- Drainage Channel
- Watercourse

Field Identified Wetland Bounaries (Type)

- Confirmed WL Bdy
- Approximate WL Bdy
- Wetland Habitat
- Wetland: Clear Cut
- Wetland: Treed Swamp
- Project Site Boundary
- Property Boundary
- Study Area
- 100m Turbine Buffer
- Native Reserve
- Public Roads
- Access Roads / Trails
- Mapped Stream
- Mapped Indefinite Stream
- Water Bodies
- Cleared Area

Hardwood Lands Community Wind Project - Survey Results

Strum CONSULTING

Date: November 2015	Project #: 14-5169
Scale: 1:6,500	Drawing #: 1
Drawn By: H. Serhan	
Checked By: A. Walter	