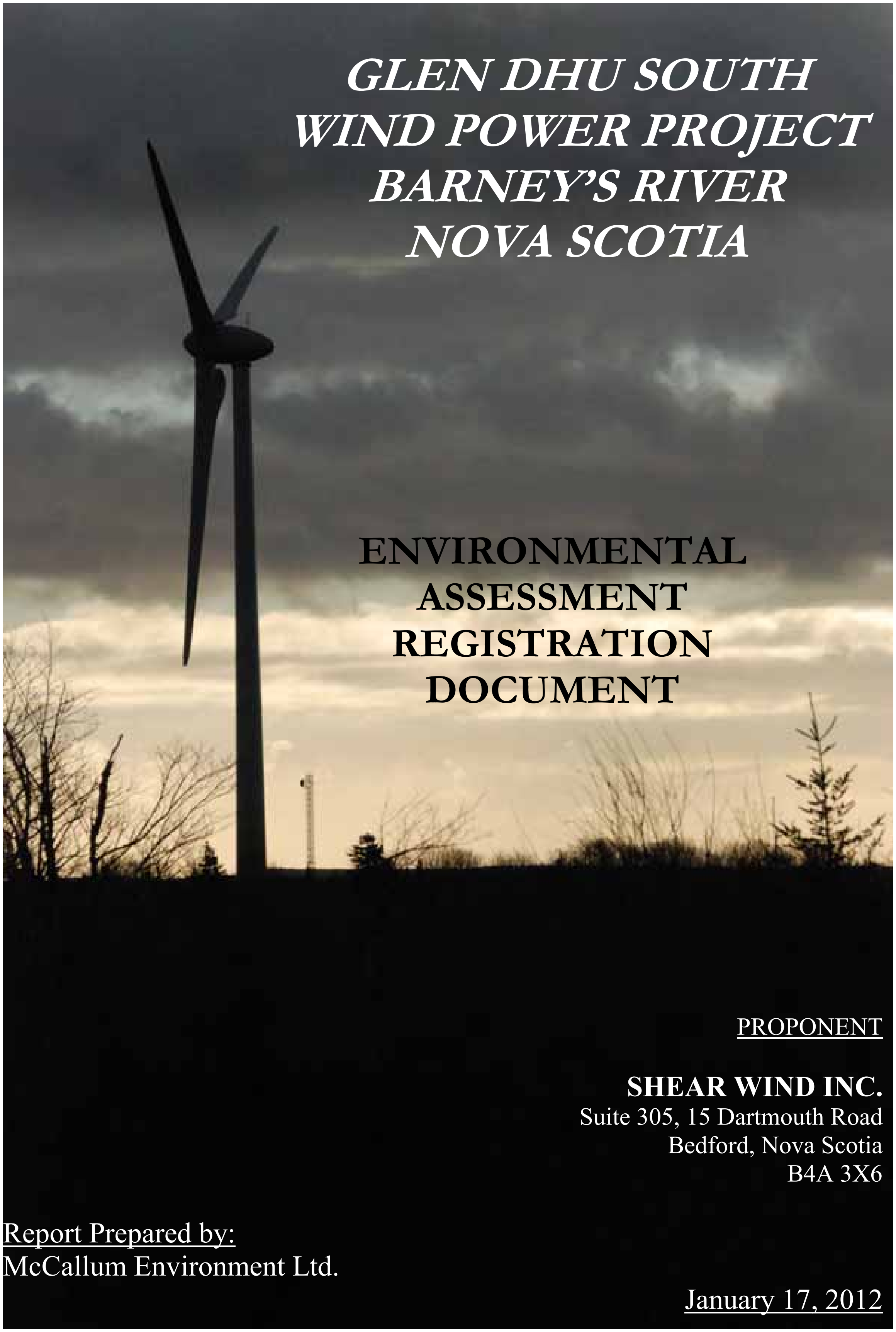

GLEN DHU SOUTH WIND POWER PROJECT BARNEY'S RIVER NOVA SCOTIA

ENVIRONMENTAL ASSESSMENT REGISTRATION DOCUMENT

PROPONENT

SHEAR WIND INC.
Suite 305, 15 Dartmouth Road
Bedford, Nova Scotia
B4A 3X6

Report Prepared by:
McCallum Environment Ltd.

January 17, 2012

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Environmental Assessment Registration Document

Name of Project: Glen Dhu South Wind Power Project

Location: Barney's River Station, Pictou County, Nova Scotia

Size of the Project: Up to 80 MW

Proponent: Shear Wind Inc.

Report Prepared by: McCallum Environmental Ltd.

Date: January 17, 2012

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EXECUTIVE SUMMARY

Shear Wind Inc. (SWI) intends to construct, own and operate a new 80 MW (nameplate capacity) wind power electrical generation project and a substation on privately owned lands located near Barney's River Station in Pictou County, Nova Scotia. There will be two easements across provincial crown land. This project is considered a second phase of the existing Glen Dhu Project and is referred to herein as the Glen Dhu South Wind Power Project (the "Project").

SWI is a public company with headquarters in Bedford, NS. Shear Wind Inc. (SWI) is a publicly held company trading on the TSX-V. Shear Wind has a range of wind farm development projects in various stages of feasibility and development throughout Canada including major opportunities in Alberta, Saskatchewan, Nova Scotia and New Brunswick. Shear Wind operates the largest wind power project in Nova Scotia - the Glen Dhu 62.1 MW Project, in addition to the Fitzpatrick 1.4 MW project.

The Project is being developed in response to the Government of Nova Scotia Request For Proposal (RFP) for the procurement of 300 GWh of renewable energy from Independent Power Producers (IPP). The RFP is scheduled for release and Project response in March 2012. SWI intends to respond to the RFP with two bids, one in the 80 MW category, and one in the 50 MW category.

This Project is considered a Class I undertaking under the Nova Scotia *Environmental Assessment Regulations*. A Class I undertaking is defined as an "electrical generating facility which has a production rating of 2 megawatts or more derived from wind, tides, or waves". As such, the Project is required to register for environmental assessment as identified under Schedule A of the *Environmental Assessment Regulations* (Nova Scotia).

This Environmental Assessment (EA), and this environmental registration document, has been completed according to the methodologies and requirements outlined in the document *Proponents Guide to Wind Power Projects: Guide for Preparing an Environmental Assessment Registration Document (Nova Scotia Environment, May 2007; Updated September 2009)* and accepted practices in environmental assessment. In December 2011, a draft of this document was submitted to the Nova Scotia Department of Environment for review and comment. Comments received, and responses to those comments (included in this document), have been tracked in the concordance table attached to the cover letter which accompanies this EA.

The specific objective of this environmental assessment is to identify potentially affected Valued Ecosystem Components (VECs), determine what effects the Project may have on each VEC, and develop mitigation techniques that will eliminate, reduce, or control any adverse environmental effects. Residual effects have been considered for determination of whether adverse environmental effects may be acceptable or whether effects are significant enough to require ongoing mitigation. Effects will depend upon duration, intensity, timing and frequency of impacts.

The Project lands encompass 2754 hectares and consist of a variable mixture of agricultural, wetlands, clear cuts, partial cuts, roads, power line corridors, plantations, and forested lands. The Project development efforts to date have included consultation with, landowners, residents, Pictou County municipal officers, First Nations and numerous regulatory agencies. The environmental assessment components have been conducted during the winter, spring, summer and fall of 2010 and 2011. SWI anticipates project construction will commence in 2012 following the approval of this environmental assessment registration and subsequent award of the RFP.

Due to the specific requirements of the RFP, the total size (energy output) of this proposed project cannot be confirmed until contract award. However, the following points are provided for clarity:

- 77 candidate turbine locations were identified and assessed as part of the field studies in 2011;
- A 100 MW turbine layout was created with the GE1.6-100 turbine prior to RFP details being available;
- Sound modeling and visual zone of influence/photomontage were completed for the GE1.6-100 turbine model;
- The RFP process with the Government of Nova Scotia limits the maximum size of the project to 80 MW. Therefore, of the 77 turbine locations, only a total of 50 turbine locations could be used;
- Following the draft submission of the EA and the receipt of comments from the various regulatory agencies, and consultation with NSDNR regarding landscape fragmentation, Shear Wind has now committed to using a larger capacity turbine to reduce the overall number of turbines, and thus the project footprint. This further reduces the total number of turbines to an expected range from 26 to 34;
- As a result of consultation with NS DNR, SWI has agreed to adjust the placement of the turbines to reduce the overall footprint of the project;
- The 50 MW layouts are limited to the project lands north of Highway 104. The 80 MW layouts are limited to the project lands north of Highway 104 and the southwest portion of the lands to the south of Highway 104;
- These revised layouts significantly reduce the overall footprint of the project by eliminating 977 ha of land base from the southeast section of the Project lands for the 80 MW layouts (35% of original land area) and 1425 ha of land base south of Highway 104 for the 50 MW layouts (52% of original land area).
- All turbines will be placed on one of the 77 assessed locations as per this document;
- Sound modeling and visual zone of influence/photomontage will be re-evaluated as

necessary once a final turbine model has been selected.

As a fundamental component of the Project, access roads, above and below ground electrical collection lines, a substation, crane pads, staging and storage yards, and temporary work space will be required.

Existing roads are present throughout the Project lands. These are usually limited to 6 metre width and are randomly dispersed throughout. In addition, a local ATV/Snowmobile club has a series of roads and trails throughout the area. Existing roads and trails account for 29 hectares of existing disturbance. Existing disturbance (which is existing agricultural, roads, houses, homesteads, hay land, etc…) accounts for 98.8 hectares (3.6%) of the total Project area.

For the purpose of analysis, the areas directly affected by proposed Project related disturbances were defined as the disturbed portion of the turbine foundations, crane pads, the access roads, distribution lines (if they were outside the boundary of the access road), substation, and temporary disturbances such as staging areas, laydown yards, or borrow pits. The total NEW disturbance that will result from the Project is 87.32 hectares. This is an increase in disturbance of only 3.3%.

When all the above noted impacts are calculated, natural areas remain. These included tracts of forests, wetlands, or stands of trees or other vegetation within the Project. These areas will continue to account for 93% of the land base. These forested natural areas are continuous, and provide suitable habitat, travelling corridors, thermal and security cover for wildlife, and are representative of forest systems throughout the Project area.

Standard construction mitigation methods will be implemented during all phases of the building of the Project to ensure there are no significant impacts of the Project on Valued Ecosystem Components (VEC). These methods were included in the development of the Environmental Protection Plan (EPP), which is included as part of this assessment. The EPP has been developed and refined from the experience with the existing Glen Dhu Project. The mitigation measures implemented on that project have been extremely successful and no environmental or non-compliance issues have occurred on that Glen Dhu Project.

The results of the Mi'kmaq Ecological Study indicate that there are no areas of first nation cultural significance expected to be impacted by the Project. As well there are no adverse effects anticipated as a result of environmental changes that occur following Project development.

Shear Wind has exceeded all required Pictou County municipal setbacks from property lines and homes, with the closest home being located 609 metres from a turbine. Sound models indicate that the Health Canada criteria for sound at a receptor of 45 dBA is not expected to be exceeded. This sound modeling will be updated once the final turbine choice has been confirmed.

All watercourse crossing location characteristics fall within the parameters for either of the two classes identified under Section 11, Sections (2) & (3) of *Minor Works and Waters (Navigable Waters Protection Act) Order.* In numerous, but not all cases, existing culverts are present on watercourses that require crossing. As such, Shear Wind Inc. would be exempt from application for approval under the Navigable Waters Protection Act.

Both McCallum Environmental Ltd. and Shear Wind Inc. are confident that the community-at-large support the development of this Project. The continued work with the Community Liaison Committee (CLC) for the existing Glen Dhu WPP, the establishment of a new CLC for this Project, past public consultation, ongoing consultation, and positive feedback received from the communities in proximity, for both the existing Glen Dhu WPP, and this proposed Project, suggest that community support for this Project is positive. Shear Wind Inc. will continue to conduct public consultation on this Project. To date no public concerns have been brought to the attention of SWI.

The magnitude of disturbance and risk associated with the Project are all considered minor given the abundance of similar VEC within the Project area and the mitigation techniques and technologies currently available. Furthermore this assessment concludes there are no significant environmental concerns and no significant impacts expected that cannot be effectively mitigated through well established and acceptable practices, or ongoing monitoring and response.

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List of Acronyms

ACCDC	Atlantic Canadian Conservation Data Centre
AGL	Above Ground Level
ASL	Above Sea Level
ATV	All-Terrain Vehicle
BOP	Balance Of Plant
BWEA	British Wind Energy Association
CanWEA	Canadian Wind Energy Association
CBC	Canadian Broadcasting Corporation
CLC	Community Liaison Committee
CMM	Confederacy of Mainland Mi'Kmaq
COSEWIC	Committee On the Status of Endangered Wildlife In Canada
CWS	Canadian Wildlife Service
dBa	Decibel
DSME	Daewoo Shipbuilding and Marine Engineering
EMI	Electro-Magnetic Interference
EPP	Environmental Protection Plan
GASHA	Guysborough Antigonish Strait Health Authority
GE	General Electric
GHG	Greenhouse Gas
GIS	Geographic Information System
GLGH	GL Garrad Hassan
GPS	Global Positioning System
GRP	Glass-fibre Reinforced Plastic
IEC	International Electro-technical Commission
IPP	Independent Power Producers
ISO	International Standards Organization
KMK	Kwilmu'kw Maw-klusagn
KMKNO	Kwilmu'kw Maw-klusagn Negotiation Office
kV	Kilovolt
LIDAR	Light Imaging Detection And Ranging
MET	Meteorological
MEKS	Mi'Kmaq Ecological Knowledge Study
MORI	Market & Opinion Research International
MW	Megawatt
NIA	Noise Impact Assessment
NSDNR	Nova Scotia Department of Natural Resources
NSE	Nova Scotia Environment
NSESA	Nova Scotia Endangered Species Act
NSPI	Nova Scotia Power Inc.
NSTIR	Nova Scotia Transportation and Infrastructure Renewal
PID	Property Identification Number
PIF	Partners In Flight
PM	Particulate Matter
POR	Point Of Reception
PPA	Power Purchase Agreement
RABC	Radio Advisory Board of Canada
REA	Renewable Electricity Administrator

RFP	Request For Proposal
SAR	Species At Risk
SARA	Species At Risk Act
SSHD	Significant Species and Habitat Database
SWI	Shear Wind Inc.
TBD	To Be Determined
TDG	Transportation of Dangerous Goods
TSP	Total Suspended Particulate
UTM	Universal Transform Mercator
VEC	Valued Ecosystem Components
WHMIS	Workplace Hazardous Material Information System
WPP	Wind Power Project
WTG	Wind Turbine Generator
ZVI	Zone of Visual Influence

1. General Information

Table 1. Project Summary

General Project Information	Shear Wind Inc. (SWI) intends to construct and operate up to an 80 MW wind power project on lands referred to as Glen Dhu South, located in Barney's River Station in Pictou County, approximately 35 km east of New Glasgow. This project is a second phase of the operating Glen Dhu Wind Power Project.
Project Name	Glen Dhu South Wind Power Project (the "Project")
Proponent Name	Shear Wind Inc. (SWI)
Proponent Contact Information	Suite 305, 15 Dartmouth Road Bedford, NS B4A 3X6 Business: (902) 444-7420 Facsimile: 416 (902) 444-7465 email: itillard@shearwind.com
Proponent Project Director	Ian Tillard Chief Operating Officer
Project Location	• The Project lands are located approximately 35 km east of New Glasgow, Nova Scotia; • The Project lands are located in Barney's River Station, Nova Scotia; • Project lands located entirely within Pictou County, Nova Scotia; and, • The approximate centre of the Project lands are located at 560247.76 m E and 5048919.15 m N.
Landowner(s)	The project lands are located on predominately freehold (private) land with two easements across provincial crown land.
Closest distance from a turbine to a residence	The nearest house will be **609 metres** from the closest proposed turbine location
Expected rated capacity of proposed project in MW	Up to 80 MW

Federal Involvement	At this time, no federal departments are providing funding. No other Canadian Environmental Assessment Act triggers (*Section 5, CEAA*) occur or are expected.
Required Federal Permits & Authorizations	• Department of National Defense Authorization; • Transport Canada; • NAV Canada; • No other federal authorizations are anticipated at this time;
Provincial Authorities issuing Approvals	a. Nova Scotia Department of Environment; b. Nova Scotia Department of Natural Resources; c. Nova Scotia Transportation and Infrastructure Renewal;
Required Provincial Permits & Authorizations	The following permits, authorizations and/or approvals will be required for this Project which will allow for the construction and operation of the Project 1. *Environmental Assessment Approval.* Approved pursuant to Section 40 of the *Environment Act* and Section 13 (1)(b) of the *Environmental Assessment Regulations* in Nova Scotia, Canada; 2. *Approval to Construct – Culvert(s),* Pursuant to *Part V of the Environment Act, S.N.S 1994-95, c.1;;* *3.* Nova Scotia Transportation and Infrastructure Renewal: *Work within Highway Right of Way Permit;* *4.* Service Nova Scotia and Municipal Relations: *Special Move Permit for over dimensional and/or overweight vehicles and loads* 5. *Wetland Alterations* Pursuant to Activities Designation Regulations, Division I, Section 5(1)(na)
Provincial Regulatory Authorities Consulted during EA and Project Development Process	Nova Scotia Environment (NSE), Policy & Corporate Services: • Vanessa Margueratt, Environmental Assessment Officer • Helen McPhail, Environmental Assessment Officer Nova Scotia Department of Natural Resources: • Mark Elderkin, Species at Risk Biologist • Peter MacDonald, Large Mammal Biologist • Mark Pulsifer, Co-Chair, Mainland Moose Recovery Team • Kim George, Regional Biologist • Harold Carroll, Director, Parks and Recreation Office of Aboriginal Affairs: • Jay Hartling and Alvaro Loyola, Director of Consultation

	Health Canada: • Allison Denning, Regional Environmental Assessment Coordinator, Atlantic Region
Municipal Authorities	County of Pictou
Required Municipal Permits & Authorizations	*Development Permit* – Municipality of the County of Pictou
Environmental Assessment Document Completed By:	Meghan Milloy, MES Robert McCallum, P.Biol McCallum Environmental Ltd. **McCallum Environmental Ltd.** 208 Kingswood Dr. Hammonds Plains, N.S. B4B 1L2

2. Project Information

2.1 PROPONENT PROFILE

The project proponent is Shear Wind Inc. (SWI), a public company with headquarters in Bedford, NS. SWI is one of Canada's fastest growing Canadian based renewable energy exploration and development companies. It is publicly traded on the TSX-V with the ticker symbol of "SWX".

Shear Wind is focused on building a strong company based on a secure and sustainable supply of clean energy. The long-term benefits will be increased value for shareholders; reliable supply of renewable energy for customers; complemented by strong community and stakeholder involvement and partnerships. The company's renewable energy plan is to strategically develop wind energy projects throughout North America by selecting exceptional wind resource properties, and by forming partnerships, joint ventures, and acquisitions to provide the additional resources required for reaching our goals.

Shear Wind Inc. is the holding company for the assets related to the existing Glen Dhu Wind Power Project, located north of this proposed Project. Shear Wind Inc., and its affiliates, own and operate more than 29 wind turbines in Nova Scotia, Canada. They are the largest wind project operator in Nova Scotia with the Glen Dhu 62.1 MW and the Fitzpatrick 1.4 MW projects. In addition, they are pursuing new utility-scale wind projects across Canada, with over 1,000 MW under development in 4 regions.

Each year the company plans to retain a portfolio of opportunities in various stages of development, and will move the most ready projects to construction. SWI's Management Team encompasses an extensive background of domestic and global business expertise with a strong entrepreneurial acumen. Engaged in the exploration and development of renewable energy in Canada, SWI is headquartered in Bedford and has a regional development office in Calgary.

SWI is committed to the development of renewable energy projects utilizing the best available wind, water and solar technologies. SWI constructs, develops and operates renewable energy generation facilities on behalf of its investors and in cooperation with the landowners and communities where the projects are located.

SWI’s Executive Management Team consists of:

- Michael Magnus, President and CEO
- Ian Tillard, Chief Operating Officer
- Bill Bartlett , Chief Financial Officer
- Louise Clarke, Vice President

The Environmental Assessment Project Team is:

- Meghan Milloy, MES, McCallum Environmental Ltd.
- Robert McCallum, P.Biol., McCallum Environmental Ltd.
- Pierre Heraud, GL Garrad Hassan
- Dr. John Kearney, John F. Kearney and Associates
- Hugh Broders, PhD.
- Steve Davis, Professional Archeologist, Davis McIntyre & Associates
- Sid Peters, Confederacy of Mainland Mi'kmaq Environmental Services
- Melanie MacDonald, MREM, McCallum Environmental Ltd.

2.2 NEED FOR PROJECT

The Government of Nova Scotia has committed to a target of 25 percent renewable electricity supply by 2015 as part of Nova Scotia's Renewable Energy Plan that was announced in 2010. Nova Scotia's total renewable electricity content is expected to more than double from 2009 levels to satisfy this target. Furthermore, the Government of Nova Scotia has committed to a target of 40% renewable electricity supply by 2020. The renewable energy production is expected to include hydro, wind, biomass, and tidal sources.

As legislated in the 2010 amendments to the *Electricity Act,* Nova Scotia will produce 25% of total electricity from renewable energy by 2015. To enable the province to achieve this goal, a minimum of 300 GWh will be procured from Independent Power Producers (IPPs). The 2010 amendments called for the government to appoint a Renewable Electricity Administrator (REA) to oversee a competitive bidding process for this renewable energy from IPPs. Having an independent entity oversee such a process is intended to promote fairness, transparency, and efficiency. In July 2011, the government appointed Power Advisory LLC to serve as the REA after a competitive application process.

In November 2011, SWI submitted an Interconnection Request and Notice of Intent to Bid in the upcoming RFP process.

The primary objective of the Request for Proposals (RFP) process will be to identify renewable IPP projects that represent the best value for electricity ratepayers.

Projects will be evaluated by the following criteria, in order of importance:

1. The project must meet the criteria stated in the Renewable Electricity Regulations and other criteria as outlined in the RFP as developed by the REA (size, location technology type, etc.);
2. Economic viability of the project;
3. Technical capacity of the proponent;

4. The anticipated in-service date;
5. Prior renewable electricity projects by proponent.

This Project is being developed in response to this government initiative.

2.3 BACKGROUND OF PROJECT

As part of its renewable energy initiative issued on March 12, 2007, Nova Scotia Power Incorporated (NSPI) has committed to supplementing its base energy supply with approximately 240 MW (increased from 130 MW at call for RFPs) of renewable generation from Independent Power Producers (IPPs). NSPI issued a Request for Proposals (RFP) from IPPs to identify and select projects to meet this objective.

The Glen Dhu Wind Power project was a response to the NSPI RFP through a Power Purchase Agreement (PPA). Under the terms of the PPA, SWI is currently delivering 165,000 MWh (megawatt hours) from wind energy at its Glen Dhu Power-Wind Project. Construction of this wind farm was completed in early 2011.

In 2010/2011, prior to the release of the aforementioned RFP, SWI retained McCallum Environmental Ltd., in addition to other third party consultants, to begin evaluating lands to the south of the existing Glen Dhu WPP. Landowner agreements were finalized, and environmental assessments were commenced at that time.

2.4 PROJECT LOCATION

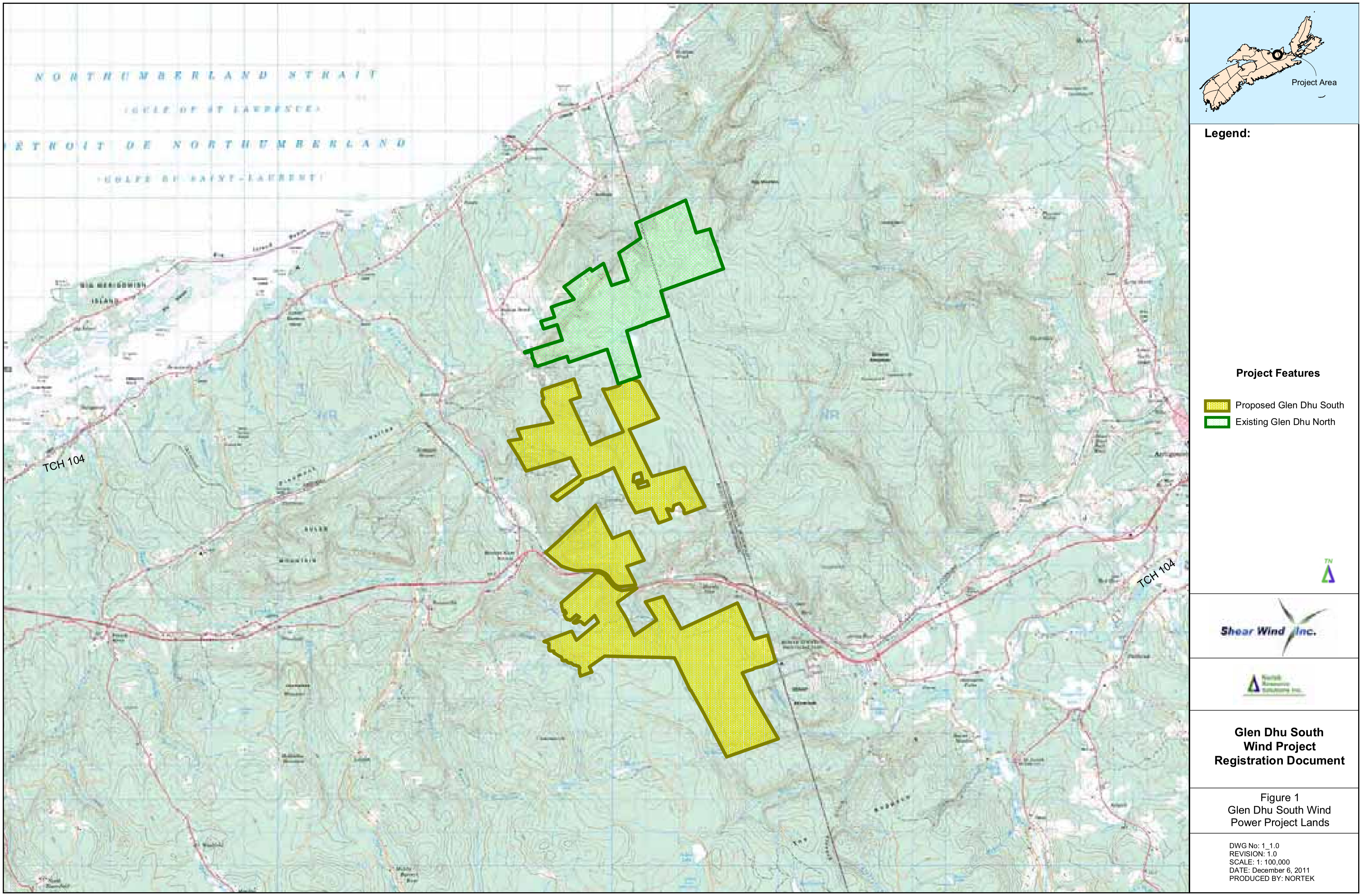
The lands are located near Barney's River Station in Pictou County, approximately 35 km east of New Glasgow along the TransCanada Highway.

The Project lands are located entirely within Pictou County, Nova Scotia. (Figure 1) The Project lands are located approximately 3.0 kilometres northeast and east of Barney's River Station, Nova Scotia (project lands north of Highway 104), and approximately 1.5 to 2 kilometres south and southwest of the community of Marshy Hope, Nova Scotia (project lands south of Highway 104). The approximate centre of the Project lands is located at 560247.76 m E and 5048919.15 m N.

The western boundary of the Project is marked by the Barney's River Road, which leads north from Highway 104 and Weavers Mountain Road to the south of the highway. The northern boundary of the Project is marked by Brown's Mountain Road, which east west just south of the current Glen Dhu Wind Power project. The eastern boundary of the Project is located at the John Munroe Road (to the north of Highway 104) and Pushie Road on the south side of the highway. The lands encompass the TransCanada Highway in this area.

Land for the turbine locations, power line corridors and access roads will be leased from landowners consisting of private individuals and corporations. Easements will be requested from Crown land parcels for upgrading of existing access roads. The presence of the project facilities will not significantly alter the present land use activities carried out by these land owners. Other than the roads, power lines and turbine sites, SWI will have no other responsibility for the stewardship of private lands, or Crown lands. SWI will take responsibility for environmental issues related its undertaking. The integration of environmental policies with other land use practices of private land owners is beyond the scope of SWI's responsibility.

Access to the project site will be off Brown's Mountain Road in Bailey's Brook, east of Barney's River Road (Exit 29 north off Highway 104) and off Weaver's Mountain Road (Exit 29 south off Highway 104). Two Nova Scotia Power 230kV transmission lines cross to the south of the project site providing easy access to interconnect the wind farm cost-effectively to the transmission system. The project location near Highway 104 will allow the transportation and handling of the components in a convenient and safe manner.



Legend:

Project Features

- Proposed Glen Dhu South
- Existing Glen Dhu North

Glen Dhu South Wind Project Registration Document

Figure 1
Glen Dhu South Wind Power Project Lands

DWG No: 1_1.0
REVISION: 1.0
SCALE: 1: 100,000
DATE: December 6, 2011
PRODUCED BY: NORTEK

The Project site is situated in a sparsely populated rural setting. The land proposed for the site is predominantly used for timber harvesting operations and contains an expansive system of existing gravel roads, logging roads and trails. The access roads and wind turbine sites are located primarily on privately owned land parcels that are set back from residences, roads and other public areas. Shear Wind has secured long-term lease arrangements with individual landowners. Land rights for the Project's substation, collector system and associated transmission facilities have also been obtained. SWI has applied to the province two easements across parcels of provincial Crown land for access roads only.

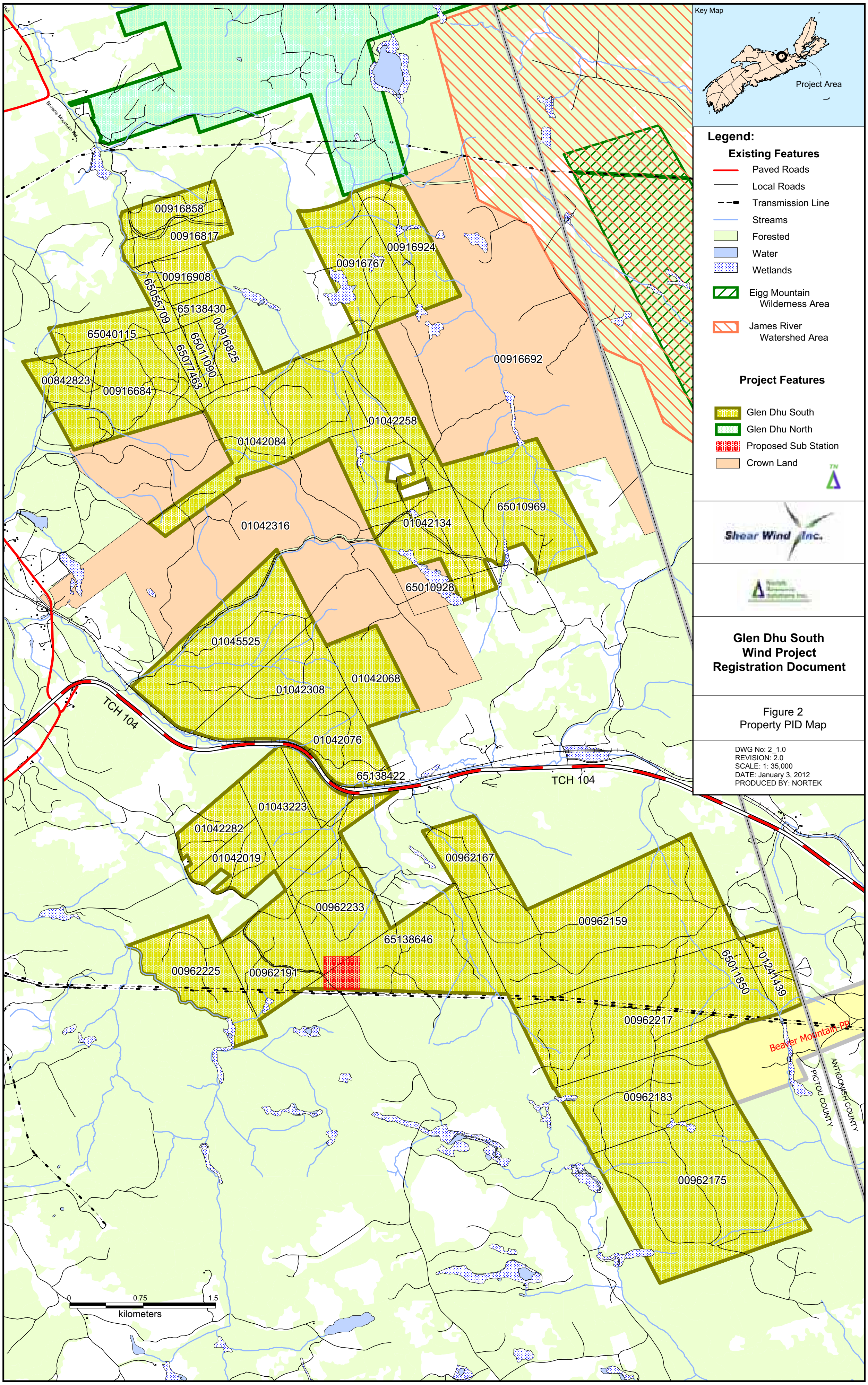
The nearest house will be **609 metres** from the closest proposed turbine location.

The following table provides a list of PIDs included in the Project.

Table 2. Project Property Identification Numbers (PIDs). *

PID	PID	PID
Privately Owned Properties		
01043223	65040115	00916825
01042076	65011090	01042084
01042019	65077463	65138430
65138646	01042258	01042076
00962225	65010969	01042068
00962217	01042134	65138422
00962183	01042134	00962167
00962175	01045525	00962159
00916858	01042308	01241439
00916924	65138422	65011850
00916767	00916817	00962191
00916858	00916817	00962191
00916858	00916817	00962233
00916908	00842823	01042282
65055709	00916684	
Crown Land Properties (Owned by NSDNR)		
01042316	65010928	00916692

***Please refer to *Figure 2* for a map with PIDs.**



Key Map
Project Area
Legend:
Existing Features
Paved Roads
Local Roads
Transmission Line
Streams
Forested
Water
Wetlands
Eigg Mountain Wilderness Area
James River Watershed Area
Project Features
Glen Dhu South
Glen Dhu North
Proposed Sub Station
Crown Land
Shear Wind Inc.
Glen Dhu South Wind Project Registration Document
Figure 2
Property PID Map
DWG No: 2_1.0
REVISION: 2.0
SCALE: 1: 35,000
DATE: January 3, 2012
PRODUCED BY: NORTEK
00916858
00916817
00916908
65055709
65138430
00916825
65011090
65077463
65040115
00842823
00916684
00916767
00916924
00916692
01042258
01042084
01042316
01042134
65010969
65010928
01045525
01042308
01042068
01042076
65138422
TCH 104
TCH 104
01043223
01042282
01042019
00962167
00962233
00962159
65138646
00962225
00962191
65011850
01241439
00962217
Beaver Mountain PP
00962183
PICTOU COUNTY
ANTIGONISH COUNTY
00962175
0
0.75
1.5
kilometers

2.5 PROJECT COMPONENTS

The Glen Dhu Project will be powered by up to 50 turbines, each rated at 1.6 megawatts (MW), for a nominal capacity of up to 80 MW in total. The proposed turbines are GE 1.6-100. This turbine choice has been used for all aspects of the environmental assessment. During additional planning and design, the turbine selection is expected to change (refer to Chapter 4 for details). If this occurs, Nova Scotia Environment will be contacted and necessary environmental assessment aspects (i.e. sound, setbacks) will be revisited and changed to reflect the change in turbine selection. Micro-siting work is ongoing with GE to determine the characteristics and ideal application at each turbine site. For purposes of this application the GE1.6-100 is used to represent the primary design option. Under normal conditions, the turbines will operate 24 hours per day, 7 days per week.

The key components of the Project include up to 50 wind turbine generators (the “turbines”) with a total installed capacity of up to 80 MW, pad-mounted or nacelle situated transformers at each turbine, a 34.5 kilovolt (kV) electrical collector system with both overhead and buried lines, and a 69 kV/138kV wind farm substation that will include a step-up transformer, control building, switchgear, support structures, and a system of access roads to the turbines.

2.5.1 Turbines

The representative values for the characteristics of the proposed wind turbine manufacturer are shown below.

Table 3. Turbine Characteristics

OPERATING DATA	
Rated power	1.6 MW
Cut-in wind speed	3 m/s
Rated wind speed	11.5 m/s
Cut-out wind speed	25 m/s
Maximum 3sec gust	52.5 m/s
Hub height	80 m
Rotational Speed	9.75 to 16.18 RPM
ROTOR	
Pitch system	Principle: Independent Blade Pitch Control Actuation: Individual Electric Drive
Diameter	100 m
Blade material type	Glass-fibre reinforced plastic (GRP)/Epoxy
GENERATOR	

Type	Doubly-fed induction type
Rated power	1620 kW
Rated voltage	600 Volts
Frequency	60 Hertz
Protection	IP 54
Cooling system	Forced Air cooled
BRAKING SYSTEM	
Aerodynamic brake	Electrically actuated individual blade pitch systems
Mechanical brake	Exists. But no technical details available
GEARBOX	
Type	Multi-stage planetary/helical gear
Ratio	1 : 118.6
Nominal load	2294 kW
YAW SYSTEM	
Type	Driven by 4 electrical driven planetary drives
Bearings	Friction bearing with gear
CERTIFICATIONS	
Design standards	IEC 61400-1
Quality	ISO 9001:2000, ISO 9001:2008, ISO 14001:2004 & OHSAS 18001:2007
TOWER	
Type	Tubular - Steel Plate
Corrosion protection	Anti-corrosion exterior/double anti-corrosion interior

Wind turbines and supporting structures typically consist of eight key components:

1. tower foundations;
2. three or four tower sections of steel or concrete with service access provided by stairs and/or service person lifts;
3. fibre glass nacelle housing the mainshaft gearbox and generator,
4. three fibre glass or carbon fibre rotor blades;
5. cast iron hub;
6. pad-mounted or internal nacelle mounted transformer;
7. electrical and grounding wires; and
8. buried grounding grid at perimeter of foundation

The average cleared area required for each turbine, including assembly areas for the turbine components but excluding the access road, power line and temporary laydown area, will be 0.8 hectares.

Each turbine will be up to approximately 80 metres in height from ground level to the hub. The swept diameter of each three bladed rotor will measure 100 metres. The rotors are variable speed, with revolutions per minute dependent upon wind conditions.

The nacelle includes bedplate/frame, fibre glass enclosure, rotor hub, mainshaft, gearbox, generator, turbine control equipment, instrumentation, and cooling/heating equipment. These components are located at the top of the tower sections and are connected to the three bladed rotor via a main shaft and hub assembly. Tower foundations may range from three to eight metres in depth depending upon site-specific soil conditions.

A pad-mounted or nacelle situated transformer will be required for each turbine (this will be determined once a turbine manufacturer has been selected) to transform the low voltage electricity created in the nacelle to medium voltage collection system level (i.e., 600 V to 34.5 kV). The pad mounted transformers will be approximately three metres long and wide and about two metres high. The electrical collection system will be comprised of a series of above ground power lines with the exception to where the collection system will go underground from the last riser pole to the turbine pad mounted transformer or directly into the turbine tower.

2.5.2 Lighting

Turbine lighting will meet the design requirements and quality assurance for lights required under *Canadian Aviation Regulations 2010-1* Part VI - General Operating and Flight Rules Standard 621.19 - Standards Obstruction Marking, Section. Transport Canada generally recommends the use of medium intensity red beacon lights.

2.5.3 Electrical Collection System

The 34.5 kV medium voltage collection system will be used to take the power from the wind turbines to the wind farm substation. The collection system will consist of one (1) to two (2) x 34.5 kV circuits. Each circuit will be designed to handle approximately 15 MW to 25 MW of wind generation. The 34.5 kV circuits will consist of both overhead and buried sections. The overhead circuits will consist of a single wooden pole construction from the substation to an area of approximately 50 to 100 metres from the turbine where the overhead section will then connect to an underground cable which will connect to the unit step-up transformer at the wind turbine. The total distance of the collection system, both overhead and underground is estimated to be approximately 25 kilometres in length with approximately 19.5 km of the system being constructed within the proposed access road boundaries.

Underground collection lines will be installed from the turbines, along the spur roads, out to the main roads. At the main roads, an above ground collection system will be used (Photo 1).

Photo 1. Above ground transmission line on existing Glen Dhu Project.
This above ground line type will be used on the Glen Dhu South Project along major roads to the substation.

2.5.4 Substation

The Project substation will step-up the voltage from 34.5kV to 138kV and will interconnect the wind farm to NS Power's 230kV transmission system.

Photo 2. Existing NSPI transmission line through south end of Project lands

The substation will be located on private land south of Highway 104 along Weavers Mountain Road (Figure 2). The substation will consist of a small control building, a main 34.5kV to 138kV step-up transformer, breakers, air disconnect switches, structural steel, protection and control equipment, metering, equipment concrete foundations, and ground grid. The substation will be secured by a chain link fence to restrict access to only authorized personnel.

The following photo was taken at the existing Glen Dhu Substation and is indicative of both footprint and infrastructure.

Photo 3. Existing sub-station at Glen Dhu Project

2.5.5 Access Roads

The access roads will be upgraded and built to accommodate the size requirements of the crane and the load specifications to support the delivery of turbine and crane components. The final access road surface will be typically 8m wide along straight sections, but will be widened through turns and as required to allow adequate access for turbine components. Ditches and culverts will be added where required to allow for proper drainage. The surface soil and grubbing will be re-located in borrow areas along the road side and graded to prevent erosion and sediment runoff. The ditches will be constructed along the road edge following provincial guidelines and procedures to control for surface water runoff. Crossover culverts or water-bars will be installed under the roads where necessary.

The Project requires the upgrade or development of 48.5 km of access within the Project lands. However approximately 60% of these roads are significant existing gravel roads across the project area, therefore only 19.41 km of new roads will be constructed within the Project lands.

Access roads will be constructed similar to the ones shown in the following photo, however, Shear Wind has committed to reducing the overall road width.

Photo 4. Existing road at Glen Dhu WPP.
This road would be typical of those built at the proposed Project.

2.5.6 Meteorological (MET) Towers

There are three Meteorological Towers located on the Project Lands. Two are located south of Highway 104 (one on the western side of the project lands, and one on the eastern side of the project lands) and the third is located in the northwest portion of the project lands, to the north of Highway 104. These MET towers are towers which carry meteorological instrumentation and anemometers (devices to measure wind speed) installed at different heights on the mast, and one or two wind vanes (devices to measure wind direction). These are connected to a data logger, at the base of a mast, via screened cables. This system is battery operated using a solar panel for recharge.

Signals that are recorded for each sensor with a ten-minute averaging period are as follows:

- Mean wind speed;
- Maximum gust wind speed;
- True standard deviation of wind speed;
- Mean wind direction;
- Mean temperature;
- Air Pressure;
- Logger battery voltage.

In recent years, it has become standard practice to download data remotely, via either modem or a satellite link. This approach has made managing large quantities of data from masts, on a range of prospective sites, significantly more efficient than manual downloading.

These MET towers were installed in 2007 and have been collecting valuable wind and meteorological data for four years.

2.5.7 Temporary Components

During the construction phases of the project, the following lists temporary Project components that will be required:

1. Storage yard (or multiple storage areas) will be required to store construction equipment, turbines, cranes, shacks, offices, parking and other necessary components. An operations building or trailers will be brought in prior to leasing or purchasing of an building for the operation and maintenance facility;
2. Temporary work space may be required along access roads and at crane pad sites. These temporary work spaces will be used as required following approval from appropriate landowners and will be reclaimed/restored following turbine erection;
3. Borrow pits may be required to provide necessary fill for access road or crane pad site creation. All borrow pits will be permitted as required;
4. Due to turbine foundation requirements, a temporary cement batch plant will be established within the project lands to supply cement for foundation construction. To date this location has not been determined. It is expected that as turbines are constructed, the batch plant may move to reduce trucking requirements;

2.5.8 Other Components

An operation and maintenance space will be leased or an existing facility may be purchased in a near-by town. The building will facilitate the day-to-day operations for the project.

2.6 PROJECT ACTIVITIES

2.6.1 Anticipated Schedule of Activities

The following milestone schedule outline the typical project schedule which takes into account the final Project development stages such as receiving regulatory approval and execution of a Power Purchase Agreement. It also allows for adequate time to procure the long lead Plant equipment such as the wind turbines and the main step-up transformer.

Table 4. Schedule

Task	Anticipated Completion Date
Geotechnical Study	2012
Engineering Design	2012
Environmental Assessment Approval	February 2012
Power Purchase Agreement	2012
Turbine Purchase Agreement	2012
Generator Interconnection Agreement	2012
Commence Construction -Clearing for roads & foundations -Roads -Pour concrete mud slabs for turbine foundations -Substation & Collection System -Turbine foundations, turbine delivery, erection	2012 Late 2012 Late 2012, early 2013 May 2013 May – July 2013 June-November 2013
Commercial Operation Date	Dec 2013

2.6.2 Activity Phases

Phase	Details
Pre-Construction	
	• Notification of residents/landowners of construction commencement • Survey turbine site locations in field • Survey access roads on project lands • Trucking & set up of temporary facilities – construction offices, workers trailers, temporary washroom facilities, etc. • Construction equipment delivery

Construction	
General	• Clearing and Grubbing of overstory vegetation • Construction of storage yards • Construction of temporary work space
Civil	• Stripping of surface soils along access roads, at turbine locations, at substation, at other required work areas • Construction of access roads, water crossings • Construction of temporary work space(s) • Construction of turbine locations and crane pads • Installation of erosion and sediment control structures • Site grading • Compaction testing of roads • Excavation of foundations with blasting (as required) and excavator • Creation of crane pads using excavated material • Installation of site drainage (aka- weeping tile) at base of turbine foundations • Installation of re-bar at turbine foundations • Installation of below ground transmission infrastructure • Installation of turbine base • Pouring of concrete for foundations • Testing of concrete foundations • Backfilling of foundations with previously excavated soils • Reclamation of surplus soils • Grading of site
Turbines	• Turbine component delivery • Crane delivery • Tower/turbine erection • Install Turbine Electrical & Padmount Transformers
Collection System	• Installation of poles and guide wires for overhead (O/H) collection system • Run overhead wires and associated infrastructure • Install and connect underground collector system
Sub-Station	• Delivery of equipment • Installation of equipment foundations and station ground grid • Installation of equipment support structures • Installation of transformer, switch gear, protection and control systems, control building, conduits, wiring, and terminations • System testing
Operations & Maintenance	
	• Reclamation of subsoils and disturbed surface soils • Weed Control • Re-seeding of disturbed soils • Grading of roads • Road maintenance • Culvert maintenance

	• Turbine maintenance • Sub-station maintenance • Equipment testing
Decommissioning	
	• De-energize facility • Removal of above ground infrastructure which includes turbine blades, nacelles, tower components, O/H distribution lines, power poles, and other support structures • Removal of crane pads and gravel from access roads • Recontouring of crane pads and access road grades • Reclamation of surface soils • Re-seeding or re-planting • Reclamation monitoring

2.6.3 Access Road Construction Methods

Proposed access routes have utilized existing roads, trails, and clearings as much as possible. There is an extensive network of existing logging roads which have been used for the majority of access roads for turbines. Over 60% of the required network of roads for the project consists of existing roads.

Construction of access roads will consist of the following:

- Surveying of the access road boundaries to 20 metres;
- Road boundaries will be flagged by surveyors;
- Cutting, de-limbing and decking all salvageable timber, as necessary, using feller buncher, skidders, chainsaws and logging trucks;
- Following removal of overstory vegetation, lands will be brushed with a bulldozer and backhoe to remove non-salvageable wood and brush. Scrub brush/grubbings will be piled along disturbance boundaries and will have breaks installed to allow for water flow where necessary. Limbs and non-merchantable material will be chipped, left in brush piles or buried underground for natural decay; depending on the site conditions.
- Bulldozers will push topsoils to the edge of the access road boundary
- Subsoils will be excavated with a backhoe from a trench line that parallels the access road alignment. These subsoils will be placed on the area of travel for the access road.
- Previously removed grubbings and topsoils will be placed into the excavated trench line and the trench line recontoured.
- Subsoils placed on the access road traveling area will be spread out using a bulldozer
- This new access road will the packed with a roller
- Crushed rock may be placed on the road and re-packed with a roller;
- A second and final layer of crushed rock may be placed over top and packed with a roller if required;

- Gravel may be used on the accesses on an as-needed basis during the construction and operational life;
- Culverts will be installed as required to maintain natural drainage according to Nova Scotia Environment and/or Department of Fisheries & Oceans standards;
- All roads will be compaction tested to ensure they meet the compaction requirements for turbine component delivery
- All ditches will be re-vegetated as per the Environmental Protection Plan (EPP), provided in Appendix I;

2.6.4 Turbine Site Construction

The erection of a turbine requires a large level work area for safe operation and the following site dimensions will be typical for the project (refer to Drawing on following page):

Table 5. Infrastructure and associated dimensions of workspace

Infrastructure	Dimensions of Workspace Required
Total Cleared Work Space Per Turbine (required for storage of turbine blades, nacelle, and tower sections during the erection process)	90 m x 90 m
Permanent Lease: Turbine base with Power Cables and Pad Mounted Transformer for use during operational life	25 m x 25 m
Crane Pad	16 m x 25 m

Construction of the turbine locations will consist of the following:

- Surveying of the turbine site boundaries to 90 metre x 90 metre dimensions;
- Boundaries will be flagged by surveyors;
- Cutting, de-limbing and decking all salvageable timber using feller buncher;
- Following removal of overstory vegetation, lands will be brushed with a bulldozer and backhoe to remove non-salvageable wood and brush. Scrub brush will be piled along disturbance boundaries and will have breaks installed to allow for water flow where necessary;

Photo 5. Typical clearing operations of a turbine site following timber removal

- Turbine sites may require soil stripping and leveling using a two lift soil stripping method in areas where bedrock is not found at or immediately below the surface.
- Drainage patterns will be maintained by installing adequate crossing structures;
- Blasting of uneven surface bedrock and foundation areas will be completed as required. All blasting will be conducted in accordance with the *General Blasting Regulations, N.S. Reg. 77/90*, or any updated versions thereof;
- Following blasting of bedrock, blasted bedrock will be excavated and used for the development of a crane pad on the turbine location. Turbine bases will be excavated to appropriate dimensions (determined by engineering requirements);
- Each turbine base is anticipated to require installation of a support structure using approximately 300 m^3 of cement and re-bar (Photos 6, 7);
- Installation of rebar and other required infrastructure;
- Pouring of concrete;

Photo 6. Typical turbine re-bar installation for the spread foot foundation.

Photo 7. Typical turbine spread footing foundation following concrete pour. Note blasted rock from foundation used on site.

Concrete for turbine foundations is expected to be supplied by a temporary concrete batch plant located at a strategic location on the project lands. The concrete batch plant is required it will be permitted by the supplier in accordance with Nova Scotia Environment regulations.

2.6.5 Turbine Erection

The erection of turbines is based upon specific site conditions found at each turbine Site. Engineering lift procedures will be required for each turbine and generated by the construction contractor.

- Lifting and construction equipment will be placed on the ground and leveling techniques will be used as required, for the safe operation of equipment;
- Two cranes will be used for each turbine component installation (one main lifting crane and one tailing crane). The main lifting crane will be situated on the leveled crane pad area immediately adjacent to the foundation pedestal. The tailing crane will be located nearby.
- Hydraulic torque wrenches will be used to tighten bolted connections between turbine tower sections.

Photo 8. Tower section installation

Photo 9. Nacelle Installation

Photo 10. Hub and Blade Lift.

2.6.6 Equipment Delivery

The following outlines the expected transportation routes (north and south of Highway 104) for delivery of turbine components (Figure 3). The routes will be subject to Nova Scotia Transportation and Infrastructure Renewal (NSTIR) approval and transportation company (TBD) approval and may therefore change.

North of Highway 104:

1. Initial delivery via Port of Halifax;
2. Transport from Port of Halifax along Highway 102 to Truro exit #14;
3. East on Highway 104 to Barney's River Station Exit #29;
4. North on Barney's River Road;
5. East on Arbuckle Road;
6. South on Brown's Mountain Road to Glen Dhu North project; and,
7. South on access road from Glen Dhu North to Project Lands. The total distance from Exit #29 is 12 km.

South of Highway 104:

1. Initial delivery via Port of Halifax;
2. Transport from Port of Halifax along Highway 102 to Truro exit #14;
3. East on Highway 104 to Barney's River Station Exit #29;
4. South on Barney's River Road;
5. East on Weaver's Mountain Road to Project Lands. The total distance from Exit #29 is 3.1 km.

These routes have been chosen due to equipment and truck sizes, turning radii available on the route, exit characteristics at exit #29, avoidance of major traffic corridors, bridge weight restrictions, and road characteristics.

Figure 1: Proposed Transportation Routes for Equipment Delivery (north and south side of Highway 104).

The following types of construction vehicles are expected to be used to construct each proposed wind turbine:

Foundation Construction

- Track Hoe
- Loader
- Roller
- Concrete Trucks
- Concrete Pump Truck
- Tractor Trailer (rebar, anchor bolts& templates)
- Rock Trucks

Access Roads Construction

- Bulldozer
- Grader
- Gravel Haul Trucks

Collection System Installation

- Trackhoe or Trencher

- Tractor Trailers (delivery of cable spools and transformers)

Turbine Erection

- Tractor Trailers (required for delivering crane components to project area WTG components would be delivered using tractor trailers of various lengths, widths and axle configurations required to accommodate the large weights and dimensions of the components.

Component deliveries / turbine include:

- Down Tower Assembly (6 delivery trucks)
- Hub (1 delivery truck per turbine)
- Nacelle (1 delivery truck per turbine)
- Tower Sections (3 delivery trucks per turbine)
- Blades (1 delivery trucks for every turbines, i.e. three blades per truck)

The approximate sizes of trucks required to deliver equipment are listed as follows:

Component	Length of trucks (feet)	Height of trucks (feet)	Approx. Gross Vehicle Weight (lbs.)	Clearance Radius on Turns (feet)
Nacelle	112’ 10”	14’ 8:	197,000	111’ 3”
Hub	78’ 0”	13’ 6”	75,000	48’ 4”
Blade	153’ 11”	13’ 6”	<70,000	133’ 0”
Tower Base	140’	15’	212,000	80’ 5”
Tower Mid	128’ 2”	15’	132,000	75’ 0”
Tower Top	123’ 7”	14’ 6”	112,000	74’ 6”

- During construction of the existing Glen Dhu project, approximately 67 trucks of equipment / turbine were required to deliver equipment (i.e. turbine parts), materials (i.e. gravel, rock) and personnel to the site. Assuming the same volume of trucking is required, approximately 3350 deliveries by truck could be required for this Project.
- Two support cranes will be required to offload each of the turbine components at their respective turbine site laydown area(s).
- Tower components will be either erected directly from delivery trailers or stored at each turbine laydown site
- Balance of Plant electrical components may be delivered to a local existing offsite storage yard prior to being delivered to site for installation.

2.6.7 Electrical Collection System

The Collection System will be installed within the Project boundaries, and will mainly consist of above ground utility wooden power poles, spaced approximately 50 metres apart. All power poles will be purchased from a supplier which has treated the poles in accordance with appropriate regulations.

Construction of the collection system will consist of the following:

- Surveying of the pole locations;

  If necessary, drilling of borehole into bedrock to approximately 5 – 8 metres depending upon subsoil/bedrock conditions;
- Installation of power poles;
- Installation of cross arm supports and pole infrastructure;
- Unspooling and stringing of power lines and fiber optic cable;
- Installation of pole mounted disconnect switches as may be required by the electrical design.

2.6.8 Sub-Station Construction

Due to work area requirements for safety, and electrical infrastructure spacing requirements, the sub-station location requires a large level work area for safe operation and the following site dimensions will be used for the Project:

Table 6. Infrastructure and associated dimensions of workspace

Infrastructure	Dimensions of Workspace Required
Total Cleared Work Space	200 metres x 200 metres

- All boundaries are located >30 metres from the high water mark of any water body or wetland;
- Drainage patterns will be maintained by installing adequate crossing structures;

Construction of the sub-station location will consist of the following:

- Surveying of the site boundaries to above noted dimensions;
- Boundaries will be flagged by surveyors;
- Cutting, de-limbing and decking all salvageable timber using feller buncher;

- Following removal of overstory vegetation, lands will be brushed with a bulldozer and backhoe to remove non-salvageable wood and brush. Scrub brush will be piled along disturbance boundaries and will have breaks installed to allow for water flow where necessary;
- Sub-station location may require soil stripping and leveling using a two lift soil stripping method in areas where bedrock is not found at or immediately below the surface.
- If necessary, blasting of uneven surface bedrock will be completed as required. All blasting will be conducted in accordance with the *General Blasting Regulations, N.S. Reg. 77/90*, or any updated versions thereof;
- Following blasting of bedrock, blasted bedrock will be excavated and used as part of the substation sub base;
- Installation of equipment foundations and station ground grid;
- Installation of equipment support structures;
- Installation of substation equipment such as the transformer, switch gear, protection and control systems, control building, conduits, wiring, and terminations

Photo 11. Substation under construction with 4 collection system circuits.

2.6.9 Waste Disposal

All hazardous materials on work sites are controlled under federal and provincial legislation. The legislation requires that employers provide specific information to workers for the safe use, handling, production and storage of hazardous materials on work sites.

There are limited waste by-products created from the wind energy generation process. Some waste will be produced from ongoing maintenance for the turbine facilities (e.g., lube and hydraulic oils). Hazardous waste materials will not be generated in large quantities and will be disposed of through conventional waste-oil and hazardous waste disposal streams as regulated in the province of Nova Scotia.

All solid waste must be properly sorted for recycling, reuse, composting, or landfilling. The segregated materials must be stored in a manner so that they will not degrade, burn, or become buried on site until they are sent to the appropriate, provincially approved waste disposal, recycling, or composting facilities.

Non-hazardous waste will be disposed of through conventional, local waste handling facilities operated by the local municipalities. As appropriate, materials suitable for recycling will be reused and/or recycled.

Controlled products are products, materials, and substances that are regulated by Workplace Hazardous Materials Identification System (WHMIS) legislation. All controlled products fall into one or more of the six WHMIS classes and each has specific handling, transport, storage, and safety requirements. All WHMIS requirements will be managed under the SWI Health & Safety program to be developed at a later date.

3. Environmental Assessment Methodologies

In an effort to identify, minimize and mitigation any environmental effects resulting from the Project, and to also determine limitations on available lands due to environmental, social, topographic, or infrastructure related setback requirements, a series of methodologies were employed during Project development which form the basis of this environmental assessment document.

This chapter details the following key aspects of the environmental assessment methodologies:

A. Biophysical: birds and bats, species at risk, wildlife, vegetation, watercourse identification, aquatic habitats, and wetland assessment and delineation.
B. Archaeological resource: field assessment for archaeological resources.
C. Mi'kmaq Ecological Knowledge Study (MEKs)
D. Noise impact assessment:
E. Visual influence assessment:
F. Electro-magnetic interference assessment

Prior to completion of field activities associated with the environmental assessment process, the project was evaluated to determine site sensitivity and corresponding levels of effort recommended for environmental assessment field studies. This evaluation is described below, followed by the detailed methodologies for all environmental assessment studies completed for the Glen Dhu South Wind Power Project.

3.1 Site Sensitivity

Using the matrix provided in the *Proponents Guide to Wind Power Projects: Guide for preparing an Environmental Assessment Registration Document (*Nova Scotia Environment, 2007, p. 8), the overall level of concern category associated with the Project was determined. The matrix matches the sensitivity of the site and the size of the proposed facility to rank projects into one of four possible categories. Generic guidance is then provided on the nature and extent of recommended baseline information and follow-up requirements for each category. The "level of concern" is therefore relative to other wind energy projects and does not reflect the threat to birds/bats posed by wind energy in comparison to other types of projects.

Table 7. Facility Size

Size	Definition
Very Large	Contain more than 100 turbines
Large	**Contain 41-100 turbines**
Medium	Contain 11-40 turbines
Small	Contain 1-10 turbines

Site Sensitivity

The determination of site sensitivity was undertaken in consultation with the Canadian Wildlife Service (CWS) and the Nova Scotia Department of Natural Resources (NSDNR). The characteristics of the region/area resulted in a potential sensitivity of "High". (Environment Canada, March 2006) Under this classification, the Project area was anticipated to affect one or more of the following characteristics:

- Site contains one or more landform factors that concentrate birds (*e.g.,* islands, shoreline, ridge, peninsula or other landform that may funnel bird movement) or significantly increase the relative height of the turbines;
- Project will disrupt large contiguous wetland or forest habitat that may be of importance to birds;
- Site is located between habitats where large local bird movements occur, or is close to significant migration staging or wintering area for waterfowl or shorebirds;
- Site contains, or is adjacent to, a small colony of colonial birds, such as herons, gulls, terns, or seabirds.
- Site is subject to increased bird activity from the presence of a large heron, gull, tern or seabird colony located in the vicinity of the site.
- Site is subject to increased bird activity from the presence of an area recognised as nationally important for birds (*e.g.,* a National Wildlife Area, Migratory Bird Sanctuary, Important Bird Area, National Park, or similar area protected provincially or territorially because of its importance to birds); and/or, Site contains species of high conservation concern (*e.g.,* birds known to have aerial flight displays, Partners In Flight/CWS priority species, etc.);
- Containing species of high conservation concern (e.g. species listed as "yellow" under NSDNR's General Status of Wild Species).

Based on the known existence of Mainland Moose habitat within and surrounding the Project Area, and the presence of several birds ranked Yellow by NS Department of Natural Resources (NSDNR), the Project was classified as having a "High" potential sensitivity.

Project Category

	Site Sensitivity			
Facility Size	**Very High**	**High**	**Medium**	**Low**
Very Large	Category 4	Category 4	Category 3	Category 2
Large	Category 4	Category 3	Category 2	Category 2
Medium	Category 4	Category 3	Category 2	Category 1
Small	Category 4	Category 2	Category 1	Category 1

Based on the determination of a Large facility size and Site Sensitivity High, the project category for the purposes of the environmental assessment process was determined to be Category 3, as described below.

Category 3. *Projects in this category present an elevated level of potential risk to wild species and/or their habitat(s), and require comprehensive surveys to gather baseline information. These will normally need to be done over the course of one calendar year unless additional concerns are identified in the process (e.g., an unexpected species at risk is found to be present), which could extend the time period. The proponent must apply standards and protocols for bird monitoring specified for "Category 3" projects as defined by Environment Canada and the Canadian Wildlife Service. Preconstruction surveys need to quantify what species are using the area and obtain measures of their relative abundance.*

Based on the Category 3 classification, the methodologies for field surveys were established keeping the recommendations noted above in mind. Baseline information was collected over a period longer than one calendar year, and bird monitoring was completed in consultation with Environment Canada and CWS employing appropriate standards and protocols (CWS 2007).

3.2 Biophysical Assessments

The field components of the biophysical environmental assessment were initiated in 2007 and 2008 during the environmental assessment process for the Glen Dhu North Project. Many field components completed for the Glen Dhu Project were completed across a larger project area that encompassed both the Glen Dhu lands, as well as the Project Lands for the Glen Dhu South proposed Project. These assessments included baseline assessments for birds (breeding bird surveys and migration assessments), bat assessments and a vegetation survey. Monitoring activities for the Mainland Moose have also been completed across the larger project area encompassing the Glen Dhu South Project area. Post construction monitoring for birds and bats has also aided in a better understanding of the biophysical environment of the general area surrounding the proposed Glen Dhu South Project.

Field assessments specific to the Project lands for the Glen Dhu South Project were completed in Summer 2010, and Winter, Spring, Summer and Fall of 2011to comply with the *Category 3* requirements listed in Section 3(A), above. These studies were aimed at highlighting the ecological linkages within the Project area, as well as with the habitats surrounding the Project area. This work included:

1. Breeding bird surveys (Summer 2010 and 2011);
2. Vegetation surveys for priority species (June and August 2011);
3. Aquatic surveys (June, August, September 2011);
4. Bat monitoring using ANABAT detectors (August to October 2011);
5. Opportunistic herpetofauna and mammal survey for priority species (May to September 2011)

6. Transects for Mainland Moose observations (proposed access roads and turbine locations)
7. Additional plant surveys along the roads and at each 100m^2 area around each proposed turbine;
8. Wetland surveys; and
9. Numerous site assessments of the turbine locations and access roads to site locations within identified constraints.

3.2.1 Wildlife Species and Habitats

Assessment of wildlife, including vegetation, and habitat was completed based on the requirements outlined in the Nova Scotia Environment (NSE) *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document* (NSE September 2008). Development of a priority list of species for each taxonomic group was completed based on a compilation of listed species from the following sources:

1) Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Federal Species-at Risk Act (SARA 2003). All species listed as Endangered, Threatened, or of Special Concern.
2) Nova Scotia Endangered Species Act (NSESA 1999). All species listed as Endangered, Threatened, or Vulnerable.
3) Nova Scotia General Status of Wild Species: All species designated as Species of Conservation Concern (Red or Yellow).

This priority list of species was narrowed by broad geographic area (for the Glen Dhu South Project- the geographic area considered was mainland Nova Scotia: North). The priority list of species was then further narrowed by identifying specific habitat requirements for each species. For example, if a listed NSESA species required open water lake habitat, and no open water lake habitat was present inside the Project footprint, this species would not be carried forward to the final list of priority species for field assessments.

The final priority list of species used for field assessments is attached in Appendix II.

Field surveys were completed in Spring and late Summer 2011 to assess for all identified priority species at each proposed turbine and access road location. For this survey, a list of all rare species records found within 100 km of the Project area was also assembled prior to the survey being undertaken (from Atlantic Canada Conservation Data Centre- ACCDC data results) to provide additional information regarding the potential presence of priority species within the Project area.

General vegetation and habitat observations were also noted at each turbine and access road locations across the Project lands.

3.2.2 Avian Monitoring

From 2007 to 2011, bird surveys have been completed on the Glen Dhu South Project lands. All assessment and reporting has been completed by Dr. John Kearney. The following studies have been completed for this Project:

a. Avian Baseline Study and Environmental Impact Assessment, August 2008
b. Update to Baseline Study, Glen Dhu Wind Energy – Phase 2 lands Breeding Bird Survey 2010, April 2011.
c. Update to Baseline Study, Glen Dhu Wind Energy – Phase 2 lands Breeding Bird Survey 2010, April 2011
d. Fall 2011: acoustic nocturnal migration monitoring devices were set up at two locations, one at Glen Dhu WPP and one at Glen Dhu South (near the power transmission line). Fall migration data is available for 2011-2012. However, this data will not be available for several months because it is cutting edge technology and the analysis is time consuming.

The three reports are included in their entirety in Appendix III. A summary of methodologies are included herein and a summary of results are included in Chapter 5.

Additional follow up work has been completed at Glen Dhu (listed below) that although do not relate directly to the Glen Dhu South Project, show the level of commitment and effort that Shear Wind has to understanding and mitigating risks associated with birds on their existing and, now proposed new Project:

2010. The Flight Behaviour of Soaring Birds at the Scarp Face: Glen Dhu Wind Farm Site. John F. Kearney & Associates. For Shear Wind Inc. 11 pp. Risk assessment based on the "Band Risk Assessment Model" of soaring birds at the Bailey's Brook Escarpment.

2010. The Pre-Dawn Descent of Thrushes at the Glen Dhu Wind Farm Site: An Acoustic Study. Prepared by John F. Kearney and Associates for Shear Wind Inc. 15 pp. Aural and digital survey of the flight calls of migratory thrushes during their pre-dawn descent at the highest elevation points on Glen Dhu North.

2011. Annual Report 2010 - Glen Dhu Wind Farm - Bird Monitoring: Construction Phase Breeding Bird Monitoring. John F. Kearney & Associates for Shear Wind Inc. 22 pp. Breeding bird survey and habitat analysis of Glen Dhu North after road and pad clearing but before tower construction.

Baseline Study

Bird surveys were conducted over a 13-month period from June 2007 to July 2008. These consisted of a preliminary assessment (June-July 2007) and four seasonal components; autumn migration (August-October 2007), winter season (November 2007-March 2008), spring migration (April-May 2008), and peak breeding season (June-July 2008). Additional peak breeding season surveys were completed in 2010 and 2011 as follow up to the original assessments. Avian surveys were conducted in accordance with methodologies outlined in *Wind Turbines and Birds: A guidance Document for Environmental Assessment* (Environment Canada/Canadian Wildlife Service, 2006) and the protocols recommended by CWS (2007).

Research methods varied according to the season and to meet the multiple objectives of a baseline study and risk assessment. During the autumn and spring migration periods, three types of surveys were conducted: migration stop-over, nocturnal passage, and diurnal passage.

The winter survey gauged the number of birds overwintering in the study area and their distribution in the different woodland habitats therein. The breeding bird survey measured the number and species of birds that nest in the study area with particular attention to their habitat requirements.

Breeding Bird Survey 2010

The survey of breeding birds in 2010 consisted of three parts: 1) nocturnal monitoring survey, 2) early breeding point counts, and 3) peak season point counts. Nocturnal surveys were conducted following the Guidelines for Nocturnal Owl Monitoring in North America published by Bird Studies Canada (Takats et al. 2001). These surveys focused on the following species that have been detected in the study area: American Woodcock, Barred Owl, Great Horned Owl, and Saw-whet Owl. Surveys took place on five nights from 15 April to 4 May 2010.

The breeding season point counts followed the protocols established by the Canadian Wildlife Service for assessing the impact of wind turbines on birds (Environment Canada 2007). The point counts were 10 minutes in duration and recorded birds in the distance categories from the observer of <50 metres, 50-100 metres, >100 metres, and flying overhead. Forty early breeding point counts were conducted from 6 to 19 May 2010. These point counts along with an additional one hundred and twenty-five peak season point counts were surveyed again from 3 to 29 June 2010.

Notes were taken on the breeding status of each species observed and classified as to whether they were possible, probable, or confirmed breeders, using the criteria developed for the Maritimes Breeding Bird Atlas. Species of special conservation concern, identified in the baseline study, were monitored during the surveys. In addition, habitat changes since the baseline study was recorded at each of the point counts stations.

Breeding Bird Survey 2011

The survey of breeding birds in 2011 consisted of three parts; 1) nocturnal monitoring survey, 2) early breeding point counts, and 3) peak season point counts. Nocturnal surveys were conducted following the Guidelines for Nocturnal Owl Monitoring in North America published by Bird Studies Canada (Takats et al. 2001). These surveys focused on the following species that have been detected in the study area: American Woodcock, Barred Owl, Great Horned Owl, and Saw-whet Owl. Due to the frequency of rain and high winds during the 2011 breeding season, only one nocturnal survey was successfully completed (May 14).

The breeding season point counts followed the protocols established by the Canadian Wildlife Service for assessing the impact of wind turbines on birds (Environment Canada, 2006). The point counts were 10 minutes in duration and recorded birds in the distance categories from the observer of <50 metres, 50-100 metres, >100 metres, and flying overhead. Twenty-one early breeding point counts were conducted from 6 to 17 May 2011. These point counts along with an additional one hundred and six peak season point counts were surveyed again from 7 June to 3 July 2011.

Notes were taken on the breeding status of each species observed and classified as to whether they were possible, probable, or confirmed breeders, using the criteria developed for the Maritimes Breeding Bird Atlas. Species of special conservation concern, identified in the baseline study, were monitored during the surveys. In addition, habitat changes since the baseline study was recorded at each of the point counts stations.

Post Construction Bird and Bat Monitoring for the Glen Dhu WPP

Post-construction bird and bat monitoring (carcass searches and follow up survey programs matching the level of effort completed in 2007 and 2008 during baseline assessments) is currently on-going at the Glen Dhu Wind Power Project. These studies help inform the proponent and the environmental team on actual impacts to birds and bats just north of the proposed Project area, allowing for potential mitigation before the fact relating to the positioning of turbines associated with the Glen Dhu South proposed Project.

3.2.3 Bat Monitoring

Monitoring for bats occurred across the Project Area in 2007 as part of the original baseline assessments for Glen Dhu Project as well as in 2011 as part of the environmental assessment field surveys for Glen Dhu South Project. The methodologies used were as follows:

2007 Assessment

Monitoring for bats was completed during original baseline assessments for Glen Dhu in late summer and fall 2007 by Dr. Hugh Broders. A total of two (2) ANABAT™ detectors were deployed for varying lengths of time during this assessment. Bat assessment was also completed during the fall migration period in 2011, at a total of four (4) locations across the Glen Dhu South Project lands.

ANABAT™ is a system designed to help users identify and survey bats by detecting and analyzing their echolocation calls. It carries a strong emphasis on passive detection, in which the detector is used as a logging device to monitor bat activity in the absence of human intervention. We used Anabat II detection systems to sample the echolocation calls of bats. Each system was deployed at ground level and consisted of an ultrasonic Anabat II detector interfaced to a CF Storage ZCAIM (Titley Electronics Ltd., NSW Australia). The seasonal timing of the sampling period corresponded to fall migration activity by migratory species and movement by resident species to local hibernacula.

During the 2007 assessment, activity was monitored at two locations (Location 1, 562682 E 5046999 N, Location 2, 559491 E 5046981 N; UTM NAD83 Zone 20 format). Detectors were placed along forest edges to maximize recordings of bats commuting or foraging in the area. Monitoring at location 1 began on the evening of 17 August 2007 to the morning of 24 August 2007 and continued from the evening of 30 August 2007 to the morning of 07 September 2007. Monitoring at location 2 was completed from the evening of 17 August 2007 to the morning of 07 September 2007.

Identification of many bat species is possible because of the distinctive nature of their echolocation calls (Fenton & Bell 1981; O'Farrell et al. 1999). Species were qualitatively identified from echolocation sequences by comparison with known echolocation sequences recorded in this and other geographic regions. In the case of species in the genus Myotis (northern long-eared and little brown bat), we did not identify sequences to the species level, as their calls are too similar to be separated. Identifications were accomplished using frequency-time graphs in ANALOOK software (C. Corben, www.hoarybat.com). A bat call sequence, defined as a continuous series of greater than two calls (Johnson et al. 2004), was used as the unit of activity.

2011 Assessment

McCallum Environmental Ltd. used Anabat bat detectors in 2011 (Titley electronics, Ballina, NSW, Australia) to passively record the echolocation calls of bats within the study area. The seasonal timing of the sampled period likely corresponded to the end of the summer residency period and the fall migration period (Griffin, 1945; Kunz et al., 2007). Four detectors sampled at ground level for varying periods of time during the study period. Additionally, one system was deployed on a meteorological tower on a hoist located 30 m Above Ground Level (AGL).

Table 8. Anabat Monitoring Locations, Fall 2011

Anabat #	Anabat Location	Coordinate NAD83 UTM Zone 20T	Date Deployed	Date Removed	Notes
Anabat 1	Turbine 22- on the ground	561062.02 m E 5051217.89 m N	August 12, 2011	October 24, 2011	On the ground entire time
Anabat 2	SE MET tower	563287.24 m E 5045237.94 m N	August 12, 2011	September 8, 2011	On the ground entire time
Anabat 3	NW Met Tower – turbine 6	558461.25 m E 5052699.24 m N	August 12, 2011	October 3, 2011	On the ground entire time.
Anabat 4	SW MET tower	559486.30 m E 5046899.60 m N	August 19, 2011	October24, 2011	Aug 19- up on hoist Aug 26- brought down to the ground – pending hurricane Sept 8- put back up hoist

Anabat 1: located in a shrub clearing with small coniferous trees near a mature forest and along the edge of woods road. No significant water near this location. The sensor was located in a grove of small trees deployed on the ground at 1 m height above the ground.

Anabat 2: located in a shrub clearing where a MET tower is located. No significant water near this location. The sensor was deployed on the ground at 1 m height above the ground.

Anabat 3: located in a shrub clearing at the edge of a woods road near the MET tower. No surface water at this location. The sensor was deployed on the ground at 1 m height above the ground.

Anabat 4: located at the MET tower and deployed at 30 m height on a bat trolley/hoist. This detector was up on the MET tower for the entire period with the exception of a short window where it was brought down pending a forecasted hurricane.

The four Anabat detectors were deployed to cover the Project area in order to gain a general understanding of bat species present in the area. The locations were identified to reflect where turbines were most likely to be placed (locations with good wind regime, near existing road infrastructure). The locations were also chosen at the edges of forested habitat, near water if possible, and at MET tower locations where a bat trolley was present to allow for collection of information at varying heights.

The detecting distance of the Anabat is affected by a number of factors, the most important one being the species of bat. Bats with high frequency, quiet or directional calls (such as horseshoes or long eared bats) may only be detected at distances of typically less than 5 metres. Bats with low frequency and loud calls such as Noctules and Serotines may be detected as far away as 100m or more. The detection range is therefore dependent on the sound characteristics of the call rather than the detector, although the most receptive zone of the Anabat is within a 90 degree cone in front of the microphone.

The raw acoustic files collected by McCallum Environmental Ltd. were then analysed, once again by Dr. Hugh Broders. The objectives of this Project were:

(1) To provide information on occurrence and relative magnitude of activity level in the proposed development area, based on analysis of acoustic data;
(2) To provide relevant information on resource requirements of local species that might be useful for informing the decision-making process on the proposed development; and,
(3) To make any relevant recommendations based on the results of this Project and any recent developments in the field.

Identification of many bat species is possible because of the distinctive nature of their echolocation calls (Fenton and Bell, 1981; O'Farrell et al., 1999). Species were qualitatively identified from echolocation sequences by comparison with known echolocation sequences recorded in this and other geographic regions. In the case of species in the genus *Myotis* (northern long-eared bat and little brown bat), there was no attempt to identify sequences to the species level, as their calls are too similar to be reliably separated. Identifications were accomplished using frequency-time graphs in ANALOOK software (C. Corben, www.hoarybat.com). An Anabat echolocation file approximates a call sequence, defined as a continuous series of greater than two calls (Johnson et al., 2004), and this was used as the unit of activity.

3.2.4 Wetlands & Aquatic Surveys

A desktop review of available topographic maps, appropriate provincial databases and aerial photography was completed to aid in determination of wetland habitat and watercourses on the Project Site. Predicted wetland areas were identified from the NSDNR Sensitive and Significant Habitats Database. Stereo pairs of air photos were also consulted as a predictor of where wetlands may exist within the landscape. Topography maps were reviewed (1:50,000, 1:30,000, and 1:10,000) to identify all mapped watercourses.

During field surveys conducted between June 1 and August 31st, 2011, each proposed turbine and access road location was assessed in the field for the presence of wetland habitat and compared against the predicted wetland areas from the desktop review. All watercourses observed at each turbine and access road location were field assessed for general characteristics, fish habitat and navigability.

Although few NSDNR mapped wetlands and few shallow water table areas appeared to exist within the Project area based on the desktop review, several wetlands were identified during field surveys. As much as was possible, turbine and access roads were moved in order to avoid field and desktop identified wetlands. Where it was not possible to fully avoid, or where it was identified that development would occur within 100 metres of observed wetland habitat, the identified wetland was delineated.

Delineation was completed based on micro-topography, and observed surface hydrology and vegetation and soils in accordance with Nova Scotia Environment wetland delineation methodology. Wetlands were delineated by an approved wetland delineator (Meghan Milloy). Wetland boundaries were documented using a handheld Garmin Summit ETrex GPS unit. Any inlet and outlet streams or features to each wetland were marked during the delineation processes and walked and mapped as necessary where stream crossings may be required for access.

All wetland data was then used in constraints modeling to identify key functions and values for each identified wetland that might be directly affected by Project construction.

All identified watercourses located along proposed access roads or turbine locations in the Project area were assessed. Each watercourse was walked and stream habitat was assessed, morphological channel measurements were taken, and pool habitats were visually observed for presence of fish

The locations of sensitive wetland habitats and water course features were mapped as shown in various Figures throughout the document and were then considered as biological constraints to the layout and development of the proposed Project.

3.2.5 Herptofauna and Mammal Surveys

Herptofaunal searches of rock outcrops, deadfall, wetland, and stream habitats were conducted and incidental observations were recorded during completion of other field surveys. No targeted mammal surveys were undertaken, other than surveys associated with the Mainland Moose, described in the following section. Incidental observations of mammals and various mammal signs across the Project area were documented and photographed during field surveys. Signs included such features as dens and nests, scat, tracks, and forage evidence. Herptofaunal and mammal observations were collected between April and October 2011.

3.2.6 Mainland Moose Assessment

Assessment of the Mainland Moose has been an integral component of all environmental assessment studies the existing Glen Dhu WPP since the commencement of the Project in 2007. Monitoring and research efforts commenced during environmental assessment activities for the Glen Dhu WPP and have continued as part of the terms and conditions of the operational Glen Dhu Wind Power Project.

SWI is committed to monitoring for the presence of the Mainland Moose for the Glen Dhu Wind Power Project. These monitoring efforts include:

- Three snow tracking surveys (snowmobile) per year
- One aerial survey every three years
- One moose pellet group inventory per year

SWI committed to expansion of the required monitoring efforts for Glen Dhu WPP to a broader area to encompass the Glen Dhu South proposed Project lands during the initial stages of monitoring associated with Glen Dhu WPP. All snow tracking and aerials surveys completed have been completed with a larger Project area encompassing both the Glen Dhu WPP and the proposed Glen Dhu South lands.

Snow Tracking Surveys

Two (2) snow tracking surveys were completed on the Project lands in 2011, encompassing an area including both the existing Glen Dhu Project area and the Glen Dhu South Project area. These snow tracking surveys involve teams of snowmobilers completing transects on snowmobiles across the Project area along existing and heavily used snowmobile trails. Survey teams were looking for sightings of moose and deer, as well as for observable tracks, pellets and carcasses/antlers of the Mainland Moose.

UTM coordinates were recorded using GPS wherever moose and deer track-ways crossed survey trails, or occurred within or adjacent to survey trails. Any unusual sightings (i.e. a moose or deer carcass, bear den, etc.) were photographed with a digital camera and UTM coordinates recorded.

The first survey was completed on January 18-20, 2011 by John Thompson and Adam Hunter, local residents of the Pictou area. This survey involved completion of over 117 km of transects across the Project area, commencing the day after a significant snow fall of 10 cm. The second survey was completed on March 26, 2011, the day after 10 cm of fresh snow by John Thompson and Adam Hunter. This survey covered the same transects as the January 2011 survey.

If proper snow conditions arise before the end of 2011, a third survey is planned for December 2011.

Aerial Survey

An aerial survey was completed on January 28, 2011. A survey team consisting of three individuals (Robert McCallum, Meghan Milloy and Gary Gregory), and the pilot, completed the survey in a Bell 206 JetRanger helicopter operated by Vision Air. The helicopter was equipped with one front seat observer and navigator, a GPS referenced digital camera, as well as two back seat observers. The aerial survey covered approximately 13,400 hectares of land. Ten to fifteen centimeters of fresh snow fell in the area the day before the aerial survey was completed.

On the day of the survey, skies were clear, visibility was excellent and in excess of 30 km, winds were light and a complete ground cover of snow was present across the entire survey Area. A GPS unit with map display was used as a navigational tool to ensure complete coverage of the survey area. The pilot had pre-programmed transects across the Project Area into the aircraft system. These transects ranged from 500 m to 1500 metres apart depending on ground cover and area. Whenever possible, the aircraft maintained an altitude of 150 m above ground and an air speed of no more than 60 knots. Additional selected areas (i.e. river/stream valleys, gorges, cleared areas, and low spots) were also assessed, especially near the eastern edge of the Project Area.

The location and time of each observation was recorded as a GPS waypoint on the aircraft's GPS system. Waypoints and track-logs were saved as MapSource files. As the survey progressed and the visibility and overstory allowed, transects were spread out. Over deciduous stands, the visibility was much improves and wider transects were appropriate. Over coniferous stands, visibility was poor due to tightly packed stands, so transects were narrowed to better view the area.

Moose Pellet Group Inventory

Moose pellet group inventories (transects on foot) were completed in May 2010 and 2011 by Jody Hamper (a local resident of the Pictou area). These surveys were completed on foot along a series of transects (15 in total) varying in length from 0.66 km to 2.95 km in length across the Glen Dhu North Project Area recording all information regarding moose and deer presence.

Moose pellet group inventories were also completed in December 2011 by Jody Hamper inside the Glen Dhu South Project area. These surveys were also completed on foot along a series of transects (8 in total) varying in length from 0.5 to 1.1 km in length. Mr. Hamper recorded all information regarding moose and deer presence along these transects.

Research Efforts

Shear Wind Inc. is currently working with the Canadian Wind Energy Association (CANWEA) to approach other wind developers across Canada to collaborate monitoring results, research results and observations regarding the Moose and its interaction with wind power projects.

In May 2011, Shear Wind contacted CANWEA to initiate collaboration with other wind power developers across Canada with regards to the Moose and its interactions with wind projects. The contact at CANWEA is Lijla Latifovic. She requested that Shear Wind provide a letter for distribution to CANWEA membership. This letter was drafted and sent to CANWEA in May 2011 and is attached to this environmental assessment in Appendix IV.

Several months passed, with active communication on Shear Wind's part with CANWEA, but little action on CANWEA's part with respect to circulation of this letter. Eventually, in September 2011, they acted on the initial request of May 2011 and distributed the letter by email to its membership.

On Wednesday May 4, 2011 Shear Wind was contacted by a consulting company in Waterloo Ontario, which was in the process of completing a research/literature search on the effects of wind power projects on ungulates. The company asked if Shear Wind would provide the results of the mainland moose monitoring at the Glen Dhu Project. The information was subsequently provided to them. Since that time the company decided to write an anecdotal account of observations of moose in and around operational wind farms that they have monitored. They are working on submitting this to a wind magazine but will likely have an in press copy ready in January, but the publication date (if there is one) is unknown.

2011 Field Assessment

Field assessment for the Mainland Moose was completed during the spring and summer 2011 as part of field surveys across the Glen Dhu South Project area. An initial meeting was held on May 31, 2011 with Mark Pulsifer (Wildlife Biologist, NSDNR, and Chair, Mainland Moose Recovery Team) to discuss methodologies relating to these field surveys. In this meeting, Mr. Pulsifer suggested the following points relating to methodologies and determination of potential effect:

- Describe the habitat as it relates to the Mainland Moose
- Record presence/absence of the Mainland Moose in the habitat
- Sample all habitat types across the Project area
- Discuss the incremental effects on the landscape (fragmentation) as a result of the Project and its potential impact/effect on the Mainland Moose
- Discuss the potential impact/effect of an increase in human access to the habitat as a result of the Glen Dhu South Project.

These suggestions were incorporated into field surveys during the spring and summer 2011. Transects were walked at all 77 candidate turbine locations (lengths varying from 100 m to 500 m). All identified wetlands were also delineated and assessed in the field, and all observations of the Mainland Moose were recorded (scat, browse, presence of moose, tracks). All observations were documented and GPS coordinates recorded. The general habitat types across the Project area were identified and transects completed assessed all types of habitats present. Results and discussion of effect/impact are outlined in Chapter 5.

3.3 Archaeological Resource Assessment

Davis MacIntyre and Associates Limited were retained to complete an archaeological resource impact assessment for the Glen Dhu Wind Power Project in June 2010. This assessment consisted of two components:

i. Phase I archaeological resource impact assessment
ii. Field reconnaissance Phase II archaeological resource impact assessment

The methodologies of these two components are described below.

3.3.1 Phase I

The assessment included consultation of historic maps, manuscripts, and previous archaeological assessments as well as the Maritime Archaeological Resource Inventory in order to determine the potential for archaeological resources in the study area. A previous archaeological assessment for the Glen Dhu Wind Power Project was conducted Davis Archaeological Consultants Limited in 2007 and 2008 (Heritage Research Permits A2007NS45 and A2008NS41) and covered much of the area being considered for this second phase of development. An archaeological reconnaissance of the study area was also originally conducted, although no significant archaeological features were encountered within the study area at that time.

As part of this assessment, a historic background study was also conducted. Historical maps and manuscripts and published literature were consulted at Nova Scotia Archives and Records Management in Halifax. The Maritime Archaeological Resource Inventory, held at the Nova Scotia Museum's Heritage Division, was searched to understand prior archaeological research and known archaeological resources neighboring the study area.

3.3.2 Phase II

A field reconnaissance of the proposed impact areas (access roads and turbine candidate sites) was conducted by Stephen Davis and Laura de Boer between 3 October and 14 October 2011. A total of 77 candidate sites for turbine locations were visited.

Many proposed access roads are centered on existing mountain or woods roads, enabling easier access to the candidate sites. Both existing roads in need of upgrades and proposed roads were included in the reconnaissance, as was a radius of at least 100m around each proposed candidate turbine location to allow for the broad square of terrain that is impacted by the installation of a turbine pad. GPS tracklogs of all reconnaissance areas were retained for records, and any sites determined to have potential for archaeological resources were recorded with photographs and GPS coordinates. The terrain and vegetation at each of the candidate sites was noted in the interest of recording negative evidence for historic cultural activity.

3.4 Mi'kmaq Ecological Knowledge Study (MEKS)

A Mi'kmaq Ecological Knowledge Study was completed by The Confederacy of Mainland Mi'kmaq (CMM) (Sid Peters) in 2011. The MEKS scope included:

1) A study of historic and current Mi'kmaq land and resource use;
2) An evaluation of the potential impacts of the Project on Mi'kmaq use and occupation and constitutionally based rights;
3) An evaluation of the significance of the potential impacts of the Project on Mi'kmaq use and occupation; and
4) Recommendations to proponents and regulators that may include recommendations for mitigation measures, further study, or consultation with Mi'kmaq.

Research was completed from within The Confederacy of Mainland Mi'kmaq research department library as well as external sources from the Nova Scotia Public Archives, Nova Scotia Museum, Cape Breton University's Mi'kmaq Resource Centre and the Colchester library. Secondary sources include Crown Land index sheets, church records, cemetery record, maps and published papers and books on Nova Scotia History.

Current Mi'kmaq land and resource use occurred within living memory or is presently occurring. The MEKS includes a study of:

1. Current Mi'kmaq land and resource use sites
2. Species of Significance to Mi'kmaq
3. Mi'kmaq Communities

Mi'kmaq knowledge on current land and resource sites will be gathered through a review of information collected through oral interviews with Mi'kmaq knowledge holders. All individuals, whom will be interviewed, will sign consent forms. Knowledge will be gathered in accordance within the spirit of the *Mi'kmaq Ecological Knowledge Protocol.*

Knowledge collected is reported in a general format only. No names or specific locations are published. Collected knowledge will be digitized and compiled to allow for an analysis of potential impacts of the Project on current Mi'kmaq land and resource use.

A system of stratified random sampling was employed to identify flora species present in the study areas of significance to Mi'kmaq. Plants were surveyed in the spring and fall of 2011. Information collected is reported in a general format only. The names of the species are not recorded.

A review of outstanding specific land claims within the study area was undertaken by CMM. There are no known specific land claims identified within the Project area, however, the record of outstanding specific land claims in no way infers that specific land claims may not arise in the future.

3.5 Noise Impact Assessment

The objectives of the Noise Impact Assessment (NIA) are to:

1. Confirm the sound level limit requirements for the Project;
2. Predict the noise levels generated by the Project and adjacent existing projects at all Points of Reception within 2 km of the turbines.
3. Compare the predicted sound level from the Project with the sound level limit.

The NIA also provides information on the noise sources, the prediction method and the parameters used for the assessment.

As Shear Wind also owns and operates the existing wind farm adjacent to Glen Dhu South comprised of 27 Enercon E82 2.3MW WTGs, and its noise contribution are included in the analysis.

116 receptor locations (i.e. Points of Reception) for the Project were validated on-site. 24 of the validated 116 Points of Reception are located within 1.5 km of a Glen Dhu South wind turbine and were considered in the analysis.

The height of these validated dwellings was set to 1.5 m and 4.5 m AGL for 1-storey and 2-storey dwellings respectively.

Since specific modeling parameters are not mentioned in the referenced documents, an approach similar to other nearby Canadian jurisdictions has been taken for this analysis. This approach includes using worst case parameters from the Ontario Noise Guidelines and the Quebec “Dévelopement durable, Environnement et Parcs” noise guidelines as inputs into the Glen Dhu South analysis.

The cumulative effect that the substations of both wind farms included in this analysis would have on nearby residents has been considered. Noise emission from each substation mainly originates from one (1) high-voltage step-up transformer.

The predicted overall (cumulative) sound pressure levels at each critical noise receptor for the aggregate of all wind turbines associated with the Project were calculated based on the ISO 9613 method, using the CadnaA software. The simulation was run with the noise emission ratings of the wind turbines and substation transformer.

3.6 Visual Influence

The degree of visibility of the wind turbines depends on their number, their relative distance, and on the span of their layout. The visibility of a project is evaluated with two tools.

The first tool is the zones of visual influence (ZVI) cartography. It illustrates the degree of visibility across the overall study area by taking into account the locations of the wind turbines and the topography of the study area. Vegetation cover and existing structures are not considered.

The second tool is the photomontages. Photomontages are produced by the superimposition of a technical drawing that shows wind turbines on the photograph of a landscape. Photomontages allow the appreciation of the degree of perception from specific viewpoints that are selected for their representativeness or for their sensitivity (inhabited areas, road of moderate to high traffic, trails and/or tourist attractions). Photomontages underline the importance of land components such as topography, vegetation cover and existing structures which all influence the degree of visibility of the wind turbines.

3.7 Electro-magnetic Interference (EMI) Assessment

A system inventory was compiled for potential receptors surrounding the Glen Dhu South Project area.

This system inventory is consistent with the requirements of the documents: *Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar Systems, Radio Advisory Board of Canada and Canadian Wind Energy Association, 2010* (RABC/CanWEA, 2010) and *the Guidelines for a Technical Engineering Report on the Impacts of Wind Turbines on CBC/Radio-Canada Services, Canadian Broadcasting Corporation - Société Radio-Canada Services, June 2008* (CBC, 2008).

4. Site Optimization, Constraints Analysis & Turbine Site Selection

A key aspect of planning a wind power project is the determination of project lands for the development and the subsequent identification of specific turbine locations within these lands.

This chapter details how Shear Wind determined project lands and turbine locations:

A. Site Optimization: determination of the most appropriate location for the project to minimize overall impact on the landscape.
B. Project Level Constraints Analysis: analysis used to determine appropriate lands for the project.
C. Turbine Level Constraints Analysis: assessment within identified project lands to determine available lands for the placement of wind turbines.
D. Turbine Site Selection: final determination of optimal turbine locations based on the wind resource, engineering and turbine manufacturer requirements, and environmental and social considerations.

4.1 SITE OPTIMIZATION

This section describes how multiple factors were considered in order to determine the project footprint in the Glen Dhu South Project area. These factors include technical (i.e. wind resource), financial, construction, socio-economic, landowner, biophysical constraints, as well as community and stakeholder feedback (from the draft submission of the registration document).

Detailed planning and analysis was completed over a period of one year to determine available lands (based on the factors described above) and to ensure that the turbines were placed within the smallest available Project lands footprint. Minimization of the Project footprint was a very important factor considered while planning this Project. This allowed SWI to reduce the impact on the local area and reduce habitat fragmentation, but also to minimize costs associated with the development of the balance of plant (BOP) to help maintain an economically viable project.

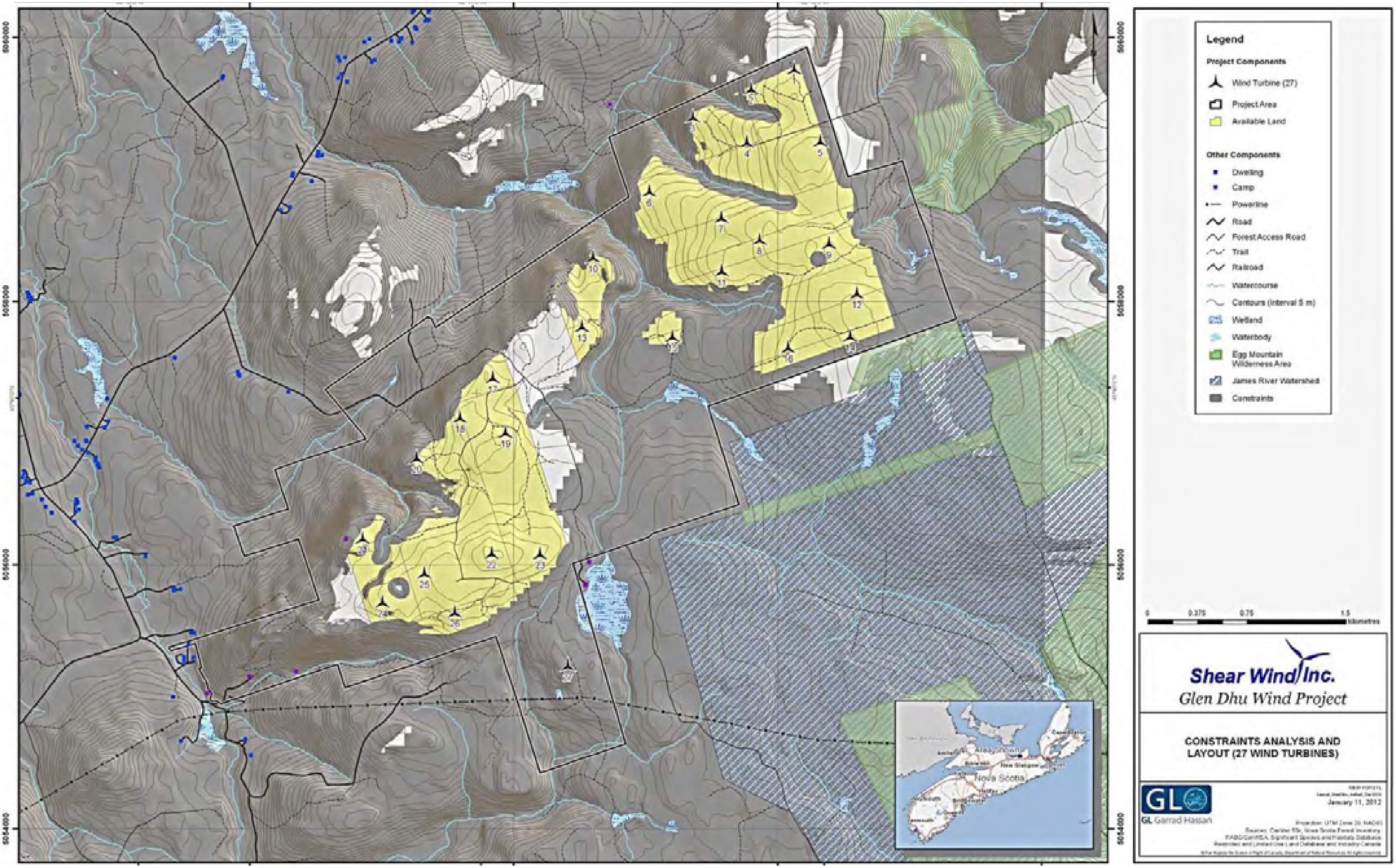
4.1.1 Glen Dhu North Project Area

Following the draft submission of the registration document Nova Scotia Department of Natural Resources [NS DNR] asked SWI to consider including additional turbines within the existing Glen Dhu North Project area.

Completion of detailed and comprehensive engineering and environmental constraints analysis during the original planning process for Glen Dhu North provides a detailed understanding of available turbine locations within that area footprint. Within the Glen Dhu North footprint, 27 turbine locations were identified as final locations and developed with Enercon E-82, 2.3MW turbines. All available identified locations were used as final turbine sites during development of Glen Dhu North (27 sites). Figure 4 shows the constraints for the Glen Dhu North Project Area and is provided to visually demonstrate the available lands within the Project area for further turbine placement. These constraints are discussed below:

A. Two centrally located PIDs within the project footprint were not available to the proponent for turbine placement. A single easement was provided across the northern edge of these parcels of land for access (road development) but the landowner was not interested in having turbines on his property.
B. The southern half of a centrally located PID within the project footprint was identified as a large area of wetland habitat and is not suitable for turbine placement.
C. The eastern section of several PIDS near the eastern edge of the project footprint was not available for turbine placement for several reasons. First, these properties are adjacent to the James River Protected Watershed Area and the Eigg Mountain Wilderness Area, and during original consultation with NS DNR, there was a request to buffer the eastern project boundary of Glen Dhu North to increase distance from these protected areas. Second, there is a current road and watercourse along the eastern sections of these PIDs, making turbine placement technically challenging in the eastern section of these properties. For both these reasons together, this area of the project footprint is not available for further turbine placement.
D. There are several watercourses and associated buffer areas which have been avoided with the Glen Dhu North Project Area.
E. There are several wetlands with in the Glen Dhu North Project area which have been avoided.
F. There are areas within the Project footprint where slopes exceed 15% and therefore these areas are not available for turbine placement.
G. Wake and Turbulence of Wind Resource: There is no available room to place additional turbines within the Glen Dhu North Project area due to turbine design specifications associated with the high ambient turbulence of the wind and interference (wake) that turbines can cause on one another. Additional wind conditions characteristic of the site (*high wind shear*- variation of the wind speed with height, *significant in-flow angle –* verticality of the wind flow, and *extreme wind speeds during frequent storms and high air density*) provide challenges when identifying a turbine model.

Completing the initial turbine layout was a challenge for many turbine manufacturers given the engineering constraints. (As a result, many manufacturers declined to install their turbines in the wind conditions characteristic of the site (high ambient turbulence intensity and in-flow angle)).


Legend
Project Components
Wind Turbine (27)
Project Area
Available Land
Other Components
Dwelling
Camp
Powerline
Road
Forest Access Road
Trail
Railroad
Watercourse
Contours (interval 5 m)
Wetland
Waterbody
Egg Mountain Wilderness Area
James River Watershed
Constraints
0
0.375
0.75
1.5
kilometres
Shear Wind Inc.
Glen Dhu Wind Project
CONSTRAINTS ANALYSIS AND LAYOUT (27 WIND TURBINES)
GL Garrad Hassan
January 11, 2012
Area Shown
New Glasgow
Nova Scotia

4.1.2 Expansion Planning: Glen Dhu South Project Area

SWI commenced consideration of expansion of the Glen Dhu Wind Power Project during construction of Glen Dhu North. Constraints were established surrounding the Glen Dhu North Project area as part of identification of the smallest possible project footprint for expansion.

The Project lands cannot be expanded to either the north or to the west as there is severe drop in elevation. Furthermore, proximity to homes north of the Project limit further development in this direction. As mentioned above, the presence of the Eigg Mountain Wilderness Area and the James River Protected Watershed Area to the east prohibit expansion east.

There is a significant gully with a watercourse located between the current Glen Dhu North Project area, and available land for expansion to the south. SWI approached potential landowners with an understanding that reduction of the project footprint to reduce the overall impact of the wind power project was a key planning requirement. Landowners were approached who were adjacent to the current Glen Dhu North project area, directly on the south side of the gully.

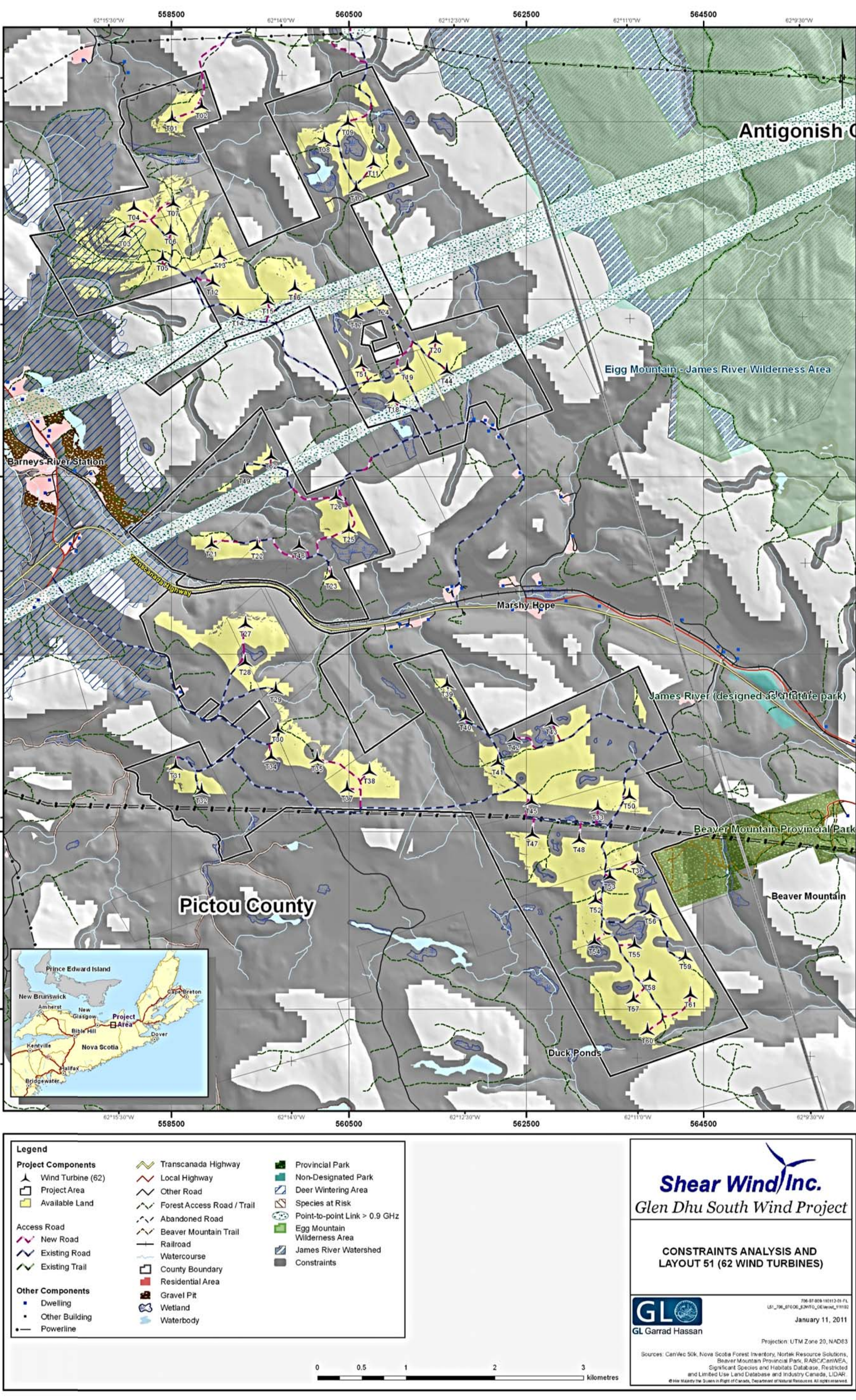
The process of identifying available land south of the Glen Dhu North Project area involved considering how to minimize the Project footprint. Figure 5 shows the constraints identified for the Glen Dhu South Project area. The Project areas identified were chosen for the following reasons:

1. **Appropriate wind regime** to make the Project economically viable (Figure 5 includes as a constraint land with wind speeds below a 7 m/s cut off);
2. Presence of **adjacent and numerous freehold lands** for placement of turbines;
3. **Detailed biophysical and technical assessment** of the area and key landowner interest and commitment allowed for identification of potential lands for expansion. During construction monitoring of the existing Glen Dhu Project, numerous and extensive site assessments were completed throughout the new Project lands to help identify biophysical and topographic constraints, access, and resource issues that could significantly affect the Project. Additional lands to the south and east were also assessed to determine if areas with reduced biophysical impacts could be identified.
4. **Existence of network of current road infrastructure** to reduce overall habitat fragmentation and reduce overall project costs. Although this road network is for forestry, many of the roads are semi-permanent in nature. The Project lands chosen represent lands that are already fragmented by significant forestry activities and other human activities that are occurring throughout the Project area. Over 60% of the proposed road layout is on existing roads across the Project area. The John Munroe Road, the Weaver Mountain Road and several other unnamed roads throughout the Project Area are used for forestry activities, commercial activities including blueberry production and Christmas tree production, ATV usage, snowmobile trails, hunting,

seasonal camping and other outdoor activities. These roads are on average 6 m wide with a significant gravel base, and many roads have significant cleared road shoulders. The fact that this road network exists within the proposed Project, and that SWI has incorporated as many of these existing roads as possible within the turbine layout will dramatically reduce new habitat fragmentation during project development.

5. **Relatively level topography and land characteristics** to allow placement of turbines as close together as practical to minimize project footprint;
6. Ability to place turbines to **meet regulatory setbacks for sound** from receptors;
7. Ability to place turbines to **meet municipal setbacks from property lines and residences**;
8. **Proximity to the existing Glen Dhu WPP** to allow for use of existing access roads within that Project, and existing transportation routes.;
9. **Proximity to the NSPI transmission corridor** to connect the Project to the grid without a significant length of interconnection from the substation;
10. **Landowner acceptance** of the Project;
11. Presence of **Beaver Mountain Provincial Park** to the east of the Project area limited the project footprint in this direction;
12. **Same land use** (forestry) across the entire Project area;
13. **No unique or isolated habitat types** identified within the Project area;
14. Suitable available land area to allow for **adequate setbacks between turbines**. Turbines can only be placed a certain distance from each other to limit the wind turbulence they create which can interfere with adjacent turbines. This interference makes each turbine less productive. Furthermore, turbine manufacturers will not allow turbines to be erected if the threshold for turbulence intensity is exceeded (as defined by the IEC Design Class of the turbine [IEC 61400-I Standard]). The turbines presented in this document inside the Glen Dhu South Project area are as close together as technically possible, based on the GE1.6-100 turbine.
15. Once an initial layout was completed, the layout was reviewed by the turbine manufacturer. The manufacturer verified the suitability of their turbine design with the wind conditions of the site and the layout provided to them by SWI.

Shear Wind Inc. understands the importance of minimization of the project footprint in order to protect habitat and reduce overall fragmentation of the landscape for wildlife, at risk species, and general ecosystem health. SWI is committed to ensuring that reduction of the Glen Dhu South Project footprint will be a key planning goal during all stages of project development.


558500
560500
562500
564500
62°15'30"W
62°14'0"W
62°12'30"W
62°11'0"W
62°9'30"W
Antigonish C
Eigg Mountain - James River Wilderness Area
Barneys River Station
Transcanada Highway
Marshy Hope
James River (designed as a future park)
Beaver Mountain Provincial Park
Beaver Mountain
Pictou County
Duck Ponds
T01 T02 T03 T04 T05 T06 T07 T08 T09 T10 T11 T12 T13 T14 T15 T16 T17 T18 T19 T20 T21 T22 T23 T24 T25 T26 T27 T28 T29 T30 T31 T32 T33 T34 T35 T36 T37 T38 T39 T40 T41 T42 T43 T44 T45 T46 T47 T48 T49 T50 T51 T52 T53 T54 T55 T56 T57 T58 T59 T60 T61 T62
Prince Edward Island
New Brunswick
Amherst
New Glasgow
Project Area
Cape Breton
Bible Hill
Nova Scotia
Dover
Kentville
Halifax
Bridgewater
Legend
Project Components
Wind Turbine (62)
Project Area
Available Land
Access Road
New Road
Existing Road
Existing Trail
Other Components
Dwelling
Other Building
Powerline
Transcanada Highway
Local Highway
Other Road
Forest Access Road / Trail
Abandoned Road
Beaver Mountain Trail
Railroad
Watercourse
County Boundary
Residential Area
Gravel Pit
Wetland
Waterbody
Provincial Park
Non-Designated Park
Deer Wintering Area
Species at Risk
Point-to-point Link > 0.9 GHz
Egg Mountain Wilderness Area
James River Watershed
Constraints
0 0.5 1 2 3 kilometres
Shear Wind Inc.
Glen Dhu South Wind Project
CONSTRAINTS ANALYSIS AND LAYOUT 51 (62 WIND TURBINES)
GL Garrad Hassan
January 11, 2011
Projection: UTM Zone 20, NAD83
Sources: CanVec 50k, Nova Scotia Forest Inventory, Nortek Resource Solutions, Beaver Mountain Provincial Park, RABC/CanWEA, Significant Species and Habitats Database, Restricted and Limited Use Land Database and Industry Canada, LIDAR.

4.2 CONSTRAINTS ANALYSIS

Once the more general process of site optimization was completed and a Project area confirmed, more detailed and site specific process of constraints analysis was completed as a major component of project planning and final turbine micro-siting.

A constraint can be specified as something to *maintain* or something to *avoid*. Many constraints can be expressed either way, such as to maintain a certain separation between known classes of objects. The desired effect of constraints analysis is to reduce the number of possible non-compliant results of Project development, while at the same time increasing the proportion of acceptable ones. A constraint can be *independent* or *contextual*. Independent constraints consider only one object, e.g., the setback distance around a known species at risk. Contextual constraints consider relations between objects, e.g. Use of a habitat area by a species at risk, resulting in expansion of the constraint.

Constraints that were used for the Glen Dhu South Wind Power Project are as follows:

1. Wind Regime: Turbine sites are selected on basis of wind regime specific to the Project lands from validated wind measurements. Collection of site specific data for wind speed and direction being crucial to determining site potential. Once specific turbine site determinations are modeled, considerations of the loss of output due to mutual interference between turbines is factored.
2. Species at Risk (SAR): species at risk locations were taken from known datasets, government databases/sources, or other relevant studies specific to the Project area. Once identification of SAR was complete, spatial setbacks were employed. Distances were based upon Federal or provincially defined setbacks for development from a particular species or habitat type.
3. Watercourse(s) and wetland(s): Natural watercourses are constrained by topography and follow the shape of the terrain surface. Natural watercourses exhibit particular shape patterns as a result of meandering/braiding and as a result of existing geology and geomorphological processes. Wetlands exist where topographic constraints allow water to pool and stagnate, causing anaerobic conditions in soils, and hydrophilic plants to prosper.
4. Existing Land Use: the nature of uses of the land within the Project boundaries. Land uses definitions are based upon field studies of land use. Once land use was determined, GIS analysis using aerial photos and polygon creation over land use is used to calculate areas. For example, the entire Project has a GIS polygon created over top. That polygon can then be analyzed to determine area based upon mapping scales.
5. Existing Infrastructure: existing roads, transmission lines, or other infrastructure may have defined regulatory setback requirements. These setbacks are dependent upon the dominant regulations for development and are mapped as linear or point source constraints.
6. Proposed Infrastructure: processes necessary to the successful production of the power

resource are known. They include turbine pad sizes, access road requirements for handling transport of equipment, transmission infrastructure requirements, work space requirements, and sub-station characteristics.

7. Regulatory Setbacks: Municipal and provincial regulatory setback requirements are defined in the applicable legislation, regulations, or guidelines; and,
8. Social Considerations: refers to the existing housing or populated areas within the Project boundaries. Housing locations are defined in a single dataset and subsequently used constrain the available spatial land base due to restrictions on development resulting from noise, visual impacts or other impacts.
9. Wildlife Habitat Type: Unique habitat identified within the Project lands includes those habitat types with limited connectivity as a result of existing land use. Habitat definitions are based upon field studies within the Project lands.
10. Topographical Constraints: Using known data from federal and provincial topographic maps were used to determine optimal locations for turbine placement. Slopes in excess of 15% were eliminated from the available land base due to construction restrictions. As greater turbine height (above sea level) results in the creation of greater energy production, the highest areas within the Project lands were identified for potential use.

The methods for turbine site selection, access road routings, substation location, and laydown yard areas were determined using constraints methods outlined below. These methods work in synergy, and none of the below mentioned processes is independent of any of the others.

- Wind regime mapping was used to identify optimal wind resource areas within the land base. This allows for effective placement of the turbines to maximize power generation from the wind resource for the Project based upon expected energy outputs within the modeled wind regimes. The mapping was completed using meteorological tower data which has been collected continuously for approximately 4 years;
- Once wind resource mapping and optimization of the wind resource models were completed, different wind turbine manufacturers were selected for modeling. As each manufacturer has different engineering inputs, designs, and outputs, each manufacturer had to be modeled independently. Each turbine type was then placed within the wind regime and mapped within the available lands according to specific engineering criteria for power production, yield, energy loss;
- Geographic Information System (GIS) mapping of the Project lands was completed using datasets for landform, land use, topography, watercourses, historical resources, and wildlife. In addition, aerial photography was used to complement the GIS datasets, with the final goal of building a robust, dynamic, and temporally valid constraints map that can be modified as turbine selection is finalized;
- LIDAR – Light, Imaging, Detection and Ranging System. It is a three dimensional high definition laser scan, completed from an aircraft. Each pixel that is created from the scan is assigned an x,y,z coordinate that allows for accurate 3D mapping of the ground layer. LIDAR provides the highest level of detail for surface topography scanning with

resolutions of 3 cm. That means that variation in micro-topography greater than 3 cm can be identified. This provides the unique ability to determine potential access road routes, turbine locations, or distribution line routes prior to field assessments.

- Within the GIS datasets the following parameters were mapped:

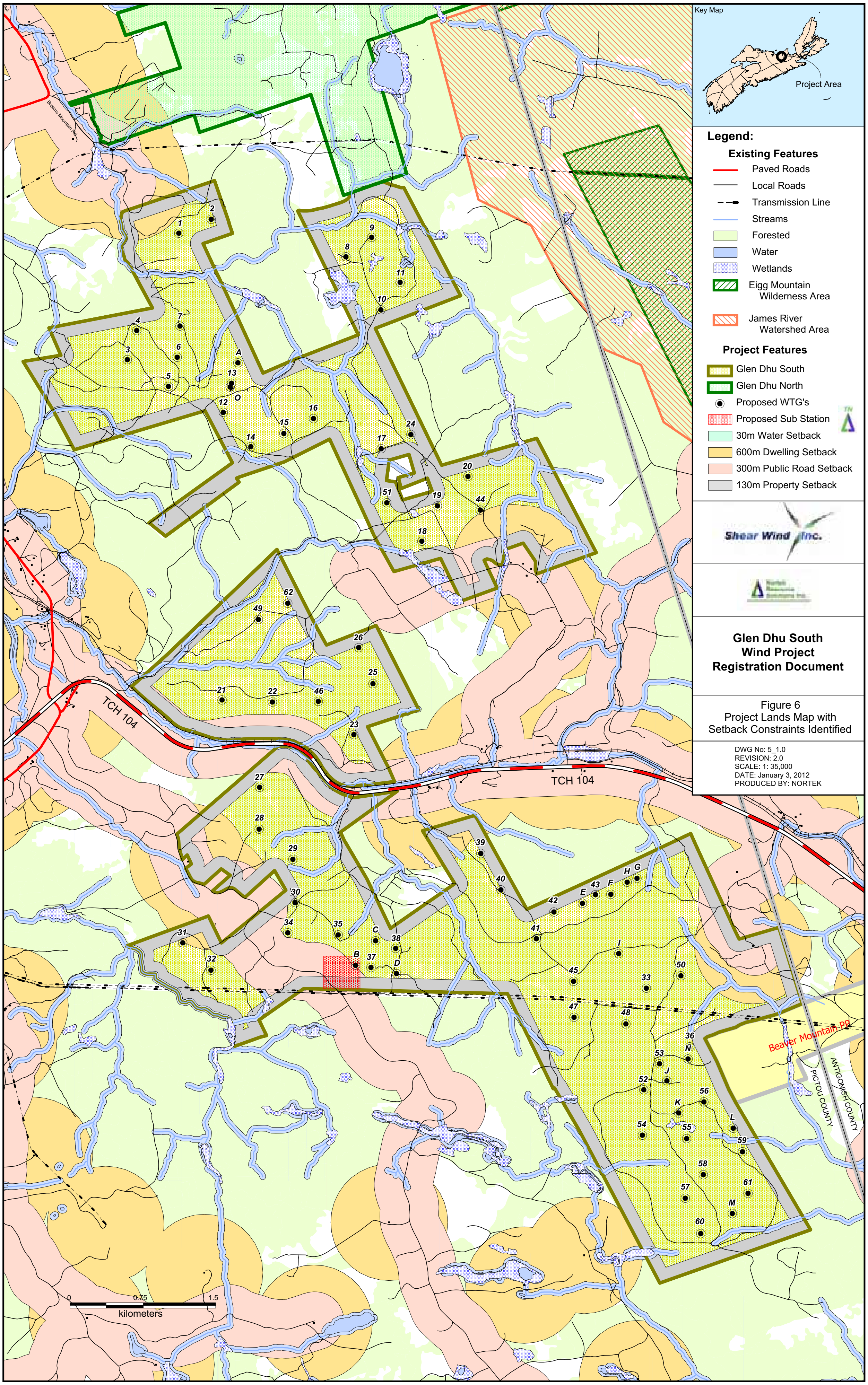
  1. Project area;
  2. Topography;
  3. Land Use;
  4. Existing infrastructure;
  5. Broadcasting (T.V. & Radio);
  6. Meteorological Towers;
  7. Residences;
  8. Existing roads (classified & unclassified) and including ATV trails;
  9. Existing transmission lines;
  10. Known wildlife sites;
  11. Known species at risk locations;
  12. Known heritage sites;
  13. Lakes, ponds or other visible open water bodies;
  14. Watercourses;
  15. Wetlands; and
  16. Property boundaries (PIDs);

- Once mapping of the above parameters was complete, setbacks were placed on the datasets for planning purposes:

  - Thirty (30) metre setbacks from lakes, ponds, open water, watercourses, and wetlands were imposed;
  - Six hundred (600) metre setbacks were placed around residences as a starting point to increase the likelihood that noise levels at those receptors would be below Health Canada recommendations of 45 dB(A). This was done prior to noise modeling being completed;
  - Municipal setbacks for development (600 m from residences except residences located on the same lot: Pictou County Land use Bylaw 2007);
  - Setbacks that may have been requested by specific landowners;
  - Setbacks from public roads (300 m: Pictou County Land use Bylaw 2007)
  - Setbacks from Property boundaries (one times the height of the turbine: Pictou County Land use Bylaw 2007);
  - Setbacks between turbines. As a general rule, due to wake loss and turbulence from blades while they are in operation, a minimum five (5) times rotor diameter (100 metres) (= 5 x 100 metres = 500 metre) setback distance is required in the prevailing wind direction between turbines, and minimum three (3) times rotor diameter (300m) setback distance is required perpendicular to the prevailing wind

direction between turbines. As a starting point for planning purposes, this setback was placed between turbines.

- Once known site specific setbacks were incorporated, the Project lands GIS map was created to show available lands for Project development after setbacks were imposed (Figure 6). The reader should note that as a result of the above noted constraints, **only 56% of the original Project Area is actually available for wind power development;**
- The wind analysis was completed, resulting in the turbine locations being placed onto this setback map. During this process, numerous turbine locations were moved to comply with known setback requirements while still attempting to optimize wind resources;
- GPS coordinates were then used to field verify the turbine locations. Further constraints analysis was completed during field assessments. For example, several turbines were moved to maintain setbacks from wetlands and watercourses that were not identified during the desktop mapping phases;
- Using the above noted information, Balance of Plant (BOP) was created (BOP includes all remaining infrastructure requirements such as access roads, distribution lines, substation location, etc…) using the same datasets and field data to ensure regulatory setbacks are maintained for all phases of the Project;
- Constraints analysis using GIS based systems, and subsequent field verification methodologies allowed development of the layout and BOP in an environmentally sustainable and regulatory compliant manner.


Key Map
Project Area
Legend:
Existing Features
Paved Roads
Local Roads
Transmission Line
Streams
Forested
Water
Wetlands
Eigg Mountain Wilderness Area
James River Watershed Area
Project Features
Glen Dhu South
Glen Dhu North
Proposed WTG's
Proposed Sub Station
30m Water Setback
600m Dwelling Setback
300m Public Road Setback
130m Property Setback
Shear Wind Inc.
Glen Dhu South Wind Project Registration Document
Figure 6
Project Lands Map with Setback Constraints Identified
DWG No: 5_1.0
REVISION: 2.0
SCALE: 1: 35,000
DATE: January 3, 2012
PRODUCED BY: NORTEK
TCH 104
TCH 104
Beaver Mountain PP
PICTOU COUNTY
ANTIGONISH COUNTY
0
0.75
1.5
kilometers

77 candidate turbine locations were identified once constraints analysis was completed and field assessments were then completed in spring and summer 2011. All 77 locations are shown on Figure 7-Turbine Location Map. However, based on the identified turbine of choice – the GE1.6-100, sixty-two (62) priority locations have been chosen for use. Access roads have also been chosen for the 62 priority turbine locations and are described below. Sound modeling and visual influence have been completed based on the 62 locations using the GE 1.6-100 turbine model. All other components of the environmental assessment process were completed for all 77 candidate turbine locations.

A potential substation location has been confirmed near the southern power lines intersecting the Project lands, south of Highway 104 on the Weavers Mountain Road.

Access Roads

The road layout for each turbine was evaluated in the field on multiple occasions by Shear Wind, the environmental team, and construction personnel. Roads were selected as follows:

- To use as much of the existing road network that exists within the area as possible. (Spur roads – those from an existing road into a turbine location are still typically required).
- Micro-topography and the location of existing wetlands, watercourses, and watercourse crossings were evaluated.
- Specific habitat types were noted, unique habitat was avoided, and vegetation assessments along the access roads were completed to avoid species at risk.
- Slopes in excess of 10% were avoided due to construction restrictions.
- Side slopes that would result in side hill cuts (which increase erosion potentials) were also avoided.

By evaluating access roads as indicated, potential long term significant impacts were immediately mitigated and/or avoided to the greatest extent possible. It is the opinion of the Project team that the access road configuration which is currently being proposed is optimal considering the above factors.

As hydrology is a key component to establishment and maintenance of wetlands and the type of wetland that will form, care was taken to mark all locations where a culvert installation might be needed to maintain natural surface water pathways. Roads were placed on heights of land whenever possible such that surface sheet flows would not be intercepted by a road and redirected or concentrated to alternate locations.

Turbines

The following summarizes how turbine locations were moved from their original locations (as provided during the c and wind resource engineering evaluations) to ensure they met all the above noted constraints, and to ensure that environmental effects were minimized, mitigated, and/or avoided. Turbine locations that were moved to ensure environmental effects were minimized are described below:

Turbine 11: Turbine location was moved to the south to avoid and minimize impact to surrounding wetland habitat. The access road will still impact some wetland habitat but due to other constraints, no additional area with reduced impacts is available.

Turbine 20: The access road location was moved to the north to avoid wetland habitat.

Turbine 25: A candidate site for an additional turbine to the south of this location was removed entirely from the candidate turbine location list, due to the presence of a large wetland with Mainland Moose habitat (identified moose scat).

Turbine 28: Turbine location was moved west to the edge of the existing access road to avoid wetland habitat and probable Mainland Moose habitat (identified moose scat).

Turbine 29: Access road to this turbine location was moved on two occasions to reduce impact to wetland and watercourse habitat.

Turbine 31: This turbine location was moved to the west side of the existing access road to avoid wetland habitat.

Turbines 31/32: The proposed access road, identified to provide best access for turbine components (slope/grade) was moved back onto the existing access road to reduce potential impact with possible archaeological resources identified in the area.

Turbine 41: This turbine location was moved south to avoid a mature stand of sugar maples trees.

Turbine 42: Both the access road and turbine location were moved to avoid impacts to wetland habitat present near this location.

Turbine 43: Both the access road and turbine location were moved to avoid impacts to wetland habitat present near this location.

Turbine 46: The main access road for a grouping of turbines, and the small spur road leading to Turbine 46 were both moved to reduce impact on wetland habitat.

Turbine 54: This turbine location was moved to the north to avoid a wetland/upland mosaic habitat present to the south of the final turbine location.

Turbine 57: This turbine location was moved south to avoid wetland habitat.

Turbine 58: This turbine location was moved south to avoid wetland habitat.

Turbine 61: This turbine location was moved to the northeast into a recent clear cut area.

4.3 TURBINE LAYOUT UPDATE

Of 77 candidate turbine locations, 62 priority locations have been identified in this registration document with a selected turbine (GE 1.6-100) based on a 100 MW layout (identified prior to the RFP details being made available that indicate a maximum project size of 80 MW). Sound and visual modeling have been completed based on this turbine selection and layout with 62 locations. Figure 7 shows the turbine layout with 62 locations (based on the 100 MW layout).

After submission of the environmental assessment registration document in draft format in December 2011, comments were received from NS Department of Natural Resources concerning potential landscape and habitat fragmentation associated with the proposed project footprint and layout. After consultation and meetings directly with NSDNR in January 2012, the following items of clarification and layout revisions have been completed by Shear Wind Inc.

At the time of registration of this environmental assessment document, the Proponent does not know how many turbines (if any) they will be given permission to build.. This decision will be determined in an upcoming Request for Proposal (RFP) process with the Government of Nova Scotia. If Shear Wind Inc. is successful in this RFP, the awarded contract will be for one of two submitted projects – up to 50 MW, or between 50 and 80 MW. How many turbines are erected, and the final placement of those turbines on the 77 candidate locations, will be finalized after the RFP award (April/May 2012).

The current layout provided in this registration document is based on a 100 MW project (62 X 1.6MW). Immediately upon contract award through the RFP, SWI would limit the total number of turbines to reflect the contract (maximum 80MW). There is no possible way that all 62 identified locations will be developed, given the restrictions identified by the Government of Nova Scotia. All turbines will, however, be placed on assessed turbine locations, as identified in this environmental assessment document. This reduction in total number of turbines will reduce the potential landscape and habitat fragmentation.

Furthermore, based on consultation with DNR, SWI has agreed to commit to using a higher capacity turbine instead of 1.6MW as originally planned, thus further reducing the total number of turbines required.

Shear Wind Inc. intends to submit proposals for a 50 MW layout and an 80 MW layout through the RFP process (among potential others smaller in total size). The following table shows how many turbines would be required for each layout, considering the potential use of a 2.3 MW or 3.0 MW machine (as examples only).

Table 9: Turbine Requirements: 50 MW and 80 MW Layouts

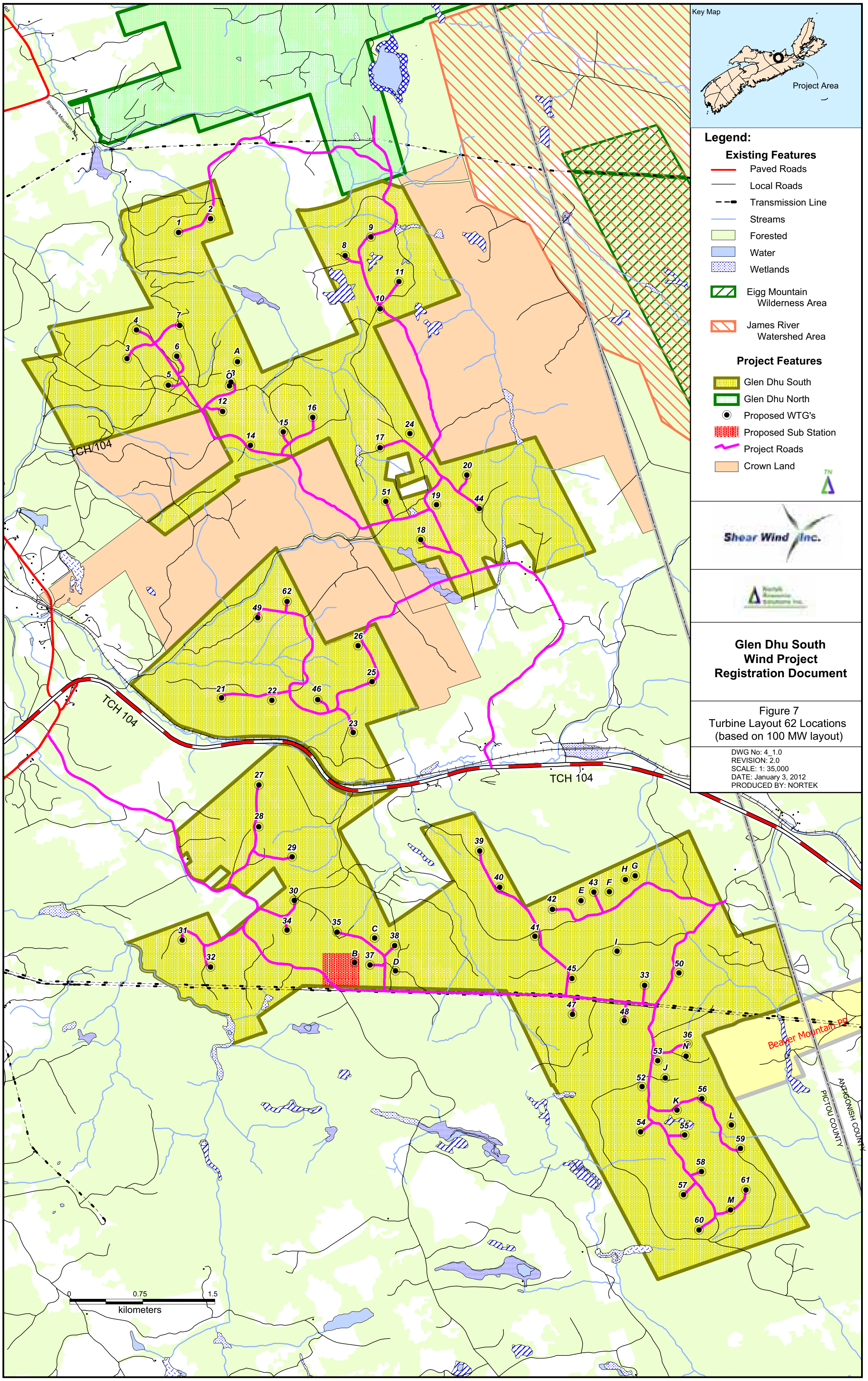
Turbine Capacity (as examples only)	**Layout**	**Total # of Turbines Required**	**Reduction in Total Project Area**	**Reduction in Project Footprint %**
3.0 MW	50 MW	16	1425 ha	52
2.3 MW	50 MW	21	1425 ha	52
3.0 MW	80 MW	26	977 ha	35
2.3 MW	80 MW	34	977 ha	35

Based on this evaluation, and SWI's commitment to use a higher capacity turbine, the total number of potential turbines will likely be in the range of 16 to 34. These turbines will be placed on some combination of the 77 sites already fully assessed as part of this environmental assessment process.

SWI has completed a preliminary review of turbine layouts for the 2.3MW and the 3.0MW machines to determine optimal placement of the turbines to maximum both energy output and revenue (both scenarios- 50 MW and 80 MW layouts). Figures 8-11 are provided on the following pages and illustrate what SWI considered to be optimal layouts. As is evident on these figures, the optimal turbine layout involves placement of the turbines across the project area.

As a result of consultation with NS DNR and its concerns relating to minimizing the project footprint and the potential for landscape fragmentation for wildlife, and especially the Mainland Moose, SWI has agreed to adjust the placement of the turbines to reduce the overall footprint of the project. Figures 12-15 shows these revised turbine layouts (both scenarios- 50 MW and 80 MW layouts) based on the 2.3 MW and 3.0 MW turbines as examples.

The 50 MW layouts are limited to the project lands north of Highway 104. The 80 MW layouts are limited to the project lands north of Highway 104 and the southwest portion of the southern lands. These revised layouts significantly reduce the overall footprint of the project by eliminating 977 ha of land base from the southeast section of the Project lands for the 80 MW layouts and 1425 ha of land base south of Highway 104 for the 50 MW layouts.



Key Map
Project Area
Legend:
Existing Features
Paved Roads
Local Roads
Transmission Line
Streams
Forested
Water
Wetlands
Eigg Mountain Wilderness Area
James River Watershed Area
Project Features
Glen Dhu South
Glen Dhu North
Proposed WTG's
Proposed Sub Station
Project Roads
Crown Land
Shear Wind Inc.
Glen Dhu South Wind Project Registration Document
Figure 7
Turbine Layout 62 Locations
(based on 100 MW layout)
DWG No: 4_1.0
REVISION: 2.0
SCALE: 1: 35,000
DATE: January 3, 2012
PRODUCED BY: NORTEK
TCH 104
Beaver Mountain Rd
ANTIGONISH COUNTY
PICTOU COUNTY
0
0.75
1.5
kilometers

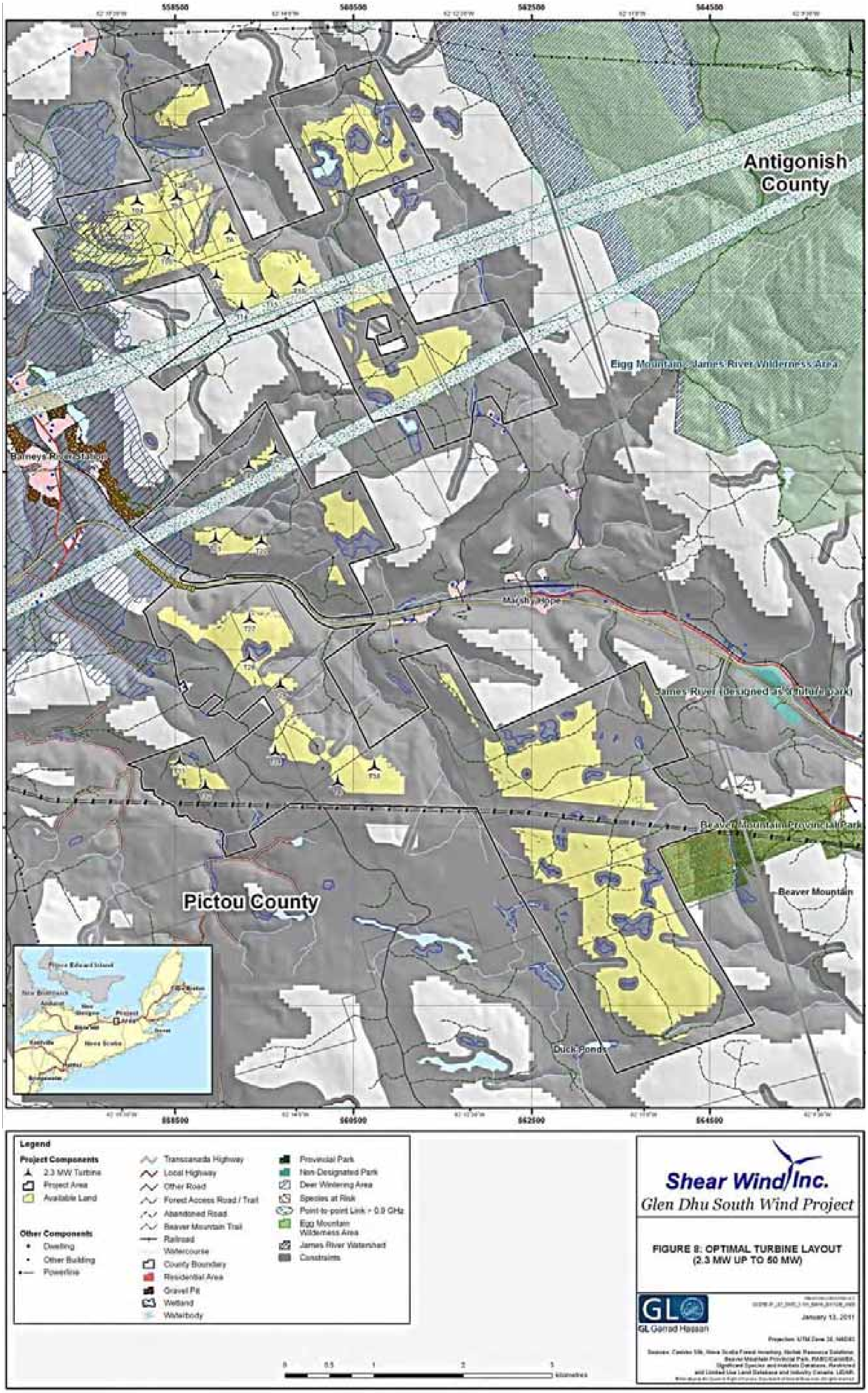


FIGURE 8: OPTIMAL TURBINE LAYOUT (2.3 MW UP TO 50 MW)

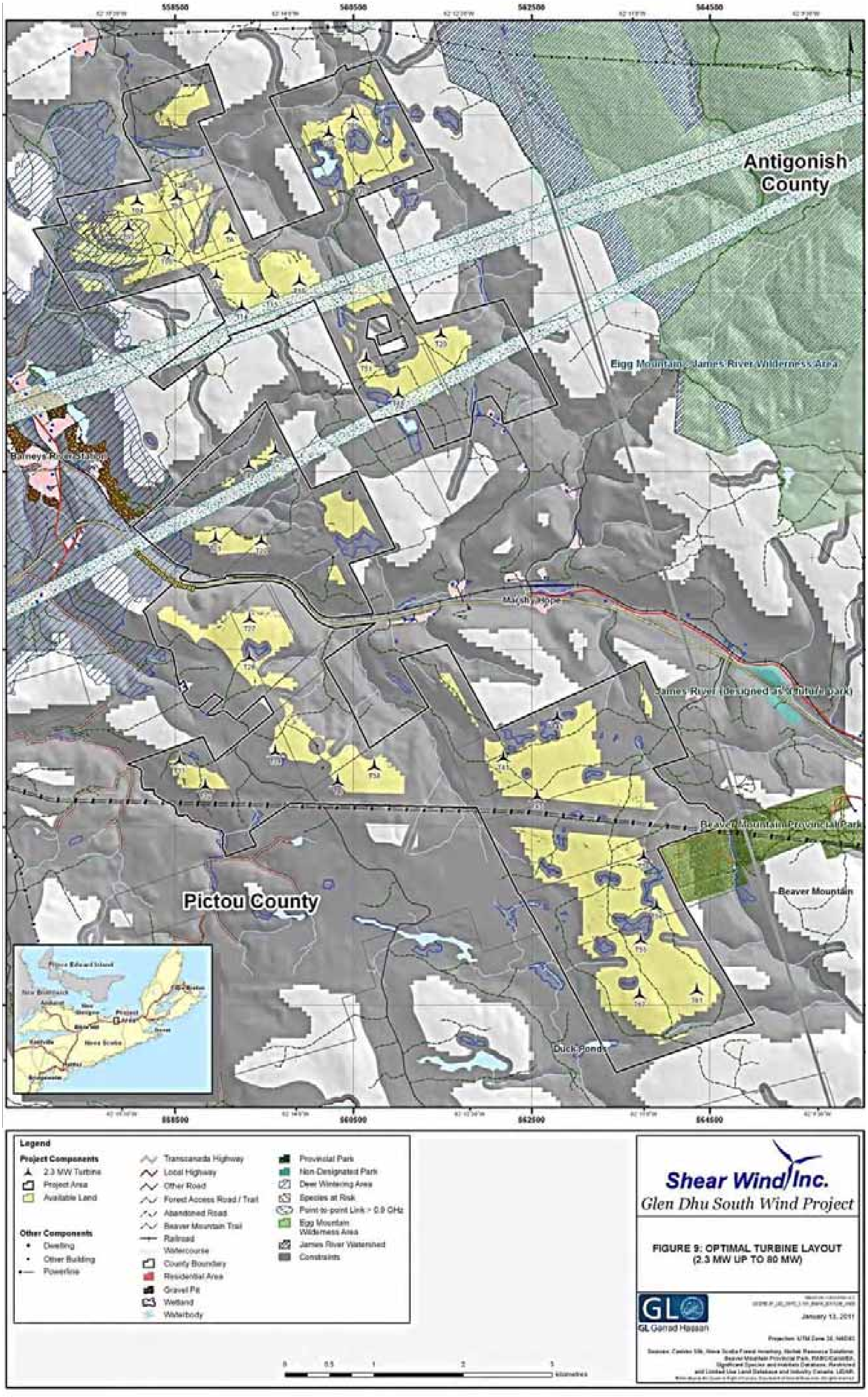
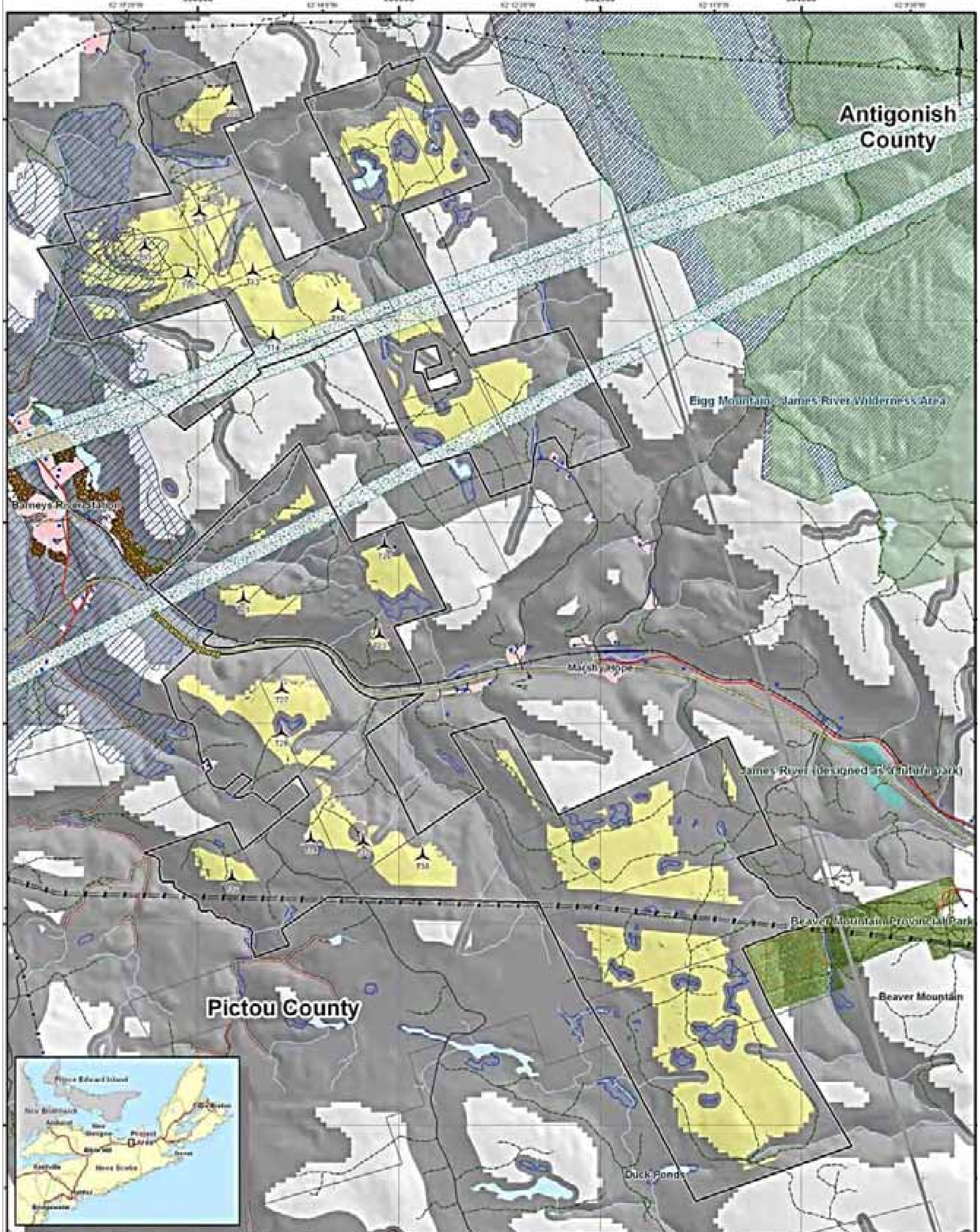


FIGURE 9: OPTIMAL TURBINE LAYOUT
(2.3 MW UP TO 80 MW)



Legend

Project Components
- 3 MW Turbine
- Project Area
- Available Land

Other Components
- Dwelling
- Other Building
- Powerline
- Transcanada Highway
- Local Highway
- Other Road
- Forest Access Road / Trail
- Abandoned Road
- Beaver Mountain Trail
- Railroad
- Watercourse
- County Boundary
- Residential Area
- Gravel Pit
- Wetland
- Waterbody
- Provincial Park
- Non-Designated Park
- Deer Wintering Area
- Species at Risk
- Point-to-point Link > 0.9 GHz
- Egg Mountain Wilderness Area
- James River Watershed
- Constraints

0 0.5 1 2 3 kilometres

Shear Wind Inc.

Glen Dhu South Wind Project

FIGURE 10: OPTIMAL TURBINE LAYOUT (3 MW UP TO 50 MW)

GL Garrad Hassan

January 12, 2011

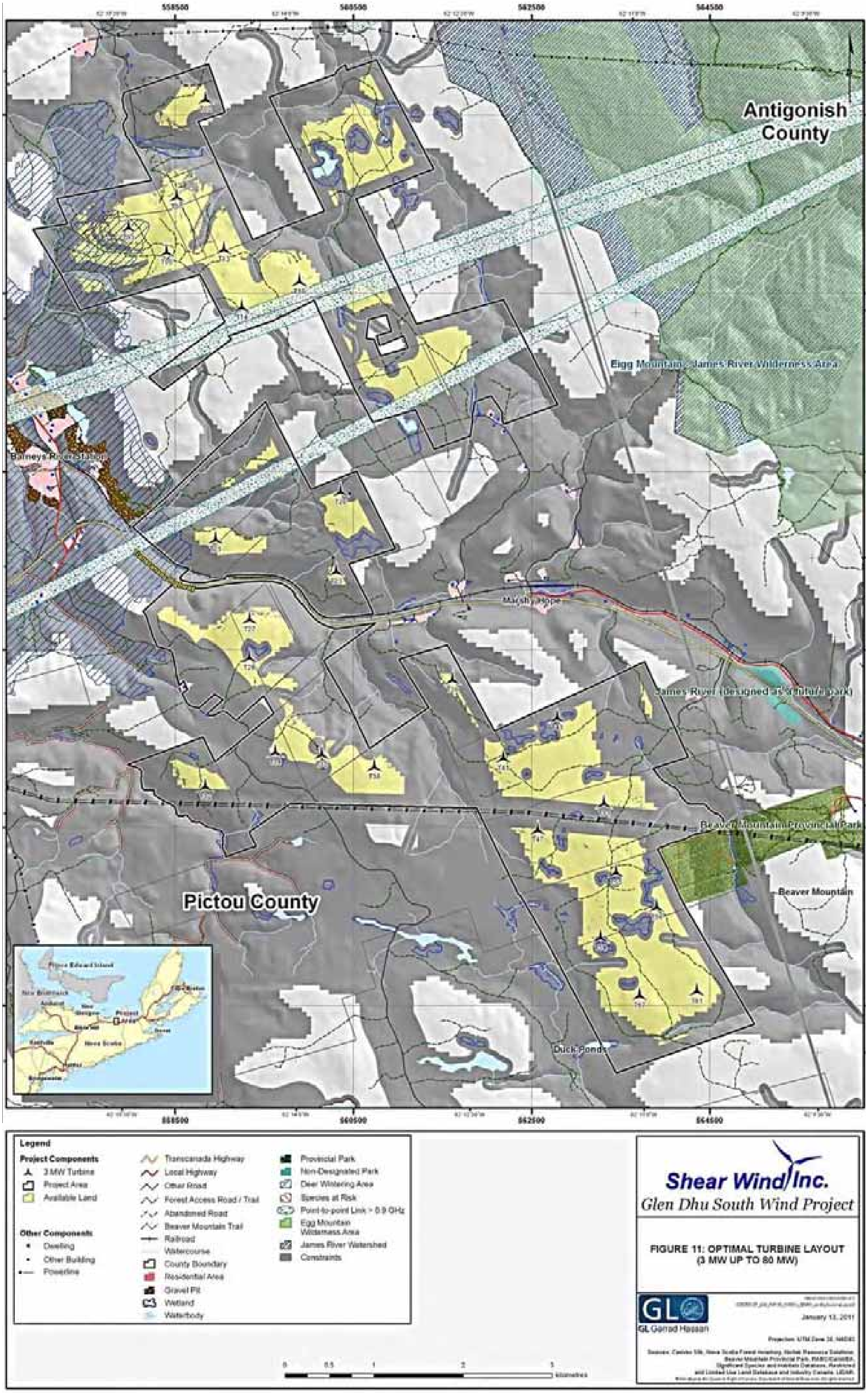


FIGURE 11: OPTIMAL TURBINE LAYOUT (3 MW UP TO 80 MW)

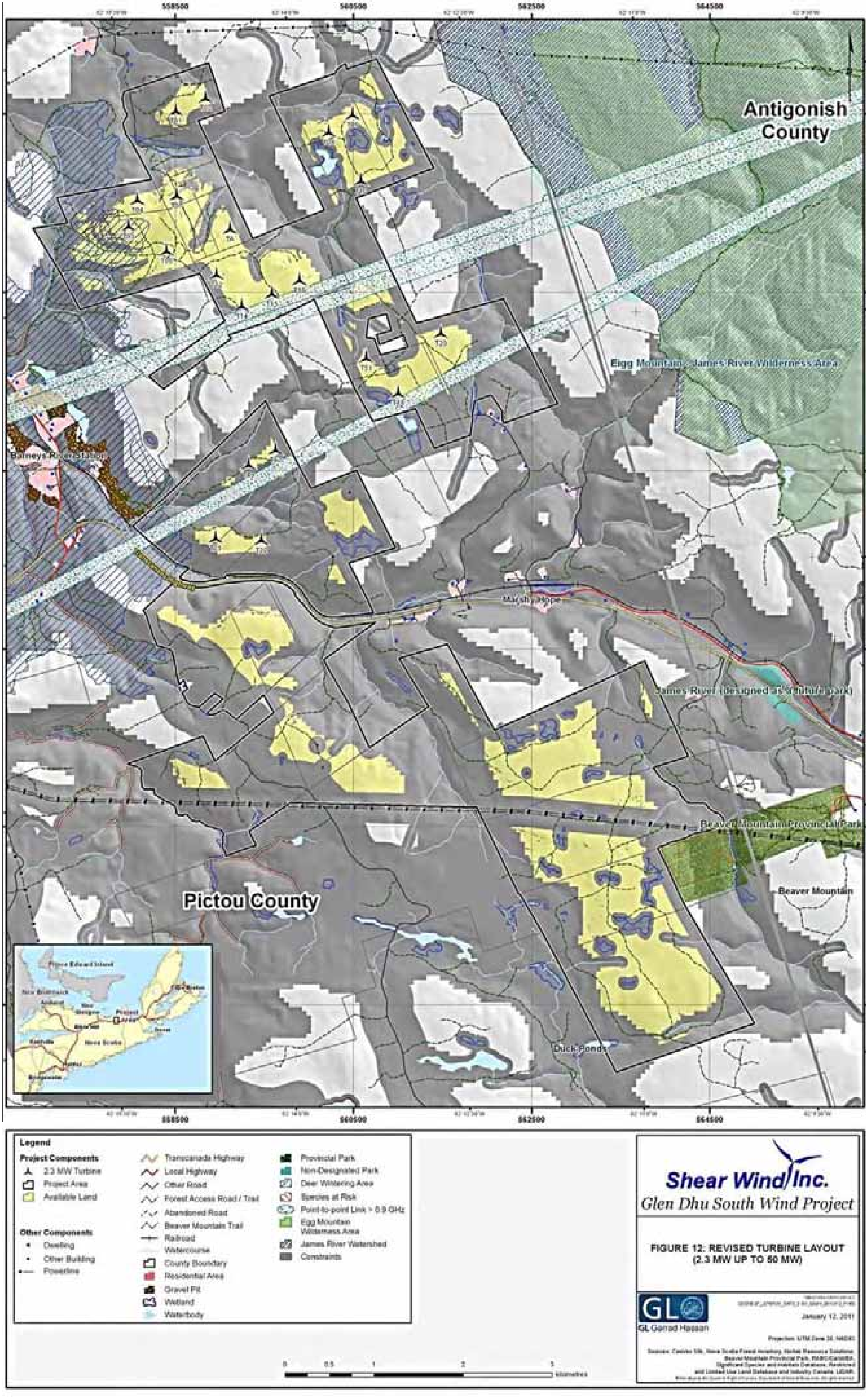
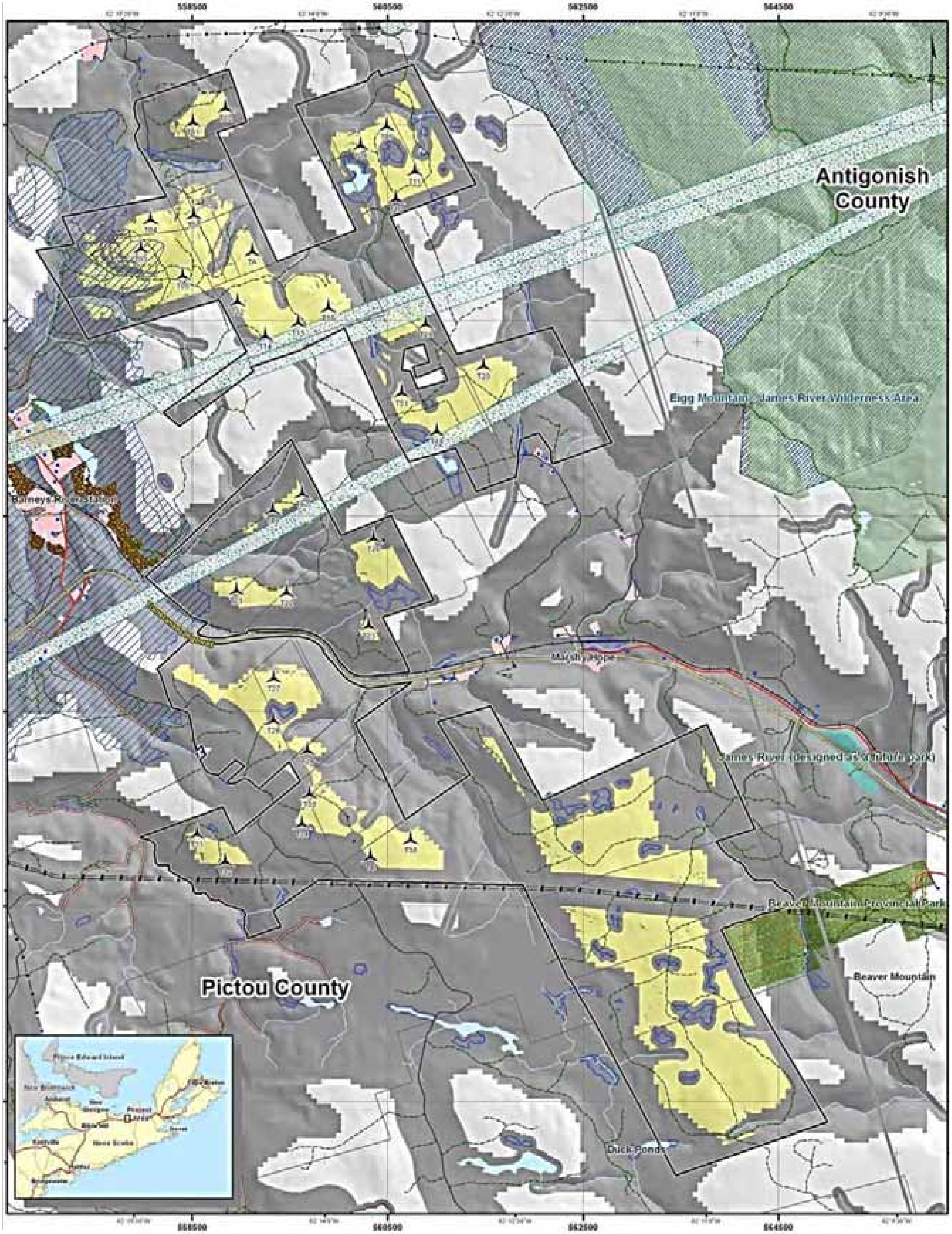


FIGURE 12: REVISED TURBINE LAYOUT
(2.3 MW UP TO 50 MW)



Legend

Project Components
- 2.3 MW Turbine
- Project Area
- Available Land

Other Components
- Dwelling
- Other Building
- Powerline

- Transcanada Highway
- Local Highway
- Other Road
- Forest Access Road / Trail
- Abandoned Road
- Beaver Mountain Trail
- Railroad
- Watercourse
- County Boundary
- Residential Area
- Gravel Pit
- Wetland
- Waterbody

- Provincial Park
- Non-Designated Park
- Deer Wintering Area
- Species at Risk
- Point-to-point Link > 0.0 GHz
- Egg Mountain Wilderness Area
- James River Watershed
- Constraints

0 0.5 1 2 3 kilometres

Shear Wind Inc.

Glen Dhu South Wind Project

FIGURE 13: REVISED TURBINE LAYOUT (2.3 MW UP TO 80 MW)

GL Garrad Hassan

January 13, 2011

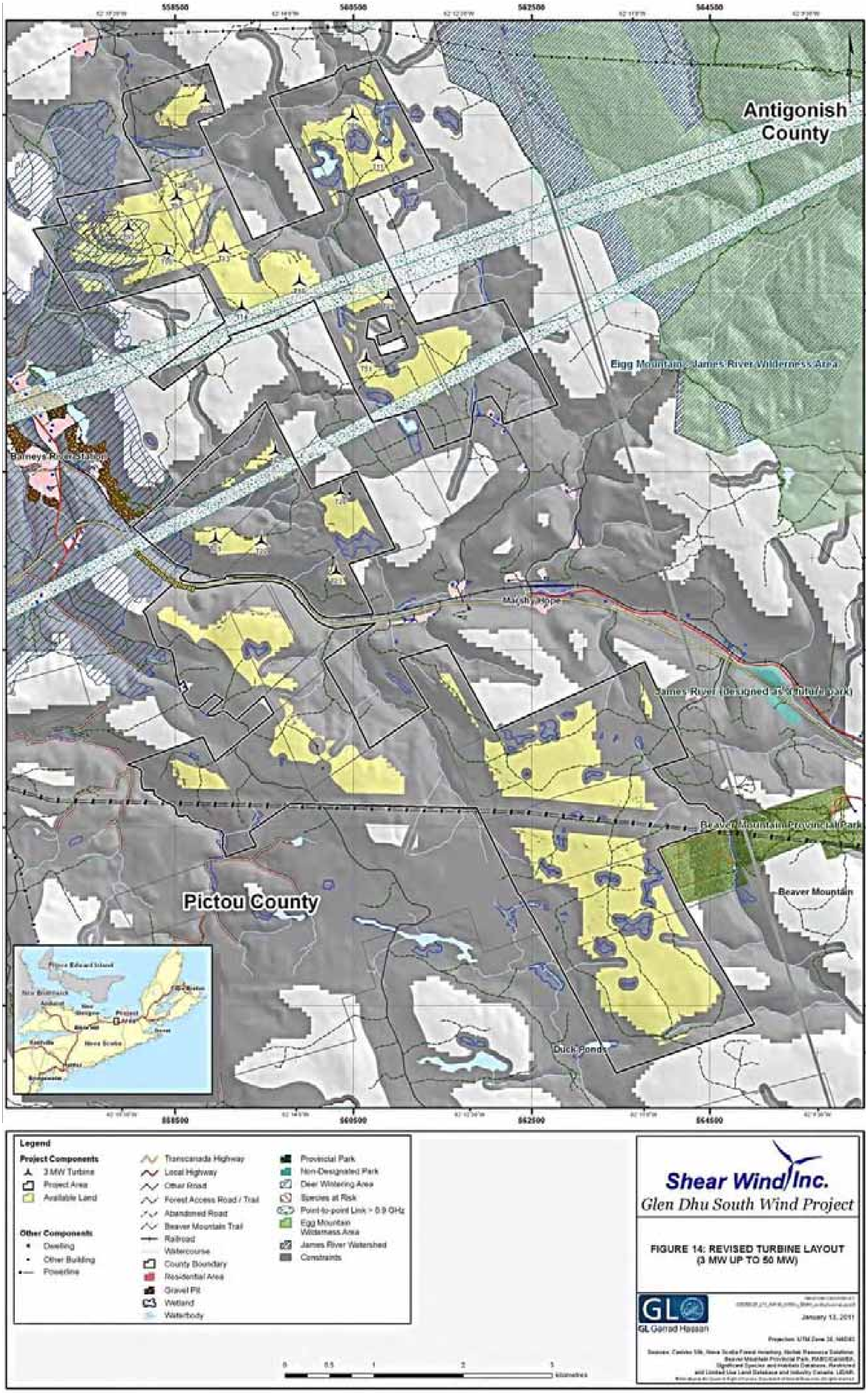
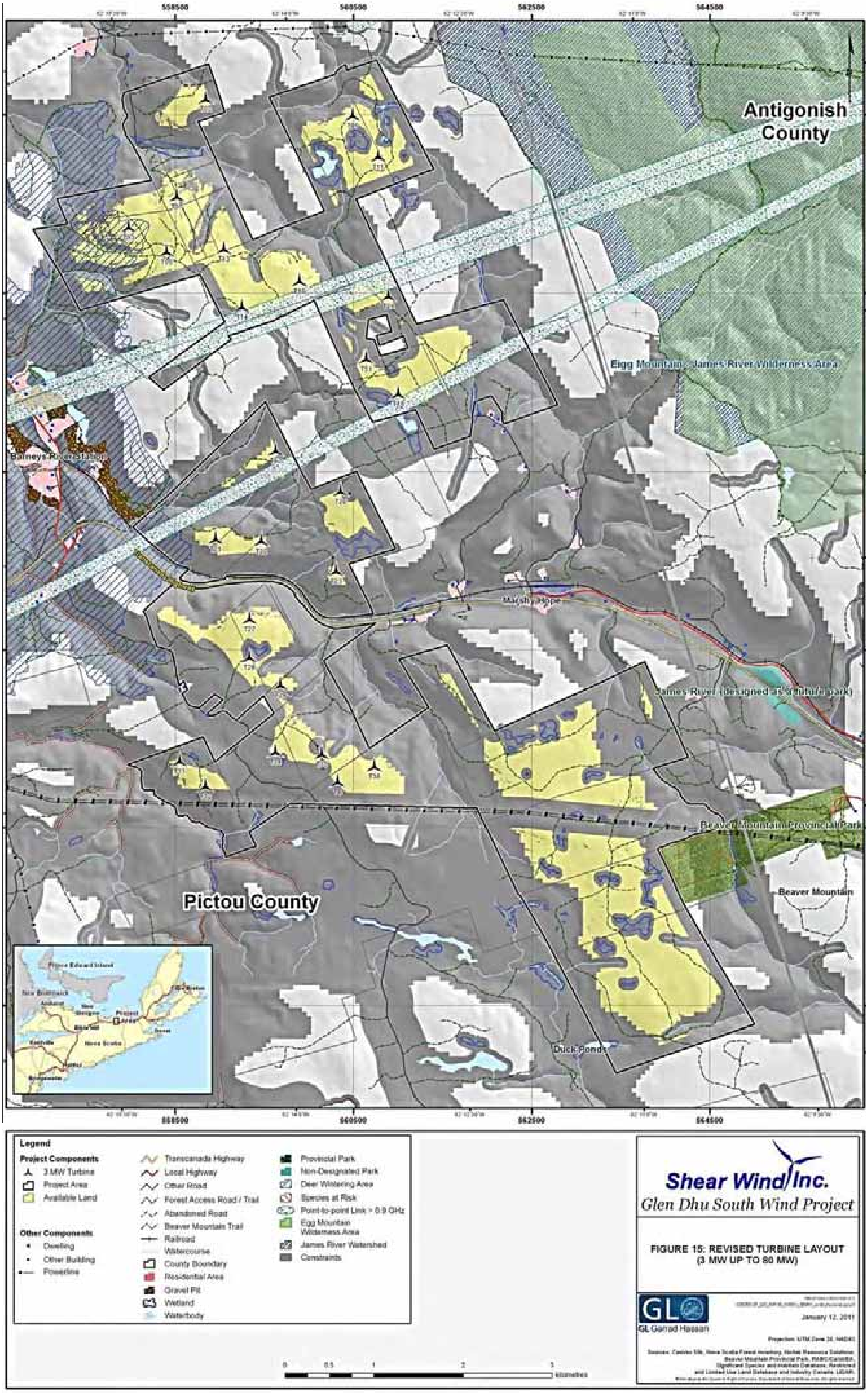


FIGURE 14: REVISED TURBINE LAYOUT (3 MW UP TO 50 MW)



Shear Wind Inc.

Glen Dhu South Wind Project

FIGURE 15: REVISED TURBINE LAYOUT (3 MW UP TO 80 MW)

GL Garrad Hassan

January 12, 2011