REPORT

Model Wind Turbine Provisions and Best Practices for New Brunswick Municipalities, Rural Communities and Unincorporated Areas

Department of Energy

EXECUTIVE SUMMARY

Wind energy development has been generally accepted as an important social, environmental, and economic opportunity. It is one of the key technologies being advanced to aid in the global climate change battle and to reduce dependence on non-renewable energy sources. There is currently a call for more clarity of legislation in this area both from communities where this technology is being implemented and from developers that are making the large investments. There is strong support for the advancement of wind power projects in many New Brunswick communities and a corresponding need among local governments for guidance in regulating these projects. This report is a resource tool to assist these local governments in the regulation of wind energy developments within their jurisdictions and within the authorities that have been granted to them by the province. The information compiled in this report is based on peer reviewed scientific research, where available, and shows the broad range of regulatory approaches that are available for consideration by local regulators. The challenge in regulating these developments lies in obtaining a balance between encouraging development, maintaining public welfare and safety, and avoiding any negative environmental or socioeconomic effects.

The Planning District Commissions in New Brunswick formed a working committee in early 2008 to research and develop model wind zoning provisions for New Brunswick. Several staff members of the working committee assisted Jacques Whitford in the production of this report. It was agreed that New Brunswick local governments would be best served by the creation of one guidance document which reflects responses to the issues that the Commissions have addressed, as well as incorporates best practices from other jurisdictions. The report was also circulated to the provincial departments of Environment, Transportation, Local Government, Natural Resources, and Public Safety for their input and comment. It was outside the scope of this project to consult with the public or local governments in the province directly. However, it is hoped that the release of this document will be useful to all New Brunswick local governments and feedback in the form of questions or comments is encouraged.

The recommended approach in this report is to recognize that a balance of factors need to be considered in regulation of wind turbines and their associated infrastructure, appreciating that over time adjustment may be required as knowledge, practice and experience grows and as these technologies evolve. This document is designed to be flexible, allowing for modifications in the future as more local experience is gained or as amendments are made to the local authority available to the local government.

It is recommended that proactive community consultation occur, among residents, staff and council, prior to the adoption of specific by-laws by a local government to establish effective and locally appropriate approaches to the regulation of wind development. Further, this consultative and participatory approach should be extended to specific developments, sites, and opportunities that may be proposed for the community. The economic, social and environmental effects associated with a specific wind development also need to be considered, not in isolation, but in relation to local and broader impacts associated with conventional New Brunswick energy sources. It is recognized that since wind development can represent an opportunity for both economic and environmental improvement, the implementation of regulations should take place as quickly as feasible. Local governments must balance the need to protect residents and their communities, the desire for flexibility from the industry, and the general desire to increase renewable energy alternatives.

The review of municipal plans and by-laws herein provides context as to how others have approached these issues. However, zoning provision and by-law decisions will, in many respects, need to be contextual in consideration of the unique characteristics of each local government – its communities, governance structure, land use patterns, geography and topography, wind potential, commitment to renewable energy alternatives, and resident's readiness or attitudes towards the developments.

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1.0 INTRODUCTION

Wind energy development has been generally accepted by the public as an important social, environmental, and economic opportunity, an important technology to deploy in the carbon constrained era associated with global climate change. There is currently a call for more clarity of legislation in this area both from communities and developers. It is recognized that since wind development represents an important opportunity, some would say necessity, for both economic and environmental improvement, the implementation of regulations is needed as rapidly as feasible.

The New Brunswick government has advocated the development of renewable energy sources in *Our Action Plan to be Self-sufficient in New Brunswick*, through renewable portfolio standards and through investments in such alternatives as biomass and tidal, with a current emphasis on wind power due to the relative maturity of the technologies. The Province has recently proposed amendments to the *Municipalities Act* to encourage such developments in and by local governments.

There is strong support for the advancement of wind power projects in many New Brunswick communities and a corresponding need for guidance in regulating these projects geared towards municipalities. The primary public issues raised surrounding wind farm developments include:

- Noise (audible and infrasound);
- Environmental effects to birds and bats;
- Property values;
- Effects on agricultural and forestry practices;
- Visual effects (visual landscape and lighting);
- Setback distances;
- Interference with telecommunications; and
- Shadow flicker, ice throw and other health and safety concerns.

There is an ever increasing need at the local government level for well researched guidance that will allow them to develop local zoning provisions that are based on best practices. A range of information is needed to allow consideration of the balance among encouraging development, maintaining public welfare and safety, and avoiding or mitigating any negative environmental effects. This report serves as such a resource for local governments of New Brunswick for use in creating provisions for the regulation of wind energy developments within their jurisdiction. This report is presented in Nine Chapters. In Chapter 1, the study context and methodology are outlined. Background information including summaries of the status of wind power development internationally followed by Canadian progress and New Brunswick's current position as well as emerging issues are provided in Chapter 2. A summary of issues of concern regarding wind generation documented in surveyed literature is provided in Chapter 3. The current regulatory environment for wind energy projects on a federal and provincial level is summarized briefly in Chapter 4. A variety of municipal regulatory approaches in several Canadian provinces and internationally are also presented in Chapter 4 and common and unique approaches and best practices are highlighted and contrasted. Land Use approaches and options for New Brunswick are presented in Chapter 5 and overall conclusions are summarized in Chapter 6. A closure statement is provided in Chapter 7 and references used in the creation of this document are listed in Chapter 8. Supporting documentation including model zoning provisions are provided as appendices to this report.

1.1 Methodology

The information presented herein is intended to provide New Brunswick municipalities and rural communities wishing to include zoning provisions in their planning framework for wind power installations with a large cross section of the most recent available knowledge regarding the subject to allow for educated decision making by local government leaders.

The approach for this project is to build on, up-date and adapt the research completed by a committee of the Planning District Commissions of New Brunswick and for several recently produced reports including:

- The Draft Wind Energy Master Plan for the Halifax Regional Municipality (HRM 2007);
- The Model Wind By-laws and Best Practices for Nova Scotia Municipalities (UNSM 2008); and
- The ongoing study entitled “Attitudinal Barriers to Continued Growth of Wind Power in Atlantic Canada”.

The overall methodology for completion of this study is described in the following tasks:

1. Description of the Current Situation and Emerging Issues worldwide and in New Brunswick

An overview of the development of renewable energy targets and enabling policies in New Brunswick is provided. Investment and development opportunities for the Province, as well as the potential for wind projects to address greenhouse gas (GHG) emission reduction targets are discussed to provide context for why the development of wind energy is seeing such rapid growth globally.

2. Discussion of Existing, New and Developing Legislation, By-Laws, Guidelines and Best Practices with Respect to Wind Turbines in New Brunswick

An analysis of existing and proposed regulations and provisions is important in understanding the issues, challenges and opportunities that each regulator and developer may face as well as the effectiveness they offer in addressing the issue they were designed to resolve.

A patchwork of regulations governs wind energy site development in New Brunswick and these are spread among a number of levels of government. Only a few municipalities or rural areas have adopted plans or by-laws that address or could address wind energy developments. Further complicating this, a large amount of the land in the province is public (Crown) land, and is governed under specific provincial regulations.

The project team revisited and updated research completed on previous associated projects. An internet search of New Brunswick local government websites was conducted and by-laws or sections of municipal plans and rural plans referring to wind energy were highlighted. A preliminary summary of regulations was gleaned from provincial departments. To understand how wind energy development is being managed within the existing regulatory framework, current planning documents were reviewed for references to wind energy. A wind committee that was formed by various members of the District Planning Commissions in early 2008 was consulted and provided guidance to the project team in many aspects of the New Brunswick municipal regulatory framework as it may apply to wind energy systems. This working committee also provided guidance during the review process of this document.

Through the departments of Local Government, Environment, Natural Resources, Transportation and Public Safety, and Energy, a group of key managers was engaged to review and comment on this document. Guided discussion with the working group and provincial department experts provided an opportunity to develop a qualitative assessment of the effectiveness of various approaches or the particular issues that can be expected to arise from specific by-law formulations. This guided the project team in building on knowledge from the municipalities.

1. Preparation of Options Respecting Recommended Model Wind Turbine Zoning Provisions and Best Practices for New Brunswick

The project team developed by-laws and best practices recommendations for:

i. Large scale, community or commercial wind turbines and wind farms; and

ii. Small scale, individual turbines (embedded generation or net metering projects).

The issues around the two different scales of project are quite different (larger scale developments in rural areas, small scale turbines potentially in urban or suburban areas). Please see the Section 1.2 below for further discussion on wind turbine scale.

The recommended by-laws address site selection and access (ground, transmission lines), tower height, sound (volume and quality), visual impact, property line setbacks, distances to residential and recreation properties, property values, public safety and health and mitigation considerations. Unless there was a clear best practice identified in each of these areas, the report presents options and highlights the benefits and shortcomings of each.

2. Compendium of Literature Supporting Recommendations

The recommended zoning by-laws and best practices are accompanied with a summary of the research carried out in support of the study, highlighting all scientific literature that was consulted in the research phase.

1.2 Definitions and Acronyms

The language of the wind energy generation industry and its regulation can be fairly technical and unfamiliar to a municipal audience. This section defines some commonly used terms and acronyms in the field and also in this report. A version of these definitions can be used by municipalities in their zoning by-laws.

Wind Turbines - Wind turbines are structures that produce power by capturing the kinetic energy in surface winds created by the sun and converting it into energy in the form of electricity. A diagram of a typical wind turbine is shown in Figure 1. A wind turbine consists of six major components:

- A rotor that aerodynamically converts the wind energy into mechanical energy on a slowly turning shaft;
- A gearbox that increases the rotor-shaft speed for the generator. Some specially designed generators run at rotor-shaft speed and do not need a gearbox;

- A generator that produces electricity;
- A control and protection system that optimizes performance and keeps the machinery operating within safe limits;
- A tower that raises the rotor high off the ground where the wind speed is greater and the effects of local obstructions are less; and
- A foundation that supports the wind turbine system, sometimes with the aid of guy wires.

The electricity generated is carried by cables to distribution or transmission lines that connect to the larger electrical grid in the case of large turbines, or to homes or business operations in the case of small turbines.

Key factors that affect the power produced by wind turbines are the strength of the wind, the area swept by the rotor and the height of the turbine. Generally, the stronger the wind resource, the larger radius of the area swept, and the greater the height of the tower, which increases the wind turbine's capacity to produce power.

Large versus Small Turbines - Turbines are often described in two broad categories – small and large. There are vast differences between large scale turbines that can be grouped into wind farms and operated as an energy generation enterprise, and small scale wind turbines that might sit on a farm or residential property and cover the electricity needs of the owner.

Large scale wind energy developments generally produce electricity to be fed directly into the power grid. By producing electricity in mass quantities, large scale wind energy replaces or complements other forms of energy. Large scale wind power production is the result of many turbines clustered together to form a wind farm which spreads over many square kilometres of land. Large scale wind farms are historically most often placed in rural settings, either on farm land or in forested areas.

Generally, municipalities have more experience with regulating large scale wind turbines. Policies and by-laws relating to small wind turbines are in more of a developmental stage. The technology for small turbines is not widespread in Canada as the economics are still not favorable in most cases. Therefore, practical experience with impacts and mitigation strategies are developing as well.

There are also vast differences in how municipalities (and the wind energy industry itself) define small and large scale wind turbines. Examples of these differing definitions are:

- Based on nameplate rated capacity (small scale is described as below either 100 kW, 200 kW or 300 kw);
- Base on the total turbine tower height (for example, below 60 m is small scale);
- Based on the rotor diameter and total swept area (rotor diameter of no more than 15 m and a total swept area of no more than 180 m^2 for small turbines);
- Based on the intended end use of the power produced (small scale is primarily for on-site consumption and large scale is generally intended to feed electricity into the provincial grid); and
- A combination of the above.

CanWEA describes large scale wind turbines as having a rated capacity of greater than 300 kW and connecting and providing power to the local utility grid. Small scale wind turbines are described as having a rated capacity of not greater than 300 kW and being use primarily for power generation for on-site use (either behind the metre or off-grid).

Many other sources also differentiate between different sizes of small scale turbines, referring for example, to mini, micro, small and medium as various categories. There is no consensus on the thresholds for defining these various categories. The literature cited throughout this report on small scale turbines covers the entire range of turbines under 300 kW.

NB Power's net metering program aligns with the small scale category and is applicable to power generators rated less than 100 kW. Large scale wind turbines connect with the transmission system and would have a formal Interconnection Agreement and a Power Purchase Agreement with the end user/purchaser of the energy generated (www.nbpower.com).

Some New Brunswick municipalities have created definitions for wind energy projects. The Village of Belledune identifies small wind energy systems as '… a wind energy conversion system consisting of a wind turbine, a tower, and associated control or conversion electronics, which has a rated capacity of not more than 10 kW and which is intended to primarily reduce on-site consumption of utility power'. On the other hand, the Village of Salisbury identifies between commercial and non-commercial wind energy. Commercial wind energy is defined as '…a single wind turbine, or multiple wind turbines, intended solely to generate electrical power for sale to the power grid.' A non-commercial wind energy system is defined as '…..a wind turbine that is subordinate and incidental to the main use on the lot and that supplies electrical power solely for on-site use…'.

In the New Brunswick Department of Natural Resources Policy *"Allocation of Crown Lands for Wind Power Projects"*, a small scale system is defined as a wind energy system that is stand-alone, non-grid connected, with no commercial sale of electricity.

In New Brunswick, for projects that produce more than 3 MW (3,000 kW), a requirement to conduct an environmental impact assessment (EIA) will be triggered as outlined in Schedule A of the *Environmental Impact Assessment Regulation*. Therefore, in this province, wind energy developments below this threshold could be considered small scale projects. Note that projects with a smaller capacity may also be provincially regulated. For example a provincial EIA is also triggered if the project will affect a wetland greater than two hectares in size, and a Watercourse and Wetland Alteration Permit (WAWA) is required for work within 30 m of a watercourse or a wetland. Taking all of the foregoing into consideration, for the purposes of this report, the definitions of large and small wind turbines are based on the intended use of the power produced, following roughly the following size guidelines:

- Large scale turbines will be considered those that are commercially operated and 300 kW capacity or higher;
- Small scale turbines will be considered those owned and operated for the owner's use and typically having a capacity of less than 300 kW.

<u>Other Related Definitions:</u>

Blade - Part of the wind turbine that rotates in the wind and extracts kinetic energy from the wind.

Decibel – The basic unit of level in acoustics, (abbreviated dB). The decibel is a logarithmic unit expressing the ration of two quantities that are proportional to power. In acoustics the decibel is used to quantify such things as sound pressure levels that people hear, sound power levels radiated by sources. dB_A **-** 'dB' stands for decibel weighted on an A-scale. 'A' refers to a weighting that is the adjustment of measured sound so that it more closely matches the perception by the human ear.

Decommissioning - The final closing down of a development or project or the point at which it has reached the end of its operational life and the process by which the site is restored to an agreed use or condition.

Electromagnetic Interference - Interference with telecommunications and radar systems.

Habitable Structures - All structures designed to accommodate people including residential, commercial, institutional, industrial and recreational buildings, but not including accessory structures such as sheds and storage areas.

Hectare – 10,000 sq metres, 2.47 acres.

Hub height – The distance from the ground to the centerline of the rotor.

Ice Throw - Ice fragments that are thrown from the blade of an operational turbine.

Nacelle - The frame and housing at the top of the tower that encloses the gearbox and generator and protects them from the weather.

Nameplate Capacity - Manufacturer's maximum rated output of the electrical generator found in the nacelle of each turbine.

Net Metering - An agreement with local utility that allows wind turbine owner to send excess electricity to the utility and then withdraw electricity when wind system does not produce power, essentially a way of 'banking' energy for the wind turbine owner. NB Power does not allow the sale of excess power. Any excess electricity not used during the current billing period would appear as a credit and is carried forward to subsequent months up to March of each year, after which it is reduced to zero (www.nbpower.com).

Off Grid - A stand alone generating system that is not connected to the utility grid.

Proponent - Developers, operators and owners or investors of wind turbine development.

Remediation - Planned process to return site as close to its original natural state as possible.

Separation Distance - The distance between the wind turbine and any specified building, structure, road, or natural feature.

Setback - Distance between a property line and a wind turbine tower.

Wind Turbine Facility (Wind Farm) - Generally, two or more large scale wind turbine generators which are connected to the transmission or a local distribution grid. Wind turbine facilities require a central computerized monitoring system that monitors the operation of the turbines. Usually a small building on site houses this system and there is a link to a headquarters off site.

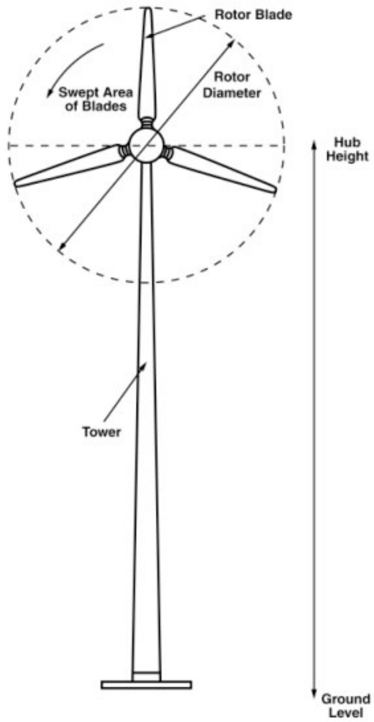


Figure 1 Wind turbine schematic. (Modified image from Natural Resources Canada)

The following is a list of commonly used acronyms associated with equipment and activities in the wind energy industry in Canada and throughout this report.

ACOA	Atlantic Canada Opportunities Agency
AD	Air Defense
AusWEA	Australian Wind Energy Association (former acronym)
Auswind	Australian Wind Energy Association (current acronym)
CIH	Certified Industrial Hygienist
CADS	Canadian Air Defense System
CPA	Community Planning Act
BC	British Columbia
BOREAS	Boreal Ecosystem-Atmosphere Study
BWEA	British Wind Energy Association
CanWEA	Canadian Wind Energy Association
CBRM	Cape Breton Regional Municipality
CCA	Capital Cost Allowance
CRA	Canadian Revenue Agency
CRCE	Canadian Renewable and Conservation Expenses
CWIF	Caithness Wind Farms Information Forum
DND	Department of National Defense (Canada)
EG&SP Act	Environmental Goals and Sustainable Prosperity Act
EUB	Energy and Utilities Board (Alberta)
GHG	Greenhouse Gas
HRM	Halifax Regional Municipality
ISO	Not an acronym, but represents the International Organization for Standardization

km	Kilometres
L_{eq}	Equivalent continuous noise level
LUB	Land Use By-law
LPA	Local Planning Authority
m	Metres
MOE	Ontario Ministry of the Environment
MGA	Municipal Government Act (Nova Scotia)
MPS	Municipal Planning Strategy
MW	Megawatts
NB	New Brunswick
NBDNR	New Brunswick Department of Natural Resources
NBENV	New Brunswick Department of Environment
NS	Nova Scotia
NREL	National Renewable Energy Laboratory
NRCan	Natural Resources Canada
NWCC	National Wind Coordinating Committee (USA)
PEI	Prince Edward Island
QEP	Qualified Environmental Professional
R&D	Research & Development
RABC	Radio Advisory Board of Canada
RCMP	Royal Canadian Mounted Police
RCS	Radar Cross Section
REPP	Renewable Energy Policy Project (USA)
RETP	Renewable Energy Technologies Program
RFP	Request for Proposal
RICS	Royal Institute of Chartered Surveyors
TEAM	Technology Early Action Measures
WECO	Wind Energy in Cold Climates
WTGs	Wind Turbine Generators
ZB	Zoning By-law

2.0 BACKGROUND

In Chapter 2, background information on existing wind energy projects and on emerging issues is provided from an international, Canadian and New Brunswick perspective. A detailed analysis of these topics is beyond the scope of this document. The information provided is meant to illustrate, in general terms, where Canada and New Brunswick in particular are positioned in terms of worldwide wind developments and what issues and initiatives may drive or hinder development in the future.

2.1 International Wind Emergence

Worldwide, wind energy development is booming. As of April, 2008, approximately 100,000 MW of wind energy was on the grid, up by 20,000 MW from a year previous, a 31% increase from 2006 (Worldwatch Institute, BTM Consult ApS 2008). Europe leads the world in installed capacity, with 56,535 MW, an 18% jump over the year previous, with wind representing 40% of new energy sources. The US is quickly catching up, however, adding 5,244 MW over the year previous, increasing cumulative installed capacity by a stunning 45%. Wind represents almost one third of all new energy sources in the US, making it second only to Germany as the largest producer of wind energy in the world, with 16,818 MW. Germany, with 40% of Europe's wind power, and 24% of the world's, is still leading the global wind movement. However, growth is slowing in some countries as good land is becoming increasingly scarce and economic factors are shifting away from wind, though other renewables are now stepping up to keep pace. Off-shore wind developments are also emerging as a solution to continuing wind development in densely populated countries with extensive coastlines such as Denmark.

Europe is still a world wind leader with most of the EU members now investing heavily in wind energy, including the UK, Italy, France, Spain, and others. This increasing diversity is now being reflected all around the world, with more than 70 countries now producing wind energy (Worldwatch Institute). China is quickly becoming a world leader, with additions far exceeding predictions, to over 6,000 MW of wind installed, and another 4,000 MW to come online this year (BTM Consult ApS 2008).

The main bottleneck in international wind production is in manufacturing. Parts manufacturers cannot keep pace with demand, which is slowing down or stalling some installations in the US. It is expected that this hurdle will be cleared next year. This bottleneck has halted the downward trend in costs, which have lowered the price of wind 50% over the last several years, with efficiencies going up. Even given the price increase, however, wind is still competitive with many other sources of energy, especially with a price being put on carbon dioxide emissions in many countries and the steadily high price of oil.

2.2 Canadian Wind Developments

Canadian wind energy production has been following international trends with major expansion in recent years, and with current production in the range of 1,900 MW and rising. The federal government, by increasing pressure on the energy sector to produce electricity without GHG emissions, has encouraged investment in clean alternatives like wind. More stringent regulations, higher fuel prices, and decreasing costs for wind energy development are making wind energy a viable alternative to conventional energy production. This can be seen in the recent Canadian growth, with an average of 51% growth from 2000-2006, and an estimated additional 700 MW of wind generation in 2008 (BTM Consult ApS 2008). From coast to coast, wind energy development can be found in virtually every province, either as proposals, in development, or already on the electrical grid.

In response to an increasingly strong public interest in addressing environmental concerns (especially climate change) the Government of Canada has supported innovative technological solutions such as renewable energy generation technologies. This has included financial support for the research and development (R&D) phases of renewable energy technologies, as well as direct incentives (capital investments, tax rebates, etc) to put renewable energy technologies on an equal footing with conventional fossil fuels.

The government of Canada currently supports various stages of wind energy development through the following mechanisms:

- ecoENERGY for Renewable Power Program - Financial payment upon production (one cent per kilowatt-hour for up to 10 years to eligible low-impact, renewable electricity projects constructed between April 1, 2007 and March 31, 2011).
- Technology Early Action Measures (TEAM) - Supports projects that are designed to develop technologies that mitigate GHG emissions.
- Atlantic Canada Opportunities Agency (ACOA) Business Development Program- offers access to capital in the form of interest-free, unsecured repayable contributions, focusing on small and medium sized enterprises.
- The Renewable Energy Technologies Program (RETP) - Funds R&D pre-commercialization, including testing and demonstration projects.
- Canadian Renewable and Conservation Expenses (CRCE) - fully deductible expenditures associated with the start-up of renewable energy and energy conservation projects for which at least 50 percent of the capital costs of the property would be described in Class 43.1.
- Class 43.1 – (Canada Revenue Agency and Natural Resources Canada) - Capital cost allowance (CCA) rate of 30 per cent for certain types of renewable energy and energy efficiency equipment.

In addition, through new regulations such as those associated with the new national carbon cap and trade market, the Government of Canada is prompting industries and communities to move towards less carbon intensive modes of production, including increased reliance on clean and renewable energy sources such as wind. In due time, the carbon market might introduce further incentives for the wind energy industry in Canada by setting up mechanisms for industries to buy renewable energy credits towards meeting their required GHG emission reduction targets.

2.2.1 Overview of Projects in Canada

Canada is known the world over as rich in natural resources. The situation is no different with wind. Given its huge land mass, extensive coastline, and relatively even dispersal of blowing wind in rural areas, wind energy has the potential to become a significant source of energy production in the country. Wind can also compliment Canada's massive hydroelectric power production, for when the wind doesn't blow, the water often flows. Currently, according to the latest estimates by CANWEA from

January 2008, roughly 1,856 MW of wind energy is currently connected to the grid, meeting 0.8% of the country's energy needs – a tiny fraction of its potential.

2.2.1.1 Large Scale

Canada's largest wind farm is currently Prince Project in Ontario, with 186 MW of electricity produced by 126 turbines. Such large scale wind farms are currently rare in Canada, however, as the 8 largest projects produce more energy than the other 73 combined. Given the relative infancy of the wind industry in this country, however, this is to be expected. As federal and provincial governments continue to encourage renewable energy, and as businesses see these investments as less risky and increasingly profitable, it is expected that large scale wind farms will become more common.

2.2.1.2 Small Scale

Small scale wind energy produces electricity for local, usually on-site energy needs, such as with a home, business, or industrial building. In this case, the turbine is placed close to the source of need, and is used to supplement electricity consumed from the grid. Any extra electricity can usually be fed into the power grid, for either later use or for a small fee.

In Canada, most wind energy projects are on a relatively small scale, producing 5 MW or less. Such small scale projects often work as pilots for larger scale production. In Nova Scotia, for instance, the Pubnico Point project, phase 1, which produces 3.6 MW, was built one year before phase 2, which produces 27 MW.

2.2.1.3 Off-grid/Net Metering

Few projects less than 300 kW have been constructed in Canada as of yet. As wind energy becomes more viable for local communities, businesses, and homes, due to the adoption of net metering policies, rising electricity costs and environmental concerns as well as more advanced programs such as Standard Offer Contracts (or "Advanced Renewable Tariffs") and customer rebates at provincial and/or federal levels, small scale production may become increasingly common.

2.2.2 Current Projects in New Brunswick

Expanding wind power and other renewable energy forms are key components in allowing New Brunswick to follow the provincial Energy Policy, the *Electricity from Renewable Resources Regulation*, issued under the *Electricity Act* in 2006, and the Minister of Energy's goal of making New Brunswick a "World Class Energy Hub". The province of New Brunswick has committed to increasing its generation capacity from renewable resources and as such has required, under the *Electricity from Renewable Resources Regulation*, that NB Power purchase 10 per cent of sales from new renewable sources by 2016. The provincial government has accelerated this time frame by asking NB Power to move immediately with the addition of an extra 300 MW of wind power in New Brunswick, which would bring the wind power generation capacity to over 400 MW once all projects planned are completed by the end of 2009. A summary of proposed and approved large scale wind projects is provided in Table 1. A larger list of projects undergoing system impact studies by the New Brunswick System Operator (NBSO) is available on the NBSO website at:

http://www.nbso.ca/Public/en/op/transmission/connecting/SIS.aspx

Table 1 Summary of New Brunswick Wind Power Projects

Project	Status	Ownership	Size	# of Turbines	Location	Land
Caribou Mountain	Proposed- in service 2009	SUEZ Energy	Up to 99 MW	33	Gloucester / Northumberland County	Crown
Lamèque Island	Proposed- in service November 2009	Acciona Energy	49.5 MW	33	Gloucester County	
Aulac	Proposed – in service November 2009	Acciona Energy	65 MW	43	Westmorland County	
Kent Hills	Approved- in service fall 2008	TransAlta	96 MW	32	Albert County	Crown
Fairfield Hill	proposed	Vector Wind Energy Inc.	21 MW	7-11	Westmorland County	
Dark Harbour	Postponed	Eastern Wind Power Inc.	20 MW	11- 14	(west side of Grand Manan)	

Figure 2 Geographic Locations of Announced New Brunswick Wind Developments,
www.nbpower.com

NB Power has stated that they are making efforts to have geographical diversity in the wind projects awarded in the province. This will allow NB Power to purchase wind energy from wind generators in areas experiencing high winds at times when wind in other areas of the province may be too low to generate any electricity from a single site. The five wind areas as defined by NB Power and depicted in Figure 2. The first two major wind announcements were for wind development in southern New Brunswick, followed by two announcements for northern New Brunswick.

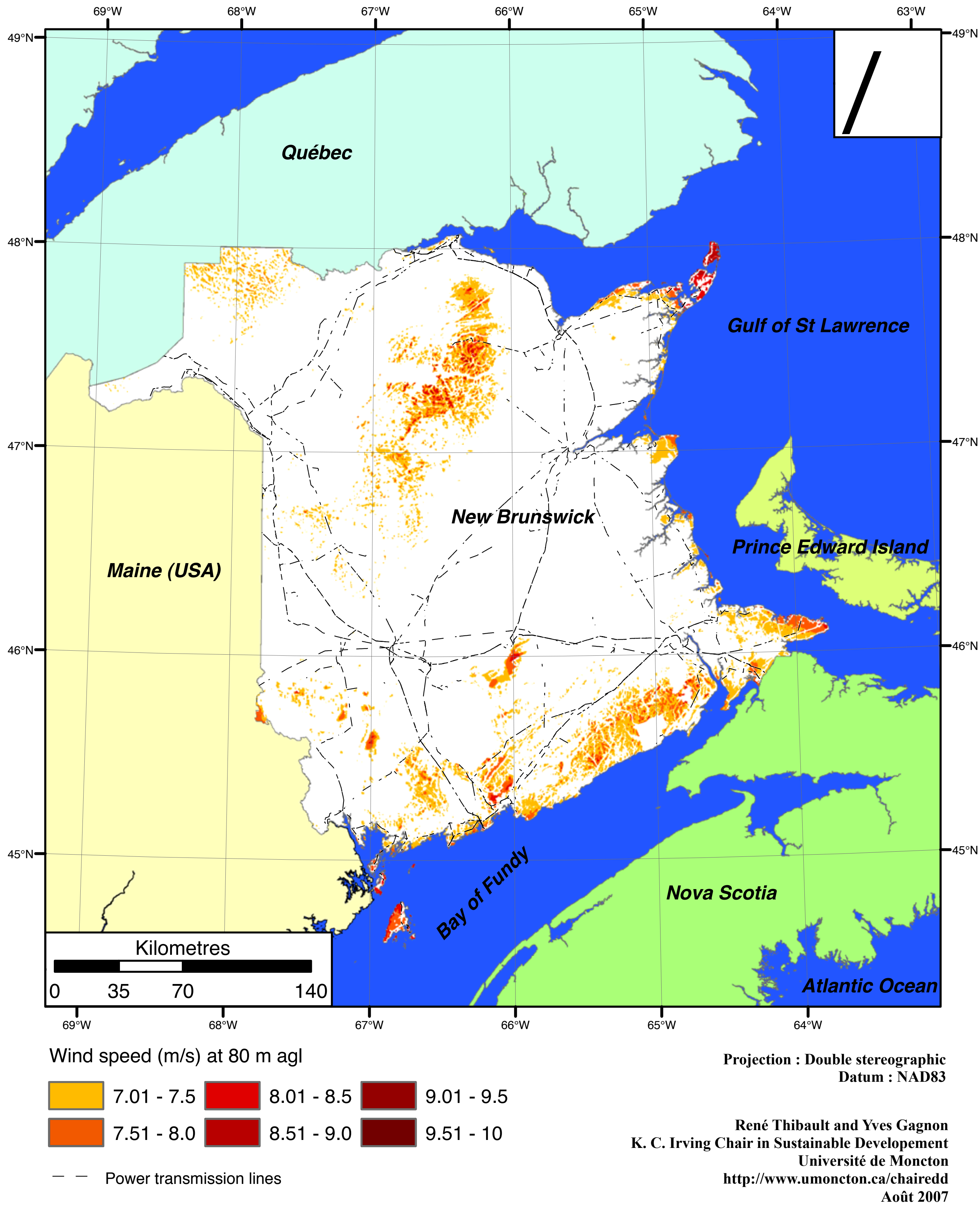
Local organizations see these developments and more to come as key opportunities in expanding wind energy production. Wind Dynamics, for instance, which has partnered up on two of the projects mentioned above, is a locally owned and operated company that specializes in renewables, and sees greater potential for wind energy in New Brunswick. Companies such as this will benefit greatly from policies and planning frameworks that recognize the role of wind energy in local development opportunities. Similarly, the Falls Brook Centre (FBC), a non-profit organization active in engaging the public about renewables, has been an educational leader with regards to wind energy and other renewable energy. They were the first net metering site in New Brunswick, and have encouraged community and cooperative ownership models for wind energy generation. As the public engages in discussions around wind energy, local organizations like FBC help to educate the public and foster the expansion and development of this renewable resource.

2.3 Wind Development Potential in New Brunswick

Researchers, lead by Dr. Yves Gagnon, the K.C. Irving Chair in Sustainable Development at the Université de Moncton, and a WEICan Board director, developed an updated, high-resolution wind map of New Brunswick in May of 2007. In addition to his work in New Brunswick, Dr. Gagnon has also developed a similar wind map in PEI and Nova Scotia. These maps show in graphical form, the potential of the wind resource around the province and have been used by NB Power and individual developers in planning their project proposals. The “Exploitable Wind Resource Map of New Brunswick” is reproduced below.

Figure 3 Wind Resource Map of New Brunswick

Source: http://www.umoncton.ca/chairedd/atlas_eoliens.html



This map describes the exploitable wind resource of the Province of New Brunswick at 80 meters above the ground level (agl) at a resolution of 200 m based on five years of meteorologic analysis RUC (Rapid Update Cycle) data. Although it is believed to represent an accurate overall picture of the wind energy resource, estimates at any location should be confirmed by measurements. The authors are not responsible of the use of the present map.

As illustrated by the colored sections in the mapping, wind development potential exists in many regions of the province, along the coasts as well as inland in areas of elevated terrain. In total, roughly 5,200 square km of land has wind resources of 7 m/s or greater – an economically viable wind source. This wind resource has a theoretical potential to produce over 41,500 MW of electricity for use in the province and export, roughly 10 times the amount of electricity produced in New Brunswick today.

2.3.1 Emerging Issues

The accelerated schedule that the provincial government has placed on increased wind generation in New Brunswick means that municipalities need to become educated on the issues and best practices surrounding wind development so that they can make informed decisions in the immediate future regarding their approach to the regulation of wind projects. Some of the emerging drivers for wind power development are presented in these sections.

2.3.1.1 Federal Government Addresses Climate Change

Government regulation is moving quickly to address issues surrounding climate change and the reduction of GHG emissions. The Federal government has recently released a framework called "Turning the Corner", which attempts to address rising emissions by setting a price on carbon dioxide emissions and setting clear limits and targets on emissions reductions. Through this framework, the government is putting increased pressure on energy producers to drastically improve existing facilities, especially those using coal or other fossil fuels, or encourage switching to renewables, such as wind, hydroelectric or biomass. As the price of carbon dioxide emissions continues to climb into the future, and as more of that money is invested in low emission technologies, wind will most likely continue to increase in popularity as a source of energy.

New Brunswick is also voluntarily involved as an observing member with The Regional Greenhouse Gas Initiative (RGGI), a multi-state, multi-province, cross border mandatory cap-and-trade program for reducing carbon emissions (www.rggi.org). The Northeast and New England states are working with the Maritime Provinces to make this the first such regional carbon emissions reduction partnership. This initiative focuses on electricity generation, which represents roughly 40 percent of the emissions created in this region. Therefore, drawing more electricity from renewable resources like wind will help New Brunswick in its participation in this program.

2.3.1.2 Amendment to Municipalities Act in New Brunswick

Local Government introduced amendments to the *Municipalities Act* in the legislature on May 15, 2008 to allow municipalities and rural communities to be generators of electricity, as defined in the *Electricity Act*.

Projects that could be undertaken by municipalities and rural communities for the generation of electricity include wind power, co-generation, solar-powered electricity and bio-gas." (Government of New Brunswick 2008)

These amendments will allow municipalities and rural communities to construct, own and operate a generation facility, and to use the electricity for their own purposes or sell it within defined parameters.

The amendments also give municipalities and rural communities the ability to acquire land to carry out this activity, and enable them to join together or to join others to share the costs and benefits of electricity generation (Government of New Brunswick 2008).

Under this bill, municipalities and rural communities will now be allowed, as other generators of electricity, to engage in three permissible activities:

- Large scale generation projects connecting directly to the transmission system (*e.g.,* a municipality could have a wind farm, or partner with others to have a wind farm, and sell the electricity by private contract to the NB Power Distribution and Customer Service Corporation (Disco), or to a customer in Maine);
- Embedded generation - a generator connects its electricity into the local distribution system and sells its electrical output to Disco (*e.g.,* a community could collect the methane gas from a decommissioned landfill, burn it and generate electricity to sell to Disco); and
- Net metering - end users of electricity displace some or all of the electricity that they would otherwise purchase from Disco by generating electricity for their own use (*e.g*., a municipality could use solar panels to heat a pool and participate in net metering with Disco).

All activities of municipalities and rural communities having potential to yield revenue require budgeting, reporting and borrowing provisions to ensure accountability and authority. The bill therefore incorporates various financial provisions, which include:

- The requirement to establish a generation facility fund and to submit a budget for this activity annually to the Minister of Local Government;
- The obligation to provide for a balanced budget; and
- The ability to charge against other operating funds at the discretion of council to ensure a balanced budget.

This bill received Royal Assent, in June, 2008, and is anticipated to be proclaimed into law in the fall of 2008. This bill is an indicator of the evolving energy market in New Brunswick and the possibility for municipalities and rural communities to become involved in energy projects in a new way in the future.

2.3.1.3 Community Ownership Models

Community or cooperative ownership and management plans are becoming increasingly common in Canada, especially following the wide success in European countries such as Denmark, Germany, Sweden, and the UK (Bolinger 2001). Examples abound as to the accomplishment of this model, with half of German wind capacity (worth nearly $20 billion) being developed by landowners and small investors (Gipe 2007). The cooperative wind energy movement in Europe has been the driving force behind the success of the industry, and could similarly boost New Brunswick's development in this area.

The Government of New Brunswick recently launched a community wind energy initiative in which residents had the opportunity to attend consultation sessions around the province. The objectives of the consultation sessions were to inform communities on community wind energy; identify issues, barriers and obstacles for community wind energy projects to develop in New Brunswick; and measure the level of interest of communities for community wind energy. These consultation sessions were guided by Dr. Yves Gagnon and further information regarding the initiative is available at http://www.nbcommunitywind.ca.

Community wind projects typically range in the magnitude of 5 to 15 MW (megawatts) and consist of between three to ten wind turbines. These wind farms will be locally owned by community members or organizations, or local ventures, with the goal of maximizing local benefits and affording individuals the opportunity to assist the province in reaching its climate change goals. This aspect of wind energy development is further discussed in Section 5.5. Given its community focus, cooperative models are complimentary to the above noted changes to the *Municipalities Act*.

3.0 WIND TURBINE ISSUES

It is difficult for local governments to rule for or against a given wind energy development, or even engage in a productive conversation and information sharing exercise with citizens in absence of scientific information and background on the issues. Fortunately, as the number of wind energy developments increases around the world, so do the research studies and information available about this renewable energy source. Although the availability of peer-reviewed articles is still limited, there is more available on the topic now than there was even a year ago. Similarly, there will be more available a year from now as the industry continues to grow at a tremendous rate. This summary of the primary issues surrounding wind energy was developed through a substantive literature review and draws as much as possible on peer-reviewed technical reports on the subject.

Note that many of the issues surrounding wind turbine development are regulated by the provincial government and the federal government. For example, the following are key issues that fall under the responsibility of the provincial government, not local governments:

- Vegetation and habitat, including birds and bats;
- Greenhouse gas emissions;
- Aviation safety;
- Telecommunication and EMI;
- Worker safety;
- Insurance;
- Performance and testing requirements;
- Decommissioning;
- Health and safety;
- Blasting activities, pre blast survey; and
- Emergency responses in case of spill, failure, blade or ice throw, soil and water contamination.

These items as well as others that are more pertinent to local government are discussed in this section to provide a more complete overview for the information of local government.

3.1 Construction

Generally speaking, the construction of a wind turbine or wind farm proceeds in a similar manner to other commercial or industrial construction projects and has similar issues such as:

- Noise from heavy equipment;
- Increased traffic to and from the site due to delivery of materials and on-site personnel;
- Loss of terrestrial and bird habitat from clearing;

- Potential for erosion and sedimentation due to clearing and grubbing;
- Dust and traffic impacts, due to the movement of equipment, including turbines;
- Emissions of air contaminants and GHGs from the combustion of fuel in heavy equipment; and
- Potential for contamination of waterways from oil or hydraulic fluid spills from heavy equipment.

These issues as they relate to wind energy projects are briefly discussed in the following subsections.

3.1.1 Noise

Given the use of heavy equipment during the construction of a wind turbine, such as excavators, cranes, and cement trucks, for example, a certain level of noise is to be expected. However, this can be mitigated to a large extent by tightening the timeframe for construction of the turbine. Noise related to the construction of a wind turbine installation is therefore likely to be of shorter duration than many other generating options (fossil fuel, nuclear, biomass, large hydroelectric).

3.1.2 Oil Spills

Oil spills from construction of wind turbine developments are very unlikely and no more likely than with construction of any facility requiring the use of heavy equipment. Most of the vehicles used, including excavators, cranes, and personnel carriers, will only be on location for a limited time period. These vehicles and associated equipment should be inspected before being moved to the development location.

3.1.3 Traffic and Roads

Roads will need to be created to get construction vehicles and related wind turbine equipment and materials to the site. Further to this, existing roads will also be affected by increased construction traffic, especially during component delivery to site. The impact of new roads and all associated traffic depends on the ecosystem, terrain, and location of the development. Environmental assessments should take into account the most sensitive areas in order to avoid them in the construction and use of any roads. Further, precautions should be taken to minimize, to the greatest extent possible, the impact of roads and transportation on the development site and areas leading to it. From previous wind turbine developments, studies have shown that roads, wind turbine base, and other associated infrastructure use 1-3% of the area of the associated ecosystem habitat (EWEA 2003). Logging, recreational, or other such roads, where available, should be used to minimize additional project footprint.

3.1.4 Vegetation and Habitat

Environmental effects to surrounding ecosystems can be mitigated or minimized through proper planning and consideration of equipment use. The footprint on vegetation and habitat should be limited to the creation of an access road, transmission line and to the site directly surrounding the wind turbine. Once construction is complete, most of this area can be left to former uses, such as cattle grazing for livestock, or for forest growth (EWEA 2003). Remediation of the surrounding environment should be a part of the post construction work.

3.1.5 Greenhouse gas emissions

A wind turbine is a modular unit, and the GHG emissions associated with the construction of a wind development are largely dictated by the project scope and type, but in both cases the emissions can be broadly categorized as mobile source emissions, or stationary source emissions.

Emissions from mobile source emissions come from the consumption of fuel used in the transportation of materials, goods, and services, and from the operation of light and heavy equipment used for site preparation and turbine deployment. On site activities that typically generate emissions in a construction environment before and during the building, alteration, rehabilitation or improvement of property in preparation for a wind development, may include, but are not limited to the following activities: grading, excavation, trenching, loading, vehicular travel, crushing, blasting, cutting, shaping, equipment staging/storage areas, and adding or removing bulk materials from storage piles.

These activities require the use of bulldozers, graders, dump trucks, pavers, excavators, cranes, and other large vehicles with articulated loads, to develop access roads and install transmission lines. In many cases, the delivery of turbines requires alterations to the flow of local traffic due to the size of the equipment, thus increasing idling time.

Other GHG emissions in a construction environment come from stationary sources, including fuel combustion in portable generators, and electricity consumption, used for activities like fabrication, grinding, and drilling operations.

The construction of individual wind turbines and cluster developments in general, would emit fewer GHG's than larger scale wind farms, however, there may be 'economies of scale' associated with larger developments, thus lowering the GHG intensity associated with each turbine deployed (turbine). Studies have shown that the construction and distribution of wind turbines produces less than 2% of the GHG emissions than would be produced by equivalent energy production through the use of fossil fuels. Further, as renewable sources of energy continue to come on line, this percentage will steadily decrease (EWEA, 2003).

3.2 Operation

Once an appropriate site has been selected and constructed, a typical wind turbine is expected to be in operation for 30 to 50 years. During its operational lifetime, a typical wind turbine is expected to be down for maintenance for less than 2% of the time (Constanti et al., 2006). A wind turbine only produces energy when the wind is blowing, often at rates between 4 m/s and 25 m/s (65-80% of the time). Anything less than this amount and there is not enough energy in the wind to draw from, anything more and most turbines stop due to safety measures. This section is intended to provide specifics about the operation of many aspects of turbine during its useful life.

3.2.1 Aviation safety

Standard setbacks surrounding airport facilities are in place to insure that there is little opportunity for physical interaction between aircraft and wind power installations. The deployment of such setbacks is already a well established practice, particularly regarding any structures with specific height characteristics (Transport Canada and Nav Canada have specific requirements). Wind turbines of the size that will be typically used in New Brunswick require aviation obstruction marking. The flashing red or white lights atop the nacelle are intended to warn aircraft of the turbine's presence. The flashing lights are particularly noticeable at night, but may also designed to be visible during the day. The obstruction lighting requirements will be determined by Nav Canada depending on the location of the nearest airport and common flight paths (Gipe & Murphy, 2005). Transport Canada currently recommends that wind turbine farms have set spacing of lights for individual wind turbines. They recommend that wind turbines in a farm array should be lit every 900 m (in the US the practice is every ½ mile) (Alf, 2008). Turbines may also be painted to improve visibility, but this may negatively intrude on the visual impact of the turbines. Transport Canada currently requires orange markings on wind turbine tips and it is revising its standard to eliminate this practice as a requirement (Alf, 2008). Aviation safety is directly related to two of the other impact topics, and thus relevant information can be found in the subsections Visual Impact and Telecommunications/Electromagnetic Interference, discussed further in Section 3.2.15 and the Section 3.2.12 respectively.

To date there has been one reported accident, which related to aviation safety and wind turbines. In 2005, a crop dusting pilot died after hitting a guy wire caused a wing to be sheared off and the plane to crash into an anemometer at a recently installed wind farm in the United States (Craig, 2006). There are no reports of wind farms causing accidents related to aeronautical problems in Canada (Alf, 2008).

3.2.2 Birds and bats

Wind turbine operation may affect birds and bats in two main ways: collisions and sensory disturbance. The most common cause of fatalities is collisions with rotors, towers, power lines, and associated structures. Studies have shown that, on average, less than two birds per turbine per year are killed via collisions (Resolve 2004). Kingsley and Whittam (2007) provide a detailed review of available information regarding turbine-related bird fatalities in North America and elsewhere. Numerous studies during the last 20+ years have been conducted to estimate bird mortality at wind farms, from a single turbine to small wind farms with dozens of turbines, to larger wind farms with thousands of wind turbines (Gill *et al*. 1996, Erickson *et al*. 2001, Percival 2001). A summary of bird death statistics from several studies for various causes is provided in Table 2.

Table 2 Summary of Bird Death Statistics According to Various Studies

Cause	Bird Deaths/Year in the U.S.	Source
Glass Windows	100 to 900+ million	Dr. Daniel Klem of Muhlenberg College
House Cats	100 million	The National Audubuon Society
Automobiles/Trucks	50 to 100 million	National Institute for Ubran Wildlife and U.S. Fish and Wildlife Service
Electric Transmission Line Collisions	Up to 174 million	U.S. Fish and Wildlife Service
Agriculture	67 million	Smithsonian Institution
Communication Towers	4 to 10 million	U.S. Fish and Wildlife Service
Oil and Gas Extraction	1 to 2 million	U.S. Fish and Wildlife Service
Hunting	More than 100 million	U.S. Fish and Wildlife Service
Wind Turbines	<40,000	National Research Council

A study undertaken in Southern Spain entitled "The effects of a wind farm on birds in a migration point: the Strait of Gibraltar" observed wind turbine effects on bird populations (Lucas *et al*. 2004). The authors concluded that, although bird impact is an important factor to consider when developing wind farms, they are no more detrimental to birds than other man-made structures. Flight behavioural patterns were studied, and associated observation of soaring birds changing their flight direction when they fly near turbines led to the conclusion that soaring birds can detect the presence of wind turbines and alter their paths.

The literature around the impacts of wind turbines on bats is relatively thin. With the exception of a few sites, studies from wind farms are reporting relatively small numbers of casualties, even taking into consideration carcass removal and searcher efficiency. One exception is the Mountaineer Wind Energy Centre on Backbone Mountain, West Virginia, where approximately 400 bats were found killed by 44 turbines during the first year of its operation (Lindsay and Kearns 2003). Of the 232 that were identified to the species level, most of the bats killed were Eastern Red Bats and Hoary Bats (Lindsay and Kearns 2003). At the Summerview Wind Farm in Pincher Creek, Alberta, post-construction monitoring recorded more than 500 bat fatalities during the fall migration period in 2005. A detailed environmental assessment was completed for this project and no significant environmental effects on bird or bat populations were expected based on current collective knowledge of bat-turbine interactions across North America and in southern Alberta specifically. Research continues at this site, supported by the proponent and led by Dr. Robert Barclay of the University of Calgary. This research has already led to a better understanding of the mechanisms of bat collisions, and potential mitigation that can reduce the incidence of collisions, and will continue to provide answers to research questions in the future. For example, further research will further examine how changes to the turbine operation can significantly mitigate bat casualties during bat migration.

The operation of wind turbines may also result in visual and auditory disturbance of wildlife, including birds. Breeding birds may avoid habitat within a zone surrounding the immediate Project footprint, although sensitivity is species-specific (Kingsley and Whittam 2004). Many species will not avoid habitat near to rotating wind turbines, as has been noted by James (2003) and James and Coady (2003), but other species show a reduction in breeding densities near turbines (Johnson et al. 2000). Habitat avoidance will most likely occur during periods of construction, and may be more intermittent during periods of operation, when human activities on-site are less frequent and would be typically of short duration.

The flight behaviour of birds may be influenced by project development. Operation of the turbines may affect bird movement through the partial obstruction of regular flight paths. Certain species (e.g., waterfowl) appear to exhibit avoidance behaviour when flying close to an operating wind farm, while others do not appear to be influenced by the presence of a wind farm (James 2003, Kingsley and Whittam 2004). Breeding birds at Pickering, Ontario, do not appear to be disrupted by the 1.8 MW operating turbine, and birds continue to nest and move within the area as before (James 2003). At night, migrants typically fly well above the height of wind turbines, typically greater than 150 m above the ground. However, to the extent wind turbines create visual or auditory features that birds may wish to avoid, this may have a constructive effect in that birds will be less likely to accidentally collide with them.

3.2.3 Blade Throw

Blade throw describes the situation when the full blade or part of the blade becomes detached from the wind turbine system and falls or is thrown through the air. There are a number of factors that can contribute to such an occurrence: unforeseen environmental events outside the design envelope; lightning damage; failure of turbine control/safety system; human error; incorrect design for ultimate and/or fatigue loads; and poor manufacturing quality (Larwood 2006).

Through constantly improving manufacturing techniques and processes, the last two forms of failure are becoming increasingly less common in the industry. For instance, in the United States, the average lightning strike rate is approximately 1 hit per turbine in 600,000 years (Garrad Hassan 2007). With blade failure probability low, blade throw is even lower (CanWEA 2007). When blade failure does occur, however, the area immediately below the blade radius is the most likely point of impact. Documented blade failure and throw distances have been studied, with the maximum distance from the tower for an entire blade of 150 m, and for a blade fragment 500 m (Garrad Hassan 2007).

Despite an extensive search, no studies were found that speak specifically to cases of blade throw associated with small turbines, or ways to mitigate such impacts. The suggestion for setbacks as cited in Larwood (2006) in the order of 1.25 to 3 times the total height of turbine is the best guidance that can be found currently as applied to small scale turbines.

3.2.4 Erosion

Large scale wind turbines are occasionally sited on slopes of hills to maximize the local potential of harnessing wind power, however this is often where there is also a higher potential for erosion. Construction can also result in increased exposure of the land area to the weather. Planning should take account of such things as time of year, as construction during the springtime can increase the amount of erosion due to seasonal runoff and increased precipitation. Erosion can also occur on access roads if they are not properly maintained. These impacts can be adequately managed through controls identified in the environmental assessment or planning stages, and should be part of an overall environmental management plan.

Onsite erosion through turbine and road placement should be minimized through proper planning and research such as through soils analysis. Once construction is completed, the area should be re-vegetated as feasible to mitigate erosion.

3.2.5 Fire

Fire is an unlikely occurrence. If a wind turbine did catch fire, most likely in the nacelle, most turbines are programmed to respond accordingly, by stopping rotation and informing maintenance personnel. This situation should be avoided for the most part if turbines are regularly checked for issues and properly maintained.

A few incidents of wind turbines catching on fire have been reported (Craig 2006). A turbine located in Wales in 1997 caught fire as a result of overheating. In Denmark in 1999, the brakes on a turbine failed as a result of a storm, causing over-rotation and subsequently a fire. In 2000, a turbine was struck by lightning in Germany, burst into flames, and then the tower split 10m above the base. In 2004, a fire started following a refit of turbines in the United States.

Due to the height of turbines, there is little action fire crews can take to reduce the damage once a turbine has caught fire. Typically the turbine will be completely destroyed. The major concern is to protect the surrounding area and public from the debris that may fall within a several hundred metre range as the turbine burns.

3.2.6 Ice throw

Ice build-up can have two main safety issues; ice can accumulate on the tower or on blades when not in use, and can drop to the area below; or ice can build up on the blades of the wind turbine while in operation, with fragments dislodging and being thrown via aerodynamic and centrifugal forces.

Risks from ice throw are minimized through a series of actions including setbacks; monitoring of weather conditions that are conducive to icing so that operational time is curtailed or reduced during these time periods; design features to reduce the build up of ice on blades and to ensure that the operating parts of a structure can withstand increases in load; use of warning signs to alert public to risk; and automatic shut down systems in the wind turbine system that respond to changes in weather, changes in vibration that may result from icing and other sensory mechanisms (Garrad Hassan 2007). Specific design features that minimize risks include the use of ice sensors to detect when ice is building up to trigger a shutdown of the operation, blade heating systems and, in areas where icing is slight, painting blades black to maximize solar radiation (Baring-Gould 2005). Some European countries require that there be manual start-up following an icing shutdown to reduce ice throw.

Currently, there is a great deal of research underway to improve design and safety measures for wind turbines that operate in cold climates as a result of the increasing number of wind turbines being installed in northern climates. In Europe, several governmental agencies are supporting a project entitled Wind Energy in Cold Climates (WECO). CanWEA is also involved in research in this area. As a number of studies have shown, the probability of ice throw beyond 200 m is very low, at roughly 3/1000s of a percent (CanWEA 2007). To further decrease this probability, mitigation measures are often used, such as automated or (remote) manual shutdown. All commercial wind turbines also include vibration monitors, which shut down the turbine when vibrations exceed pre-set limits, as a result of ice buildup or other obstructions (Garrad Hassan 2007). Both the physical limits of ice throw and the safety features of the wind turbine severely reduce the likelihood of damage beyond 200 metres.

Despite an extensive search, there were no studies found that speak specifically to the case of ice throw associated with small turbines. A CanWEA survey of municipal minimum setbacks for small wind turbines indicates a wide range from 15 m to all property lines to 3 times total turbine height from habitable buildings, although there was no indication in the survey as to why municipalities have introduced specific setback distances (i.e. public safety, visual, noise, etc.) (CanWEA, Small Wind Siting and Zoning Study 2006). Some small wind proponents maintain that icing with small turbines is not a realistic problem since the blades become so heavy with the ice that they stop turning. Ice therefore will ultimately break off or melt and fall straight down to the base of the turbine, although it is recognized that there are no specific studies on smaller wind turbines and ice throw (Sagrillo 2003). The question of what happens to the ice during a start up phase is unclear as well as how this may apply to the various sizes of small wind turbines. Given that recommended setbacks for ice throw and blade throw are similar in the case of large turbines (Larwood 2006), it may be reasonable to assume that similar guidelines for blade throw (1.25 to 3 times turbine height) are appropriate to also shield against ice throw in the case of small wind turbines. Therefore, as with blade throw, setback from sound guidelines will go beyond the safety radius generally required for ice throw (CanWEA 2007).

3.2.7 Noise

3.2.7.1 General Noise Overview

As noise is a complex subject, some general introductory information is thought to be useful for those who do not have a background in acoustics. A complete description of acoustics is beyond the scope of this document, however, it is hoped that enough information is provided to give a general understanding.

Sound is produced by any vibrating body and is transmitted in air as a longitudinal wave motion. It is, therefore, a form of mechanical energy and is typically measured in energy-related units. For humans, sound is defined as acoustic energy in the frequency range that can be heard by the human ear - from 20 to 20,000 Hz. Noise is generally defined as “unwanted sound” and is thus subjective in nature. One of the most basic descriptors of sound is the sound pressure level (SPL). The SPL of a sound reflects only its magnitude and does not refer to the source of the sound or the character of the sound. Sound pressure levels are most commonly measured and described in decibels (Denoted dB) or A-weighted decibels (Denoted dB_A). A-weighted decibels more closely correlate with the subjective loudness of a sound, as discerned by the human ear.

Typical sound pressure levels range from about 20 dB_A in an extremely quiet wilderness area to between 50 and 70 dB_A in towns during the day time, 90 dB_A or more in industrial settings to well over 120 dB_A near to a jet-aircraft at take-off (Berglund, Lindvall 1995). The sound pressure levels of some familiar sounds are compared in Figure 4.

Figure 4 Comparison of decibel levels (http://www.hse.gov.uk/noise/advice.htm)

Another basic descriptor of sound is the Sound Power Level (PWL). This is a basic quantity which describes the amount of acoustic power radiated by a source (*i.e.*, motor, generator, wind turbine). It is the fundamental quantity which produces a sound pressure level (SPL) at a certain distance from a source. It is used to define the source for assessment purposes and to calculate the SPL at a receptor. The PWL is also usually described in decibels or A-weighted decibels. Several slight variations of the equation to calculate sound pressure level at a distance from the turbine based on the sound power level of the specific turbine exist which take into account the hub height, the distance from the base of the turbine to the receiver, air absorption and ground absorption losses.

Understanding the nature of sound travel in the outdoor environment is important to understanding the implications of various set back distances from turbines. Sound measured at a certain distance from a point source is reduced by about 6 dB_A at twice that distance. For example, if the sound from a source at a distance of 1 metre is 75 dB_A then at 2 metres it will be approximately 69 dB_A and at 4 metres 63 dB_A and so on. When more than one source is involved, the reduction of noise with distance may vary depending on the arrangement of the sources with respect to the receptor. Other factors such as complex topography, obstructions between the noise source and the receptor as well as atmospheric conditions, especially wind direction can also complicate the attenuation (reduction effect) of distance. These issues are dealt with through the use of computer modelling programs based on atmospheric physics. Many modelling protocols require that worst case atmospheric conditions or conditions that favor sound transmission (high wind speeds, wind blowing from the source towards the receptor) be assumed to give conservative modelling results.

A widely used "rule of thumb" for the loudness of a particular sound is that the sound must be increased in intensity by 10 dB_A for the sound to be perceived as twice as loud. For example it takes ten violins to sound twice as loud as one violin. Although this rule is widely used, it must be emphasized that it is an approximate general statement based upon a great deal of investigation of average human hearing but it is not to be taken as a hard and fast rule (Georgia State University 2005). Another rule of thumb is that differences of 3 dB are just perceptible, especially in a fluctuating sound, but 5 dB is distinctly perceptible.

3.2.7.2 Wind Turbine Noise

During operation, wind turbine generators produce noise from mechanical components (gearbox, generator and yaw motors) as well as from the interaction of the air and the turbine blades and structure. The noise a wind turbine creates is normally expressed in terms of its sound power level. Although this is measured in dB, it is not a measurement of the noise level which we hear but of the noise power emitted by the machine. The sound power level from a single wind turbine is usually between 90 and 100 dB_A (BWEA 2008).

Generally, wind turbines radiate more noise as wind speed increases. The increased noise generation has often been found to be less perceptible to people due to the concurrent increase in background sound levels generated from the higher winds (moving trees, flags) which masks the sound of the wind turbine. Several publications indicate that the greatest intrusion of wind turbine noise over background occurs at relatively low wind speeds (HGC 2007).

There is a vigorous and controversial public debate regarding sound emitted from wind turbines. Issues include sound emission, infrasound, and appropriate separation distance to protect residents and properties that are adjacent to wind developments. Varying perspectives regarding concerns around noise, infrasound, and amplitude modulation have translated into to a variety of inconsistent regulations and guidelines. The lack of commonly accepted standards has impacted the industry worldwide. Inconsistency in regulations challenges developers and equipment manufacturers who benefit from consistent expectations and playing field. This state of flux and dispute also makes it difficult for municipalities and other regulators to easily select best practices to adapt to their regulatory frameworks.

For clarity, it is useful to note that the literature on sound focuses on three categories:

- Noise – which consists of those frequencies audible to the human ear at various tones and comfort levels;
- Infrasound – which has frequency too low to be detectable by the human ear and instead may be experienced through "vibrations"; and
- Amplitude Modulation (AM) – which is a low frequency modulation of a wide set of frequencies.

In all cases, the debate centers on the levels, duration and time frequency of sound that can negatively impact human health or quality of life. The debate is further complicated by the difficulty in measuring or verifying health or quality of life impacts. The extent to which complaints or concerns regarding noise voiced by neighbours or opponents of wind energy projects arise from indisputable evidence or as an opposition tactic is also disputed but unknown. According to B. Regan, CIH. and T.G. Casey, QEP. the only health effect of wind turbine noise is annoyance (Regan Casey 2006).

Infrasound

Frequencies below 16 or 20 Hz are referred to as infrasonic frequencies. Specifically relating to infrasound from wind turbines, the report "Wind Turbines and Infrasound" submitted by HGC Engineering to the Canadian Wind Energy Association (CanWEA 2006) concludes that, "based on Canadian and international studies, infrasound generated by wind turbines should not be considered a concern to the health of nearby residents. The report states that older turbine models with downwind rotors created infrasound, but this is no longer a concern with modern turbines given that the low frequencies generated by new turbines have not been found to be a health concern. The report also explains that what is often confused as infrasound from wind turbines is actually the modulated (pulsing) amplitude modulation.

Perception of sound from 100 Hz down to about 2 Hz is a mixture of auditory and tactile sensations. For example, frequencies around 10 Hz, can cause discomfort through a modulation of the vocal cords (Birgitta Berglund & Thomas Lindvall,1995). Reactions caused by extremely intense levels of infrasound can resemble those of mild stress reaction and may include bizarre auditory sensations, describable as pulsation and flutter. Intense levels of infrasound can cause resonance responses in various organs in the human body, although long-term effects of such stimulation are not known. No scientific documentation was found indicating any of these types of reactions have been caused by wind turbines.

According to "Wind Turbine Facilities Noise Issues", a report prepared by Aiolos Engineering Corporation for the Ontario Ministry of the Environment and issued in December of 2007, the noise measurement results from wind turbines show the absence of significant low frequency components (Aiolos Engineering 2007). Data from van den Berg's dissertation show that the infra-sound levels are well below the threshold of human perception (van den Berg 2006).

Amplitude Modulation

Amplitude modulation is generally described as when the sound level rises and falls with time, perceived as a throbbing or pulsating "swish", "whoosh" (Pedersen 2007).

With regard to amplitude modulation, Dr. G.P. van den Berg has conducted several studies and published peer-reviewed articles. In his opinion, amplitude modulation is a concern regarding wind development. He has researched and published multiple documents on the 'pulsing' sound wind turbines can make when the atmospheric conditions are stable. This often happens late in the day, early evening and nighttime, and causes the turbines to generate a sound that has been described by nearby residents as "a clapping noise", and is incidentally at a frequency close to a beating human heart. The impulsive noise is created each time a blade passes the tower. The following excerpt references data taken from Dr. van den Berg's study of a 30 MW, 17 turbine farm in Northwestern Germany:

> On quiet nights the wind park can be heard at distances of up to several kilometres when the turbines rotate at high speed. On these nights, certainly at distances between 500 and 1,000 m from the wind park, one can hear a low pitched thumping sound with a repetition rate of about once a second (coinciding with the frequency of blades passing a turbine mast). In daytime these pulses are not clearly audible and the sound is less intrusive or even inaudible (especially in strong winds because of the then high ambient sound level).

Complaints have come from residents (in the Netherlands) living 500 m and more from the farm, and annoyance was expressed by residents up to 1,900 m away. Sound measurements were taken 400 m and 1,500 m away over 400 night hours in four months. Wind speeds at hub height at night were up to 2.6 times higher than expected, leading to up to 15 dB higher sound levels than during the day. Dr. van den Berg concluded in part, "The number and severity of noise complaints near the wind park are at least in part explained by the two main findings of this study; actual sound levels are considerably higher than predicted, and wind turbines can produce sound with an impulsive character" (van den Berg 2007). The Aiolos Engineering Corporation report "Wind Turbine Facilities Noise Issues", reviewed van den Berg's scientific evidence for increased annoyance from wind farm noise at night and had some criticisms for the conclusions made based on the data. This report suggests that future research must provide stronger scientific data to validate noise concerns (Aiolos Engineering 2007). As is the case with developments in general, complaints are not universal and the means to assess actual impacts are not easily measurable and quantifiable.

It is also impossible to generalize about the distances at which specific noise levels will be evident since audible noise from any wind development is always contextual. Audible noise measurements from a turbine or wind farm will vary widely depending on the manufacturer and nature of the turbine, landscape, wind speeds, time of measurement, weather and other climatic conditions. It can be further difficult to compare measurements cited from noise monitoring due to varying methodologies, equipment types and scope of area (i.e. whether regulation or monitoring protocol is based upon distance, property line or nearest dwelling, and if so whether at exterior or interior).

Noise from Small Scale Turbines

Most studies on noise from wind energy generation have concentrated on large, commercial scale wind turbines. Noise concerns related to small wind turbines have not extensively documented. Since the late 1990s, anecdotal reports and audio recordings have pointed to concerns with noise impacts but there has been a lack of quantifiable data that gives accurate measures for noise emissions. The National Renewable Energy Laboratory (NREL) published a series of tests on the performance of small and household-size wind turbines in 2003 (Migliore, van Dam, Huskey 2003).

In a research paper by the NREL on acoustic tests for small wind turbines in the U.S., the authors recognized the unfavourable reputation of small wind turbine noise associated with “high tip speeds, furling or blade flutter”. The researchers recognized that because small wind turbines will most likely be placed closer to residences than large wind turbines the issues related to noise may be of greater importance than when siting large turbines. The importance of having reliable data on noise emissions was noted, for both the wind turbine installer and local authorities, so that noise emissions were understood and effective mitigation measures could be put in place. The research project tested eight small wind turbines between 400 W and 100 kW and noted that several models tested showed significant progress towards quieter turbines (Migliore, van Dam, Huskey 2003). Results of the testing on several small turbines and estimated sound pressure levels at 300 metres are provided in Table 3.

Table 3 Sound Power Levels for Small Scale Turbines (Migliore, van Dam, Huskey 2003)

Type of Turbine	Hub Height (m)	Rotor diameter (m)	Power Rating (kW)	Sound Power Level (dBA) at 9 m/s	Sound Power Level (dBA) at 13 m/s	Sound Pressure Level (dBA) at 13 m/s wind, 300 m from base
AIR 403	13.3	1.14	0.4	84.2	97.7	39
AIR X (updated version of 403)	13.3	1.14	0.4	81.3	88.8	30
Whisper H40	9.1	2.1	0.9	87.4	96.3	37
North Wind 100	25	19.1	100	95.1	100.8	42
Excel BW03	36.5	7	10	102.2	112.2	53
Excel SH3052 (updated version of BW03)	36.5	6.17	10	92.3	99.0	40
AOC 15/50	25	15	50	101.9	NA	39

The conclusions of the field testing conducted in 2003 by the NREL team of Migliore, van Dam and Huskey as summarized in Table 3 above, showed substantive noise reduction in the modified turbines tested (Excel and AIR) versus their predecessors.

3.2.8 Oil spills

Modern turbines have very limited amounts of oil, which would be found in the nacelle for use as a mechanical lubricant. Spills would most often be observed as leaks down the side of the turbine, and should gain the notice of maintenance crews who regularly check over the turbine.

Several incidents have occurred involving the leaking of lubrication oil, mostly in Germany. In 2005, oil from a nacelle in Rheinland-Pfalz leaked from the machinery and down the tower. Some oil also found its way onto the blades, causing it to be thrown over a large area during operation. The amounts and concentrations were modest and the environmental effects, while adverse, were not deemed significant.

Sometimes these events are precipitated by other damage to the nacelle, such as in Saxony, Germany in 2003 where a turbine was destroyed by a storm, causing oil to contaminate the immediate area.

Here too, the significant effects were localized and amenable to remediation. In most cases, problems with leaks can be anticipated and avoided (NWCC 2002).

Maximum volumes of fluids as stated in the Spill Response Plan for the Kittitas Valley Wind Farm in Washington State (1.5-3 MW turbines) were 85 gallons/turbine of hydraulic oil and 105 gallons/turbine of gearbox lubricating oil. (Energy Facility Site Evaluation Council 2008)

3.2.9 Property values

There is a commonly expressed public concern that neighbouring property values will decrease as a result of wind energy development. However, there is little evidence to either verify or refute this concern, especially in Canada. From amongst the literature, there was found to be no documented evidence that wind turbines – even large scale wind farms – have ever lowered values for surrounding properties.

The British Wind Energy Association (BWEA) recently posted a news article in March 2007 that concludes that the effect of wind development on property values is neutral or positive. This conclusion is based on an independent study conducted by the Royal Institute of Chartered Surveyors (RICS) and Oxford Brookes University which found that there was no clear relationship between the location of wind farms and property prices in the nearby vicinity. The study also states that the belief that wind developments affect housing prices is nothing but an "urban myth". The RICS published a report in 2004 which concluded that any negative impacts wind development had on property value was reversed after a period of two years. However, the more recent aforementioned study by the same group goes as far as asserting that there is no credible empirical evidence that demonstrates a direct link between wind energy projects and housing values.

The Renewable Energy Policy Project (REPP – United States Government-funded agency) conducted a study in 2003 throughout the US which found similar conclusions. It examined ten different wind farms and their impact on property values in comparison to neighbouring test communities (typical growth rates, prices previous to development). With ten different wind farms being studied on these three different variables, 30 cases were deemed to have been studied. The study focused on wind farms installed between 1998 and 2001 with greater than 10 MW capacities. Over 25,000 property sales records were examined over a span of six years (pre and post development). The study, entitled The Effect of Wind Development on Local Property Values (2003), found that in twenty-six of the cases studied land and home values were higher than any of the control cases (before wind development, a comparable community, etc). There was no evidence of a decrease in property value. It should be noted that in the cases of increase, the increase could not be directly attributed to the presence of a wind farm due to a lack of relevant information.

3.2.10 Shadow flicker

Shadow flicker occurs when the angle of the sun and the rotating blades align with habituated areas. These moving shadows 'flicker' as the blades turn, and can affect residents living in this plane of view. Shadow flicker is dependent on the weather conditions (sun is shining or not), geographical position, topography and time of day. The duration and severity of shadow flicker effects varies depending on the time of year. The wind direction can also affect the potential impact because the rotor orientation will change according to its direction. Finally, the distance of the rotor from a receptor will influence the impact, since light perception diminishes with distance. The primary impact of shadow flicker is annoyance. Similarly, blades with glossy surfaces can be a visual nuisance.

There is limited history of specific regulatory guidance or requirements in Canada on shadow flicker, although when noted, 20-30 hrs/year of flicker is typically considered to be the threshold for concern. A British government ministry states that at a distance of 10 rotor diameters (usually equivalent to 400 to 800 m) a person should not experience shadow flicker (Department for Business Enterprise and Regulatory Reform, UK). Shadow flicker can be calculated by modeling tools considering the machine geometry and latitude of the site (Allen 2005).

Some jurisdictions, such as Germany, limit the amount of allowable shadow flicker to 30 hours per year (EWEA, 2003). Proper planning and computer modeling can discover where shadow flicker occurs and how it can be minimized given placement in the terrain and in relation to the surrounding area, which may or may not be inhabited. Further, should it be found that shadow flicker does occur at certain times during the year, a turbine can be programmed to shut down until the sun has moved to a position that precludes shadow flicker (EWEA 2003).

A report prepared for the County of Essex, Ontario by the Jones Consulting Group, outlines several standards that are used globally to mitigate against the impacts of shadow flicker. These include limiting the amount of time a receptor is affected by shadow flicker to a maximum of 30 hours per calendar year and a maximum of 30 minutes per day (based on a worst case calculation – maximum shadow during a day between sunrise and sunset on a cloudless day); maximum of 30 hours per year based on actual/real predicted values as opposed to worst case calculation (based on a German court decision to tolerate 30 hours of actual shadow flicker per year and then applying the probability of sunshine for the area); and separation of the turbine and receptor of a minimum distance of 10 rotor diameters. Variations of the maximum 30 hours per year of shadow flicker have become the prominent standard in use globally. The distance that should be calculated is for receptors within 1,300 m of a turbine with a total height of 140 m (Jones Consulting Group, 2007).

With regard to small wind turbines, it is suggested that there are no problems associated with shadow flicker due to the lower height of the turbine towers, the smaller length of the blade, the thinner width of the blade, and the faster rate that small wind turbine blades rotate as compared to large scale blades (for example, 28 rpm for smaller scale and 16 rpm for larger turbines). There may be some shadow casting but generally there has been no demonstrated shadow flicker (Sagrillo 2003).

3.2.11 Structural failure

Structural failure of wind turbines is not a common occurrence in relation to the number of operational turbines around the globe, but when it does happen it can be quite dangerous due to the size and weight of the components. Geotechnical investigations are required prior to foundation installation to ensure stability of the location and placement of the turbine; however, it is the structural integrity of the turbine itself that is questioned.

A variety of structural failures over the past few decades are worth highlighting. In Westpahlia, Germany, lightning struck a turbine, causing a fire and the mast to split. In Denmark, a storm caused brake failure in three turbines, resulting in all three being destroyed. At another location in Germany, a single turbine suddenly collapsed. Concrete damage was quoted as the cause. Two towers collapsed in Holland during a storm at separate locations. In Cornwall, UK, an entire wind power station consisting of 22 turbines was shut down as a result of metal fatigue. The same thing happened at two farms in Wales. In Norway, the nacelle and rotor of a turbine broke away from the tower as a result of overloading the brakes and safety systems. Again in Germany, a turbine completely collapsed after just two weeks; the cause was faulty welding. There are many more incidents which could be cited, some of which caused human fatalities, but this list gives a basic overview of the potential damages.

Issues with structural failure mainly involved storm damage to turbines and tower collapse. Poor quality control and component failure can also be responsible. The industry constantly improves these processes to ensure continued integrity of the structure. These industry improvements, combined with site specific assessment for projects, ensure the risk of tower failure is negligible (CanWEA 2007). Seeking out equipment that is technologically advanced and appropriate to the conditions, as well as establishing safety fallback systems will help to mitigate overall risk.

3.2.12 Telecommunications and electromagnetic interference (EMI)

There is an expressed public concern that wind energy development will generate electromagnetic interference that affects the operation of microwaves, televisions, and radar or radio transmissions. Sources show that this interference can be avoided and mitigated if properly planned.

Wind turbines can interfere with communication systems that use electromagnetic waves. This is caused mainly by the turbine blades, which sometimes scatter the signals as they rotate. Such scattering can weaken or otherwise interfere with telecommunications signals. EMI mainly affects television reception, aircraft navigation and landing systems, as well as microwave links, with television reception being the most common problem. These impacts are amplified by proximity to the turbine. EMI effects on FM radio, cellular phones and satellite services are very unlikely to occur. EMI is a site-specific issue, so it is recommended that an onsite assessment be performed to identify any effects on telecommunication services in the area as well as the interference zones (EWEA 2003). This assessment information should be used to find appropriate setback distances from radio, telecommunication, radar and seismoacoustic systems. CanWEA recommends following 2007 guidelines developed by the Radio Advisory Board of Canada (RABC). They included this explanation in their "Technical Information and Guidelines on the Assessment of the Potential Impact of Wind Turbines on Radio Communication, Radar, and Seismoacoustic Systems report" (CanWEA 2007):

> Air defense (AD) radars must be capable of tracking friendly and hostile targets within Canada's aerospace. Detailed studies have shown that Wind Turbine Generators (WTGs) cause a number of serious problems with respect to AD radars. These problems include blanking, reducing the radar's ability to detect real targets, clutter, false targets, and reporting inaccurate positional information on real targets.
>
> Any organization considering establishing a WTG site, within a 100 km radius of an AD radar, should contact the Department of National Defense (DND). DND can determine if the proposed WTG is within line of sight of the radar beam and/or if interference problems are likely. In order to avoid potential interference with air defense radars used in support of national sovereignty, it is important to consult with the appropriate authority prior to establishing a WTG site.

In relation to small turbines, CanWEA has stated that there is no electromagnetic interference from small turbines due to their size and also the materials from which they are built. A CanWEA study quotes a representative from the National Renewable Energy Laboratory saying that there has been no indication of a problem with electromagnetic emissions and no study has been undertaken in this area since it is not perceived to be an area of concern. Small turbines are in fact used in to power remote telecommunication systems and military facilities (Small Wind Siting and Zoning Study, CanWEA 2006).

Proper planning, communication with all invested parties, and responsible site selection will avoid and mitigate any potential telecommunications interference issues in relation to wind energy development.

3.2.13 Traffic and roads

Road construction and use should be minimal during the operation of a turbine. Once construction is complete, vegetation should be allowed to encroach on the road to a limited extent, so as to reduce ecosystem barriers. All together, it is estimated that the temporary impacts from the construction of roads, turbine pads and substations were 0.4 to 2.6 acres per turbine (Resolve 2004). This number decreases over time, as local ecosystems are allowed to encroach on the road system. Such encroachment also minimizes erosion and general wear and tear during use.

It should be noted that often, several turbines are placed close together, as their individual capacities are not enough to meet demand or to replace large, oil or coal burning plants. Therefore, roads and turbine bases will be multiplied based on the number of turbines planned for construction. Further, as the technology continues to mature, larger turbines with greater energy generation potential are able to replace several smaller turbines, reducing the overall site road infrastructure requirements in some cases.

3.2.14 Vegetation and habitat

As discussed above, a wind turbine uses a minimal amount of land for construction and maintenance, largely in the construction of an access road, the turbine base, and associated structures. These disturbances can be minimized through proper site use, planning, and remediation. One important consideration is whether to bury all project power cables. This has two key benefits. First, buried cables are protected from severe events, like ice or wind storms, which could damage or destroy the power cables if they were above ground. Also, by burying the cables, most likely below or adjacent to the access road, less environmental habitat will be encroached. This also reduces the number of bird kills that would have been produced by the power lines. If the turbine is built on a farm, underground power lines also increase the amount of land that can be used for agriculture or livestock (Gipe & Murphy 2005). Burying all cables in Canada and in New Brunswick in specific is not common practice as this is cost prohibitive and not conducive to routine maintenance. The same environmental benefit can be achieved by running above ground cables adjacent to existing access roads as opposed to clearing new land for the lines.

As mentioned above, given the diffuse nature of wind energy, it is necessary to locate several turbines in proximity to achieve the same capacity as conventional fossil fuel power plants. Therefore, wind energy installations require larger areas than conventional power plants. This is due to aspects such as turbine spacing, topography, location of power lines and other associated facilities, in conjunction with other issues such as protected areas, access roads, land use objectives of the community and incompatibility in land-use. Given all of this, typical wind turbine projects use roughly 1 to 3% of the land area on which they are placed (EWEA 2003). Fragmentation of current habitat by access roads, transmission lines or the turbines themselves, may affect breeding of certain species and the loss of area-specific resources for sensitive species. Additionally this fragmentation, as well as other environmental effects such as noise, could lead to habitat avoidance by native species, causing displacement of populations and potentially reduced energy consumption due to limited feeding.

Wind turbines are often placed on livestock and agriculture farms in European countries, where cows are often seen grazing close to the turbines. Such lack of disturbance was also found in farms in the US, where turbines were placed on farmland with minimal negative consequences (NWCC 2005). This shows that wind energy can often coexist with other land use purposes.

3.2.15 Visual

One of the primary areas of concern for the public when considering the development of wind turbines is the associated visual impact. Given that many modern turbines reach heights of 60 to 100 metres, with large, rotating blades, wind turbine placement planning should be done in consideration of the visual or aesthetic influence. Incorrect placement can influence the enjoyment, comfort and beauty of a natural landscape. Certain areas are more sensitive to this visual impact, such as protected natural areas, or those used for recreation or tourism (EWEA 2003). Visibility does not, however, equate to visual impact. Many communities already accept water towers, silos, cell phone towers, and utility poles and lines as part of the landscape and wind turbines could follow suite with these common place infrastructure.

Many of the negative aspects associated with the visual landscape can be mitigated or minimized. Ensuring uniformity in such things as distance, type, and height of turbines can reduce visual irritation. Such things as minimizing fencing and roads, burying power lines and minimizing ancillary structures can all improve the visual influence. Inclusion of the community in the planning phase and review by the public can work to mitigate visual impact to the greatest extent possible by increased familiarity with the structures function and purpose. Integration of turbines aesthetically into the landscape and sharing of economic benefits with local communities may help to reduce negative attitudes to wind energy (EWEA 2003). It has been shown that if local residents feel a sense of ownership over the turbines, their visual impact can be made positive.

The aspects discussed below have been identified by several jurisdictions as being important factors to consider in controlling the visual impact of wind turbines:

Colour - As presently written, Canadian federal aviation laws recommend turbines to be painted in orange and white stripes, which may result in the turbines being more visually present within their environment than what might otherwise be expected. To date we are not aware of any existing wind turbines that actually employ this colour scheme. Recent communication with Transport Canada officials indicates that this recommendation is being reviewed since the orange markings cause reduced visibility of the blade when rotating (Mason, personal communication 2007). The common practice is to colour the turbines with a matte finish so as to reduce reflection.

Scale - The spatial design of a wind farm should be developed in context with the existing landscape. While wind farms certainly affect the perception of a landscape, an installed wind farm should ideally not dominate or take over a landscape, but instead should be in balance with what previously exists, such as numbers of other human-made structures.

Spacing - The spacing of turbines largely depends on the surrounding environment. Where the wind farm is surrounded by vegetation or a complex and/or irregular landscape pattern, irregular spacing may be more appropriate. Where turbines are located on a regular landscape, turbines may have less visual impact if they are in turn spaced in a regular (e.g., linear) or uniform manner.

Numbers - A single tower at a certain height may not be as imposing on the landscape as having more than one and therefore may be permitted in some environments. Height plays an important role regarding the visual dominance of the structure(s), but the challenge with placing restrictions on height is that it can lead to a requirement for more turbines to generate the same amount of power. Typically, the higher the turbine the more energy it can generate, thus requiring fewer turbines to generate a fixed amount of electricity. The height is also an important factor regarding the visual components indicated above. A key challenge regarding the height of the turbines is the dominating effect it can have on the landscape and/or surrounding properties.

Lights and signage - Placement of lights and signs on turbines can also affect their visual impact. From investigations undertaken in Canada, the only lighting that are usually installed on wind towers are flashing red beacons at the top of the nacelle unit as required by aviation regulations. Industry representatives are working with Transport Canada and Environment Canada to establish clear and practical guidelines for turbine lighting to minimize night time lighting effects overall.

Wires and cables - Some minor visual impacts are also associated with placement of wires and cables. Typically, if the connection to the grid is made above ground there will be an additional visual impact on the landscape, compared to if the cables are trenched. With respect to small turbines it is important to clearly mark guy wires for small wind structures that use guyed towers to ensure that they are visible and do not become a safety hazard on the property.

Overall, the visual impacts of wind energy development must be considered largely a subjective matter. Some jurisdictions are deciding not to allow construction of wind turbines on that basis, while others are proceeding either regardless of concerns, or after deeming them insignificant. In some measure, local perspectives on visual impacts actually reflect the culture of an area and the attitudes of its citizens generally towards matters such as economic development, alternative energy and the importance of longstanding community patterns.

3.2.16 Public Safety and Related Considerations

3.2.16.1 Climbing Hazard

Wind turbine towers do not require greater access restrictions (*e.g.,* special fencing) than other similar poles and towers. Just as with similar structures, wind turbine towers can be constructed to prevent falls. Some tower models even lack hand- and foot-holds, discouraging trespassers. Other small units are designed not to be climbed, but to be lowered to the ground for maintenance and repairs (Rhoads-Weaver, 2006).

3.2.16.2 Guy Wires

Guy wires contribute significantly to risk and should be avoided if possible. Towers as high as 200 metres can be built without guy wires but this can be prohibitively expensive. For 90 to 120 metre towers, which are more common, non-guyed construction can be done cost effectively (Resolve, 2004).

If guy wires are used, it is recommended that they be marked up to a height of 2 metres (Rhoads-Weaver 2006).

3.2.16.3 Line Worker Safety

National standards address the safety of the electrical equipment. All wind infrastructure must comply with local utility and safety requirements. In the 25 years that utilities have been required to interconnect wind turbines to their grids in the U.S., no utility has filed a liability claim against a turbine owner over electrical safety (Rhoads-Weaver 2006).

3.2.16.4 Insurance for Installers and Owners

All wind turbine installers, owners, and operators should have property insurance coverage in the event of damage due to weather, fire, or vandalism, as well as liability coverage for property and personal injury. Small turbine operators can add insurance through an existing homeowner's policy. Some residential owners of small wind turbines have found it difficult or impossible to obtain homeowners insurance coverage at a reasonable cost. Commercial owners have had no reported problems with insurance (Rhoads-Weaver 2006). Prospective owners of small wind turbines are encouraged to check with their insurance company prior to having the turbine installed. In instances where there are leasing agreements in place the landowner would be responsible to have insurance but the financial burden should be negotiated between the developer and the landowner as part of the land lease agreement.

3.2.16.5 Interference

The rotors on small-scale turbines are not large enough to interfere with TV or communications signals, and their blades are made from materials that signals can pass through: e.g. wood, fibreglass, and plastic (Rhoads-Weaver 2006). Larger turbines may cause interference if in close proximity to telecommunications towers, and should be cleared with the operators of these towers to ensure this is not an issue. No documentation was found that indicates wind turbines could disrupt telecommunications or radio waves through electromagnetic interference.

3.2.16.6 Notification and Approvals Needed for Air Traffic Safety

Both Nav Canada and Transport Canada are responsible for aeronautical safety and require notification of wind turbine construction under certain criteria in order to ensure that these developments can be noted on aeronautical maps and flight plans and that they are appropriately marked and lit for visual identification by aircraft. Nav Canada requires notification of any wind turbines that are specifically to be constructed within 10 km radius of an airport (regardless of height) and any wind turbine outside of the 10 km radius that is taller than 30.5 m. The proponent needs to complete the Land Use Submission Form of Nav Canada. Transport Canada is specifically concerned about lighting and marking of wind turbines. Transport Canada needs to be informed of any wind turbine higher than 30 m. The proponent needs to complete the Obstruction Clearance Form of Transport Canada.

3.2.16.7 Wind Turbine Performance Testing Requirements

Wind turbine certification is becoming increasingly important for companies competing in the international marketplace. In support of the U.S. wind energy industry, the National Renewable Energy Laboratory (NREL) now offers testing services at the National Wind Technology Center (NWTC) that lead to wind turbine certification.

NREL certification test reports provide an important element in the documentation package required for certification. These tests provide a third-party assessment of a wind turbine's characteristics. Certification testing requires adherence to a strict quality assurance system and use of methods that are recognized by certification agents. Testing conducted includes power performance, noise emissions, and blade structural tests. The first two tests are currently required for certification and are done in accordance with well-defined procedures that have obtained international acceptance. These procedures are being formalized in standards by the International Electrotechnical Commission (IEC). In addition to the IEC protocols, NREL abides by guidelines that are established jointly by wind turbine testing laboratories throughout the world. Blade structural tests are not now required for certification, but are strongly recommended by NREL.

There are currently no performance testing standards for small turbines however there has been a small wind certification council (SWCC) formed that will work with the small wind industry, governments, and other stakeholders to develop and implement quality certification programs for small wind turbines (under 200 square meters swept area, about 65 kW). Both grid-tied and off-grid turbines are eligible, however the Standard does not cover electric water pumping wind turbines. Specifically, SWCC will certify that, at the time of testing, small wind turbines meet or exceed the performance, durability, and safety requirements of the AWEA Standard. This certification will provide a common North American standard for reporting turbine energy and sound performance. (WEICAN 2007)

4.0 APPROACHES TO WIND TURBINE REGULATIONS

There are a number of items related to wind turbine projects that are regulated by the provincial and federal government. The provincial government requires an environmental impact assessment (EIA) for projects greater than 3 MW. With current technologies, a single large turbine can generate from 1 to 3 MW, and typically a wind turbine farm will be greater than 10 MW. Therefore large scale wind energy projects require a provincial EIA. Noise, potential environmental effects on birds and wildlife, expected visual influence, potential ground water influences, potential for impacts on human health and public safety are all items that would be regulated through the provincial EIA process of a wind turbine farm.

An overview of existing federal and provincial legislation that may apply to wind turbine projects is provided in this section, followed by an overview of local government approaches to regulating wind turbine projects.

4.1 Federal and Provincial Legislation

An overview of the regulations that are applicable to wind turbine developments federally and provincially is provided in this chapter.

4.1.1 Federal Overview

Wind power developments are regulated federally primarily through the environmental assessment process. An overview of acts and regulations administered by the federal government that may relate to wind projects are summarized in Table 4.

Table 4 Potentially Applicable Federal Acts and Regulations

Act or Regulation	Departments or Agencies Typically Involved	Examples of Possible Triggers
Environmental Assessment (EA) – most likely a screening level assessment in accordance with the requirements of the *Canadian Environmental Assessment Act*	Canadian Environmental Assessment Agency – coordinates Federal EA Involvement of other departments depends on the trigger for the review, The following may be involved as Responsible Authorities or to provide expert advice: Natural Resources Canada Fisheries and Oceans Environment Canada Transport Canada Health Canada Atlantic Canada Opportunities Agency (ACOA) (funding trigger)	Construction on federal land Application for federal funds (EcoEnergy, ACOA or other) Requirement for any federal permits, licenses or approvals that are on the *Law List Regulations*
Fisheries Act – subsection 35(2) authorization	Fisheries and Oceans Canada	Possible environmental affect on fish habitat
Navigable Waters Protection Act	Transport Canada	Potential environmental effect on navigable waters
Blasting permit near fisheries	Environment Canada	Possible environmental effect on fished waters
Species at Risk Act	Environment Canada	Possible environmental effect on species at risk

Table 4 Potentially Applicable Federal Acts and Regulations

Act or Regulation	Departments or Agencies Typically Involved	Examples of Possible Triggers
Migratory Birds Convention Act	Environment Canada	Possible effect on migratory birds
Aeronautical Safety	Transport Canada	Any structure taller than 30 m
Aeronautical Safety	Nav Canada	Any structure taller than 30.5m or within a 10km radius of an airport
Seismoacoustic Monitoring Equipment	Natural Resources Canada	Possible effect on monitoring array (considered for radius of at least 10–50km)
Air Defence Radar	Department of National Defence (DND)	Possible effect on radar (considered for radius of at least 100km)
Air Traffic Control Search Radar	DND and Nav Canada	Possible effect on radar (considered for radius of at least 60km)
Canadian Coast Guard Vessel Traffic Radar System	Canadian Coast Guard	Possible effect on radar (considered for radius of at least 60km)
Military Airfield	DND	Considered for a radius of at least 10km
Weather Radars	Environment Canada	Possible effect on radar (considered for radius of at least 80km)
Radio Communication	Industry Canada, DND and RCMP	Possible effect on radio (considered for radius of at least 1km)

Environment Canada has also recently issued two guidance documents to aid in addressing the environmental effects on birds, "Wind Turbines and Birds- A Guidance Document for Environmental Assessment" and "Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds". (Environment Canada 2007)

4.1.2 Provincial Overview

The acts, regulations and guidelines that currently apply provincially are summarized in Table 5.

Table 5 Potentially Applicable Provincial Acts and Regulations

Approval Requirement or Guideline	Departments or Agencies Typically Involved	Examples of Possible Triggers
Environmental Impact Assessment Regulation	Department of Environment (for Technical Review Committee, other departments, and agencies at the provincial, federal or local level are typically involved in the review as members)	All electric power generating facilities with a production rating of three MW or more All electric power transmission lines exceeding sixty-nine thousand volts in capacity or five km in length
Motor Vehicle Act	Department of Public Safety, Department of Transportation	Requests for transporting materials beyond weight and size restrictions.
Crown Lands and Forests Act, Allocation of Crown Lands for Wind Power Projects Policy	Department of Natural Resources	Requests for wind energy projects on Crown land, cutting permits, and work permits during fire season.
Watercourse and Wetland Alteration Regulation	Department of Environment	Facilities constructed within 30 m of a wetland or watercourse. wetlands must be identified, delineated, and assessed in the field as described in Wetland *Delineation Requirements for Large Scale Linear Projects*
Electrical Installation and Inspection Act	Department of Public Safety	All electrical systems and equipment with exceptions of electrical and communication utility systems, equipment and wiring on aircraft, ships, trains and automotive equipment, motor rewinding and

Table 5 Potentially Applicable Provincial Acts and Regulations

Approval Requirement or Guideline	Departments or Agencies Typically Involved	Examples of Possible Triggers
		repairing of radios and other electronic equipment. The Department should be contacted for further details.
Community Planning Act	Department of Environment	Various Land Use Regulations
Municipalities Act; An Act to Amend the Municipalities Act, Bill 59	Department of Local Government	A municipality may construct, own and operate a generation facility and may use the electricity for its own purposes or sell it to a distribution electric utility or another person, but shall not distribute it or provide it as a service to its residents.
Electricity Act	Department of Energy	Various regulations regarding the generation and distribution of electricity

The New Brunswick Department of Environment (NBENV) has issued several guidance documents for environmental assessments in New Brunswick. The document entitled "A Guide to Environmental Assessment in New Brunswick" outlines the project types which require an EIA registration under the regulation as well as guidance for contents of the submission and the consultation process. In relation to zoning in specific NBENV states in "A Guide to Environmental Assessment in New Brunswick" that:

"Registrations for projects taking place in areas with municipal or rural land-use plans or zoning by-laws in place must include a letter from the planning authority indicating that the project is in compliance with the plans and by-laws. If a re-zoning is required, it must be completed prior to submission of the registration, unless multiple locations for the project are still being considered (e.g. if alternative routes are still being considered for linear facilities such as highways, power lines, etc.). In the later case the registration must at a minimum demonstrate that consultation with the appropriate planning authority has been initiated."

In the event that the planning authority has some apprehension towards re-zoning prior to reviewing NBENV's decision regarding the EIA submission it is thought that there is some flexibility in this process. For example, in the event that consultation has been initiated with the planning authority, NBENV may allow submission of the registration and give a determination for the project with one of the conditions being compliance with land-use plans or zoning by-laws. The municipality should contact the Director, Project Assessment and Approvals Branch, Department of Environment for further guidance.

The NBENV has issued a supporting document to the *Environmental Impact Assessment Regulation*, entitled "Additional Information Requirements for Wind Turbines". This document was developed to assist proponents in preparing registration submission for wind turbines and outlines the considerations to be included in an EIA registration document including:

- Siting considerations;
- Physical components and dimensions of the project;
- Descriptions of the existing environment (habitat, wind statistics);
- Summary of potential environment effects (anticipated bird and bat mortality, anticipated noise, expected visual influence, potential ground water influences, potential for impacts on human health and public safety); and
- Summary of proposed mitigation and follow-up monitoring.

The Department of Environment is currently in the process of developing a draft document, *Guidelines for Siting Wind Turbines in New Brunswick* that will specify minimum setbacks between wind turbines and a variety of environmental features. These will apply to wind power installations undergoing an EIA.

A "wind power on Crown lands" risk assessment was conducted in early 2004 by the Department of Natural Resources, with one of the highest risk areas identified being the nonexistence of a policy to deal with wind power on Crown lands. This led to the development of a draft interim policy. The objective of this policy is to provide a consistent approach in the allocation of Crown lands to wind power exploration and developments. This document prescribes minimum setback distances for a variety of land uses. The setback distances from the Crown lands document are reproduced in Table 6.

Table 6 Department of Natural Resources Setbacks for Wind Turbines on Crown Lands (NBDNR 2005)

Land Use/Cover	Setbacks
Crown lands boundaries, lakes, watercourses, wetlands and coastal features (as defined by the Coastal Areas Protection Policy)	150 m, or 1.5 x height of turbine, whichever is greatest
Public highways, roads and streets (including roads and streets within the boundaries of a city, town or village), designated as highways under the Highways Act; and areas designated for those purposes in a plan adopted under the Community Planning Act	500 m, or 5 x height of turbine, whichever is greatest
Existing recreational, institutional and residential areas, and areas designated for those purposes in a plan adopted under the Community Planning Act	500 m, or 5 x height of turbine, whichever is Greatest
Other built-up areas, e.g. industrial areas	150 m, or 1.5 x height of turbine, whichever is greatest
Communication, fire, airport and other tower structures Archaeological & Historical Sites (listed by the Culture & Sport Secretariat) Wind power option agreement areas, wind test towers and wind farms, either existing or under application review; unless occupied by, or part of applicant's proposal	500 m, or 5 x height of turbine, whichever is greatest
Endangered species habitat (NB Endangered Species Act); important migratory bird nesting sites and migration routes (Migratory Birds Convention Act); important water-bird breeding colonies; national wildlife refuges; wildlife management areas (Fish & Wildlife Act)	1000 m

Note: *From the centre of a wind test tower or turbine

If the application for Crown lands is located in an area where a municipal plan, rural plan, basic planning statement or zoning by-laws or regulations are in effect, the proponent will have to show conformity to them or apply for an amendment. Otherwise, a Site Development Plan will have to be completed and submitted to NBDNR in order to carry out either exploration or wind farm development. For any application that requires an amendment, NBDNR may undertake the evaluation of the application but will not make a final offer to the applicant until the amending by-law or regulation has been enacted. Where the application to amend a plan and/or zoning by-law or regulation is rejected, NBDNR will reject the application (NBDNR 2005).

4.2 Land Use Planning in New Brunswick

Planning is regulated under the *Community Planning Act* and the *Municipalities Act* which are administered by the New Brunswick Department of Environment and the New Brunswick Department of Local Government. The *Municipalities Act* provides the legislative framework for municipal powers and responsibilities. It outlines administrative, financial, and operational responsibilities. The *Community*

Planning Act establishes the overall planning framework in the province, identifying planning jurisdictions, planning responsibilities and powers, and processes for adoption of planning policy, by-laws and regulations.

Within New Brunswick land falls generally into two categories of governance, unincorporated or incorporated areas. Unincorporated areas are the responsibility of the Department of Environment and are defined under the Act as those areas of the Province not located within the boundaries of a city, town, village or rural community. An incorporated area is one that is located within the boundaries of a city, town, village or rural community. As a clarifying note, it should be stated that unincorporated areas are the responsibility of the Department of Environment for planning purposes, yet are the responsibility of the Minister of Local Government administratively.

Of the 102 Municipalities in NB there are 8 cities, 26 towns and 68 villages, with a combined population totalling approximately 63% of NB's total population (729,997 persons) (Local Government Resource Manual 2007). There are also currently 3 rural communities. A rural community, like municipalities in the province, has a locally elected council, the authority to make decisions on behalf of the community it serves, and the responsibility of providing local services and enacting by-laws. Approximately 37% of New Brunswickers have no form of local government, as they live in unincorporated areas. These unincorporated areas are divided into 269 identified Local Service Districts. Recently, the New Brunswick Premier has appointed a Commissioner to review the structure of local governance in New Brunswick, and recommend areas for re-structuring. The results of this study are expected in the fall of 2008 and it is anticipated there will be greater focus on Regional Planning models.

It is important to note that the Province is already divided into Planning Districts that are governed by District Planning Commissions. District Planning Commissions are given power under the Act to represent and higher staff to administer planning regulations that have been established by municipalities, rural communities and the province on behalf of unincorporated areas. Within the Province of New Brunswick there are currently twelve District Planning Commissions. A map showing the location of Planning Districts and status of community planning is shown in Appendix A.

Some New Brunswick municipalities have included policy statements in their Municipal or Rural Plans that define their approach to wind turbine development. For example, some identify the desirability of wind power making reference to goals around renewable energy and energy efficiency. Most municipalities that have provided for wind turbine development have enabled wind turbines in resource, agriculture or conservation type zones. Sometimes the development of wind turbines is subject to terms and conditions or Section 39 of the *Community Planning Act*. Some municipalities do not include any provisions for wind turbine development, but note that wind turbines are exempt from height regulations.

There are fairly significant variation among New Brunswick municipalities in their policy and regulatory responses to wind energy in terms of the planning mechanisms used. This is briefly summarized in Table 7.

Table 7 Current Regulatory Approaches to Wind Development Among New Brunswick Municipalities (2008)

Municipality	Applicable Wind Turbine Regulatory Approach
City of Fredericton	The Municipal Plan references wind turbine development as an area for further study in order to ensure land use regulations mitigate the potential negative impacts associated with the use.
Edmundston	Wind turbines are permitted, subject to terms and conditions in a constructible conservation zone.
Town of Caraquet	Requiring only minimal setbacks from property lines, wind turbines are permitted as-of-right and considered as an accessory use or structure.
Belledune	Small-scale wind turbines are considered as accessory uses or structures under 10kW and are permitted as-of-right, subject to a variety of regulatory and application requirements. Wind turbines and wind farms are also permitted as-of-right in an industrial zone.
Grand Manan	Wind farms are identified as a permitted use in Rural Zones.
Lameque	Development of wind farms is permitted in one resource zone, 'Zones Naturelles', but is subject to Section 39 of the Community Planning Act.
New Maryland	The erection of a wind turbine is permitted as an amendment to the zoning by-law and is subject to terms and conditions as imposed by Council.
Saint-Léolin	The economic value of sustainable and alternative energies is identified in the Rural Plan. Wind turbine development, both large and small scale is permitted, however is subject to terms and conditions, as identified by the Commission and respective provincial government departments.
Salisbury	The Salisbury Municipal Plan identifies a difference between large scale commercial wind turbine development, and small-scale non-commercial development. Commercial wind energy development is considered to be a potential area of future study and regulation, if it becomes desirable as a use in Salisbury. However, non-commercial or small-scale wind energy is permitted as an accessory use in all zones, subject to provisions as identified in the Zoning By-law.
Town of Shippagan	Development of wind turbines is subject to Section 39 of the Community Planning Act, and it is identified as a potential use in two zones, a resource and a conservation zone.
Beaubassin East (Rural Plan)	Encouraging renewable energy is identified as a key goal of the community, and wind turbine development is identified in particular. It is also identified that potential negative impacts, particularly visual and noise should be mitigated. The development of small and medium wind turbines is subject to terms and conditions under Section 34 of the Community Planning Act with provisions identified in the Rural Plan. Wind farms are subject to Section 39 of the Community Planning Act.
Lower Kennecbecasis Rural Plan (Unincorporated Area)	Wind turbines are identified as a permitted use in two zones, the Resource and General Mixed Use Zone. (Note this Rural Plan is still in Draft format)
Upper Kennebecasis Rural Plan (Unincorporated Area)	Wind turbines are identified as a permitted use in two zones, the Agriculture and Resource Zone, but is subject to terms and conditions as identified by the Planning Commission. (Note this Rural Plan is still in Draft format)

This variation is not unique to New Brunswick. A similar range of policy approaches are in place within Nova Scotia, and throughout Canada and internationally as well. An example of regulatory approaches in Nova Scotia is provided below in Table 8.

Table 8 Current Regulatory Approaches to Wind Development Among Nova Scotia Municipalities (2007)

Municipality	Applicable Wind Turbine Regulatory Approach
District of Argyle	Wind turbines are permitted as-of-right in multiple zones except Coastal Wetland zone by development permit and subject to by-law requirements.
District of Barrington	Wind turbine generators are permitted to locate as-of-right by development permit in specified zones subject to by-law requirements.
Town of Truro	Development of wind turbines (total height not exceeding 80 m) will be by development agreement only in identified zones.
County of Cumberland	Small scale turbines (no greater than 100kW and power generated primarily for on site consumption) are permitted as accessory use in any zone where accessory uses are permitted. Large scale turbines are permitted by development permit subject to by-law requirements.
Region of Queens Municipality (Planned areas only)	Wind turbine generators were considered as-of-right in some zones but with proposed revisions to LUB, utility scale wind turbines are now being considered by development agreement.
Cape Breton Regional Municipality	Utility scale wind turbines are permitted as a General Provision throughout the municipality subject to by-law requirements.
County of Pictou	Utility and domestic scale wind turbines are permitted by development permit anywhere in planning area subject to by-law requirements.
County of Kings	Small scale turbines (no greater than 100kW and less than 52m) are permitted by development permit in specific zones subject to by-law regulations and turbines under 6.1m are permitted as accessory structures in any zone.
Municipality of East Hants	Mini and small scale wind turbines are permitted as of right subject to by-law requirements and large scale turbines are subjected to site plan approval and associated requirements.
District of Guysborough	Wind turbines and wind farms are permitted by development permit in certain zones subject to by-law requirements.
District of Lunenburg	Small wind turbines (less than 12,000 kWh per year) are permitted in designated zones and large scale wind turbine or multiple wind turbines capable of producing in excess of 12,000 kWh per year are permitted through a development agreement process in District 3.
HRM	Wind turbines permitted by development permit in certain zones subject to by-law requirements.

All Ontario municipalities surveyed use site plan control mechanisms for large scale wind turbine development. In Alberta, municipalities surveyed use a combination of development agreements and site plan control mechanisms. The City of Charlottetown only requires a building permit process. While in some cases small wind turbines are permitted as accessory uses, they can also be subject to site plan control mechanisms as has been done, for example, in Grey Highlands, Ontario.

4.3 Regulatory Approach Case Studies

This section describes the approaches used by municipalities to address the various impacts described earlier. Some municipalities have provisions to address a major issue directly (*e.g.,* noise by-laws), while others have a framework that addresses several issues simultaneously (*e.g.,* setback distances accounting for noise, blade throw, ice throw etc) or a combination of both. Depending on what type of planning policy mechanism is used (*e.g.,* permitted use vs. Agreement under Section 39) the approaches described below may be more prescriptive (*e.g.,* by-laws) or discretionary (*e.g.,* directions or requirements for inclusion in development application).

The following sections include the experience of municipalities listed below as well as a few others:

New Brunswick: City of Fredericton, Edmundston, Town of Caraquet, Belledune, Grand Manan, Lameque, New Maryland, Saint-Léolin, Salisbury, Town of Shippagan, Beaubassin East (Rural Community), Lower Kennecbecasis (Unincorporated Area), Upper Kennebecasis (Unincorporated Area)

Nova Scotia: County of Pictou, Town of Truro, County of Kings, District of Guysborough, Cape Breton Regional Municipality, Region of Queens Municipality, County of Cumberland, District of Barrington, District of Argyle, Halifax Regional Municipality, Municipality of East Hants, District of Lunenburg

Prince Edward Island: City of Charlottetown

Ontario: Municipality of Grey Highlands, County of Bruce, Township of Huron-Kinloss, Township of Frontenac Islands, County of Prince Edward, City of Windsor

Alberta: Municipal District of Pincher Creek, Municipal District of Taber

In the case of all municipalities, the by-laws examined were existing by-laws with the exception of HRM which is currently undertaking a major consultation and policy development process for wind turbines, and the Upper Kennebecasis and Lower Kennebecasis Rural Plans in New Brunswick, which were reviewed in Draft format. Some of the by-laws were recently passed as in the case of Bruce County, Grey Highlands, East Hants and Pictou.

4.3.1 Regulatory Monitoring and Review

It is important to note that with new municipal by-laws, the issues related to the experiences of practical applications, enforceability and challenges (on the part of both proponents and citizens) will continue to emerge. Just as wind technology is changing and requiring adaptation, municipal by-laws will continue to change and adapt in response to technology changes and the practical experience of wind turbine development in local contexts. A review of wind turbine development will therefore become an important process in support of Rural Plans, Municipal Plans and By-Laws which attempt to regulate wind projects. Under Section 72 of the Community Planning Act, municipalities are required to complete a review of their Municipal Plan and Zoning By-Law at least every five years. This review interval presents an ideal time to consider wind energy technology. Further, some New Brunswick municipalities that adopt by-laws around wind energy may find it necessary to review within a shorter time-frame than the five-year requirement, because of changes in technology or wind development pressures.

Many other municipalities have also adopted formal review processes, for example, the Municipal District of Pincher Creek planned for a review of wind turbine development in its Municipal Development Plan. Council was required to undertake a study which would examine the impact of wind energy development when 300 wind energy systems were constructed or 450 systems had been approved. Pincher Creek is currently in the process of this assessment having gone through the first stage of public consultation and proposed by-law amendments. Similarly, Grey Highlands requires that after one year of the wind energy system being approved and commencing operation, Council will undertake a review of the approval process including any public comments related to the facility and consider if amendments are required to any future planning process. The municipality is currently entering the process of establishing a Dispute Resolution Protocol that will create a complaint procedure for the public and identify solutions for remediation. Kings County policy for small wind turbines requires that council reassess the wind turbine policies within 5 years of adoption to review how many turbines are sited, the impact on tourism and landscape, the incidents of bird and bat kills, and any other identified issues.

4.3.2 Application Process

The following information represents a sample of the type of information requested by local governments in the application processes for wind turbine developments.

Large Scale Turbines

There are no examples of formal application processes that have been designed specifically for large scale turbines in New Brunswick. The Kent Hills project was considered by the Moncton District Planning Commission under their existing subdivision and building permit processes, however the Commission did require additional documentation be provided, such as engineering drawings for both the foundation and tower. One of the most comprehensive examples of an application process in Atlantic Canada is in Cumberland County, Nova Scotia. The application process required a tentative site plan showing all buildings, boundaries and natural features and alterations of site and environment for 1 km in addition to meeting the requirements for the zone where the facility was located. Prior to construction the municipality required a final site plan, decommissioning plan, copies of documentation of approvals from Transport Canada and Nav Canada, copies of all environmental assessment documentation required under the *Canadian Environmental Assessment Act* and any approvals or certificates required under the *Nova Scotia Environment Act* and regulations. The municipality also requires emergency response plans for site safety and adequate emergency service personnel training, and a professional engineer’s design and approval of turbine base.

In BC, development of wind turbines on Crown land requires a report submitted by the proponent in the project development stage that includes two distinct sections: project definition and impact assessment. The development plan must include location, timing, construction particulars, public access and safety, installed turbine capacity, targeted long term production levels, environmental management strategies, site security, reclamation and decommissioning and other matters reasonably requested by the Ministry of Agriculture and Lands.

The Municipal District of Taber requires an accurate site plan including the location of overhead utilities on or abutting the subject lot or parcel; analysis of visual impact including the cumulative impact of other wind turbines and impact of overhead transmission lines; scale elevations or photos of turbines – total height, tower height, rotor diameter and colour; manufacturer’s specifications; analysis of noise impact; specifications of foundations or anchor design; results of public consultation; status of government approvals including Nav Canada, Transport Canada, provincial government requirements; information regarding public safety; impacts to the local road system including required approaches from public roads; and a plan outlining decommissioning and reclamation of site. Pincher Creek has requirements similar to Taber but in addition includes a referral process by which the council shall consider the input from the adjacent jurisdiction if its boundaries are located within 2 km of the wind turbine system and municipal district landowners within a 2 km radius.

The Township of Frontenac Islands may require all or any of the following: noise impact study; visual impact study to determine impact and mitigation measures for shadow or reflection of light onto adjacent sensitive land uses; visual impact study on landscape as viewed from lake, road or other public lands; a study to prevent negative effect on airstrips or telecommunications; and a study to determine impact and mitigation for identified natural heritage features.

Huron-Kinloss Council requires a site plan for the area within 500 m of subject property; approval of professional engineer for design; agreement to be subject to site plan control; compliance with noise mitigation requirements; Transport Canada approval if sited within 10 km of airport; fulfill any requirements of the environmental screening process of province; and when placed on agricultural land ensure the continued use of prime agricultural land for farm use and minimize loss of production farm land.

In their letter dated May 1st, 2008 regarding Application Requirements for Large Wind Energy Conversion Systems, the County of Bruce outlines extensive application requirements. They suggest the following considerations in their approval process: setbacks ranging from 400 to 700 m, shadow flicker requirements (defining non-participatory and sensitive receptors), proof of certification, no more than 25% of non-participatory land owners parcels can be impacted by potential noise exposure, provincial environmental screening report, federal EA clearance, general project description, turbine specifications, a noise evaluation (including mapping base on lands impacted by a >40 dB emission level), visual effect modelling, NAV Canada/Transport Canada Clearance, grid connections and routing, project phasing, information regarding electromagnetic interference, turbine foundation drawings (certified by professional engineer), environmental management plan outlining environmental mitigation/decommissioning and rehabilitation, sensitive receptor table, and information regarding zones of theoretical visibility.

Large and Small Scale Turbines

The Town of Truro requires a scaled plan with height and design configuration, including colour and lighting; location of proposed site and setbacks, topography, location and proximity to roadways and proposed access to site, distance to residential areas and other structures, existing and proposed vegetation, fencing and other security measures; written confirmation that turbine(s) will not affect telecommunications and radar; written confirmation that turbine(s) have been reviewed or will not require approvals from Transport Canada; graphic representation indicating visual impact of wind turbine on surrounding properties and from various vantage points throughout town; non-refundable processing fee plus advertising deposit; and any other information requested.

In Grey Highlands the process includes the following sections: preliminary consultation, public notification, information requirements and peer review. The preliminary consultation includes staff, proponent and Council to review the proposal and scope the requirements. Public notification outlines the process of notification. Information requirements are necessary information that must be provided for large systems and may be required for micro, small or medium systems: environmental impact assessment; visual impact assessment; planning justification report; site plan information; copy of documentation as part of environmental assessment acts; provide evidence that there will be no electromagnetic interference; provide report assessing shadow flicker impacts and mitigation measures; noise impact report; ice throw report; and management plan. A peer-reviewed report, at the proponents cost, may be required at council's discretion.

Developers in the UK are required to apply for a permit from the local planning authority (LPA) for any wind projects less than 50 MW. Local officials check to ensure the plans are in accord with national, regional, and local regulations. The developer's environmental statement and the public's response to consultation are considered in the final decision made by the planning committee. If the project is rejected at this stage, the developer can appeal the decision. It is reported that there has been a one in three success rate of appeals.

Small Scale Turbines

The most comprehensive example of a small scale application process in New Brunswick is in the Village of Salisbury, which regulates the development of non-commercial wind energy systems. These types of systems are defined as 'wind turbine that is subordinate and incidental to the main use on the lot and that supplies electrical power solely for on-site use'. These types of turbines are permitted as an accessory use in all zones, In their Zoning By-law, the Village of Salisbury sets out the requirements for application which include, the manufactures information regarding the type of turbine, total height, rotor diameter, rated output, and Canadian Safety Certification, a site plan, and authorization documents from Transport Canada and Nav Canada. The County of Kings requests that proponent provides manufacturer's information and Canadian Safety Association certification; a site plan for location of turbines in relation to lot lines, dwelling and adjacent dwellings; authorization documents from Transport Canada and Nav Canada; and an environmental impact assessment where required. The Municipal District of Taber requires an accurate site plan including the location of overhead utilities on or abutting the subject lot or parcel; scale elevations or photos of turbines – total height, tower height, rotor diameter and colour; manufacturer's specifications; analysis of noise impact; specifications of foundations or anchor design; and information regarding public safety.

Pincher Creek requires manufacturer's information, letter of approval from Nav Canada, noise data indicating noise levels below 30 dB_A at property line in districts where use is discretionary and provide an analysis for noise to any residence located on adjacent properties within 200 m radius, evidence that strobe and shadow effect will not affect the enjoyment of the adjoining residences, and any other evidence requested.

The City of Charlottetown requires a site plan; location and proximity to other structures, residences, power lines or other utility lines within a radius equal to three times the tower height; certification by engineer or manufacturer; certified sound level values, approval from Transport Canada that the turbine development complies with the *Aeronautics Act* and the Charlottetown Airport Zoning regulations.

4.3.3 Decommissioning

While it is important to make provisions and plans for decommissioning of turbines before they are erected, the municipality faces a significant challenge in enforcing requirements for decommissioning. Regardless of the challenges with enforcement, municipalities that have provisions for wind energy development often include requirements regarding decommissioning. Municipalities vary in the detail they require from wind turbine developers for decommissioning of turbine(s); some only require a date by which inactive turbines will be decommissioned. For example, the Village of Salisbury provided a provision for decommissioning in their by-laws. After one year of inactivity, the owner of the turbine must remove it from the lot. If the turbine is to be reused after inactivity or replaced, an application to do so must be submitted to village council. Otherwise, the owner has 60 days to remove the turbine and all supporting structures.

Grey Highlands includes in its decommissioning plan method of removal, reinstatement of the lands to its prior use, and estimation of the costs of decommissioning and how this would be funded entirely by the developer including the determination of securities. Proponent will submit a status report to council within 3 months of a turbine not producing power which will identify the reason for the shut down and estimated timeframe to return to operational status. If the turbine is not operational within 1 year or longer, at the discretion of council, decommissioning of the turbine will commence according to management plan.

4.3.4 Health and Safety

Most commonly, setbacks are the mechanism used to protect the community against most of these issues. Other possible approaches are explored in this section.

Ice Throw

There is little mention of specific measures to deal with ice throw and ice shedding impacts of wind turbines in the municipalities surveyed. An exception is Municipality of Grey Highlands which requires an ice throw report that includes an assessment of the likelihood of ice throw and the mitigation measures which should include the use of an ice detection system and operational protocols to eliminate or minimize ice throw risks. The municipality also requires a map outlining the extent of risk of ice throw around each turbine overlaid on a site plan illustrating features on and off the site. Design standards (certification and type approval) are required in the management plan to reduce risks associated with ice throw.

CanWEA recommends for large scale turbines a minimum distance of the blade length plus 10 m from public roads, non-participating property lines and other developments as a setback distance to address ice throw. Based on current wind turbine systems being installed that have blades ranging from 38 to 42 m the setback would range between 48 to 52 m from roads or property lines. For proposed wind turbine systems within 50 to 200 m of a public road, a risk assessment must be done and mitigation measures put in place to minimize individual risk. CanWEA states that beyond 200 m the risk of ice throw is essentially removed; however, as indicated in Section 2, there is considerable difference of opinions on what this “safe distance” may be.

Planners in Bruce County have recommended in a review process of the Official Plan that in the county’s planned overview of wind turbine policies that further research be undertaken with Environment Canada and other weather experts on cold weather operation of wind turbines and potential safety issues in light of changing weather patterns.

Turbine Tower Design

The issues related to safety and tower design include the height of turbine blade from grade and generally the minimum requirement of rotor blade clearance from grade is 7.5 m. CanWEA suggests that a minimum of distance between the lowest reach of rotor blades and the ground be 8 to 10 m. Municipalities require fencing, lockable gates and/or lockable doors to address tower access and safety depending on the design of the wind turbine system. For monopole designs generally a lockable door is a sufficient requirement. For other turbine designs, security fences (of at least 1.8 m in height) with lockable doors are required. There are often specifications in by-laws that a ladder or other access device not be located closer to the ground than 3 to 3.7 m.

For small wind turbines that are supported by guy wires, CanWEA recommends that the innermost and outermost guy wires be clearly visible to a height of 2 m above the guy wire anchor lines. In a survey conducted on behalf of CanWEA of by-laws for small wind turbines, either blade clearance was not mentioned specifically or a separation distance between the blade tip and grade ranged from 4.5 m to 6.1 m (Small Wind Siting and Zoning Study 2006). For example, the Village of Salisbury requires that for small turbines, any climbing apparatus must be located a minimum of 3 m above grade and rotor clearance is set at 4.5 m above grade. They also require that anchor points for guy wires be located on the property that the system is located on, with a minimum setback of 3 m from all property lines for guy wires. The Village of Belledune requires that wind turbine towers shall not be climbable up to 3 m above ground level and that all access doors to electrical equipment must be lockable. The blade ground clearance required is 10 m.

There is varying opinion about the safety of small wind turbines mounted on roofs and attached to sides of buildings. In Europe, there is growing interest in urban wind turbine applications that would include these types of applications but research into their viability and safety is at an early stage. In North America there is not a lot of practical experience with these applications (WINEUR 2005). The County of Kings allows the mounting or attaching of a turbine to another structure only if the turbine is less than 6.1 m.

Blade Throw, Turbine Structural Failure

Some municipalities address issues of blade throw through ensuring that wind power systems meet the approved standards of organizations such as the International Electrotechnical Commission and Canadian Safety Association and having a professional engineer’s approval of the project. Grey County, for example, requires design standards (certification and type approval) in the management plan to reduce risks associated with blade throw. Research in California (Larwood 2006) indicated that municipalities were using setbacks between 1.25 and 3 times the total height of the turbine to provide protection from blade throw. There was no conclusive appropriate setback distance proposed by the study and further research is continuing in the area.

In their suggested proposals for setbacks for large wind turbines in Ontario, CanWEA recommends setbacks for residential and town/village boundaries be calculated according to the separation distances required to prevent impacts from noise in Ontario rural areas. CanWEA suggest that the setbacks would be sufficient to prevent negative impacts from blade throw since they were generally greater than 250 m. CanWEA recommends for large scale turbines a minimum distance of the blade length plus 10 m from public roads, non-participating property lines and other developments as a setback distance to address blade throw. Based on current wind turbine systems being installed that have blades ranging from 38 to 42 m the setback would range between 48 to 52 m from roads or property lines. For proposed wind turbine systems within 50 to 200 m of a public road, a risk assessment must be done and mitigation measures put in place to minimize individual risk.

Oil Spills

There were no specific references to prevention of oil spills in the municipal by-laws surveyed. A local authority in Massachusetts (County of Barnstable Massachusetts, cited in HRM Draft Wind Energy

Master Plan 2006) has recommended that tower structures be designed to contain any spills or leakages.

<u>Fire Damage and Risk</u>

There were no specific by-laws relating to fire damage and risk in the municipalities surveyed. A couple of municipalities requested proponents to provide an emergency management plan (Grey Highlands and Cumberland County), which would encompass emergencies related to fire. In Australia, local fire departments are specifically contacted by wind farm developers so that an emergency plan is coordinated and access to locked gates and facilities is planned for.

<u>Aviation Safety</u>

Many municipalities require that a wind turbine proponent provide documentation that the system is in compliance with applicable air safety regulations concerning lighting, colour and markings, height and location. Any structure taller than 20 m above ground level, within 6 km of an airport, or 2 km of a Transport Canada radar, radio navigation or radio communication tower needs to be reviewed by Transport Canada. Nav Canada and DND also require notification of turbine developments within 10 km of airports. Nav Canada requests notification of any proposed structure taller than 30.5 m. Some municipalities specifically require written approval from Transport Canada when a large turbine is sited within a 10 km distance of an airport (County of Bruce). The Town of Charlottetown requires approval from Transport Canada and compliance with any Federal or Provincial regulations pursuant to the Aeronautics Act and the zoning regulations of the local airport. The Beaubassin-East Rural Plan requires that both small and medium size wind turbines cannot interfere with air navigation or contravene provincial or federal law. The Village of Belledune requires that the wind turbine be artificially lighted to the extent required by Transport Canada and NAV Canada.

4.3.5 Shadow Flicker

The possibility of shadow flicker being a drawback to wind turbine use was noted in a few of the case studies. This issue was either unresolved in the development, or mitigated through analysis of the site (NWCC 2005).

Pincher Creek requires the proponent to provide evidence that strobe/shadow effect will not affect the enjoyment of the adjoining residences for small wind turbines. Town of Truro requires that wind turbines do not cause existing residences to experience shadow or flicker. The Township of Frontenac Islands can require a visual impact study to determine impact and mitigation measures required for shadow or reflection of light coming from any part of the wind turbine onto adjacent sensitive land uses.

In Grey Highlands, a report assessing impact of shadow flicker on any point of reception and proposed mitigation measures is required. The methodology used for a report for large scale facilities is based on all turbines within 1300 m of a point of reception, a maximum of 30 hours of shadow flicker per year at any point of reception modeled on the astronomically worst case scenario, and graphic modeling of shadow flicker for the site.

The County of Bruce is proposing an amendment that would include a regulation that states that shadow flicker, experienced by a sensitive non-participatory receptor within 1500 m of a the turbine, shall not exceed a maximum of 30 hours per year of maximum of 30 minutes per day as a result of the wind turbine. Shadow flicker calculations would be based on “worst case scenario” in that prevailing weather or cloud cover conditions will not be taken into consideration. Mitigation of shadow flicker will not be considered. Shadow casting for all sensitive non-participatory receptors located within 500m need to be calculated and the results of modelling provided. The use of the worst case scenario calculation is anticipated by the planning department to be a contentious issue.

4.3.6 Height

Although it was not a common issue for most developers, in some instances, height was a problem with community members. The Calumet County Board in Wisconsin, for example, placed a moratorium on constructing wind turbines over 100 feet (30.5 m), after facing community resistance to the visual impact of wind turbines (NWCC 2002).

In many municipalities there is a general provision in the by-laws that exempts several forms of towers and spires, including those of wind generation systems, from height restrictions. These types of provisions allow for the erection of a wind turbine.

Some municipalities have an additional provision restricting the total height of wind turbines in order to manage the scale and visual impacts of such structures. The total height is measured from the finished grade to the uppermost extension of the rotor blade. The tallest wind turbine in the world currently is just over 200 m tall (located in Lassow, Germany). Example restrictions can be found in Table 9 below.

Table 9 Example of Height Restrictions

Town	Height Restriction (m)
All turbines	
Town of Truro, NS	80
Township of Huron-Kinloss, ON	120
Township of Frontenac Islands, ON	130
Small Turbines	
County of Kings, NS	52 m, 6.1 m for turbine attached to another structure
East Hants, NS	52 m
Windsor, NS	30 m
Charlottetown, PEI	23 m
Salisbury, NB	45 m
Belledune, NB	12 m, 15 m, 20 m
Beaubassin-East, NB	12 m

CanWEA's publication (Small Wind Siting and Zoning Study 2006), notes that small to medium wind turbines generally require tower heights of 24-50 m to reach reasonable wind currents that are adequate for generating energy. The CanWEA document ties in lot size requirements to height restrictions for example, for property sizes between 0.1 ha and 0.2 ha the wind turbine tower height would be limited to 25 m and for property sizes of 0.2 ha or more there would be no wind turbine tower height limitation. The height of the turbine can affect the setback distance if setbacks are based on a formula that multiplies the total height of the turbine by a factor such as height multiplied by 2 or 5.

The Village of Salisbury, for instance, requires a minimum lot size of 0.2 ha for small scale wind turbine development, but sets maximum height at 45 m. The Village of Belledune takes the scaled approach, requiring 12 m. where the lot contains between 6,000 and 15,000 square metres, 15 m in the case where the lot contains between 15,001 and 25,000 square metres, and 20 m in the case where the lot exceeds 25,000 square metres. Beaubassin-East Rural Plan sets area at a minimum of 4000 square metres, and a maximum height of 12 m.

4.3.7 Management Plan

Some municipalities require management plans as part of the development agreement application. The management plan for Grey Highlands includes the following categories: procedures for rehabilitation/reinstatement of temporary disturbance areas; construction details; traffic management with details on volumes, frequencies and haul routes of construction vehicles; decommissioning details; emergency management plan which includes details concerning on-site safety and measures to train emergency services personnel; preventative maintenance; and design standards and safety protocols to reduce the risks associated with ice throw and blade/turbine failure.

The County of Bruce is considering the requirement of an Environmental Management Plan that outlines the construction details; operational and maintenance requirements of the wind turbine systems; establishes the process for complaints, any required mitigation measures and required monitoring; and a description of how decommissioning and rehabilitation of the turbines and ancillary infrastructure will be handled.

4.3.8 Noise

Policies and regulations to mitigate issues with noise from wind turbines vary greatly across jurisdictions in Canada and internationally. The most common approach to date has been to introduce a prescribed setback distance as described further in the section on setbacks, given that noise levels decrease with increasing distance. Establishing a setback distance that will be sufficient to mitigate noise issues in all instances in a jurisdiction while not imposing overly strict requirements on industry is a major challenge of this approach. A second approach, used by a growing number of municipalities and recommended by CanWEA and by the wind industry generally, is to use a decibel approach, setting a standard for the acceptable sound level at a receptor such as the outside of a neighbouring residence. The decibel approach is considered a best practice as it takes into account the number of total turbines, the location of each and the noise generated by the specific technology involved (performance based) as opposed to arbitrary distances applied to all wind turbine installations. There is considerable variation in the acceptable decibel levels between jurisdictions. The acceptable level is also influenced by the setting (if it is in an urban or rural area, with rural areas having lower levels of background sound) or the time of day (higher levels are more common during the day). Noise strength is affected by siting and environmental conditions at the site – the distance sound travels, air absorption (affected by weather conditions), reflection, screening (terrain), vegetation and ground (Søndergaard DELTA). The World Health Organization has defined 30 dB_A as an acceptable level inside a residence bedroom (WHO 1999) which is approximately a sound level of 40-45 dB_A outside of the residence once sound has passed through an open window. For wind turbines, CanWEA recommends a sliding scale for acceptable sound level starting at 40 dB_A at wind speed of 4 m/s, rising to 53 dB_A at 11 m/s. This approach corresponds to the Ontario methodology and New Brunswick EIA requirements for wind turbines.

The amount of noise disturbance associated with a wind turbine depends on several factors including the type of turbine, distance from residences, number of turbines, and the existing or background ambient noise levels. This may be the reason why it is difficult to reliably forecast and avoid noise disturbance by conventional land-use planning techniques such as a setback distance. There are also a variety of perspectives, but little in the way of substantive research or human health risk assessment, to reach definitive conclusions as to the significance of adverse effects regarding human health, with respect to the types and levels of noise associated with wind development. Different experts and stakeholders have therefore come to different conclusions on what an appropriate set-back or allowable noise level may be and some of regulations currently used are shown in Table 10.

The following is a list of sample regulations from around the world, inclusive of both decibel regulations and setback requirements (modified from "Wind Turbines: Noise and Setback Regulations: a Brief Summary" by Kaija Metuzals 2006 and AIOLOS Engineering Corp 2007). Note that there may be multiple regulations for each location and this list is not all-inclusive.

Table 10 Sample Regulations for Noise

Country	dB	Separation Distance	Name or Date of Regulation	Source
New Zealand	40 dBA or L_{95} + 5 dBA	200-400 m recommendation		Leventhall 2004, Aiolos Engineering Corporation
United States: New York	50 dBA or ambient + 5 dBA (Town of Clinton)	92 m	N/A	Mollica 2004 *in* Wind energy dev: a guide for local authorities in NY 2002.
United States: California	Max 60 dBA	Height of tower = 100 m	N/A	s.4290 – Handbook of Permitting 2003
United States: Washington	Daytime, Residential: 60 dBA, Commercial/Industrial: 65-70 dBA Nighttime: Residential: 50 dBA, Commercial/Industrial: 55-60 dBA	305 m		
United States: Maine	Daytime, Residential: 60 dBA, Commercial/Industrial: 70 dBA, Rural 55 dBA Nighttime: Residential: 50 dBA, Commercial/Industrial: 60 dBA, Rural 45 dBA	N/A		
United States: Oregon	Ambient + 10 dBA	350 m minimum or 1000 m non consenting		Aiolos Engineering Corporation
Denmark	45 dBA in open areas 40 dBA near residential		1991	Pedersen 2003 and www.windpower.dk, Aiolos Engineering
Denmark		4x height = 600 m	N/A	Sondergaard 2005 in NWCC, Washington DC
Germany	Daytime: 55 dBA/50 dBA in residential and 45 dBA in sensitive areas (hospitals, schools, ect) Nighttime: 40dBA/35 dBA in residential and 35 dBA in sensitive areas	N/A		Aiolos Engineering Corporation
The Netherlands	40dBA at night at 1m/sec, 50dBA during the day at 12m/s	N/A	Besluit v.18 oktober , 2001	Pedersen 2003
France	No more than 3dBA at night or 5dBA during the day over background levels		Loi 92-1444 du 31 dec. 1992	Pedersen 2003
Sweden	40dBA at the exterior of dwellings		2001	Pedersen 2003 Noise annoyance from wind turbines – a review
United Kingdom	5dBA above background noise both day and night	N/A	ETSU DTI 1996 and ETSU-R-97, 1996	Pedersen 2003 www.britishwindenergy.co.uk/ref/noise.html

Table 10 Sample Regulations for Noise

Country	dB	Separation Distance	Name or Date of Regulation	Source
World Health Organization	30dB indoors	N/A	1999, 2005	Berglund et al. 1999 Pierpont 2005
Ontario	Whichever is greatest -Urban Areas, wind speeds below 8 m/s: 45 dBA or hourly background level -Rural Areas, wind speeds below 6 m/s: 40 dBA or hourly background level Wind speeds above 8 and 6 m/s each type: wind induced background level LA_{90} plus 7 dBA or hourly background level	N/A	NPC-205 or NPC-232	OME 2004
Alberta	Night - Nighttime + 10 dBA Day – 40 dBA-56 dBA	N/A	EUB	
British Columbia	40 dBA at residential property	Siting must conform to ISO 9613-2		

In addition to the location where the regulation is assessed (indoors, outdoors, at property line) there are many other subtle variations in the above listed regulations related to the methods used to establish background sound levels, the protocols for modelling and whether follow-up monitoring is required after commissioning or only in the event of complaints.

More detail regarding the Ontario regulation is provided as the wind turbine limits presented in the MOE guidance have been recommended by HGC Engineering in their report "Wind Turbines and Sound: Review and Best Practice Guidelines", completed for CanWEA in 2007. The MOE method and regulatory values have also recently been advocated by the New Brunswick Department of Environment for use in the provincial environmental assessment process (NBENV 2008). The Ontario Ministry of Environment (MOE) has published guidelines limiting sound levels from stationary sources, with separate limits for rural and urban areas (NPC-232 and NPC-205 respectively). An acoustically urban area has been defined as an area with man-made sound, with traffic being the dominant source. Rural areas are those which are dominated by natural sounds (*i.e*., flow of water, birds, wind in trees). In addition the MOE has published a document entitled "Interpretation for Applying MOE NPC Technical Publications to Wind Turbine Generators". This document provides criteria for the combined impact of all wind generators in an area as a function of wind speed. The criteria are presented in A-weighted decibels in Table 11.

The revised NBENV document "Additional Information Requirements for Wind Turbines" requires that a noise study be completed for all noise sensitive locations (including recreational, residential and institutional uses) within 1 km of the nearest turbine. The study must demonstrate compliance with the noise criteria, as provided in Table 11 below, predicted at the building exterior. The noise study must consider the layout of the wind farm and the local topography. Several commercially available noise modelling programs can be used to predict the noise at the nearest receptors.

Table 11 MOE Noise Criteria for Wind Turbines

Wind Speed (m/s)	4	5	6	7	8	9	10	11
Wind Turbine Noise Criteria (dB_A)	40	40	40	43	45	49	51	53

Source: PIBS 4709 Interpretation of Applying MOE NPC Technical Publications to Wind Turbine Generators.

The MOE procedures to assess wind farm noise were evaluated as part of the Aiolos Engineering 2007 study. The conclusions of the review were that the procedures are sound for most situations however there are some revisions which may improve the methodology regarding penalties for noise characteristics and accounting adequately for the effects of meteorological conditions.

The only municipality to directly regulate wind turbine noise in New Brunswick is the Village of Belledune, which requires that small wind turbines shall not exceed 45 dB_A (as measured at any point situated along the property lines). To create some flexibility in the regulation, the Village also provides an alternative in the event the ambient noise level (exclusive of the development) exceeds 45 bB_A. In this case, the standard is adjusted to equal the ambient noise level. The ambient noise level is calculated by using the highest whole number sound pressure level in dB_A, which is succeeded for more than five (5) minutes per hour.

Municipal by-laws on noise in New Brunswick, where they exist, are generally defined qualitatively, for example: "activities that unreasonably disturb the peace and tranquility of a specific area are not permitted". Quantitative standards in terms of acceptable decibels of sound for wind turbines have not been established at the provincial level in New Brunswick other than through the EIA permitting process.

In Ontario, the provincial government requires that wind turbines have a Certificate of Approval (Air) under Section 9 of the *Environmental Protection Act* for turbines located within 1 km of a receptor. Specific guidance for wind turbines is given in urban and rural areas and supplemented in the document "Interpretation for applying MOE Technical Publications to Wind Turbine Generators" (note that Ontario's Ministry of the Environment has recently initiated a review of the noise policy for wind turbines). In urban areas, the lowest sound level limit at the point of reception (dwelling where sound or vibration is received) under conditions of average wind speed (up to 8 m/s) is 45 dB_A, while in rural areas, it is 40 dB_A. Noise impact assessments calculate sound pressure levels at each critical point of reception for each wind turbine or wind farm and are to use the ISO 9613 standard.

In Alberta, Directive 038: Noise Control of the Energy and Utilities Board (EUB), states the requirements for noise control that apply to all operations and facilities under the jurisdiction of the EUB including wind turbines (those approved under the Hydro and Electrical Energy Act). The directive sets permissible sound levels for outdoor noise at the point of receptor. The basic sound level at night time is determined to be 40 dB_A L_{eq} and 50 dB_A L_{eq} during daytime. A Noise Impact Assessment is required to ensure that possible noise impacts are considered prior to construction and operation and new wind turbine development must use computer modelling that includes the cumulative effects of adjacent wind farms or wind turbines. The directive also states that a new development must not exceed a sound level of 40 dB_A L_{eq} (night time) at 1.5 km from the facility fence line if there are no closer dwellings.

In British Columbia, the provincial government developed the Wind Power Projects on Crown Land Policy (2005) that states wind turbine sound level will be reduced to a maximum of 40 dB_A on the outside of an existing permanently-occupied residence not owned by the proponent or the closest boundary of existing, undeveloped parcels zoned residential and not owned by the proponent. The BC policy states that the locations of the turbines will be determined through modelling, using a methodology that satisfies the ISO 9613-2 standard. The sound level requirement will be applied to residences and undeveloped parcels zones residential in existence at the time of application. Unlike Ontario which does not require a sound assessment when the distance of turbine and receptor is greater than 1 km, the B.C. policy requires every wind farm to undergo computer model analysis for potential sound impacts.

Municipalities are also initiating the inclusion of specific requirements from wind energy proponents in reports on noise impacts. The Municipality of Grey Highlands Official Plan requires a Noise Impact Report for large scale wind energy systems (and possibly for smaller systems) that includes characteristics of noise emanating from individual wind turbines and the cumulative levels of multiple wind turbines; air absorption based on frequency; ground effects such as vegetation, buildings and structures and topography; weather effects including prevailing wind direction, wind speed and variations in wind speed at different heights and potential for lower background noise levels; tonal noise at discrete frequencies and/or an identifiable pattern that may be heard through background noise; broadband noise created by interaction of blades and atmospheric turbulence; and low frequency or impulsive noise. The Municipal District of Pincher Creek requires that development applications include an analysis of potential noise at the site of installation, the boundary of the parcel containing the development and any habitable residence within a 2 km distance for large wind energy conversion systems and for small wind energy conversion systems an analysis for noise to any residences that are located on adjacent properties within a 200 m radius.

The County of Bruce is considering including some provisions in their Official Plan that would ensure that large wind turbine generating systems be planned in a way that no more than 25% of a neighbouring non-participatory landowner's lot would be impacted by a potential noise exposure from a turbine that would be greater than that allowed by the provincial guidelines for a sensitive receptor. This same county is considering requiring proponents to provide a map that shows all lands and sensitive receptors potentially impacted by the >40dB_A emission levels so as to give context of how noise from turbines will affect neighbouring landowners. As well, consideration will be given to regulation that requires new land uses in zones that permit wind energy conversion systems to be developed in accordance to provincial noise regulations.

With regard to small wind turbines, CanWEA in their publication "Small Wind Siting and Zoning Study,", proposes that the mean value of the sound pressure level from small wind energy systems not exceed more than 6 dB_A above background sound, as measured at the exterior of the closest neighbouring inhabited dwelling for wind speeds below 10 m/s. In Alberta, the Municipal District of Pincher Creek requires that noise levels for small scale wind energy conversion systems in land use districts where use is discretionary should not exceed 30 dB_A at the property line.

4.3.9 Electromagnetic, Radio, Telecommunications, Radar and Seismoacoustic Systems

Several municipalities require some form of documentation from Nav Canada that would address some of the potential electromagnetic interference issues. The only specific reference to electromagnetic interference in the policies and by-laws surveyed in Canada was in the Municipality of Grey Highlands which requires evidence that electromagnetic interference will not occur as a result of the proposed development and refers to potential impacts on the integrity of the Government of Ontario's Public Safety Network. The Beaubassin-East Rural Plan requires that wind turbines do not interfere with telecommunications, as does the Village of Belledune Rural Plan.

The Radio Advisory Board of Canada (RABC) and CanWEA developed the Technical Information and Guidelines on the Assessment of the Potential Impact of Wind Turbines on Radio Communication, Radar and Seismoacoustic Systems in 2007 to provide guidance for proponents to determine if there is a possibility that a proposed wind farm may impact these systems. The document is not intended to be used for the basis of any regulatory decision; however, it is important for municipalities to be aware of the potential constraints for wind turbine proponents based on these systems being present in the municipality. Determining whether there would be unacceptable interference would have to take place through site specific analysis. The document outlines general guidelines for determining the consultation zone – a zone where a proponent would require consultation with the appropriate agency responsible for the system:

- For point-to-point system, over-the-air reception (FM transmitter), cellular type network, satellite system, and land mobile networks the radius of consultation should be at least 1 km.
- For Natural Resources Canada monitoring array, the radius of consultation should be at least 50 km and least 10 km from a single monitoring station.
- For seismoacoustic monitoring array, the radius of consultation zone should be 10 km.
- For DND Air Defence Radar the radius of the consultation zone should be at least 100 km and the radius for DND or Nav Canada Air Traffic Control Search Radar should be at least 60km.
- For a major military or civilian airfield the radius of the consultation zone should be at least 10 km.
- For Environment Canada Weather Radar the radius of consultation zone should be at least 80 km.

The RABC and CanWEA document also provides contact information for the appropriate agencies and more detailed information about zones of consultation and how they are determined.

Several Nova Scotian municipalities have recently been contacted by DND facilities in their areas concerning developments of wind turbines, indicating that this topic is an emerging concern for both DND and municipalities. One municipality has been requested to contact the local DND facility to ensure strategic placement of future wind turbines in relation to Defence Radar Infrastructure within a 60 km radius of DND radar facilities.

In relation to small turbines, there currently seem to be no concerns related to electromagnetic interference (CanWEA, Small Wind Siting and Zoning 2006), although how small turbines are defined may not be consistently understood among various parties concerned with this issue.

4.3.10 Roads

Wear and tear on existing roads can be an issue during the construction phase of development, but can be minimized with professional care or repaired once construction is complete. New roads will typically also have to be constructed to the building sites. Descriptions of this infrastructure can usually be included in the application process, and is often discussed with the public in community meetings. In the case of the Fenner wind farm in Madison County, New York, engineering studies were conducted before construction to determine what impact new road construction and use would have (NWCC 2005).

Grey Highlands requires a traffic management plan that includes details on volumes, frequencies and haul routes of construction vehicles. In Pincher Creek, the application process requires a report on impacts to local roads that includes approaches from public roads and follows municipal road standards. For developments on Crown land in BC, roads are permitted up to maximum of 20 m in width. In the Town of Frontenac Islands wind farms will have access to a public road either deeded by right of way or licence.

4.3.11 Separation Distances and Setbacks

Separation distances are determined by such considerations as noise, blade and ice throw, and proximity to inhabited structures. Separation distances can be defined at the federal, provincial and municipal level. For example, some distances will be defined by federal agencies concerned with aeronautical safety, protection of fish habitat, navigable waters, species at risk, and migratory birds. Some provinces such as Ontario, Alberta and British Columbia have province-wide noise guidelines for industry and utilities with specific reference to wind turbines. Note that these noise guidelines are defined by decibel levels as shown in Table 10 and 11.

The use of the terms separation and setback are used interchangeably in this text. Technically, a setback describes the distance between a property line and a building. Separation distance would be used to describe the distance required to separate structures in other circumstances (separation based on noise levels, other structures, safety concerns, etc.). Due to the fact that the majority of the literature reviewed and the municipal by-laws surveyed used the term setback to describe both the technical definition and all other separation considerations, this report predominately uses the term setback to describe both mechanisms.

Some municipalities only have setbacks for regulating the placement of turbines in relationship to closest receptors or dwellings while other municipalities have a series of setbacks for dwellings on and off site, roads, property lines, other turbine developments, and special zones. An established setback from a neighbouring dwelling will protect residents within the dwelling from the unwanted impacts of wind turbines (e.g. noise) while an established setback from the property line will protect neighbouring properties in their entirety – thus for example, allowing neighbouring properties full liberty in building new structures anywhere on their site without having to worry about impacts of the wind turbines on any such new structures. The Regional Municipality of Cartier in Manitoba originally considered a separation distance of 2 km to adequately allow for aerial spraying of crops, but as a result of recent research, now believe 500 m will be sufficient for this purpose (personal communication 2008).

Determining setbacks is often a community concern, especially by those neighbouring the turbine sites. Often, these neighbours are informed well in advance of construction as part of the application process for development (NWCC 2005). Modeling or standards are set to ensure safety and minimization of disturbance, which can receive community approval. For instance, the Chanarambie wind farm, in Murray County, Minnesota, approved setbacks based on noise disturbance modeling (NWCC 2005).

The Province of New Brunswick has created guidelines for wind turbines that are to be placed on Crown land. These guidelines create setbacks for a number of conditions, from roads to watercourses as presented in Table 8. Further, the Department of Environment is currently in the process of developing a draft document: “Guidelines for Siting Wind Turbines in New Brunswick” that will specify minimum setbacks between wind turbines and a variety of environmental features. These will apply to wind power installations undergoing an EIA.

The Village of Salisbury, NB, allows for the installation and use of non-commercial (e.g. small scale) wind turbines to offset electricity use. The village council has chosen to take proposals and make decisions on a project by project basis. “Council will provide means by which on-site non-commercial wind energy system can be permitted and to prevent conflicts with neighbouring uses, Council will provide standards within the zoning by-law that will serve to alleviate the potential nuisance and unsafe conditions that could result from random placement of small-scale wind turbines” (Salisbury proposed municipal plan). Restrictions on possible small scale wind turbines in Salisbury include lot size (e.g. must be larger than 0.2 ha), maximum height (45 m), and setbacks (1.5 times height of turbine).

The Village of Belledune has a number of setback restrictions, requiring that all small wind turbines be located 150 m from any existing dwellings (unless occupied by the owner of the system). The Village also requires that the turbine be located two times the total height of the structure from side and rear lot lines, and 30 m from any public street or public utility lines or structure. The Town of Caraquet has minimal setbacks of 2 m, while the Rural Plan of Beaubassin-East requires a setback from buildings of the height of the turbine, and a setback from property lines of 15 m for small turbines, and 50 m for medium size turbines.

Beyond these provincial provisions for setbacks, there are a number of other examples to look to. In some cases, the development of setbacks from either dwellings or property lines will greatly affect the ability of proponents to build wind turbines. In Nova Scotia, the County of Pictou changed its draft setback criteria from originally having setbacks for property lines to setbacks for dwellings since the lot sizes in the county were of the size which would severely restrict wind turbine development if based solely on property lines. The change to setbacks for dwellings allowed for greater opportunity for development of wind turbines. Similarly, Cumberland County measures setbacks from "an existing building intended for human occupation on a neighbouring property," not from property lines. This is to avoid problems associated with narrow properties (common in NB); putting the separation where it is needed and not inadvertently restricting development on neighbouring properties through a reverse application of setbacks.

It is important to also note that there can be sensitivities with respect to road setbacks. In some cases, particularly in rural New Brunswick, there are different classifications of roads. Some roads may be unpaved, access roads with minimal public use. If a municipality creates setbacks from all roads, without delineating different classes of road, it may inhibit wind turbine development in some rural areas. Care should be taken with definitions for these road setbacks, if they are applied.

Table 12 illustrates examples of application of various types of setbacks used in Canadian municipalities.

Table 12 Setback Approaches and Examples

Type of Setback	Description and Examples
Setbacks to dwellings on neighbouring property	These setbacks are calculated in many different ways. Municipalities have used setbacks based on a multiple of the total height of the tower. Some municipalities determine the setback according to the size of the radius of the blade or a multiple thereof. Land use by-laws may also be used to specify requirements for notification of neighbours within a specified radius of a wind turbine development. Examples include: ▪ Twice the total height of a horizontal or vertical axis rotor for utility scale (Argyle) ▪ The greater of 500 m or 3 times or 300% of the height of the wind turbine (grade to highest point of rotor arc) (Cumberland) ▪ For a utility wind turbine height (height of tower plus the radius of the rotor) up to 76.2 m the setback is 175.3 m; for a wind turbine height greater than 76.2 m the setback increases .304 m for each 0.304 m increase in height (CBRM) ▪ Minimum setback is 600 m for utility scale. When a residence is constructed within the setback distance of utility scale turbines erected after the effective date of the by-law, the wind turbine development may expand as long as it is not located closer to the residence than the initial wind turbine development. (Pictou) ▪ No wind turbine closer than 400 m to adjacent residential or commercial property (Guysborough – Districts 4,5,6 & portions of 1&2) ▪ No wind turbine closer than 15 m of twice the distance of the blade radius from the boundary whichever is greater to an adjacent residential property (Guysborough – Northeastern Guysborough Planning Area) ▪ Minimum setback to rural residential is 600 m for turbine above 40kW (Huron-Kinloss) ▪ Minimum setback from dwelling outside wind turbine zone is 350 m (Township of Frontenac) ▪ Minimum setback from nearest neighbour's dwelling 150 m to 600 m depending on zoning and size of lot and size of kilowatts permitted (Prince County) ▪ Not less than twice the height of the turbine (ground to top of rotor's arc) from dwelling (Taber) ▪ Not less than four times height (arc) from dwelling unit (not belonging to the owner of the land on which the turbine is to be situated). (Pincher Creek) ▪ Twice the height of turbine (arc) from buildings on adjacent lot for small turbine (Charlottetown) ▪ Minimum setback is three times total height from any existing habitable building (PEI) ▪ Minimum setback of 110% of total height of the turbine from nearest dwelling. When tower of small system is attached to a building the min. setback from the nearest dwelling on a different lot will be equal to 110% of the total height of the tower. (City of Windsor)
Setbacks with dwellings on site	Some municipalities explicitly state that there are no setback requirements for turbines from dwellings on the site as the turbine while other municipalities require setbacks that include distances based on a multiple of tower height from all habitable units regardless of which property they are on. Setbacks are also sometimes set for accessory buildings related to wind turbines. Examples include: ▪ Twice the total height of a horizontal or vertical axis rotor from a large turbine in any zone (Argyle) ▪ Minimum setback from an existing building for human occupation on site is 1.25 times or 125% of height of large scale turbine (Cumberland) ▪ Setbacks are waived for dwelling of owner of the property of utility scale turbine (CBRM) ▪ No setback requirement for residences on same lot for utility scale turbines (Pictou) ▪ Minimum setback 1.10 times the total wind turbine height for residential buildings and 10m from all lot lines (or provisions for setbacks from roads whichever is greater) for accessory wind generation facilities - >40kW (Huron- Kinloss) ▪ Minimum setback from dwelling in wind power zone is 5m plus the blade length (Township of Frontenac) ▪ One and a half times the height of turbine (arc) from building on property for small (Charlottetown) ▪ Minimum setback is 3 times total height from any existing habitable building but can build closer on the lot if it meets the above criteria and if permit holder is owner of lot and if turbine is not closer to dwelling on lot than the distance equal to total height of turbine, (PEI)

Table 12 Setback Approaches and Examples

Type of Setback	Description and Examples
Setbacks from property lines	Setbacks from property lines are calculated using a variety of measures including set distance, calculation based on a multiple of the total height of turbine and length of blade plus a defined number of metres. Some municipalities include setbacks for turbine accessory facilities from property lines as well. Municipalities will waive setbacks from property lines if neighbouring owner grants permission or if the properties are held in same ownership. Examples include: ▪ Minimum setback from external property line is the length of the rotor arc plus 7.5 m for large scale (Cumberland) ▪ Minimum setback from all property lines is one times the height of turbine (ground level to height of rotor blade in vertical position) for utility scale (Pictou) ▪ No closer than 400 m from property boundary line for wind farms (Guysborough) ▪ No closer than 4 times the total height of turbine from adjoining property lines and in case of wind farms greater or lesser setbacks can be considered through an impact study (East Hants) ▪ Minimum setback from property line for village residential zone is 350 m and minimum setback for property line for other zones is length of turbine blade plus 5 m (Township of Frontenac Islands) ▪ 1.2 times the height of turbine (arc) from buildings on adjacent lot for small (Charlottetown) ▪ Minimum setback from adjacent lot lines shall be a measurement equal to the length of 7 rotor blades (Lunenburg, District 3) ▪ Not locate closer than total height of turbine from lot line that is not owned by permit holder – unless permit holder gets permission from owner of land (PEI) ▪ No turbine will be positioned any closer than 1.5 times the total height of the turbine to any tenure boundary in any direction for safety reasons (BC Crown land)
Setbacks from roads	Setbacks from nearby roads may be calculated using the variety of measures including set distance, calculation based on a multiple of the total height of turbine and length of blade plus a defined number of metres. Examples include: ▪ Minimum setback from public highway is 1 times or 100 percent of the height of turbine (Cumberland) ▪ Minimum setback from boundary of public road is 300 m for utility scale (Pictou) ▪ Minimum setback 1.25 total height of turbine from right-of-way line for >40kW (Huron- Kinloss) ▪ Minimum setback is length of turbine blade plus 5m (Township of Frontenac) ▪ Not less than twice the height of the turbine (ground to top of rotor's arc) from dwelling and meet other setbacks that cover principal use and if this is not sufficient for public roads the setback can be increased(Taber) ▪ Setbacks must meet principal use in district and can be increased to reduce impact for utility scale (Pincher Creek) ▪ Not to be closer than total height of turbine to nearest road/right of way except for access road (PEI) ▪ Public road footage requirement may be waived if lot for wind turbine abuts and fronts upon a private road or on a 'K' road or if existing lot or newly created lot is served by an existing right-of-way (or if a new right of way is created it shall have a minimum width of 6m) for utility scale (Argyle and Barrington)
Setbacks for multiple turbines on a site	Municipalities sometime regulate the separation distance between turbines on a site and increase minimum setbacks when there are multiple turbines on one site. Some municipalities do this on a case by case basis taking into consideration proximity to other immediate land uses, density of turbine development, underlying utilities and information gathered from development hearing. Examples include: ▪ Minimum separation between small scale turbines shall be equal to or exceed the height of the tallest turbine (Kings County) ▪ Setback can be increased from minimum when there are multiple turbines (Taber)
Setbacks for multiple wind turbines on multiple properties	Municipalities have developed setbacks for turbines on multiple properties in several different configurations including: setbacks for wind turbines on adjacent properties but different projects, setbacks for wind turbines on adjacent properties but same project, setbacks for wind turbines on adjacent properties of same ownership. Examples include: ▪ Setbacks for wind turbines on adjacent properties but different projects- Minimum setback is four times the diameter of the rotor for large scale turbines (Cumberland) ▪ Setbacks for wind turbines on adjacent properties of same ownership and which contain wind turbines- Minimum yard requirement may apply to the abutting yard – measured from tower base to the lot line for utility scale (Barrington)

Table 12 Setback Approaches and Examples

Type of Setback	Description and Examples
Setbacks for special zones	Municipalities have instituted setbacks for special zones such as coastal shorelines and lakeshores. Examples include: ▪ Where wind turbines abut coastal shoreline (actual high-water level) or the Coastal Wetlands zone boundary line, the minimum yard requirement for the abutting yard is ½ the diameter of the rotor blade's full arc plus applicable minimum yard requirement for utility scale (Argyle) ▪ Where wind turbines abut coastal shoreline (actual high-water level) the minimum yard requirement of the abutting yard is not less than ½ the diameter of the rotor's arc plus applicable minimum yard requirement. Where abutting yard is within Coastal Wetland zone and the distance as measured from the CW zone boundary to the coastal shoreline is greater than the minimum yard requirement of not less than ½ the diameter of the rotor's arc plus applicable minimum yard requirement, then the minimum yard requirement will be the greater distance for utility scale(Barrington) ▪ No wind turbines within 100 m of a lake edge (Guysborough) ▪ Provincial government - Wind turbines should not be constructed within 100 metres of any permanent or temporary (ephemeral) wetland. For major wetlands providing habitat for large numbers of migrating or breeding waterfowl, the set-back may need to be greater (Alberta Sustainable Resource Development – Fish and Wildlife Division)
Setbacks for small wind turbines	Setbacks for siting small turbines include the following mechanisms: distance from line determined by total height of turbine, distance from line determined by total height of turbine multiplied by a numeric value, and distance from line determined by not exceeding a maximum rotor diameter on a lot according to differing lot sizes. Municipalities have also defined minimum lot size for turbines, particularly small turbines, which limits the development of turbines on certain lots. Examples include: ▪ Setback of 183 m from neighbouring residential dwellings for small scale turbines (Kings) ▪ At minimum, setback for small scale should be equal to turbines total height (base to tip of rotor blade) from lot lines, dwellings, public parking lots and public right of ways (Kings County) ▪ Mini turbines (under 1000 W) shall have a setback of the total height of the tower from adjoining property lines and small scale wind turbines (under 10 kW and under 52 m) shall have a setback of 1.5 times the total height of tower from adjoining property lines (East Hants). ▪ Setback from lot line is not less than the proposed height of the small turbine (Proposed Bruce County) ▪ On lot area of less than 1.0 ha the rotor diameter will not exceed a max of 7 m (total swept area of no more than 40 m^2); on property of more than 1.0 ha the rotor diameter shall not exceed a max of 15.0m (total swept area of 180 m^2) (Proposed Bruce County) ▪ Horizontal distance measured at grade from tower to the property boundary is at least the total height of the turbine (Taber) ▪ Base of system shall be located 4 times the height of the tower from property line; only one system allowed per titled area (Pincher) ▪ Roof mounted turbines are not permitted; only on lots of minimum width and length of 3 times the height (arc) of the turbine, not in front or side yard area, guy wires and anchors should not be located closer than ¼ of the height of the turbine (arc) to the property boundary (Charlottetown) ▪ Twice the height of turbine (arc) from buildings on adjacent lot for small turbine (Charlottetown) ▪ One and a half times the height of turbine (arc) from building on property for small (Charlottetown) ▪ Minimum setback of 110% of total height of the turbine from nearest dwelling. When tower of small system is attached to a building the min. setback from the nearest dwelling on a different lot will be equal to 110% of the total height of the tower. (City of Windsor)

CanWEA has undertaken a substantive study on this topic and developed a set of recommendations for large scale turbines in rural Ontario concerning setbacks. These recommendations identify two key considerations when establishing setback distances: ensuring acceptable sound levels for surrounding dwellings and ensuring public safety for ice shedding and turbine failure. CanWEA's recommended setbacks for large turbines in rural areas are as follows:

- Neighbouring Dwelling Setbacks: calculated with the Ontario Ministry of the Environment regulations for appropriate sound level limits for rural areas (estimated at 250 m or greater given current wind turbine technology)
- Public Road Setbacks: a minimum distance equal to one blade length plus 10 m from the nearest public road (proponent to demonstrate through risk assessment and mitigation measures that individual risk is minimized for turbines proposed within 50 m to 200 m of the public road).
- Property Line Setbacks: a distance equal to one turbine blade length plus 10 m from all property lines unless appropriate agreements or easements are put in place with adjacent property owners.
- Radio, Telecommunication, Radar and Seismoacoustic System Setbacks: determined according to a review of the guidelines developed by the Radio Advisory Board of Canada and CanWEA.
- Environmentally Sensitive Areas and Natural Feature Setbacks: determined through site-specific study as part of either provincial or federal environmental assessment processes.

CanWEA's proposed recommendations for setbacks for small scale wind turbines (rated capacity of 300 kW or less) in the following categories:

- Neighbouring Dwelling Setbacks: calculated so that the mean values of sound pressure level for small turbines do not exceed more than 6 dB_A above background noise for wind speeds below 10 m/s.
- Property Line Setback: turbine based no closer to the property line than the height of the wind turbine tower (excludes the height of the rotor) and no part of the wind system structure, including guy wire anchors, extend closer than 3 m to the property boundaries of the installation site. Setbacks can be waived from adjacent properties if the adjacent owner agrees to an easement binding on current and future owners.

This property setback is further defined in the proposed height restrictions for small wind turbines. CanWEA recommends that for property sizes between 0.1 ha and 0.2h a, the wind tower height (excludes the height of the rotor) be limited to 25 m. For property sizes of 0.2 ha or greater there will be no limitation on wind turbine tower height subject to the setback requirements outlined above and the proposed height does not exceed height recommended by manufacturer or distributor of the system.

4.3.12 Testing or Meteorological Towers

There are few references to testing or meteorological towers in the jurisdictions surveyed. There are policies that enable these towers to be established for certain periods of time, for example in BC on Crown land a licence is given for a 2 year period for occupation of monitoring towers. Wind testing and meteorological towers require temporary use by-law and site plan control approval in Grey Highlands. Temporary test towers to assess wind energy resources may be erected for the life the project, otherwise removed within one year of inactivity in the County of Cumberland.

4.3.13 Visual

As with other aspects that are typically part of the application process, turbines are positioned with visual impacts in mind. Most developers will produce material that includes visual aspects, so that concerns can be dealt with ahead of construction and commissioning the turbines. This was the case with the Blue Mountain wind farm, in Comanche County, Oklahoma (NWCC 2005). Community engagement processes in the development of wind turbine siting are important for evaluating the public's concerns of any negative aspects regarding visual impacts. In some instances, associated structures where constructed to blend in with the surrounding area, such as by having operation structures look like barns (NWCC 2005).

In December 2006, a judge in Abilene, Texas set the foundation for future nuisance claims against wind power in his jurisdiction by throwing out the plaintiffs' (neighbouring citizens) claims that the wind turbines in question (FPL Energy's Horse Hollow Wind Energy Center) constituted a visual nuisance. Texas law can be interpreted broadly but this judge declared that a wind farm's visual appeal is entirely subjective; therefore, not relevant in court (Tillotson & Pinker).

The Jones Consulting Group Ltd. considered the subjectivity of the visual impacts of wind turbines within their constraints analysis for the Town of the Blue Mountains in Ontario (Jones Consulting Group Ltd. 2007). Their analysis endeavoured to address this, through utilization of a consistent methodology. They outlined visual sensitivity of an area – the natural, uninterrupted landscape that exists – as well as the visual absorption capacity – the ability for that natural, uninterrupted landscape to absorb change. In the same region, the Niagara Escarpment Commission, an Ontario provincially mandated commission that maintains the Niagara Escarpment area to ensure compatible development with the natural environment, has taken a position prohibiting any large scale wind development facilities anywhere within the Niagara Escarpment Plan partially due to their assessment of negative visual impacts.

The Village of Belledune regulates small turbine visual impacts by requiring that all small turbines be painted a non-reflective, non-obtrusive color, and cannot be used for displaying any advertising except for reasonable identification of the manufacturer of the installation. There are no municipalities that require a visual impact assessment through an as-of-right/permitted use application, although there are many that regulate wind turbines by requiring terms and conditions or a re-zoning in order, which could use those processes too enable a visual impact assessment.

The Town of Truro, Nova Scotia, believes a workable visual impact assessment could be addressed through the development agreement process where all parties have the opportunity for input and appeal. This process takes into account diverse perspectives and makes a decision considering the views of all who participate. The Municipal District of Taber, Alberta has a similar process; holding an open meeting for questions and concerns considering visual impacts and other concerns, to be heard by a council who will then deem whether or not a proposed wind development project is suitable for the area and citizens.

The County of Bruce is considering a provision in amendments for large scale wind turbines to request a description of the visual effect for the proposed turbines that includes at a minimum, photo montages that simulate the appearance of turbines and transmission lines from key locations and an assessment of how the turbines will affect view, These representations would be undertaken by individuals or firms with experience in visual assessment. A detailed landscape analysis indicating 'Zones of Visual Influence' could be requested by the County in locations of high landscape quality.

Similar practices are in effect in Alberta. In the Municipal District of Taber development applications for wind turbines may be required to provide an analysis of the visual impact of the project especially with respect to the scenic qualities of the landscape. The analysis would include the cumulative impact of other systems in the area and the impact of overhead transmission lines. The Municipal District of Pincher Creek requires all transmission lines from the wind system to the substation or grid to be underground and is currently considering a review of wind energy policies that includes the visual impact on landscape.

Internationally, there is growing literature on the visual impacts of wind turbines and guidelines for how to assess visual impacts. An Australian government funded report by the Australian Wind Energy Association and the Australian Council of National Trusts developed the “Wind Farms and Landscape Values National Assessment Framework” (2007). The framework gives a clear sequence of steps for dealing with the subjective aspect of wind farm development and is a resource to help develop a consistent approach to landscape assessment – what the identified landscape values are, how the wind farm development will impact them and what mitigation processes can be implemented. The Scottish National Heritage has a policy statement on siting wind turbines and natural heritage for turbines over 50kW. The government of the United Kingdom, in their “Planning for Renewable Energy, A Companion Guide to PPS22”, outlines a process on how local authorities can develop landscape and visual impact assessments identifying zones of visual influence including cumulative and sequential effects. New York State Energy Research and Development Authority’s Wind Energy Tool Kit lists the visual and aesthetic impacts that need to be considered and that may require mitigation. The list includes siting, professional design, screening, downsizing, relocation, camouflage/disguise, low profile, alternate technologies, non-specular materials, lighting, maintenance, decommissioning and offsets.

From these examples, it can be seen that, though visual impacts are often times a subjective matter, consensus can be reached through a fair, participatory process for accessing public concerns and working to minimize them. Regulations and policies further improve this process when formal mechanisms for vetting concerns are clearly laid out.

4.3.14 Birds and Bats

There are several steps that can be taken to minimize the occurrence of animal mortality and habitat infringement. Projects should be sited on areas with disturbed habitat wherever possible. Sites with major bird attractants, such as popular migratory corridors, should be avoided. Attention should be paid to impacts on specific species, not just general numbers of kills. Habitat should also be considered in siting. In addition, perch sites should be eliminated from wind facilities as much as possible. The use of guy wires should be avoided, with transmission lines being placed underground to minimize project footprint and likelihood impact mortality. Lighting should also be minimized, with only a limited number of towers being lit using only white or red strobes at no more than 24 pulses per minute (Resolve, 2004). These practices, if combined, can reduce the negative impact turbines may have on local and migratory bird and bat populations.

4.4 The Role of Public Consultation, Education and Communication

Community engagement, education, and consultation processes have been an integral part of nearly all of the above mentioned case studies. Often, the developer is proactive in beginning this engagement process early on, so as to address any concerns directly, rather than dealing with resistance once construction has begun. Organized opposition to wind development is not common, but individuals, who often live near the intended site, tend to have concerns or comments that need to be responded by the developer directly.

Given the potential for public sentiments to run high on matters connected with renewable energy and wind power in particular, it is wise to engage the public in a meaningful conversation and consultation on these topics in advance of any specific project proposals. Ideally, communities work towards energy plans or some form of comprehensive energy strategy. This would be a good place to initiate community conversations around renewable energy development. The policy stage, at which municipalities establish their by-laws and procedures around wind power development, is also an important stage to engage in more specific communications around wind energy. A public hearing prior to issuing a development permit for a wind energy development is often not the most fruitful point for an open and multi-faceted community discussion on this topic to begin. By this stage, opinions, priorities and points of view may have already solidified based on informal and incomplete information. Public engagement should be sought early in the decision making process on wind energy issues if at all possible.

Examples of successful public consultation and communication activities have been demonstrated at different stages in the planning process for renewable energy. In Great Britain, the government identifies local planning authorities as both policy makers and direct agents for change in implementing appropriate renewable energy developments. The government actively encourages local councils and planning authorities to engage with local communities on renewable energy, its benefits and possible negative impacts, prior to dealing with actual project proposals. This strategic planning system is also encouraged to ensure that there is early involvement of communities in key decisions. Local authorities are expected to play a pivotal role in interpreting and acting upon national and regional renewable energy targets at the local level.

Specific renewable energy proposals also present an opportunity for consultation, education and effective communication. Auswind has included a Stakeholder Communication and Consultation Plan in their Best Practices document. The proponent maintains records of all consultations undertaken, including who was consulted, by what method, what issues were raised and how they were addressed. These records form the basis of a consultation report for the planning application which will be updated as the project evolves. The District of Taber in Alberta places great importance on ‘development hearings’ for each proposed development. These hearings provide an open forum for questions, concerns, opinions and education in the community and have contributed to the successful development of two wind farms. Proponents are often required to provide information on the public consultation process as part of the application process for the project and also for input from the public on specific topics such as visual impacts.

The Fenner wind farm, in Madison County, New York, did a thorough permitting process, with a heavy focus on community outreach and education. The developer held several public open houses and community meetings so as describe how wind energy works and will be developed, showing what the site would look like after construction (using simulated photos), and addressing questions and comments. The developer all practiced full disclosure with the community so as to ensure support. In this instance, community support was so strong that the developer decided to expand the wind farm so as to include more land owners, who had noted a desire to be included in the development (NWCC 2005). Local town’s people now strongly support this wind development and its continuance.

Some jurisdictions are recently introducing innovative community-based models for wind development that are moving from consultation to participation to encourage, develop and finance wind projects. For example, ‘revenue participation’ and ‘flip’ (ownership percentage flips to greater local ownership at a certain stage in a project) financial structures are being used in Minnesota so local landowners can participate in the development of utility-scale wind power (Yarano 2008). The goal of these projects is to return financial benefits to landowner beyond the typical land lease payments provided in projects developed by utilities or independent power producers. In exchange for these increased financial benefits, local landowners take a greater role in early development of the projects, occasionally including start-up cash contributions, securing land rights and applying for local permits. By participating in the risk and rewards of development, local communities increase local financial benefits by keeping energy dollars at 'home'. According to the Minnesota Department of Commerce., there are currently more than 850 MW of community-based wind projects completed, under contract or being negotiated with Minnesota utilities.

By working with the public early on in the planning phase, and gathering local wind energy champions, project developers can also gain a sense of history in the community. This is important in certain instances, as some communities may have resentment from previous wind developments that were not followed through with or which caused community hostility. Such historical issues have posed challenges to developers who were not prepared for community opposition.

It should also be noted that EIA projects require public consultation as part of the overall EIA, including the requirements for First Nation consultation in relation to any project that would require a Crown land lease. The Department of Environment should be contacted for further details on these requirements.

4.5 Community Ownership

Community or cooperative ownership and management plans are becoming increasingly common in Canada, especially following the wide success of European countries such as Denmark, Germany, Sweden, and the UK (Bolinger 2001). Examples abound as to the success of this model, with half of German wind capacity (worth nearly $20 billion) being developed by landowners and small investors (Gipe 2007). The cooperative wind energy movement in Europe has been the driving force behind the success of the industry, and could similarly boost New Brunswick's development in this area.

Contrary to developer-led models, which are initiated, funded and operated by an outside interest, community-led models are driven and managed by local community members and organizations (Bolinger 2001). This format is fairly flexible, however, as often community or cooperative ownership can include developers to help raise capital or gain experience where it is lacking in the community. Renewable energy, because of the relatively small unit generation size, is more appropriate for decentralized ownership, allowing many of the benefits to remain in the community (Gipe 2007). This is one of the reasons why this model has grown so rapidly in Germany and Denmark, for instance, which is enhanced by the enthusiasm and support of local professionals and manufacturers (Toke 2005). These wind development schemes then tend to scale-up based upon previous experience and success.

There is no one cooperative or community ownership model to follow, as culture and policies differ. "Denmark, where community ownership began, makes use solely of general partnerships that for the most part operate according to cooperative principles. Sweden has employed two models – the real estate commune and the consumer cooperative. Germany's primary model is more commercial in nature – a limited partnership with a developer's limited liability company as general partner" (Bolinger 2001, 2003). Whatever the model, however, the benefits to local ownership seem to be the same: raised public awareness and increased support, increased local economic development, new sources of capital, and openness to future expansion. This contrasts with developer-led projects, which can often meet resistance because of a cautious view of outside business 'invading their landscape' (Bolinger 2001). Further, if smaller community models can be located closer to the point of need rather than larger wind farms, costs for hook-up and transmission can be reduced.

Though not as common as in the EU, Canadian communities have started to develop wind energy. Peace Energy of BC provides a good example of a community that realized its wind resources and worked with the provincial government and private industry to develop, while keeping a stake in the project. Windshare, a community-led organization in Ontario, similarly worked with Toronto officials to erect the first urban wind turbine in North America, and have since expanded their horizon to study and invest in new initiatives around the Great Lakes. Closer to home, Sou'Wester Windfield in Nova Scotia uses an RRSP investment model, to generate local capital to invest in their wind energy development. All of these examples have varying levels of community management and show that such models can exist in a variety of settings and approaches to development. Similar efforts could be duplicated in New Brunswick.

5.0 OPTIONS FOR NEW BRUNSWICK

The key issues surrounding wind energy were described in Section 3 and the policies commonly used to regulate these issues were discussed in Section 4. This section further discusses options for policies and weights the pros and cons of the various approaches in consideration of New Brunswick's local government structure.

The following sections outline some of the options available for local governments wishing to regulate wind energy development. In light of the literature review presented in this report it should be clear that there is no scientific or societal consensus on many aspects of wind energy development. There is significant controversy around some impacts of wind energy (for example the question of a safe distance from receptor for protection against noise impacts, or even the more simple question of how many birds and bats are killed by wind turbines). These controversies will likely continue into the future, at least until a more significant body of literature has been produced around the topic of wind energy and its impacts. Local government bodies, however, cannot wait for scientific consensus on all issues before they move forward on by-laws, given that lack of action may have even more negative impacts on a community (for example, in terms of missed opportunities for economic development or citizen dissatisfaction) than introducing less-than-perfect legislation.

It should also be recognized that the assertive development of wind energy potential is in accord with broader New Brunswick, Atlantic Canadian, national and global concern and commitments regarding environmental protection and particularly global climate change. Wind energy has been generally accepted as one of the most promising and important renewable energy technologies, the rapid timely growth of which is deemed critical in addressing these significant global and regional challenges. The uncertainties regarding impacts to local residents and local environmental or socio-economic components must be considered in light of these larger issues. The ongoing environmental and human health effects of conventional non-renewable energy sources are also well known and in many aspects significant. In so far as these effects can be reduced or in essence exchanged by an increase in renewable alternatives is generally believed to be of social benefit. This is particularly the case, if care is taken to simultaneously implement measures to reduce energy demand, so that an increase in alternative energy accelerates a reduction in conventional energy sources.

Therefore, despite the uncertainties in the science, local governments should feel justified in their attempts to introduce policy around wind energy. There is currently a call for more clarity of legislation in this area both from communities and developers. Communities want to ensure that their interests and their properties are protected. Developers want clarity in what they can and cannot do and they too have an interest in ensuring that communities are protected and satisfied so as to prevent a back-lash to this fairly young industry. Local governments need to carefully balance the need to protect the character, health and safety within communities with the desire for flexibility, respecting the strong desire to support alternative, renewable energy options, the advantages associated with economic opportunities and from the industry, the benefits arising from regulatory certainty and attractive business prospects. Each community therefore needs to consider its interests, values and its own unique socio-political circumstances in moving forward on wind energy legislation.

To establish effective and locally appropriate approaches to the regulation of wind turbines, there is a need for a community conversation in different local governments in New Brunswick, among citizens, municipal staff, council and commissions. This report and especially the planning tools and options presented in this section are meant to frame and inform (with the best of available information) these community conversations. They are not meant to tell a local government body how to modify their regulatory and policy frameworks. Those decisions are ultimately vested in political and administrative leadership and must be made by that leadership at the local level. It is also pointed out that in many respects wind energy issues transcend jurisdictional boundaries and therefore there are worthwhile reasons to consider regional and in so far as jurisdictional issues can be resolved, provincial or even inter-provincial policies and regulations.

5.1 General Planning Tools

There are a variety of planning mechanisms and tools used by municipalities and rural communities for regulating wind energy developments. Broadly speaking, these range from fairly prescriptive (*e.g.*, permitted or conditional uses) to highly discretionary (*e.g.,* rezoning, development schemes, development agreements). On the prescriptive side of the spectrum, applications for permitted uses are simply judged against a standard checklist of regulations. The application process is fairly simple and quick, but there is little flexibility in the evaluation system. At the discretionary end of the spectrum, applications are considered on a case by case basis and their suitability is determined through a consultative decision-making process that involves the local council or commission and potentially the community, but it is a longer and more expensive process. The pros and cons of various mechanisms at the disposal of practitioners are further described below.

In addition, the relevance of these tools will differ depending on the type of planning framework that has been enabled for a given areas. Land essentially falls into three different categories in New Brunswick, incorporated areas, unincorporated areas, and rural communities. Within this framework, there are a wide variety of possible planning tools that can apply, such as Municipal Plans, Rural Plans, Basic Planning Statements and Zoning. When a community has no planning framework in place they are governed primarily by Provincial Subdivision and Building Regulations. Further discussion around Subdivision and Building regulatory tools is provided in section 5.2. The following tools apply to areas with Zoning By-laws or Rural Plans:

Permitted Uses

Under Section 34(3) of the *Community Planning Act*, a Zoning By-law enables local governments to identify uses of land that are permitted within certain zones subject to compliance with a set of prescribed standards. These standards may also be conditional based on the type of use, building or structure. Using this standard planning mechanism, a wind turbine development can be identified as a permitted or conditional use in a zone and therefore be permitted 'as-of-right' when it complies with prescribed standards.

Strengths:

- Permitting wind turbines to develop 'as-of-right' in particular zones provides certainty to developers and enables development of wind industry.
- By using a set of predetermined criteria it ensures that projects will be evaluated against a consistent set of standards.
- Approvals can be obtained within a relatively short period of time.

- Typically a less expensive approval process.

Challenges:

- This is a generic approach that can exclude areas from wind turbine development which on a case-by-case basis may be suitable for turbines or farms. It can also allow wind turbine development in areas that for social or environmental reasons may be unsuitable.
- Allowing wind turbines to develop as-of-right makes it difficult to articulate quantitative regulations that will adequately cover all impacts of wind energy development projects. For example, visual impacts are more difficult to manage through zoning standards.
- Wind turbine technology is changing at a rapid pace. Requirements established on the basis of current technology could quickly become redundant or potentially burdensome for wind development in the future.
- Knowledge about the positive and negative issues of wind turbines, as well as societal thresholds of acceptance of these issues is evolving. Standards and requirements that are currently set may become out-of-date before necessary amendments can be made.
- There is no formal opportunity to draw on local knowledge or provide for public input into the development proposal as part of the application process.
- There is no ability to enforce decommissioning and environmental management plan requirements.

<u>Conditional Uses</u>

Under Section 34(3)(f) of the *Community Planning Act*, a Zoning By-law enables local governments to identify uses of land that are permitted within certain zones subject to compliance with a set of prescribed standards. In addition to this, a use permitted in a zone can also be made subject to terms and conditions as imposed by a Planning Advisory Committee or Commission, as identified under Section 34(3)(c), subject to Section 34(5). These conditions must be related to health, safety, well-being and protection of properties within zone or abutting zones.

Strengths:

- Allows the municipality or rural community to establish locational criteria for wind turbines and enables flexibility in designing adequate conditions relevant to the site, technology and project specifics.
- Permitting wind turbines to develop as-of-right in particular zones subject to terms and conditions provides certainty to developers and enables development of wind industry.
- Approvals can be obtained within a relatively short period of time.
- Typically a less expensive approval process.

Challenges:

- There is a need for clear and concise criteria for assessment so that developers and local governments have a mutual understanding of the extent of the assessment and potential conditions that could be imposed. There is greater potential (or perception thereof) that projects will not be treated evenly and consistently as terms and conditions are project specific.
- The terms and conditions imposed by the Planning Advisory Committee or Commission are limited to health, safety and well being and protection of properties within zone or abutting zones.
- There is no ability to enforce decommissioning requirements.

Rezoning or Integrated Development Zones

Another tool available under the *Community Planning Act* is using a rezoning or the creation of an Integrated Development Zone to enable any given proposal. See Section 38 and 39 of the *Community Planning Act*. In either case, when a proposal is made to establish a wind turbine or a wind turbine farm, the zoning by-law could be amended to enable the proposed use. Once the change to the zoning by-law is approved, the development can proceed as a permitted use, however it may be subject to terms and conditions or an agreement as established under Section 39 of the *Community Planning Act*.

Strengths:

- The process is site specific which allows the municipality or rural community to use the process to establish locational criteria for wind turbines without having to predetermine the location on the ground.
- Provides a process through which the local government can require further study of the potential impacts of wind turbine/farm development, and allows for more thorough evaluation and consideration of contentious issues such as noise, visual and safety impacts.
- The onus is more clearly on the developer to identify and assess impacts and propose mitigation procedures.
- Provides a process through which the local government can enforce decommissioning and require financial bonds (Section 39(8)).
- Public input into the development is required, and thus the opportunity to address community concerns is provided.
- There is more direct control provided to the Council or the Commission over the development.

Challenges:

- There is a need for clear and concise criteria for assessment so that developers and municipalities have a mutual understanding of the extent of the assessment and potential conditions that could be imposed.
- Creates greater uncertainty for developers as the decision is subject to Council or Commission approval, and it can be difficult to predetermine what terms and/or conditions will be applied. This can affect the viability of a given project due to financial and timing considerations.
- There is greater potential (or perception thereof) that projects will not be treated evenly and consistently as agreements are project specific.
- The process is a lengthier and at times onerous process, and requires a more significant investment of resources for both the developer and local government.
- Development planning staff and Council or the Commission may not have the appropriate skill set to evaluate the information provided by the developer so as to make an informed decision.
- Could be perceived as a challenge to the development of wind turbines on the part of some developers.

Development Scheme (Does not apply to areas governed by Rural Plans)

The Development Scheme is a tool provided under Section 32 of the *Community Planning Act*. A Development Scheme is a By-law that carries out or amplifies any project, providing it is not inconsistent with a municipal plan. In this case, a use such as a wind farm could be permitted subject to the statements, drawings and details included in the scheme. Council is the ultimate authority in determining conformance with the scheme.

Strengths:

- The development scheme could be used to identify the conditions that can be imposed and the scope of assessment, which provides clarity for the developer.
- The process is site specific, and thus, can take into account site specific factors such as environmental impacts and development obstacles.
- Public input into the development scheme is required, and thus the opportunity to address community concerns is provided.
- There is more direct control provided to Council/Commission over the development.

Challenges:

- Creates greater uncertainty for developers as the decision is subject to Council/Commission approval, which can affect the viability of a given project due to financial and timing considerations.
- Development planning staff and Council/Commission must have the appropriate skill set to make an informed decision on the development scheme requirements and approval.
- The process is a lengthier and at times onerous process, and requires a more significant investment of resources for both the developer and local government.
- Could be perceived as a challenge to the development of wind turbines on the part of some developers.

Development Agreement (Does not apply to areas governed by Rural Plans)

Development agreements allow specific development standards to be negotiated in addition to those required by the existing regulatory framework (zoning by-law, subdivision plan etc.). This is identified under Section 101 of the *Community Planning Act*. The process results in a legal agreement of the range of conditions that the developer is required to meet. The agreement is registered against the property and runs with the land until it is discharged.

Strengths:

- Can be used to supplement permitted uses or conditional uses and provides a stronger mechanism through which to encourage further study of the potential impacts of wind turbine/farm development, and allows for more thorough evaluation and consideration of contentious issues such as noise, visual and safety impacts.
- The onus is more clearly on the developer to identify and assess impacts and propose mitigation procedures.
- The process is site specific, and thus, can take into account site specific factors such as environmental impacts and development obstacles.

Challenges:

- Presupposes or requires the willingness of the developer to use the agreement.
- Development planning staff must have the appropriate skill set to make an informed decision on the development agreement requirements.

- The process is a lengthier and at times onerous process, and requires a more significant investment of resources for both the developer and local government.
- Could be perceived as a challenge to the development of wind turbines on the part of some developers.

5.1.1 Other Applicable By-laws, Regulations and Information

Provincial Subdivision and Building Regulations

In unincorporated areas key legislation regulating development are the provincial subdivision, setback and building regulations. A brief overview of these regulations as they may apply to wind energy developments is provided below.

Provincial Subdivision Regulation, Community Planning Act, NB Regulation 80-159

This regulation does not apply to Cities, Towns or Villages and Rural Communities with a subdivision by-law in effect. In essence, it applies primarily to unincorporated areas without any planning framework in place. This regulation prescribes the provisions surrounding streets, lots, blocks and parcels of land. It requires that every lot, block and other parcel of land in a proposed subdivision 'shall abut a street owned by the Crown, or such other access as may be approved by the commission as being advisable for the development of land.' This has important implications if a lot is being subdivided for wind turbine development, as the commission can exempt the requirement for public street frontage, providing flexibility. This is particularly relevant, since wind turbines typically do not require road access except for maintenance purposes. A lot in this bylaw is defined as 'a parcel of land or two or more adjoining parcels of land held by the same owner and used or intended to be used as the site for a building or structure or an appurtenance thereto'. Traditionally, commissions have interpreted this definition to mean that only one main building or structure is permitted on a lot. This means that subdivision will be required if there is an existing building or structure on a piece of land that a turbine is being developed on (Personal Communication, Planning Commissions). This regulation also details minimum lot sizes of 4000 m^2 for unserviced lots. This means that in unincorporated areas there are very few subdivision rules that will impede the development of wind turbines.

Provincial Building Regulation, Community Planning Act, NB Regulation 81-126

This regulation does not apply to municipalities or rural communities which have enacted a building by-law. Essentially it applies to unincorporated areas without a planning framework in place. This regulation details provisions relating to minimum lot sizes, location of buildings and structures (among others). It would have limited implication for wind turbine development; setbacks are minimal for structures.

Provincial Building Regulation, Community Planning Act, NB Regulation 2002-45

This regulation applies in unincorporated areas and in rural communities that have not enacted a building bylaw. The regulation identifies that 'a person shall not undertake or continue the building, locating or relocating, demolishing, altering or replacing of a building or structure unless, it conforms with the National Building Code, and a development and building permit has been issued. This regulation therefore outlines the requirements for development and building permits, along with associated fees. The regulation also identifies that an application shall 'contain such other information as the development officer or building inspector may require for the purpose of determining compliance with this Regulation'. Building Inspectors and Development Officers will require engineered stamped drawings for both the foundation and the tower of wind turbines.

Provincial Set-back Regulation, Community Planning Act, NB Regulation 84-292

This regulation does not apply to cities or towns, or villages or rural communities that have a rural plan by-law or zoning by-law in place. It therefore applies to unincorporated areas without a planning framework in place. It requires particular setbacks from roads. A minimum setback of 7.5 m is required from the boundary of a village street or highway and a minimum setback of 15 m is required from the boundary of an arterial or collector highway. Further certificate of setbacks are required for any building or structure within 30 m of the boundary of a highway or village street. These setbacks would not address some of the health and safety concerns such as blade and ice throw from wind turbines under all circumstances.

Municipal or Rural Community Subdivision By-Law

Under Section 42 of the *Community Planning Act*, Councils or Rural Community Councils can enact a subdivision by-law to regulate the subdividing of land. This allows for a wide variety of regulations to be created, from prescribing application processes for subdivision approval, prescribing classes of subdivision and contribution for lands for public purposes. Generally the application of a subdivision by-law to wind turbine development will be specific to the lot fabric and requirements of any given application. The CPA under Section 42 (c) also requires that lot abut a street, however it indicates that access other than a street can be approved subject to the approval of the advisory committee or commission. Section 48 of the CPA provides the development officer with the power to exempt land from subdivision. In particular, Section 48 (1) (a) provides the Development officer to exempt 'any subdivision in which each parcel of land is not less than 2 Hectares in area and in which any parcel that fronts on a publicly owned street has a rectangular width of at least one hundred and fifty meters at the minimum set-back established by a by-law or regulation hereunder affecting the land'. Depending on the configuration of lots, this could assist municipalities and rural communities in enabling wind turbine development.

Subdivision Variance

Under Section 46(1) an advisory committee or commission is granted the ability to permit a variance subject to such terms and conditions as it sees fit. In this instance the commission or advisory committee can permit a reasonable variance which in its opinion is desirable for the development of land in accordance with the general intent of the by-law and other policies. This process can also require the involvement of other land owners in the neighbourhood of the proposed subdivision. This process can provide flexibility in dealing with subdivision for wind turbine development.

Provincial Crown Land

A large portion of the land in New Brunswick is owned by the Crown. Section 96 of the *Community Planning Act* indicates that 'the Crown or an agent thereof' can be exempt from compliance with the Act, and by-laws or regulations under the Act. In the instance where land is leased from the Crown, there is potential for this provision to apply to wind developers. This issue was addressed in a wind turbine application handled by the Greater Moncton Planning Commission who were requested to exempt the wind developer from the requirement for subdivision, given the development was occurring on Crown land. In this instance, it was decided that ultimately the wind developer was not an agent of the Crown and that any request for exemption would need to come from the Crown. Further to this, as shown in Table 6 of this report, the Department of Nature Resources has requirements for Wind Turbines on Crown lands.

Building By-Law

Under Section 59 of the *Community Planning Act* it is identified that a Council or Rural Community Council can 'enact a building by-law to prescribe standards for the building, locating or relocating, demolishing, altering, structurally altering, repairing or replacing or any combination thereof, a building or structure', and may also 'prescribe a system of permits'. This section also identifies that they 'may prescribe any reasonable standards in relation to structures' for which standards are not provided under the National Building Code'.

It is anticipated that building permits will be required for wind turbine applications. Although wind turbines are not buildings and are not suitable for occupancy, wind turbines can be considered as structures and engineered drawings can be required for approval to construct. Further detail on application requirements is provided below.

Application Process

Before the application process begins, a project developer and the permitting agency will often meet to discuss the proposed project, in order to help ensure that both are aware of the process for application and permitting. Depending on the scale of the project or the community sensitivity surrounding an application, this can also be a good time for the developer to engage major stakeholders, such as local leaders, landowners, and the public at large. These stakeholders can review draft material and studies related to the project. This allows the developer to be aware of local concerns before submitting a formal application, and provides the community the opportunity to become educated about the project and voice any concerns they have at an early stage in the development process (NWCC 2002).

In most cases the formal application process starts when the developer officially submits documents for a permit or planning application. The type and amount of information in the application will vary, depending on the type of application, and the approving body. The information provided during the application process will be used to assess the short- and long-term implications associated with the project, be they economic, environmental, or social. If there is potential for negative implications due to the project, the permitting agency should discuss this with the developer and work together to provide alternatives or mitigating measures. Depending on the location and type of development, an Environmental Assessment may also be triggered, which will also have to be completed as part of the overall application process.

The application process, whether for a permitted use, rezoning or development agreement, will require proponents to describe certain aspects of the proposed development. The following are lists of elements that a local government may wish to include in the requirements in its application process. These lists were generated by compiling the requirements in other application processes from a selection of municipalities throughout Canada. There is no need for local governments to require all of the items on these lists in their own application process, nor would all requirements be appropriate for all types of applications (permit applications will likely be much less onerous than rezoning applications). The requirements of the application should also be in line with any by-laws put in place (e.g. if there is a by-law limiting height, then the application for a development permit would typically require an indication of proposed heights).

Large Scale Turbines - Potential Content of Application

- Project definition including installed turbine(s) capacity, targeted long term production levels, scale elevations or photos of turbines showing total height, tower height, rotor diameter and colour;
- Site plan showing all buildings, boundaries and natural features and alterations of site;
- Turbine manufacturer's specifications and professional engineer's design and approval of turbine base;
- Analysis of visual impact including the cumulative impact of other wind turbines and impact of overhead transmission lines, mitigation measures for shadow or reflection of light onto adjacent sensitive land uses;
- Analysis of noise impact including a map indicating all lands and sensitive receptors impacted and estimated noise levels at property lines and receptors;
- Impacts to the local road system including required approaches from public roads;
- Study to determine impact and mitigation for identified natural heritage features;
- Copies of completed forms from Transport Canada and Nav Canada for turbines taller than 30 m and 30.5 m respectively;
- Evidence of notification to DND and Nav Canada if within a 10 km radius of airfield;
- Copies of all documentation required for *Canadian Environmental Assessment Act* and *New Brunswick Environmental Impact Assessment Act* if applicable;
- Evidence of notification to DND, Nav Canada, Natural Resources Canada or other applicable agencies regarding potential radio, telecommunications, radar and seismoacoustic interference if applicable;
- Evidence and results of public consultation if conducted;
- When placed on agricultural land, evidence of the continued use of prime agricultural land for farm use;
- Emergency response plans for site safety; and
- Decommissioning and reclamation plan.

Small Scale Turbines – Potential Content of Application

- Description of proposed project including scale elevations or photos of turbines – total height, tower height, rotor diameter and colour;
- Manufacturer's information and Canadian Safety Association certification;
- A site plan for location of turbines in relation to lot lines, dwelling and adjacent dwellings;
- Analysis of noise impact including a map indicating all lands and sensitive receptors and estimated noise levels at property lines and receptors;
- Copies of completed forms from Transport Canada for turbine heights of 30 m or higher and copies of notification of Nav Canada for turbine heights of 30.5 m or higher;
- Evidence of notification to DND and Nav Canada if within a 10 km radius of airfield;

- Evidence that strobe and shadow effect will not affect the enjoyment of the adjoining residences; and
- Evidence of preliminary consultation and public notification.

5.2 Regulatory Options to Address Specific Issues

5.2.1 There are a number of issues related to health and safety of wind energy generation facilities that local governments should be aware of. Possible planning responses that could be included in by-laws, zoning provisions or provincial regulations are outlined below. Health and Safety

Ice Throw:

Option 1: Require a minimum separation distance of 1.5 to 3 times the total turbine height for large and small scale turbines from receptors, roads and property lines.

Option 2: Require an ice throw report that includes an assessment and map of the likelihood of ice throw through the site and on neighbouring properties, as well as mitigation measures such as ice detection systems and operational protocols to eliminate or minimize ice throw risks.

Note that setbacks of approximately 500 m have been suggested to completely eliminate the risk from ice throw (Finnish Meteorological Institute 1996). According to Garrad Hassan's 2007 report approximately 220 m is the critical distance for ice throw from a turbine (a 'safe' distance, beyond which there is negligible risk of injury from ice throw). A separation distance of 2 to 3 times the total turbine height from property lines is recommended if municipalities are concerned about protecting future land use on adjoining properties. Due to lot sizes this may restrict the development of wind turbines so municipalities will need to balance the rights to protect future land uses of adjoining properties with facilitating development of wind energy in their municipality based on their local context. Provisions are also provided in some municipal by-laws that these setbacks can be waived if adjacent landowners are in agreement. As identified in section 4.3.11, consideration should also be given to road classification when determining setbacks.

Ultimately, the decision on the appropriate setback should lie with elected council.

Turbine Tower Design

Require a minimum distance of 8 m between the lowest reach of rotor blades and the ground; and minimum distance of 3.5 m between the lowest reach of ladder (or other access device) and the ground for both large, small and mini scale turbines. Also require fencing (of at least 1.8 m in height), lockable gates and/or lockable doors to address tower access and safety for towers that are not of a monopole design.

Blade Throw

Option 1: Require a minimum separation distance of 1.5 to 3 times the total turbine height for large and small scale turbines from receptors, roads and property lines.

Option 2: Require design standards, and/or a professional engineer's approval that the wind turbine meets approved standards of responsible safety associations.

A separation distance of 2 to 3 times the total turbine height from property lines is recommended if municipalities are concerned about protecting future land use on adjoining properties. Due to lot sizes this may restrict the development of wind turbines so municipalities will need to balance the rights to protect future land uses of adjoining properties with facilitating development of wind energy in their municipality based on their local context. Provisions are also provided in some municipal by-laws that these setbacks can be waived if adjacent landowners are in agreement. As identified in the section 4.3.11, consideration should also be given to road classification when determining setbacks.

Ultimately, the decision on what the appropriate setback should be lies with elected council.

Turbine Structural Failure

Require design standards, and/or a professional engineer's approval that the wind turbine meets approved standards of responsible safety associations.

Fire, Oil Spill, etc

Require an emergency management plan as part of the application process.

Aviation Safety

Require copies of completed forms from Transport Canada when a turbine is above 30 m. Require copies of completed forms from Nav Canada when a tower is above 30.5 m. Require copies of completed forms from Nav Canada or DND when a large or small turbine is sited within 10 km of an airport.

5.2.2 Shadow Flicker

Option 1: Require a visual impact study that includes an analysis of shadow flicker and its impacts and proposed mitigation measures on adjacent properties within 1.3 km for large scale turbines and a visual impact study that includes an analysis of shadow flicker and its impacts and proposed mitigation measures on adjacent properties for small turbines.

Option 2: In addition to the visual impact study, include a by-law quantifying the level of shadow flicker acceptable. One option is a worse case maximum of 30 hours of shadow flicker per year of maximum 30 minutes per day experienced by a receptor as a result of the wind turbine. Another option is maximum of 30 hours per year of maximum 30 minutes per day based on actual/real predicted values.

5.2.3 Height

The municipality will typically need a provision exempting wind turbines from height restrictions for structures within most zones.

In addition, some municipalities have attempted to restrict the height of wind turbines to limit visual impacts. It is debatable that communities are sensitive to the difference in visual impacts associated with height (i.e. a 120 m turbine is not less publicly acceptable than a 100 m turbine). Taller turbines are able to catch higher speed winds and generate more power and are thus more desirable. With a rapidly growing industry, the typical total height of large turbines is growing rapidly, so a height restriction that appears non-restrictive today might appear restrictive in a few years. For the above mentioned reasons, municipalities may choose to not regulate the height of turbines. A restriction on the height of turbines is not necessary if the setback provisions depend on it (*i.e.,* if the setbacks are set to a multiple of the total turbine height for example), this is especially true for smaller turbines. Height restrictions can be developed for municipalities that are concerned about height and its visual impact.

Option 1: Include a provision excepting wind turbines from typical height restrictions in a zone. Do not regulate maximum total turbine heights.

Option 2: Include a provision excepting wind turbines from typical height restrictions in a zone. Set a maximum total turbine height for large, small scale turbines; for example 120 m for large, 60 m for small turbines.

5.2.4 Management Plan

A management plan may be required as part of the application process to clarify the responsibilities of the owner/developer in various stages of project lifetime. It may include: construction details; operational and maintenance requirements; traffic management with details on volumes, frequencies and haul routes of construction vehicles; the process for complaints; any required mitigation measures and required monitoring; emergency management plan; design standards and safety protocols to reduce the risks associated with ice throw and blade/turbine failure, decommissioning details. The management plan overlaps with several of the other provisions included in this section (*e.g.,* decommissioning plan, emergency plan etc). Also note that management plans are only enforceable under a discretionary process (e.g. re-zoning).

5.2.5 Noise

As a main public concern, the issue of noise certainly merits addressing through municipal legislation. There are three approaches to regulating noise. The first is to require a certain maximum allowable noise level (either at the property boundary or at nearest receptor) in dB (A-weighted is most common). A second approach is to require a separation distance (either from property boundary or nearest receptor) large enough to ensure noise (including infrasound and amplitude modulation) does not negatively impact those beyond the site. A third approach would be to combine criteria for maximum allowable noise with minimum separation requirements, allowing the minimum separation distance to be reduced pending demonstrated levels.

The use of sound level ("decibel") criteria is a recent approach to regulating noise in Atlantic Canada; while other provinces have a longer history of using this approach. In Ontario, for example, the provincial government has a specific provincial noise standard and assessment protocol that wind turbines must meet. Municipalities require in their by-laws that wind turbines meet this standard. If there are problems with non-compliance to the decibel regulation then the onus is on the province to investigate and ensure that the noise complaint is resolved. A provincial noise standard protocol means that the standard is developed and reviewed by the province. New Brunswick has taken the first step towards implementing a provincial standard protocol by requiring noise assessment following the Ontario methodology for all wind developments greater than 3 MW which are within 1 km of receptors (NBENV 2008).

New Brunswick municipalities need to consider the implications and possible challenges of implementing a decibel approach. The municipality needs to define the noise standard and the protocol for the baseline noise assessment. The onus would be on the municipality to interpret and assess possible non-compliance with the decibel regulations once a turbine has been commissioned. Possible ways to reduce the level of responsibility for this, both financially and technically, are to require compliance testing by the proponent as part of the permitting process. Compliance testing would mean that the proponent agrees to a follow-up testing protocol as defined by the municipality (for example, testing of sensitive receptors in a defined period of time once the turbine development has been commissioned). Alternatively, municipalities could require as part of the permitting process that proponents test decibel readings if complaints are received after the wind turbine has been commissioned. These two mechanisms would place the financial and technical responsibility for responding to complaints and non-compliance with the decibel regulation on the proponent.

In both the case of decibel standard and separation distance, there is a decision as to whether the property line or the nearest receptor (usually defined as nearest habitable dwelling) is the appropriate reference point. Using the property boundary as reference point ensures that no part of a road or neighbouring property is negatively impacted by noise from the wind turbine. This can be restrictive and, in some cases, may lead to a complete prohibition of wind turbines in a municipality if the lot shapes and sizes are challenging. One recommended alternative is to use the property boundary as a reference point but include a statement in the by-law specifying that the reference point can be changed to nearest dwelling, if the proponent can provide written consent from adjacent property owners. In Alberta, where the ERCB Directive specifies the dwelling as the reference point, it is at the energy utilities risk that the property owner is free to erect a dwelling closer to the energy utility, and that the utility would then be required to meet the criterion at the reduced separation distance. In Ontario, the property line is the determinant, and thus there is no risk to the wind turbine proponent that the criteria may effectively change.

Option 1: Require a sound limit including a specific dB_A limit and/or dB_A above background noise levels at the exterior of the nearest habitable dwelling.

The decibel approach is promoted by CanWEA and other champions of the wind energy industry as it allows for relaxation of actual setbacks if developers can show that the turbine(s) are not so noisy as to change the overall sound levels at the neighbouring properties. Also, this approach is required by the NBENV for projects undergoing EIA (greater than 3 MW). This approach is more cumbersome as measurements need to be made at the property line and/or receptors, however it can be less restrictive than a setback. This approach encourages technical innovation to reduce sound emissions from the turbines. It can also be used for both large scale and small scale applications. While there are no universally accepted dB_A standards, the range proposed most often by other municipalities in recent standards as were summarized in Table 10, is 35 dB_A to 55 dB_A or 5 to 10 dB_A above background noise levels at the exterior of the nearest habitable dwelling.

Option 2: Require an absolute separation distance from the exterior of the nearest habitable dwelling.

There has been much controversy over the appropriate setback for masking the impacts of noise from a wind turbine. The distance at which all or most effects are either eliminated or deemed to be is insignificant is far from agreed. The typical setbacks of 200 to 350 m which were commonly put in place just a few years ago have now been seen to be more generally extended to 400 to 600 m in a number of more recent regulations. Even these distances have been challenged by some emerging research, experts, commentators and advocates who are calling for more conservative setbacks of 1 to 2 km for large scale turbines. A 1600 m or greater separation distance is very conservative but advocates of this approach argue that these distances are necessary to negate and eliminate any possible negative effects relating to noise and other wind turbine impacts. Others believe that a less stringent but still conservative 1000 m separation distance is adequate to accomplish the same objective. No examples of 1000 m setbacks were identified in Europe where wind development is to this date considerably more prevalent and population densities typically higher than North America. Many advocates contend that the noise associated with wind development, while noticeable, is not significant and that the more typical shorter setback distances accompanied by assessment of site specific circumstances in the context of broader consideration of community and societal benefits are entirely satisfactory. They argue that over time, as wind development becomes more commonplace, it will, like many features of modern life in the developed world, be accommodated without substantial negative effect or perception. This well established view asserts that larger setbacks are too restrictive and may in effect eliminate the possibility of wind energy generation in some municipalities and in many specific locations where the optimal wind conditions are found in areas (such as coastal regions) where long established pre-existing uses are prevalent. Councils will therefore need to balance the opportunity for development, broader environmental and social considerations with protection against noise impacts on residents.

Option 3: Require a general provision for noise limits in the by-law (not specific to wind turbines) limiting sound levels to a dB_A limit and/or dB_A above background noise levels at the exterior of the nearest habitable dwelling.

As previously described, there are few quantitative limits to noise levels for New Brunswick municipalities (Belledune being one exception). This means that a noise by-law of this sort, specific to wind turbines, could be argued to discriminate against wind turbines, while other “noisy” structures (roads, factories, other operations) are not subjected to noise limits. Municipalities could introduce a general noise by-law to this effect, or this may be done at the provincial levels similar to Ontario and Alberta.

Option 4: Require a separation in metres from the property line OR a sound limit in dB_A and/or dB_A above background noise levels at the exterior of the nearest habitable dwelling.

This option combines options 1 and 2 and is recommended as a way of putting a protective separation distance in place while giving the developers the option of forgoing that distance if they can prove that noise levels at the property boundary are within prescribed limits. This option encourages the developer and the industry to develop innovative solutions that address problems regarding noise levels, while also providing assurance that at a given setback the development will not be challenged.

5.2.6 Electromagnetic, Radio, Telecommunications, Radar and Seismoacoustic Systems

Impacts or radio waves and electromagnetic interference are typically addressed by other regulatory bodies and do not need to be regulated by the municipality per se. However, municipalities should include a provision in the requirements for the application process on wind turbines, asking for evidence of communication with appropriate bodies (DND, Nav Canada, Transport Canada, or other appropriate bodies.) Note that most such concerns can be addressed through design (e.g. keeping the turbines away from line of sight of transmission towers) or mitigated with technological fixes (e.g. devices amplifying radio signals, put in place by wind energy developers). The municipality should require a description of mitigation methods in the application.

5.2.7 Roads

If roads and local traffic is a concern, the municipality can require a traffic study to be included as part of the application process. Note that this can be part of a more comprehensive management plan for the site.

5.2.8 Separation Distances and Setbacks

Through Section 4 appropriate separation distances have been described to protect against health and safety and noise complaints. Best practices for noise regulation use a sliding decibel scale which allows for performance based regulation as opposed to an arbitrary setback distance. There are no additional reasons for introducing setbacks of any kind. In accord with the options described above, it appears that a minimum setback of 1.5 to 3 times the total turbine height for large scale turbines from receptors, roads and property lines is appropriate if noise concerns are dealt with separately (through a decibel noise limit approach). Setbacks for small and mini turbines are not as well researched; the suggested setbacks are 1.5 to 3 times total turbine height of small and mini scale turbines from property lines and roads.

Please note that municipalities can get quite sophisticated with setback requirements, defining various reference points (receptor, property lines, nearest road, structures on own site etc.) as described in Section 4.3.11. The most common and straight forward practice is to require setbacks from either property line or habitable dwellings on adjacent properties. This means that municipal by-laws attempt to protect the neighbours against a development, leaving the responsibilities for self-protection to the owners of the wind development (therefore, for example, not requiring a setback from structures on the same lot as the wind turbines). Another common practice is to waive setback requirements if adjacent properties are owned by the same owner or are of the same nature (i.e. used for wind energy generation).

5.2.9 Visual

As mentioned earlier in this chapter, municipalities can require a visual impact assessment as part of the application process. Ultimately, visual impacts are difficult to control, given that they are subjective. Some by-laws that can reduce the visual impacts of turbines include:

- All wind turbines should be a coloured in a solid light colour and include a non-reflective matte finish (unless otherwise required to conform with Transport Canada regulations for aviation safety).
- Signage should only be permitted on the nacelle unit and relate to the owner, operator or manufacturer of the wind turbine.
- No lighting should be placed on the exterior of the wind turbine unit above a height greater than 5 m, except as required by Transport Canada for aviation safety purposes. Any other lighting used shall be directional lighting towards the ground.
- Cables used for the transfer of power from the property to the main grid or buildings consuming the energy generated should be placed underground if feasible.

5.2.10 Birds and Bats

In order to minimize the impacts to habitat and species, prevention measures can include developing resource (species, forest and/or open space) management plans in conjunction with wind facility siting, in order to minimize turbine footprint/forest clearing, and encourage forest re-growth, and protect species habitat.

5.2.11 Repowering and Decommissioning

As discussed in Section 4.3.3, local governments can face challenges in requiring decommissioning activities due to a lack of ability to enforce, especially when development takes place 'as-of-right'. None the less, provisions for decommissioning should be included in policy and regulatory frameworks as much as possible to state that the responsibility and cost of taking down a wind turbine after its use lies with the owner/developer. Local governments may also want to consider that prior to decommissioning older wind turbine sites can be repowered by removing the older, often less efficient, models and replacing them with newer, more economic turbines. Repowering a wind farm can save long-term costs and build upon a reliable asset and local governments may also want to consider including policy options for repowering. According to CanWEA, industry is generally repowering older turbines and looks to keep sites in operation for 30 to 50 years.

Where a Rezoning, Integrated Development Zone or Development Agreement is used as a planning mechanism for permitting turbines, municipalities can require a decommissioning plan included in the application process. Guidance on decommissioning from the municipality may include the timeframe within which the structure(s) should be removed. One to two years after the structure has ceased to produce power is a reasonable timeframe for beginning the decommissioning process or at the very least giving notice of project shut-down to municipal council, which may then specify the time period within which structures will have to be removed. Provisions may also include the degree to which the site needs to be reclaimed by specifying that all structures, including ancillary structures need to be removed, and that the proponent is responsible for returning the land to its natural state. If plans for repowering a given site are included, local governments may want to consider including procedures for enabling the repowering of a given site.

6.0 CONCLUSIONS

The main objective of this project has been to review the literature available on wind energy and its regulation at the local government level, and to generate a model set of provisions that can be used by New Brunswick municipalities and rural areas. Given the range of options put forward in this report, it is clear that local governments will need to make several decisions about how they regulate wind energy and what specific by-laws they put in place. There are no internationally accepted standards for addressing some of the most controversial issues surrounding wind energy (including noise). Instead there are a broad range of possibilities, each with their own advantages and disadvantages. Elected officials will have to decide how restrictive they will want to be in their approach to regulation and in the specifics of their by-laws based on larger societal goals and objectives, and balancing of various risks (*e.g.,* health risks to nearby residents versus risks from climate change if a transition to alternative energy sources is delayed).

For the reasons mentioned above, it is not possible to put forward one model set of provisions that municipalities can take off the shelf and use right away without debate. However, Appendix C of this report includes examples of model zoning provisions, with the primary goal of providing municipalities with some appropriate legal language to use around the topic of wind energy development. The model zoning provisions have been written to suit the needs of those New Brunswick local governments who will modify and integrate ideas and text from this document into their own existing zoning by-laws or zoning provisions.

While the inclusion of provisions in planning documents is an important step for municipalities serious about addressing the questions around wind energy development, they are likely to be most effective in the context of broader efforts at the municipal, provincial, regional and national level. Some additional areas of special consideration are summarized below.

There is a need for the creation of community energy plans or other strategic planning exercises in communities to address larger issues around energy diversification and competing uses. Such a document might address questions such as how energy will be used, who will benefit from new energy projects, who will control the infrastructure, whether compensation or direct benefits will be allocated to effected populations etc. These questions should ultimately be answered through community dialogues as they directly impact the future of municipalities and citizens.

There is a need for further research into many aspects of wind energy generation. There are many uncertainties concerning the impacts of both large scale and small scale turbines. Particularly, there is a lack of independent technical studies in Atlantic Canada given its climatic context. Furthermore, there is very little information about the changes that can be expected in terms of performance of wind turbines given the exceedingly present impacts of climate change such as increased extreme weather events. Municipalities and municipal organizations are well-advised to raise these concerns with senior levels of government and encourage further research in this field, specifically in the local context.

Local governments are advised to engage in discussions over the issues discussed in this report with the appropriate provincial bodies. In addition to enacting specific regulations, the Province has the power to ensure that municipalities make a genuine effort to address wind energy in the course of their land use planning. Further the structure of governance in New Brunswick means that unincorporated areas of New Brunswick without Rural Plans do not have many regulatory controls in place to guide wind turbine development. The Department of Local government may want to review additional responses to wind turbine development that could be added to help regulate these areas, particularly if wind turbine development is prevalent.

As the New Brunswick government conducts a review of local governance, it is anticipated there will be increased opportunity and focus on models of regional cooperation in planning and service delivery. As part of this review of the local governance structure, the Commissioner will identify structures and mechanisms to bring about regional cooperation, examine how to better integrate land use planning (particularly in unincorporated areas bordering municipalities) and economic development. (Government of New Brunswick, 2008 b) The results of this study could have important implications for wind turbine development. In planning for wind energy and facilitating its uptake, a regional approach may be most appropriate. This would expand the marketplace for new technologies, promote uniformity of regulations, and share the costs of research, development and planning.

Consideration should be given to mechanisms for enhancing community and landowner benefits and proactive compensation regimes. Evidence suggests that some of the objections to wind development focused on specific potential effects are in essence employed as a means of stalling or preventing developments that cause local residents to accommodate disruptions, new activities and changes without sharing in potential benefits. These changes to communities associated with wind development impact a range of long held community values including aesthetic and quality of life factors. It is useful to recognize that these concerns can, at least in part, be mitigated with financial, participatory and consultative mechanisms.

As described earlier, the growth and promotion of wind energy development is in accord with provincial, national and international commitments regarding an overall shift to renewable energy sources. This is generally deemed imperative against the spectra of climate change concerns and the need to rapidly reduce GHG emissions by shifting from GHG intensive non-renewable energy sources while simultaneously reducing overall energy demand. Therefore the uncertainty regarding issues and impacts associated with wind energy development needs to be evaluated in balance and context with the known effects and impacts arising from current patterns of energy production and use.

7.0 CLOSURE

This report was undertaken exclusively for the purpose outlined herein and was limited to the scope and purpose specifically expressed in this report. This report cannot be used or applied under any circumstances to another location or situation or for any other purpose without further evaluation of the data and related limitations. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties. Jacques Whitford accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

Jacques Whitford makes no representation or warranty with respect to this report, other than the work was undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Any information or facts provided by others and referred to or used in the preparation of this report were assumed by Jacques Whitford to be accurate. Conclusions presented in this report should not be construed as legal advice.

This report represents the best professional judgment of Jacques Whitford personnel available at the time of its preparation. Jacques Whitford reserves the right to modify the contents of this report, in whole or in part, to reflect the any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

This report has been prepared by a team of Jacques Whitford professionals. If you have any questions or concerns about this report, please do not hesitate to contact the undersigned.

JACQUES WHITFORD LIMITED

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Project Manager	Project Director
(506) 457-3216	(506) 457- 3211

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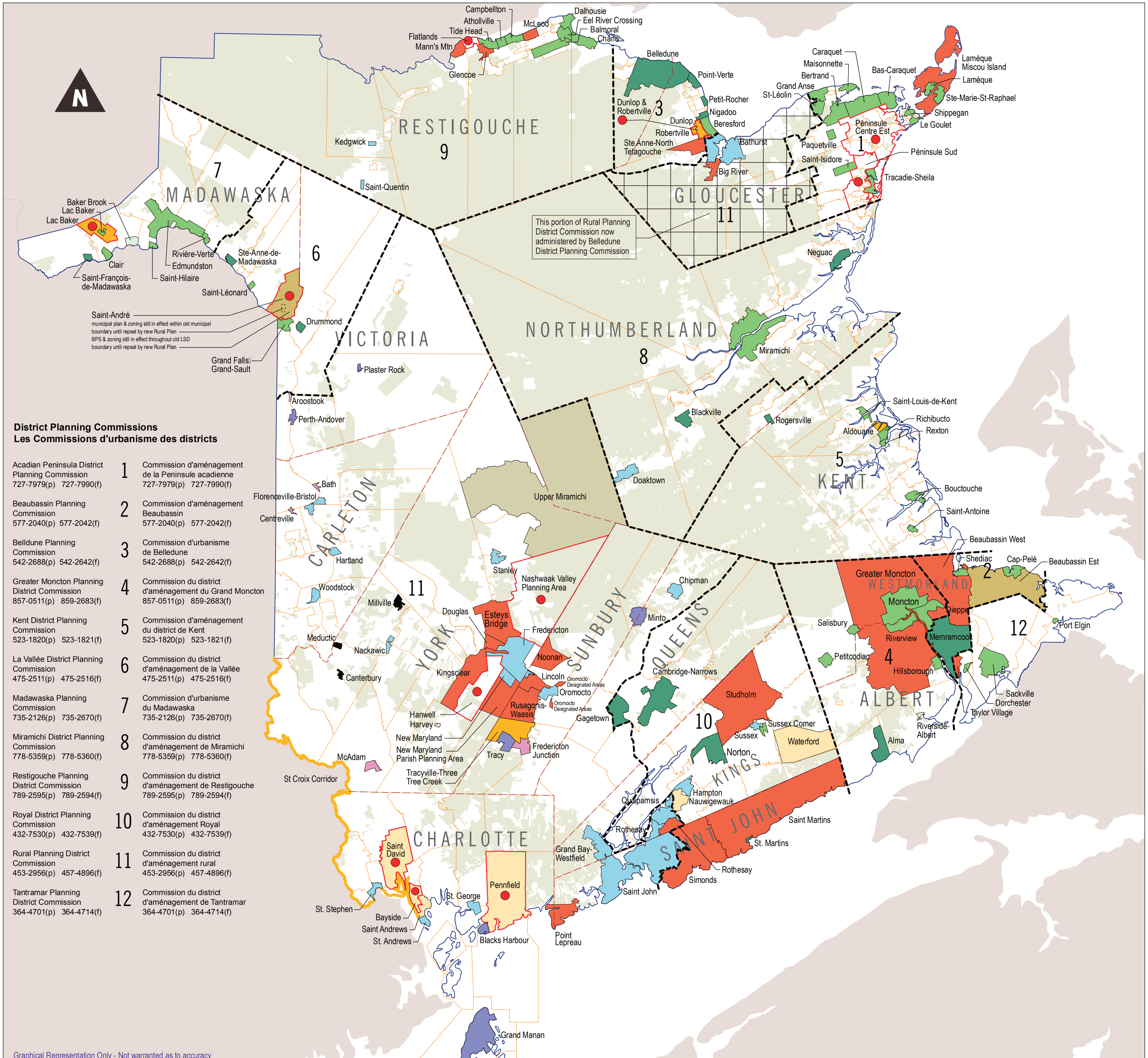
Community Power Fund - www.cpfund.ca/
Energy4All - www.energy4all.co.uk/
Fallsbrook Centre "Community-Based Wind Energy Development In New Brunswick" - www.fallsbrookcentre.ca/technology/community_wind.htm
National Wind - www.nationalwind.us/
Peace Energy - www.peaceenergy.ca/
Sou'Wester WindField - http://www.scotianwindfields.ca/community/souwester
Town of Salisbury - http://www.salisburynb.ca/By-Laws.htm
Windshare - www.windshare.ca
Wind-Works – www.wind-work.org

APPENDIX A

Land Use Planning Map



District Planning Commissions
Les Commissions d'urbanisme des districts

Acadian Peninsula District Planning Commission 727-7979(p) 727-7990(f)	1	Commission d'aménagement de la Peninsule acadienne 727-7979(p) 727-7990(f)
Beaubassin Planning Commission 577-2040(p) 577-2042(f)	2	Commission d'aménagement Beaubassin 577-2040(p) 577-2042(f)
Belldune Planning Commission 542-2688(p) 542-2642(f)	3	Commission d'urbanisme de Belledune 542-2688(p) 542-2642(f)
Greater Moncton Planning District Commission 857-0511(p) 859-2683(f)	4	Commission du district d'aménagement du Grand Moncton 857-0511(p) 859-2683(f)
Kent District Planning Commission 523-1820(p) 523-1821(f)	5	Commission d'aménagement du district de Kent 523-1820(p) 523-1821(f)
La Vallée District Planning Commission 475-2511(p) 475-2516(f)	6	Commission du district d'aménagement de la Vallée 475-2511(p) 475-2516(f)
Madawaska Planning Commission 735-2126(p) 735-2670(f)	7	Commission d'urbanisme du Madawaska 735-2126(p) 735-2670(f)
Miramichi District Planning Commission 778-5359(p) 778-5360(f)	8	Commission du district d'aménagement de Miramichi 778-5359(p) 778-5360(f)
Restigouche Planning District Commission 789-2595(p) 789-2594(f)	9	Commission du district d'aménagement de Restigouche 789-2595(p) 789-2594(f)
Royal District Planning Commission 432-7530(p) 432-7539(f)	10	Commission du district d'aménagement Royal 432-7530(p) 432-7539(f)
Rural Planning District Commission 453-2956(p) 457-4896(f)	11	Commission du district d'aménagement rural 453-2956(p) 457-4896(f)
Tantramar Planning District Commission 364-4701(p) 364-4714(f)	12	Commission du district d'aménagement de Tantramar 364-4701(p) 364-4714(f)

Municipality / Municipalité
(member of a District Planning Commission / membre d'une commission du distict d'aménagement)

- Rural Plan / Plan rural
- Municipal Plan & Zoning / Plan municipal et zonange
- Municipal Plan / Plan municipal
- BPS & Zoning / Déclaration des perspectives d'urbanisme et zonage

Municipality / Municipalité
(not a member of a District Planning Commission / non-membre d'une commission du distict d'aménagement)

- Rural Plan / Plan rural
- Municipal Plan & Zoning / Plan municipal et zonange
- BPS & Zoning / Déclaration des perspectives d'urbanisme et zonage
- Basic Planning Statement (BPS) / Déclaration des perspectives d'urbanisme
- No Plan / Sans plan

Rural Community / Communauté rurale

- Rural Plan / Plan rural
- No Plan / Sans plan

Local Service District / District de services locaux

- Rural Plan / Plan rural
- BPS & Zoning / Déclaration des perspectives d'urbanisme et zonage
- Basic Planning Statement (BPS) / Déclaration des perspectives d'urbanisme

- Rural Plan in progress / Plan rural en cours
- Provincial Crown Lands Terres de la Couronne (provincial)

Status of Community Plans
Etats des Plans en aménagement du territoire

May 2008 / mai 2008

Sustainable Planning Branch - Department of Environment
Planification durable - Ministère de l'Environnement

New Nouveau Brunswick

APPENDIX B

Summary of Current NB Wind Planning

Jacques Whitford

REVIEW OF NEW BRUNSWICK PLANNING DOCUMENTS FOR REFERENCES TO WIND ENERGY	
Search Parameters:	Source for Listing of Municipalities and Rural Communities: http://www.gnb.ca/0370/0376/0001/NB-Municipalities.pdf Source for Listing of Planning Commissions: http://mpdc-cdam.ca/links/Other_Commissions.htm Documentation Searched: Municipal Plans and Zoning Bylaws, as available on local government websites and planning commission websites. Search Terms: English Documents: wind and energy French Documents: éolienne et énergie
City of Bathurst	No Planning documentation available on website referenced
City of Campbellton	No Planning documentation available on website referenced
City of Dieppe	3.13 HEIGHT REGULATIONS 3.13.1 The height regulations of this By-law shall not apply to church spires, water tanks, elevator enclosures, silos, flagpoles, television or radio antennae, communication towers, ventilators, skylights, barns, chimneys, clock towers, windmills or solar collectors attached to the principal structure except where specifically regulated, provided that such buildings or structures conform to all restrictions of other Government authorities having jurisdiction. Page 39, Zoning Bylaw http://www.dieppe.ca/doc/download/FINAL%20ZONING%20BYLAW.pdf
City of Edmundston	CONSERVATION ZONE (Section 8) Constructible Zone: Any land, building or structure may only be used for the purposes of the permitted uses as specified in schedule A; P 52, Section 8: Conservation, Zoning Bylaw Constructible Zone (A1): Permitted Use: Wind turbines (under conditions) P13, Schedule A, Zoning Bylaw The Commission may, subject to such terms and conditions as it considers fit, authorize for a temporary period not exceeding one year, a development otherwise prohibited by this by-law; and require the termination or its removal at the end of the authorized period. Pg 12, Section 2: General Provisions, Zoning Bylaw P.35.F) It is proposed to continue our efforts toward expanding the territory serviced by the Edmundston Energy Department. Pg. 39, Edmundston Municipal Plan http://www.edmundston.ca/contenu_fr.asp?choixcontenu=4 La Municipalité d'Edmundston est l'une de trois villes au Nouveau-Brunswick qui opère son propre service électrique. http://www.edmundston.ca/contenu_fr.asp?choixcontenu=19
City of Fredericton	Wind Power

	(16) Council shall direct further study on the placement of power windmills to ensure appropriate land use regulations are in place to mitigate any potential negative impacts. Pg. 65, Section 2.11: Environment, Fredericton Municipal Plan http://www.fredericton.ca/en/citygovernment/resources/Section2.11Environment.pdf http://www.fredericton.ca/en/citygovernment/bylaws_zoning.asp
City of Miramichi	14.3.7 Energy Conservation Proposal: 1) It is a proposal of Council to encourage energy conservation through implementation of policies and proposals in other sections of this Plan which encourage more compact and efficient development as well as working with suppliers of electric power and natural gas. Pg 62, City of Miramichi, Section 14: Environment and Appearance, Municipal Development Plan HEIGHT REGULATIONS 3.1.17 Unless located in the Business Park – Airport Zone, the height regulations of this By-law shall not apply to church spires, water tanks, elevator enclosures, silos, flagpoles, television or radio antennae, ventilators, skylights, barns, chimneys, clock towers, windmills or solar collectors attached to the principle structures except where specifically regulated in this Bylaw or by other Federal, Provincial or Municipal legislation in effect. Pg 19, Zoning Bylaw, City of Miramichi http://www.miramichi.org/en/cityhall-bylaws-e.asp
City of Moncton	Municipal Development Plan: No reference to wind City of Moncton Zoning Municipal Development Plan Z-102: A number of references throughout the document to energy, energy consumption, alternatives to fossil fuels, energy conservation, energy efficiency. Pgs. 51, 61, 90, 92, 102, 103, 105, 123, 140 2.12.2 Structures excepted from height restrictions Outside of those areas described in Schedule “B”, the height regulations of this By-law shall not apply to church spires, water tanks, elevator enclosures, silos, flagpoles, television or radio antennae, communication towers, ventilators, skylights, barns, chimneys, clock towers, windmills or solar collectors attached to the principle structures except where specifically regulated, provided that such buildings or structures conform to all restrictions of other Government authorities having jurisdiction. Pg 24, City of Moncton Zoning By-law Z-202 No references to Energy in the City of Moncton Zoning Bylaw http://www.moncton.ca/Residents/By-Laws.htm
City of Saint John	No Planning documentation available on website referenced
Town of Beresford	No Planning documentation available on website referenced http://www.acadie-bathurst.com/
Town of Bouctouche	No Planning documentation available on website referenced http://www.bouctouche.ca/site/
Town of Caraquet	Plan D’Urbanisme Municipal , Ville de Caraquet : no references to eolienne/energie

<table>
<tr><td></td><td>
TABLEAU 1 : USAGES, BÂTIMENTS ET CONSTRUCTIONS ACCESSOIRES AUTORISÉS SPÉCIFIQUEMENT POUR TOUTES FORMES D'HABITATIONS
<table>
<tr><th>Usages, bâtiments et constructions accessoires autorisés</th><th>Cour et marge avant</th><th>Cour et marges latérales</th><th>Cour et marge arrière</th></tr>
<tr><td>27. Issue de secours requise par un règlement municipal pour un bâtiment existant</td><td>non</td><td>oui[8]</td><td>oui</td></tr>
<tr><td>28. Antenne de radio ou de télévision ou de télécommunication rattachée au bâtiment, sauf parabolique, éolienne et capteur solaire
a) Distance minimale d'une ligne de terrain (m)</td><td>non</td><td>oui[9]
2,00</td><td>oui[9]
2,00</td></tr>
</table>
[9] Permis dans les cours seulement et non dans les marges.
Pg. 49, Arrêté de Zonage: no. 211

http://www.ville.caraquet.nb.ca/bylaws.cfm
</td></tr>
<tr><td>Town of Dalhousie</td><td>No Planning documentation available on website referenced
www.dalhousienb.com</td></tr>
<tr><td>Town of Grand Bay-Westfield</td><td>No reference to wind or energy in Municipal Plan Bylaw
No reference to wind or energy in Zoning Bylaw

http://www.town.grandbay-westfield.nb.ca/townhall/by-laws/default.htm</td></tr>
<tr><td>Town of Grand Falls</td><td>No Planning documentation available on website referenced
http://www.grandfalls.com/</td></tr>
<tr><td>Town of Hartland</td><td>No Planning documentation available on website referenced
www.town.hartland.nb.ca</td></tr>
<tr><td>Town of Lameque</td><td>No Planning documentation available on website referenced
http://www.lameque.ca/</td></tr>
<tr><td>Town of Nackawic</td><td>No Planning documentation available on website referenced
www.nackawic.com</td></tr>
<tr><td>Town of Oromocto</td><td>ENERGY CONSERVATION
10.9 The Town should encourage conservation of fossil fuels, energy and raw materials in the operation and maintenance of the Town. Good land development practices can conserve energy and yield important financial savings.
Pg 32, Municipal Plan BY-LAW 410A

No references to wind in Municipal Plan

Zoning Bylaw not available online at the time of search (June 12, 2008)

http://www.oromocto.ca/generalOneCol/jpage/1/p/ByLaws/content.do</td></tr>
<tr><td>Town of Quispamsis</td><td>(4) Energy Conservation
(a) It is a proposal of Council to encourage energy conservation through implementation of policies and proposals in other sections of this Plan which encourage more compact and efficient development as well as working with suppliers of electric power and natural gas.
Pg 40, Section 14: Environmental Quality, Municipal Plan Bylaw 037)</td></tr>
</table>

	No reference to wind or energy in Zoning Bylaw (BY-LAW NO. 038 A BY-LAW OF THE MUNICIPALITY OF QUISPAMSIS RESPECTING ZONING) http://142.166.3.145/by-laws.cfm
Town of RIchibucto	No Planning documentation available on website referenced http://www.richibucto.org/
Town of Riverview	No Planning documentation available on website referenced www.town.riverview.nb.ca
Town of Rothesay	No reference to wind or energy in Rothesay Municipal Plan Bylaw No Reference to wind or energy in Rothesay Zoning By-law No. 02-02 http://www.rothesay.ca/rothesay-developmentserv-municipalplan.cfm
Town of Sackville	No Planning documentation available on website referenced http://www.sackville.com/town_hall/bylaws/
Town of Saint-Léonard	No Website Available
Town of Saint-Quentin	No Planning documentation available on website referenced www.saintquentin.nb.ca
Town of Shediac	No Planning documentation available on website referenced http://www.shediac.org/
Town of Shippagan	No Planning documentation available on website referenced www.ville.shippagan.com
Town of St Andrews	No Planning documentation available on website referenced www.townofstandrews.ca
Town of St George	No Planning documentation available on website referenced www.town.stgeorge.nb.ca
Town of St Stephen	No References to wind or energy in Municipal Plan No Zoning Bylaw available on website referenced www.town.ststephen.nb.ca
Town of Sussex	No References to wind or energy in Municipal Plan or Zoning Bylaw http://www.sussex.ca/town-document-listing.cfm?argCategory=By-Law
Town of Tracadie-Sheila	No Planning documentation available on website referenced http://www.tracadie-sheila.ca/
Town of Woodstock	Planning Documents Under Review at the time of search (June 12, 2008) No references to wind or energy in proposed Municipal Plan and Zoning Bylaw http://www.town.woodstock.nb.ca/
Village of Alma	No Website Available
Village of Aroostook	No Website Available
Village of Athoville	No Planning documentation available on website referenced www.atholville.net
Village of Baker-Brook	No Website available
Village of Balmoral	No references of eolienne or energie in Plan D'Urbanisme, Arrête No. 13 or Arrête de Zonage, Arrête No. 15 http://www.balmoralnb.com/am_arretes.asp?id=16
Village of Bas-Caraquet	Website not available at time of search. (June 12, 2008) http://www.bascaraquet.com/

Village of Bath	No Website Available
Village of Belledune	Goal and Objective: Energy efficiency Assessment of the wind energy potential in Belledune. Pg 17, Section 2.1 Goals and Objectives, Definition "SMALL WIND ENERGY SYSTEM OR SWES" means a wind energy conversion system consisting of a wind turbine, a tower, and associated control or conversion electronics, which has a rated capacity of not more than 10 kW and which is intended to primarily reduce on-site consumption of utility power. For the purpose of this by-law, the total height of a SWES shall mean the distance measured from the ground level to the blade extended at its highest point. Section 62: Small Wind Energy Systems (1) ZONES: Small Wind Energy Systems (SWES) may only be developed in an Industrial Zone (IND Zone) and in a Rural Zone (RU Zone). (2) ACCESSORY: Small Wind Energy System shall only be permitted as an accessory structure to a main use existing on the same property. (3) NUMBER: A maximum of one (1) SWES is permitted per property. (4) VISUAL APPEARANCE: SWES shall: (a) be painted a non-reflective, non-obtrusive color, (b) be artificially lighted to the extent required by Transport Canada and NAV Canada, and (c) not be used for displaying any advertising except for reasonable identification of the manufacturer of the installation. (5) LOT AREA: No SWES shall be developed on a lot having an area less than 6,000 square metres. (6) HEIGHT: The height of the overall structure shall not exceed (a) 12 metres in the case where the lot contains between 6,000 and 15,000 square metres, (b) 15 metres in the case where the lot contains between 15,001 and 25,000 square metres, and (c) 20 metres in the case where the lot exceeds 25,000 square metres. (7) SET-BACK: No SWES shall be developed less than: (a) 150 metres of a dwelling existing at the time of the development, unless such dwelling is occupied by the owner of the SWES, (b) Two times the total height of the structure from any side or rear lot line, (c) 30 metres from any public street, and (d) 30 metres from any public utility lines or structure, unless otherwise approved in writing by the utility company. (8) (MINIMUM GROUND CLEARANCE: The blade of any wind turbine shall, at its lowest point, have ground clearance of no less than 10 metres. (9) NOISE: Small Wind Energy System shall not exceed 45 dBA, as measured at any point situated along the property lines. (10) In the event the ambient noise level (exclusive of the development in question) exceeds the applicable standards set in Subsection (9), the applicable standard shall be adjusted so as to equal the ambient noise level. The ambient noise level shall be expressed in terms of the highest whole number sound pressure level in dBA, which is succeeded for more than five (5) minutes per hour. (11) SIGNAL INTERFERENCE: No SWES shall cause any interference with electromagnetic communications, such as radio, telephone or television signals. (12) ENGINEERING: The construction plans of the overall structure, including the tower, the base and the footings, shall be approved and stamped by a licensed professional engineer. (13) APPROVED WIND TURBINES: Wind turbine must have been approved by a national standard association such as CSA or NRC. The installation shall conform to the Provincial Electrical Code of New Brunswick.

	(14) WIRING: All wiring between the wind turbine and the receptor or substation shall be underground. (15) SAFETY: Wind turbine towers shall not be climbable up to 3 metres above ground level. All access doors to electrical equipment shall be lockable. p. 167, 168 Rural Plan, Provisions about secondary and accessory uses, buildings and structures, Section 62, Small Wind Energy Systems, Rural Plan Section 74: Industrial Type 1- IND-1 Zone 74.1 Permitted Uses (1) No development shall be undertaken or permitted, nor shall any land, building or structure be used within any IND-1 Zone for any purposes other than: (u) a wind turbine or a wind farm, 74.7 Accessory building or structure (1) No accessory building or structure may (a) exceed 30 metres in height, except for wind turbines and telecommunication towers, and Pg 194, 195, 196, 197, Zones, Section 74, Industrial Type 1 – IND-1 Zone, Rural Plan http://www.belledune.com/bylaws.php
Village of Bertrand	No Website Available
Village of Blacks Harbour	No references to wind or energy in Rural Plan By-law No. _03-9 http://www.villageofblacksharbour.com/bylaws.htm
Village of Blackville	No Planning documentation available on website referenced www.villageofblackville.com
Village of Bristol	No Planning documentation available on website at time referenced (June 12, 2008) http://www.villageofbristol.ca/html/bylaws.htm
Village of Cambridge-Narrows	No Planning documentation available on website referenced www.cambridge-narrows.ca http://www.royaldpc.com/PDF_Documents/Plans/CNarrows_RPlan.pdf
Village of Canterbury	No Website Available
Village of Cap-Pele	No Planning documentation available on website referenced http://www.cap-pele.com/
Village of Centre Ville	No Planning documentation available on website referenced http://www.villageofcentreville.ca/index.htm
Charlo	No Website Available
Chipman	No Website Available
Clair	No Website Available
Doaktown	No reference to wind or energy found in Rural Plan http://www.doaktown.com/Final_Aug_31_Doaktown_Plan.pdf
Dorechester	No Planning documentation available on website referenced http://www.dorchester.ca/village_hall/by_laws.php

Drummond	No Planning documentation available on website referenced http://www.sn2000.nb.ca/comp/drummond/index.html
Eel River Crossing	No Website Available
Florenceville	No Website Available
Fredericton Junction	No Website Available
Gagetown	No reference to wind or energy in Gagetown Rural Plan http://www.royaldpc.com/PDF_Documents/Plans/Gagetown_%20Consolidated_RPlan_April_2007.pdf
Grand Manan	"wind farm" means the use of lands, structures and/or buildings placed for the commercial generation of electrical power by means of wind energy. Page 20, Definitions, Rural Plan RR Zones - Rural Zones Permitted Uses 4(1) In a Rural Zone, any land, building or structure may be used for the purpose of, and for no other purpose: (xvi) a commercial use: (39) a wind farm. Pg. 39, Section 4 Zones, Rural Zones, Rural Plan
Grand Anse	No Planning documentation available on website referenced www.grande-anse.net
Harvey Station	No Website Available
Hillsborough	No Website Available
Kedgwick	No Website Available
Lac Baker	No Website Available
LeGoulet	No Planning documentation available on website referenced http://www.peninsuleacadienne.ca/
Maisonnette	No Website Available
McAdam	No Website Available
Meductic	No Website Available
Memramcook	No Website Available
Millville	No Website Available
Minto	No Planning documentation available on website referenced http://www.village.minto.nb.ca/index.html
Neguac	No Planning documentation available on website referenced http://www.neguac.com/services_en.html
New Maryland	There is no reference to wind or energy in the Municipal Plan of New Maryland. 6.13 Wind Turbines 1) The erection of a wind turbine shall only be permitted as an amendment to the zoning by-law and

	subject to such terms and conditions as may be imposed by Council. Pg. 12, Section 6, General Provisions, Zoning Bylaw http://www.vonm.ca/main/home.html
Nigadoo	No Website Available
Norton	No reference to wind or energy in Rural Plan http://www.royaldpc.com/PDF_Documents/Plans/VNorton_RPlan.pdf
Perth-Andover	No Planning documentation available on website referenced http://www.perth-andover.com/
Petitcodiac	No Website Available
Petit-Rocher	No Planning documentation available on website referenced www.acadie-bathurst.com
Plaster Rock	No reference to wind or energy in Rural Plan www.plasterrock.com
Pointe-Verte	No Website Available
Port Elgin	No Planning documentation available on website referenced www.villageofportelgin.com
Rexton	No reference to wind or energy in Municipal Plan and Zoning Bylaw http://www.villageofrexton.com/bylaws.html
Riverside-Albert	No Planning documentation available on website referenced http://www.riverside-albert.ca/
Rivière-Verte	No Website Available
Rogersville	No Planning documentation available on website referenced www.rogersville.info
Saint-André	No Planning documentation available on website referenced www.sn2000.nb.ca/comp/saint-andre
Saint Antoine	No Planning documentation available on website referenced http://www.village.stantoine.nb.ca/
Sainte-Anne-de-Madawaska	No Website Available
Sainte-Marie-Saint-Raphaël	No Planning documentation available on website referenced www.ste-marie-st-raphael.ca
Saint-François-de-Madawaska	No Website Available
Saint-Hilaire	No Website Available
Saint-Isidore	No Planning documentation available on website referenced www.saintisidore.ca
Saint-Léolin	No Website Available

Saint-Louis-de-Kent	No Website Available
Salisbury	No Website Available
St. Martins	No reference to wind or energy in Draft Rural Plan posted on website. http://stmartinscanada.ca/PDFs/ruralplandraft2006.pdf http://www.royaldpc.com/PDF_Documents/Plans/STMartins_RPlan.pdf
Stanley	No Website Available
Saint-Isidore	No Website Available
Sussex Corner	No Planning documentation available on website referenced http://www.sussexcorner.com/bylaws.htm
Tide Head	No Website Available
Tracy	No Website Available
Communauté rurale Beaubassin-est	No Website Available
Saint André	www.sn2000.nb.ca/comp/saint-andre
Simonds Parish	No reference to wind or energy in the Simonds Parish Rural Plan http://www.royaldpc.com/PDF_Documents/Plans/Simonds_RPlan.pdf
Studholm Parish	No reference to wind or energy in the Studholm Parish Rural Plan http://www.royaldpc.com/PDF_Documents/Plans/Studholm_RPlan_Amend1.pdf
Royal District Planning Commission	
Lower Kennebecasis	DRAFT Lower Kennebecasis Rural Plan (Draft as available June 12, 2008) http://www.royaldpc.com/PDF_Documents/News/LK_DraftforPublicComments.pdf The Lower Kennebecasis Planning Area consists of the Local Service Districts of Kingston, Rothesay, Hampton, Norton, and the Westfield East. “wind generator” means a generator specifically designed to convert the kinetic energy in wind into electrical energy (electricity) and connected to an electrical utility grid; Pg 43, Definitions, 5.5 Height Restrictions (1) The height restrictions of this Rural Plan shall not apply to a silo, chimney, church tower, drying elevator, mining elevator shaft, communication antennae, water storage facility, or wind generator. Pg 50, General Provisions 8.0 RESOURCE “RES” ZONE The Resource zone is created to reduce the loss and fragmentation of valuable resource lands, as well as the spread of development into areas with limited public services and infrastructure. The zone includes lands that are remote from built-up development, as well as undeveloped backlands abutting the periphery of existing development located along existing public roads. 8.1 Permitted Uses (1) Any land, building or structure in the RES zone may be used for the purpose of, and for no other purposes: (x) a wind generator Pg 63 , Section 8 Resource Zone, Rural Plan 10.0 GENERAL MIXED USE - “GMU” Zone The General Mixed Use zone is established to allow for a continuation of traditional mixed uses in areas of existing development. In large part, the predominant land use form in these areas is linear development fronting onto existing public roads. Wherever the General Mixed Use zone abuts the Resource zone, this plan allows for a limited transition area within the abutting portion of the Resource

	zone. In this transition area, permitted land uses include all of those listed in the GMU zone. Please refer to the Resource zone (Section 10.2) for provisions related to transition areas. 10.1 Permitted Uses (1) Any land, building or structure in the GMU zone may be used for the purposes of, and for no other purpose than: (xxi) a wind generator p. 76, Section 10: General Mixed Use Zone, Rural Plan
Upper Kennebecasis Rural Plan	DRAFT Upper Kennebecasis Rural Plan (Draft as available June 12, 2008) http://www.royaldpc.com/PDF_Documents/Plans/UKennebecasis_RPlan_DRAFT2007.pdf Local Service Districts of Cardwell, Havelock, Sussex, Studholm and Waterford Please Note: Lands within the Town of Sussex and the Village of Sussex Corner are not included in this planning exercise. 6.5 Height Restrictions (1) The height restrictions of this Rural Plan shall not apply to a silo, chimney, church tower, drying elevator, mining elevator shaft, communication antennae, water storage facility, barn, feed or bedding storage use, or wind generator. p. 31, General Provisions The Agriculture zone is created to reduce the loss and fragmentation of important agricultural lands, and to reduce land use conflicts that impede the viability of the agriculture industry. Generally, the Agricultural zone includes cleared farmland as well as uncultivated lands containing high quality agricultural soils. 9.1 Permitted Uses (1) Any land, building or structure in the “AG” zone may be used for the purpose of, and for no other purpose than: (b) The following main uses, subject to terms and conditions that may be set by the Planning Commission: (i) a wind generator p. 39., Section 9: Agricultural Zone, Rural Plan 10.0 RESOURCE “RES” ZONE The Resource zone is created to reduce the loss and fragmentation of valuable resource lands, as well as the spread of development into areas with limited public services and infrastructure. The zone includes lands that are remote from built-up development, as well as undeveloped backlands abutting the periphery of existing development located along existing public roads. (b) The following main uses, subject to terms and conditions that may be set by the Planning Commission: (ix) a wind generator Pg. 45, Section 10: Resource Zone, Rural Plan
Saint John Tributaries Rural Plan	DRAFT Rural Plan No Document Available as of June 12, 2008 http://www.royaldpc.com/News_Plans_SJT.htm Local Service Districts of Brunswick, Cambridge, Johnston, Kars, Waterborough and Wickham is being created.
Simonds Rural Plan	DRAFT Rural Plan No Document Available as of June 12, 2008 http://www.royaldpc.com/News_Plans_Simonds.htm

	Local Service District of Simonds
Sussex Corner Draft Rural Plan	DRAFT Rural Plan http://www.royaldpc.com/News_Plans_Scorner.htm Sussex Corner 6.10 Height Regulations (1) The height regulations of this Rural Plan shall not apply to church spires, water tanks, elevator enclosures, silos, flagpoles, television or radio antennas, ventilators, skylights, barns, chimneys, clock towers, windmills or solar collectors attached to the principle structures except where specifically regulated. P, 34, General Provisions, Sussex Corner Rural Plan http://www.royaldpc.com/PDF_Documents/Plans/NEW_SCorner_RPlan_Map.pdf
Greater Moncton District Planning Commission	
Salisbury	7.3 Wind Energy Conversion Systems Volatile energy prices, advanced technology and better market conditions mean that the development of large and small wind power systems in New Brunswick is inevitable. Therefore, Council may be approached with requests to locate wind turbines in the Village. Although Village Council supports this abundant, renewable and non-polluting energy resource, Council does recognize that the size, use and rated output capacity of these developments are very different. Therefore, in order accommodate wind energy technology, while ensuring land use compatibility, it is essential for Council to distinguish between the different types of wind energy conversions systems and determine where they can be located. Non-commercial wind energy systems allow homes and businesses to generate electricity on-site. This on-site generation is then used to offset the customer's own consumption. Non-commercial wind energy systems will be deemed to be an accessory use and will be permitted in all zones. However, the Zoning By-law shall include provisions that regulate the number, the size and location of non-commercial wind energy systems in order to ensure safety and avoid conflict with surrounding land uses. On the other hand, commercial wind energy systems produce electricity that is sent directly to the provincial electricity grid. These turbines, usually grouped with other turbines to form a wind farm, are much larger than non-commercial wind turbines. Considering that Salisbury has not been identified as a suitable location for a commercial wind energy system and given the necessary studies required to mitigate the impacts from a commercial system, a policy to permit the development of this land use is premature at this time. However, if future studies indicate that Salisbury does have the potential to accommodate a commercial wind energy system, the Municipal Development Plan can be revisited at that time. 7.3.1 Policy It shall be the intention of Council to provide new opportunities for energy generation systems within the Village. 7.3.2 Policy Council will provide means by which on-site non-commercial wind energy system can be permitted and to prevent conflicts with neighbouring uses, Council will provide standards within the zoning by-law that will serve to alleviate the potential nuisance and unsafe conditions that could result from random placement of small-scale wind turbines. 7.3.3 Proposal

	Council may undertake measures to respond to the NB power net-metering program for on-site power generation. P 24 Chapter 7 Utility, Municipal Plan COMMERCIAL WIND ENERGY SYSTEM means single wind turbine, or multiple wind turbines, intended solely to generate electrical power for sale to the power grid. Pg 7, Definitions, Zoning Bylaw MAXIMUM RATED OUTPUT CAPACITY means the maximum power produced by the wind turbine operating at optimal wind speed. Pg. 11, Definitions, Zoning Bylaw NON-COMMERCIAL WIND ENERGY SYSTEM means a wind turbine that is subordinate and incidental to the main use on the lot and that supplies electrical power solely for on-site use, except that when a parcel on which a non-commercial wind turbine is installed also receives electrical power supplied by a utility company, excess electrical power generated by the noncommercial wind turbine and not presently needed for on-site use may be used by the utility company in exchange for a reduction in the cost of electrical power supplied by that company to the parcel for on-site use, as long as no net revenue is produced by such excess electrical power. Pg. 11, Definitions, Zoning Bylaw PUBLIC UTILITY means any building, structure, plant, or equipment essential to the provision and operation of services to the general public including, but not limited to, the provision of electricity, water, sewerage disposal, communication services and infrastructure, pipelines, railway, roads and sidewalks, traffic management systems, vehicular and pedestrian bridges, gas distribution systems and energy generating wind structures Pg. 12, Definitions, Zoning Bylaw TOTAL HEIGHT OF WIND TURBINE means the total measurement from the base of the turbine to the tip of the rotor blade. Pg 15, Definitions, Zoning Bylaw WIND TURBINE TOWER means the guyed or freestanding structure that supports a wind turbine generator. Pg. 16, Definitions, Zoning Bylaw Non-commercial Wind Energy System (3) Notwithstanding Section 3.9(1)(2), non-commercial wind energy system shall be subject to the provisions of Section 5 of this By-law. Pg 19, Section 3.8, Accessory Buildings, Zoning Bylaw 3.11 Height Regulations The height regulations of this by-law shall not apply to church spires, lightening rods, water tanks, elevator enclosures, silos, flagpoles, television or radio antennas, ventilators, skylights, barns, chimneys, clock towers, monuments, windmills or solar collectors attached to the principle structures

	except where specifically regulated. Pg. 20, Height Regulations, Zoning Bylaw 4.0 Utility Uses With the exception of communication towers which shall be subject to terms and conditions, all other public and private utility uses such as water, wastewater, storm drainage, natural gas lines, treatment facilities, lift stations, pumping stations, power lines, telephone lines and cable lines shall be a development permitted in any zone. Pg. 56, zoning Bylaw 5.0 Wind Energy System Non-Commercial Wind Energy System (1) Non-commercial wind energy systems shall be permitted as an accessory use in all zones, subject to the following provisions: (a) Minimum lot area – 0.2 ha; (b) Maximum tower height – 150 feet (45m); (c) Only one non-commercial wind energy turbine shall be permitted per lot; (d) Shall be setback, at minimum, 1.5 times the total height of the wind turbine from the rear, front and side lot lines, dwellings, transmission lines, and public rightof- ways; (e) Any climbing apparatus shall be a minimum of 3 m above grade; (f) The rotor clearance shall be a minimum of 4.5m from grade; (g) Subject to the National Building Code, a non-commercial wind energy systems under 6m may be mounted on or attached to another structure; (h) Anchor points for guy wires shall be located on the property that the system is located on. The minimum setback for the guy wire anchors shall be 3 m from all property lines. (i) There shall be no signs, advertisements or objects attached to or added to the turbine. (j) In addition to the application for a development permit, the following information is required: i. Provide the manufactures information regarding the type of turbine, total height, rotor diameter, rated output, and Canadian Safety Certification. ii. Provide a site plan, drawn to scale, showing the location of the non-commercial wind energy system in relation to lot lines, dwelling and distance from adjacent dwellings. iii. Submit authorization documents from Transport Canada and Nav Canada. (2) The owner shall remove the non-commercial wind energy system from the lot following one year of inactivity. A new application shall be submitted and approved before a new turbine is installed or a wind turbine is restarted after the expiration of the one-year period. All supporting structures shall be removed within 60 days of the notification by the Village. Pg. 56, Zoning Bylaw http://www.gmpdc.ca/bylaws.php
Petitcodiac	Height Regulations 3.9 The height regulations of this By-law shall not apply to church spires, water tanks, elevator enclosures, silos, flagpoles, television, or radio antennae, ventilators, skylights, barns, chimneys, clock towers, windmills, monuments, lightning rods, or solar collectors attached to the principle structures except where specifically regulated. Pg. 25, Rural Plan http://www.gmpdc.ca/webcura/files/150.pdf
Village of Alma	No reference to wind or energy in Rural Plan http://www.gmpdc.ca/webcura/files/188.pdf

Riverside-Albert	3.9 HEIGHT REGULATIONS The height regulations of this By-law shall not apply to church spires, water tanks, elevator enclosures, silos, flagpoles, television or radio antennae, ventilators, skylights, barns, chimneys, clock towers, windmills, monuments, lightening rods or solar collectors attached to the principle structures except where specifically regulated. Pg. 24, Rural Plan http://www.gmpdc.ca/webcura/files/62.pdf
Village of Hillsborough	No references to wind or energy in the Village of Hillsborough Rural Plan http://www.gmpdc.ca/webcura/files/405.pdf
Greater Moncton Unincorporated Area	No references to wind or energy in the Greater Moncton Rural Plan http://www.gmpdc.ca/webcura/files/366.pdf
Beaubassin Planning Commission	
Plan rural de la communauté rurale Beabassin-est Beaubassin-east Rural Plan	R) Énergie Principe La communauté a pour principe d'encadrer et d'encourager l'implantation d'équipements qui permettent de créer de l'énergie de manière non polluante. La communauté a pour principe d'encadrer l'implantation d'éoliennes sur son territoire. Propositions Il est proposé que l'implantation d'éoliennes ou de tous les autres équipements pour de l'énergie non polluante respecte la qualité du milieu de vie des zones habitées et des paysages ruraux. Il est proposé que des normes et des dispositions d'implantation et d'intégration soient définies de manière à minimiser les impacts visuels négatifs sur le paysage bâti et naturel, les modifications des aires naturelles et les nuisances sonores et/ou olfactives. http://www.beaubassin.nb.ca/english/source/partners/beaubassin-east/rural_plan/annexe.html Éoliennes 10.23(1) Sous réserve des paragraphes (2), (3) et (4), les éoliennes sont permis sous réserve qu'elles rencontrent les modalités et les conditions que la commission peut établir en vertu de l'alinéa 34 (4) c) de la Loi sur l'urbanisme. 10.23(2) L'implantation de petites éoliennes devra respecter les dispositions d'implantation et d'intégration suivante : a) aucune petite éolienne ne peut être d'une grandeur supérieure à 12 mètres ; b) aucune petite éolienne ne peut être implantée dans la cour avant réglementaire ; c) aucune petite éolienne ne peut être implantée à moins d'une distance de 15 mètres de retrait d'une

limite étant le retrait minimum permis;

d) aucune petite éolienne ne peut être implanté à une distance égale à la hauteur de celle-ci par rapport au bâtiment principal ou secondaire avoisinant;

e) seulement une petite éolienne par lot sera permise;

f) la grandeur minimale du lot pour l'implantation d'une petite éolienne doit être d'au moins 4 000 mètres carrés;

g) aucune petite éolienne ne peut être implantée à l'intérieur d'une terre humide;

h) l'implantation d'une petite éolienne ne pourra interférer l'espace aérien relatif à la navigation aérienne ou contrevenir à toute loi ou juridiction fédérale ou provinciale;

i) l'implantation d'une petite éolienne ne pourra interférer avec les tours de télécommunications; et

j) les petites éoliennes devront être de couleur neutre afin de minimiser l'impact visuel.

10.23(3)
L'implantation de moyennes éoliennes devra respecter les dispositions d'implantation et d'intégration suivante :

a) aucune moyenne éolienne ne peut être d'une grandeur supérieure à 12 mètres ;

b) aucune moyenne éolienne ne peut être implantée dans la cour avant réglementaire ;

c) aucune moyenne éolienne ne peut être implantée à moins d'une distance de 50 mètres de retrait d'une limite étant le retrait minimum permis;

d) aucune moyenne éolienne ne peut être implantée à une distance égale à la hauteur de celle-ci par rapport au bâtiment principal ou secondaire avoisinant;

e) seulement une moyenne éolienne par lot sera permise;

f) la grandeur minimale du lot pour l'implantation d'une moyenne éolienne doit être d'au moins 4 000 mètres carrés;

g) aucune moyenne éolienne ne peut être implantée à l'intérieur d'une terre humide;

h) l'implantation d'une moyenne éolienne ne pourra interférer l'espace aérien relatif à la navigation aérienne ou contrevenir à toute loi ou juridiction fédérale ou provinciale;

i) l'implantation d'une moyenne éolienne ne pourra interférer avec les tours de télécommunications; et

j) les moyennes éoliennes devront être de couleur neutre afin de minimiser l'impact visuel.

10.23 (4)
Un accord devra être conclu en vertu de l'article 39 de la Loi sur l'urbanisme pour toute demande de parc éolien.

http://www.beaubassin.nb.ca/english/source/partners/beaubassin-east/rural_plan/partiec10.html

Beaubassin West Rural Plan	No references to wind or energy in Rural Plan http://www.beaubassin.nb.ca/english/source/partners/beaubassin-west/beaubassin-west.html
Cap-Pele Municipal Plan	No references to eolienne or energie in Plan d'aménagement municipal du village de Cap-Pelé http://www.beaubassin.nb.ca/english/source/partners/cap-pele/plan_municipal/plan_municipal_cap-pele.html
Plan d'aménage-ment rural du village de Memramcook	2.2(3) Dans toutes les zones créées par le présent arrêté, l'utilisation des terrains aux fins de la fourniture : a) d'énergie électrique; b) de gaz naturel ou de pétrole; c) de l'eau et du stockage de l'eau; d) du traitement et de l'élimination des matières usées; e) de la collecte des eaux, y compris les eaux pluviales; f) des rues; ou, g) de tout autre service public, y compris l'emplacement ou l'édification de toute construction ou installation aux fins de la fourniture de l'un des services susmentionnés, constitue une fin particulière que la Commission peut, sous réserve du paragraphe 34(4)(c) de la Loi, assujettir à des modalités et conditions, ou qu'elle peut interdire dans les cas ou on ne peut pas raisonnablement s'attendre à ce que ces modalités et conditions soient respectées. http://www.beaubassin.nb.ca/english/source/partners/memramcook/plan_rural/partiec2.html
Shediac Municipal Plan	No references to wind or energy in the Shediac Municipal Plan http://www.beaubassin.nb.ca/english/source/partners/shediac/municipal_plan/shediac_municipal_plan.html
Miramachi District Planning Commission	
Miramachi Municpal Plan and Zoning Bylaw	As Above
Village of Blackville Rural Plan	No references to wind or energy http://www.mpdc-cdam.ca/bylaws/Bylaw57.pdf
Village of Neguac Rural Plan	No references to wind or energy http://mpdc-cdam.ca/bylaws/Village_Neguac_Rural_Plan_bylaw99-33.pdf
Municipal and Rural Plan Bas Caraquet	No references to eolienne or energie in Municipal Plan and Zoning Bylaw http://capa.peninsuleacadienne.ca/cartes_et_plans/arrete_municipal_bascaraquet.pdf http://capa.peninsuleacadienne.ca/cartes_et_plans/arrete_zonage_bas.pdf
Caraquet	As above
Grand Anse	No References to eolienne or energie in Zoning Bylaw http://capa.peninsuleacadienne.ca/cartes_et_plans/arrete_zonage_grand-anse.pdf
Lameque	No References to eolienne or energie in the Municipal Plan http://capa.peninsuleacadienne.ca/cartes_et_plans/arrete_plan_municipal_lam_119.pdf Le groupe « naturel » comprend une classe d'usages regroupant diverses activités comportant une utilisation du sol nécessitant de grandes surfaces à des fins de conservation, de loisirs ou d'exploitation compatibles des ressources naturelles.

	10.1 ZONES N (ZONES NATURELLES) 10.1.2 Usages permis dans les zones N (naturelles) 10.1.2.1 Les terrains, bâtiments ou constructions à l'intérieur d'une zone N ne peuvent être affectés qu'aux fins (xix) une éolienne, en vertu de l'article 39 de la Loi sur l'urbanisme. Pg. 27, Section 10 http://capa.peninsuleacadienne.ca/cartes_et_plans/arrete_zonage_Lam_120.pdf
Paquetville	No reference to eolienne or energie http://capa.peninsuleacadienne.ca/cartes_et_plans/arrete_zonage_paquetville.pdf
Shippagan	No reference to eolienne or energie in the Municipal Plan http://capa.peninsuleacadienne.ca/cartes_et_plans/AZ__ship_2007.pdf CHAPITRE 9 : ZONES NATURELLES, RÉCRÉATIVES ET DE PROTECTION Ce groupe comprend deux (2) classes d'usages (naturels et récréatifs et de protection). La classe naturelle rassemble toutes les activités d'exploitation des ressources naturelles. La classe récréative et de protection regroupe les diverses activités comportant une utilisation du sol nécessitant de grandes surfaces à des fins de conservation et de loisirs. 9.1.2 Usages permis dans les zones N (naturelles) 9.1.2.1 Les terrains, bâtiments ou constructions à l'intérieur d'une zone N nepeuvent être affectés qu'aux fins : (viii) une éolienne en vertu de l'article 39 de la Loi sur l'urbanisme Pg. 33, Arrete de Zonage 9.2 ZONES RP (ZONES RÉCREATIVES ET DE PROTECTION) 9.2.2 Usages permis dans les zones RP (récréatives et de protection) 9.2.2.1 Les terrains, bâtiments ou constructions à l'intérieur d'une zone RP ne peuvent être affectés qu'aux fins : (xiv) une éolienne en vertu de l'article 39 de la Loi sur l'urbanisme; Pg. 36, Arrete de Zonage
village de Ste-Marie-St-Raphaël	No reference to eolienne or energie in the Municipal Plan or Zoning Bylaw
village de St-Isidore	No reference to eolienne or energie in the Zoning Bylaw
village de Saint-Léolin	Principe 5.4 Encourager le développement économique basé sur le développement durable et les énergies alternatives à l'intérieur du secteur naturel, de protection et récréatif tout en maintenant une excellente qualité de vie pour les villageois. Ce principe se traduit Proposition 5.4.1 en permettant l'implantation d'éoliennes commerciales, noncommercialesou domestiques avec certaines conditions émises par la Commission et par les ministères concernés. http://capa.peninsuleacadienne.ca/cartes_et_plans/PM_St-Léolin.pdf Unable to access Zoning Bylaw at time of search (June 12, 2008)
Ville De Tracadie-Sheila	No reference to eolienne or energie in the Municipal Plan or Zoning Bylaw

Tantramar Commission (website not working June 12, 2008)

APPENDIX C

Model Zoning Provisions

MODEL ZONING PROVISIONS FOR WIND ENERGY

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INTRODUCTION

This Model Zoning Provisions for Wind Energy is part of the document entitled 'Model Wind Turbine Provisions and Best Practices for New Brunswick Municipalities, Rural Communities and Unincorporated Areas'. The full document will be referred to as the 'Report', and the Model Provisions for Wind Energy will be referred to as this 'Model Provisions' in the explanatory notes contained in this document.

Zoning regulations can be structured in different ways and differ from community to community. These Model Provisions are written to follow in a typical Zoning By-law structure, but are not meant to provide municipalities with direction on the overall structure of their own Zoning By-law. The primary purpose of this document is to identify components of a Zoning By-law that can be used to regulate wind turbines. Provisions have been set out to illustrate the wide variety of options available under the New Brunswick Community Planning Act.

It is noted that some communities within New Brunswick land use is governed by a Rural Plan. Although communities using this planning tool do not typically have a stand-alone Zoning By-law, there can be zoning provisions contained within the Plan. Sections of the document which would NOT apply to a Rural Plan have been noted.

The Model Provisions provide examples and options to assist communities to develop provisions that suit the needs of the specific municipality or rural community. Each municipality or rural community will make its own decisions on which option(s) to choose. Explanatory comments are provided, where appropriate, immediately after each option. The comments also highlight areas where there may be ongoing questions surrounding interpretation or implementation of particular provisions, which may require further clarification or assessment in the New Brunswick context.

SECTION 1 DEFINITIONS

The following definitions were taken from a number of sources and provide a fairly broad range of examples. It may not be necessary to include all of the definitions. The Zoning By-law should only define terms that are used in the text of the Zoning By-law. Some examples of potential conflicts in existing by-laws relating to wind turbines are italicized below.

"array" means two or more wind turbines that are physically interconnected;

"blade" means the part of the wind turbine that rotates in the wind and extracts kinetic energy from the wind;

"blade clearance" means in reference to a horizontal axis rotor, the distance from grade to the bottom of the rotor's arc;

"decommission" means the final closing down of a development or project or the point at which it has reached the end of its operational life and the process by which the site is restored to an agreed use or condition;

“guy wire” means a cable or wire used to support a tower;

“habitable dwelling” means structures designed to accommodate people including residential, commercial, institutional, industrial and recreational buildings, but not including accessory structures such as sheds and storage areas;

“height” *means the vertical distance of a building or structure between the finished grade and highest point of the building exclusive of any accessory roof construction such as a chimney, steeple or antenna.*

The above is an example of a definition for height that can be found in an existing Zoning By-law. When integrating provisions for wind turbines, it is important to examine existing definitions for consistency. Typically, wind turbine height is defined by the height from grade to the highest vertical extension of a wind turbine at the top of the rotor’s arc. This would fall outside of this existing definition. When writing provisions, a new definition for wind turbine height would need to be included, or the existing height definitions would need to be adjusted accordingly. A definition for wind turbine height has been included in this list of definitions for reference.

“horizontal axis rotor” means a wind energy conversion system, typical of conventional or traditional wind turbines;

“kilowatt or (kW)” means a measure of power for electrical current;

“Large scale wind turbine or LWT” means a wind turbine which has a power generation capacity of greater than ______.

There is great variation in how turbines are classified according to nameplate capacity. Municipalities have chosen either no classification, two classifications (large and small) or several classifications (for example, large, medium, small and mini) based on different criteria. For further information on this topic please refer to Section 1.2 the Report. The Planning District Commission’s Wind Energy Working Committee (PDCWC) has suggested that a nameplate capacity of 100kW and over is an appropriate range for large turbines.

“mini wind turbine or MWT” means a wind turbine which has power generation capacity of no greater than _____.

As noted above, there are a variety of types of wind turbine classifications. A definition for mini wind turbines has been included, in addition to large and small turbines, as there is increasing awareness of alternatives to traditional power generation, and municipalities may need to field requests from community members for power generation. For further information on this topic please refer to Section 1.2 the Report. The PDCWC has suggested that a nameplate capacity of up to 10 kW is an appropriate range for mini turbines.

"nacelle" means the frame and housing at the top of the tower that encloses the gearbox and generator and protects them from the weather;

"nameplate capacity" means the manufacturer's maximum rated output of the electrical generator found in the nacelle of the wind turbine;

"receptor" means any form of housing, dwelling, institutional use, and any type of use not typically exposed to sound levels greater than ______ . For the purposes of this definition, a receptor also includes any yards within a radius of _______ m around any main building occupied for such uses.

Noise is a controversial issue and there are drawbacks to both the decibel limit approach and the separation distance approach. The literature review has shown 35 to 55 dBA 5 to 10 dBA above the current background noise levels regulation (whichever is greater) as being viable options. Research shows that the lower values are more conservative guidelines, but ones that will limit challenges resulting from noise emissions. For further explanation, refer to sections 3.2.7, 5.3.8 and 6.2.7 of the Report.

"rotor's arc" means the largest circumferential path traveled by the wind turbine's rotor blade.

"rotor clearance" means the distance between the bottom tip of the blade at its lowest possible extension and the ground;

"remediation" means the process to return a site to as close to its original natural state as possible;

"separation distance" means the distance measured from centre of the base of the wind turbine tower to any specified building, structure, road or natural feature.

"wind turbine setback" means the distance measured from the base of the wind turbine tower to property lines;

"shadow flicker" means a condition that occurs when the sun is low on the horizon and the blades pass between the sun and an observer creating a flickering;

"small scale wind turbine or SWT" means a wind turbine which has a power generation capacity of not less than _____ and no greater than ____;

Please refer to comments on large scale wind turbines and mini wind turbines above. For further information on this topic please refer to Section 1.2 the Report. The PDCWC has suggested that a nameplate capacity of 10kW to 100kW is an appropriate range for turbines falling into this category.

"utilities" *means the components of a water, sewage, storm water, cable television, electrical, power, natural gas or telecommunications system.*

The above is an example of a definition for utilities that can be found in a typical existing Zoning By-law. Wind turbines can be considered a component of the electrical and/or power system. Therefore, it is important to consider how utilities are enabled in a Zoning By-law. Municipalities and rural communities may wish to explicitly preclude wind turbines from being considered as a component of a utility, or they may wish to include wind turbines within the definition. Further comments on this can be found in the Model Provisions under Section 3.2.

"vertical axis rotor" means a wind energy conversion system where the rotor is mounted on an axis perpendicular to the earth's surface;

"watercourse" means a lake, river, stream, ocean or other body of water;

"wetland" means land commonly referred to as a marsh, swamp, fen or bog that either periodically or permanently has a water table at, near or above the land's surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation and biological activities adapted to wet conditions; as defined in the New Brunswick Clean Water Act, "wetland" means land that (a)either periodically or permanently, has a water table at, near or above the land's surface or that is saturated with water, and

(b)sustains aquatic processes as indicated by the presence of hydric soils, hydrophytic vegetation and biological activities adapted to wet conditions.

"wind energy conversion system" means equipment, machinery and structures utilized in connection with the conversion of wind to electricity. This includes, but is not limited to, all transmission, storage, collection and supply equipment, substations, transformers, site access, service roads and machinery associated with the use. A wind energy conversion system may consist of one or more wind turbines;

"wind farm" means an array of large scale wind turbines;

There is great variation in how wind farms are classified both according to the number of turbines on a site and to the overall power generation capacity of the turbines. Usually the term wind farm refers to an array of large scale commercial wind turbines, however, a municipality may choose to include an array of SWT in the definition of "wind farm". The wind turbines on a wind farm would usually be connected to the transmission or a local distribution grid. For further information on this topic please refer to Section 1.2 of the Report.

"wind monitoring or meteorological tower" means a tower used for supporting an anemometre, wind vane and other equipment to assess the wind resource at a predetermined height above the ground;

"wind turbine" means a structure that produces power by capturing the kinetic energy in surface winds created by the sun and converting it into energy in the form of electricity and includes the wind turbine tower, rotor blades and nacelle;

“wind turbine height” means the height from grade to the highest vertical extension of a wind turbine at the top of the rotor’s arc;

“wind turbine tower” means a freestanding structure or a structure attached to guy wires that serves to support other parts of the wind turbine.

SECTION 2 GENERAL PROVISIONS

This section typically encompasses provisions that apply to overall land use within the municipality's jurisdiction. Some municipalities and rural communities may choose to regulate wind turbines within this section, and examples of possible provisions are included. Further, examples of standard clauses that may be found in a municipality's existing By-law that could potentially provide conflict have been highlighted and are italicized.

2.1 Development Permits

Some New Brunswick Zoning By-laws contain Development Permit provisions. Zoning By-laws which include these provisions generally outline administrative requirements for Development Permits. For example, most state that a Development Permit must be obtained prior to undertaking development, and that it must conform to all provisions in the By-law. Some Zoning By-laws go further, indicating the length of time that a permit is valid for, uses that do not require development permits, or the fee structure associated with a development permit. It is also important to note that some municipalities and rural communities may require the development permit as part of the building permit. Municipalities and rural communities can use Development Permit provisions to regulate wind turbine development. Further explanation is offered below.

2.1.1 Administration

a) No person shall undertake a development nor shall a development permit be issued unless the proposed development conforms to all provisions of this By-law.

b) Any development permit shall be valid for a period of one (1) year from the date of issue or, in the case of a permitted development that has begun, until the development is completed or is discontinued for a period of 6 (six) months and any permit may be reissued upon request, subject to review by the Development Officer.

c) Where any development permit is issued, such permit may include permission of any single development, or of more than one development, or of any or all elements related to any development, provided that such are specified by the permit and provided also that no development permit shall pertain to more than one (1) lot.

d) Notwithstanding 3.1.1, no development permit shall be required for the following:

  i. any wind turbine permitted according to Section ____ of this By-law.

If desired, municipalities and rural communities could include provisions to exclude a wind turbine or certain types of turbines subject to other sections in the By-law. For example, the above clause allows for a provision that a development permit is not required for a mini wind turbine, but that other provisions of the by-law must be met before development proceeds. The PDCWC has recommended that Development Permits be required for Wind Turbine development applications.

2.1.2 Application for Development Permit

Development Permits for wind turbines could be managed in two ways. Wind turbine developers could be expected to meet the general development permit requirements (these provisions would apply generally to all applications for development within a given municipality) or specific development permit requirements could be created for wind turbines. These provisions are not mutually exclusive, and could be used in conjunction with one another depending on how the By-law is structured.

a) Every application for a development permit shall be accompanied by a sketch or plan, in duplicate, drawn to an appropriate scale and showing:

i. the shape and dimensions of the lot to be used;
ii. the size, shape, bulk, location and use of existing and proposed buildings, equipment, structures, access roads, right of ways, and utilities;
iii. the distance from the lot boundaries and size of every building or structure proposed to be constructed, already constructed, or partly constructed, on the lot;
iv. the distance from every building or structure proposed to be constructed on the lot to every habitable dwelling on abutting lots;
v. the proposed location and dimension of any parking space, loading space, driveway, and landscaped area;
vi. the location of fences, signs, buffers and retaining walls;
vii. the location of any natural features, watercourse(s) and wetland areas and the location of any existing or proposed building or structure in relation to the natural features, watercourse or wetland;
viii. any other information the Development Officer (or Building Inspector) deems necessary to determine whether or not the proposed development conforms to the requirements of this By-law or codes.

2.1.3 Application for Wind Turbine Development Permit

a) In addition to the requirements outlined in Section 3.1.2, applications for a development permit for a wind turbine or wind farm shall be accompanied by:

i. Project definition including the manufacturer's nameplate capacity for each installed turbine, targeted long term production levels, scale elevations or photos of turbines showing total height, tower height, rotor diameter, rotor clearance, and colour;

ii. Site plans showing proposed site alterations, the proposed grade and surface drainage pattern, and estimate of the flow of surface water or stormwater drained outside the property;

iii. Turbine manufacturer's specifications and professional engineer's design and approval of turbine base;

iv. Evidence of an agreement enabling the connection of the turbine(s) to the provincial electricity grid;

v. Analysis of visual impact including the cumulative impact of other wind turbines and impact of overhead transmission lines, mitigation measures for shadow or reflection of light onto adjacent sensitive land uses;

> Deciding whether something is visually intrusive is more difficult to quantify than most other impacts where quantitative measurements can be compared to specific guidelines or requirements. Municipalities and rural communities may only want to include this requirement for large turbines or wind farms, or they may consider it necessary to review the impact for each application. Analysis of visual impacts is an emerging area. For this reason municipalities and rural communities will benefit from reviewing information on how the wind turbine(s) and associated structures might impact local residents. For further explanation, refer to sections 3.2.10, 3.2.15, 5.3.5, 5.3.13, 6.2.4, 6.2.11 of the Report.

vi. Analysis of noise impact including a map indicating all lands and sensitive receptors impacted by the ______dBA emission level (or ______dBA above background, whichever is greater) emission level (or other noise level specified in by-laws) and estimated noise levels at property lines and receptors;

> Noise is a controversial issue and there are drawbacks to both the decibel limit approach and the separation distance approach. The literature review has shown ranges from 35 to 55 dBA or 5 to 10 dBA above the current background noise levels regulation as being viable options. Research shows that the lower values are conservative guidelines, but ones that will limit challenges resulting from noise emissions. For further explanation, refer to section 3.2.7, 5.3.8 and 6.2.7 of the Report.

vii. Analysis of impact of the wind turbine(s) on bird nesting sites, bird migration areas and bat migration areas.

> The impacts of wind turbines on bird and bat mortality can be significantly reduced if projects are planned carefully and mitigation strategies are implemented. An initial site evaluation and an assessment of local knowledge can provide the basis to predict the effects a wind energy

development might have on resident and migratory bird and bat species in the area. For more information refer to section 5.3.14 and 6.2.10 of the Report.

viii. Impacts to the local road system including required approaches from public roads;

ix. Copies of documentation required (obstruction clearance form) from Transport Canada for turbines taller than 30 metres and Nav Canada for turbines within 10 km of an airport or taller than 30.5 metres outside the 10 km range;

For further explanation of requirements of Transport Canada and Nav Canada concerning aviation safety refer to sections 3.2.1, 4.6 and 5.1 of the Report.

x. Copies of all documentation required for Canadian Environmental Assessment Act and New Brunswick Environmental Impact Assessment Regulations if applicable;

This refers to federal and provincial requirements for environmental impact assessments (EIA). An EIA may be required by the federal government if a federal body, money, land or regulatory authority is required. An EIA by the provincial government will be required if the wind turbine(s) produces 3 megawatts or more of energy.

xi. Evidence of notification to DND, Nav Canada, Natural Resources Canada regarding potential radio, telecommunications, radar and seismoacoustic interference if applicable;

For further explanation of the issues related to potential interference of wind turbines with these systems refer to sections 3.2.12, 5.1, 5.3.9 and 6.2.8 in the Report.

xii. Emergency response plans for site safety; and

xiii. Decommissioning and reclamation plan.

Items 3.1.3 a. xi and xii help to ensure the municipality that the applicant has considered emergency response such as a fuel leak, blade throw or turbine collapse as well as the expected life of the turbine(s) and how it will be decommissioned. It is important to recognize that the municipality does not have the authority to require a decommissioning plan to be carried out. If the project is subject to a provincial EIA (i.e. 3 MW or greater) a decommissioning plan is likely to be part of the approval issued by the provincial government. The provincial government, in this context, does have the authority to enforce compliance with the decommissioning plan as it is laid out in the provincial approval.

The list of information requirements in section 3.1 of the Model Provisions reflect a broad range of items that should be considered when placing a wind turbine. This is an extensive list of requirements, and municipalities and rural communities may not feel it is necessary to include all items. Municipalities and rural communities may also want to consider requesting a range of items, depending on what type of turbine is being applied for, be it mini, small or large. Further examples of possible requirements according to wind turbine type are provided below in Section 3.6 of the Model Provisions.

In New Brunswick, applications for wind turbine developments over 3 MW require registration for an environmental impact assessment (Note: there are other possible triggers as well). In preparing an EIA Registration, wind developers are also expected to provide information with respect to: Siting considerations; Physical components and dimensions of the project; Descriptions of the existing environment (habitat, wind statistics); Summary of potential environment effects (anticipated bird and bat mortality, anticipated noise, expected visual influence, potential ground water influences, potential for impacts on human health and public safety); and Summary of proposed mitigation and follow-up monitoring. For further information see Section 5.1 of the Report.

Municipalities and rural communities may not have the resources at hand to properly evaluate visual, noise pressure or shadow flicker impacts/studies. Those municipalities and rural communities will need to work to develop resources, identify resources for hire, or coordinate with other levels of government in order to overcome these gaps. Municipalities and rural communities may choose to rely on provincial/federal approval processes for larger projects and the analysis required for the more complex impacts associated with large scale wind turbine developments.

2. 2 Frontage on a Street

No development permit shall be issued except where the lot or parcel of land intended to be used, or upon which the building or structure it to be erected, abuts and fronts on a public street or road except where specifically provided for within this By-law.

This is a clause taken from an existing Zoning By-law. Wind turbines or farms are often developed in remote areas of a municipality. In these areas the lot fabric is rural in nature and existing lots do not always abut a public street. While it is important that wind turbine/farms have road access agreements in place, the requirement for direct frontage can be limiting, particularly in rural areas given the existing lot fabric. Municipalities and rural communities may want to revisit these types of clauses to ensure that greater flexibility is enabled for wind turbine development. It is noted that under the NB Provincial Subdivision regulations, and the CPA, Planning Advisory Committees and Planning Commissions have the ability to vary this requirement.

2.3 Height Standards

The height restrictions of this By-law shall not apply to a silo, chimney, church tower, drying elevator, mining elevator shaft, communication antennae, water storage facility, or ***wind turbine****.*

This is a standard height clause that can be found in the General Provisions of many municipal Zoning By-laws. If a municipality is developing specific height restrictions for wind turbines, clauses directly referencing wind turbines or windmills need to be revisited. Examples of possible approaches are included below:

- The height standards of this Plan shall not apply to a silo, chimney, church tower, drying elevator, mining elevator shaft, communication antennae, water storage facility, or wind turbine **except where specifically regulated in this By-law.**

- The height standards of this Plan shall not apply to a silo, chimney, church tower, drying elevator, mining elevator shaft, communication antennae, water storage facility~~, or wind turbine~~.

2.4 Multiple Uses

In any zone, where any land or building is used for more than one use, all provisions of the by-law relating to each use shall be satisfied, except as otherwise provided.

This is an example taken from an existing NB Zoning By-law. If a municipality is considering regulating wind turbines, they may also wish to give consideration to how they enable multiple land uses at the site. For example, in 3.4 above, the municipality has made provision for multiple uses. However, some municipalities and rural communities restrict multiple uses, or limit them to accessory uses. Depending on whether a wind turbine is classified as a use (accessory use, zone enabled use), municipalities and rural communities may wish to give consideration to multiple use clauses to ensure they are enabling, if that is their intention.

2.5 Utility Uses

Public and private utilities installations such as water, wastewater, storm drainage, natural gas lines, treatment facilities, lift stations, pumping stations, power lines, telephone lines and cable lines are permitted in any zone provided:

i. that such use is necessary or essential; and

ii. that such installations are made compatible with the surrounding properties to the satisfaction of the Development Officer.

This is an example taken from an existing NB Zoning By-Law. As discussed in Section 2 of the Model Provisions, wind turbines may fall under the definition of a utility. In many by-laws utilities are enabled in a wide-variety of zones. Some municipalities and rural communities may wish to consider wind turbines as a utility in order to create a wide-reaching policy. However, if a municipality is creating restrictions around wind turbine development, provisions for utilities should be visited to ensure there is no conflict. A municipality may wish to exclude wind turbines from the definition in this case.

2.6 Wind Turbines

Municipalities and rural communities may wish to enable wind turbines generally, subject to specific requirements depending on the type of wind turbine. This approach allows municipalities and rural communities to regulate wind turbines, while not working the specific requirements into each specific set of zoning requirements. If a municipality wants to enable wind turbines as a permitted use, the PDCWC has suggested that this may be one of the most straightforward amendments.

2.6.1 Application for Mini/Small Wind Turbine Development Permit

The following is a list of proposed requirement for the location and installation of MWT and SWT. For the purposes of this section, it can be assumed that small and mini can be used interchangeably. While the list of requirements is the same, it may be appropriate that different numerical values be applied, depending on the type of turbine. For example, municipalities and rural communities may want to require a greater separation distance for SWT turbines over MWT. Municipalities and rural communities may want to further differentiate between MWT and SWT within their regulations by including separate requirements for each type of turbine

a) Every application for a development permit for a small wind turbine shall be accompanied by the following documents:

   i. Turbine manufacturer's specification including plans and photos of turbines showing wind turbine height, blade diameter, rotor clearance, and colour, and the manufacturer's nameplate rated output capacity;
   ii. Evidence of an agreement enabling the connection of the turbine(s) to the provincial electricity grid;
   iii. Canadian Standards Association (CSA) approval and proof of conformity with the Provincial Electrical Code of New Brunswick;
   iv. Professional engineer's design and approval of the wind turbine base and tower; and
   v. Copies of documentation requiredforTransport Canada and NAV Canada.

2.6.2 Mini/Small Scale Wind Turbine Requirements

a) A small wind turbine shall only be permitted in the following zone(s) _________.

Where a Zoning By-law exists with multiple zones the municipality will have to consider which zones are appropriate for wind turbines. Some zones may be appropriate for MWT or SWT but not for LWT or wind farms.

b) The total height of a small wind turbine shall not exceed_____ metres.

Total turbine height varies according to wind turbine models and to changing technology. Height restrictions can be related to visual impacts and safety. Further municipalities may not wish to restrict height if using a separation distance or setback formula that is based on numeric value times the height of the turbine. For further information refer to Section 5.3.6 and 6.2.5 of the Report. Each municipality or rural community must determine which zones will permit mini wind turbine.

A municipality may also chose to include a requirement to maintain a separation distance between the wind turbine and the nearest habitable dwelling. This provision should not be necessary where separation distances are provided to address noise, as in item 3.6.2 g) below. For further explanation on this topic refer to sections 5.3.8 and 5.3.11 of the Report.

Other considerations for mini and small turbines that may be addressed in a by-law include whether or not to allow these turbines to be mounted on or attached to other structures, whether or not to limit the number of turbines on a single lot, and whether to include setbacks from specific zones.

c) The rotor clearance of any small wind turbine shall not be less than____ metres;

The rotor clearance is a safety issue and recommendations for clearance start at 8 m. For further information refer to section 5.3.4 of the Report.

d) A small wind turbine shall be setback no less than _____ times the total height from the property line:

Setbacks and separation distances for mini turbines based on safety issues have not been clearly documented. If noise regulations are met, the major considerations of this separation are related to physical safety: blade throw, ice throw, structural failure, etc. Municipalities and rural communities need to check the manufacturer's recommendations for safety practices related to siting and installation of the specific wind turbine model. For further information refer to sections 5.3.4, 5.3.11, 6,2,3 and 6.2.10 of the Report.

Please note that setbacks from property lines can be a limiting clause, particularly when there a multiple properties that form part of the same wind turbine array. For a potential resolution to this, please refer to section 3.6.2 n) of the Model Wind Provisions.

e) A small wind turbine shall be setback no less than _____ times the total height from:

Refer to explanation 3.6.2 b) and d) in the Model Provisions and Section 5.3.11 of the Report. Setbacks from public roads can be a limiting clause, particularly in rural areas. There are different classifications of roads, and some have minimal public use. If a municipality creates setbacks from all roads, without delineating different classes of road, it could inhibit wind turbine development. Care should be taken with definitions for these road setbacks if they are applied.

i. any existing public highway, road, or street;

ii. any future public street that is reserved on a subdivision plan approved under the Community Planning Act, or any proposed highway, or road;

iii. any proposed highway or road on a rural plan or a municipal plan enacted under the Community Planning Act;

iv. any public trail (cycling, walking, ATV, snowmobile, cross-country skiing, etc);

f) A small wind turbine shall be setback no less than ____ from any watercourse, water body, or wetland.

This provision is in addition to any requirements of the Watercourse and Wetland Alteration Regulation under the Clean Water Act. A 30 m separation distance from a watercourse or wetland is generally recommended to protect the aquatic ecosystem from damage and contamination.

g) The mean value of sound pressure level from a wind turbine shall not exceed ____ dBA or____ dBA above the background noise levels (whichever is greater) at the nearest receptor.

Noise is a controversial issue and there are drawbacks to both the decibel limit approach and the separation distance approach. The literature review has shown 35 to 55 dBA or 5 to 10 dBA above the current background noise levels regulations are viable options depending on the setting. Research shows that the low values are conservative guidelines, but ones that will limit challenges resulting from noise emissions. For further explanation, refer to section 3.2.7, 5.3.8 and 6.2.7 of the Report.

h) Any climbing apparatus associated with the wind turbine shall be a minimum of ______metres above grade.

This provision relates to safety and a suggested value is 3.5 m. For further information refer to section 5.3.4 in the Report.

i) Any guy wires associated with a wind turbine must be clearly visible to a height of ____ metres above the guy wire anchor lines.

A greater number of guy wires create an increased hazard for bird, bat, small plane, or human collisions. Essential guy wires need to be clearly visible to a recommended height of 2 m to help reduce the risk. For further explanation, refer to section 5.3.4 of the Report.

j) All structures associated with the wind turbine, including guy wire anchors shall be setback no less than 3 m from the property line.

k) All outdoor storage associated with a wind turbine facility shall be screened from view from adjacent properties and roads or highways.

This provision relates to reducing visual impacts. For further information refer to section 5.3.13 of the Report.

l) Small wind turbines shall be painted or finished in a non-reflective and non-obtrusive colour; be artificially lighted to the extent required by Transport Canada an NAV Canada, and

This provision relates to ensuring aviation safety and reducing visual impacts. For further information refer to sections 5.3.4 and 5.3.13 of the Report.

m) The owner of a small wind turbine that has been inactive for more than ____consecutive months shall remove the wind turbine within ____days from the date of notification.

Each municipality and community is responsible for setting its own timeframe for decommissioning. A possible timeframe is if a Mini Wind or a Small Wind Turbine has been inactive for more than twelve consecutive months is shall be removed within 60 days from the date of notification.

n) The setback requirements from a property line shall be waived where the adjoining property will be used for wind turbine development and the turbines on both properties will be connected to the same array.

> This provision is intended to ensure that wind turbine development on adjoining properties is not hindered by property line setbacks. A municipality may wish to consider obtaining some form of assurance from the property owners to ensure that the wind turbine development occurs.

2.6.3 Application for Large Scale Wind Turbine Development Permit

a) Every application for a development permit for a large-scale wind turbine shall be accompanied by the following documents:

   i. A site map shall be prepared for each property intended for the development of a large-scale wind turbine at a scale not less than _____. In addition, a site plan shall be prepared for the entire region covered by the wind farm at a scale not less than _____. The site plan shall indicate the location of each individual wind turbine plus all associated secondary and accessory buildings, structures, and infrastructure;

   ii. Turbine manufacturer's specification including plans and photos of turbines showing wind turbine height, blade diameter and colour, manufacturer's nameplate rated output capacity, Canadian Standards Association (CSA) approval and proof of conformity with the Provincial Electrical Code of New Brunswick;

   iii. Evidence of an agreement enabling the connection of the turbine(s) to the provincial electricity grid;

   iv. Professional engineer's design and approval of the wind turbine base and tower;

   v. In the case of a wind farm, a visual impact study approved by a professional engineer, architect, or planner showing the visual impacts of each individual wind turbine and the cumulative visual impacts of the entire wind farm on receptors, attractions and establishments, etc. This impact study shall contain detailed computer and photographic simulations, drawings and map with all proposed wind turbines, substations, transmissions lines, and accessory buildings and structures;

   > See section 3.1.3 a) iv) of the Model Provisions.

   vi. A shadow flicker impact study approved by a professional engineer, architect, or planner including diagrams, maps, and computer simulations showing the shadow flicker projection for a calendar year and the mitigation measures proposed, in relation to affected properties, receptors, roads, and sensitive areas;

Shadow flicker is the visual impact that results when the sun passes behind the blades of a wind turbine and casts a shadow which then flickers as the blades rotate. Shadow flicker is dependent on the weather conditions (sun is shining or not), geographical position, topography, the time of day and the time of year. This is an emerging concern so regulation is developing. There are several options suggested to both mitigate the impacts of shadow flicker and to reduce the exposure of residents to its impact. For further explanation, refer to sections 5.3.5 and 6.2.4 of the Report.

vii. A pre-construction background noise survey approved by a professional noise consultant with measurements representative measurements at nearby receptors within __ kilometres of the proposed development. The background noise levels shall be conducted in accordance with internationally recognized standards and include seasonal and daytime variations;

See Section 3.6.2 g) of the Model Provisions. The NBENV requires a noise assessment under EIA where residents are within 1 km.

viii. A noise impact study approved by a professional noise consultant that includes:

i. a description and maps of the noise produced by each wind turbine, including the range of noise levels expected and the tonal and frequency characteristics expected;

ii. a description and map showing the potential noise impacts, including estimates of all expected noise levels at receptors within __ km of the turbines during construction and operation of the wind turbines;

iii. a description of the projects proposed noise control features, including specific measures proposed to mitigate noise impacts from sensitive receptors to a level of insignificance.

See Section 3.6.2 g) of the Model Provisions. The NBENV requires a noise assessment under EIA where residents are within 1 km.

ix. Copies of documentation required for Transport Canada and NAV Canada;

x. Certificates of Determination, Approval to construct and/or Approval to operate issued by the Minister of Environment, as required;

xi. Emergency Protection Plan (EPP) submitted to the province and the municipality or planning commission, as required; and

xii. A document showing a timeline set prior to the construction phase of the project with a starting and ending date when the construction project will be completed.

2.6.4 Large Scale Wind Turbine Requirements

a) A large-scale wind turbine (LWT) shall only be permitted in the following zone(s)

Where a Zoning By-Law exists with multiple zones the municipality will have to consider which zones are appropriate for wind turbines. Some zones may be appropriate for MWT or SWT but not for LWT or wind farms.

b) An LWT shall only be permitted where there is evidence of an agreement enabling the connection of the turbine(s) to the provincial electricity grid;

c) The total height of a large-scale wind turbine shall not exceed_____ metres.

Total turbine height varies according to wind turbine models and to changing technology. Considerations for height restrictions relate to visual impacts, safety and how the height affects separations distances if using a formula that is based on numeric value times the height of the turbine. Many municipalities and rural communities do not restrict height for large scale turbines. If safety separation guidelines are met through other provisions, then visual impact may be a factor in restricting height. A typical large scale wind turbine currently in use in Canada would be between 100 and 120 metres. For further information refer to sections 2.1, 5.3.6, 6.2.5 of the Report.

d) The rotor clearance of any large wind turbine shall not be less than____ metres;

See Section 3.6.2 c) of the Model Provisions.

e) A large wind turbine shall be setback no less than _____ times the total height from the property line:

Setbacks from property lines may not be required, depending on what other setback or separation distance requirements a municipality has chosen to implement. It is important to recognize that this setback is not intended to address noise and visual effects on habitable dwellings, and instead is implemented to address safety issues such as ice and blade throw. A recommendation for a large turbine setback is 2 to 3 times the total turbine height. Due to lot sizes this may restrict the development of large wind turbines so municipalities will need to balance the rights to protect future land uses of adjoining properties with facilitating development of wind energy in their municipality based on local context.

Where a larger setback is selected, a provision to allow the setback to be waived where adjoining property owners are in agreement may be necessary, see 3.6.4 r) below.

For further information refer to sections 5.3.4, 5.3.11, 6.2.3 and 6.2.10 of the Report.

f) The minimum separation distance for a large wind turbine from a habitable dwelling located on the same property is ______times the total turbine height.

This provision is intended to protect the dwelling and its occupants from damage or injury due to blade throw, ice throw, tower collapse, etc. Not all municipalities require separation distances for dwellings on the same site but leave it for the property owner to address. A separation distance of 1.5 total turbine height is a suggested guideline. For further information refer to sections 5.3.4, 5.3.11, 6.2.3 and 6.2.10 of the Report.

g) A large wind turbine shall be setback no less than _____ times the total height from:

See Section 3.6.2 e) of the Model Provisions.

i. any existing public highway, road, or street;

ii. any future public street that is reserved on a subdivision plan approved under the Community Planning Act, or any proposed highway, or road;

iii. street that is proposed on a rural plan or a municipal plan enacted under the Community Planning Act;

iv. any public trail (cycling, walking, ATV, snowmobile, cross-country skiing, etc);

h) A large wind turbine shall be setback no less than ____ from any watercourse, water body, or wetland.

See Section 3.6.2 f) of the Model Provisions.

i) The mean value of sound pressure level from a wind turbine shall not exceed ____ dBA or____ dBA above the background noise levels(whichever is greater) at the nearest receptor.

See Section 3.6.2 g) of the Model Provisions.

j) No accessory buildings or structures associated with a wind turbine project shall be less than _____ metres from any property lines

k) Any climbing apparatus associated with the wind turbine shall be a minimum of ______metres above grade.

See Section 3.6.2 h) of the Model Provisions.

l) A wind turbine tower shall not contain any commercial advertising. The hub or nacelle may display only the manufacturer's name or logo. Site signs shall be limited to those which identify the wind power facility, locate access points and provide safety information.

This provision relates to reducing visual impacts. For further information refer to section 5.3.13 in the Report.

m) All wiring and power lines between each individual wind turbine and the substation or grid shall be underground.

This provision relates to reducing visual impacts and reduces the potential for bird/bat mortality. For further information refer to section 5.3.14, 5.4.1 and 6.2.10 in the Report.

n) All outdoor storage associated with a wind turbine facility shall be screened from view from adjacent properties and roads or highways.

The provisions in this section and the following two sections, relate to reducing visual impacts. For further information refer to section 5.3.13 in the Report.

o) The design of the accessory buildings and structures shall, to the extent reasonably possible, use material, colours, textures, screening, and landscaping that will blend with the wind farm to the natural setting and the existing environment.

p) Large scale wind turbines shall;

i. be painted or finished in a non-reflective and non-obtrusive colour; and

ii. be artificially lighted to the extent required by Transport Canada an NAV Canada.

q) The owner of a large wind turbine that has been inactive for more than ____consecutive months shall remove the wind turbine within ____days from the date of notification.

r) The setback requirements from a property line shall be waived where the adjoining property will be used for wind turbine development and the turbines on both properties will be connected to the same array.

> This provision is intended to ensure that wind turbine development on adjoining properties is not hindered by property line setbacks. A municipality may wish to consider obtaining some form of assurance from the property owners to ensure that the wind turbine development occurs.

> The list of information requirements in section 3.6.1-3.6.4 of the Model Provisions reflects a broad range of items that should be considered when placing a wind turbine. This is an extensive list of requirements. Municipalities may not feel it is necessary to include all items or there may be additional items that they feel are important in their context.
>
> In New Brunswick, applications for wind turbine or wind farm developments over 3 MW require registration for an environmental impact assessment (Note: there are other possible triggers as well). In preparing an EIA Registration wind developers are also expected to provide information with respect to: Siting considerations; Physical components and dimensions of the project; Descriptions of the existing environment (habitat, wind statistics); Summary of potential environment effects (anticipated bird and bat mortality, anticipated noise, expected visual influence, potential ground water influences, potential for impacts on human health and public safety); and Summary of proposed mitigation and follow-up monitoring. For further information see Section 5.1 of the Report.
>
> Municipalities may not have the resources at hand to properly evaluate visual, noise pressure or shadow flicker impacts/studies. These municipalities may wish:
>
> - to develop these resources internally;
> - to identify such resources for hire; or
> - to coordinate with other levels of government
>
> to overcome these gaps. Municipalities (particularly those with limited resources) may choose to rely on provincial/federal approval processes for larger projects and the analysis required for the more complex impacts associated with large scale wind turbine developments. To that end, this process might be appropriate for a wind turbine or array of turbines that produce greater than 200

kW but less than 3000 kW (3 MW) of energy, recognizing that the EIA process for projects that exceed 3 MW capacity.

SECTION 3: ZONING PROVISIONS

3.1 Permitted Use

a) No development shall be permitted nor shall any land, building or structure be used on a lot within the _____ zone for any purpose other than one or more of the following main uses:

   i. A wind turbine.

A municipality may choose to enable wind turbines in particular zones. Each municipality will have to consider which zones are appropriate for wind turbines. Some zones may be appropriate for MWT or SWT but not for LWT or wind farms. A list of possible requirements for wind turbines can be found in section 3.6.2 and 3.6.4 of the Model Wind Provisions.

3.2 Conditional Use

a) Notwithstanding 4. 1. a), the use of any land, building or structure for one or more of the following main uses shall be a particular purpose which the Planning Advisory Committee/Commission may impose terms and conditions, and may prohibit the use where compliance with the terms and conditions imposed cannot reasonably be expected:

   i. A wind turbine.

Under the Community Planning Act, each municipality has the ability to enable uses that are subject to Terms and Conditions as required by the Planning Commission or Planning Advisory Committee. Each municipality will have to consider which zones are appropriate for wind turbines. Some zones may be appropriate for MWT and SWT as a permitted use, but LWT or wind farms subject to terms and conditions. It is important to note that some municipalities identify Conditional Uses as a regulatory requirement under General Provisions, while others may identify under specific zones. For further discussion on Conditional Uses, see section 6.0 of the Report.

3.2 Re-Zoning

a) Standards or requirements for all wind turbine development in the _____Zone shall be established pursuant to an agreement approved by Council under Section 39 of the *Community Planning Act*.

Some municipalities may wish to enable wind turbines in a particular zone or zones, but require that they be guided by an agreement subject to Council approval under Section 39 of the *Community Planning Act*. A rezoning may be further enhanced by adding a Development Agreement under Section 101 if endorsed by the developer. Further discussion on this option can be found in section 6.0 of the Report.

In the above regulation, '_____Zone' could be replaced by 'any Zone', and used under General Provisions.

It is important to note that Section 101 of the Community Planning Act does not apply to Rural Communities.

A wind energy project that produces 3 MW or more of energy will trigger the provincial Environmental Impact Assessment Regulations. If this is the case, extensive information will be collected and assessed during the EIA process. A local government will be able to participate in this process as a stakeholder to minimize any duplication of effort. Therefore, the process described in 4.2 might be appropriate for a wind turbine or array of turbines that produce greater than 200 kW but less than 3000 kW (3 MW) of energy.

3.3 Integrated Development Zone

4.3.1 Integrated Development Zone Permitted Uses

a) No development shall be undertaken nor shall any land, building or structure be used on any lot within any ID (Integrated Development) Zone except where Council has approved the development of a specific proposal pursuant to Section 38 of the *Community Planning Act*.

4.3.2 Integrated Development Zone Requirements

a) Standards or requirements for development in any ID (Integrated Development) Zone shall be established pursuant to an agreement approved by Council pursuant to Section 39 and/or 101 of the *Community Planning Act*.

Some municipalities may wish to enable wind turbines as an Integrated Development Zone, and further require that they are subject to Section 39 of the *Community Planning Act*. Further discussion on this option can be found in section 6.0 of the Report.