

DRAFT
GUIDEBOOK
for the
MAINE MODEL WIND ENERGY FACILITY
ORDINANCE



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Acknowledgements

The Model Ordinance reflects the review of numerous ordinances and reports related to small and large wind energy facilities from a variety of jurisdictions. The Model Ordinance and guidebook were drafted by Fred Snow, Community Planner at Kennebec Valley Council of Governments under contract with the Maine State Planning Office (SPO). Drafts of the ordinance and guidebook were reviewed and edited by Phil Carey and Todd Burrowes from SPO. Appreciation extends to James Cassida, Permitting Coordinator at MAINE DEP, for contributing guidebook sections about MAINE DEP regulations concerning sound and scenic resources. Special thanks extend to the following for their thoughtful review and comments on the Model Ordinance: Jeff Austin, Maine Municipal Association; Juliet Browne, Verrill, Dana, LLP; Jane Campbell, Richard Fortier, Jane Gallagher, and Tim Vrabel, Maine Public Utilities Commission; James Cassida, Maine Department of Environmental Protection; Judith Dorsey, private citizen; Representative Stacey Fitts; Trudy Forsythe, National Renewable Energy Laboratory; Meredith Grieg, All Seasons Home Improvement Company; Mary Anne Hayes, Maine Rural Partners; Liz Hertz and Kathleen Leyden, SPO; Jody Jones, Maine Audubon; Sue Jones, Community Energy Partners; Jeremy Payne, Independent Energy Producers of Maine; Marcia Spencer-Famous, Maine Land Use Regulation Commission; and Steve Timpano and Steve Walker, Maine Department of Inland Fisheries and Wildlife.

Introduction

Wind energy provides multiple environmental and economic benefits. According to the American Wind Energy Association, development of just 10 percent of the windiest states (Maine is ranked eleventh nationally and is ranked first in New England.) would provide more than enough energy to displace emissions from the nation's coal-fired power plants and eliminate its major source of acid rain. In fact, running a single 1 megawatt wind turbine can displace 200 tons of carbon dioxide (CO₂) in one year, which is equivalent to the annual CO₂ benefit gained by planting one square mile of forest. Also, unlike oil or natural gas, the availability of wind energy is not affected by international conflicts or embargoes. Large wind projects create construction jobs, permanent jobs (each large wind turbine requires 3 maintenance technicians), and many valuable spin-off benefits to businesses such as hotels, restaurants, and material suppliers. They contribute significantly to local municipal revenues while placing little or no burden on local schools or public infrastructure.

Concerns about rising energy costs, climate change and energy security have generated a lot of interest in wind energy facilities of all sizes; from the small "consumer-scale", to the medium-sized "community-scale" to the largest "grid-scale". Small wind facilities are typically installed by homeowners or small businesses in order to lower electric bills. Community-scale wind energy facilities are often located on the site of a school, factory or institution and to produce electricity for use on-site. Grid-scale facilities are the largest class and they are designed to supply electricity to the regional electric power grid.

While wind power has obvious benefits, wind energy development, like any other type of development, has potential for adverse and sometimes controversial effects. For instance, community members' opinions about the aesthetics of wind turbines may differ. Since, to be effective, wind turbines need to be tall enough to take advantage of the most productive and consistent winds, they will often stand well above surrounding trees and buildings. This can make them a very noticeable and, thus, much debated feature in parts of the community.

As noted above, every type of development has the potential to result in negative impacts, yet some Maine municipalities currently lack ordinances to adequately manage those impacts. Other municipalities have ordinances that address typical commercial and residential development quite well but still leave local reviewers ill-prepared to make decisions on how best to accommodate the development of wind energy. For instance, many ordinances have maximum height restrictions for structures (typically 35 feet). Such height restrictions were typically not meant to regulate the height of wind turbines, but their unintended consequence is to effectively prohibit all but the smallest of them. An ordinance written to regulate more traditional forms of development will also lack standards for potential effects unique to wind energy facilities, such as shadow flicker.

About the Model Ordinance

There is **no state mandate** for a municipality to adopt any ordinance to regulate wind energy development. For a municipality that chooses to adopt such an ordinance, there is **no state mandate** to adopt the Model Wind Facilities Ordinance, either in whole or in part. The Model Wind Energy Facilities Ordinance is provided solely as a resource for any municipality that is considering adopting an ordinance to regulate wind energy development.

Recognizing the challenges municipalities face in regulating wind energy facilities, and hoping to foster consistency between state and local approaches to their regulation, the Governor's Task Force on Wind Power Development recommended that the State Planning Office (SPO) develop a model ordinance, for **voluntary** use by Maine municipalities, which is designed to:

- Expedite well-sited wind energy development to advance state climate change and renewable energy policies and provide related business opportunities
- Facilitate coordination of and consistency between state and local review through use of common terms, standards, and findings, where appropriate
- Recognize and provide specific approaches to address issues of local concern

This Maine Model Wind Energy Facility Ordinance is SPO's response to that recommendation as well as to the numerous requests from towns to SPO and regional planning organizations for a model that can be used to regulate wind energy facilities of all sizes.

The Model Ordinance prescribes application requirements and sets review standards to address various concerns such as environmental impacts, visual impacts, noise and safety. Some requirements and standards apply to all types of wind energy facilities while others apply only to one type or another. This is because the complex technical standards and requirements for professionally-prepared data that are appropriate for the larger facilities (Type 2 and Type 3), are not feasible or appropriate for the small facilities (Type 1).

The Model Ordinance addresses the most complex issues relating to large wind energy facilities by using the same requirements that are used by Maine DEP in its review of wind energy developments. Adapting Maine DEP's regulations for local use promotes consistency and creates a useful overlap between state and local reviews. The use of common terms and standards can allow local officials to benefit from the prior experience of state reviewers in interpreting and applying shared language. It also creates the local option for Maine DEP's analyses and findings to be used by the local reviewing authority in its review and decision.

The Model Ordinance may be used as a stand-alone ordinance provided there is an existing municipal appeals process or, if not, that appeals section is added. The Model Ordinance may be integrated with an existing local development review ordinance provided that duplicative provisions are removed and any contradictions are rectified. In any case, municipalities are advised that the Model Ordinance is only a model. Important factual and legal circumstances may vary significantly among municipalities. Any municipality considering the use or adoption

of the Model Ordinance, either in whole or in part, is strongly encouraged to consult with and seek the advice of a qualified attorney.

About the Guidebook

This guidebook to the Maine Model Wind Energy Facilities Ordinance has been developed to help local officials, applicants and citizens better understand its provisions and standards.

Each entry in the guidebook relates to a particular part of the Model Ordinance. The specific part to which an entry relates is indicated by a heading number which corresponds to the numbered sections and subsections of the Model Ordinance. The guidebook entries for some Model Ordinance sections (e.g. 8.0 Classification of Wind Turbines) may include one or more headlined paragraphs for which no specific subsection number is applicable. Not every section of the Model Ordinance has been found to warrant an entry, so there are gaps in the numerical sequence.

Guidebook entries can contain terms that are specifically defined in the Model Ordinance. An effort has been made to capitalize these terms when used in a context where their defined meaning may be crucial or illuminating. The definition of these and other terms are found in Section 4.0 of the Model Ordinance. In addition, the terms “Model Ordinance” and “Model”, when capitalized, refer exclusively and specifically to Maine Model Wind Energy Facility Ordinance.

Throughout the guidebook, contact information and web links are provided where applicable in order to allow readers to obtain additional information.

Wind Energy Planning and Zoning Considerations

The Model Ordinance deals exclusively with development review and does not directly address planning and zoning issues. This may be of no concern in communities that have no zoning except for shoreland zoning. On the other hand, communities with comprehensive plans and town-wide zoning ordinances should consider amending those documents if they wish to shape the geographic pattern of wind energy development within the town.

Obtaining information about the wind resources in your community is a key step in planning for wind energy development. Wind suitable for energy development typically has a reliable speed in the 15 to 30 mph range. (Most wind turbines are designed to generate at maximum capacity in 20 to 25 mph winds and will not operate outside an 8 to 50 mph wind speed range.) The US Department of Energy’s National Renewable Energy Laboratory (NREL) offers wind maps, data and analysis tools that can help local planners understand the nature and location of wind resources in their town. These can be found on the NREL website: <http://www.nrel.gov/wind/>.

Although the Model Ordinance is not a zoning ordinance, it can offer clues about whether and how a town may wish to address wind energy development in its comprehensive plan and

zoning ordinance. For instance, local planners should note that, while the Model Ordinance has no minimum lot size requirement, its safety setback standard (equal to 1.5 times the Turbine Height) effectively requires that each Wind Turbine be surrounded by a minimum area of land commensurate with its Turbine Height. For example, the area surrounding a facility with a Turbine Height of 80 feet will need to be about one acre, while a Turbine Height of 170 will result in a setback area of over 5 acres. Therefore, when identifying areas suitable for Type 2 and Type 3 Wind Energy Facilities, which are typically tall, local planners can narrow their search to parts of town where sufficiently-large parcels of land can be found. By the same token, knowing that the setback standards will effectively limit Turbine Heights on small lots, they may conclude that “Type 1 Wind Energy Facilities” is a land use that can appropriately be permitted in all zones including more densely-settled areas.

Noise standards can have similar planning and zoning implications. Most sound from Wind Turbines comes from rotor blades and mechanical parts. All things being equal (e.g. design, build quality, etc.), the size (and noise-generating potential) of rotor blades and mechanical parts increases along with the generating capacity of the turbine. Since the strictest sound limits apply near homes, it follows that the generating capacity (i.e. noise potential) allowed in an area should go down as the number and proximity of homes (i.e. residential density) goes up. (This is just a rough “rule of thumb” to help guide zoning decisions. Noise from a given proposed facility will best be controlled through the establishments of sound level limits, as is done in the Model Ordinance.)

Many comprehensive plans and zoning ordinances may need little or no change in order to accommodate wind energy development. Under many zoning ordinances, a Wind Energy Facility that generates power primarily for, and on the site of, a residence, farm, business, institution, factory or other permitted primary land use, would simply be allowed as an accessory use. Typically, such facilities could be accommodated with no change to the comprehensive plan or zoning ordinance. Similarly, if a comprehensive plan anticipates a use such as “natural resource industries” in a rural area, that may be sufficient to support the large-scale development of wind energy in that part of town. Notwithstanding this kind of general support, it may still be advisable to amend the comprehensive plan to make that support more specific. It may also be necessary or advisable to add the specific use (e.g. Wind Energy Facility, Type 3) to the list of uses permitted in that zone.

Communities wishing to explore their wind energy development planning and zoning options should consult their regional planning organization and their town attorney or the Maine Municipal Association (<http://www.memun.org>). Publications, technical assistance documents and other information about comprehensive planning and land use regulation in Maine can be found at the SPO website: <http://www.maine.gov/spo/landuse/index.htm>.

Guidance on Model Ordinance Provisions

8.0 Classification of Wind Energy Facilities

Classification Criteria

Since potential development impacts tend to increase with the scale of the development, the model's review process and standards vary according to the scale of the proposed facility. The model classifies each proposed facility as one of three types (1, 2 or 3) based on two criteria: the facility's aggregate generating capacity and whether or not the facility requires a state Site Location of Development permit. Proposed facilities in the smallest class, Type 1, are further divided into two categories (1A and 1B) based on two criteria: turbine height and the total number of turbines. The smallest facilities (Type 1A) are subject to the simplest review while the largest (Type 3) are subject to the most comprehensive review.

Aggregate Generating Capacity

Wind turbines, like nearly all power plants, have a rated power generating capacity measured in watts, usually in units of a thousand (kilowatt/kW) or a million (megawatt/MW). Typically the capacity of wind turbines for residential use range from 2 to 10 kW while a farm-scale turbine might have capacity of 20 kW. Turbines serving a school or other institution, a small business or a group of homes often range from 50 to 100kW. At the upper end of the spectrum, each turbine in a large "grid-scale" wind development may have a capacity of 1.5 MW (1500kW) or more. Typically, the manufacturer of the wind generator will provide its rated generating capacity among the unit's specifications. Some very small units may be assembled by the applicant from components bought separately. In these cases, the applicant should provide a written estimate of the generating capacity along with supporting documentation. In all cases, this criterion applies to the combined generating capacity of all turbines that make up the facility. [In cases where a turbine does not generate electricity but converts wind energy into another form (e.g., compressed air) the kilowatt-equivalent generating capacity of the turbine can be determined using a conversion factor .

Site Location of Development Permit

The state Site Location of Development Act requires that a permit be obtained from the Maine Department of Environmental Protection (Maine DEP) for construction of any "Development of state or regional significance that may substantially affect the environment". The definition for such a "development" is found in Title 38, section 482, subsection 2. That definition reads, in pertinent part, as follows:

"Development of state or regional significance that may substantially affect the environment," in this article also called "development," means any federal, state, municipal, quasi-municipal, educational, charitable, residential, commercial or industrial development that:

- A. Occupies a land or water area in excess of 20 acres ;...(or)*
- C. Is a structure as defined in this section;...*

The definition for "structure", which is found section 482, subsection 5, reads as follows:

Buildings, parking lots, roads, paved areas, wharves or areas to be stripped or graded and not to be revegetated that cause a total project to occupy a ground area in excess of 3 acres. Stripped or graded areas that are not revegetated within a calendar year are included in calculating the 3-acre threshold.

Therefore, according to the Model Ordinance definitions, a Wind Energy Facility with a generating capacity of 100 kW or greater that requires a Site Location of Development Act permit (i.e. meets the "development" definition, above) is classified as Type 3, while a facility with a capacity of 100 kW or greater that does NOT require a Site Location permit (i.e. does NOT meet the "development" definition) is a Type 2 Facility.

Type 1 Classification Criteria

As noted above, Type 1 facilities fall into two categories: 1A and 1B. This distinction is based on two criteria: turbine height and the total number of turbines. In order for a facility to be classified as Type 1A, it must fall below the threshold for both criteria. If the facility meets or exceeds the threshold for either criterion, it is classified as Type 1B.

Turbine Height

The model ordinance uses a turbine height threshold of 80 feet to distinguish between Type 1A and Type 1B. This standard reflects the need to balance two potential effects of increasing turbine height: greater visual prominence and greater generating efficiency.

Our research found one wind energy report noting that as wind turbines approach and exceed 80 feet they become more noticeable and more difficult to blend into a community's landscape. We found a number of municipalities that have this or a similar height threshold. A Brewster, Massachusetts, official said that city's ordinance, which has a comparable height threshold and buffering provisions similar to those of this model, has worked well.

On the other side of the equation, staff persons from the Maine Public Utilities Commission and the National Renewable Energy Laboratory stress the critical importance of sufficient turbine height to the effectiveness of these devices. Their experience with a small wind energy program is that many newly-installed residential-scale turbines cannot qualify for a government rebate because they are too low to gain adequate access to the wind. They see the simple Type 1A permit process as one that will appeal most to the typical home wind generator and urge municipalities to set as high a threshold as possible.

Number of Turbines

The model assumes that the potential impacts of a given facility increase as the number of turbines proposed increases. Therefore, the classification that enjoys the most expedited review process, Type 1A, is limited to a single turbine.

9.0 Administration

9.7 Professional Services

This provision authorizes the municipal reviewing authority to obtain assistance from a consultant or attorney at the applicant's expense. Typically, the municipal reviewing authority may rely on MAINE DEP determinations with regard to the more complex review criteria, such as those regarding noise, shadow flicker, and effect on scenic resources. However, in cases where the municipality chooses or is required to assess compliance with complex criteria independently, expert assistance may be warranted.

While some Type 2 facilities do not require MAINE DEP certification, under the provisions of the model ordinance, the same criteria used for MAINE DEP certification would be applied by the municipal reviewing authority to all applications for Type 2 facilities. In cases where there is no MAINE DEP certification, and thus no Maine DEP findings for the municipal reviewing authority to consider, professional assistance may be warranted.

While the municipal reviewing authority must ensure that it has sufficient information on which to act, it should also try to minimize costs to the applicant. In cases where the local and state review processes require submission of the same professionally-prepared information, the applicant should be allowed to avoid duplication of cost and effort by submitting the same information to both parties.

Due to its smaller scale and simpler review criteria, the municipal review authority should typically have no need for professional assistance with the review of an application for a Type 1B facility.

10.0 Application Submission Requirements

10.1 General Submission Requirements

10.1.7 MDIFW and MNAP Notification

The applicant must notify the Maine Department of Inland Fisheries and Wildlife (MDIFW) and the Maine Natural Areas Program (MNAP) of a proposed wind energy facility by sending each a brief written description of the proposed facility which includes the total number turbines and the height of each turbine. The description must be accompanied by a segment of a 7.5 minute United States Geological Survey (USGS) topographic map on which the proposed turbine location(s) are indicated. USGS can be obtained from online. The Municipal Reviewing Authority will need to decide what constitutes acceptable evidence of notification. At a minimum, the applicant should be expected to submit copies of the notifications. Postal mailing receipts, either obtained by the sender or returned from the addressee can further confirm the notification. In the case of applications for Type 3 Wind Energy Facilities, evidence of submission of a Site Location of Development Permit application can be accepted since both agencies are notified of the proposed project as part of the Maine DEP review process.

Note that the Model Ordinance does *not* require comments from the MIFW or MNAP (see Natural Resources Protection, below).

Maine Department of Inland Fisheries and Wildlife notification is to be sent to:

Maine Department of Inland Fisheries and Wildlife
Attn: Environmental Coordinator
284 State Street, State House Station #41
Augusta, Maine 04333-0041
(207) 287-8000
www.state.me.us/ifw

Maine Natural Areas Program notification is to be sent to:

Maine Natural Areas Program
Attn: Information Manager
State House Station #93
17 Elkins Lane
Augusta, Maine 04333
(207) 287-8044
Maine.nap@Maine.gov
www.Maine.gov/doc/nrimc/mnap/assistance/index.htm

10.1.13 Visual Information

There are several ways to determine how proposed wind turbines might look from various vantage points. If the terrain is suitable, the best method is to hire a crane which can extend to the height of the turbine. Helium weather balloons can also work but are difficult at windy sites. Photo-simulation that superimposes properly-scaled representations of the proposed turbine(s) onto photographs of existing views is another option.

10.2 Additional Submission Requirement for Type 2 and Type 3 Applications

10.2.10 Other Relevant Studies, etc.

This provision addresses instances when, in order to make an informed decision, the municipal reviewing authority needs information not found in the required application submission list. For instance, a sound consultant hired by the town (see Professional Services, above) may need to review the applicant's wind data in order to properly assess the sound study. In such a case, the municipal reviewing authority can require that the wind data be provided for that purpose. In all such cases, the municipal reviewing authority should specify which review standard or standards the additional information relates and why it is needed.

11.0 MET Towers

Wind resources vary considerably from site to site, and with the height above the ground. This variation requires that wind characteristics at a site be fully understood before a wind turbine is proposed or erected. The most common and effective way of measuring the wind at a site is by using a wind monitoring or meteorological (MET) tower. These towers typically have anemometers attached to measure the wind and are typically used to make such measurements for at least a year. Although the height of the tower will vary depending on local topography and vegetation, the most common type of MET Tower consists of a temporary structure between 130 and 160 feet high supported by guy wires. Under subsection 12.9 of the Model Ordinance, bird flight diverters must be installed on all guy wires in order to minimize potential bird fatalities.

The Model Ordinance provides an expedited review process and requires only a building permit for temporary MET Towers. Since accurate wind data is critical for the siting, design and impact assessment of a Wind Turbine, it is in the interest of the community, as well as the applicant, that accurate data be obtained. Facilitating For this reason, the model ordinance is designed to facilitate the collection of this data by providing a simplified permitting process.

To erect the most commonly-used type of MET Tower, some land clearing is typically required, both to create room to lay the tower on the ground before winching it into an upright position, and to provide room for guy wires. For a 130 foot tower and 160 foot tower respectively, a minimum diameter of 160 to 240 feet needs to be clear to accommodate the guy wires with an area of between 135 to 165 feet available to lay the tower. For large towers, clearing of 0.5 to 1.5 acres might be required, which could be a concern in some sensitive areas. The model ordinance requires the applicant to restore the site to its original condition to the extent practicable.

12.0 General Standards (Applicable to all Facility Types)

12.1 Safety Setbacks

The safety setback is intended to reduce the hazard posed to abutting property by accumulated ice thrown from turning rotor blades. It also provides protection to abutting property in the unlikely event of a catastrophic tower failure.

It is important to note that the safety setback is a *minimum* setback that only addresses safety issues and that does not address any other issue such as noise or visual impacts. Meeting the safety setback requirement does not eliminate the need for a proposed facility to also meet every other review standard. Therefore, in order to satisfy noise or visual impact requirements, a Wind Turbine's location from the property line may need to be far beyond the minimum safety setback. The safety setback standard used in the model ordinance is equivalent to that found in Maine DEP rules.

12.2 Natural Resource Protection

Maps from the state *Beginning with Habitat* program can be a good resource for the Municipal Reviewing Authority when making a preliminary determination as to whether a proposed facility is located in or near a sensitive environmental area. BwH map entitles *Primary Map 2: High Value Plant*

and Animal Habitats will be of particular value. If maps for your town have not yet been prepared, they may be requested. If maps have been prepared for your town, they can be viewed and downloaded at: www.beginningwithhabitat.org/the_maps/map_availability.html.

Whether or not the proposed facility appears to be in or near an environmentally sensitive area, the applicant must still satisfy Model Ordinance section 10.1.7, which requires that evidence of MDIFW and MNAP notification be submitted (see 10.1.7, MDIFW and MNAP Notification, above). Note, however, that comments from either agency need not be received in order for the application to be found complete or for it to be approved. A notified agency will submit written comments only if it has concerns regarding the application, so the absence of comments from an agency can rightly be seen as indicating that the agency has little or no concerns regarding the application.

For review of Type 3 applications, comments from the notified agencies can be expected to be submitted to the Maine DEP. The Municipal Reviewing Authority may wish to request those comments directly from the agencies or from the Maine DEP, or it may wish to require the applicant to provide them (see Other Relevant Studies, etc., above). The Municipal Reviewing Authority may accept the issuance by the Maine DEP of a Site Location of Development Act permit for a proposed facility as a solely sufficient basis for finding that the local Natural Resources Protection standard has been met.

12.4 Controls and Brakes

Under certain conditions, the force of the wind can cause the rotor of a Wind Turbine to spin so fast that it can disintegrate. This can occur during very high winds (e.g. 50+ mph) or if a malfunction causes the Wind Turbine “lose load” (i.e. resistance to rotor rotation from the electrical generator). In order to prevent this kind of failure, nearly every Wind Turbines is designed with “overspeed controls” that limit the rotational speed of its rotor.

Overspeed controls usually include both aerodynamic e features and mechanical brakes. Aerodynamic control can be achieved by designing the turbine to automatically “furl” (i.e. turn out of the wind) or to change the angle of its rotor blades to let the wind “spill”. In most cases, mechanical brakes should augment the aerodynamic controls. Section 12.4 of the model ordinance allows the Municipal Reviewing Authority the latitude to accept an overspeed control system that does not have both a mechanical and an aerodynamic component; however, this exception is intended for small machines that can operate safely without both. As with all review criteria, the burden of proof is on the applicant, and it will be the role of the Municipal Reviewing Authority to judge the sufficiency of the documentation submitted in support of granting the exception.

12.7 Blade Clearance

Contact of the wind with the ground or other objects or surfaces creates air turbulence. This turbulence disrupts the energy of the air flow and greatly reduces the ability of rotor blades of a Wind Turbine to efficiently harness that energy. In order to minimize the effect of ground and object-induced turbulence, and in order to provide a safe distance between turning rotor blades and persons and property on the ground below, the model ordinance includes a 25-foot minimum blade clearance standard. Our review of ordinances in other jurisdictions found this standard ranging from 15 to 75 feet, with a 25-foot clearance requirement being common.

12.9 Tower Structure

With the exception of MET Towers, the model ordinance requires every tower to be a tubular monopole unless the applicant demonstrates to the satisfaction of the Municipal Reviewing Authority that the use of a monopole is not practicable. Monopole towers have several advantages over guyed and lattice towers:

- Their simpler “cleaner” appearance tends to be less visually discordant with their surroundings.
- They tend to require fewer trees to be cut since clearing of trees for guy wires is not necessary.
- They facilitate safe cold-weather access to tower-mounted equipment.
- They tend to lower overall bird mortality by reducing attractive perching opportunities and eliminating guy wires.
- They allow electrical equipment and cabling to be enclosed and protected from the elements.

Instances where the Municipal Reviewing Authority could find the use of a monopole Tower not practicable include, but are not limited to, cases where the applicant for Type 1A or Type 1B permit demonstrates that there are additional costs associated with the use of a monopole that cause the proposed facility to become economically unfeasible.

12.10 Erosion Control

The *Maine Erosion Control Handbook for Construction: Best Management Practices* shows how to incorporate Best Management Practices (BMPs) for erosion and sedimentation control into project planning, design and construction. This compilation of BMPs provides a menu from which project designers and contractors can choose practices appropriate to specific projects and sites. The selected temporary and permanent BMPs, which may employ structures, vegetation, or both, will provide the best protection against erosion on and discharge of sediments from construction sites.

12.11 Building-Mounted Turbines

The Model prohibits building-mounted turbines because of several inherent problems. These turbines transmit vibrations that can stress the building frame and that are often noticeable and annoying to occupants. Also, most roofs have a very limited capacity to support weight of a Wind Turbine and the wind forces to which it is subjected. In addition, all rooftops create wind turbulence, which will often seriously interfere with the efficiency of a building-mounted turbine.

12.13 Visual Screening

Note: the Visual Screening provisions apply only to Type 1B and Type 2 Wind Energy Facilities.

The purpose of the visual screening provision is to require applicants to take advantage of simple, no-cost and low-cost opportunities to reduce some of the visual impacts of their Wind Turbines. It does not require applicants to take any extraordinary measures to “hide” Wind Turbines or to “make them invisible”. It does not require or support the denial of an application simply because there may be no practical way to screen certain views of a Wind Turbine. It does, however, allow the Municipal Reviewing Authority to require a good faith effort on the part of the applicant to take advantage of such opportunities when they exist.

In some cases, a Wind Turbine can be sited to take advantage of topography, vegetation, and buildings so that the view of it from a point in or near an Occupied Building or Scenic Resources is eliminated or obstructed. In such cases, the Municipal Reviewing Authority may require the location of a proposed Wind Turbine to be adjusted to take advantage of a screening opportunity provided that doing so will not significantly interfere with access to the wind. In no case can the Municipal Reviewing Authority require an adjustment to a Wind Turbine location if doing so will create a conflict with any other review criteria (e.g. safety setback, control of noise, protection of natural resources, etc.).

The Municipal Review Authority may require the applicant to visually screen the view of a Wind Turbine from a Residence or Scenic Resource provided that the screening is both “feasible and effective”. In certain situations, the addition a landscape element (e.g. a shrub, tree, berm, fence, etc.) can effectively screen the view of a much taller object from a particular viewpoint. Given the nature of visual perspective, such screening must usually be located relatively close to the viewpoint (e.g. a picture window, porch swing, etc.) in order to be “effective”. The potential for effective screening can be assessed through examination of photographs taken from the viewpoint, or from a visit to the site.

The question of whether or not it is “feasible” to create a screen with landscaping will depend on a number of factors including: 1) the consent and cooperation of the owner of the site to be landscaped, 2) the cost of the landscaping, 2) the overall budget and economics of the proposed Wind Energy Facility, 3) the nature and degree of the potential visual impact and, 4) the degree to which screening can mitigate the visual impacts. The Municipal Reviewing Authority should weigh these factors to make sure that the cost of any screening required is commensurate with the scope of the project.

Special Standards for Type 1A and Type 1B Wind Energy Facilities (13.0)

Control of Noise (13.1)

The noise control standards for Type 1 Wind Energy Facilities are much simpler than the Type 2 and Type 3 standards. The complexity of the Type 2 and Type 3 standards, which are based on Maine DEP rules, require professional expertise and impose costs on the applicant that are not commensurate with the size, scope and potential impacts of a Type 1 Wind Energy Facility. Therefore, the sound limits in Section 13.1 are roughly equivalent to the Type 2 and Type 3 limits but are combined with application requirements, measurement protocols and enforcement provisions designed to greatly limit or eliminate the need for professional assistance.

For instance, the application for a Type 1 Wind Energy Facility is not required to submit an expensive predictive sound study. Instead, the applicant is required to submit a signed acknowledgement of the applicant’s responsibility to meet applicable sound limits and to take remedial action if the Codes Enforcement Officer finds that they are not being met.

NOTE: SPO staff is continuing work on a sound measurement protocol for section 13.1. This protocol will appear in the final version of this guidebook.

Special Standards for Type 2 and Type 3 Wind Energy Facilities (14.0)

Sound Limits and Assessment (14.1)

All Type 2 and Type 3 Wind Energy Facilities are subject to the sound standards found in Appendix B of the Model Ordinance. These standards closely follow the standards applied by Maine DEP for facilities subject to its review. The Maine DEP standards, which include standards for short-duration repetitive sound, were developed with the help of independent sound experts. Should Maine DEP amend any of its standards, or establish any new standards, the Model Ordinance will be revised to reflect those changes.

Due to the technical nature of acoustics and the corresponding complexity of the Type 2 and Type 3 sound standards, the Municipal Reviewing Authority may choose to enlist the assistance of a qualified consultant at the applicant's expense (see 9.7 Professional Services, above). Alternatively, in the case of a facility for which a Maine DEP certificate or permit is required, section 14.7 of the Model Ordinance stipulates that the Municipal Review Authority may deem the issuance of that certificate or permit sufficient to meet the sound standards of section 14.1.

Insofar as the Model Ordinance sound standards for Type 2 and Type 3 facilities closely follows those used by the Maine DEP, it will be instructive to understand more about how the Maine DEP applies its standards. The following summary of the Maine DEP sound/noise review process for wind energy development was contributed by James Cassida, Permitting Coordinator, Maine Department of Environmental Protection:

An applicant for a Site Location of Development permit for a grid-scale wind energy development (Model Ordinance, Type 3) or a Siting Certification for Small-Scale Wind Energy Development (Model Ordinance, Type 2 generating power for sale or use by a person other than the generator) must submit evidence as part of their application to the Department that they have designed the project such that it is in compliance with all applicable noise rules pursuant to Chapter 375 (10). As a standard practice, the applicant is required to hire a qualified sound consultant to conduct a sound level study. The sound level study is conducted to model expected sound levels from the proposed project and compare the model results to operational standards outlined in Chapter 375 (10). The sound level assessment/model takes into account the specifications of the proposed wind turbines and the location of the proposed development relative to abutting properties or other "protected locations" as defined in Chapter 375 (10) (G) (16).

In general the Department requires the applicant to do the following:

- 1. Conduct a pre-development sound study in order to demonstrate, by measurement, the ambient sound present at the proposed construction location. Ambient sound is defined as the all-encompassing sound associated with a given environment, being usually a composite of sounds from many sources at many directions, near and far, including the specific development of interest at a specified time. The ambient measurements must be made at representative protected locations for periods of time sufficient to adequately characterize the ambient sound*

condition. At a minimum, the measurements must be made on three different weekdays during all hours that the development will operate. As wind energy developments will operate 24/7 if wind conditions are present the Maine Department requires applicants to include 24/7 measurements in their calculation of ambient sound. The Maine Department requires wind energy developers to apply quiet limits of 55 dBA during daytime and 45 dBA at night at all nearby protected locations in accordance with Chapter 375 §10 (H) (3) (1), even if pre-development ambient sound levels under weather conditions suitable for wind turbine operation exceed area thresholds of 45 dBA daytime and 35 dBA night.

2. The sound assessment/model should be developed using the CADNA/A software or comparable program to map area terrain in three dimensions, locate the proposed turbines, and calculate outdoor sound propagation from the wind turbines. Area topography and wind turbine locations must be obtained based on United States Geological Survey (USGS) topographic information and project design. The sound level estimates must be calculated for simultaneous operation of the specific wind turbine equipment, at all prospective turbine locations, operating at full power as defined by the manufacturer. The wind turbines must be treated as point sources at the hub height of the specific wind turbine equipment above base grade elevation using sound power levels from the manufacturer. Sound level estimates should be based on the operating sound level at full power plus an uncertainty factor of an additional 2 dBA based on actual measurements of similar wind turbines during full operation.
3. Sound levels from the proposed wind turbine operation must be calculated for all receiver points in the vicinity of the proposed project and depicted on the set of plans. Receiver points represent nearby "protected locations" where the most stringent nighttime limits apply. Chapter 375 §10 (G) (16) defines a protected location in pertinent part as "any location, accessible by foot, on a parcel of land containing a residence or approved subdivision.... near the development site at the time a Site Location of Development application is submitted..." In all cases, the nighttime limits apply within 500 feet of any living or sleeping quarters on a protected location.
4. Sound level attenuation from the wind turbines to the receiver points must be calculated by the acoustic model in accordance with ISO 9613-2 "Attenuation of sound during propagation outdoors". ISO 9613-2 is an international standard commonly used for predicting sound levels from noise sources for moderate downwind condition in all directions. The prediction model must calculate attenuation due to distance, atmospheric absorption, and intervening terrain and factors must be applied for ground absorption assuming a mix of hard and soft ground. To be conservative in calculating attenuation, the surfaces of nearby lakes must be specifically mapped and assigned no ground absorption as appropriate for a hard, reflective surface. In addition, the model calculations must exclude attenuation from foliage. The stated accuracy of sound level attenuation calculations per ISO 9613-2 is plus or minus 3 dBA. In order to compensate for inaccuracy inherent in the calculation and measurement methods, 3 dBA must be added to the specified sound power levels.
5. Short duration repetitive (SDR) sounds are a sequence of sound events each clearly discernible that cause an increase of 6 dBA or more in the sound level observed before and after an event. SDR sound events are typically less than 10 seconds in duration and occur more than once within an hour. When routine operation of a development produces SDR sound, 5 dBA is added to the observed levels of the SDR sound for purposes of determining compliance with applicable sound limits. Measurements and observations by applicants for projects previously reviewed by the Department indicate that sound levels can fluctuate over brief time periods as noted by the passage of wind turbine blades, however the observed measurements indicate that these sound level fluctuations typically range from 2 to 4 dBA and thus do not result in the 6 dBA increase

required to be an SDR sound as set forth pursuant to Chapter 375 §10 (C) (1) (e). However, because analysis of amplitude modulation is beyond the scope of models that calculate outdoor sound propagation, the Department recommends that applicants incorporate the 5dBA to the observed levels of the SDR sound in order to produce as conservative an estimate as possible. If applicants chose not to apply the 5 dBA for SDR sound the Department will condition the permit approval to require a detailed post-construction compliance protocol to establish if SDR sounds are in fact an issue on the proposed project site. If SDR sounds occur for a significantly large percentage of time, application of the 5 dBA penalty after-the-fact could result in locations with modeled sound levels of 43 dBA or greater exceeding the 45 dBA limit for periods of the SDR sound event.

Use of Public Roads (14.2)

Road authorities are typically concerned about the impacts that major construction projects can have on roads. The construction of commercial wind turbines requires hauling very heavy components and construction equipment to the site. The nacelle (generator and gearbox unit) for a single commercial wind turbine weighs over 50 tons. The foundations for these turbines require over 200 yards of concrete each. Cranes for construction may weigh a few hundred tons when assembled. Damage can occur to roads. Impacts may include rutting, damage to road geometry, and crushed culverts.

The Model Ordinance calls for the applicant to pay for the town engineer or road commissioner to document pre-construction and post-construction road conditions. This documentation is crucial for implementing the requirement that any road damage resulting from construction of the facility be promptly repaired at the applicant's expense.

Artificial Habitat (14.4)

The primary goal of this provision is to lower overall raptor mortality from the Wind Energy Facility by minimizing any artificial habitat that might attract raptors or raptor prey. Some examples of such artificial habitat include, but are not limited to, electrical equipment boxes on or near the ground that can provide shelter and warmth, and any components of towers or related structures that provide horizontal perching opportunities. In determining whether this provision has been met, the Municipal Reviewing Authority shall consider comments and recommendations, if any, provided by the Maine Department of Inland Fisheries and Wildlife (MEDIFW).

Effect On Scenic Resources (14.5)

This section of the Model Ordinance details how the Municipal Reviewing Authority reviews the potential effect of a Type 2 or Type 3 Wind Energy Facility on Scenic Resources. The standards closely mirror those used by Maine DEP in its review of "grid scale" (i.e. Type 3) facilities and the Municipal Reviewing Authority may deem issuance of a Maine DEP permit as sufficient to meet this section with regard to Scenic Resources of state and national significance, but not those of local significance. Scenic Resources of local significance are not considered under Maine DEP standards, so the Municipal Reviewing Authority will need to review for effects on those local resources without the benefit of a parallel Maine DEP review. Also, since Maine DEP Siting Certificate process does not include a review of effects on Scenic Resources, the Municipal Reviewing Authority will be solely responsible for that review for all Type 2 Wind Energy Facilities.

Given the close similarity between the review provisions in the Model Ordinance and those used by Maine DEP, the following summary of the Maine DEP process by Jim Cassida, Permitting Coordinator, Maine Department of Environmental Protection, will provide helpful guidance to Municipal Reviewing Authority members:

In determining if a proposed wind energy development will have a scenic impact the Maine Department of Environmental Protection (Department) uses the criteria established in Public Law, Chapter 661 and further described in Chapter 35-A "Expedited Permitting of Grid-Scale Wind Energy Development" § 3451- 3453. This criterion is used for both grid-scale projects reviewed under the Site Location of Development Law (Site Law) and non grid-scale projects that require a permit under the Natural Resources Protection Act (NRPA).

The criteria established in Chapter 35-A requires the applicant to identify all scenic resources of state or national significance that are located within 3 miles of the proposed project location and that the proposed facility be visually modeled from these locations. In addition, the Department may require visual modeling from all scenic resources of state or national significance that are located within 8 miles of the proposed facility. The list of eligible scenic resources is limited to those places listed in Title 35-A§ 3451 (9). Scenic impacts from any scenic resource not included in the defined list may not be considered by the Department in the review of a wind energy development.

In making findings regarding the effect of a wind energy development on scenic character the Department considers the significance of potentially affected scenic resource of state or national significance, the existing character of the surrounding area, the expectations of the typical viewer, the project purpose, the duration of potentially affected public uses and the scope and scale of the potential affect of views. The Department may not determine that a proposed wind energy development has an unreasonable adverse impact on scenic character based solely on the fact that the facility is a highly visible feature in the landscape.

Shadow Flicker (14.6)

Shadow Flicker is defined as alternating changes in light intensity caused by the movement of Wind Turbine blades casting shadows on the ground or a stationary object. Shadow Flicker is not the sun seen through a spinning wind turbine rotor, nor what an individual might view moving through the shadows of a wind farm.

Shadows cast from Wind Turbines generally occur near the turbines although this will vary depending on the time of year, the time of day, and Turbine Height. At distances greater than 1000 feet from a Wind Turbine, Shadow Flicker usually only occurs at sunrise or sunset when cast shadows are sufficiently long. At nearby locations (e.g. dwellings) this temporary effect is usually perceived as a nuisance rather than a potential hazard, but it is nonetheless important to consider when siting a turbine.

Since the position of the sun can be plotted in relation to the location of a proposed Wind Turbine, the time and duration of Shadow Flicker at any particular location can be accurately predicted. Computer modeling tools, such as WindPro, are used to generate the predictions. The assumption of in the

computer model is that every day will have ideal conditions for generating Shadow Flicker (i.e. sunny and windy). Therefore the actual incidence of Shadow Flicker can safely be expected to be less than predicted.

With the predictive information, adverse effects on neighboring properties can often be avoided or mitigated. For some locations, this can be achieved by adjusting the proposed location of a Wind Turbine. For other locations, a tree planted in a strategic spot may block Shadow Flicker in the same way that it can screen the view of a Wind Turbine.

While neither the Model Ordinance nor the Maine DEP rules set a specific Shadow Flicker limit, current Maine DEP practice is to limit maximum possible annual Shadow Flicker to no more than 30 hours. Any municipality wishing to do so, can include a specific hour limit in its local ordinance.

Relationship to Maine DEP Certification and Permitting (14.7)

14.7.1

Prior to construction of any Type 2 Wind Energy Facility intended to generate electrical energy “for sale or use by a person other than the generator”, the applicant must obtain a Maine DEP Siting Certificate. This certificate can be issued only if the proposed facility meets Maine DEP safety setback, noise, and Shadow Flicker standards. Section 14.7 of the Model Ordinance stipulates that if a Maine DEP Siting Certificate has been issued for a proposed Type 2 Wind Energy Facility, the Municipal Reviewing Authority may, on the basis of that certificate, find that the equivalent local standards for safety setback, noise, and shadow flicker standards have been met. Since these standards, particularly those for noise and Shadow Flicker, require review of highly technical information, the ability of the Municipal Reviewing Authority to rely on the expertise of Maine DEP staff can save considerable time and effort. It can also promote consistency between state and local reviews and reduce the exposure of the local decision to a legal challenge.

(As noted in guidebook entries relating to sections 9.0 and 14.1, above, an applicant proposing a Type 2 Wind Energy Facility intended to generate electrical energy that is not for sale or use by a person other than the generator must not and cannot obtain Maine DEP Siting Certificate. In those cases, the Municipal Reviewing Authority must review the application for safety setback, noise and Shadow Flicker without the benefit of a Maine DEP review.)

14.7.2

For the same reasons cited for section 14.7.1, above, the Model Ordinance provides that if the required Maine DEP Site Location of Development Act permit has been issued for a proposed Type 3 Wind Energy Facility, the Municipal Reviewing Authority may, on the basis of that permit, find that the local standards for safety setback, natural resource protection, control of noise, shadow flicker and scenic resources of state and regional significance have been met. Again, as with the certified Type 2 applications, this approach can save the MRA time and effort reviewing these sections while promoting consistency.

Design Safety Certification (14.10)

While setbacks remain the primary mechanism for ensuring public safety in the Model Ordinance, proper design and construction of Wind Turbines are also crucial for reducing the risk of catastrophic

turbine failure and injury to persons and damage to property. Over the past few decades, the wind energy industry has developed design and safety standards. These standards are codified in the International Electro-technical Commission (IEC) 61400 Series. The U. S. Underwriters Laboratory (UL) began certifying Wind Turbine compliance with these standards several years ago. Other third party certification organizations have been operating in Europe for many years. These include organizations such as Germany's Germanischer Lloyd, Norway's Det Norske Veritas, and Denmark's RISO.

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