Section 1A
Alternatives Analysis

1.0 PROJECT DESCRIPTION

The *Revised Oakfield Wind Project* is a proposed wind energy project located in Oakfield, Aroostook County, Maine. It is an amendment and expansion of a project previously permitted by the Maine Department of Environmental Protection (MDEP) and the U.S. Army Corps of Engineers (Corps). The project includes a total of 50 turbines and associated infrastructure located throughout the Oakfield Hills. Infrastructure will include roads, an electrical collector system, and a substation. A 115-kilovolt (kV) generator lead transmission line delivering power from the project to the ISO-New England grid is the subject of a separate amendment application and alternatives analysis.

This application by Evergreen Wind Power II, LLC (Evergreen II) for the *Revised Oakfield Wind Project* amends the original Oakfield Wind Project as follows:

- change the approved turbines in the original project area from 34 General Electric (GE) 1.5-megawatt (MW) with a 77-meter rotor diameter and an 80-meter tower, to 25 Vestas V-112 3.0-MW turbines, with a 112-meter rotor diameter and an 84 meter tower;
- add temporary and permanent meteorological (met) tower locations;
- change turbine pad size, turbine locations, road widths, and some road locations;
- eliminate the northern substation;
- add 25 Vestas V-112 3.0-MW turbines in new project areas;
- add a new substation location; and
- change the point of electrical interconnection.

This amendment would increase the size of the Oakfield Wind Project to 50 turbines with a potential generating capacity of 150 MW. Figure 1 shows the complete project area with revised turbine locations and additional turbines. A comparison of the original GE turbine layout and the proposed Vestas turbine layout in the original project area is illustrated in Figures 2A and 2B. The GE turbines would have been 389 feet tall, fully extended; the Vestas turbines will be 459 feet tall, fully extended. The project would be located in the Town of Oakfield and T4R3 WELS.

Electricity generated by the turbines would be collected from the turbines at 34.5 kV, and “stepped up” to 115 kV at the new substation on South Oakfield Road. The northern substation approved as part of the original project would not be constructed. From substation location on South Oakfield Road, electricity would be transmitted by the proposed Maine GenLead transmission line to a point in Chester where it would tie into the existing Bangor Hydro Electric system. That transmission line is the subject of a separate amendment application by Maine GenLead, LLC. Evergreen II and Maine GenLead, LLC are separate legal entities, both owned by First Wind Holdings, LLC.

2.0 PROJECT PURPOSE AND NEED

2.1 PROJECT PURPOSE

The purpose of the project is to expand the Oakfield Wind Project, a commercially-viable, low-impact wind energy project in Maine.

2.2 PROJECT NEED

The need is clear for facilities that generate clean, renewable energy, and the demand for such facilities is high. Regional energy demand is increasing each year. Greenhouse gases from fossil fuel emissions are affecting the environment and the climate. Particulates from combustion contribute to Maine having the second highest asthma rates in the country in 2009.[1] The federal government has stressed reducing dependence on foreign sources of energy. A wind power project such as the Oakfield Wind Project addresses each of these concerns, and the Maine GenLead project will serve as the necessary conduit to bring this clean, renewable wind power to the New England market.

[1] *The Maine Statewide Asthma Plan*, May 2010, Maine Center For Disease Control and Prevention

Despite the fact that New England has seen substantial investment in new power production facilities in the past decade, the power supply in New England does not appear to be sufficient to meet future demand. According to the ISO-NE *2009 Regional System Plan*, due to the reduced overall demand for electricity in 2009, there likely will be sufficient electrical generation capacity to meet consumer needs through 2018, provided the 37,283 MW of cleared capacity is operational by 2011.[2] However, this same report also states that peak demands may not be met as early as 2010. One of the operational capacity forecasts determined that a shortfall of 120 MW could occur by the summer of 2010, and a deficit peak of 1,150 MW could occur by the summer of 2012. Energy to meet these peak demands would have to come from outside the region.

There is also a need to reduce greenhouse gases through the employment of clean, renewable energy. In 2009, approximately 70 percent of the region's installed generator capacity was fossil fuel-based (i.e., natural gas, oil and coal), and only about 14 percent of generation capacity was from renewable resources such as hydroelectric, pumped-storage, and wind power. The actual generation of electricity in 2008 utilized fossil fuels for approximately 57 percent of the electrical energy produced and 14 percent for renewable resources.[3] In the past decade, Maine and New England have set statewide and regional goals and policies designed to address greenhouse gas emission concerns. The primary policy designed to address these concerns is the Regional Greenhouse Gas Initiative (RGGI). The RGGI is a cooperative effort by 10 Northeast and Mid-Atlantic states, including Maine, to limit greenhouse gas emissions. The RGGI is the first mandatory, market-based carbon dioxide emissions reduction program in the United States and is designed to help cap and control carbon dioxide emissions from power production facilities without increasing the energy cost passed onto consumers. The RGGI meets these goals by setting a cap on total emissions that will decrease gradually until it is 10 percent lower than at the start of the program.[4] The program then allows individual production facilities to meet the cap by trading credits. Unlike fossil fuel-based power production facilities, wind power projects can provide power without any carbon dioxide emissions, or acid-rain producing SO_x, and therefore provide a means for meeting increasing energy demands consistent with the goals and objectives of the RGGI.

Additionally, New England relies heavily on natural gas as a source of energy production (approximately 40% of energy production in 2008 was from natural gas).[5] From 2000 to 2005, a large percentage of the new power plants in New England were natural gas-fired facilities, increasing regional reliance on natural gas. In the 1990s, natural gas was relatively inexpensive and price volatility was low. Since 2000, however, natural gas prices have doubled, resulting in regional electric energy price spikes and concerns about the lack of diversity within the ISO-NE energy portfolio.[6] As a result, system planners have identified as a priority the need to diversify the types of fuels used to generate electricity and decrease the region's dependence on natural gas.[7]

[2] ISO New England, Inc. October 15, 2009. *2009 Regional System Plan.* Available at: http://www.iso-ne.com/trans/rsp/2009/rsp09_final.pdf. Cited on June 25, 2010.
[3] Id.
[4] Regional Greenhouse Gas Initiative (RGGI) CO_2 Budget Trading Program. Available at: http://www.rggi.org/home. Cited on June 25, 2010.
[5] ISO New England, Inc. October 15, 2009. *2009 Regional System Plan.* Available at: http://www.iso-ne.com/trans/rsp/2009/rsp09_final.pdf. Cited on June 25, 2010.
[6] *New England Electricity Scenario Analysis*, ISO New England Inc., pg. 1, Aug. 2, 2007. Available at: http://www.iso-ne.com/committees/comm_wkgrps/othr/sas/mtrls/elec_report/index.html.
[7] *2006 Regional System Plan*, ISO New England Inc., Sec. 5, Oct. 26, 2006. Available at: http://www.iso-ne.com/trans/rsp/2006/rsp06_final_public.pdf.

In 2004, the Maine State Legislature enacted legislation designed to encourage low-emission power production facilities. The Electric Restructuring Act includes a renewable portfolio standard, which requires retail power suppliers to include 30 percent of renewable or efficient sources in their portfolios. In 2007, the Legislature enacted an Act to Stimulate Demand for Renewable Energy, which adds the requirement that retail power suppliers include certain percentages of new renewable resources. The requirement begins with 1 percent in 2008 and increases by 1 percent per year to 10 percent in 2017.[8] Through this legislation, Maine's goal was to return greenhouse gases to 1990 levels by 2010 and reduce these levels by an additional 10 percent by 2020. To achieve this goal, the combined legislation was intended to foster an environment conducive to development and encourage the use of an energy portfolio that includes more environmentally favorable sources by requiring suppliers to include this power in their portfolios. Additional legislation passed in 2009 furthered the intent to reduce greenhouse gases by setting a goal to cut consumption of liquid fossil fuels by 30 percent by 2030.[9]

In 2008, the Maine Legislature made a significant statement of its preference and desire to attract wind power in the State through its adoption of recommendations of the wind power task force.[10] This emergency legislation, referred to loosely as the "Maine Wind Energy Act" (the Act), mandated the State to "take every reasonable action to encourage the attraction of appropriately sited development related to wind development" and includes measures designed to streamline and standardize the regulatory process for wind farm development. It was deemed to be "immediately necessary for the preservation of the public peace, health and safety."[11] The Act goes further to state that the encouragement of wind energy may displace power generation through fossil fuels and thus "improve environmental quality."[12] In addition to specific provisions governing the permitting of wind power in Maine, the Act establishes a goal of developing at least 2,000 MW of installed wind power capacity in Maine by 2015, and 3,000 MW of installed capacity by 2020. Currently, there are 432 MW of commercial wind power operating, under construction or permitted in Maine. With a potential of 150 MW, power from the Revised Oakfield Wind Project represents an important and substantial step toward meeting the State's goal of developing more than 2,000 MW of wind power by 2015.

3.0 ALTERNATIVES ANALYSIS

Evergreen II has extensively examined practical alternatives in selecting the site for the expansion project. The objective of this analysis is to describe the screening process that led to the selection of the proposed facility locations as the Least Environmentally Damaging Practicable Alternative (LEDPA).

According to Site Location of Development Law, 38 M.R.S. § 487-A(4), the MDEP will review alternatives for transmission and pipelines and "shall consider whether any proposed alternatives to the proposed location and character of the transmission line or pipeline may lessen its impact on the environment or the risks it would engender to the public health or safety, without unreasonably increasing its cost." Anticipating that the MDEP and the Corps will view the summit development and generator lead transmission line as a single and complete expedited wind energy development, Evergreen II has included an alternatives analysis in this summit amendment application. The alternatives analysis for the generator lead is included in the generator lead amendment application.

For each alternative presented below, a discussion is provided regarding feasibility, logistics, and potential environmental impacts. A number of options were reviewed, with the ultimate goal of identifying

[8] Maine Public Utilities Commission Review of Emerging Technologies as Eligible Resources under State's Portfolio Requirement, Feb. 10, 2005. Available at: http://www.maine.gov/mpuc/staying_informed/legislative/2005legislation/emerging_tech_rpt.htm). Annual Report on the New Renewable Resource Portfolio Requirement, Maine Public Utilities Commission, March 31, 2008. Available at: www.maine.gov/mpuc/legislative/archive/2006legislation/RPSreport.doc

[9], P. L., ch 372 (effective September 12, 2009); *An Act Regarding Maine's Energy Future.*

[10] P.L. 2007, ch. 661 (effective Apr. 18, 2008); An Act to Implement Recommendations of the Governor's Task Force in Wind Power Development.

[11] Id.

[12] Id.

an alternative that meets the project purpose and has the least environmental impacts. As discussed more thoroughly below, the selected expansion sites are the most practicable sites available.

3.1 Wind Project Site Selection

The Oakfield site was selected for expansion because it best meets the project purpose of expanding the Oakfield Wind Project, a commercially viable, low-impact wind energy project in Maine. Evergreen II considered multiple factors when selecting the site for expansion, both in terms of overall environmental impacts and economic viability of sites throughout the state. These factors include the quality of the wind resource, site geography in terms of efficient layout and construction ease, compatibility with existing land uses, costs and logistics of delivering power, and environmental impacts. The Town of Oakfield's strong support for the initial Oakfield project was another factor considered in choosing this expansion site.

As noted above, the Governor's Task Force on Wind Power Development made a number of recommendations that were adopted by the Maine Legislature during the 2008 legislative session (The Act). The Task Force delineated an area where grid size wind power project development should be expedited, including the town of Oakfield. This area includes the entirety of Maine's organized towns and portions of the unorganized territories. A number of areas within the expedited area are currently being developed by Evergreen II affiliate companies. Additionally, it should be emphasized that state and federal policies promote the development of multiple clean, renewable energy sources. Accordingly, sites or areas not selected in this application may nonetheless be practicable and appropriate for future development, particularly if the aggressive goals set by the Legislature for development of wind power in Maine are to be realized.

3.1.1 Analysis of Selected Wind Project Sites

Quality of Wind Resource
As reflected in the wind resource mapping for the State of Maine (Figure 3), there are several distinct locations that have high class wind resources across the state. Much of the area identified in this broad-based mapping for the state occurs where there are competing interests to wind power. Because of this, Evergreen II expanded its review area outside of these mapped resources to those areas that were not identified through the resource mapping but have potential for a usable wind resource. Met towers have been erected in prospective turbine array sites to gather site-specific wind resource data.

Evergreen II has collected data on wind speed, direction, and consistency in the Oakfield Hills since December 2003 and has determined that the site is suitable for wind development. This amendment takes further advantage of the wind resource in the area. The land form and surrounding landscape suggest that the site is an unusually good wind resource for its setting and elevation.

Geography
Locations with strong wind resources are only valuable as development locations if the geography of the area allows turbine arrays to be built at a reasonable cost. The two factors to consider when selecting a site for a turbine array are geography for turbine layout and wind capture purposes and geography for construction purposes.

The expansion area of the Oakfield Hills include a series of peaks with linear or near linear ridgelines in close proximity to other smaller peaks, making Oakfield Hills ideally positioned to capture the prevailing wind that dominates northern and eastern Maine. The topography surrounding the Project turbine arrays is rolling terrain, and the elevation to the Oakfield Hills peaks rises gradually. This is ideal for wind projects, as the wind can compress and accelerate as it rises up the ridge face. The majority of the area has moderate slopes and is readily accessed due to existing logging roads, which also helps to minimize construction costs.

Evergreen II's review of numerous prospective sites statewide and in the more local area indicates that the expansion areas of the Project have the appropriate combination of good wind resource, ridgeline orientation, gradual grades, and linear adjacent ridgelines close enough to connect to one another. This combination is not typical, and makes the selected sites ideal for wind development.

Compatibility with Existing Land Uses
The proposed wind turbine array for the Project would be located in an area that currently is used for commercial logging operations, a land use particularly compatible with wind power development. Logging activities can continue in the surrounding area unimpeded, and the existing network of logging roads in and around the site can be utilized and upgraded where appropriate to provide construction and operational access, thereby minimizing the need to develop new roads. To the extent that Evergreen II improves existing roads or needs to build new roads, these improvements would facilitate continued commercial land management activities in the area. In some instances, new roads will need to be built in order to avoid the wetland impact associated with upgrading the existing roads. These improvements from the proposed development would have a positive and synergistic impact on existing uses and would serve to reduce overall environmental impacts.

Many potential alternative sites lack the compatibility of land uses. Locations may be incompatible with residences in close proximity to potential turbine locations, protected viewsheds, or significant natural features. The expansion areas are distant from any population concentrations. A commercial forest area with an existing road network is a tremendous asset for any potential site because it significantly reduces the environmental impact of the Project.

Minimal Environmental Impacts
The Oakfield Hills are not unique in terms of recreational opportunities or as conservation areas that would be adversely impacted by the development. The turbine arrays will not be located within an area that requires special protection, and there are no documented occurrences of rare, threatened, or endangered plant or animal species within the development area. Two plant species of special concern, large toothwort (*Cardamine maxima*) and Goldie's fern (*Dryopteris goldiana*), have been identified within the project area, but these species will not be disturbed by development. The Project design minimizes impact to wetlands and streams, additional forest fragmentation in this area would be minimal, and there is minimal impact to Significant Wildlife Habitats. The site utilizes existing roads and clearings in order to minimize vegetation clearing to the extent practicable. Twenty-one historic sites have been identified that may have some impact from the Project; the project design avoids them all.

Areas across the state where wind is the strongest and most consistent are often the most sensitive. This makes the Project site stand out in that both a strong and consistent wind is available, and environmental impacts of developing the area to capture this resource would be minimal.

4.0 AVOIDANCE AND MINIMIZATION

Evergreen II undertook significant efforts to identify the LEDPA for the expanded Project. Throughout planning and design, wetland impacts were avoided, and unavoidable wetland impacts were minimized to the maximum extent possible. The final design for the entire summit Project includes approximately 4.01 acres of wetland clearing, 10,932 square feet of permanent wetland fill, and 0.60 acres of temporary wetland fill.

4.1 AVOIDANCE

Efforts to avoid wetland impacts throughout the amended Project were ongoing during Project planning. This involved using existing roads and placing roads and turbine platforms outside of wetland areas to the maximum extent practicable. Project components avoided permanent wetland fill impacts except for roads.

The design of the entire Project took into consideration wetland impacts associated with turbine pad and road design. Turbine pads were shifted slightly or moved completely in order to avoid wetland areas. The area around turbines S06 and S07 was carefully designed to avoid the many proximate wetlands. The road leading from turbine E12 to E06 was rerouted after the discovery of a Significant Vernal Pool near the original alignment. Similarly, the road near E10 was moved to the east to avoid a Significant

Vernal Pool buffer. The result of this effort is that there are no wetland impacts associated with the turbine pads.

As a result of the modifications to the Project design, large areas of wetlands were completely avoided. While all impacts could not be avoided, the total area of impact has been significantly reduced. Impacts to areas that could not be avoided will continue to be minimized.

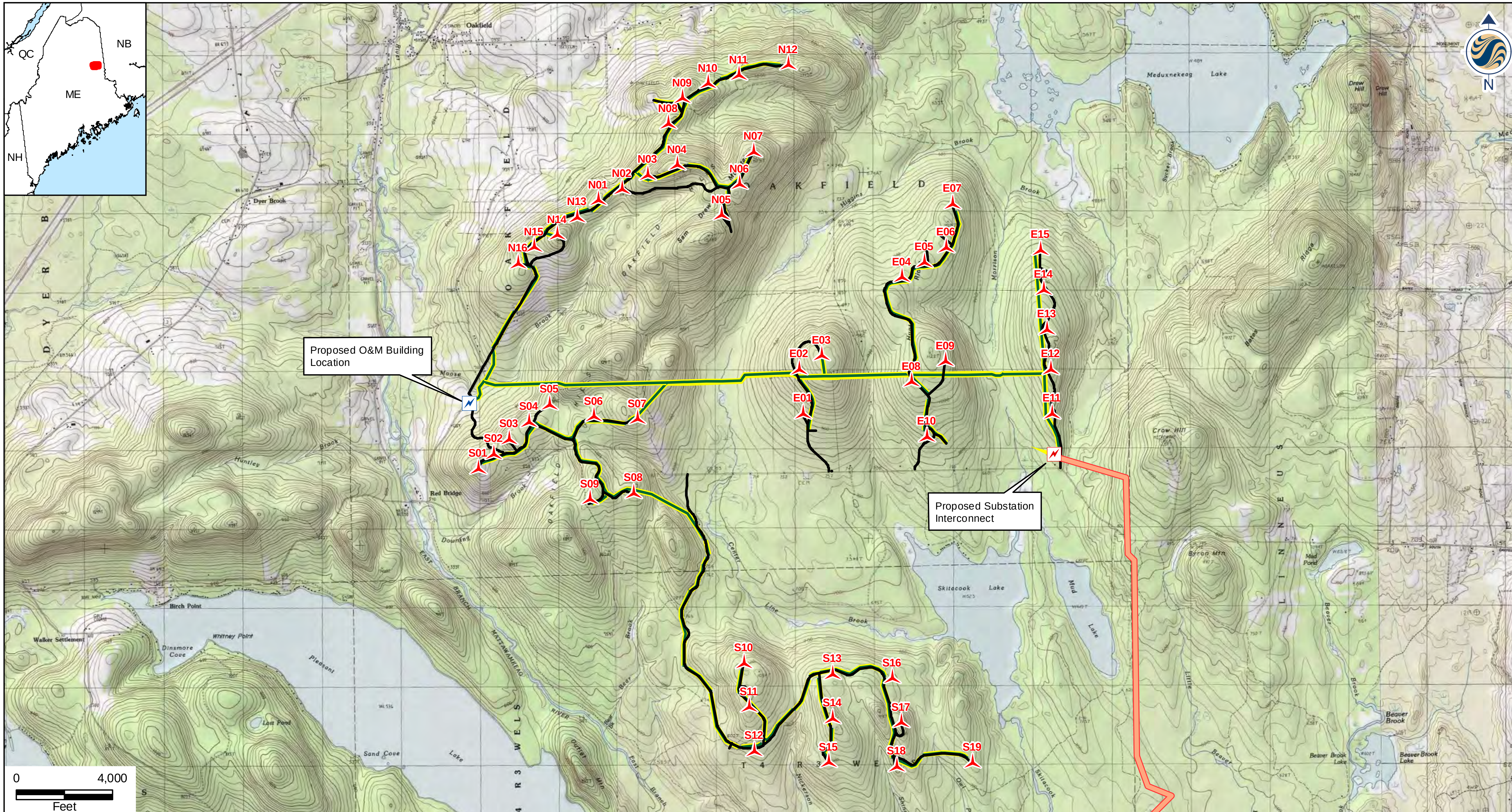
4.2 MINIMIZATION

Generally, flat areas crossing wetlands were avoided. In the areas where wetland impacts could not be avoided, Evergreen II minimized wetland impacts by using various techniques. Some techniques used to minimize impacts included narrowing road shoulders where possible and modifying cut and fill slopes on both roads and turbine pads. Buffers were maximized to allow larger riparian areas between roads and turbine pads and wetland areas. In numerous areas, roads were threaded through some wetland areas to ensure that they crossed at the narrowest point and have minimal effect on the wetland function.

Impacts for the collector line were also minimized. For example, the western end of the collector going to the substation was taken out of a linear alignment in order to avoid poles in wetlands and maximizes stream buffers. Near the eastern end of that same line, the collector was also realigned to avoid fill impacts. Temporary mats rather than granular fill will be used to cross wetlands during construction, reducing temporary impacts and avoiding permanent impacts. The use of the existing road in the design of the collector line also minimizes overall clearing and fragmentation of the area.

The result the avoidance and minimization effort for the Project is that for more than 19 miles of new and improved roads and locating 50 turbines, there is 0.25 acre of wetland fill and 4.01 acres of wetland clearing.

Figures



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Legend

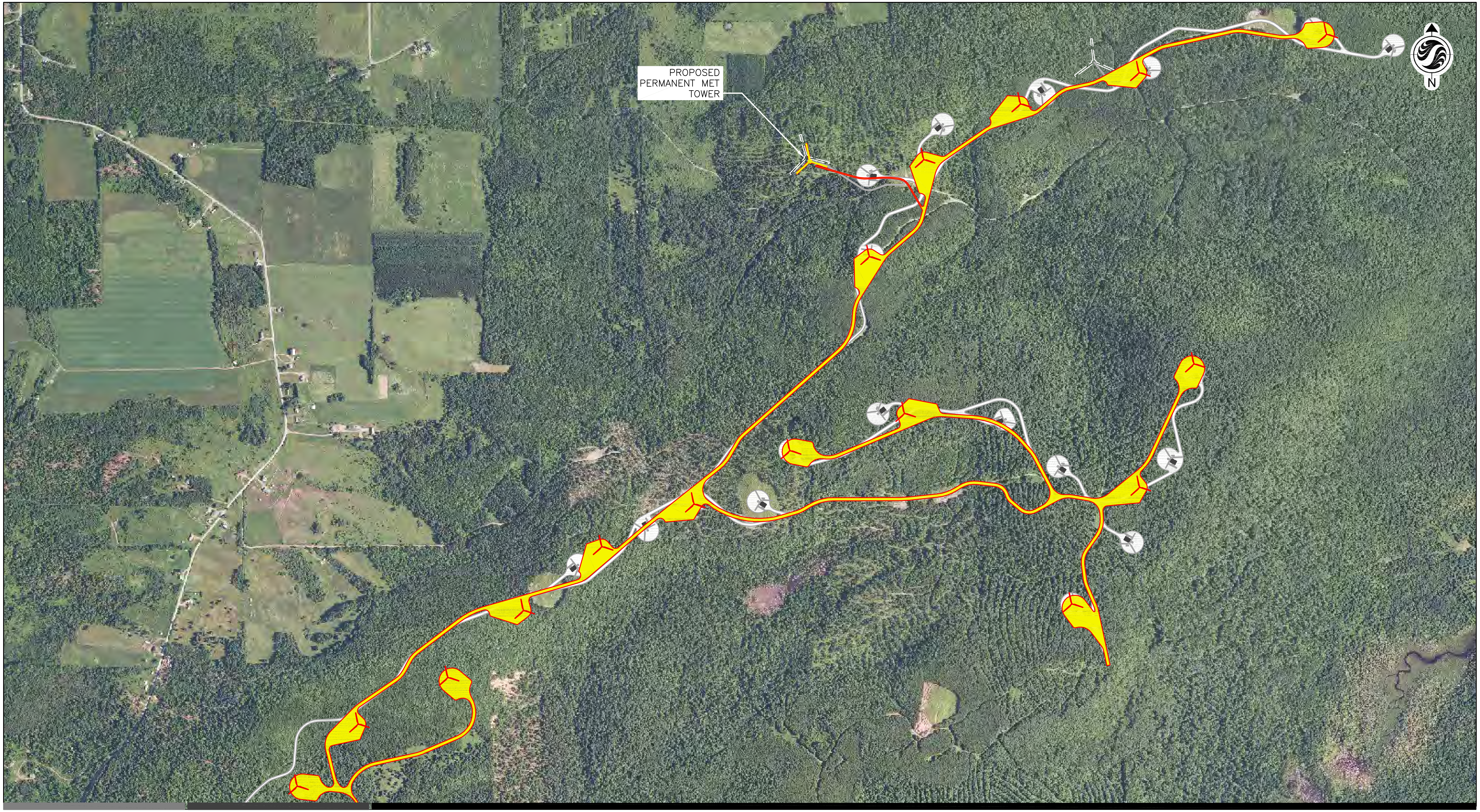
- Proposed Turbine (Vestas 50)
- Proposed 115kv Transmission Corridor
- Proposed Collector Corridor
- Proposed Access Roads

195600518

Client/Project
Evergreen Wind Power II, LLC
Oakfield Wind Project Amendment
Oakfield, Maine

Figure No.
1

Title
Summit Project Development Area
May 2011



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Legend

50 Vestas v112 Turbine Layout (05-06-2011)

Oakfield Proposed Revised Layout
(Vestas v112 3.0 MW Turbines and
Associated Roadways)

Oakfield Permitted Layout
(GE 1.5 MW Turbines and Associated Roadways)

0 1000'

1" = 1000'

Client/Project 195600518

Evergreen Wind Power II, LLC

Oakfield Wind Project Amendment

Oakfield, Maine

Figure No.

2A

Title

Oakfield 1 Turbine Comparison

May 2011

195600518-F2A-B-Summit-11x17Aerial-051211Vestas50vsGE_Oak1.dwg

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Legend

50 Vestas v112 Turbine Layout (05-06-2011)

Oakfield Proposed Revised Layout (Vestas v112 3.0 MW Turbines and Associated Roadways)

Oakfield Permitted Layout (GE 1.5 MW Turbines and Associated Roadways)

0 1000'

1" = 1000'

Client/Project 195600518

Evergreen Wind Power II, LLC

Oakfield Wind Project Amendment

Oakfield, Maine

Figure No.

2B

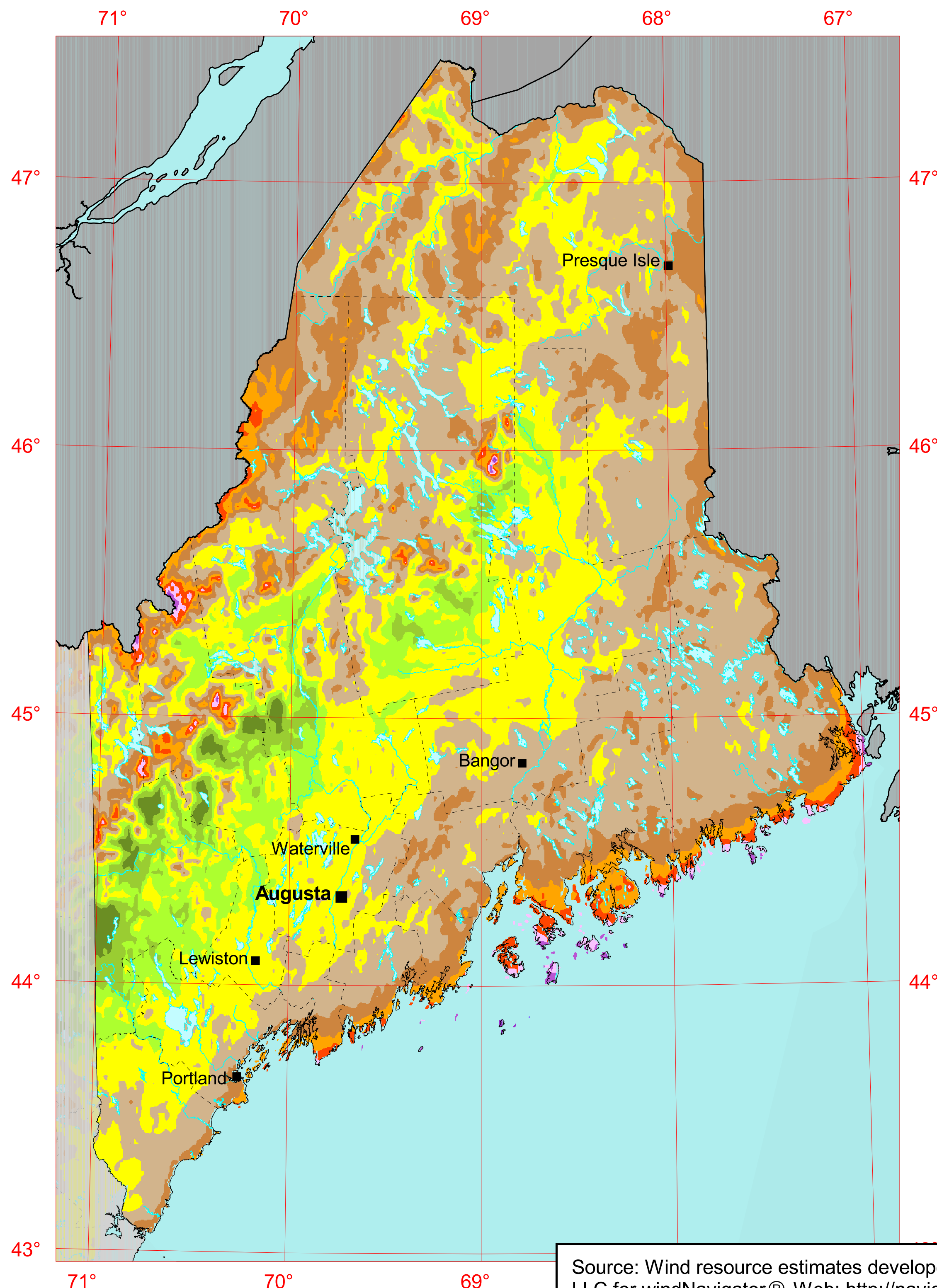
Title

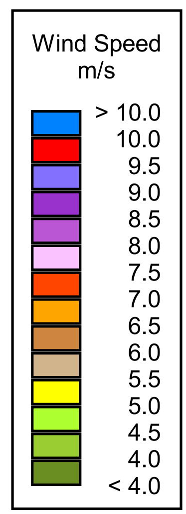
Oakfield 1 Turbine Comparison

May 2011

195600518-F2A-B-Summit-11x17Aerial-051211Vestas50vsGE_Oak1.dwg

Maine - Annual Average Wind Speed at 80 m





Source: Wind resource estimates developed by AWS Truewind, LLC for windNavigator®. Web: http://navigator.awstruewind.com | www.awstruewind.com. Spatial resolution of wind resource data: 2.5 km. Projection: UTM Zone 19 WGS84.

25 0 25 50 75 100 125 Kilometers

20 0 20 40 60 80 Miles

AWS Truewind

NREL National Renewable Energy Laboratory

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26-JAN-2010 4.1.1